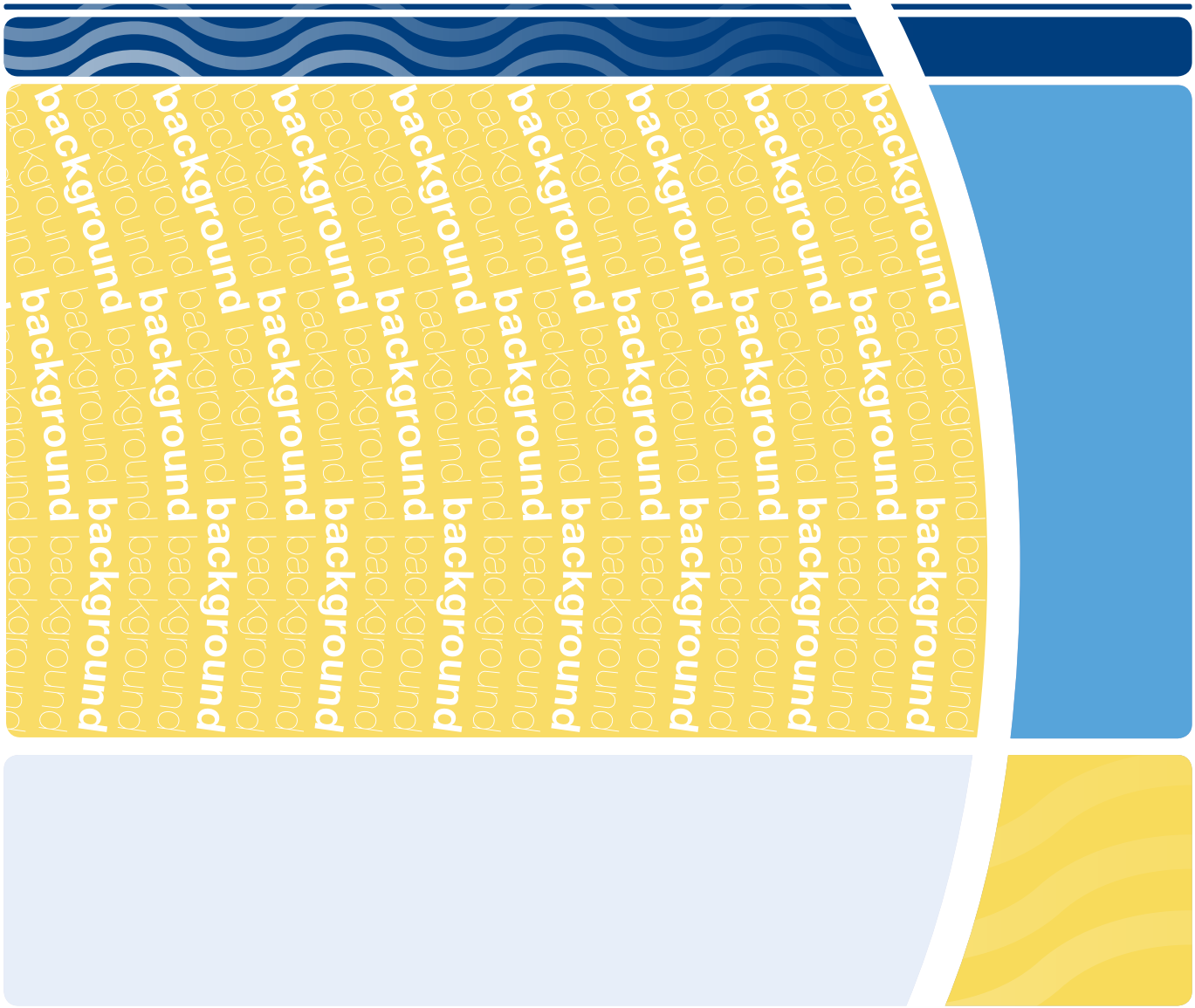
NSW GOVERNMENT | Office of Water

Water Sharing Plan

Intersecting Streams Unregulated and Alluvial Water Sources

Background document



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The Office of Water is part of the NSW Department of Primary Industries. It manages the policy and regulatory frameworks for the State's surface water and groundwater resources to provide a secure and sustainable water supply for all users.
The Office of Water also supports water utilities in the provision of water and sewerage services throughout New South Wales.

Water Sharing Plan for the Intersecting Streams Unregulated and Alluvial Water Sources – Background document

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Introduction

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

In recent years, plans for the unregulated[1] rivers and groundwater systems have been completed using a 'macro' or broader-scale river catchment or aquifer system approach. Approximately 95 per cent of the water extracted in NSW is now covered by the *Water Management Act 2000.* The macro planning process is designed to develop water sharing plans covering most of the remaining water sources across NSW. Each macro plan covers a large river basin rather than a single sub-catchment, or in the case of groundwater systems, a type of aquifer such as fractured rock. These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

The *Water Sharing Plan for the Intersecting Streams Unregulated and Alluvial Water Sources* (the plan) covers six surface water sources, together with two alluvial groundwater sources (refer to Appendix 1).

Water sharing rules that the plan focuses on are:

- environmental water rules – the share of the water reserved for the environment
- access rules – which determine when extraction is allowed (for example, above a set river height, proportion of full capacity of a pool, or set volume at a gauge)
- dealing rules – which control the trade of water, both the transfer of share components of an access licence and the assignment of water allocation between access licences, as well as changing the location for water extraction.

The following additional water sharing rules have been prepared:

- long-term average annual extraction limits (LTAAELs) – a growth-in-use assessment and management tool
- rules for granting access licences – what types of licences may be granted
- rules for granting works approvals – what types of set back conditions are required
- system operation rules.

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

- the purpose of the statutory plan
- a physical description of the Intersecting Streams catchments including land and water use
- the process of plan development including scope, history and basis for decisions
- the relationship between the plan and the Basin Plan
- the use of adaptive management
- the activities associated with implementation, monitoring and review of the plan.

[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.

The objectives of the plan are to:

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

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

- the *Water Sharing Plan for the Intersecting Streams Unregulated and Alluvial Water Sources* – a legal instrument written in its required statutory format
- *Water sharing plans – Inland NSW unregulated and alluvial water sources – Overview* - a plain English version of the plan explaining the key sections and rules
- rules summary sheets for each water source detailing the management rules.

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

- *Macro water sharing plans - the approach for unregulated rivers. A report to assist community consultation* – explains the method used to classify and set water sharing rules for unregulated streams across the state
- *Macro water sharing plans - the approach for unregulated rivers. Access and trading rules for pools* – explains the method used to set access and trading rules for pools within unregulated sources across the state
- *Macro water sharing plans - the approach for groundwater. A report to assist community consultation* – explains the macro approach to groundwater methodology, including assessment of risk and determination of sustainability indexes for aquifers

Purpose of the plan

Why are water sharing plans being prepared?

Expansion of water extraction across New South Wales 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.

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

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

In conjunction with other provisions of the *Water Management Act 2000,*, water sharing plans also set rules so that commercial users can also continue to operate productively. In general, commercial licences under the *Water Management Act 2000* 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 the plan, a number of benefits will flow to water users including:

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

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

Environmental considerations

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

Unregulated water sources

Most of the demand for water from unregulated systems usually occurs at those times when stream flow is low. While there is only limited research on the importance of protecting very low flows, a body of evidence suggests low flows are essential for maintaining water quality, allowing passage over riffles for fish and other fauna to pools used for drought refuge, maintaining those parts of aquatic ecosystems that are most productive. For example, the faster flowing riffle areas between pools usually contain the highest abundance and diversity of aquatic fauna. Although many streams will naturally stop flowing in dry times, it is the increased frequency and duration of drying as a result of extraction that has the potential to impact on stream ecosystems.

Accordingly, in order to protect a proportion of these very low flows for the benefit of the environment, the plan imposes new access restrictions on days when flows are low. This is achieved by establishing 'cease-to-pump' rules that describe when water must not be extracted, depending on the amount of flow in the river on any given day.

When a 'cease-to-pump' event has been activated for a period of time eventually flows will increase again above the 'cease-to-pump' level. After a 'cease-to-pump' has occurred, a 'commence-to-pump' will then be activated to let users know that they are able to extract water again. The 'commence-to-pump' level can vary between management zones and may be immediate once the river levels have exceeded the or a higher level specified by the 'commence-to-pump' or it may be delayed for a period of time after river levels have exceeded the 'cease-to-pump' level.

Existing rules

A number of licences within the plan area previously had cease-to-pump conditions under the *Water Act 1912*. These ranged from a specific flow rate or volume at a gauge to 'no visible flow at the pump site'. In the past, these conditions have only been applied to specific licences and not at a water source or management zone level as a whole. In some water sources there has been no previous history of a cease-to-pump condition imposed during low flow periods. These are mainly in water sources with few or no users. Some water sources have also been subject to statutory restrictions and suspensions in the past. These have mainly occurred during summer months and have ranged from sharing a total extraction limit averaged over a given period to a total suspension on irrigation pumping when flows are less than a certain level at the gauge.

