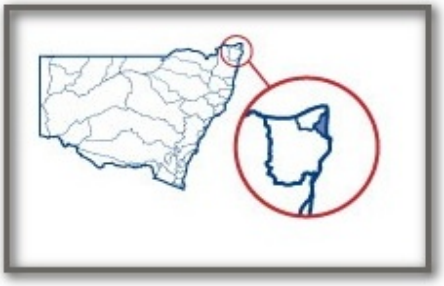
Department of Primary Industries
Water

Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources

Background document



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Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources Background Document

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Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across New South Wales following the introduction of the *Water Management Act 2000* (WMA 2000). These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water. In July 2004, 31 water sharing plans commenced in NSW, bringing these water sources and some 80% of water extracted in NSW under the management and licensing provisions of the WMA 2000.

In recent years, water sharing plans for unregulated[1] rivers and groundwater systems have been completed using a broad scale 'macro' approach based on whole river catchments or aquifer systems. Approximately 95% of the water extracted in NSW is now covered by the WMA 2000. The macro planning process was designed to develop water sharing plans covering most of the remaining water sources across NSW. Each macro plan covers a large river basin rather than a single sub-catchment, or in the case of groundwater systems, cover a particular type of aquifer (for example fractured rock). These macro plans generally apply to catchments or aquifers where there is less intensive water use.

The *Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources 2015* (hereafter referred to as the Brunswick water sharing plan) covers 9 surface water sources (some of which also include areas of upriver alluvial aquifers) and 1 groundwater source (that covers an area of floodplain alluvial aquifer) which are grouped into a single extraction management unit (refer Appendix 1).

This document provides background to the development of the rules in the Brunswick water sharing plan. It includes information on the purpose of the plan and the policy framework that supports it, a description of the Brunswick catchment including land and water use, and the process of developing the various water sharing rules in the plan. This document is part of a range of material available specifically on the plan including:

- the *Water Sharing Plan for the Brunswick Unregulated and Alluvial Water Sources 2015* - a legal instrument written in its required statutory format
- *An overview of water sharing plans for unregulated and alluvial water sources in coastal NSW*
- Rule summary sheets for each water source detailing the water sharing rules.

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

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

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

Purpose of the plan

Why are water sharing plans being prepared?

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

In December 2000, the NSW parliament passed the WMA 2000 which has the overall objective of "sustainable and integrated management of the State's water for the benefit of both present and future generations" (DLWC 2001). Water sharing plans play a major role in achieving this objective by providing a legal basis for sharing water between the environment and consumptive water users.

Under the WMA 2000, water sharing plans must protect water sources and their dependent ecosystems, and must protect the basic rights of landholders to extract water. In this way, environmental water and basic landholder rights are afforded priority over licensed water extractions. Among licensed water users, priority is given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and other industries.

Water sharing plans also recognise the economic benefits that commercial users such as irrigation and industry can bring to a region. When a plan commences, access licences held under the *Water Act 1912* are converted to access licences under the WMA 2000 which separates the water licences from land tenure. This facilitates the trade of access licences and encourages more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

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

Benefits for water users

The introduction of water sharing plans will benefit water users by providing:

- greater certainty by setting water sharing arrangements for a 10 year period
- clear trading and access rules which will help foster trading of water
- greater security with existing water licences converted to perpetual water access licences under the WMA 2000

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. The Brunswick water sharing plan sets rules for unregulated streams and alluvial aquifers in the plan area. The scope of the plan is discussed later in this report.

Unregulated streams

Rivers naturally experience a range of flows which are necessary for different hydrologic, geomorphic, biological and chemical processes to occur. Flood flows are required to scour channels, rework sediments, and inundate floodplains; medium flows oxygenate water and allow fish passage; and low flows maintain connectivity and assist the survival of aquatic and riparian flora and fauna. To preserve a healthy river system this range of stream flows must be maintained.

In order to protect a proportion of these flows for the benefit of the environment, water sharing plans impose new access restrictions on days when stream flows are low. This is achieved by establishing cease-to-pump rules that require users to stop taking water when flows fall below a set level.

Each water source in the Brunswick plan area has been classified as having high, medium or low instream values. Water sources with high instream value are protected through the plan by not allowing any water licences to be traded into the water source. Trades are allowed into some water sources with lower value in order to encourage the movement of extraction from higher to lower environmental value areas.

Alluvial aquifers

Aquifers are underground layers of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be extracted. Aquifers can store large volumes of water, often accumulated over thousands, or tens of thousands of years. Water enters (or recharges) aquifers via rainfall, surface flows from rivers and lakes, or flow from adjacent aquifers. Water sharing plans aim to achieve sustainable groundwater extraction by limiting extractions to a proportion of the aquifer recharge. The remainder of the recharge is reserved for the environment.

The Brunswick water sharing plan defines access rules for alluvial aquifers in the plan area. Water sharing rules for fractured rock and porous rock aquifers and coastal sands aquifers are dealt with in the respective *Water Sharing Plan for the North Coast Groundwater Sources.*

The Brunswick water sharing plan also includes rules on the location of new works and extraction from existing works to protect high priority groundwater dependent ecosystems and other environmentally sensitive areas such as rivers or streams.

Objectives of the plan

The objectives of the Brunswick water sharing plan are to:

a) protect, preserve, maintain and enhance the important river flow dependent and high priority groundwater dependent ecosystems of these water sources

b) protect, preserve, maintain and enhance the Aboriginal, cultural and heritage values of these water sources

c) protect basic landholder rights

d) manage these water sources to ensure equitable sharing between users

e) provide opportunities for enhanced market based trading of access licences and water allocations within environmental and system constraints

f) provide water allocation account management rules which allow sufficient flexibility in water use

g) contribute to the maintenance of water quality

h) provide recognition of the connectivity between surface water and groundwater

i) adaptively manage these water sources

j) contribute to the “environmental and other public benefit outcomes” identified under the “Water Access Entitlements and Planning Framework” in the Intergovernmental Agreement on a National Water Initiative (2004).

Scope of the plan

The Brunswick water sharing plan covers two discrete water resources: unregulated rivers and alluvial groundwater. Since there are no regulated rivers in the plan area, the water sharing plan applies to all rivers in the plan area.

Incorporating both the surface and groundwater resources into the one plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these resources.

Water sharing plans divide plan areas into several “water sources”, which usually coincide with sub-catchment boundaries. Access and trading rules are developed for each of these water sources. If water sharing rules need to be more refined, water sources may be divided into management zones. Conversely, rules about annual extractions are generally made at a broader scale within Extraction Management Units (EMUs), which usually consists of several water sources.

The Brunswick water sharing plan comprises 9 surface water sources (some of which also include areas of upriver alluvial aquifers) and 1 groundwater source (that covers an area of floodplain alluvial aquifer) which are grouped together into the Brunswick River Catchment EMU.

The location and extent of these water sources are shown on Figure 1. The Brunswick water sharing plan does not have any management zones.

Policy framework

A number of national, state and regional plans and policies guided the development of water sharing plans for the NSW North Coast, including:

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

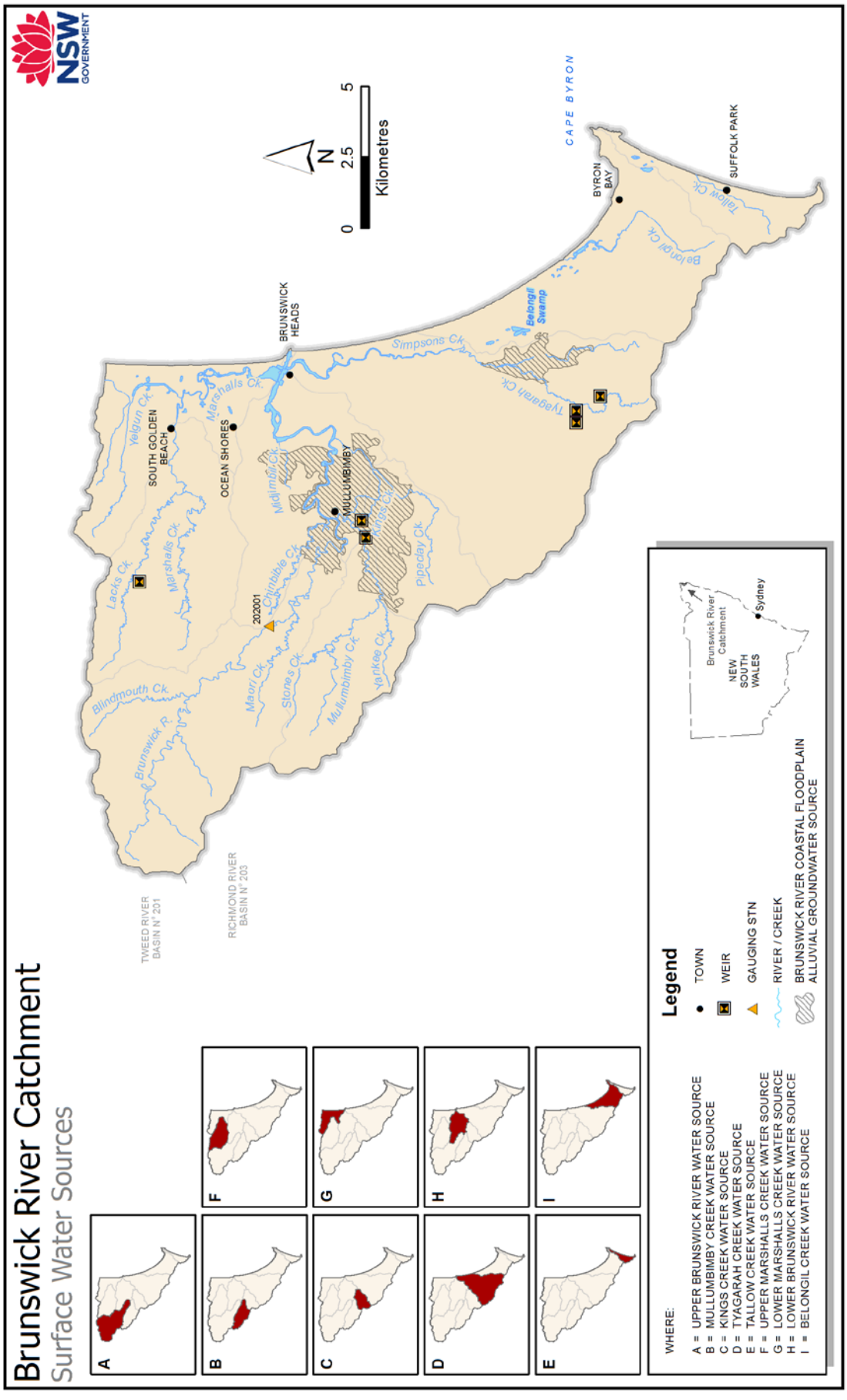
The Water Management Act 2000

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

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

The latest copy of the WMA 2000 is available from the NSW government legislation website.

Figure 1: Brunswick River WSP Area



Access Licence Dealing Principles

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

The Dealing Principles specify that dealings must consider:

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

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

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

National Water Initiative

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

The NWI sets out guidelines, outcomes and timelines for water plans and planning processes. Until 2014 the NWI was implemented and monitored by the National Water Commission, an independent statutory body responsible for providing advice to COAG on national water issues. The Commission was responsible for undertaking a biennial assessment of each state's progress with implementing the NWI. The role of the National Water Commission ceased in December 2014 and some of its water management functions will be transferred to other agencies.

