



Department of
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Water sharing plan for the Belubula Regulated River Water Source

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*. 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 by separating water licences from land tenure. In July 2004, 31 plans commenced in NSW, bringing these water sources and some 80 per cent of water extracted in NSW under the management and licensing provisions of the *Water Management Act 2000*.

More recently, water sharing plans for the unregulated¹ rivers and groundwater systems have been completed using a 'macro' or broader-scale river catchment or aquifer² system approach called the macro planning process. Over 95 per cent of the water extracted in NSW is now covered by the *Water Management Act 2000*.

The *Water Sharing Plan for the Belubula Regulated River Water Source* (the Belubula Regulated Plan) covers the regulated Belubula River downstream of Carcoar Dam (refer to Appendix 1).

This document provides background to the development of the rules in the plan and includes:

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

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

- the *Water Sharing Plan for the Belubula Regulated River Water Source* - a legal instrument written in its required statutory format
- rules summary sheet for the water source detailing the proposed management rules.
- *Water sharing plans – Belubula Regulated River Water Source – Overview* – a plain English version of the plan explaining the key sections and 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.

² An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted.

Purpose of the plan

Why are water sharing plans being prepared?

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

In December 2000, the NSW parliament passed the *Water Management Act 2000* (the Act) which sets the overall objective of “sustainable and integrated management of the State’s water” (DLWC, 2001). Water sharing plans play a major role in achieving this objective.

Under the Act, water sharing plans must:

- protect water sources and their dependent ecosystems
- protect the basic rights of landholders to extract water.

In effect, environmental water and basic landholder rights are afforded priority over licensed water extractions.

Amongst licensed water users, access to town water supplies and stock and domestic water is given priority over extractions for commercial purposes such as irrigation and other industries. Water sharing plans provide the legal basis for sharing water between the environment and consumptive purposes.

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

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

Benefits for water users

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

- greater certainty – water sharing plans set out the water sharing arrangements for a 10 year period
- clear trading and access rules which will help foster trading
- greater security – *Water Act 1912* licences are converted to perpetual water access licences under the *Water Management Act 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.

Rivers naturally experience a range of flows. These various flows 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 fauna and flora. To preserve a healthy river ecosystem, this range of stream flows must be maintained.

In order to protect a proportion of low flows for the benefit of the environment, the Belubula Regulated Plan imposes a minimum end of system flow which must be maintained at all times.

In addition, a 'commence/cease to pump' rule is applied to the taking of water from uncontrolled flows when dam levels are low, to ensure that freshes (medium stream flow events) are available to the environment. The commence/cease to pump rule requires users to only commence taking unregulated water once flow is above a specified level.

Scope of the Plan

The Belubula Regulated Plan covers the Belubula Regulated River Water Source, which falls within the Lachlan Water Management Area. The Belubula Regulated River Water Source covers the Belubula River from Carcoar Dam to the confluence with the regulated Lachlan River and is located within the Murray-Darling Basin.

Other water sources in the Lachlan Water Management Area are covered by separate water sharing plans, including the:

- *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources*
- *Water Sharing Plan for the Lachlan Regulated River Water Source*
- *Water Sharing Plan for the Mandagery Creek Water Source*
- *Water Sharing Plan for the Lower Lachlan Alluvial Groundwater Source*
- *Water Sharing Plan for the Murray-Darling Basin Fractured Rock Groundwater Sources*
- *Water Sharing Plan for the Murray-Darling Basin Porous Rock Groundwater Sources*

Description of the plan area

The area covered by the Belubula Regulated Plan (refer to Appendix 1) comprises the regulated Belubula River which is situated within the Lachlan River catchment and has a total length of approximately 165 kilometres. The plan area is located in the central west of NSW and is situated close to the towns of Carcoar and Canowindra.

The regulated river stems from Lake Carcoar above Carcoar Dam, six kilometres upstream from the township of Carcoar and continues downstream to the junction with the regulated Lachlan River. There is also a small length of the Belubula River upstream of Carcoar Lake which is unregulated and therefore not within the plan area.

The major unregulated tributaries flowing into the regulated Belubula River include Candomine Creek, Cadiangullong Creek, Flyers Creek, Cowriga Creek, Coombing Creek, Mandurama Ponds, Limestone Creek, Licking Hole Creek and Jacks Creek. It is important to note that these tributaries are managed under the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012* and not the Belubula Regulated Plan.

The Belubula River is regulated through releases from Carcoar Dam. The storage capacity of the dam is 35,800 ML and has a small catchment area of 230 kilometres squared (State Water Corporation n.d.). Given this small catchment area, water levels in the dam readily fall during dry periods.

Carcoar Dam was built on the Belubula River in 1969/1970 for the purposes of providing a regular supply of water for irrigation and stock and domestic use and is currently operated by State Water Corporation (State Water Corporation n.d.).

Only ten per cent of total annual flow in the river comes from dam releases, the remaining 90 per cent is derived from inflows from unregulated tributaries. The annual average flow in the river is 174 GL where daily flows can range between 0 and 5.5 GL.

Due to the high connectivity between the regulated Belubula River and the adjoining alluvial aquifer which is located in the downstream half of the system, flow from the river into the alluvial aquifer is well recognised. The most recent study undertaken on this groundwater/surface water connectivity in the Belubula suggests that it could be as great as 90 per cent (SKM, 2012). Data from stream flow gauging along the regulated Belubula River indicates overall a gain in flow upstream of Canowindra and a loss in flow downstream of Canowindra (Kolstad, 2009).

Research has shown that loss of surface flow into the adjoining aquifer is linked to groundwater extraction (SKM, 2010 and 2012). Although the impact on total annual flows is low, there is a significant impact on streamflow during periods of low flow in the dry season (SKM 2012). It is suggested that this could result in an increase in the number of days that the river experiences low flows (SKM 2012).

High environmental value areas

Little information is available on the ecological features of the regulated Belubula River. A number of threatened or endangered species have been recorded or are predicted to occur in the river (refer to Appendix 2). The listed flora and fauna are sensitive to extraction; some of which are highly sensitive to extraction. Historically Cod, Macquarie Perch, Golden Perch and Blackfish have been found in the Belubula River (MDBA and Trueman, 2012).

In the lower reaches of the river, downstream of Canowindra, there are few wetland features (e.g. billabongs) which are generally in poor health (Driver pers. comm.).

Land use history

Prior to European settlement in the 1800s, the Wiradjuri people predominately occupied the Lachlan catchment area however the area was also shared with nine other nations including Dhurug, Ngunawal, Gundungurra, Wongaibon, Barindji, Yitha Yitha, Muthi Muthi and Nari Nari (Lachlan CMA, 2006).

In 1815, surveyor George Evans explored west into the Eugowra district and the Lachlan River. During this trip he passed near modern Blayney which lies at the headwaters of the Belubula River (LPMA 2011). The township of Carcoar, situated on the Belubula River, is the third oldest settlement west of the Blue Mountains (Central NSW Museums, 2010). During the 1830s European settlement moved west from the coast following fertile land along the inland rivers (AboutNSW, 2008a).

Although European settlement began around 1815, the population increased substantially following the discovery of gold in the 1850s (Lachlan CMA, 2006). With this, inland NSW held some of the most densely populated areas in the state.

The first lucerne crop was grown around Canowindra in 1863 and became a vital crop during the 1950s (SMH, 2008). Today many industries flourish on the Belubula River including lucerne, wheat, wool, fat lambs, vines and vegetables. Favourable aspects such as a good climate for growing produce, the presence of local processors in the region, access to the Sydney markets and supplies of irrigation waters make the area favorable to agriculture (DPI, 2005).

Clearing has also made way for urban development, which is now scattered across the catchment. Today approximately 1700 people live in Canowindra (SMH 2008) and 500 people in Carcoar (AboutNSW, 2008b). Both of these towns are situated on the Belubula River.

Mining is the other key landuse that impacts on the plan area with in the area with Cadia Valley Operations one of Australia's largest gold mines utilising water from the regulated Belubula River. The mine has significant water demands for processing and the regulated Belubula River is one of several water sources used to satisfy these requirements. The mine provides a significant socioeconomic contribution to the region.

Climate

Summer in the catchment is hot, with mean maximum temperatures in January at Canowindra 34°C (BOM 2011). Winter is cool to mild with the mean maximum temperature in July at Canowindra 15°C and the mean minimum temperature 1.6°C (BOM, 2011). Frosts are also common in winter (CSIRO 2007).

The mean average rainfall for Canowindra is around 600 mm, 790 mm further upstream at Mandurama and in the headwaters 805 mm at Blayney (BOM, 2011). Although rain falls throughout the year, it is slightly higher during the summer months.

Entitlement and use

There are approximately 114 water access licences in the area covered by the plan, totaling 27,219 ML of entitlement. This entitlement represents approximately 15 per cent of the mean annual flow. Most of the licences are located in the lower half of the system between the Lyndon gauge and Helensholme gauge at the end of the system.

There has been an embargo on granting new surface water licences across NSW, with the embargo applied to the regulated Belubula River in 1982.

Table 1 shows the total entitlement for each licence category in the regulated Belubula River and the number of licences in each category.

Table 1 Total entitlement and number of licences for each water source (approximate)

Access Licence Type	Entitlement (shares)	Number of licences
High Security	1,095	7
Stock and Domestic	233	33
General Security	22,766	73
Supplementary Water	3,125	1

The majority of licences are used for irrigation, with a significant proportion also used for mining. Irrigation water is applied primarily to grapes and lucerne. In 2006 grapes were the main crop (NSW Office of Water, 2012) however more recently there has been a conversion from grapes to lucerne production (Sritharin pers. comm.).

One of Australia's largest gold mine Cadia Valley Operations (CVO), extracts water from the regulated Belubula River. The river is one of several water sources used by CVO for their operations.

There are no licences on the regulated Belubula River for the purposes of town water supply but water is extracted for stock and domestic use through basic landholder rights (not requiring a licence).

Metering data indicates that the current usage rates are well below full development and vary significantly from year to year. Between years 1997/1998 and 2009/2010 the average annual usage was 3,400 ML per year with maximum usage occurring in 2002/2003 at 12,168 ML. This high variability results from a combination of changes including changes in commodity production (move from grapes to lucerne), availability of inactive entitlement, and variations in rainfall.