Proposed rules

Upon commencement of the plan, surface water licences in all unregulated water sources are subject to 'cease-to-pump' rules (excluding licences listed in Schedule 2 of the plan). Rules vary depending on where a licence is located within the plan area. This information can be found on individual rules summary sheets available on the Office of Water's website at www.water.nsw.gov.au

In instances where the existing 'cease-to-pump' rule under the *Water Act 1912* was based on a higher flow rate or height at a gauge than the 'cease-to-pump' proposed by the plan, the existing 'cease-to-pump' rule will take precedence.

Alluvial groundwater sources

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. Aquifers can store large volumes of water, often accumulated over thousands, or even tens of thousands of years – this is referred to as 'storage'.

The volume of water in storage is recharged in a number of ways depending on the type of the groundwater system. Recharge usually comes from rainfall, surface water bodies such as rivers, or through the flow from adjacent aquifers.

Water sources are defined as 'highly connected' if 70 per cent or more of groundwater pumped in an irrigation season is derived from stream flow (see section *Managing surface water and groundwater connectivity*).

Existing rules

Access licences for groundwater extraction have not been subject to annual limits or daily management.

Proposed rules

In the alluvial groundwater sources covered by the plan, 100 per cent of groundwater storage is reserved as planned environmental water.

Recharge to the alluvial groundwater source is shared between the environment and extractive users. The proportion of recharge reserved for the environment is intended to reduce the risk of unsustainable groundwater extraction in the long term. Planned environmental water for the recharge component is based on a risk assessment process which weighed up risks to the aquifer against socio-economic risks and determined a sustainability index for the aquifers.

The alluvial groundwater sources have been classified as less highly connected and thus will be managed by groundwater rules only.

The plan also includes rules on the location of new works and extraction from existing works to protect high-priority groundwater dependent ecosystems (GDEs), high-priority karst systems and other sensitive environment areas such as rivers or streams.

Scope of the plan

The plan covers the hydrological catchments of the NSW Intersecting Streams unregulated water sources, as well as the Paroo and Warrego alluvial groundwater sources. The water sources within the Murray-Darling Basin include:

- Culgoa River
- Mooni River
- Narran River
- Paroo River
- Warrego River
- Yanda Creek
- Paroo Alluvial
- Warrego Alluvial

The plan does not cover the following:

- water contained in any fractured rock or porous rock
- water contained in the NSW Great Artesian Basin groundwater sources
- water taken under a floodplain harvesting access licence with a share component that does not specify one of the water sources within the plan.

Due to the nature of the connectivity between the alluvial aquifers and the unregulated rivers, the surface water and groundwater associated with the alluvial aquifers will be managed under a single plan. This approach is consistent with the national framework for managing the impacts of groundwater and surface water interaction.

Water management units

Water sharing plans can include the following hydrological planning units.

Where appropriate, an **extraction management unit** (EMU), consisting of one or several water sources, is specified for the purpose of establishing a geographic area over which the long-term average annual extraction limit (LTAAEL) applies. An available water determination (AWD) is made for each licence category within the EMU and any growth in extraction above the LTAAEL is managed across the EMU, not at an individual water source level.

Where an EMU is not specified, the LTAAEL applies to the **water source** and any growth in extraction above the LTAAEL is then managed at that level. This is the case for the Intersecting Streams as the water sources covered are not hydrologically connected, thus growth in one water source would not impact another. A water source is made up of one or more hydrologic sub-catchments, and is the unit at which most water sharing rules apply.

A **management zone**, representing a portion of a water source, may then be specified so that more refined implementation of access or trading rules can be applied, if required. In this plan the Narran River water source has been split into four management zones to allow for more refined management.

Description of the plan area

The area covered by the plan (refer to Appendix 1) comprises the NSW portions of the Mooni River catchment (754 square kilometres), the Narran River catchment (14,000 square kilometres), the Culgoa River catchment (11,800 square kilometres), the Warrego River catchment (11,375 square kilometres), and the Paroo River catchment (40,450 square kilometres). The Yanda Creek catchment (42,052 square kilometres) is also a part of the plan area, which exists wholly inside NSW. The six surface water catchments of the Intersecting Streams cover a total area of 120,431 square kilometres. The plan is predominantly located along the northern NSW / Queensland Border, stretching south to include the catchment of Yanda Creek. Localities within the plan area include Lightning Ridge, Goodooga, Enngonia, Hungerford, Wanaaring, White Cliffs and Cobar. The plan is bound by the NSW / Queensland Border to the north, the Bulloo Overflow, Lake Bancannia, and Lower Murray-Darling catchments to the west, the Barwon-Darling River and Bogan catchment to the east, and the Barwon-Darling River, Lachlan and Lower Murray-Darling catchments to the south.

The plan area is characterised by low relief with elevations ranging from 100-300 metres above sea level. The character of the contemporary river channel system and its physical structure is largely influenced by evolution of the drainage networks across the Intersecting Streams catchments.

Geologically, the Intersecting Streams form the northern edge of a large intercratonic Cainozoic basin which has in-filled with mainly continentally derived alluvial sediments. There are numerous bedrock areas within the catchments: the Ordovician to Cretaceous metamorphic, granite, and sandstone, which form a heavily dissected landscape around the marginal areas of the catchments.

The topography of the Intersecting streams falls within three defined bioregions:

- the Mooni, Narran and Culgoa water sources are located within the ‘Darling Riverine Plains’ bioregion
- the Warrego and Paroo water sources are located within the ‘Mulga Lands’ bioregion
- Yanda Creek water source is located in the ‘Cobar Peneplain’ bioregion.

River valley patterns characterise an inland drainage system associated with a depositional area. Flattening of the landscape, characteristic of the Intersecting Streams catchments was primarily through infilling of a prior landscape by younger Cainozoic sediments. Drainage networks in these catchments comprise distributary, anabranching and meandering systems typical of flat riverine plains with some bordering alluvial fans. The southern drainage direction of the Intersecting Streams border catchments (Mooni, Narran, Culgoa, Warrego and Paroo) can be traced back to the rifting in the late Cretaceous – early Tertiary (60-80 million years ago), associated with the formation of the Tasman, and which resulted in the Great Divide and Canobolas Dividing Ranges. The upwarping of the eastern margins of Australia provided an impetus for a flow reversal in the greater Barwon-Darling River system, from a north-east, to a south-west flowing drainage system. It has been suggested by Abell (1990) that further up-warping of the Great Divide at the northern most extremities of the Barwon-Darling Catchment resulted in the drainage network development of the Paroo, Warrego, Culgoa, Narran and Mooni systems. As such, the Paroo, Warrego, Culgoa, and Narran Rivers are probably the youngest drainage systems in the greater Barwon-Darling River catchment.

The Intersecting Streams water sources cover a large area with many different types of plant communities. The various plant communities that can be found in the Intersecting Streams water sources are listed below:

- The north-eastern water sources of the Darling Riverine Plains bioregion support river red gum (*Eucalyptus camaldulensis*) and river cooba (*Acacia stenophylla*) communities, along with river paperbark (*Melaleuca trichostachya*) and in the northern areas stands of Coolabah (*Eucalyptus microtheca*). Black Box (*Eucalyptus largiflorens*) is also common on the plains in

the Culgoa and Narran water sources. Away from the river channels, many plains are treeless, supporting only grasses and shrubs such as old man saltbush (*Atriplex nummularia*), bladder saltbush (*Atriplex vesicaria*) and Mitchell grass (*Astrebla* sp). Hills and undulating landscape may give rise to woodlands.

- The north-western water sources of the Mulga Lands bioregion are predominantly covered by mulga (*Acacia aneura*), however, communities of western bloodwood (*eucalyptus terminalis*) and poplar box (*Eucalyptus populnea*), with mallee (*Eucalyptus* sp.), white cypress pine (*Callitris glaucophylla*), silver-leaf ironbark (*Eucalyptus melanopholia*), beefwood (*Grevillea striata*), leopardwood (*Flindersia maculosa*) and bluebush (*Maireana* sp.) are also common in the northern and eastern areas of these water sources. Spinifex (*Triodia* sp.) is also common along the ridges. Dense areas of woody shrubs extend across sand plains. Black box (*Eucalyptus largiflorens*), coolabah (*Eucalyptus microtheca*), river cooba (*Acacia stenophylla*), yapunyah (*Eucalyptus ochrophloia*) and eurah (*Eremophilia bignoniflora*), together with lignum (*Muehlenbeckia cunninghamii*), canegrass (*Eragrostis autralasica*), saltbush (*Atriplex* sp.) and copper burr (*Sclerolaena* sp.) are typically found on the alluvial clays of the water sources.
- Yanda Creek is the only water source that is located within the Cobar Peneplain bioregion, which is characterised by an undulating hilly landscape with shallow red earth soils, where the vegetation is mainly open woodlands of bimble or poplar box (*Eucalyptus populnea*), red box (*Eucalyptus intertexta*) and white cypress pine (*Callitris glaucophylla*).