Natural Resource Commission targets

The Natural Resource Commission (NRC) was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this, the NRC has developed a Standard for Quality Natural Resource Management, along with 13 state-wide targets for natural resource management which have been embedded in the NSW State Plan. The Standard is designed to apply to natural resource management at all scales including at the state, regional, catchment and local level.

The NRC's Standard requires the use of the best available knowledge, 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 are progressing. The NRC reviews water sharing plans against this standard and its associated targets. In 2013 the NRC reviewed 31 water sharing plans that were due to expire in 2014 and provided advice to the Minister for Primary Industries.

In 2012 the NRC reviewed the state-wide standard and targets, including monitoring, evaluation and reporting arrangements in NSW. They recommended five new state-wide targets that provide a sharper focus on the key long-term issues of concern to the

Government and community and revised the monitoring, evaluation and reporting strategy to support the implementation of the new targets.

Northern Rivers Catchment Action Plan

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

The Northern Rivers Catchment Action Plan 2023 is a 10-year strategic plan that sets the direction for the sustainable use and care of the natural resources of the NSW Northern Rivers Region. The Brunswick water sharing plan contributes to the goals and targets of this plan, in particular Goal 3, relating to the maintenance of diverse, healthy, connected and productive natural environments. The implementation of water sharing plans on the North Coast is one of the key strategies to be implemented in supporting land and water managers to maintain or improve the condition of priority freshwater, marine and estuarine assets (NRCMA 2013).

Water planning policies and considerations

A number of policies and guidelines have been developed since commencement of the WMA 2000. These policies have arisen in response to specific water management issues that need to be considered during the development of water sharing plans. These policies directly influence the planning process and the formulation of water sharing rules.

Protecting pools, lagoons and lakes

Pools in NSW can provide an important source of water for licence holders, landholders and communities. Pools also have a key ecological function as a critical refuge and habitat for flora and fauna. For the purpose of this policy a pool refers to any lentic water bodies (standing water) within or associated with unregulated rivers in NSW, including water bodies that fall within the definition of a lake according to the Dictionary of the WMA 2000 (the exception is tidal pools and estuaries).

The policy document *Macro water sharing plans – the approach for unregulated rivers. Access and trading rules for pools* can be found on the Office of Water website www.water.nsw.gov.au. This document provides guidance for Interagency Regional Panels in setting water access and trading rules for pools that are covered by unregulated river water sharing plans.

The general approach is to establish a default access rule where no draw down is allowed below full pool capacity for the majority of pools. This default rule may be reviewed where it is justifiable and feasible to do so, to allow limited access to pools based on local hydrological, environmental and socio-economic considerations.

Default rules vary depending on the pool type. Generally the default rule for artificial pools is to adopt the existing licence conditions; however in some circumstances where this may not be appropriate, alternate rules will need to be developed. For natural pools, the default rule requires users to stop pumping when the pool is less than its full capacity (approximated by the greatest pool volume at which there is no visible flow leaving the pool).

The plan process does allow for more lenient access rules to be set if the default rules would significantly impact on current irrigation operations.

Managing surface water and groundwater connectivity

A key objective of the NWI is 'recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource'. Most alluvial aquifers have a relatively high degree of connectivity with their associated surface water sources. Accordingly, most alluvial water sources are included in a water sharing plan that covers both surface water and its connected alluvial groundwater. Conversely, most porous rock, fractured rock and coastal sands aquifers are considered to have a lesser degree of connectivity and are included in groundwater-specific plans.

The document *Macro water sharing plans – the approach for groundwater. A report to assist community consultation* provides further information about the principles used to develop water sharing rules for groundwater sources.

Protecting basic landholder rights

As defined under the WMA 2000, basic landholder rights (BLR) consist of domestic and stock rights, harvestable rights and native title rights. Water may be extracted under these rights without the need for a water access licence; although where groundwater is accessed under a domestic and stock right, the bore must still be approved by the Office of Water.

The WMA 2000 requires that water sharing must protect BLR. The plan does this by identifying the requirements for domestic, stock and native title rights at the start of the plan and considering these requirements when designing the rules for licensed water extraction. Because the access rules for licensed extraction do not apply to BLR, extractions taken under BLR are afforded higher priority than licensed extractions.

The requirements of harvestable rights have been inherently considered in the water sharing process, as access rules are based on river flows that result after harvestable rights extractions have occurred. There are currently no extractions for native title rights, however the plan allows for these rights should they be activated during the plan's ten year term.

Domestic and stock rights can be restricted by the Minister to protect the environment or public health, or to preserve existing BLR. However, these restrictions are outside the framework of the water sharing plan.

The Brunswick water sharing plan provides an estimate of the water requirements for BLR within each water source, noting that these rights may increase during the life of the plan. The water sharing plan cannot limit or restrict these rights, but the WMA 2000 provides for restrictions on BLR through the development of mandatory guidelines.

Protecting town water supply access

Under the WMA 2000, extractions for town water supply are afforded a higher priority than extractions for commercial purposes such as irrigation. Water sharing plans recognise this priority by ensuring that a full share of water is allocated for annual town water supplies except where exceptional drought conditions prevent this. Local water utilities (LWUs) such as local councils are issued with local water utility access licences. The WMA 2000 allows for annual trade but not permanent trade of entitlement between local water utility access licences.

Protecting Aboriginal values

Aboriginal people have a spiritual, customary and economic relationship with land and water that provides an important insight into natural resource management. The NSW Government established the Aboriginal Water Initiative in 2012 to facilitate effective engagement with Aboriginal communities in the water sharing process and ensure that measurable Aboriginal water outcomes are achieved. The Initiative aims to build Aboriginal peoples' capacity to participate as water users, protect their rights to water, maintain a healthy environment, and take full advantage of economic opportunities.

Water sharing plans recognise the importance of rivers and groundwater to Aboriginal culture. The plans will allow Aboriginal communities to apply for water access licences for cultural purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and for cultural and ceremonial purposes. Aboriginal cultural licences can also be used for drinking, food preparation, washing and watering domestic gardens. These cultural licences are limited to 10 ML/yr per application. Opportunity for granting licences for Aboriginal cultural purposes throughout the Brunswick catchment is included in the water sharing plan.

For further information refer to *Our Water Our Country. An information manual for Aboriginal people and communities about the water reform process* which is available from the Office of Water website www.water.nsw.gov.au

Protecting estuary health

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

The document *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation* provides further information about the principles used to determine estuary sensitivity to freshwater inflows.

Water interception activities

Changes in land use activities can potentially result in the interception of significant quantities of surface runoff and through-flow. Activities that can impact on water quantity include 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 within a plan's extraction limit.

Water sharing plans cannot restrict the volume of water collected under harvestable rights[2] but can place restrictions on instream dams – dams that are located on streams of third order or higher. Under state-wide policy the construction of new instream dams is prohibited in those water sources in which high instream values have been identified.

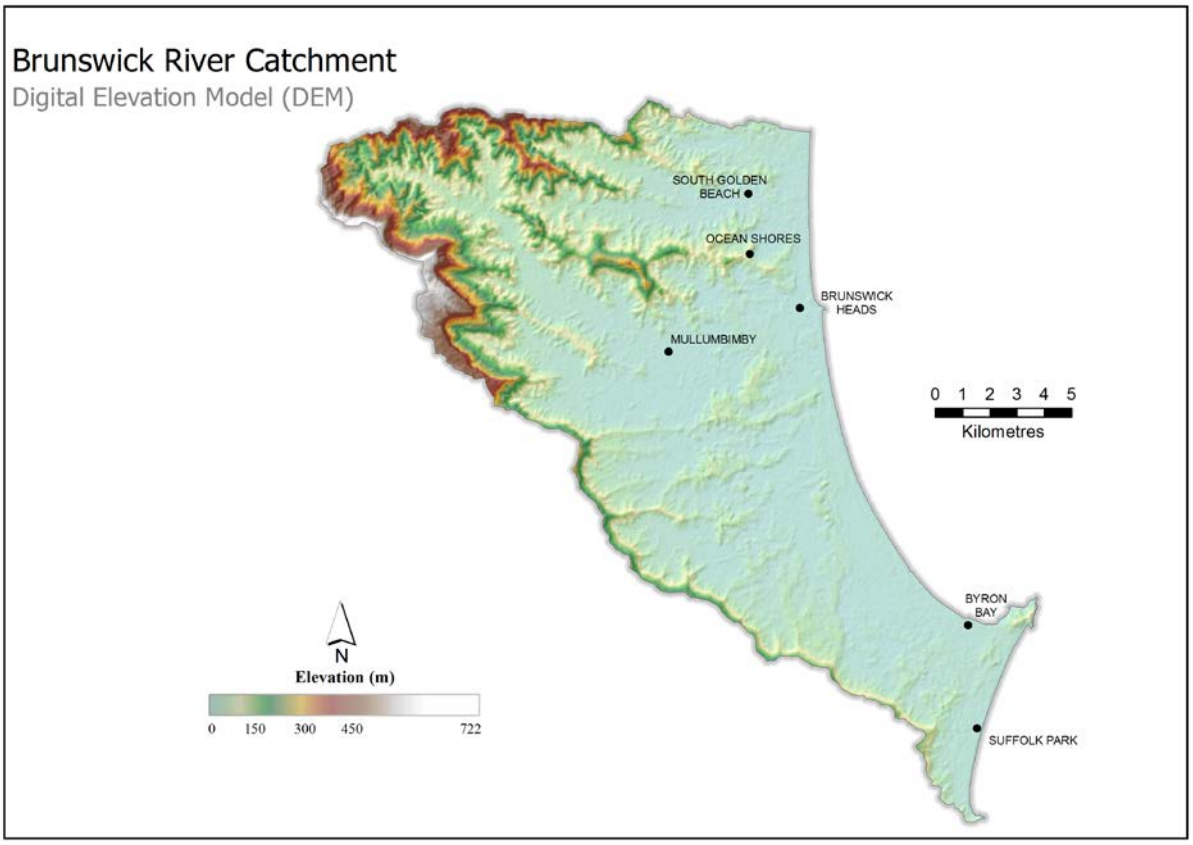
[2] The maximum harvestable right dam capacity is calculated based on providing the ability to harvest 10% of the mean annual runoff from the landholder's property. It is determined using a calculator provided on the Office of Water website, with input parameters being property location and property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

Description of the plan area

Catchment description

The area covered by the Brunswick water sharing plan (Appendix 1) comprises the Brunswick catchment and the adjoining smaller coastal catchments of Belongil and Tallow Creeks to the south, extending along the coastline from Broken Head north to Wooyung. It contains a total of 9 surface water sources and one discreet groundwater source which are grouped into one EMU and covers a total area of approximately 273.3 km^2 on the far north coast of NSW. Elevations rise steeply across the catchment from sea level on the coast to around 700 metres in the Burringbar and Koonyum Ranges, which form the western and southern boundaries of the catchment (see Figure 2).