Pre-plan operational rules

A number of water sharing rules were in place prior to the commencement of the Belubula Regulated Plan. These rules include:

- *Accounting* - Annual accounting for all licences types
- *Account limit* - 200 per cent account limit for general security licences
- *Carryover* - permitted but does not apply to sleeper licences or high security licences
 - is forfeited if not used in the first year
 - can be traded
 - these rules did not apply during the recent drought
- *End of system flow* - minimum 10 ML/day to be maintained at the Helensholme gauge to provide for stock and domestic rights and ensure an end of system flow. Did not apply during recent drought.
- *Minimum flow release* – 2 ML/d to provide for stock and domestic requirements directly downstream of the dam.
- *Off-allocation flows* - access only available for general security licence holders
 - can access up to 20 per cent of their entitlement
 - can extract water when flow at Helensholme gauge is >10 ML/day

- can extract water when the effective available water³ is < 20 per cent
- water extracted from off-allocation flows is debited against any future increases in announced general security allocations in the same water year
- *Trading*
 - temporary transfers limited to 100 per cent of the transferee's entitlement
 - no transfers permitted for unembargoed purposes such as stock and domestic and town water supply
 - temporary trading permitted for more than 5 years if a property management plan has been approved
 - no conversion of licences from general security to high security
 - these rules applied prior to the drought

Access to off-allocation flows was introduced during the drought (2006) when there was little or no water available in the dam for general security licence holders. This allowed water users access to tributary inflows which were available at times in the system.

³ Effective available water is the sum of total water available for take in accounts (including carryover and allocations) as a percentage of total general security entitlement.

Interagency panels

The Office of Water is responsible for implementing the *Water Management Act 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 the preparation of water sharing plans, including the State Interagency Panel and the Interagency Regional Panels.

State Interagency Panel

The State Interagency Panel (SIP) has overall responsibility for the statewide strategic direction of water sharing planning, 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 SIP also has the role of making water sharing decisions in cases where the Interagency Regional Panel (IRP) cannot reach agreement or where the issue has statewide significance.

The SIP is chaired by the Office of Water and comprises representatives from the Office of Water, the NSW Office of Environment and Heritage (OEH), catchment management authorities (CMAs), 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

Interagency Regional Panels (IRP) were established to develop water sharing plans. The IRP consists of two representatives from Department of Primary Industries (DPI): one from the Office of Water and another DPI representative covering both agricultural and fisheries interest, and one representative from OEH.

A representative from the relevant CMA(s) will also attend meetings (as an observer) so that they can provide advice on consultation issues and other matters within their areas of expertise.

The key responsibilities of the IRP are to:

- consider relevant policy matters and ensure water sharing rules are consistent with state policy
- review the hydrological (water management) units provided by the Office of Water
- review existing and generic water sharing rules as to their applicability⁴
- make recommendations on the water access and dealing (trading) rules for each water source
- assist the CMA 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 IRPs used local knowledge and expertise in developing and recommending the water sharing rules through a consensus decision-making approach.

Appendix 3 lists the names of representatives on the Belubula IRP and their areas of expertise, and also lists their colleagues who they had access to for specific technical and scientific information.

⁴ This includes reviewing water access conditions imposed on users through announcements or orders under the *Water Act 1912* during low flow conditions.

Policy framework

There are a number of legislative and policy documents that impact on and direct the development of water sharing plans. These include:

- National Water Initiative
- *Water Management Act 2000*
- *Access Licence Dealing Principles Order 2004*
- Murray Darling Basin Cap Agreement
- The Basin Plan (*Commonwealth Water Act 2007*)
- Natural Resource Commission's statewide targets
- Lachlan Catchment Action Plan

National Water Initiative

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

The NWI sets out guidelines, outcomes and timelines for water plans and planning processes. The National Water Commission is an independent statutory body responsible for providing advice to COAG on the implementation of the NWI and national water issues and undertakes a biennial assessment of each state's progress with implementing the NWI for this purpose.

Water Management Act 2000

The object of the *Water Management Act 2000* (the Act) is the sustainable and integrated management of the state's water for the benefit of both present and future generations.

The Act was passed by the NSW Parliament in December 2000, establishing a complete new statutory framework for managing water in NSW. For the first time, NSW had a comprehensive water legislation to guide water management activities.

The Act is based on the concept of ecologically sustainable development – development today that will not threaten the ability of future generations to meet their needs.

The Act was driven by the need for NSW to secure a sustainable basis for water management for several reasons.

During the 1990s NSW was at the limits of its available water resources – new licences for commercial purposes could no longer be issued across most of NSW and a limit had been placed on the total volume of water that can be extracted across the inland of NSW under the Murray–Darling Basin Cap

The decline in the health of our rivers, groundwater, floodplains and estuaries was being seen through increasing water quality problems, loss of species, wetland decline and habitat loss. As a result, the Act recognises the need to allocate and provide 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 licences from land. The main tool

the Act provides for managing the State's water resources are water sharing plans. These are used to set out the rules for the sharing of water in a particular water source between water users and the environment and rules for the trading of water in a particular water source.

Because of the major changes required by the legislation, the Act has been progressively implemented. Since 1 July 2004 the new licensing and approvals system has been in effect in those areas of NSW covered by operational water sharing plans – these areas cover most of the State's major regulated river systems and therefore the largest areas of water extraction. As water sharing plans are finalised and commenced for the rest of the state, the licensing provisions of the Act are introduced extending the benefits for the environment of defined environmental rules and for licence holders of perpetual water licences and greater opportunities for water trading.

The latest copy of the [Water Management Act 2000](#) is available from the NSW government legislation site.

Access Licence Dealing Principles Order 2004

The *Access Licence Dealing Principles Order 2004* (commonly referred to as the Ministers Dealing Principles) commenced in 2004. It draws on the objects and water management principles of the Act and provides State-wide guidance and rules for applications to undertake water dealings including trade.

The Minister's 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.

Rules for specific types of access licence dealings (such as conversion to a new category, subdivision, consolidation, assignment or rights or allocation, changing water sources, amending extraction components and interstate dealings) are also included. The Minister's Dealing Principles specify when a dealing is prohibited and what requirements must be met in order for a dealing to be permitted.

Water sharing plans must be consistent to the Minister's Dealing Principles. Water sharing plans can also put additional restrictions in place such as restricting trade into a particular area due to its environmental value or hydrological stress.

Murray-Darling Basin Cap Agreement

The combined Lachlan-Belubula regulated river system is subject to agreements and statutes which cover water management within the Murray-Darling Basin (the Basin). The plan for the regulated Belubula River therefore has to be developed within the context of the Basin and existing commitments to water sharing.

Water diversions from rivers in NSW progressively increased throughout the last century, but most rapidly in the 1980s. Growth in water diversions:

- takes more water away from the river and may threaten its environmental health
- reduces water available to other legitimate businesses thus increasing competition and the potential for inequitable access
- reduces flows from upstream river systems into downstream systems.

In 1994, the Murray-Darling Basin Ministerial Council (MDBMC) undertook an assessment of water diversions across the Basin. This found that the level of diversions at that time were placing stress on both the environmental health of our river systems and the reliability of supply to water users; and that diversions were continuing to increase. In response, the MDBMC introduced a diversion limit – the Cap – in 1995.

Schedule F of the Murray-Darling Basin Agreement (the Agreement) was then introduced in 1996 and set the operating framework for the Cap. In NSW, the Cap is defined as the average yearly volume of water that would have been diverted under 1993/94 levels of development and management rules. There is no MDBMC Cap on groundwater diversions.

Under the Agreement, water sharing plans are required to be developed to ensure consistency with the Cap. This means that the long-term average annual extraction limit (LTAAEL) for regulated and unregulated water sources must be equal to or less than the Cap. NSW has chosen to divide the surface water Cap into unregulated and regulated components. In regulated water sources, licences were volume based and diversions were metered with good records of past use for establishing the Cap.

The Cap for the regulated Belubula River is reported to the Murray Darling Basin Authority at the combined Lachlan and Belubula catchment scale. However, the Office of Water has assigned a portion of the Cap volume to each valley for the purpose of managing growth in use growth in use in each valley (see section on growth-in-use below).

The Basin Plan

The Commonwealth *Water Act 2007* requires the Murray-Darling Basin Authority (MDBA) to develop a water management plan for the Murray-Darling Basin; the “Basin Plan”. The Basin Plan will be a legally enforceable document that provides for the integrated management of all the Basin’s water resources. Some of the main functions of the Basin Plan will be to:

- set and enforce environmentally sustainable limits on the quantities of surface water and groundwater that may be taken from the Basin’s water resources
- set Basin-wide environmental objectives, water quality objectives and salinity objectives
- develop efficient water trading regimes across the Basin
- set requirements that must be met by state water resource plans
- improve water security for all uses of the Basin’s water resources.

The Basin Plan will provide the new foundation for managing the Basin’s water resources in accordance with any rules and plan accreditation criteria established by the MDBA.

At the heart of the Basin Plan will be limits on the quantities of surface water and groundwater that can be taken from the Basin water resources. These are known as ‘sustainable diversion limits’ (SDLs). As the SDLs come into effect, they will replace the current Murray-Darling Basin Ministerial Council Cap on diversions from the Basin. They will set limits on the taking of both groundwater and surface water from the Basin.

Further details can be found on the MDBA website www.mdba.gov.au in the Basin Plan section.

Natural Resource Commission’s statewide targets

Water sharing plans also comply with the Natural Resources Commission’s (NRC) statewide standards and contribute to the relevant statewide targets such as Targets five and six (see www.nrc.gov.au for details) which is a requirement of the State Plan under Goal 22 (see

www.nsw.gov.au/stateplan for details). The NRC was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this, it has developed and recommended a Standard for Quality Natural Resource Management and 13 statewide targets for natural resource management in NSW, which have been embedded in the NSW State Plan. As with the NWI, the components of the State Standard focus on the use of the best available knowledge, use of appropriate information management systems, delivery of integrated outcomes, engagement of the community, and regular monitoring, measuring, evaluation and reporting to specify how delivery of the targets is progressing. The NRC reviews water sharing plans against the State Standard and its associated targets.

Lachlan Catchment Action Plan

The Belubula Regulated Plan is consistent with and contributes to the catchment targets identified in the Lachlan Catchment Action Plan (www.lachlan.cma.nsw.gov.au), in particular catchment target CT4:

”by 2016, riverine and aquifer ecosystem condition and quality are maintained and improved”.