Land use history

Heavy grazing throughout much of the Intersecting Streams water sources has resulted in vast areas being covered by a dense regrowth of woody shrubs. This shrub layer is for the most part unpalatable to stock, and the encroachment and proliferation of these species is a major problem throughout the semi-arid rangelands of NSW.

Present information indicates that Aboriginal occupation in NSW has existed for at least 45,000 years, and with further research this figure may be extended. Prior to European settlement in the mid 1800's, the lands of the Intersecting Streams were home to 6 Aboriginal tribal groups. The Barkindji people were located mainly around the lower Darling and lower Paroo water sources. The Parundji occupied the lands to the north of the Barkindji, along the banks of the Paroo. The Naualko people occupied the western banks of the Warrego, whilst the Barabinja and the Ualarai people lived in the lower Culgoa and Narran water sources.

Indigenous tribes remained in these localities until the late 1860s, when pioneering pastoralists arrived and occupied these landscapes for grazing and agriculture, displacing the original inhabitants. Populations of the above tribes is unknown, however, after the 1919 influenza epidemic, there were only 70 members of the Maliangapa people (a tribe living in the far north-west corner of NSW and only moderately affected by the arrival of pastoralists), still living in traditional tribal culture in the north-west corner of NSW (OEH, 2011).

European settlement took place around the 1860s when pastoralists arrived in search of grazing lands for sheep and cattle. Large stations became established in the area, and the introduction of riverboats increased the number of people moving to the area. Indigenous people were employed as stockmen, farmhands, or domestic help on stations and also as timber cutters for pastoral progress and to fuel fires on the steamboats which were beginning to ply their trade up and down the Darling River.

Today the area is made up of large pastoral stations, which occupy all the leasehold land within the plan area aside from, the scattering of localities, and national parks or nature reserves.

There are areas within the plan area that remain under native vegetation and some of these are protected as national park or nature reserves. In particular, the Paroo River water source is protected

through an inter-governmental agreement between NSW and Queensland, similarly, the terminal Narran Lake, at the end of the Narran River system is a RAMSAR protected wetland.

Climate

The Intersecting Streams water sources of NSW experience a semi-arid climate characterised by hot dry summers and mild dry winters. Temperatures exceed 40°C for short periods during December to February. Frosts are frequent during the winter months. The mean annual temperature for the plan area is 15 to 20°C. Minimum average monthly temperature is 1.6 to 4.9°C, whilst the maximum average monthly temperature is 30.8 to 35.4°C. Rainfall throughout the water sources ranges from 213 millimetres (mm) in the western catchments to 500 mm in the eastern and southern catchments. There is a slight increase in rainfall in the summer months, although predominantly the monthly averages are within 10 mm of each other throughout the year.

Stream flows

The average annual discharge has been approximated at: 100,000 megalitres per year (ML/year) for the Mooni River, 460,000 ML/year for the Culgoa and Narran Rivers, 10,000 ML/year for the Warrego River and 1,000 ML/year for the Paroo River. There is no reliable data for discharge of Yanda Creek.

Variability in stream flows occurs between seasons as well as across the catchment. Between seasons in the wetter months (summer to early autumn) flow can be greater than the drier months (late winter to spring). Flooding is a sporadic event in the Intersecting Streams and is usually associated with the cyclonic rain depressions in the Queensland portions of the water sources that results in intense rainfalls and flash flooding.

Stream flow is currently measured at 15 gauging stations within the Intersecting Streams water sources as listed in Table 1. Records from both the current (listed below) and discontinued gauging stations provide a history of stream flows throughout the plan area and have been used in the development of the plan.

Table 1 Stream gauging stations in the plan area

Station name	Water source	Station no.	Period of record	
			Start	Finish
Mooni River at Gundablouie	Mooni River	417001	24/08/1944	Ongoing
Narran River at Wilby Wilby	Narran River	422016	02/11/1964	Ongoing
Narran River at Narran Park	Narran River	422029	14/02/2002	Ongoing
Narran River at Angledool 2	Narran River	422030	11/04/2002	Ongoing
Narran River at Bundah	Narran River	422031	31/03/2008	Ongoing
Narran River at Back Lake	Narran River	422034	10/12/2009	Ongoing
Bokhara River at Bokhara	Culgoa River	422005	06/09/1944	Ongoing
Bokhara River upstream of Weir	Culgoa River	422032	09/12/2009	Ongoing
Culgoa River upstream of Collerina	Culgoa River	422011	27/10/1964	Ongoing
Culgoa River at Brenda	Culgoa River	422015	01/01/1926	Ongoing
Warrego River at Ford's Bridge	Warrego River	423001	29/11/1921	Ongoing
Warrego River at Ford's Bywash	Warrego River	423002	29/11/1921	Ongoing
Warrego River at Barringun 2	Warrego River	423004	30/05/1993	Ongoing
Cuttaburra River at Turra	Warrego River	423005	31/05/1993	Ongoing
Paroo River at Willara Crossing	Paroo River	424002	23/11/1975	Ongoing

Groundwater

There are two alluvial aquifer systems included in the plan, namely the Paroo alluvial and the Warrego alluvial groundwater sources. There are 18 bore licences in the Paroo alluvial groundwater source and 16 bore licences in the Warrego alluvial groundwater source. These licences are for a range of purposes including stock and domestic access and town water supply.

Climate change and variability

The CSIRO Murray-Darling Basin Sustainable Yields Project assessment was undertaken for 18 regions including the Paroo, Warrego, Condamine-Balonne and Barwon-Darling all of which contain the water sources of the Intersecting Streams. The CSIRO 2007 report made the following conclusions for the Intersecting Streams water sources:

- The effects of climate change by 2030 will have the following effect on surface water availability; a three per cent reduction in the Paroo River water source, a 6.5 per cent reduction in the Warrego River water source, an 8.5 per cent reduction in the Culgoa River and Narran River water sources, and an 11 per cent reduction in the Mooni River water source.
- The recent climate (1997 to 2006) was similar to the long-term average climate.
- The best estimate of climate change by 2030 would not impact surface water diversions in the Paroo water source, but reduce diversions by 2.4 per cent in the Warrego water source, 4.2 per cent in the Culgoa and Narran water sources, and 6.1 per cent in the Mooni water source.
- Likely future development of farm dams (13 per cent growth) and groundwater (77 per cent growth) would reduce average river inflows by 3 per cent, increase stream flow leakage to groundwater by 14 per cent and reduce surface water diversions by 4 per cent.

However, CSIRO also reports that the hydrological impacts of climate change in the Murray-Darling Basin remain very uncertain. Rainfall-runoff modelling with climate change projections from global climate models indicates that future runoff in the Intersecting Streams water sources is more likely to decrease than increase. The CSIRO report suggests that the best estimate 2030 climate scenario is a 6 per cent reduction in mean annual runoff. The extreme estimates (from different climate models under high global warming) range from a 31 per cent reduction to a 39 per cent increase in mean annual runoff.

Under the best estimate 2030 climate, there would be a five per cent reduction in water availability, an eight per cent reduction in end-of-system flows and a one per cent reduction in surface water diversions overall (CSIRO, 2007). Under the wet extreme 2030 climate there would be increases of 38 per cent in average water availability, 52 per cent in end-of-system flows and 10 per cent in surface water diversions (CSIRO, 2007). Under the dry extreme 2030 climate there would be decreases of 30 per cent in average water availability, 39 per cent in end-of-system flows and 17 per cent in surface water diversions (CSIRO, 2007).

The rules in the plan determine how the risk from climatic changes is apportioned between users and the environment. These are discussed in the section on implementation, monitoring and review.

Entitlement and use

There are approximately 124 water licences in the area covered by the plan, totalling 24,152 megalitres of entitlement. This entitlement is divided between unregulated surface water and alluvial groundwater. The majority of licences are used for irrigation, with a significant proportion also used for domestic, stock and town water supply.

Current water entitlement across the plan water sources is listed in Table 2.

Table 2 Total entitlement and number of licences for each water source

Water source	Entitlement (ML/year)	Number of licences
Unregulated water sources		
Mooni River	1,063	9
Narran River	8,908	26
Culgoa River	4,044	21
Warrego River	9,571	17
Paroo River	541	9
Yanda Creek	0	8
TOTAL SURFACE WATER	24,127	90
Alluvial groundwater sources		
Warrego Alluvial	25	16
Paroo Alluvial	0	18
TOTAL GROUNDWATER	25	34
TOTAL	**24,152**	**124**

Licensed entitlement tends to be greater in the eastern surface water sources where there is a greater security of water, although there are some quite large volume surface water licences in the Warrego River water source. Water in the Yanda Creek water source is very intermittent, and consequently the eight surface water licences in this water source have no recognised entitlement.

The alluvial groundwater licences are located evenly down the main trunks of both the Warrego and Paroo Rivers. There are 16 alluvial licences in the Warrego Alluvial groundwater source, which are mainly used for stock and domestic purposes. Enngonia and Bourke town water supplies both have alluvial licences on the system with no defined entitlement volume. There are 18 alluvial licences in the Paroo Alluvial groundwater source, 17 of those licences are for stock and domestic purposes and one is for Wanaaring town water supply.