Figure 2: Landform



The catchment is bounded to the north and west by the Tweed River catchment and to the south and west by the Richmond River catchment. About 48% of the catchment is relatively flat with slopes less than 3 degrees and elevations of less than 10m above sea level. A further 19% is classed as undulating to hilly (slopes from 3-11 degrees) with hilly to steep land (slopes from11-18 degrees) occupying 12% and rugged mountainous land (18-27 degree slopes) occupying 16% of the catchment. Slopes which are greater than 27 degrees account for 4% of the catchment.

The Brunswick catchment is drained by the Brunswick River, which begins in the Burringbar Ranges. After reaching Mullumbimby, it traverses the catchments flatter coastal areas until it is joined by its two large tributaries Marshall and Simpson's Creeks, at Brunswick Heads and then discharges to the Pacific Ocean. Downstream from Mullumbimby the river comes under the tidal influence of the estuary.

The Belongil catchment, covering a total area of approximately 33 km^2, is drained by Belongil Creek to an estuary comprising a small intermittently closed and open lake / lagoon (ICOLL)

which meets the sea to the north-west of the town of Byron. Similarly, the Tallows catchment, covering a total area of approximately 9 km^2 also drains to an ICOLL on the southern outskirts of Byron Bay.

A large portion of the Brunswick catchment consists of mountainous terrain or low lying poorly drained country (TCM 1990). There are significant parcels of environmental reserves surrounding both Brunswick Heads and Byron Bay.

Located within the catchment are the major towns of Byron Bay, Mullumbimby and Brunswick Heads as well as the smaller settlements of Ocean Shores and Suffolk Park and many other smaller villages. Overall there is a relatively high density of rural settlement within the catchment.

As part of the North Coast of New South Wales, the area has been the fastest growing part of the state since the late 1960s and attracts large numbers of tourists, sea changers and retirees.

Water management structures

All of the rivers and creeks in the Brunswick water sharing plan area are unregulated, having no major dams for water supply or instream structures. Most water users rely on natural flows for their water supply, although small dams and weirs may be present.

Aboriginal history

Prior to European settlement, the Arakwal people, of the Bundjalung Nation, were the traditional owners and custodians of the region. For at least 22,000 years the Arakwal Bumberlin people have occupied an area stretching from Seven Mile Beach to the south to the Brunswick River in the north, extending west to the mountain range and east into the Tasman Sea. The wider Bundjalung Nation extends from the Clarence River in the south to the Nerang River in south-east Queensland to the north, reaching westwards to the Great Dividing Range (Arakwal People of Byron Bay, 2011).

The area where the coastal town of Byron Bay is now located has traditionally been an important meeting place for the Arakwal people, neighbouring clans with which they maintained close relations, and people of the Bundjalung Nation. Due to the regular tribal gatherings in the catchment, middens were common, though many have since been destroyed by sand mining activities occurring since 1930 (BHCC, 2015). One particular midden near The Pass, Byron Bay is estimated to be over 1,500 years old.

After early European settlement in the area in the 1830s, a massacre south of Suffolk Park forced local Aboriginal families to move to safer areas within the region. Cultural values in the region were further impeded by the construction of the lighthouse on Cape Byron in 1901, which destroyed an Aboriginal men's ceremonial ground (Arakwal People, 2011).

Following the Mabo decision, the Bundjalung People of Byron Bay lodged a native title claim in 1995, with a further claim in 1997 for additional land in the Byron Shire. After long negotiations, an indigenous land use agreement (ILUA) between the Government and the Bundjalung People of Byron Bay (Arakwal) was registered in August 2001. The first agreement of its kind in Australia, it subsequently led to the establishment of the Awakwal National Park (Office of Environment and Heritage, 2014). A further two ILUAs were entered into on December 2006.

Early European settlement and land use

Following the charting of the Brunswick River by Captain Rous in 1828, European settlement began approximately 20 years later with a forestry industry based on cedar and other timbers established in the catchment. The felling and milling of these timbers, and their subsequent transportation down the Brunswick River soon led to the establishment of the township of Brunswick Heads (BHCC, 2015).

As Brunswick Heads grew in importance as an established sea port for transporting harvested cedar to the Sydney market, the natural abundance of timber species suitable for the crafting and maintenance of boats allowed for the development of a large boat-building industry (Brunswick Valley, 2009). As those employed within the cedar and boat–building industries frequently moved up the river, a camp site was established at the junction of the arms of the Brunswick River, flourishing into a village and later becoming the town of Mullumbimby.

Beef grazing, on lands that were squatted on ("stations"), occurred from about 1840. Activity in what later became classified as the "services sector" emerged during the 1860s and 1870s. During the second half of the nineteenth century, the government constructed the North Coast Road from Hexham to Grafton and on to Murwillumbah. In 1894, a railway line was completed from Lismore through Murwillumbah to Byron Bay. Once the Byron Bay Jetty was opened in 1888, the reliance of Brunswick Heads as a port was diminished, though the Brunswick River remained an important link to the sea for the agricultural industry that succeeded the early pioneers.

Dairying emerged as a major form of primary production in northern NSW in the first half of the twentieth century. In 1895 the North Coast Fresh Food and Cold Storage Co-operative was established at Byron Bay to trans-ship dairy output. In 1926 the co-op adopted the name Norco.

Current land use

The western portion of the catchment consists largely of mountainous country of little agricultural value. In the east there is some good agricultural land on gently undulating country dissected by moderate to steep ridges, however much of the eastern catchment contains low lying, poorly drained country.

Horticulture and dairying are important agricultural enterprises in the Byron Shire. Banana growing is largely confined to Main Arm, Mullumbimby and The Pocket on steep land. Bananas and avocados are often grown together. Increasing areas of sandy loam and alluvial soils around Mullumbimby, Byron Bay and Brunswick Heads are being cropped to grow vegetables such as lettuce, cucumbers, cauliflowers and cabbage for the local markets.

Over recent years dairy farmers have turned to beef production as dairy output has become concentrated in Victoria. Land use over the coastal plain is now dominated by grazing with cropping and horticulture comprising the next most extensive land use. Irrigation is minimal and used mostly for pasture production with small volumes also used for tropical fruits, nurseries and turf growing (see Figure 3 and Table 1 below). Town water supplies for the major urban centres are sourced from storages in the adjacent Richmond catchment.

In recent years, beef cattle grazing has become (by far) the most valuable item of primary production in the catchment, followed by fruit and nut growing. While agriculture and forestry provided the main basis to growth in earlier times, this has recently been overshadowed by tourism and retirement industries.

Table 1: Landuse in the Brunswick catchment

Land use category	Area Km2	Proportion of catchment (%)
Grazing	172.43	63.1
Native Landscape	39.02	14.3
Dryland Cropping and Horticulture	31.57	11.6
Conservation	20.44	7.5
Irrigation	6.49	2.4
Marsh/wetland	3.16	1.2

Land use in the towns of Brunswick Heads and Mullumbimby is predominantly residential, with retail and commercial land uses present in the central business area of Mullumbimby, and retail along the old Pacific Highway in Brunswick Heads.

Climate

The Brunswick catchment is characterised by a sub-tropical climate, with a pronounced summer/autumn wet season and a winter/spring dry season. The Catchment is one of the wettest in NSW. Average annual rainfall varies from 1,700-1,800 mm on the coastal plain to around 2,700 mm at the top of the Richmond Ranges in the west of the catchment (Figure 4). The mean annual rainfall on the coast is 1868 mm at Cape Byron Lighthouse and 1758 mm at Mullumbimby (BOM 2015). Rainfall is highest in summer and autumn with July, August and September being the driest months (Figure 5). Mean monthly rainfall varies from less than 100 mm in September to over 240 mm in March.

The Brunswick catchment is considered to be at the southern limit of cyclonic activity on the east coast of Australia .The Bureau of Meteorology estimates that an average of one event in every two cyclone seasons is likely to affect the catchment and may cause intense flooding. The Brunswick River catchment experiences severe local thunderstorms which can occur any month of the year, but are more frequent between September and January.

The Brunswick catchment has the highest runoff per km^2 in the North Coast Region (Resource and Conservation Assessment Council 1996a) and increases at the end of the wet season as water tables rise and infiltration decreases. Runoff as a percentage of rainfall is 29% (Resource and Conservation Assessment Council 1996a).