The Lachlan Catchment Action Plan (CAP) recognises that the implementation of water sharing plans is the main mechanism to ensure riverine ecosystems, and groundwater condition and quality are maintained or improved and that this is achieved through the sharing of water between beneficial users. The Belubula regulated Plan specifically contributes towards Management Target 14 which is

“surface water sources are being managed in accordance with the water sharing plans”

The plan will contribute to achieving the catchment target by:

- setting a defined share of water for riverine ecosystems
- protecting very low flows
- adopting an adaptive management approach, giving the Minister the ability to adjust rules once information becomes available, or upon remake of the next plan.

One of the CMA’s responsibilities as observer on the IRP, was to provide them with advice on the alignment of the proposed classification and extraction limits and rules with the priorities in the Lachlan CAP.

Other considerations

There are a number of state policy issues that require consideration with the development of the Belubula Regulated Plan and the associated water sharing rules.

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 some level of connectivity with their associated surface water sources. Accordingly, most alluvial water sources are included in a water sharing plan that covers the surface water to which it is connected. Whilst this is not the case in the Belubula Regulated Plan, as the connectivity of water between the regulated Belubula River and the Belubula Valley Alluvium is managed through rules in the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*.

In the Basin, it is generally not practical for groundwater and surface water to be treated as one water source due to the MDBA Cap not applying to groundwater sources within the Basin.

Consistent with the statewide approach, extractions from alluvial aquifers which are highly connected to regulated rivers are managed on an annual basis via available water determinations.

Protecting basic landholder rights

Under the *Water Management Act 2000* (the Act), **basic landholder rights** (BLR) are made up 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 in the case of accessing groundwater under a domestic and stock right, the bore must still be approved by the Office of Water.

The principles of the Act require that water sharing must protect BLR. The Belubula Regulated Plan does this by identifying the water requirements for domestic and stock and native title rights at the start of the plan and taking these requirements into consideration when designing rules for licensed water extractions. As the access rules for water access licences do not apply to BLR users, this provides these users with a higher priority of water access. The requirements of harvestable rights have been inherently considered as the design of access rules is also based on river flows that result after harvestable rights extractions have occurred. There are currently no extractions for native title rights. However, these rights may 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 basic landholder rights. These restrictions are outside the framework of the plan.

The Belubula Regulated Plan provides an estimate of the water requirements for domestic and stock rights, noting that these rights may increase during the life of the plan. The plan cannot limit or restrict these rights, but the *Water Management Act 2000* itself provides for restrictions on basic landholders rights, through the development of mandatory guidelines.

Protecting town water supply access

Towns have a higher priority of access to water than commercial licences. Water sharing plans recognise this priority by ensuring that a full share of water is allocated for annual town water supplies except where exceptional drought conditions prevent this. The annual share for every town water supply will be specified on the town's licence. Towns may be able to sell part of their annual account water to other towns but, unlike commercial users, will not be able to sell the licence outright.

Any development of new water storages in the area covered by the Belubula Regulated Plan must be undertaken within the bounds of this plan. The plan is not prescriptive in endorsing any particular option since economic considerations vary over time. Instead, the plan sets a framework within which development of future water supplies can occur in a sustainable manner.

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 is determined to ensure that Aboriginal culture is maintained across the state and that Aboriginal communities benefit from the new opportunities that the water market will bring.

The water sharing plans recognise the importance of rivers and groundwater to Aboriginal culture. They will allow Aboriginal communities to apply for a water access licence for cultural purposes such as manufacturing traditional artifacts, hunting, fishing, gathering, recreation, and for cultural and ceremonial purposes. An Aboriginal cultural licence can also be used for drinking, food preparation, washing, and watering domestic gardens. These cultural licences are limited to 10 megalitres per year per application.

Water interception activities

A change in land use activities can potentially result in the interception of significant quantities of water. Examples of 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 (NWI), significant interception activities should be accounted for within a water sharing plan's extraction limit.

Acknowledgement of floodplain harvesting activities

Floodplain harvesting is the collection, extraction or impoundment of water flowing across floodplains, excluding the following types of water extraction:

- taking of water under any other type of water access licence that is not a floodplain harvesting access licence or an applicable water access licence exemption
- taking of water under a basic landholder right, including the harvesting of rainwater runoff
- runoff of irrigation water and stormwater which is subsequently captured in tailwater return systems or other means in accordance with licence conditions or methods which have been approved by the Office of Water

Floodplain harvesting works can generally be put into two categories:

- Purpose-built works specifically built to facilitate floodplain harvesting, including pumps, structures or other works that divert water into or from storages, supply channels, depressions or otherwise impound flows.
- Works built for multiple purposes that have the effect of facilitating floodplain harvesting, such as:
 - levees, conveying works and off-river storages constructed in billabongs or depressions
 - below-ground level channels from which the water is delivered into storages.

Floodplain flows can originate from local runoff that has not yet entered the main channel of a river, or from water that has overflowed from the main channel of a stream during a flood.

Volumetric entitlements, measurement and long-term limits for floodplain harvesting may be established in the future under the NSW Floodplain Harvesting Policy.

Risk of interception through forestry expansion

The projected growth in commercial forestry plantations in the Lachlan Valley has been assessed to be negligible (CSIRO, 2007), and as such the risk of increased interception of throughflow from forestry expansion is considered to be low.

In river dams

In-river dams on streams of third order or greater are permitted subject to:

- the Farm Dams Policy (harvestable rights)
- the NSW Weirs Policy
- the water sharing plan, and
- a minimal harm test under the *Water Management Act 2000*.

Under the Farm Dams Policy, a farm dam that is less than the maximum harvestable rights dam capacity is considered a basic landholder right and can be built on a first or second order stream without the need for a water access licence.

Under the NSW Weirs Policy, the construction of new weirs is discouraged, but can be done where “it can be demonstrated that the primary component of the proposal is necessary to maintaining the essential social and economic needs of the affected community” (DLWC, 1997).

If the criteria of the Farm Dams Policy, the NSW Weirs Policy and the water sharing plan can be met, then an application can be made. The application would be assessed against the minimal harm test under the Water Management Act 2000.

Developing the plan

The plan rules were developed by the Belubula IRP based on consensus decision making. The approach used for setting the rules involved the consideration of government policy and followed by rule refinement based on local knowledge and expertise.

Information about how rules were developed for this system is provided below, as well as how these rules were modified by the IRP or changed as result of consultation.

Water sharing rules for regulated water sources

Water sharing rules that the IRP focused on included:

- rules for the protection of environmental assets
- access rules for uncontrolled flows – which set the conditions under which extraction from these flows is permitted
- dealing rules – which control the trade of water (both the permanent transfer of access licence entitlements and the temporary assignment of water allocation between access licences, the change of water sources and the location for extraction).

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

- extraction limits – which set the total volume of water that can be extracted on a long-term average annual basis from the water source
- assessing growth – how growth in diversions are assessed
- accounting rules – how accounts are managed and how much water can be held in accounts.

Hydrological modelling to inform rule development

Hydrologic modelling refers to the use of a numerical computer tool to simulate river flows, dam storage, water extraction, losses and operation, irrigation demands and water sharing plan rules. Hydrologic modelling can assist in understanding of the implications of different water sharing rules on flows and dam storage and thereby impacts on environmental assets and extraction.

In NSW, the Integrated Quantity and Quality Model (IQQM) is the preferred hydrologic model for water planning. A full description of IQQM, including details about model structure, algorithms, and assumptions are described in the IQQM Reference Manual (DLWC, 1995).

The model relies on calibrations against historical stream flow, rainfall, dam operation and water extraction activities. The IQQM cannot forecast flows or determine flood levels, determine the state of the catchment in the future, explicitly assess the impacts of catchment change, or assess the effectiveness of individual farm cropping practices or operation.

The Office of Water developed and calibrated an IQQM model for the regulated Belubula River to assist the IRP in assessing the implications of the water sharing rules including, environmental flows, accounting rules, the long term average annual extraction limit and access to uncontrolled flows.

More details of the river gauges used and the hydrological modelling undertaken for the development of the Belubula Regulated Plan, are available in Appendix 4.

During the plan development process, the model was refined to better represent the current patterns of water extraction from the system. These refinements included more accurate modelling of extractions for the purpose of mining and the inclusion of off-stream storages which are currently being used to store water extracted from uncontrolled flows.

Consultation to inform rule development

The IRP's initial draft rules underwent targeted consultation⁵ with specific interest groups and water users, whereas the formal public exhibition⁶ of the draft Belubula Regulated Plan incorporated wider public consultation.

The CMA assisted with the public consultation process, and ensured that all stakeholders and interested parties had an opportunity to examine and comment on the proposed water sharing rules. In particular, stakeholders were encouraged to provide:

- feedback on the practical elements of the proposed water sharing rules - to make certain they are easily implemented by the licence holders
- confirmation that there are no unintended outcomes from the plan – it is essential that this be given due consideration before the plan is finalised
- specific comments on the Minister's notes included in the draft plan.

Negotiated outcomes

A critical aspect of developing water sharing rules is talking to stakeholders about the proposed rules and how they will affect water users and local communities. This local input was essential in developing the final recommendations for the Belubula Regulated Plan. In some areas, water users worked with planning staff, providing information and discussing management options and possible impacts.

Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the draft Belubula Regulated Plan was conducted with the Belubula Landholders Association at Canowindra in December 2010. The objectives of this consultation were:

- to provide background to key stakeholders as to why the plan was being developed, how it had been developed, what water sharing rules were proposed and how stakeholders could provide feedback
- to provide a 'first opportunity' to informally consult and to test the suitability of the proposed water sharing rules.

Public exhibition of the draft water sharing plan

Public exhibition of the draft Belubula Regulated Plan was held from 26 March to 11 May 2012, with a public meeting held at Canowindra. The objectives of this consultation were:

- to provide background to stakeholders as to why the plan was being developed, how it had been developed, what water sharing rules were proposed and how stakeholders could provide feedback
- to formally consult with a broad range of stakeholders to explain the proposed water sharing rules and how they will be implemented

⁵ Targeted consultation refers to informal consultation held with key stakeholders to test the suitability of the proposed water sharing rules and provide feedback on the rules potential impacts.

⁶ Public exhibition is the formal exhibition of a draft plan where the Minister invites submissions on the draft plan and in particular will seek comment on a range of key issues.

- to seek feedback in writing from stakeholders and the general community about the proposed water sharing rules.

Twenty-two written submissions were received from a wide range of stakeholders. The IRP reviewed all the submissions and subsequently made numerous changes to the draft water sharing rules proposed. During this review process, if updated data became available, it was also incorporated into the planning process.