Water extraction

Water extraction in the Intersecting Streams is utilised for a range of uses which include: irrigation, stock, domestic, mining, town water supply, industrial, and recreational purposes. The sandy substrate characteristic of the Intersecting Streams catchments negates most attempts at broad scale crops and pastures, although cotton farming is still a relatively successful enterprise in the eastern water sources, and grazing occurs throughout all the plan area.

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

Local water utility requirements

A number of town water supplies, which range between large storages to small direct river extractions, are located within the Intersecting Streams water sources. These supplies are administered through various local and shire councils.

Bourke Shire Council has an alluvial licence in the Warrego and a surface water licence on the Paroo River for town water supply for Hungerford and Wanaaring respectively. Brewarrina Shire Council has

a surface water licence on the Bokhara River in the Culgoa water source for town water supply to Enngonia. The Central Darling Shire has a surface water licence in the Paroo for town water supply to White Cliffs, and Cobar Water Board has a surface water licence for low security mining and recreation purposes on Yanda Creek.

Table 3 shows the town water supplies, water sources and entitlements for those utilities within the plan area.

Table 3 Town water supplies, location and entitlement volume in the plan area

Water supply	Water source	Entitlement (ML/year)
Enngonia	Culgoa River	91
Hungerford	Warrego Alluvial	0
Wanaaring	Paroo River	25
White Cliffs	Paroo River	196
Cobar Water Board	Yanda Creek	0

Developing the plan

Project groups

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 the varying policy and statutory requirements of the relevant NSW Government agencies are met. The panel also has the role of making water sharing decisions in cases where the interagency regional panel cannot reach agreement or where the issue has statewide significance.

The State Interagency Panel is chaired by the NSW Office of Water and comprises representatives from the Office of Water, the NSW Office of Environment and Heritage (OEH), three 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 overall project management.

Interagency regional panel

The plan rules were developed by the Intersecting Streams Interagency Regional Panel (IRP),which comprises representatives from the Office of Water, OEH and DPI with input from the Western Catchment Management Authority. The IRP was responsible for the resolution of a number of water sharing matters associated with water management in the plan area. Appendix 2 lists the names of the IRP representatives and their areas of expertise. The IRP had access to staff from other agencies to provide technical and scientific information. The key roles of the IRP were to:

- review the hydrological (water management) units provided by the Office of Water
- assign economic, social and environmental values and undertake risk and value assessments to classify each unregulated water source
- review the existing licence conditions as to their applicability
- make recommendations on the water access and trading rules for each water source
- assist the Western CMA with the public consultation on the proposed rules
- review submissions received during public exhibition and recommend changes where necessary to the water sharing rules.

The IRP used local knowledge and expertise in recommending the water sharing rules and where agencies had particular issues those issues were highlighted during the public consultation and exhibition period for specific attention.

The IRP also considered the ability to manage and monitor flow in a water source. For example, where there was no flow gauging station they assessed the risks:

- recommending new gauges be installed for high-risk or highly stressed water sources, or
- suggesting alternatives such as ‘staff’ gauges (which measure river height but not flow) or visible flow references where the risk to instream value was low.

State Groundwater Panel

The State Groundwater Panel (SGP) provides a senior level forum for discussing and resolving a wide range of water planning and policy issues specific to groundwater. The SGP plays a specific role in reviewing and, where appropriate, modifying the outcomes of the regional groundwater assessments and the proposed groundwater sharing rules to ensure consistency across the state for aquifer types.

The group is chaired by the NSW Office of Water and has representatives from the Office, OEH, DPI and CMAs. The panel had access to staff from the agencies to provide further technical and scientific information.

Policy context

There are a number of national and state policies that impact on and direct the development of water sharing plans.

Murray-Darling Basin Cap

The Intersecting Streams comprise 11 per cent of the total area of the Murray-Darling Basin (the Basin) and are subject to agreements and statutes which cover water management within the Basin.

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 levels of diversions at that time were placing stress on both the environmental health of our river systems and the reliability of supply to water user and that diversions were continuing to increase. In response, the MDBMC developed the Murray-Darling Basin Agreement, which introduced a diversion limit – the Cap. NSW became a signatory to the Agreement in 1995.

Schedule F (now Schedule E) of 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 Cap on groundwater diversions.

In the Basin, 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. In unregulated water sources licences were area based and not metered so the assessment of Cap is more difficult. As part of a volumetric conversion process, irrigation licence holders were surveyed as to the area that they had irrigated over the six year period (1993-1999) and conversion rates developed to establish licensed entitlements and derive average levels of water use based on crop water requirements. There was no discernable pattern of growth in irrigated areas over the survey period in any of the river systems, so the Cap is based on the information calculated as an average of the yearly assessments over the survey period.

National Water Initiative

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

The NWI has a number of relevant requirements for water planning in Clauses 23, 25, 35 to 40, 52, 78, 79 and Schedule E (refer to the National Water Commission website www.nwc.gov.au in the Water Reform section for details). This intergovernmental agreement contains provisions on water planning including:

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

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

Natural Resources Commission

The macro water sharing plans must also comply with the NSW Natural Resources Commission's (NRC) statewide standards and contribute to the relevant statewide targets such as Targets 5 and 6 (see www.nrc.gov.au for details) which is a requirement of the NSW State Plan (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, the NRC 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. Table 4 lists the state targets and how these are met within the 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 plans against this Standard and its associated targets.

Table 4 Contribution of the plan to the relevant NRC statewide targets

Relevant statewide target	Plan's contribution
By 2015 there is an increase in the recovery of threatened species populations and ecological communities (Target 3)	- some access and trading rules developed to help protect water dependent threatened species where these were identified and the risk to these from extraction is high
By 2015 there is an improvement in the condition of riverine ecosystems (Target 5)	- sets a defined share of water for riverine ecosystems - protection of very low flows - trading rules to maintain or reduce entitlement in high value streams - adaptive management, giving the ability to adjust rules once information becomes available or at the end of plan period.
By 2015 there is an improvement in the ability of groundwater systems to support their groundwater dependent ecosystems and designated beneficial uses (Target 6)	- rules will be applied which protect significant GDEs
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained (Target 8)	- rules will be applied which protect sensitive environmental areas - protection of a proportion of wetland storage volume - trading rules to maintain or reduce entitlement in high value wetlands sources - protection of very low flows
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being (Target 12)	- plans provide a defined share to water and defined certainty of access - separation of land and water enhances trading and value of licences - establishment of perpetual and compensable water access licences provides security for business investment - water markets encourage movement of water licences to high value uses - rules developed which consider community dependence on water extraction

Catchment action plan

The plan is consistent with and contributes to the Western Catchment Action Plan of January 2007. The catchment plan can be found on the Western CMA website www.western.cma.nsw.gov.au in the 'Your Region' section.

One of the CMA's responsibilities on the IRP is to provide advice on the alignment of the proposed classification and extraction limits and rules with the priorities of the Wester Catchment Action Plan.

Basin Plan

The Commonwealth *Water Act 2007* requires the Murray-Darling Basin Authority (MDBA) to prepare and oversee a Basin Plan. The Plan is 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 Basin water resources
- set Basin-wide environmental objectives, and water quality 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 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 Basin water resources. These are known as 'sustainable diversion limits' (SDLs). As the SDLs come into effect, they will replace the current MDBMC Cap on diversions in 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.

Other considerations

There are a number of policies and water related issues that required consideration during the development of the plan.

Protecting Aboriginal values

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

Initial consultation sessions provided some insights into Aboriginal cultural values associated with unregulated rivers. Aboriginal communities have indicated that water sharing rules should protect natural instream values. Whilst Aboriginal groups acknowledge the rights of commercial water users, they believe that this entitlement should not be at the expense of the environment or cultural values. In their view, the priority for water sharing plans should be to provide for natural flowing rivers with healthy aquatic biodiversity. This is consistent with the proposed provisions of the plan.

Furthermore, opportunities for granting licences for Aboriginal cultural purposes throughout the Intersecting Streams catchments are included in the plan. These can be used for purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and ceremonial purposes. The plan also allows for the identification of water for significant Aboriginal cultural sites. The process of identifying these sites and their water requirements is currently being developed by the Office of Water as part of an extensive consultation program being rolled out across NSW in 2011 and 2012 with funding from the National Water Commission.

For more information on macro water sharing plans and Aboriginal water users, visit the Office of Water website at www.water.nsw.gov.au.

Protecting environmental values

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

Protecting pools, lagoons and lakes

Pools in NSW can provide an important source of water for access licence holders, basic landholder rights holders and communities. Pools also have a key ecological function as a critical refuge and habitat for flora and fauna. Pools include lentic water bodies (standing water) in or associated with unregulated rivers across NSW, including anything falling within the definition of a "lake" found in the Dictionary of the *Water Management Act 2000*, except for tidal pools and estuaries.