Figure 3: Average rainfall in the Brunswick River Catchment

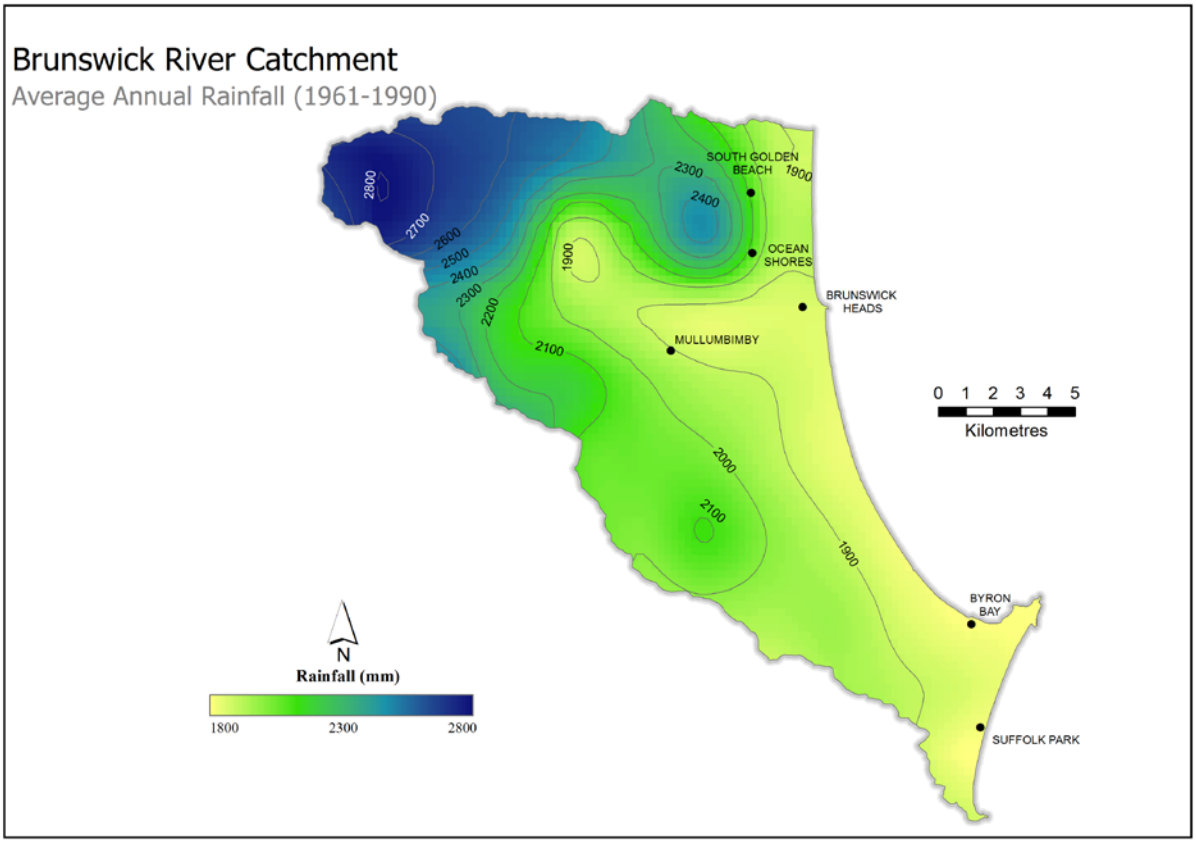
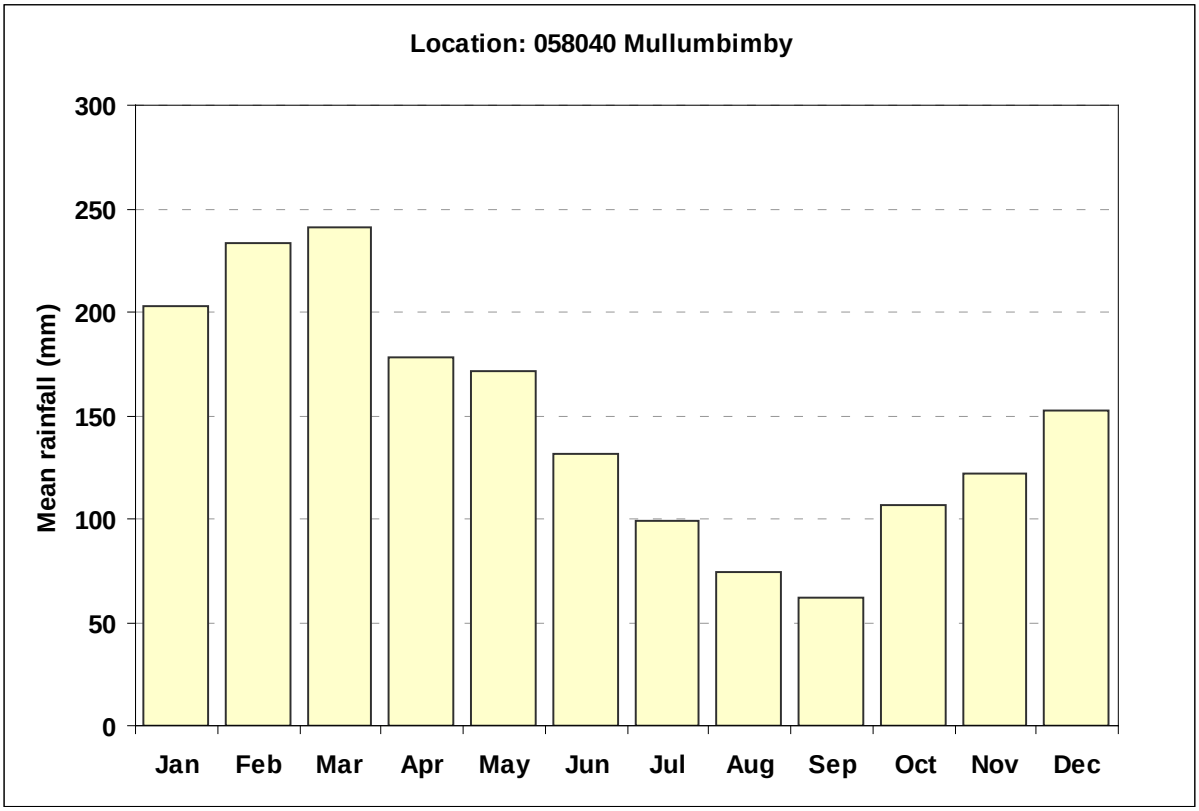


Figure 4: Mean monthly rainfall at Mullumbimby (1898-2010)



Ecological values

Wetlands and estuarine habitats such as mangroves and seagrass are very sensitive ecosystems, vital to the maintenance of inshore fisheries resources and the provision of habitat for many birds, especially waterfowl. Approximately 3% (714 ha) of the Brunswick Catchment has been classified as wetland (The Distribution of Wetlands, R.T. Kingsford, K. Brandis, R. Thomas, P. Crighton, E. Knowles and E. Gale, 2003).

Some areas of these wetlands along the coastal zone of the Brunswick catchment are protected under State Environmental Planning Policy 14. The catchment area also contains some communities of ecological significance, often adjacent to the streams within the saltmarshes and mangrove forests. An example of the later can be seen along the length of the Belongil Creek system.

Over many years the coastal plain of the Brunswick catchment has been extensively cleared for grazing and sugar cane cropping. Remnants of the Big Scrub lowland rainforest that previously covered 750 km^2 of the far north coast are to be found in areas of the catchment. Less than one percent of this endangered ecological community remains today.

Some areas of the Brunswick catchment are protected within national parks and nature reserves. Most of this reserved area lies along the coastal strip and protects a number of significant coastal wetlands and estuaries. Tyagarah Nature Reserve (8.5 km^2) is a thin strip of protected coast encompassing seven kilometres of unspoiled beach backed by coastal heath. The Billinudgel Nature Reserve (7.7 km^2), listed as nationally significant in the Directory of Important Wetlands in Australia (DEWHA 2010a), protects the largely undisturbed wetlands of Billinudgel Creek. The wetlands comprise extensive areas of swamp sclerophyll forest dominated by broad leaved paperbark and reeds Native vegetation to the north and south of the reserve provides a link to other protected areas including Brunswick Heads Nature Reserve and Mooball National Park (NPWS 2000).

Brunswick Heads Nature Reserve is a small conservation area that lies along the northern bank of the Brunswick River and Marshalls Creek. The reserve contains important estuarine habitats associated with the Brunswick estuary, as well as areas of littoral rainforest (an endangered ecological community).

Threatened species

The Brunswick catchment provides habitat for a number of significant species and ecological communities that are protected under the *Threatened Species Conservation Act 1995*. Threatened fish, frog, bird and wet flora species occur in all the water sources within the plan area, as do the endangered ecological communities.

The ecological values and threatened species known or expected to occur in each of the Brunswick water sources are identified in Appendix 3. The occurrence of these species has been considered as part of the macro-classification approach to determine the water sources with high environmental values.

Estuary sensitivity

Estuary specialists from the Office of Water and Office of Environment and Heritage (OEH) have assessed each of the state's estuaries to determine how sensitive they are to changes in freshwater inflows (DWE 2009).

The assessment ranks the sensitivity of estuaries based on their physical attributes – size, shape and the ratio of catchment size to the surface area of the estuary. Small estuaries, such as the coastal lagoons within the Brunswick plan area tend to be highly sensitive to inflow variations, with most being only intermittently connected to the ocean. Open mature wave dominated barrier estuaries such as the Brunswick River are generally less sensitive to inflow variations. As they mature and infill with sediment they tend to become long and narrow 'river' estuaries.

Table 2 lists the sensitivity of each of the estuaries in the Plan area. The method used for assessing estuary sensitivity is detailed in '*Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*'.

Table 2 Inflow sensitivities for the estuaries within the plan area

Name of estuary	Inflow sensitivity - low flows	Inflow sensitivity - high flows
Brunswick River, Lower Brunswick	Medium	Medium
Brunswick River, Lower Marshalls Creek	Medium	Medium
Brunswick River, Simpson Creek	Medium	Medium
Belongil Creek	High	High
Tallow Creek	High	High
Broken Head Creek	High	High

Groundwater

Groundwater aquifers in the Brunswick catchment are primarily found in fractured rock, unconsolidated alluvial sediments and coastal sands. Alluvial sediments can be categorised as "upriver alluvium" or "coastal floodplain alluvium". Upriver alluvium nominally occurs upstream of the tidal limit and is sandier than coastal floodplain alluvium.

Both classifications of alluvial aquifers are included in the Brunswick water sharing plan. The Brunswick water sharing plan does not differentiate between upriver and coastal floodplain alluvium; both types of alluvium are subject to the same rules.

The main upriver alluvial aquifers are found in the main arm of the Brunswick River and Mullumbimby Creek where unconsolidated sediments are found to a depth of 15 m.

The Brunswick River Coastal Floodplain Alluvial Groundwater Source is defined as the unconsolidated alluvial deposits associated with the lower Brunswick River extending from approximately 2 km east of Mullumbimby to approximately 2 km west of Mullumbimby. The unconsolidated alluvial sediments of the Brunswick River Coastal Floodplain Alluvial groundwater source is the most utilised aquifer in the catchment.

Also included is a smaller non-contiguous areas of unconsolidated alluvial deposits associated with Simpsons Creek (which flows into the lower Brunswick River) upstream of Tyagarah Airport and between the Pacific Highway and the Tyagarah Nature Reserve. There are currently no licences to extract groundwater from the Tyagarah area.

These coastal floodplain alluvial deposits generally consist of fine grained sand, silts and clays ranging up to 4km wide and 20m in depth. As a result of this finer material, the groundwater yields are generally low and are typically only suitable for stock purposes. The water quality of these areas can be quite variable with some areas being quite fresh and others being impacted by estuarine environments resulting in higher salinities. Additionally, these coastal floodplain alluvials are often underlain by acid sulfate soils which results in restricted suitability of pumping of groundwater and subsequent poor water quality. Due to these yield and water quality constraints, utilisation of the aquifer is considered to be low.

Part of the smaller non-contiguous area of these unconsolidated alluvial deposits associated with Simpsons Creek has been identified as a groundwater dependent ecosystem (Belongil Swamp)

River flows

There is currently one active gauge within the Brunswick catchment that monitors streamflows on a daily basis (Table 3). Gauge 202001, named the Brunswick River at Durrumbul (Sherrys Crossing) Gauge has been operational since 1 November 1954.