Water Sharing Rules

Protecting environmental values

The IRP reviewed each of the available water sharing rules relevant to regulated systems that are specifically directed at protecting environmental values i.e. end of system flow, environmental contingency allowances (ECAs), transparent and translucent flow releases and access to uncontrolled flows. The IRP agreed to retain the current end of system flow rule which is 10 ML/day at the Helensholme gauge (412033) and recommended rules for accessing uncontrolled flows (see section on *uncontrolled flows* below).

The IRP agreed that ECAs and transparent / translucent flow releases were not suitable for this system for the following reasons:

- Environmental Contingency Allowance (ECA) – to deliver an adequate flow (i.e. bankfull flow 3,000-5,000 ML/day) over several days for the purpose of watering environmental assets or addressing water quality issues would require a substantial proportion of stored water. The IRP agreed that even if the dam was full, storing an adequate ECA volume in the dam could have a significant impact on allocations. Given this impact and the substantial flow contribution from tributaries into the regulated system (90 per cent of total flows), it was agreed by the IRP not to adopt an ECA.
- Transparent/Translucent flow releases – given the small capacity of the dam (36 GL), the size of its catchment and the fact that 90 per cent of flows in the regulated Belubula River are derived from tributary inflows, the outcome of implementing these types of releases from the dam would reduce the security of the dam and would probably result in only a small change in the overall flow regime of the river. The IRP therefore recommended that transparent / translucent flows not be adopted for the Belubula Regulated River.

Managing extraction

Long term average annual extraction Limit (LTAAEL)

The Belubula Regulated Plan adopts a 'long-term planning approach' to sustainable water use by setting a **long-term average annual extraction limit** (LTAAEL), monitoring the benefits and impacts of the water management rules, and reviewing the LTAAEL and management rules if required.

It is current NSW policy that the LTAAEL for regulated rivers in the Murray–Darling Basin must not exceed the Cap. Therefore, to ensure that systems are managed in line with the Cap, it is prudent to set water sharing rules that result in an LTAAEL that is less than or equal to the Cap.

The LTAAEL for the regulated Belubula River is the lesser of

1. the long-term average annual extraction from this water source that would occur with the water storages and water use development that existed in 2009/10, domestic and stock rights, native title rights, the share components existing at the commencement of the plan and application of the water sharing rules as defined in the plan; or

2. the long-term average annual extraction from this water source that would occur under the Murray-Darling Basin Ministerial Cap baseline conditions as agreed under the Murray-Darling Basin Agreement in Schedule 1 of the *Water Act 2007* (Cth).

A calculation of the long-term average annual extraction that would occur under the conditions specified in (1) has been made using the Belubula Integrated Quantity and Quality Model (IQQM). The LTAAEL is calculated to equal 7.37 GL (Belubula IQQM model run lachw106.sqq). The LTAAEL is based on the long-term relationship between climatic variability and water availability. This is modelled by the IQQM which utilises long-term rainfall and flow records (for more information refer to Appendix 4).

The Belubula IQQM is also used to calculate the long-term average annual extraction that would result from the Cap baseline conditions as specified above in (2). This modelled average equates to 7.38 GL (Belubula IQQM model run lachC71A.sys).

Growth-in-use

To protect the water set aside for the environment and the supply to existing users, it is important to control any growth in water used over time that is above the limit specified in the plan i.e. growth in extractions above the LTAAEL. In the event that extractions are assessed as exceeding the LTAAEL, then extractions will be reduced until they are brought back to the LTAAEL. This will be done by reducing either the available water determination or take limit for access licences.

The method used for assessing growth-in-use detailed in the water sharing plans covering most regulated rivers in NSW, including the Lachlan Regulated River Water Source, compares the LTAAEL with modelled long-term average annual extractions using 'current development conditions' and the rules in the water sharing plan. The 'current development conditions' represent the development conditions at the time the assessment is undertaken. In these regulated water sharing plans the LTAAEL is considered to have been exceeded if the long-term average annual extraction under 'current development conditions' exceeds:

- the LTAAEL by three per cent or more, or
- the LTAAEL by more than half the difference between the LTAAEL and the Cap long-term average annual extractions, or
- the Cap long-term average annual extractions, or
- the LTAAEL has been exceeded in three consecutive annual assessments.

This approach however, is not suitable for detecting true growth in the regulated Belubula River given the highly variable nature of extraction in this system. This historical pattern of high variability needs to be allowed for when determining a suitable assessment process for detecting growth-in-use in the Belubula Regulated River Water Source. The chosen assessment process should not only allow for variability in usage, but should also detect true growth in a time frame that reduces impact on the environment and users.

The two-staged approach recommended by the IRP was modeled on that included in the recently developed water sharing plan for the Peel Regulated River Water Source; a water source very similar to the regulated Belubula River. It is located on the western slopes, the dam has a small catchment area, tributary inflows make up a significant proportion of total flows in the regulated river and the ratio of the LTAAEL to entitlement is low.

The first stage involves comparing the *observed* average annual extractions over the previous 10 years with the *modelled* average annual extraction for the same time period using the Belubula IQQM under the plan conditions. If the observed 10 year rolling average is 10 per cent greater than the modelled 10 year rolling average, then a more intensive 2nd stage assessment is triggered.

The more intensive 2nd stage assessment process compares the long-term average annual extraction under 'current development conditions' with the LTAAEL. The 'current development conditions' are updated in the model to include the most recent irrigator behaviour parameters, including updated irrigated areas and on-farm infrastructures. This process for assessing growth above the LTAAEL is similar to the Cap auditing process used for all NSW inland regulated river systems.

If in the 2nd stage assessment the long-term average annual extraction under 'current development conditions' exceeds the LTAAEL by three per cent or more, then a growth-in-use response is triggered to bring extractions back to the LTAAEL. To achieve this general security access licences are subjected to a reduction in the take limit and supplementary water access licences are subject to a lower available water determination. This reduction will be applied at the beginning of a water year. An equal reduction will be applied to both general security and supplementary water access licences.

Initially, the IRP recommended a 5 year rolling average with a 10 per cent trigger level for the 1st stage assessment. However, feedback from public exhibition highlighted concerns that a growth-in-use response will be triggered given the high ratio of inactive to active entitlement and the level of usage in comparison to the LTAAEL. Water users proposed that the assessment method should include a 10 year rolling average with a 20 per cent trigger.

The IRP further reviewed the historical usage outputs from the Belubula IQQM, and agreed that the 5 year rolling average was still too sensitive to background usage fluctuations and a 10 year rolling average was more suitable. However, the IRP recommended retaining the 10 per cent trigger as a higher percentage would make the assessment process too insensitive to detecting underlying growth; particularly since usage was now to be averaged over 10 years rather than 5 years.

Available water determinations

Available water determinations (AWDs) are primarily used to credit allocations into a licence's water allocation account and are a reflection of seasonal water availability. For general security licences which are subject to continuous accounting (see section on *carryover and account management* below) an AWD is made when sufficient water flows into the dam.

For 'high priority' access licences, in all but exceptional droughts an AWD is made at the start of each water year and will be 100 per cent. This equates to 100 per cent of the share component for stock and domestic access licences and 1 ML per unit share for regulated river (high security) access licences.

For supplementary water access licences an AWD will be made at the beginning of the water year and will be 1 ML per unit share unless a growth in use response is triggered. In this case it will be reduced (see section on *growth in use* above).

The AWD for general security licences is a maximum of 100 per cent per unit of share component but can be less depending on water levels in the dam (see section on *carryover and account management* below).

Carryover and account management

A water allocation account is established for each water access licence. Water is credited to the account when an AWD is made, and debited when water is extracted. A licence holder's account is not permitted to go into debit. In the Belubula Regulated Plan, different licence categories have different accounting rules.

Given that the account management rules primarily impact water users, the IRP agreed to specifically ask the Belubula water users as part of targeted consultation for their preferred account management

rules. The rules below which are contained in the Belubula Regulated Plan are those proposed by the water users.

Regulated river (general security) access licences

Accounts for these access licences operate continuously (continuous accounting) where water is credited to an account through an AWD when sufficient water flows into the dam.

A take limit applies to all general security access licences and is the maximum amount of water that can be used in any one year (even if there is a greater volume in the account). The take limit will be 1 ML per unit of share component unless total extractions from the water source exceed the LTAAEL (see section on *growth in use* above)

Similar to the accounts for regulated river (general security) access licences in the Lachlan Regulated River Water Source, the accounts in the Belubula Regulated Plan are split into two sub-accounts. One contains allocations that may be taken in the current water year (sub-account A) and the other contains allocations that can be held for extraction in future water years (sub-account B).

At the beginning of each water year sub-account A is adjusted so that it holds no more than the take limit. If sub account A holds less than the take limit, then allocations will be moved from sub-account B into A up to a maximum volume equal to the take limit. Conversely, if at the beginning of the water year sub-account A holds more than the take limit, water allocations will be moved across to sub-account B until sub-account A equals the take limit.

Regulated river (general security) access licences can carry over unused water allocations up to a maximum account limit of 130 per cent of their share component. Before the plan commenced, the account limit was 200 per cent. However, the IRP noted that with this 200 per cent account limit the water held in accounts could potentially be greater than the capacity of the dam resulting in reduced allocations for general security users (even if the dam is full). By setting the maximum total account limit at 130 per cent of the share component, the maximum volume of water held in accounts will not exceed the capacity of the dam. The IRP agreed to set the account limit at the capacity of the dam to minimize the risk of reduced allocations for general security access licences.

Although the water users supported the account management rules they proposed during public exhibition that the account limit be reviewed after a number of years given their uncertainty of the impact of the new accounting rules. A review and potential amendment of the account limit was incorporated into the plan (see section on *amendment provisions* below).

Regulated river (high security), stock and domestic and supplementary water access licences

High security, domestic and stock and supplementary water access licences will continued to be managed on an annual basis (annual accounting) with no carryover and where allocations are credited to their accounts at the start of each water year and at the end of the year any remaining water allocations in an account will be forfeited.

Access to uncontrolled flows

Uncontrolled flows in the regulated Belubula River refer to unregulated flows that enter the system either from tributaries downstream of the dam or from dam spills. Historically, under the *Water Act 1912* these flows were referred to as off-allocation flows, whereas under the *Water Management Act 2000* they are referred to as uncontrolled flows.