'*Macro water sharing plans – the approach for unregulated rivers. Access and trading rules for pools'* can be found on the Office of Water website www.water.nsw.gov.au. This document has been developed to provide additional guidance for interagency regional panels in setting water access and trading rules for pools that are covered by unregulated river water sharing plans.

The approach uses an assessment of the environmental values of the pools to select rules that adequately protect these values while not having a disproportionate effect on water availability for extraction. Because it is not practical to identify and create site-specific rules for every natural pool in a water sharing plan area, the focus of the approach adopted is to establish a default access rule of no drawdown below full pool capacity for the majority of pools. The default rule may then be modified by interagency regional panels in specific circumstances if it is justifiable and feasible to do so to allow limited access to pools based on local hydrological, environmental and socio-economic considerations.

Different default rules apply depending on the pool type. The default rules are for:

- Artificial pools created by structures covered by a water supply work approval
  - Existing licence conditions to continue
  - Exempt from the drawdown rule constraints that apply to natural pools
  - For in-river dams, consider a dead storage cease to pump rule if there are outlet works lower than the top of the crest of the weir.
- Natural pools
  - Users must cease to pump when the pool is less than its full capacity

'Full capacity' can be approximated by the greatest pool volume where there is no visible flow out of that pool.

The approach further differentiates between two categories of natural pools. Category 1 pools are natural pools that are any of the following:

- not a stream (regardless of size)
- on a flood-runner or floodplain
- on an effluent that only commences to flow during high flows.

Category 2 pools are all natural pools that are not in category 1 and can be found within the channels of perennial or intermittent rivers. As flows subside in the channels of intermittent rivers, pools remain and may be permanent or temporary in nature.

Water sharing plans contain amendment provisions to allow for changes to be made to access and trading rules for a particular pool or category of pool should new information be gained through environmental and/or socio-economic studies relating to pools in a plan area.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes determined to some extent by the availability of groundwater. GDEs can include cave systems, springs, wetlands and groundwater dependent endangered ecological communities (EECs).

The methodology utilised for the identification and scheduling of high-priority GDEs in the macro planning process involves two stages consistent with the NSW State Groundwater Dependent Ecosystem Policy (DLWC, 2002).

Stage 1 Prior to the commencement of the plan

Stage 1 occurs during the initial development of a macro water sharing plan. It involves a desktop exercise assembling all known records of GDEs and includes interrogating known data bases, GIS records and other studies followed by the identification of the high priority GDEs. This stage is undertaken by an interagency group with staff from the NSW Office of Water (now within the Department of Primary Industries), NSW Office of Environment and Heritage, and agriculture, fisheries and aquaculture specialists from the NSW Department of Primary Industries. This is equivalent to Step 1 and Step 2 set out in the 'Rapid Assessment Process for Groundwater Dependent Ecosystems' described in the NSW State Groundwater-Dependent Ecosystem Policy (DLWC, 2002).

The desktop assessment in Stage 1 allows the plan to protect GDEs of known high conservation value from year 1 of the plan where time and resources are not available to conduct detailed field studies and analysis. GDEs that have been identified through other processes as having important conservation significance are listed in a schedule to the plan and rules are developed to protect them. For example, GDEs listed under the Directory of Important Wetlands, RAMSAR listed wetlands, communities listed under the *Threatened Species Act 1995* and Karst Conservation Reserves listed under the *National Parks and Wildlife Act 1974* by the Karst Conservation Unit of the NSW Office of Environment and Heritage are added to the GDE Schedule for the commencement of the plan.

The IRP then has the opportunity to review and amend the GDE list as well as the rules that have been developed to protect them based on their expertise. If the rules vary substantially from the standard rules that have been developed to protect GDEs, then the proposed rules may be submitted to the State Groundwater Panel for endorsement.

The list of high priority GDEs compiled at this stage can be either amended after year five of the plan as further GDEs are identified or during the life of the plan on submission to and approval by the Minister.

Stage 2 During the life of the plan

Stage 2 occurs during the life of the plan and is a comprehensive assessment of the individual GDEs. Stage 2 involves a significantly more detailed analysis of GDEs to build upon the desktop assessment undertaken at Stage 1 based on the 'Groundwater Dependent Ecosystems: Assessment, Registration and Scheduling of High Priority: Manual to Assist Groundwater Macro planning' (DNR, 2006). This involves undertaking a comprehensive assessment of all records of known GDEs to determine their ecological value. High ecological value for an ecosystem is defined as an ecosystem in a natural or near-natural condition, health and integrity assessed in terms of four criteria, which are:

- ecosystem condition/level of disturbance
- rarity of the dependent biota or physical features
- diversity
- special features.

The manual sets out the process for weighing the ecological values to achieve an overall ranking of high, medium and low-priority for each GDE. Those determined to be of high-priority are then listed in the NSW GDE records and included in schedules to the plans. Changes to the rules that protect the GDEs will also be made, where appropriate.

Protecting basic landholder rights

Under the *Water Management Act 2000*, extraction of water for **basic landholder rights** does not require a licence, although in the case of accessing groundwater under these rights, the bore must still be approved by the Office. Basic landholder rights include water for domestic and stock purposes

extracted from a water source fronting a landholder's property or from any aquifer underlying the land, harvestable rights and for native title rights.

The principles of the *Water Management Act 2000* also require that water sharing must protect basic landholder rights. The plan does this by including an estimate of the water requirements for basic landholder rights at the start of the plan. There are currently no extractions for native title rights. However, these rights may be activated during the plan's 10 year term.

Furthermore, the access rules apply to licensed water users but not to extractions for basic landholder rights. This in effect affords these basic landholder rights some additional protection.

Domestic and stock rights can be restricted by the Minister to protect the environment or public health, or to preserve existing basic landholder rights. These restrictions are outside the framework of the plan. The Office of Water is developing a regulation which will limit extractions under domestic and stock rights to a reasonable volume where they are metered and more clearly define what is considered to be reasonable purposes, which is important where they are not metered.

The estimate of basic landholder rights for the Intersecting Streams water sources draws on the reasonable take and use zones and the domestic and stock consumption allowances from the NSW Office of Water's draft Mandatory guidelines for the take and use of water under domestic and stock rights. Consideration is given to both surface and groundwater estimations simultaneously, effectively reducing the double counting of these rights in the estimations. The method is summarised as follows:

- Areas of significant reliance on groundwater and surface water are determined
- 2005 land use data held by NSW Office of Water is used to determine grazed area as defined by the draft RUG and a consequent volume determined by applying the stock consumption allowance (megalitres per hectare) from the draft guidelines, to estimate stock watering use in each water source.
- ABS Population and Housing Census data by collector districts is used to calculate the number of houses in each water source and the domestic consumption allowance (megalitres per 'house') from the draft guidelines is applied to estimate the total domestic water use for each water source.

Protecting town water supply access

Towns have a higher priority for 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 operator'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.

In unregulated surface water and groundwater sources, towns will not need to change their existing water access arrangements unless their current infrastructure is unable to meet their water needs and requires upgrading. In this case, when a major augmentation of the works occurs, town water utilities will need to, as a minimum, meet conditions specified in the plan to ensure that there is enough water flowing to protect the environment and consider any potential impacts on other consumptive users.

Managing surface water and groundwater connectivity

A key objective of the National Water Initiative of 2004 is 'recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource'.

For the purposes of developing plans for inland aquifer systems in NSW, the Office of Water has defined a highly connected system as a system in which '70 per cent or more of the groundwater extraction volume is derived from stream flow within a single irrigation season'. This is a simplified

version of, but still reasonably consistent with, the key findings and conclusions circulated for discussion among state jurisdictions by the Murray-Darling Basin Commission (MDBC) in their report *Evaluation of the connectivity between surface water and groundwater in the Murray-Darling Basin* (MDBC, 2008).

Using the above definitions of connectivity, the groundwater sources covered by the plan will be treated as a 'less highly connected' system and will continue to be tied to groundwater only rules.

Granting new access licences

Plans make provision for the application for new access licences in addition to those prescribed by the Water Management (General) Regulation 2004. If additional licences are granted in a water source and usage is assessed to have exceeded the long-term average annual extraction limit (LTAAEL), then growth management provisions in the plan are implemented.

All water sources in the Intersecting Streams have been embargoed under the *Water Act 1912* for the application of new licences. These embargoes include:

- Intersecting Streams alluvial groundwater sources:
    - In November 2006 an embargo on the issuing of new licences was gazetted. This was replaced on 10 February 2007 with an embargo on further applications for licences.
- Intersecting Streams unregulated water sources:
    - An embargo order was made for unregulated surface water licences in the unregulated areas including those in the Intersecting Streams on 23 October 1998. It was replaced on 12 May 2000 and again with the current embargo on 20 May 2005.