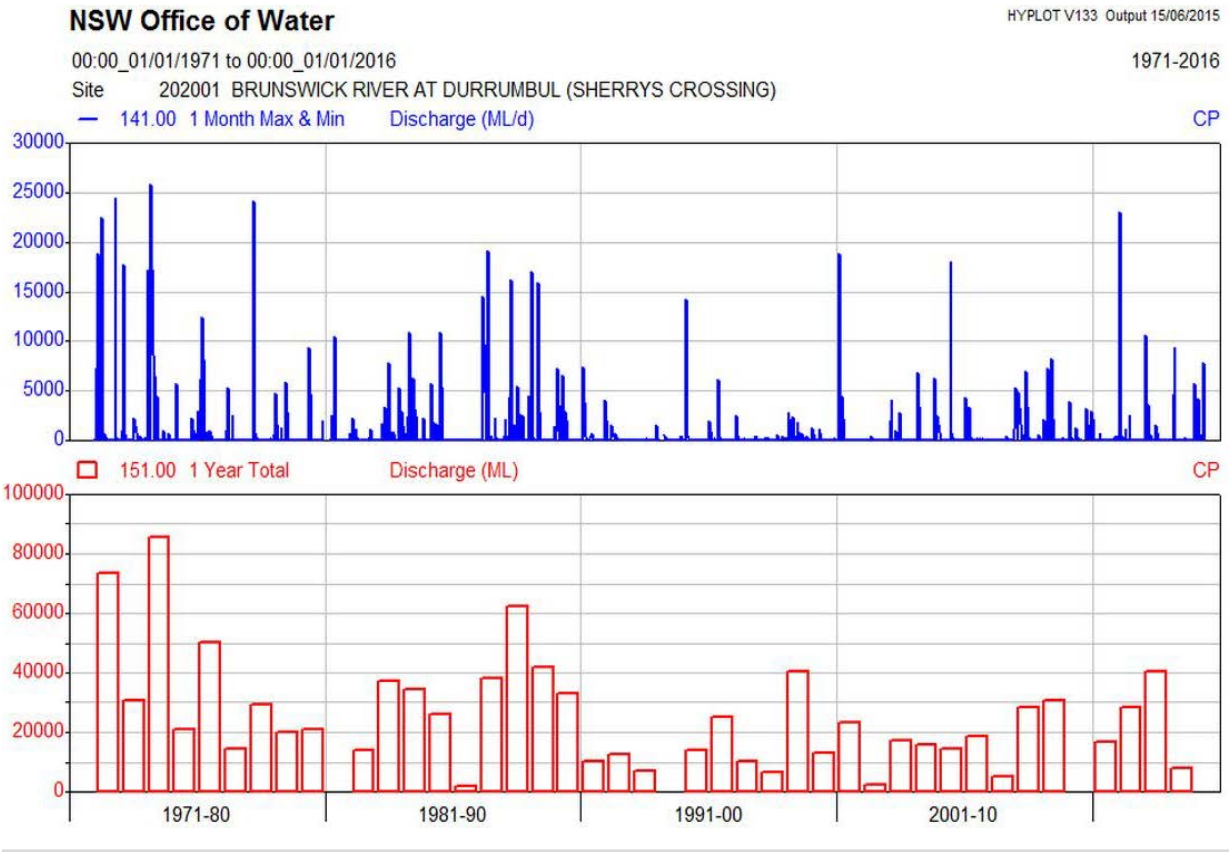
This gauge is the flow reference point which is used to define the water sharing rules within the Upper Brunswick River, Mullumbimby Creek and Kings Creek Water Sources.

Figure 7 shows the variability of flow over the period of record.

Table 3: Current river gauges in the Brunswick catchment

Gauge	Location	Catchment area	Mean Annual Flow	Commenced
202001	Brunswick River at Durrumbul	34.00 km^2	31,223 ML	1954

Figure 5: Daily and annual stream flows in the Brunswick River at Durrumbul



Entitlement and water use

At the commencement of the water sharing plan, there were approximately 221 water licences in the Brunswick River water sharing plan area, totalling approximately 2,729.5 ML/yr of entitlement (Table 4). This entitlement is divided between unregulated surface water and alluvial groundwater.

The Brunswick water sharing plan assumes full development of all entitlement in setting the extraction limits that form part of the water sharing rules. For the Brunswick catchment the sum of the peak demands for all water sources has been calculated as approximately 17 ML/d.

Water extraction in the unregulated water sources

Water users in the Upper Brunswick River water source have had water sharing arrangements in place since 2003 following the gazettal of the plan that was prepared following the work undertaken by the North Coast Water Management Committee. Accordingly, these users have been authorised under the *Water Management Act, 2000*.

The remaining water sources in the Plan area will be subject to a water sharing plan on commencement of this Plan.

Table 4: Total entitlement* and number of licences for each water source at plan commencement

Water source	Unregulated river entitlement^ (ML/yr)	Aquifer access entitlement (ML/yr)	Number of licences
Belongil Creek	0	NIL	0
Kings Creek	33	22	11
Lower Brunswick River	14	59	50
Lower Marshalls Creek	228	44	12
Mullumbimby Creek	88	8	12
Tallow Creek	103	NIL	1
Tyagarah Creek	1061.5	0	14
Upper Brunswick River	664	35	42
Upper Marshalls Creek	277	25	27
Brunswick River Coastal Floodplain Alluvial	NIL	68	52
TOTAL	**2,468.5**	**261**	**221**

* Under the WMA 2000, licences are granted "share component" rather than "entitlement". The term "entitlement" has been retained in this document due to its common usage. Share component is granted as unit shares for unregulated river access licences and as ML/yr for local water utility and domestic & stock access licences. For ease of reporting, the total share component has been recorded as ML/yr.
^ Includes unregulated river access licences and domestic & stock access licences. Eurobodalla Shire Council's local water utility access licence is included in the aquifer access licence total as all town water is extracted from the alluvial bores rather than from the river pump.

The majority of the unregulated surface water licences are located in three water sources: Upper Brunswick River, Upper Marshalls Creek and Tyagarah Creek water sources.

Of the total surface water entitlement, approximately 94% is for irrigation, 4% for farming purposes, and the remainder used for stock and domestic purposes.

Long-term records of water use are not available in the Brunswick catchment as there is not yet broad scale metering in unregulated catchments on the north coast.

Water extraction in the alluvium

Most of the existing alluvial groundwater licences are located in the alluvium along the main trunk of the Brunswick River within the Upper Brunswick River water source and in the Brunswick Coastal Floodplain Alluvial.

Of the total licenced groundwater entitlement, approximately 76% is for stock and domestic use and 24% for irrigation. Although domestic and stock bores need to be authorised, water access licences are not issued for groundwater extracted for domestic and stock purposes.

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

Local water utility requirements

Town water within the plan area is provided by Rous Water, a County Council that supplies bulk water to its four constituent Councils – Ballina, Byron, Lismore and Richmond Valley.

The exception to this in the Plan area is the township of Mullumbimby, whose water supply is sourced from Laverty's Gap Weir (Byron Shire Council, 2015).

The primary source of town water supplied by Rous Water is Rocky Creek Dam. Their supply network also includes Emigrant Creek Dam, a Wilsons River source, and a number of bores in the Ballina, Woodburn and Richmond Valley areas (Rous Water, 2015). Laverty's Gap Weir, which draws its water from the upper catchment system of the Wilsons River, was constructed in 1939. These town water sources are all located outside of the Plan area.

The process of developing the Brunswick River water sharing plan

The Office of Water is responsible for implementing the WMA 2000, including developing water sharing plans for the state's water resources. The Office of Water has established several interagency panels to assist with the development of water planning policies and water sharing plans. The preparation of the Brunswick water sharing plan was guided by 2 panels:

- the State Interagency Panel
- the North Coast Interagency Regional Panel.

The role of each of these panels is discussed below.

In summary, the draft Brunswick water sharing plan was prepared based on:

- feedback from stakeholders during targeted consultation undertaken in 2006.
- the indicative rules generated by a risk and values classification (explained later in this section), and
- the deliberations of the Regional Panel.

The draft plan was publicly exhibited throughout the plan area. Comments and feedback received during the public exhibition period were considered by the Working Group and the Regional Panel in finalising the water sharing plan.

This section describes the panels and briefly discusses the process of developing the Brunswick water sharing plan including the risks and values classification, refining the indicative rules, and the specific outcomes of panel deliberations, targeted consultation and public exhibition.

Full details of the macro-planning approach and the classification method is available in the document *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation*. This document is available on the Office of Water website www.water.nsw.gov.au.

State Interagency Panel

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

The State Interagency Panel is chaired by the Office of Water and comprises representatives from the Office of Water, Office of Environment and Heritage (OEH), Local Lands Services (LLS, formerly catchment management authorities), and agriculture, fisheries and aquaculture specialists from the NSW Department of Primary Industries (DPI). The Office of Water is responsible for the overall project management.

Interagency Regional Panel

The North Coast Interagency Regional Panel (the Regional Panel) comprises representatives from the Office of Water, OEH, DPI and initially, the North Coast LSS (formerly Northern Rivers Catchment Management Authority) as an observer. Appendix 4 lists the names of panel representatives and their areas of expertise, and also lists NOW officers who provided specific technical and scientific information to the panel as required.

The key responsibilities of the Regional Panel are to:

- review the water management units provided by the Office of Water
- review economic, social and environmental values and undertake risk and value assessments to classify each unregulated water source
- review existing and generic water sharing rules as to their applicability
- make recommendations on water access and dealing rules for each water source
- ensure proposed water sharing rules are consistent with state policy
- assist with consultation on the proposed rules
- review submissions from targeted consultation and public exhibition, and make changes where necessary to the water sharing rules.

The Regional Panel used local knowledge and expertise in developing and recommending the water sharing rules through a consensus decision-making approach.

Water source classification method

In developing water sharing plans for unregulated rivers, the Office of Water classifies each water source based on the risks and values of water extraction.

Specifically the classification process involves assessing:

- instream values (such as threatened fish species) and the risk to these values posed by existing or increased extraction
- hydrologic stress, based on the demands for licensed extraction relative to river flows
- the risk to instream values posed by extractions
- extraction value, 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 requiring licensed water extraction
- the sensitivity of estuaries to the removal of freshwater inflows.

For the Brunswick water sharing plan, each water source was classified according to these values and risks. The Regional Panel then reviewed these classifications against a range of reference material and data including irrigation data, hydrologic data, aquatic ecology information, fisheries data, and threatened species data. Extraction patterns by local water utilities were also examined. A list of data and reference material that was used by the panel can be found in Appendix 5.

As part of this review, the Regional Panel revised the initial indicative classifications for water sources developed in 2006 through:

- the application of revised flow dependency data
- the application of updated 80th%ile flow volumes and Peak Daily Demand estimates
- the inclusion of additional threatened species and endangered ecological communities.

The finalised water source classifications (Appendix 6) were used to generate indicative access and trade rules which provided the basis for deliberations and the development of draft water sharing rules.

Refining the indicative rules

Guided by the indicative access and trade rules, the Regional Panel used local knowledge and expertise to develop the access and trade rules for the draft water sharing plan. Indicative rules were revised based on site specific considerations such as:

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

For example, water users in the Brunswick catchment have long recognised the need for a cease-to-pump and have willingly participated in water sharing arrangements since 2003. Consideration was also given to each of the estuaries in the plan area to see if any additional catchment-wide protection was required. The specific requirements of threatened species in relation to reproductive needs, migration or other particular ecological activities were considered where information was available.

Consultation and public exhibition

Targeted consultation on the proposed rules for the Brunswick River draft water sharing plan was undertaken in 2006. Using the feedback from this process to further refine the indicative access and trading rules, the Regional Panel prepared the draft Brunswick water sharing plan to be publicly exhibited.

Public exhibition is the formal exhibition of a draft water sharing plan where the Minister invites submissions on the draft plan and in particular seeks comment on a range of key issues

Public exhibition of the draft Brunswick water sharing plan was held from 16 February until 30 March 2015, with the plan documents available for viewing at NOW offices (Wollongbar and Murwillumbah) and Byron Shire Council (Mullumbimby).

Documents which formed part of the exhibited package encouraged stakeholders to provide:

- feedback on the practical elements of the proposed water sharing rules to ensure they are easily implemented by licence holders, including the suitability of the proposed water sources and management zones, flow reference points and access and trading rules where significant changes were proposed from current management.
- confirmation that there were no unintended outcomes from the plan
- specific comments on the Minister's notes included in the draft water sharing plan.

While no public meetings were held as part of the consultative process, all licensees were individually written to and individual appointments were offered.

One appointment was taken up, a number of telephone enquiries were made and no written submissions were received. Enquiries were general in nature and the minor comments made were reviewed by NOW. The Interagency Regional Panel (IRP) was advised that there were no changes to the draft WSP recommended.