The Belubula Regulated Plan contains rules for general security and supplementary water access licences for accessing uncontrolled flows. Different rules apply to general security access licences and supplementary water licences.

At the commencement of the plan there is only one supplementary water access licence in this water source. Prior to plan commencement, this licence was already subject to specific conditions in relation to accessing off-allocation flows. These conditions have been written into the plan as water sharing rules for supplementary water access licences.

Access to uncontrolled flows will be made available in accordance with announcements made by the Office of Water.

Initially the IRP recommended that the current rules for accessing off-allocation flows be adopted for regulated river (general security) access licences that the current rules for accessing off-allocation flows be adopted i.e. 20 per cent of entitlement can be accessed from off-allocation flows when the effective available water⁷ (EAW) for general security licences is 20 per cent or less. However, the IRP did review the flow level at which users could commence to extract i.e. when flows were above 10 ML/day at the Helensholme gauge.

This 10 ML/day commence/cease to pump rule is incompatible with the end of system flow rule recommended by the IRP which requires a minimum of 10 ML/day to be maintained at the Helensholme gauge. The implication being that when the EAW for general security licence holders is 20 per cent or less, they could commence to extract uncontrolled flows when only a small amount of additional water was in the system. The IRP's intention was to provide access to uncontrolled flows only when a flow event was moving through the system.

The IRP explored options for setting the commence/cease to pump rule including the option of implementing different flow levels for summer and winter (Model runs W070, W071, W072, W073, W074 – refer to Appendix 4). Initial modelling results indicated that there was no advantage of setting seasonal commence/cease to pump levels as most of the extraction for irrigation occurred during the summer months.

Given that the regulated Belubula River is primarily unregulated (90 per cent of flow in the system), the IRP agreed to use the macro classification process to provide guidance on setting the commence/cease to pump flow level. Based on the macro classification process, the IRP determined that for the Belubula Regulated River Water Source both the level of risk to instream values and the level of economic dependence were high. Based on these criteria, the macro classification process recommends a cease to pump at the 95th percentile of flows. This was adopted by the IRP and under operational conditions pre-plan, the 95th percentile is equal to 14 ML/day (see Base case W068 in Appendix 4).

The water sharing rules presented to the water users during targeted consultation were modelled in Model Run W075 (refer to Appendix 4).

During targeted consultation, water users requested that additional access to uncontrolled flows was provided based on the following:

- that total extraction is a small proportion of average annual flows,
- that additional access would have minimal impact on these flows,
- that additional access would reduce pressure on the dam storage levels whilst increasing the opportunity for extracting water.

Based on this feedback the IRP agreed to recommend an increase in access to uncontrolled flows but only under the following conditions:

- it causes minimal impact on the flow regime,

⁷ Effective available water is the sum of total water available for take in accounts (including carryover and allocations) as a percentage of total general security entitlement.

- the modelled LTAAEL under the increased access rules is not greater than the Cap.

After targeted consultation, the Belubula IQQM model was refined to better reflect the patterns of extraction, including the addition of off-stream storages in the model. Feedback from targeted consultation had revealed that some water users had built off-stream storages to hold off-allocation water for future use. Water users advised that the total capacity of these storages approximated 1,500 ML.

Given the model refinement, the base case scenario was remodelled (model run W086 – refer to Appendix 4) and the flow duration curve for the updated base case conditions (under operational conditions pre-plan) indicated that the 95th percentile was equal to 13 ML/day.

The IRP explored several options of increasing access to uncontrolled flows all of which were based on the premise of minimising flow regime and third party impacts, minimising the risk of breaching the Cap and retaining the original intent of the rule (i.e. as a drought contingency measure).

Initial modelling suggested that in allowing users to take more than 50 per cent of their entitlement from uncontrolled flows, the increased extraction could cause a breach in the Cap.

Based on this, the IRP considered three scenarios for increasing access to uncontrolled flows as shown in Table 2 and detailed in Appendix 4. The objectives behind the scenarios was to give the IRP a sense of impact on flows and diversions when different percentages of entitlement were extracted, when different commence/cease to pump flow triggers were implemented and when different EAW trigger levels were implemented.

Given that the response by some water users to the permitted access to uncontrolled flows was to build off-stream storages, the IRP noted that a further increase in access could result in further development of off-stream storages. Consequently, the three modelled scenarios included a 100 per cent increase in the total volume of off-stream storage in the model (i.e. 3,000 ML). This provided some indication of the potential future impact on the flow regime and the future risk of breaching the Cap (see Table 3).

Table 2: Scenario runs modelled to assist in the development of rules for accessing uncontrolled flows

Model Run number	Rules for Accessing Uncontrolled Flows		
	Effective Available Water	Flow at Helensholme gauge	Percentage of entitlement that can be extracted
W091	≤20%	≥13 ML/day	20%
W092	≤50%	≥13 ML/day	50%
W093	≤50% and >20%	≥18 ML/day	50%
	≤20%	≥13 ML/day	

Table 3: Average total diversions as modelled for the regulated Belubula River under various scenarios

Model Run	Long-term average annual diversions (ML/yr)
W091	7325
W092	7446
W093	7439

Impact on the flow regime for each of the three scenarios was assessed using flow duration curves. These are presented below in Figures 1 - 4.

Figure 1 – presents the lower end of the flow duration curves which represent daily flows for the whole period of record (111 years of record) for each scenario;

Figure 2 – flow duration curves represent only those days common to each scenario when the effective available water for general security access licences is < 20 per cent

Figure 3 – flow duration curves include only those days common to each scenario when the effective available water for general security access licences is between 20 and 50 per cent

Figure 4 – presents the lower end of the flow duration curves for the conditions represented in Figure 3.

The figures below present flow duration curves for flows at the Bangaroo gauge which was replaced by the Helensholme gauge (more details in Appendix 4).

Figure 1 indicates that overall there is only a small impact on the overall flow regime (a few megalitres across the percentile range) if access to uncontrolled flows is increased to 50 per cent of entitlement. The difference in flows at each percentile is around 5 ML/day

The results in Figure 2 suggest that when general security allocations are low, allowing a greater percentage of entitlement to be accessed from uncontrolled flows (scenarios W092 and W093) causes a decrease in the volume of low to medium flows. This decrease is around 5 ML/day. Although this is not a significant portion of the moderate flows, the increase in access means that the frequency that flows greater than the commence/cease to pump occur decreases i.e. a change from a frequency of 95 per cent to 80 per cent of the time.

Under scenario W091 in Figure the curves represents no extraction from uncontrolled flows as in this scenario it is only permissible when the EAW is below 20 per cent. Figure 3 shows a similar pattern to Figure 2 where the impact on the flow regime is apparent on moderate and low flows. However, in this case the impact on moderate flows is greater than on low flows. Figure 4 shows the moderate and low flow portion of the flow duration curve. The impact of allowing increased access to uncontrolled flows shows a maximum decrease of around 20 ML/day for moderate flows which is a notable impact.

It is evident when comparing scenarios W092 and W093 that the higher commence/cease to pump level in scenario W093 results in slightly less impact on the medium to low flow regime.

Figure 1: Lower end of flow duration curves for modelled flows at Bangaroo Gauge under different rules for accessing uncontrolled flows.

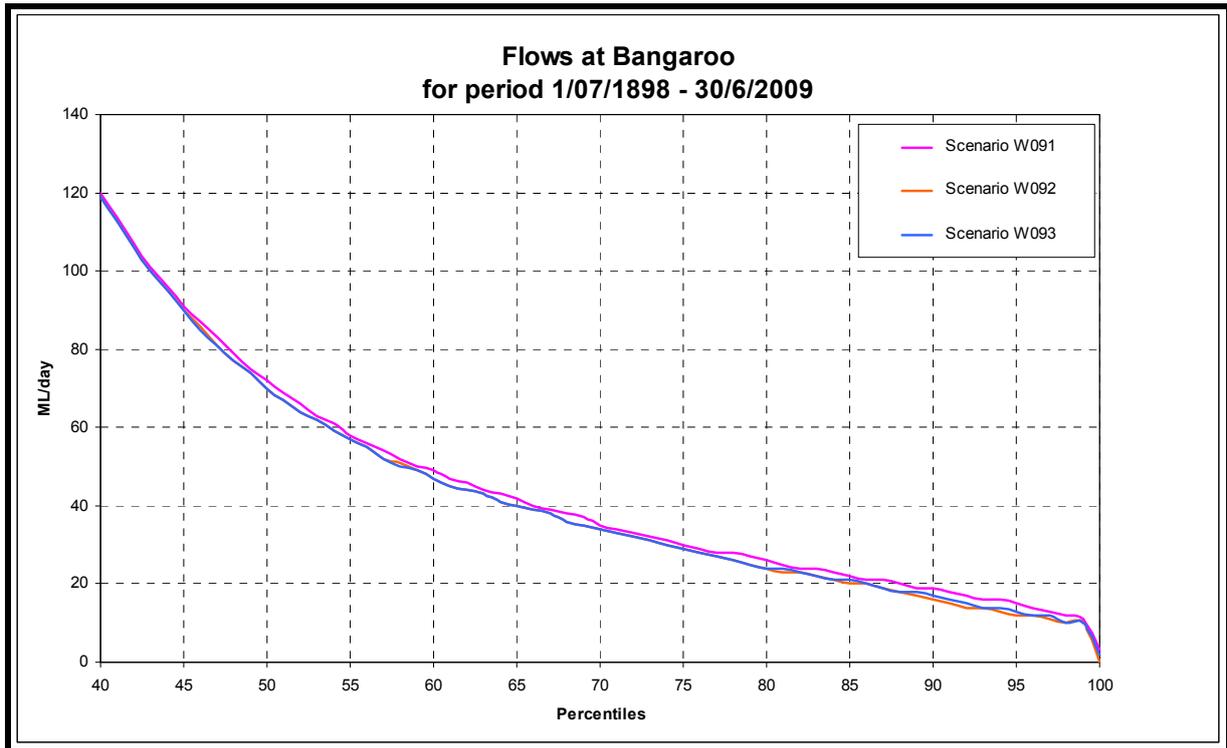


Figure 2: The lower end of the flow duration curves for modelled flows at Bangaroo Gauge under different rules for accessing uncontrolled flows when effective available water for general security licences is 20% or less.