In consideration of the previous embargo orders on the Intersecting Streams water sources, the plan does not permit additional applications for licences outside those provided for under the regulations. The Water Management (General) Regulation 2004 prescribes a number of different types of specific purpose access licences for which applications may be made. Clause 19 of the Water Management (General) Regulation 2004 allows for applications to be made for the following specific purpose access licences:

- a local water utility [domestic and commercial] access licence, for the purpose of domestic consumption and commercial activities
- a domestic and stock [domestic] access licence, for the purpose of domestic consumption
- an unregulated river [town water supply] access licence, for the purpose of supply to communities for domestic consumption and commercial activities
- an aquifer [town water supply] access licence, for the purpose of supply to communities for domestic consumption and commercial activities
- any category of specific purpose access licence that has a subcategory 'Aboriginal cultural', for Aboriginal cultural purposes.

Under the plan, applications for specific purpose access licences may be made in accordance with Clause 19 of the Water Management (General) Regulation 2004, and an access licence may be granted in accordance with a dealing. The plan limits the application for an Aboriginal Cultural licences to 10 megalitres per year per application.

Development of future water supply access

Any development of new water storages in the Intersecting Streams unregulated and alluvial water sources must be undertaken within the bounds of the plan and the *Water Management Act 2000*. The plan is not prescriptive in endorsing any particular option since economic and social considerations vary over time. Instead, the plan sets a framework within which development of future water supplies can occur.

Mandatory conditions

The plan sets out provisions that will be applied as mandatory conditions to water access licences and water supply work approvals. These mandatory conditions are designed to protect the rights of all users in the water source and to give affect to the environmental water rules of the plan. They cannot be removed or altered unless the plan itself is amended.

Rules for unregulated water sources

Water sharing rules

Water sharing rules that the IRP focused on consist of:

- access rules – which determine at what flow rates, or height at a gauge, or proportion of full containment level of a pool, and what times extraction is allowed and whether these should change in certain climatic circumstances
- dealing rules – which control the trade of water (both permanent transfer of access licence entitlements and 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
- rules for granting works approvals – what types of set back conditions are required
- rules for the protection of a specific environmental asset.

Developing the access and dealings rules

There are 90 surface water licences in the six unregulated water sources of the plan area. There are 15 current gauging stations, which cover the Mooni, Narran, Culgoa, Warrego, and Paroo water sources.

The Interagency Regional Panel (IRP) used local knowledge and expertise in developing the water sharing rules. Once the proposed water sharing rules were determined, a check was undertaken to ensure that the rules are consistent in their application and are practical to implement across the catchment.

For the majority of water sources no rule, other than a cease to pump when there is no visible flow in the vicinity of the pump site, could be recommended due to:

- many existing licences having no access rules, therefore any change to access should be incremental to allow irrigators time to adjust
- the lack of appropriate reference points (e.g. river gauges) other than the pump site
- if there was a suitable river gauge within the water source, a flow rule using the gauge would be quite stringent and would impact significantly on current irrigation operations, given that many streams only flow intermittently

This access rule provides, at a minimum, protection of natural pools which are important for drought refuge, as well as domestic and stock water supplies.

In the Narran water source, a number of licences have existing access conditions that relate to flow heights at the New Angledool No. 2, the Wilby Wilby and the Narran Park stream gauges. These access conditions have been accepted by the IRP, and provide satisfactory levels of environmental protection, and have been adopted for the entire water source.

In water sources where the existing access rule on an individual's *Water Act 1912* licence was more stringent than the indicative rule, generally the existing access rule was adopted, given that there would be no adverse social or economic impact to that individual as there would be no change to current operations. In these circumstances the IRP acknowledged that many of the rules had been negotiated by water users, had been in place for a long period of time and seemed to be adequately protecting environmental values while providing security for water users.

Access to very low flow

Those activities that are considered critical human needs or animal health requirements are permitted to access the very low flow, i.e. below the 'cease-to-pump' defined in the access rules. Although the level of extraction is small relative to entitlement, it is in direct competition for environmental water requirements at its most critical time. Licences with access to very low flows include:

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

Trading of access entitlement

The water market is an effective and equitable way to reallocate water between users. The National Water Initiative sets out guidelines for water trading. Trading can occur either on a permanent or temporary basis. Trading of water entitlement needs to be addressed in the plan within a framework that maximises the flexibility for users to be able to use water to its highest value but does not adversely impact on environmental values of water sources or existing users.

The rules for trading of water in the Intersecting Streams were determined by the IRP taking into consideration socio-economic and environmental factors. Trading within each water source will be permitted. There will be no trading into any of the water sources so as to minimise potential competition for extraction in ephemeral stream systems, and to protect environmental values.

An amendment provision will be included in the plan to include interstate trading in line with an intergovernmental agreement should such an agreement be negotiated during the life of the plan.

Managing extraction

Setting the unregulated river long-term average annual extraction limit

Surface water extractions within the NSW's portion of the Murray-Darling Basin have been capped at those volumes that would have occurred under 1993/94 levels of development and management rules, following NSW becoming a signatory to the Murray-Darling Basin Ministerial Council Agreement, in 1995.

The plan includes six unregulated water sources that will be individually managed under a long-term average annual extraction limit (LTAAEL).

The long-term average annual extraction limit for each unregulated water source is equal to the total of the estimated annual extraction of water averaged over the period from July 1993 to June 1999 for those entitlements issued under Part 2 of the *Water Act 1912* immediately prior to the commencement of the plan; plus an estimate of annual extraction of water under domestic and stock rights and native title rights at the commencement of the plan.

From year six of the plan term, a growth in use response will be triggered if average annual usage over five years for a water source exceeds the LTAAEL by more than five per cent.

Available water determination

Each year, an available water determination (AWD) will be made defining how much of the share component will be available under each category of licence. Specific purpose access licences such as

domestic and stock or local water utility access licences, will generally receive 100 per cent of their share component, although in years of exceptional drought the daily access rules may limit extraction to the extent that annual entitlement can not be fully realised.

Generally the AWD for unregulated river and unregulated river special additional (high flow) access licences will be one megalitre per unit share. However for the first year of the plan, a one-off announcement of two megalitres per share will be made. This, combined with the carryover rules (see next section), will enable licence holders to use up to twice their water allocation in a year provided that over a consecutive three year period they do not exceed the sum of their water allocations for those three years.

An AWD for unregulated river and unregulated river special additional (high flow) access licences of less than 1 ML per unit share may be made if the extractions are assessed as exceeding the LTAAEL and a growth in use response is required for a water source. This will mean that general purpose access licences may in the future, if there is significant growth in water use; receive fewer megalitres in their water account than they have shares.

Carryover and water accounts

A water allocation account will be established for each water access licence. Water is credited to the account when an AWD is made, and debited when water is extracted.

Unregulated rivers have enormous variation in annual flow volumes. As such, unregulated river access licence account management will operate under three year accounting rules, subject to compliance with the daily access rules. Available water determinations combined with the carryover will enable licence holders to use up to twice their water allocation in a year provided that over a consecutive three year period they do not exceed the sum of their water allocations for those three years. For the first three years of the plan, this maximum volume that may be taken may not exceed a volume equal to three times the access licence share component (where this is expressed in megalitres), or three ML per unit share (where the share component is expressed in unit shares). This restriction in the first three years is due to the allocation of 200 per cent (where share component is expressed as a volume) or two ML per unit share (where share component is expressed in unit shares), made in the first year of the plan to allow the operation of these accounting rules from year one of the plan.

The maximum amount of unused water allocation that can be carried over from one water year to the next in unregulated river access licence accounts will be 100 per cent of the share component (where this is expressed in ML), or 1 ML per unit share (where share component is expressed in unit shares).

Water interception activities

Changed land-use activities can potentially intercept significant quantities of water. Examples of this include increased farm dam capacity in a catchment or significant areas of new forestry plantations. The National Water Initiative requires significant interception activities to be accounted for.

Exemptions for farm dams

Farm dams currently require an access licence only when:

- they are located on a third order (or greater) river, irrespective of the dam capacity or purpose
- they exceed the maximum harvestable right dam capacity for the property, which in the central division of NSW is a capacity that enables the ability to capture 10 per cent of the

mean annual runoff from the property. In the western division, up to 100 per cent of runoff can be captured or

- they are on a permanent (spring fed) first or second order stream.

Unlicensed extraction from farm dams that doesn't match any of the above criteria is permitted as a harvestable right. The full activation of harvestable rights within the area of the plan is considered highly unlikely. The plan, therefore allows for an estimate of the current activation of basic landholder rights within the LTAAEL. The current activation of harvestable rights is therefore implicitly, rather than explicitly, included within this estimate. The provisions relating to harvestable rights are unaffected by any of the rules established in the plan. However, the uptake of harvestable rights will be monitored to determine if at any stage total unlicensed dam capacity has increased to a level considered significant in terms of interception and to inform the implementation of the NWI.

Acknowledgement of floodplain harvesting activities

Floodplain harvesting is the collection, extraction or impoundment of water flowing across floodplains. Floodplain flows can originate from local runoff that has not yet entered the main channel of a river, or from water that has flowed out of the main channel during a flood.