The local Aboriginal community was consulted over a period time by officers of NOWs Aboriginal Water Initiative program.

Water sharing rules

The Brunswick River water sharing plan establishes a framework for water sharing that defines:

- planned environmental water to protect instream environmental values
- water that is required to meet BLR

- water that is required to meet licensed water extraction (including domestic and stock, local water utilities, unregulated river access licences and aquifer access licences)
- long-term extraction limits and available water determinations (AWDs) for each water source
- rules for granting access licences
- rules for water allocation account
- flow classes and daily access rules for managing licensed extraction from unregulated rivers and alluvial aquifers
- rules for water supply work approvals
- access licence dealing rules, which control the trade of water within or into other water sources.

The following section provides further background on each of these components, and outlines the information and methods used in developing the specific water sharing rules.

Planned environmental water

The water sharing plan identifies and protects water for environmental purposes in each water source. This is defined as 'planned environmental water' and consists of water that is remaining within the stream or aquifer after water has been taken for BLR and access licences in accordance with the rules of the plan.

In unregulated streams planned environmental water is generally delivered through two mechanisms:

- On a daily basis environmental water is protected through the implementation of cease-to-pump rules and total daily extraction limits which are applied to water access licences.
- On an annual basis environmental water is protected through the establishment of long term average annual extraction limits.

The Regional Panel set cease-to-pump rules for each water source in the Brunswick catchment which are discussed in the section on daily flow rules. For water sources where cease-to-pump rules could not be practically linked to a gauging station, the plan applies simple visual rules to protect environmental water such as a 'no visible flow' rule, and no pumping from instream or off-river pools when the pool is less than full capacity.

Requirements for water

The water sharing plan defines all of the licensed and unlicensed requirements for water within the Brunswick catchment.

Basic landholder rights (BLR), which comprises access to water for domestic and stock purposes and for native title rights, must be provided for and protected within a water sharing plan. The water sharing plan provides an estimate of the water requirements for domestic and stock rights within each water source. BLR requirements were estimated using the number of properties with river frontage in each water source, and estimated water usage based on property size, climatic region and land use.

At the start of the Brunswick water sharing plan:

- BLR were estimated at 300 ML per year
- domestic and stock access licences were estimated at 103 ML per year
- local water utility access licences were estimated at 0 ML per year
- unregulated river access licences were estimated at 2,437.5 ML per year
- aquifer access licences were estimated at 193 ML per year.

Managing extractions

The Brunswick water sharing plan establishes long term average annual extraction limits (LTAAELs) to manage extractions from surface water resources and alluvial groundwater in the EMU.

The LTAAEL for the Brunswick River EMU comprises:

- the number of share components in the Belongil Creek, Kings Creek, Lower Brunswick River, Lower Marshalls Creek, Mullumbimby Creek, Tallow Creek, Tyagarah Creek, Upper Brunswick River and Upper Marshalls Creek water sources at plan commencement (2,437.5 ML/yr), plus
- an estimate of BLR in these water sources (300.6 ML/yr), plus
- any share components granted in the water sources over the life of the plan under the *Water Management (General) Regulation 2011*.

At plan commencement, the LTAAEL for the Brunswick River EMU was 2,738.1 ML/yr. The LTAAEL for the Brunswick River Coastal Floodplain Alluvial Groundwater Source is 763 ML/yr.

The LTAAEL for the EMU incorporates an allowance to increase entitlement following conversion of low flow entitlement to high flow entitlement.

To protect water for the environment and the supply to existing users, it is important to control any growth in water use that is above the LTAAEL. For the Brunswick River EMU, a reduction in allocated water may be triggered if the average annual usage over any three year period exceeds the LTAAEL by more than five per cent. Reductions in allocation will be implemented by reducing the available water determination (AWD) which is the basis of crediting water into the water allocation account of each water access licence. The AWD for unregulated river access licences is set at 1 ML per unit share unless a reduction in allocation is required. If a reduction in allocation is required, the AWD for unregulated river access licences will be reduced to less than 1 ML per unit share in order to manage extractions.

Specific purpose access licences such as domestic and stock or local water utility access licences, will be permitted to extract 100% of their share component, except in years of exceptional drought. During periods of extremely low stream flow, daily access rules may limit extraction so that the full annual entitlement cannot be realised.

This approach to managing long term extractions in the Brunswick water sharing plan is the default position adopted for all unregulated rivers across the state.

Granting new access licences

Consistent with the WMA 2000, the Brunswick River water sharing plan does not permit the granting of new unregulated river access licences. Any new commercial development must purchase entitlement from existing access licences consistent with the dealing rules defined in the water sharing plan. The water sharing plan does however permit the granting of several other categories of access licence: Aboriginal community development, Aboriginal cultural, domestic and stock licences (only from tidal pools) and high flow only access licences.

Aboriginal community development access licences

Many of the rivers in NSW already have a high number of irrigation licences and are generally judged to be stressed, particularly during dry times when river flows are low. This effectively prevents the issuing of any new irrigation licences. However in some coastal rivers, higher and more reliable flows are common and provide an opportunity for licences to be granted for Aboriginal community development activities, provided this additional extraction would not negatively impact on ecological values.

In coastal catchments, Aboriginal community development licences[3] (ACDLs) may be granted which allow water to be pumped from rivers during the high flows and stored in farm dams or tanks, to be used as needed. For the purpose of issuing these licences, high flows are defined as those that are exceeded 50% of the time (the top half of the flow regime).

The North Coast Regional Panel recommended that no new licences be granted in water sources with high conservation value, or in areas that could not support high flow licences. On this basis, the Brunswick water sharing plan has made provision for the granting of ACDLs in the following water sources: Upper Brunswick River water source and the Brunswick River Coastal Floodplain Alluvial groundwater source.

Since granting ACDLs would mean less water remains in the river at these higher flows to meet other users' and environmental needs, it is necessary to limit the total volume that can be extracted for Aboriginal community development purposes. The water sharing plan allows ACDLs to be granted for a total of up to 102 ML/year in the Upper Brunswick River water source and 100 ML/yr in the Brunswick River Coastal Floodplain Alluvial groundwater source.

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

Aboriginal cultural access licences

Aboriginal cultural access licences of up to 10 ML per year may be granted to Aboriginal persons or Aboriginal communities for any personal, domestic or communal purpose such as drinking, washing, gardening, making traditional artefacts, or for recreation or ceremonial purposes. The water sharing plan allows for the granting of these licences in any water source.

High-flow-only access licences

Many of the coastal unregulated rivers within NSW have significant competition for water during dry periods. Therefore, there is merit in developing incentives that aim to move extraction out of the low flows and into the higher flows, to improve environmental conditions and reduce competition. To utilise higher flows, it is generally necessary to construct on-farm water storage. Water can then be pumped during periods of higher flow and stored for use at a later time, therefore enhancing security of supply.

The Brunswick River water sharing plan includes an incentive to allow those licences that are converted to high-flow-only access to be granted additional volumes of water. The plan states that for every unit of unregulated river access licence entitlement surrendered, 5 units of unregulated river (high flow) access licence entitlement will be granted. The high flow access commences at the 30th percentile (i.e. the flow that is exceeded on 30% of days).

State-wide guidelines recommend that high flow conversions only be adopted in specified water sources if:

- the water source is classified as having important instream values at high risk from extraction or in water sources having high hydrological stress
- there are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment

[3] These are a 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 permanently traded and as such will remain in the Aboriginal community for the life of the licence. These arrangements are currently being reviewed by the Office of Water.

- there is a no highly sensitive estuary or other identified high flow sensitive feature such as a wetland within the EMU
- there is no significant extraction already occurring in high flow periods

The Regional Panel considered these factors in relation to the Brunswick plan area and recommended that high flow conversions be made available in the following water sources:

- Kings Creek (37.4 unit shares, ie a cap of 187 ML),
- Mullumbimby Creek (59.4 unit shares, ie a cap of 297 ML) and
- Upper Brunswick River (88 unit shares, ie a cap of 440 ML).

Water allocation accounts

Water usage by individual licence holders is managed through water allocation accounts. Water is credited to the account when an AWD is made (at the start of the water year), and debited as water is extracted throughout the water year. A licence holder's account is not permitted to go into debit.

Unregulated rivers have enormous variation in annual flow volumes between years. It is important to allow this variability to be reflected in water accounting practices. Unused water allocation may be carried over from one water year to the next. The maximum amount that may be carried over in unregulated river access licence accounts is 100% of the share component, where share component is expressed in megalitres; or 1 ML per unit share, where share component is expressed in unit shares.

Unregulated river access licence accounts are managed under three-year accounting rules, subject to compliance with the daily access rules. AWDs combined with any carryover allowance will enable licence holders to use up to twice their water allocation in a year provided that over a consecutive three year period they do not exceed the sum of their water allocations for those three years.

An example of three year accounting for an unregulated river access licence holder with a share component of 50 shares is shown in Table 5.

Table 5 Example of unregulated river access licence accounting rules for a licence with 50 unit shares

Year	Balance brought forward (ML)	AWD (ML/unit share)	Account balance after AWD credited (ML)	Usage (ML)	Account balance at end of year (ML)	Water Carried Over to next year (ML)
1	0	2	100 ML	0	100	*50
2	50	1	100 ML	50	50	50
3	50	1	100 ML	**100	0	0
4	0	1	50 ML	***0	50	50

* Only 50 ML can be carried over as carryover is limited to 1 ML/unit share. The remaining 50 ML is forfeited
** 100 ML is the maximum that can be extracted in this year, that is, twice the unit shares for the year
*** Although with the AWD there is 50 ML in the account, no water is available for extraction as the maximum extraction over three years is the sum of AWDs in those 3 years which in this example is 150 ML and this was extracted in year 2 and 3 so no extraction can occur in year 4

Final water access rules

Following public exhibition and consideration of the issues raised during public exhibition, the water sharing rules were finalised. The final water access rules including flow classes, cease-to-pump rules adopted by the Regional Panel are summarised in Table 6.

For some water sources, the Regional Panel recommended that cease-to-pump rules be implemented incrementally to provide water users time to adapt to the new rules.

In water sources where the existing cease-to-pump rule under the *Water Act 1912* was more stringent than the proposed rule, the existing access rule was generally adopted. This was based on the premise that with no change to current operations there should be no adverse social or economic impact. In these circumstances the Regional Panel acknowledged that many of the existing cease-to-pump rules had been negotiated by water users or stipulated as outcomes of Rural Land Board hearings, had been in place for a period of time; and seemed to be adequately protecting values while providing certainty for water users.

This information may also be found on individual rule summary sheets for the Brunswick catchment that are available on the Office of Water's website www.water.nsw.gov.au. These rules were developed using the risk and value assessment, a wide range of resources, targeted consultation and public exhibition.