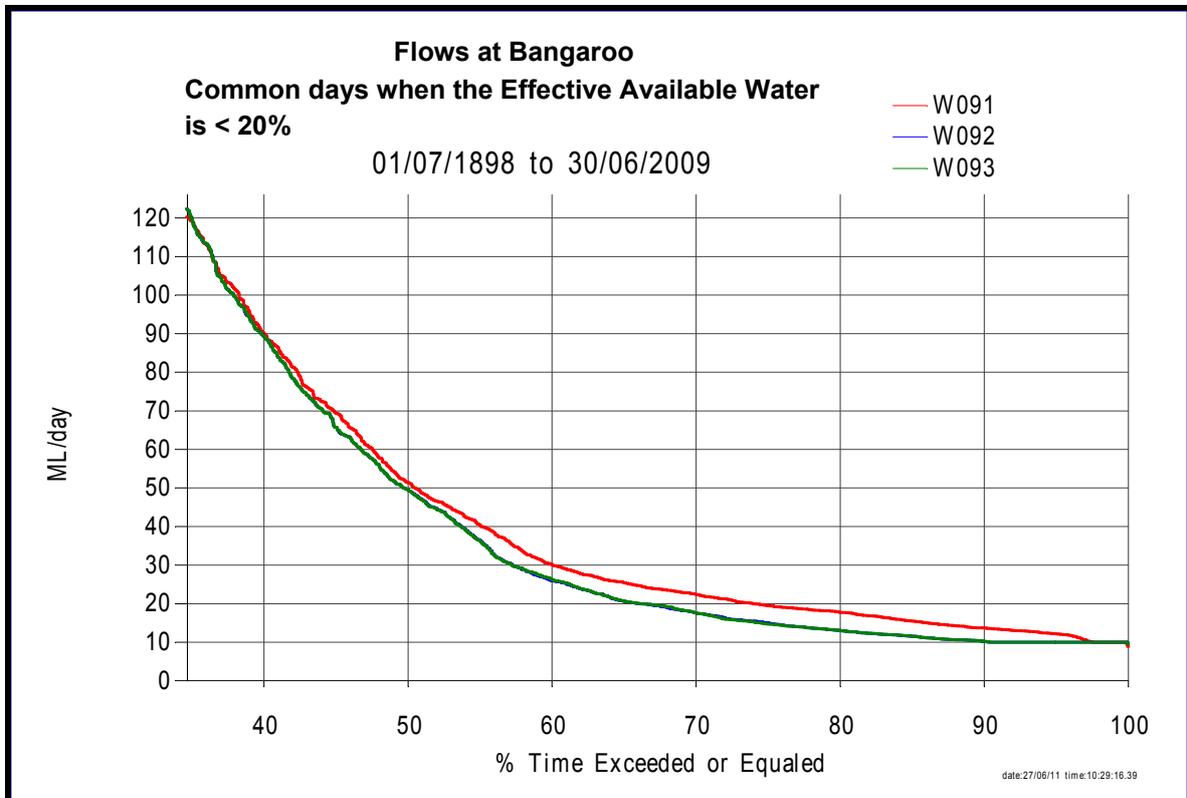


Figure 3: Flow duration curves for modelled flows at Bangaroo gauge under different rules for accessing uncontrolled flows when the effective available water is between 50% and 20%.

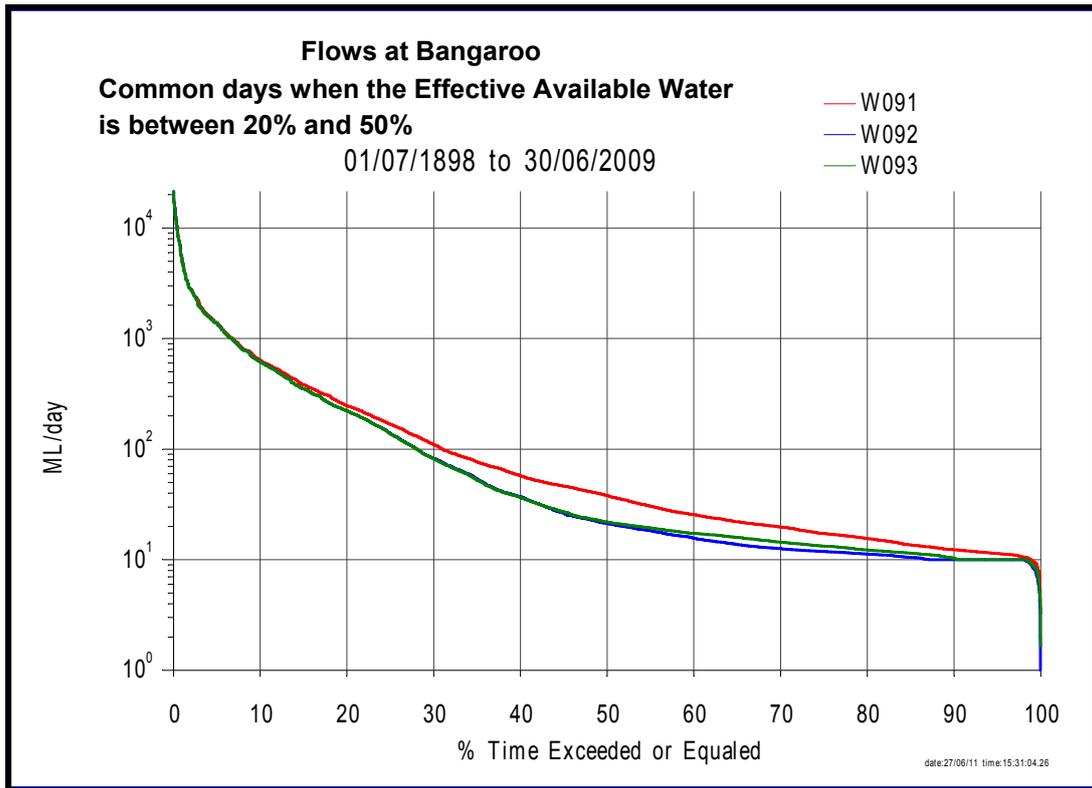
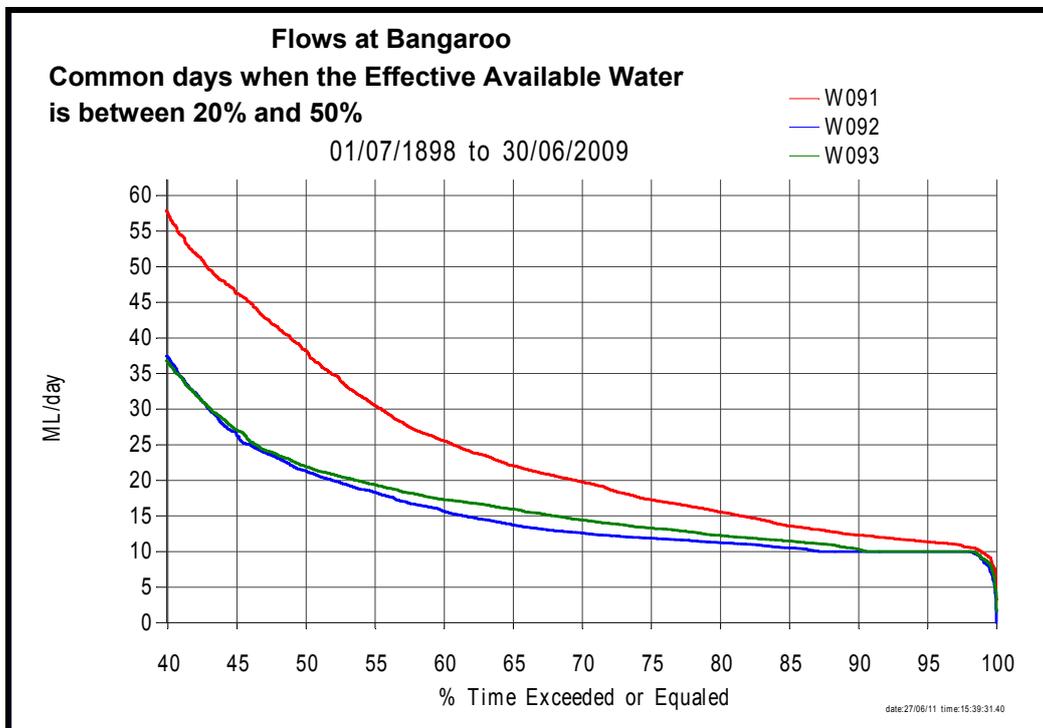


Figure 4: The lower end of the flow duration curves as depicted in Figure 3.



The IRP acknowledged that the overall impacts highlighted by the hydrological analysis were minimal but were more apparent when allocations were getting low. It also noted that the hydrological analysis

presented in the three scenarios were greater than under current development conditions given that they included a 100 per cent increase in off-stream storages.

On the basis of minimising impact on the flow regime and third parties, minimising the risk of breaching the Cap and retaining the original intent of the rule (i.e. as a drought contingency measure) the IRP recommended the following rules for accessing uncontrolled flows

- General security licence holders can access up to 50 per cent of their entitlement from uncontrolled flows when:
 - the EAW is >20 per cent and ≤50 per cent and the flow at the Helensholme gauge is 20 ML/day or greater
 - the EAW is ≤20 per cent and the flow at the Helensholme gauge is 13 ML/day or greater.

The staged commence/cease to pump was recommended by the IRP in order to reduce the impact of increased access on the flow regime. The commence/cease to pump was set at 20 ML/day in line with the access condition already applicable to supplementary water access licences. This not only ensures equity between the general security and the supplementary water access licence holders but also reduces the risk of reducing flow levels before supplementary water access licence holders are permitted to access water. That is, if general security access licence holders are subject to a lower commence/cease to pump they can start extracting before the supplementary water access licence holders and could keep the river below the 20 ML/day at Helensholme for a period otherwise longer than if they had the same commence/cease to pump.

These rules recommended by the IRP not only afford general security water users greater access to uncontrolled flows but also:

- results in a LTAAEL which is less than the Cap
- has minimal overall impact on the flow regime
- ensures equity of access between general security and supplementary water access licence holders
- reduces third-party impacts;
- reflects the original intent of allowing access to uncontrolled flows during dryer conditions.

Following feedback from public exhibition, the IRP agreed to also allow high security users access to uncontrolled flows on the basis of ensuring equity of access during dry times. High security water users would only be accessing uncontrolled flows in extreme drought conditions. The following rules apply to high security licences.

- High security users can access up to 50 per cent of their entitlement from uncontrolled flows when:
 - the sum of the available water determinations for that water year are >20 per cent and ≤50 per cent and the flow at the Helensholme gauge is 20 ML/day or greater
 - the sum of the available water determinations are less than ≤20 per cent and the flow at the Helensholme gauge is 13 ML/day or greater.