Floodplain harvesting can generally be characterised as follows:

- diversion or capture of floodplain flows using purpose built structures or extraction works to divert water into storages, supply channels or fields or to retain flows, or
- capture of floodplain flows originating from outside of irrigated areas using works built for purposes other than floodplain harvesting, or
- opportunistic diversions from floodplains, depressions or wetlands using temporary pumps or other means.

In unregulated river water sources, floodplain harvesting has generally already been recognised and licensed as part of the process that converted area based water licences to volume based licences.

However, further volumetric entitlements for floodplain harvesting may be established through the development of a NSW Floodplain Harvesting Policy. As a result, the plan may be amended at a later date in order to deal with the management of floodplain harvesting.

Construction of dams

Rainfall runoff harvesting dams

The capture of water in a rainfall runoff harvesting dam requires no licence if the dam is within the maximum harvestable right dam capacity for the property on which it is located (see '*Exemptions for farm dams'*). The capture of water in a rainfall runoff harvesting dam beyond the permissible harvestable right requires a water supply works approval and a licence nominating this work that has a share component (entitlement), with a volume equal to or greater than the capacity of the dam. Extraction from these dams is not subject to the 'cease-to-pump' for the water source or management zone.

In river dams

The plan specifically prohibits a water supply work approval for a new in-river dam being granted on a third or higher order stream in the Paroo River water source. This has been recommended due to the impact of dams on environmental values. Licences that nominate existing water supply works approvals for in river dams and extract water from their in river pools will not be subject to the 'cease-to-pump' for the water source or management zone.

Rules for alluvial groundwater sources

Background

Water sharing rules for the alluvial aquifers occurring along the Warrego and Paroo Rivers are included within the plan. These aquifers are contained within the alluvial deposits comprising a wide range of sediment derived materials. The alluvial groundwater sources are comprised of Quaternary aeolian sands and alluvial sediments surrounding small areas of Tertiary silcretes in the northern portion of the alluviums. Small areas of Palaeozoic bedrock are characterised in the central section of the alluviums, whilst in the lower reaches of both systems; Devonian quartz sandstone is surrounded by Quarternary Aeolian sands and alluvial clays.

In the alluvium of the unregulated rivers, groundwater is largely derived from rainfall. The Intersecting Streams experiences variable rainfall over time and groundwater levels in these areas of alluvium respond readily to climatic conditions. In these unregulated alluvials, the storage is limited and when the groundwater level falls below the bed of the river, the river runs dry.

Water sharing rules

Protecting environmental values

The plan protects environmental values in the Intersecting Streams alluvial groundwater sources by reserving the total storage volume and a proportion of recharge to the sources as planned environmental water.

Estimates of rainfall recharge have been derived using the macro method[2], but the groundwater source also has significant recharge from other sources such as river recharge. As a precautionary approach, only a portion of the recharge from rainfall has been made available for extraction and recharge from any other sources is included as planned environmental water.

Water sharing rules for GDEs

Although no high priority groundwater dependent ecosystems have been identified within the Intersecting Streams alluvial groundwater sources, there are many significant flora community assemblages and associated fauna identified on the surrounding floodplains that may at times be dependent on groundwater. Many of these plant communities occur on buried prior river channels that still have some longitudinal connectivity with the river. More research is required to quantify their degree of dependence on the groundwater sources. Some research has been conducted into the identification of invertebrates that live within the alluvial aquifers; however, no specific water requirements for these invertebrates have been established at this stage.

Managing extraction

The long-term average annual extraction limit (LTAAEL) for these groundwater sources is set by applying the macro groundwater planning risk assessment method. This method determines the percentage of estimated rainfall recharge which should be reserved as planned environmental water. By deduction, the remainder of the rainfall recharge estimate is the LTAAEL.

In general under the risk assessment process, 100 per cent of rainfall recharge is reserved as planned environmental water in high conservation areas of each groundwater source. The planned

[2] The macro method for groundwater is outlined in *Macro water sharing plans - the approach for groundwater. A report to assist community consultation.* See www.water.nsw.gov.au for the most recent version of the report.

environmental water reserved for the groundwater source outside the high conservation value areas is been based on a sustainability factor, which is set at a minimum of 30 per cent and a maximum of 95 per cent, reflecting the variation in risk to groundwater sources identified through the process.

The risk assessment includes assessing aquifer and socio-economic risk, identifying mitigation actions, and then determining the sustainability factor for the groundwater source. For more information about the macro groundwater planning risk assessment method please refer to the report: *Macro water sharing plans – the approach for groundwater. A report to assist community consultation*, which can be found on the NSW Office of Water website www.water.nsw.gov.au.

The long-term average annual extraction limit (LTAAEL) for the Warrego Alluvial groundwater source is equal to 976 megalitres per year, and the LTAAEL for the Paroo Alluvial groundwater source is 1,026 megalitres per year (ML/year), calculated by multiplying the sustainability index of the water sources by the recharge to non-high conservation value areas of each water source, as shown below:

- Warrego LTAAEL = sustainability index (0.25) x recharge to non-high conservation value areas (3,904 ML/year) = 976 ML/year
- Paroo LTAAEL = sustainability index (0.25) x recharge to non-high conservation value areas (4,104 ML/year) = 1,026 ML/year

Available water determination

The maximum available water determination (AWD) for a water source is used to manage growth in extractions above the LTAAEL, if growth is assessed to have occurred, then maximum AWDs will be reduced to respond to this growth i.e. a maximum AWD of less than 1 ML/unit share.

AWDs are primarily used to credit water into a licences water allocation account. The AWD for aquifer access licence in each of the groundwater sources in the plan is 1 ML/unit share, i.e. 100 per cent of entitlement; unless a growth-in-use response is required.

Carryover and water accounts

In the Intersecting Streams alluvial groundwater sources there will be no carryover of entitlement from one water year to the next. The maximum amount of water permitted to be taken from the groundwater source in any one water year is equal to the water allocation accrued in the water access licence account for that year.

Rules for water supply works approvals

In accordance with the principles of the *Water Management Act 2000*, the plan sets rules to minimise the cumulative impacts resulting from groundwater extraction. To do this, the plan specifies rules which prohibit new/amended works from extracting water within certain distances of other water users, contamination sources, GDEs and groundwater dependent culturally significant sites. This is to prevent significant levels of water table drawdown of water occurring in the local vicinity of these users and sites.

Standard distance rules were developed for the macro plans through internal meetings of regional and state panels consisting of regional groundwater experts and representation from DPI and the OEH to incorporate a socio-economic and environmental perspective. These panels compiled sets of distance criteria based on previous studies, substantial local knowledge and experience. This experience included knowledge of analytical and numerical models and their results, such as those used in dry-land salinity studies until the late 1990s. A consistent set of rules for common groundwater aquifer types (for example fractured rock, alluvium, coastal sands and porous rock) was then produced by

comparing the various rules proposed by the regional panels based on what has worked in the past in similar geological provinces.

Groundwater flow modelling with representative aquifer parameters was used to calculate water balances and also provided water table draw-down at different distances under a 24 hour/day pumping regime for one year. The modelling was undertaken to test the distance criteria produced by the IRPs to protect regulated stream flow and base flow in the unregulated systems. The modelling indicated that the water table fluctuation due to pumping was not above natural variations if the access rules in the plan are implemented. For high priority GDEs such as karst GDEs, the distances were set so that overall ecosystem health would remain the same and resulting impacts on drawdown would be within seasonal water level movements. For other GDEs, water users and significant sites, only a minimal level of impact was permitted.

The standard set of distance criteria then went to the State Groundwater Panel for approval. The SGP, when negotiating the final rules, weighed the social, environmental and economic impacts of extraction on groundwater sources to set an acceptable level of drawdown near critical sites and other water users. Since then, the standard rules have been further tailored as a result of further development of macro plans.

As the distances are based on a combination of experience and modelled estimates of drawdown, the macro plans allow for these distances to be altered in some cases. For example, the distances to minimise interference with other works may be reduced if a proponent can demonstrate in a hydrogeological study that no more than minimal impact will occur on existing extraction at a lesser distance.

The plan details rules applying to water supply work approvals including:

- rules for amending water supply work approvals for replacement groundwater works
- rules to minimise interference between neighbouring water supply works
- rules for water supply works located near contamination sources
- rules for water supply works located near sensitive environmental areas, including rules to protect water levels near GDEs
- rules for water supply works located near groundwater dependent culturally significant sites
- rules for the use of water supply works located within restricted distances.

The Minister has the discretion to grant or amend a water supply work approval at a lesser distance if satisfied that the location of a water supply work at this distance will not compromise the intent of the rules, as specified by the exceptions in the plan. Refer to the plan for the distance rules applying to each groundwater source covered by the plan.

Trading of access entitlement

The water market is an effective and equitable way to reallocate water between users. The National Water Initiative sets out guidelines for water trading and these will be largely superseded in the Murray-Darling Basin once the Basin Plan commences. Trading can currently occur either on a permanent or temporary basis. The Minister's *Access Licence Dealing Principles Order 2002* currently prohibits the trade of entitlement from a groundwater source to a surface water source. Trades are only permitted between sources where there is a hydrological connection. There is no hydrological connection between the Intersecting Streams alluvial groundwater sources, and therefore there will be no trading of access entitlement between the Paroo and Warrego alluvial groundwater sources, however trades within each groundwater source are permitted, subject to assessment.