Table 6: Summary of access rules for the Brunswick River water sharing plan

Water source	Flow classes	Access rules	Flow reference point
Upper Brunswick River	Very low flow ≤ 2 ML/d A Class = 2 - 7 ML/d B Class = 7 - 11 ML/d C Class (high flow) > 11 ML/d	Cease-to-pump at 2 ML/d Commence-to-pump when flows have exceeded 4 ML/d over a 24 hour period Pumping is restricted to a maximum of six hours per day between 18:00 and 8:00 when flows are less than 4 ML/d	202001
Kings Creek Mullumbimby Creek	Very Low Flow ≤2 ML/d A Class = 2 - 11 ML/d C Class (high flow) > 11 ML/d	Cease-to-pump at 2 ML/d Pumping is restricted to a maximum of six hours per day between 18:00 and 8:00 when flows are less than 4 ML/d	202001
Lower Marshalls Creek	Very Low Flow = No visible flow A Class = Visible flow	Cease-to-pump when there is no visible flow at the reference point	Tweed Valley Way crossing of Yelgun Creek
Tyagarah Creek	Very Low Flow = No visible flow A Class = Visible flow	Cease-to-pump when there is no visible flow at the reference point	Pacific Highway crossing of Tyagarah Creek
Upper Marshalls Creek	Very Low Flow = No visible flow A Class = Visible flow	Cease-to-pump when there is no visible flow at the reference point	Walkers Lane crossing of Upper Marshalls Creek
Belongil Creek, Lower Brunswick River Tallow Creek	No flow classes defined	Licence holders are not permitted to take water when there is no visible flow at the pump site, or where water is being taken from a pool, when the volume of water in that pool is less than the full capacity of the pool.	Pump site or the outflow of the pool from which water is taken

Access to very low flow

Those activities that are considered critical human needs or animal health requirements are permitted to access very low streamflows, that is, flows below the cease-to-pump. Licences with access to very low flows are listed in Schedule 2 of the plan. They include the taking of water for:

- domestic supply

- town water supply, until major augmentation of the scheme infrastructure occurs
- fruit washing
- cleaning of dairy plant and processing equipment for the purpose of hygiene
- poultry washing and misting
- cleaning of enclosures used for intensive animal production for the purposes of hygiene.

Total daily extraction limits

One of the plan's main objectives is to share water between users during low flows. This objective is achieved through the use of total daily extraction limits (TDELs). A TDEL is the total volume of water that may be extracted daily under access licences from an unregulated river in a particular flow class. TDELs are used where peak daily demands exceed supply and a cease-to-pump rule alone is not sufficient to ensure an adequate environmental share of the water within that flow class.

Daily extraction limits are calculated based on a policy method developed by the Office of Water that assigns a proportion of extraction from the upper limit of each flow class. Full details of this policy can be found in the document *Advice to Water Management Committees. No. 6 Daily extraction management in unregulated rivers* which is available on the Office of Water website www.water.nsw.gov.au

Under this policy, daily extraction limits should generally be set at less than 30% of the flow threshold. However where demands for extraction are already very high and the economic impact of a significant reduction in access would be high, the volumes may be set at up to a maximum of 60 per cent of the upper limit of the flow class.

The application of daily extraction limits is however dependent on the existence of a comprehensive gauging network and the use of water meters. While this infrastructure is not currently in place within the Brunswick Catchment water sources, the plan allows for TDELs to be established in these water sources at a later date, if required.

Alluvial licences

Following advice provided by NOWs hydrogeologists, the Regional Panel agreed that the connectivity between groundwater and surface water within a 40 metre wide buffer zone along the river from the high bank was minimal. Accordingly it was considered unnecessary to impose access management rules on the few alluvial licences for existing bores located within this buffer zone

The exceptions are also provided for access licences for stock and domestic, local water utility, food safety or essential dairy care purposes. However at some future time, alluvial bores may be subject to local impact rules, which are developed to address local groundwater issues, and are implemented through Ministerial Orders.

Water supply works approvals

Construction of dams

Consistent with state-wide policy, the Brunswick River water sharing plan prohibits the construction of instream dams in the following water sources which have been assessed to have high instream values: Belongil Creek, Lower Brunswick River, Lower Marshalls Creek, Tallow Creek and Tyagarah Creek.

Construction of bores in alluvial aquifers

The Brunswick water sharing plan sets the distances that new bores may be permitted to be constructed from streams, other bores, GDEs and cultural sites. These distance rules were set based on the following state-wide recommendations prepared by the State Groundwater Panel.

The plan prohibits new bores within 40 metres of a third order stream or higher, except for bores that:

- are the result of a conversion from an unregulated river access licence, or
- are drilled into the underlying non-alluvial material, and the slotted intervals of the production bore commence deeper than 30 metres, or
- the applicant can demonstrate that the bore will have minimal impact on base flows in the stream.

In relation to distances from other bores, new groundwater bores are not permitted within:

- 100 metres of an approved water supply bore nominated by another access licence
- 100 metres of an approved water supply bore from which BLR is being extracted
- 50 metres from the property boundary unless the owner of the adjacent property consents in writing
- 500 metres from an approved water supply bore that is used by a local water utility or major water utility
- 100 metres from a Department observation or monitoring bore

These restrictions do not apply if the new bore is solely for accessing BLR, or is replacing an existing groundwater bore or is for the purpose of monitoring or environmental management. The Regional Panel recommended that new bores may be permitted closer than the minimum distances if a hydrologic assessment is undertaken and can demonstrate that the impacts of extraction will be minimal.

The water sharing plan specifies rules for new bores located near high priority GDEs and culturally significant groundwater dependent sites. At the start of the plan there was only one high priority GDE specified and no cultural sites. Should other GDEs or cultural sites be identified during the life of the plan, the plan rules state that no new works will be approved within 100 metres of either type of site for bores that supply BLR, and within 200 metres for any new water access licences.

Dealing rules

The objective of dealing rules (trading rules) is to allow the development of a water market whilst recognising and protecting the needs of the environment and third party interests. The NWI has established guidelines for water trading. Trading of water entitlement within the water sharing plan area needs to maximise the flexibility for users to be able to use water to its highest value without having an adverse impact on water sources or existing water users.

The water sharing plan details the trading rules for the Brunswick as shown in Table 7 below.

Table 7: Summary of water dealing rules

Water source	Dealing rule	Justification
Belongil Creek	Trade into water source not permitted	There are no surface water licences and no areas of upriver alluvial within the water source
Kings Creek	Trade into water source permitted from Mullumbimby Creek, Tyagarah Creek and Upper Brunswick River Water Sources only, subject to a maximum water source entitlement of 50% of the 80th percentile (70 ML)	Medium hydrologic stress

Water source	Dealing rule	Justification
Lower Brunswick River	Trade into water source permitted from Kings Creek, Mullumbimby Creek and Upper Brunswick River Water Sources only, subject to mandatory conditions regarding impact on freshwater wetlands mapped under *State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14)*	Medium sensitivity of the estuary to both low and high flow inflows and the high environmental value of the wetlands
Lower Marshalls Creek	Trade into water source permitted from Upper Marshalls Creek Water Sources only, subject to a mandatory condition regarding impact on freshwater wetlands mapped under SEPP 14	Medium sensitivity of the estuary to both low flow and high flow inflows, the high hydro stress rating, the presence of extensive downstream wetlands and the absence of any gauging station
Mullumbimby Creek	Trade into water source permitted from Kings Creek and Upper Brunswick River Water Sources only, subject to no net gain above total licenced entitlement in the water source at the Plan's commencement	To limit adverse impact on the Stuttering Frog
Tallow Creek	Trade into water source not permitted	High sensitivity of the estuary to both low flow and high flow inflows
Tyagarah Creek	Trade into water source not permitted	High hydrologic stress of the waterway
Upper Brunswick River	Trade into water source permitted from Kings Creek and Mullumbimby Creek Water Sources only, subject to no net gain above water source entitlement at the Plan's commencement	High hydrologic stress
Upper Marshalls Creek	Trade into water source permitted subject to no net gain above total licenced entitlement in the water source at the Plan's commencement	High hydrologic stress of the waterway

Alluvial groundwater licences:

- are subject to the same dealing rules as surface water licences, i.e. not permitted to be traded into areas with high instream values or high hydrological stress
- may be traded between alluvial aquifers, subject to assessment
- are not permitted to be converted to surface water licences

Surface water licences are permitted to be converted to alluvial groundwater licences, subject to assessment.

Adaptive management

Adaptive management refers to the practice of change in response to new information such as monitoring or some other improvement in understanding. In the case of water sharing plans, such information could include socio-economic studies, hydrological modelling, ecological studies and information about Aboriginal cultural values.

Adaptive management is a requirement of both the WMA 2000 and the NWI, and has been allowed for during the life of the Brunswick River water sharing plan through the inclusion of amendment provisions. These provisions allow some aspects of the water sharing plan to be changed within defined limits. Specific amendment provisions in the Brunswick water sharing plan are discussed below. Following this is a discussion about monitoring, evaluation and reporting which are key activities for the adaptive management of water sharing plans.

Amendment provisions

The Brunswick River water sharing plan includes a number of specified amendments that may be made to the plan during its 10 year period of operation. Standard amendments that apply to all water sharing plans include:

- amending water sources, management zones or EMUs
- establishing new or additional flow classes in any water source where management zones are added or amended
- amending water sources for which dams on third order streams or higher will not be granted
- amending requirements for metering or record keeping in relation to licensed access works
- updating information in Schedules or deleting them if no longer required.

The final Brunswick water sharing plan also includes the following amendment that is specific to the Brunswick catchment.

- **Flow classes for Tyagarah Creek Water Source**

  The Plan contains an amendment provision that allows the establishment of new or additional flow classes in the Tyagarah Creek Water Source to approximate a cease-to-pump condition at a newly installed gauge once adequate flow reference information has been gathered, that will be equivalent to the 95th percentile at the newly installed gauge.

Monitoring, evaluation and reporting

The Office of Water has developed a Monitoring, Evaluation and Reporting Framework in collaboration with key stakeholders. The framework conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates an adaptive management approach to water planning required under the principles of the WMA 2000. The evaluation framework aims to inform the community of the outcomes of water sharing plans, and to collate the results of various legislatively required evaluations and relevant knowledge to inform the review of the water sharing plans. The framework will assess the inputs, outputs and outcomes of the water sharing plans and their operations. The assessment will consider:

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

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

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

Performance indicators

Part 2 of the water sharing plan includes a number of standard performance indicators that will be monitored over the life of the water sharing plan. It is not practical to monitor all issues in all water sources. The performance indicators identify that monitoring will be undertaken for specific issues in key water sources. The actual procedure for monitoring each indicator may change over the period of the water sharing plan as improved methods are developed.

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

Audit

The WMA 2000 requires that water sharing plans be audited regularly, at intervals of not more than five years, to determine whether the provisions of the plan are being implemented. Under section 44 of the Act the Minister for Natural Resources, Lands and Water must appoint an Audit Panel to undertake this review.

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

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

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

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

Plan review

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

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

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

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

Glossary

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

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

Alluvial, alluvium: Sediment deposited by a stream of running water, in particular along riverbeds or floodplains.

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

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

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

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

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

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

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

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

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

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

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

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

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

Full capacity: The volume of water that is impounded in the pool, lagoon or lake when the level of water in the pool, lagoon or lake is at the highest water level where there is no visible flow out of that pool.

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

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

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

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

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

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

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

Pools: Lentic water bodies (standing water), including anything falling within the definition of a "lake" found in the Dictionary of the WM Act, except for tidal pools and estuaries.