Dealings

Dealings (trading) rules are intended to provide for efficient water markets whilst recognising and protecting the needs of the environment and third-party interests. In water sharing plans, dealings are allowed within a regulated river water source but not into or out of the regulated river water source.

The Belubula Regulated Plan sets out trading rules as follows:

- INTO the water source
 - Not permitted
- WITHIN the water source:
 - Permanent trade permitted for all high security, general security and supplementary water access licences
 - Temporary trade is permitted, except:
 - From a general security account holding water that cannot be used in that water year (sub-account B) to an account holding water that can be used in the current water year (sub-account A)
 - If the trade would result in the total account exceeding 1.3 mega litres per unit share
 - No conversion of licences to a new licence category

The plan also contains an amendment provision for trade to occur in the future between the Lachlan Regulated River and the Belubula Regulated River water sources (see section below on *amendment provisions*).

Adaptive management

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

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

Amendment provisions

There are a number of amendment provisions which allow the Belubula Regulated Plan to be changed as a result of further studies or to allow implementation of specific rules. The amendment provisions detailed in this section were part of the rule development process undertaken by the IRP. There may be other general amendment provisions included in the plan which are not mentioned in this document. Please refer to the plan for a full list of amendment provisions.

Account management rules

During public exhibition users requested that there be a review of the maximum account limit during the term of the plan given the uncertainty around the new accounting rules and their effects on water users.

Based on this feedback, the IRP recommended an amendment in the plan that allows for a variation in the account limit following a review of the limit in year four and year eight of the plan. The review will involve assessing the socio-economic impact of the account limit and will be undertaken in consultation with the water users.

Intervalley trading rules

The *Water Sharing Plan for the Lachlan Regulated River Water Source 2003* (the regulated plan) contains provisions that enable dealings to occur from the Belubula Regulated River Water Source to the Lachlan Regulated River Water Source. However this can only occur if the conversion factor protects environmental water, domestic and stock rights, native title rights and the reliability of supply to all other access licences in the Lachlan Regulated River Water Source.

During public exhibition, water users requested that trades should also be permitted from the Lachlan Regulated River Water Source into the Belubula Regulated River Water Source. The IRP consequently included an amendment in the Belubula Regulated Plan to allow such trade for general security access licences. Dealings are only permitted if there is no net change in the level of total entitlement as set at the commencement of the plan (i.e. 27, 291 ML).

Evaluation of plan performance

The evaluation framework for water sharing plans is currently being developed. The objectives of the project are to:

- Inform the community of the results from the 10 year operation of water sharing plans
- Collate the results of the various legislatively-required evaluations, along with other relevant learnings to inform the remake of water sharing plans.

The evaluation framework will use a system of “program logic” to organise the inputs, outputs and outcomes from water sharing plans and their operation. Evaluation questions and monitoring indicators allow assessment of these steps to rate a water sharing plan for its:

- Process of development (appropriateness)
- Performance during operation (efficiency)
- Socio-economic environmental and cultural outcomes (effectiveness).

The Office of Water’s approach conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates the adaptive management approach to water planning required under the principles of the *Water Management Act 2000*. The Office has also chosen to organise the evaluation questions and monitoring indicators using the NSW Natural Resource Commission’s auditable standard for natural resource management.

Performance indicators

The Belubula Regulated Plan includes a number of performance indicators that will be monitored over the 10 year life of the plan.

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

The water sharing plan Environmental Flows Monitoring and Modelling program has been designed to make the results of environmental flows studies more transferable between water sources and to develop more generic relationships between flow, hydraulics and ecological responses. In adopting this approach it enables a more efficient and effective evidence-based approach to support monitoring and evaluation requirements of NSW water sharing plans and identifies specific knowledge gaps to allow further investigative work to be prioritised.

Plan review

Under the *Water Management Act 2000*, the Natural Resources Commission is required to undertake a review of the Belubula Regulated Plan prior to any decision to extend its term or to make a new plan.

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

- An audit of the plan, at intervals of no more than five years, for the purpose of ascertaining whether its provisions have been given effect to. This audit is to be carried out by the State Interagency Panel, which has now been appointed by the Minister (for Primary Industries).
- An audit of the plan by the Natural Resources Commission to assess to what extent the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the relevant catchment management area. The Natural Resources Commission will call for public submissions when undertaking its review.

Glossary

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

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

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

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.

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

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

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

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

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.

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

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

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

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

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

Security: The legal status and tenure of a right to access water. This includes the level and assurance that a water access entitlement will provide that which it specifies. Security thus includes the reliability of supply. The range of water access entitlement characteristics detailed in the NWI contributes to the security of a water access entitlement.

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

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

Water sharing plan (plan): A plan made under the *Water Management Act 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.

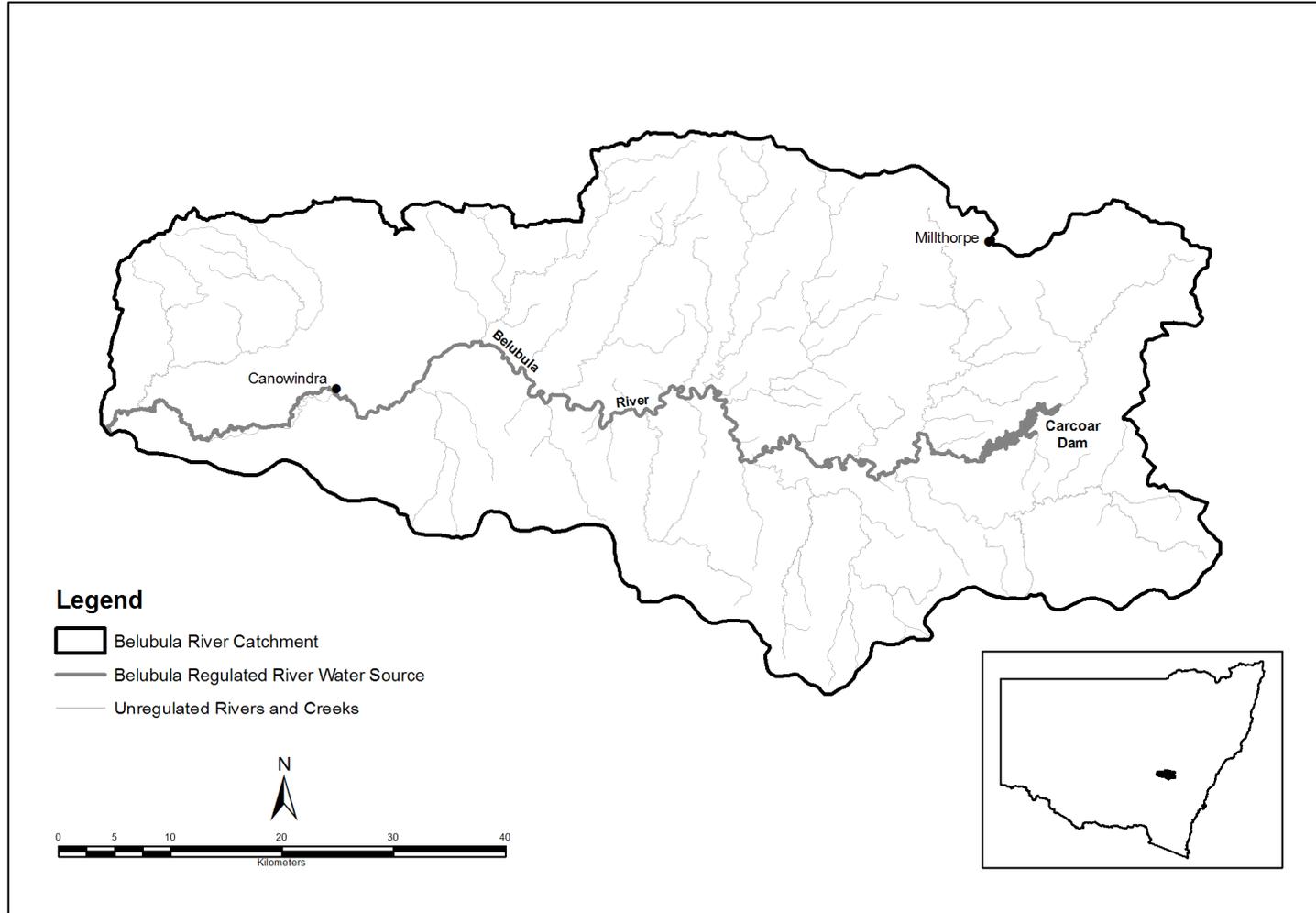
Water year: The 12 months running from 1 July to 30 June.

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Appendices

Appendix 1: Water sharing plan map



Appendix 2: Identified threatened species

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

It should also be noted that some threatened species are highly sensitive to low flow extraction, whilst other threatened species, such as plants that occur in the riparian zone, are less sensitive.

Accordingly, threatened species considered to be highly sensitive to low flows are given a highly priority for protection.

The table below shows threatened species that are known (K) or expected (E) to occur in the Belubula Regulated River.

Species	Regulated Belubula River
Fish Species	
Macquarie Perch	K
Silver Perch	K
Southern Pygmy Perch	K
Murray Cod	K
Frog Species	
Booroolong Frog	K
Southern Bell Frog	K
Sloane's Froglet	E
Birds	
Australasian Bittern	K
Black-necked Stork	K
Black-tailed Godwit	E
Blue-billed Duck	K
Brolga	K
Freckled Duck	K
Magpie Goose	E
Painted Snipe	K
Regent Honeyeater	K
Other Fauna	
Larged-footed Myotis	K
Endangered Ecological Community (EEC)	
The aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River	K

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. The assessments are not absolute – for example the absence of threatened species for an assessment does not necessarily mean the threatened species are not present. These assessments should not be used for any purpose other than classification of catchment management units as part of the Macro Water Sharing Planning process.