Consultation

The plan was placed on public exhibition on 13 December 2010 for a period of 20 weeks until 29 April 2011. The extended exhibition was as a result of summer flooding in the plan area. The plan was displayed in Bourke, Brewarrina, Cobar, Dubbo and Parramatta, and was also available online through Office of Water website. A public meeting for the plan was held in Bourke on 19 April 2011. This explained the methodology and requirements of the plan. Submissions from the public were invited during the public exhibition period, and all the licence holders within the plan area were informed of the plan being on public display and were invited to have input into the plan through a submission process should they be inclined to do so. Two submissions were received through the public exhibition process. No changes were made to the draft plan as a result of submissions received.

Implementation

Implementation programs

An implementation program may be established that sets out the means by which the objectives of the plan are to be achieved. The process for monitoring of the performance indicators will be outlined in the implementation program.

An annual review of the implementation program will be conducted to determine whether the implementation program is being effective in implementing the water sharing provisions. The results of this review will be included in the NSW Office of Water's Annual Report.

Monitoring water extractions

Each water sharing plan establishes the relevant mandatory conditions for extraction, including that all licences undertake measurement of extraction as required by the Minister. The Office of Water will develop a measurement of extractions strategy to meet the objectives of the NSW Water Extraction Monitoring Policy.

Measurement of extractions may be via meters fitted to approved water supply works. Different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the affect that the operation of the work may have on the water source and other water users. Telemetry systems will be placed onto all meters, subject to availability.

Compliance

The NSW Office of Water will undertake compliance activities as necessary to enforce each individual's licence conditions, which are developed based on the provisions of the plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the Office of Water. Reports may be made by calling 1800 633 362 or emailing watercompliance@water.nsw.gov.au. For more information, visit the NSW Office of Water website at www.water.nsw.gov.au

Adaptive management

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

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

Monitoring of plan performance

The Office of Water is also developing a Monitoring, Evaluation and Reporting (MER) Framework. This framework will be developed in collaboration with key stakeholders and will be consistent with the MER needs of the Natural Resources Commission and the National Water Commission. The intention is that the framework can be applied to existing water sharing plans and macro water plans to enable the development of a specific MER plan.

Performance indicators

The 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.

Plan review

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

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

- an audit of the plan, at intervals of no more than five years, for the purpose of ascertaining whether its provisions have been 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) as having this role.
- an audit of the plan by the Natural Resources Commission to assess to what extent the water sharing provisions have contributed to the relevant statewide targets, and natural resource standards and targets in the relevant catchment management area. The Natural Resources Commission will call for public submissions when undertaking its review.
- an annual review of Implementation Programs.
- the application of information from the relevant monitoring and evaluation programs to inform progress against the relevant statewide targets and requirements of the National Water Commission under the National Water Initiative.

Glossary

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

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

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

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

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*.

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

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

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

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

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

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

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

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

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

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

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

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

Pools: Lentic water bodies (standing water), including anything falling within the definition of a "lake" found in the Dictionary of the *Water Management Act 2000,* except for tidal pools and estuaries.

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.

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

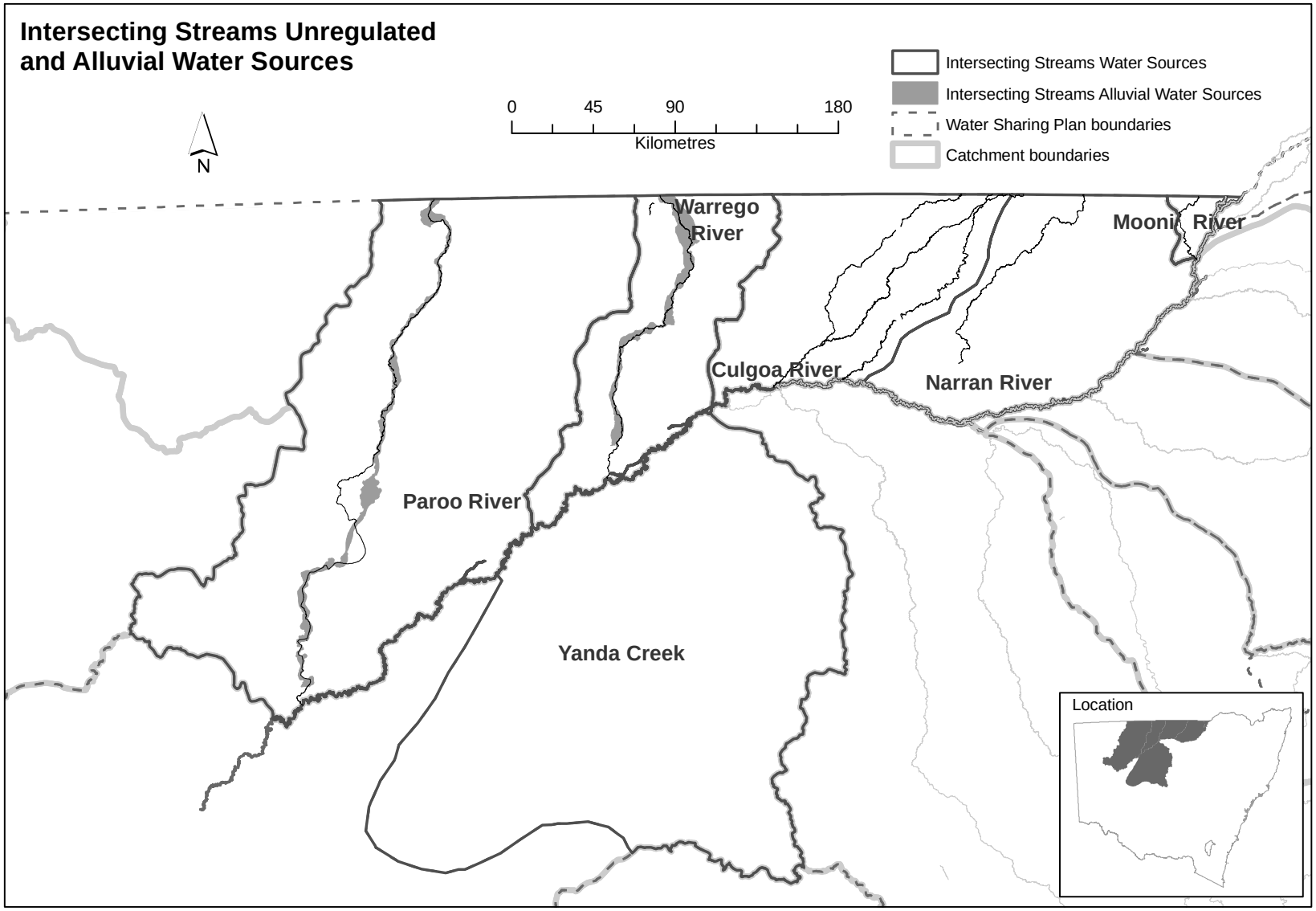
Visible flow: The continuous downstream movement of water that is perceptible to the eye.

Water sharing 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.

Appendices

Appendix 1: Water sharing plan map



Appendix 2: Interagency regional panel and support staff - membership and expertise

Name	Agency	Role	Expertise
		Interagency Regional Panel	
Dave Miller / Anna Bailey	NSW Office of Water	Agency Representative	Water planning/administration/policy. Geomorphology. Riparian management. Stream ecology/restoration.
Greg Markwick	DPI	Agency Representative	Thirty years experience in the NSW Department of Agriculture including 5 years as a District Officer at Bourke, 15 years as a 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.
Peter Terrill	OEH	Agency Representative	Peter has worked as a water management and water environmental specialist since 1987. He has had several positions within the NSW water and environmental departments as well as with the former MDBC. He is currently an environmental water manager responsible for the unregulated river systems of north-western NSW.
Ken Harrison	WCMA	CMA Observer	Natural resource management in Far Western NSW, including: program development and implementation, project management, soil conservation, and land and water management. Community liaison and engagement.
		Support Staff	
Jamie Foster	NSW Office of Water	Plan coordinator	Water policy and planning, stream and riverine ecology, plan development and implementation, facilitation and project management.
Richard Wheatley	NSW Office of Water	Plan support	Western NSW Licensing Officer, extensive local knowledge of surface and groundwater issues, users, WUA's, local access arrangements and reference points.
Emily Turner	NSW Office of Water	Plan support	Water planning, support documentation
Dave Miller	NSW Office of Water	Independent Facilitator	Water planning/administration/policy. Geomorphology. Riparian management. Stream ecology/restoration.
Mark Harris	NSW Office of Water	Independent Facilitator	Water policy and planning experience.

Appendix 3: 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 Northern Rivers area.

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

Volumetric Conversion Database (VolCon) – used to help determine the Peak Daily Demand (PDD) for each water source.

Regional Geographic Information Systems – 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 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.

Other projects and reference material

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