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

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

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

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

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

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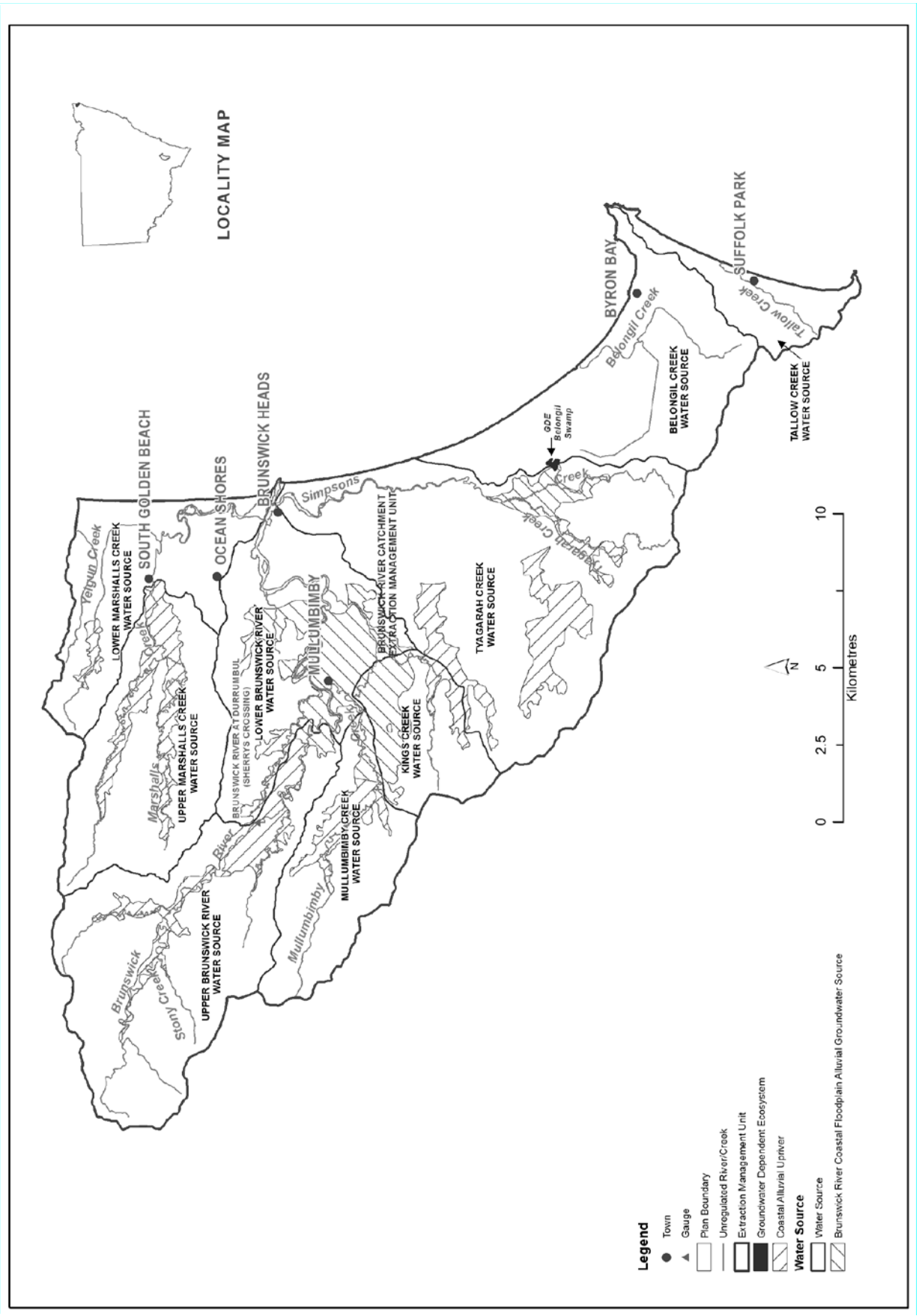
Appendix 1

Water sharing plan map



Appendix 2

Water management units established by the Brunswick water sharing plan

Brunswick Unregulated and Upriver Alluvial Water Sources
Brunswick Catchment Extraction Management Unit
Belongil Creek Water Source Kings Creek Water Source Lower Brunswick River Water Source Lower Marshalls Creek Water Source Mullumbimby Creek Water Source Tallow Creek Water Source Tyagarah Creek Water Source Upper Brunswick River Water Source Upper Marshalls Creek Water Source
Other
Brunswick River Coastal Floodplain Alluvial

Appendix 3

Identified threatened species

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

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

Table 8 shows details on the presence of threatened species in each water source according to the following coding.

Scoring for fish: 0 = none present, 1 = present but not key location, 2 = present and key location

Scoring for others: 0 = species not known or modelled to be present, 1 = species modelled to be present, 2 = species known to be present

Table 8: Threatened species and other environmental values known or expected to occur in the Brunswick catchment water sources

	Belongil Creek	Kings Creek	Lower Brunswick River	Lower Marshalls Creek	Mullumbimby Creek	Tallow Creek	Tyagarah Creek	Upper Brunswick River	Upper Marshalls Creek
Threatened fish species									
Oxleyan pygmy perch	1	0	1	1	0	1	1	0	0
Eastern cod	0	0	0	0	0	0	0	0	0
Purple spotted gudgeon	1	1	0	1	1	0	1	1	1
Threatened frog species									
Fleay's Barred Frog	0	0	0	0	0	0	0	0	0
Giant Barred Frog	0	1	0	0	2	0	0	2	2
Green and Golden Bell Frog	2	0	0	1	0	2	1	0	0
Green-thighed Frog	0	0	0	0	1	1	0	1	1
Loveridge's Frog	0	0	0	0	1	0	0	1	1
Olongburra Frog	2	0	2	1	0	2	1	0	0
Pouched Frog	0	1	0	0	1	0	0	1	1
Stuttering Frog	0	0	0	0	1	0	0	1	0
Tusked Frog	0	0	0	0	0	0	0	0	0
Wallum Froglet	2	1	2	1	0	2	1	0	0
Threatened bird species									
Beach Stone-curlew	0	0	0	0	0	0	0	0	0
Black Bittern**	2	1	2	2	2	2	1	1	1
Black-necked Stork**	2	1	2	2	1	1	2	2	1

	Belongil Creek	Kings Creek	Lower Brunswick River	Lower Marshalls Creek	Mullumbimby Creek	Tallow Creek	Tyagarah Creek	Upper Brunswick River	Upper Marshalls Creek
Brolga	2	0	0	2	0	0	0	0	0
Comb-crested Jacana	2	0	2	0	0	0	0	0	0
Mangrove Honeyeater**	0	0	0	0	0	0	0	0	0
Osprey**	0	0	0	0	0	0	0	0	0
Australasian Bittern	0	2	2	0	0	2	0	0	0
Threatened mammal species									
Large-footed Myotis	2	0	2	2	2	2	0	0	0
Threatened wet flora									
Austromyrtus fragrantissima	0	2	2	0	2	0	2	2	2
Ball Nut	2	2	2	0	2	2	2	2	2
Diploglottis campbellii	0	0	0	0	2	0	2	0	2
Phaius australis	2	0	2	0	0	2	0	0	0
Phyllanthus microcladus	0	0	0	0	2	0	0	2	0
Thorny Pea	2	0	0	0	0	0	0	0	0
Endangered ecological communities									
Freshwater wetlands on coastal floodplains	2	2	2	2	2	2	2	2	2
Swamp sclerophyl forest on coastal floodplains	2	2	2	2	2	2	2	2	2
Declared locations									
SEPP wetlands	2	0	2	2	0	2	2	0	0
RAMSAR	0	0	0	1	0	0	0	0	0

Disclaimer:

The Office of Environment and Heritage (OEH) 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. Regional Panels considered a range of information and used local knowledge in determining a final classification. The assessments are not absolute – for example the absence of threatened species for an assessment does not necessarily mean the threatened species are not present.

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

Appendix 4

Interagency Reference Panel and support staff

Table 9: North Coast Regional Panel-membership and expertise

Name	Agency	Role	Expertise
Dave Miller	Office of Water	Agency Representative	Water planning/administration/policy. Geomorphology. Riparian management. Stream ecology/restoration.
Rik Whitehead	DPI-Agriculture	Agency Representative	Regional experience in NRM management, coastal agricultural industries, catchment management and interagency coordination.
Marcus Riches	DPI-Fisheries	Agency Representative	Regional experience in NRM management, catchment planning, fisheries management and interagency coordination
Toong Chin	OEH	Agency Representative	Regional experience in NRM management, floodplain planning and interagency coordination.

Table 10: Support staff membership and expertise

Name	Agency	Role	Expertise
Tim Rabbidge	Office of Water	Plan coordinator	Water policy and planning, plan development and implementation, facilitation and project management.
Peter Hackett		Technical Support (SW licensing)	Licensing officer, local knowledge of water users, local access arrangements and reference points.
Chris Rumpf		Technical Support (GW licensing)	Licensing officer, local knowledge of water users, local access arrangements and reference points.

Appendix 5

Reference information used by Interagency Reference Panel

Office of Water data sets

- Licensing Administrator System – the Office of Water state-wide database holding the licence details including volume of entitlement, location details and stream orders.
- Hydstra – Hydstra is an Office of Water state-wide database that holds all flow record data.
- 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 – used to help determine the Peak Daily Demand for each water source.
- Regional Geographic Information Systems – the Office of Water land use and topographic information

Other data sets

- Stressed rivers reports – used as the basis for identifying where there are instream barriers.
- Threatened species (fish) –NSW Government databases.
- Threatened species (other) – NSW Government databases.
- Index of Social Disadvantage – Australian Bureau of Statistics.
- Employment in Agriculture - Australian Bureau of Statistics

Other agency data

- National Parks and Wildlife (OEH) Wildlife Atlas – state-wide flora and fauna database
- NSW Fisheries (NSW DPI) modelled data sets (Fish Community Index, Fish Community Vulnerability).
- NSW Fisheries (NSW DPI) freshwater and saltwater recreational fishing database.

Appendix 6

Final classification summary

Table 11: Value matrix used to determine indicative dealing rules

	Low hydrologic stress or hydrologic risk	Medium hydrologic stress or hydrologic risk	High hydrologic stress or hydrologic risk
High Instream Values	**a** Belongil Creek Lower Brunswick River Lower Marshalls Creek Tallow Creek	**b**	**c** Tyagarah Creek
Medium Instream Values	**d**	**e** Kings Creek Mullumbimby Creek	**f** Upper Brunswick River Upper Marshalls Creek
Low Instream Values	**g**	**h**	**i**

Table 12: Risk matrix used to determine indicative access rules

	Low dependence on extraction	Medium dependence on extraction	High dependence on extraction
High Risk to Instream Values	**A**	**B**	**C** Tyagarah Creek
Medium Risk to Instream Values	**D**	**E**	**F** Upper Brunswick River
Low Risk to Instream Values	**G** Belongil Creek Lower Brunswick River Tallow Creek	**H**	**I** Kings Creek Lower Marshalls Creek Mullumbimby Creek Upper Marshalls Creek