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

Name	Agency	Role	Expertise
Interagency Regional Panel			
Tracey Brownbill	NSW Office of Water		Graduate Diploma Water Science (Monash University), Bachelor of Science (University of Melbourne). Sixteen years experience in natural resource management, the last six years in water management.
Gary Coady (Replaced by Tracey Brownbill)		Agency Representative	Extensive experience in water management policy and planning
Greg Markwick	DPI		Thirty year experience in the State Dept of Agriculture including five years a District Officer at Bourke, 15 years as Regional Director with Primary Industries in the western region. Involved in developing water sharing plans in the regulated and groundwater systems of the Macquarie and Lachlan Valleys.
Paul Packard	OEH		Senior Wetlands and Rivers Conservation Officer. Nineteen years experience in conservation assessments and natural resource management in SE NSW including involvement in development of the Kangaroo River water sharing plan as a member of the Shoalhaven Illawarra Water Management Committee.
Fin Martin	Lachlan CMA	Observer	Catchment Coordinator - Water Management Advisory Services & Sustainable Ecosystems
Support Staff			
Maksudal Bari	NSW Office of Water	Socio-economics	MSc and PhD in Agricultural Economics (University of London, UK). Sixteen years experience in water economics, management and policy with the NSW Office of Water and its predecessors. Nine years university teaching and research experience in Bangladesh.
Patrick Driver		Water resources evaluation	Bachelor of Science (La Trobe University), Ph.D (University of Canberra, Diploma in Government (Project Management, IPAA). Monitoring and reporting for water sharing plan development and evaluation. Fourteen years with the NSW Government, including coordination of statewide monitoring and research programs.
Lyn Gorham		Licensing	Bachelor of Land Management (University of Sydney), Certificate IV in Government. Sixteen years experience in water resource management, the last 12 years in water licensing.
Tahir Hameed		Hydrology	More than 20 years experience in water resource management modelling. Currently managing Macquarie and Lachlan River system models.
Manju Mathew		Communications	Bachelor of Science and Masters in Mass Communication and Journalism. Over six years experience as a journalist with the Times of India and Business Sydney. Ten years experience in corporate communications within both the public and private sectors.
Vicki Martin		GIS	Bachelor of Applied Science (University of Canberra). Twenty years experience with the NSW Government including water quality monitoring, contingency planning, community based natural resource management, data management and geographic information systems.

Name	Agency	Role	Expertise
Nicky Smith		Plan coordinator	Bachelor of Science and Master of Science. Five years experience examining hydrological effects of land use change and associated issues for catchment management in Vitoria and a further four years working on vegetation and salinity planning. Fourteen years experience in water management with the NSW State Government.
Sri Sritharan	State Water	Regulated river operations	Civil engineer with over 20 years experience in water delivery operations and management in the Lachlan and Macquarie River systems. Currently, Water Delivery Manager with State Water managing water delivery operations in the Lachlan and Macquarie Rivers and Fish River water supply schemes.
Kimberley Williamson	NSW Office of Water	Planning support	Bachelor of Environmental Studies (Adelaide University). Four years experience in water education and water management.

Appendix 4: Hydrological modelling

Configuration of the IQQM model

The hydrological model used for water sharing and management in NSW is the Integrated Quantity and Quality Model (IQQM). This hydrological model has been developed to assess the impacts of different water sharing rules. This is achieved by simulating the major hydrological processes in a river system under specific water sharing rules. The IQQM is set up to reproduce the average long-term behaviour of a river system for planning purposes, not specifically to reproduce individual daily flow behaviour in any particular year.

This numerical computer tool simulates river flows, dam storage and operation, consumptive demands, losses, crop demands, diversions, orders, water sharing rules, accounting and resource assessment. The input data utilised by the IQQM includes, rainfall, evaporation, inflows, crop type and irrigated area, storages, stock and domestic extractions, and diversions for town water, mining etc.

To validate the accuracy of the model, the IQQM is calibrated to achieve the best possible match between the modelled output and the observed data over a given period of record. The model calibration is performed over a period where data are available and there is sufficient climatic variability. The IQQM is calibrated to match reservoir levels, diversions and flows over the calibration period.

The gauging stations that were used for the Belubula IQQM model are included in the table below.

Gauging Station	Length of Record
Bangaroo	1956-1975
Canowindra	1992-1999
Flyers Creek	1976-1993
Coombing Creek	1971-1993
Candomine Creek	1966-1994
Nyrang Creek	1966-1994
Carcoar Dam	1970 - current

Extension of stream flow records

To understand the implications of different water sharing rules, it is important to have modelled river flow sequences that cover a range of climatic scenarios (wet, dry and medium periods). In the absence of historical streamflow data, the calibrated IQQM can estimate historical streamflows from historical rainfall records on a daily time-step.

The Belubula IQQM was calibrated from Carcoar Dam to the junction of the Belubula River with the Lachlan River. Streamflow records have been collected since 1938 from the Bangaroo streamflow gauge and the replacement Helensholme streamflow gauge. Using the Belubula IQQM these streamflow records were extended back to 1898 allowing the long-term behaviour of streamflows (1898 to 2009) under different water sharing rules to be assessed over a range of climatic conditions.

Modelled scenarios

The model was used primarily to assess the likely impacts of water sharing rules on the flow regime and water users. The IQQM was primarily used for the development of the water sharing rules for accessing uncontrolled flows. The model was also used to determine the Long Term Average Annual

Extraction Limit (LTAAEL). The base case model runs represent the Belubula Regulated River Water Source under pre-plan operational conditions.

Model Run Number	Run Description
W068 BASE CASE	<p>General Security, High Security, Stock and Domestic and Mining license volumes (as at June 2009)</p> <p>Diversion calibration</p> <p>Resource assessment</p> <p>Additional reaches and flow calibration for upstream of Canowindra</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge (gauge predating the Helensholme gauge) is greater than 10 ML/day. Maximum 20% of entitlement extracted from uncontrolled flows.</p> <p><i>Minimum Flow Target</i> - Minimum flow target of 10 ML/day is maintained at the Bangaroo gauge from dam releases</p> <p>No carryover of unused general security allocations</p> <p>Minimum dam release of 2 ML/day for basic rights users directly below dam</p>
W070	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump when the flow is ≥ 24 ML/day and must cease to pump when the flow is < 24 ML/day at the Bangaroo gauge.</p>
W071	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump when the flow is ≥ 49 ML/day and must cease to pump when the flow is < 49 ML/day at the Bangaroo gauge.</p>
W072	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump in summer when the flow at the Bangaroo gauge is ≥ 10 ML/day and in winter when the flow is ≥ 73 ML/day and must cease to pump when the flow at the Bangaroo gauge is < 10 ML/day in summer and < 73 ML/day in winter.</p>
W073	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump in summer when the flow at the Bangaroo gauge is ≥ 10 ML/day and in winter when the flow is ≥ 110 ML/day and must cease to pump once the flow at the Bangaroo gauge is < 10 ML/day in summer and < 110 ML/day in winter.</p>

Model Run Number	Run Description
W074	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump in summer when the flow at the Bangaroo gauge is ≥ 12 ML/day and in winter when the flow is ≥ 170 ML/day and must cease to pump when the flow at the Bangaroo gauge is < 12 ML/day in summer and < 170 ML/day in winter.</p>
W075	<p>W068 with a change to uncontrolled flows</p> <p><i>Uncontrolled Flows</i> – General security users are allowed to divert uncontrolled flows (being modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction). Water users can commence to pump when the flow at the Bangaroo gauge is ≥ 14 ML/day and must cease to pump when the flow is < 14 ML/day.</p>
<p>W086</p> <p>NEW BASE CASE</p>	<p>General Security, High Security, Stock and Domestic and Mining license volumes</p> <p>Diversion calibration</p> <p>Resource assessment</p> <p>Additional reaches and flow calibration for upstream of Canowindra</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge ≥ 10 ML/day. Maximum 20% of entitlement extracted from uncontrolled flows.</p> <p><i>Minimum Flow Target</i> - Minimum flow target of 10 ML/day is maintained at the Bangaroo gauge from dam releases.</p> <p>No carryover of unused general security allocations.</p> <p>Minimum dam release of 2 ML/day for basic rights users directly below dam</p> <p><i>Off-stream storage</i> – 1.5GL of off-stream storage.</p>
W091	<p>W086 with changes to uncontrolled flows and off-stream storage</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge is ≥ 13 ML/day. Maximum 20% of entitlement extracted from uncontrolled flows.</p> <p><i>Off-stream storage</i> – 3 GL of off-stream storage.</p>

Model Run Number	Run Description
W092	<p>W086 with changes to uncontrolled flows and off-stream storage</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge is ≥ 13 ML/day. Maximum 50% of entitlement extracted from uncontrolled flows.</p> <p><i>Off-stream storage</i> – 3 GL of off-stream storage</p>
W093	<p>W086 with changes to uncontrolled flows and off-stream storage</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when:</p> <p>EAW for general security licences is less than 50% (modelled as 50% maximum on-allocation extraction) and when the flow at the Bangaroo gauge ≥ 18 ML/day; or when</p> <p>EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge is ≥ 13 ML/day.</p> <p>Maximum 50% of entitlement extracted from uncontrolled flows</p> <p><i>Off-stream storage</i> – 3 GL of off-stream storage</p>
W106	<p>W086 with changes to uncontrolled flows, off-stream storage and account limit</p> <p><i>Uncontrolled Flows</i> – general security users can divert uncontrolled flows (modelled as supplementary water) when the:</p> <p>EAW for general security licences is $\leq 50\%$ (modelled as 50% maximum on-allocation extraction) and when the flow at the Bangaroo gauge is ≥ 20 ML/day; or when</p> <p>EAW for general security licences is less than 20% (modelled as 80% maximum on-allocation extraction) and when the flow at the Bangaroo gauge ≥ 13 ML/day.</p> <p>Maximum 50% of entitlement extracted from uncontrolled flows</p> <p><i>Off-stream storage</i> – 1.5 GL of off-stream storage</p> <p><i>Account Limit</i> – account limit 130%</p>

Appendix 5: Interagency regional panel reference materials

Office Data Sets

Licensing Administrator System (LAS) – the Office of Water statewide database holding the licence details including volume of entitlement, location details and stream orders.

Hydsys – Hydsys is an Office of Water statewide database that holds all flow record data. Flow records are available for most water sources in the Central West area.

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

Regional Geographic Information Systems – the Office of Water Land use and topographic information

Central Data Sets

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

Threatened species (fish) – Data supplied by NSW fisheries within the DPI.

Threatened species (other) – Data supplied by OEH.

Index of Social Disadvantage – Australian Bureau of Statistics.

Employment in Agriculture - Australian Bureau of Statistics

Other Agency Data

National Parks and Wildlife (OEH) statewide atlas – statewide flora and fauna database

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

NSW Fisheries (DPI) freshwater and saltwater recreational fishing database.