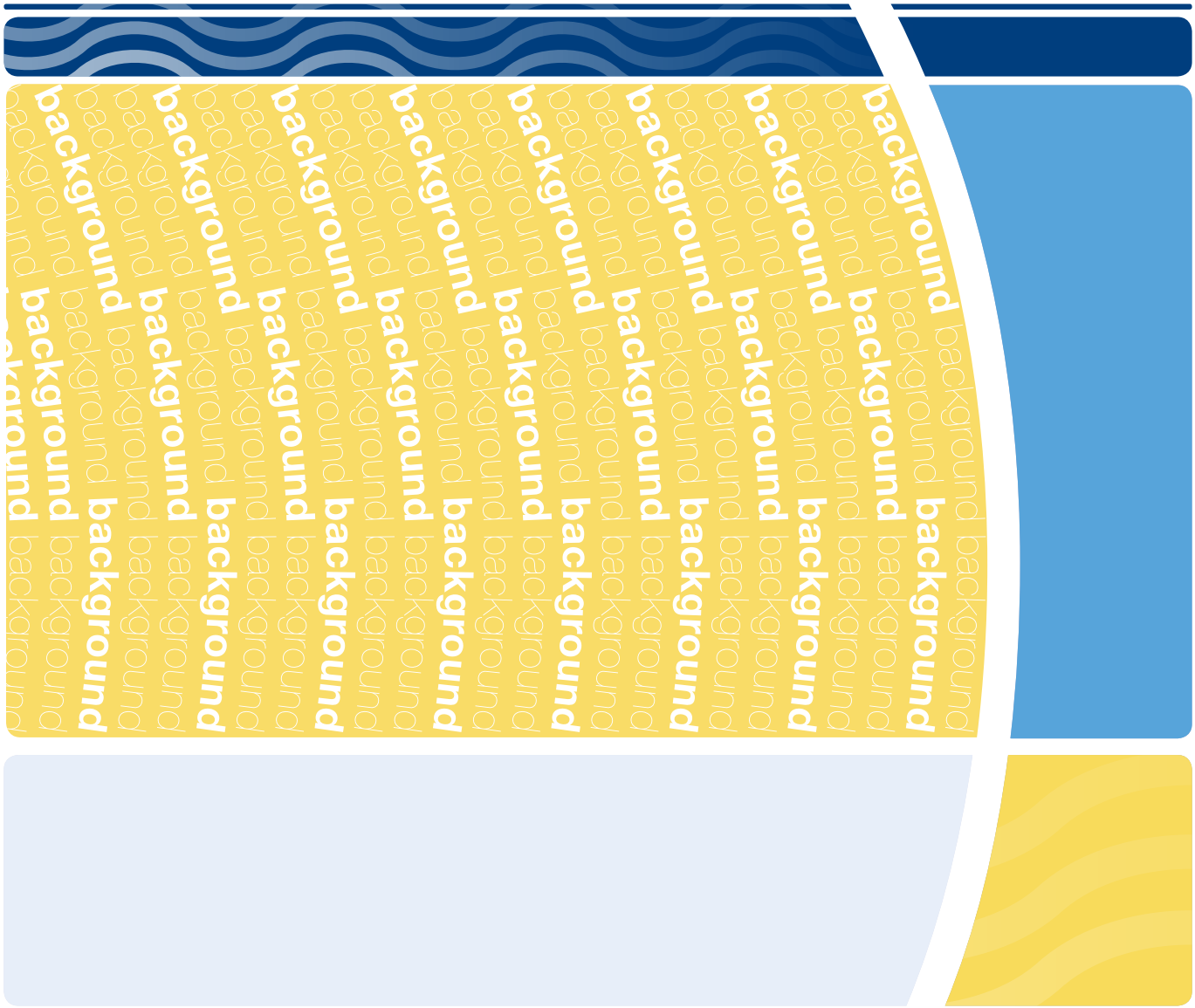
NSW GOVERNMENT | Office of Water

Water Sharing Plan

North Western Unregulated and Fractured Rock Water Sources

Background document



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The NSW Office of Water 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 North Western Unregulated and Fractured Rock Water Sources – Background document

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Introduction

Water sharing plans (plans) are being progressively developed for rivers and groundwater systems across New South Wales following the introduction of the *Water Management Act 2000* (WMA 2000). These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water. In July 2004, 31 plans commenced in NSW, bringing these water sources and some 80 per cent of water extracted in NSW under the management and licensing provisions of the WMA 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 WMA 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, cover a particular type of aquifer (e.g. 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 North Western Unregulated and Fractured Rock Water Sources* (formerly the Draft Water Sharing Plan for the North Western Unregulated Water Sources and the North Western Fractured Rock Groundwater Sources) covers four water 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 flow rate)
- dealing rules – which control the trade of water, both the transfer of share components of an access licence and assignment of water allocation between access licences, as well as changing the location for water extraction.

In developing environmental water rules, access rules and dealing rules, other water management rules are considered, including:

- long-term average annual extraction limits – 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 background to the development of the rules in the plan and includes:

- the purpose of the statutory plan
- a physical description of the north-western catchment including land and water use
- the process of plan development including scope, history and basis for decisions
- 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.

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

- the *Water Sharing Plan for the North Western Unregulated and Fractured Rock 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 relating to the unregulated water source
- *Water sharing plans - Inland NSW groundwater sources – Overview* – a plain English version of the plan explaining the key sections and rules relating to the groundwater sources
- rules summary sheets for each water source with licences.

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 method used to classify and set water sharing rules for groundwater across the state
- *Setting rules for water sharing plans* – information outlining the key steps for developing the rules.

Purpose of the plan

Why are water sharing plans being prepared?

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

Water sharing plans provide a legislative basis for sharing water between the environment and consumptive purposes. Under the *Water Management Act 2000* (the WMA 2000), a plan for the sharing of water must protect each 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. On commencement access licences held under the *Water Act 1912* are converted to access licences under the WMA 2000 and land and water rights are separated. This facilitates the trade of access licences and can encourage more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

In conjunction with other provisions of the WMA 2000, water sharing plans also set rules so that commercial users can also continue to operate productively. In general, commercial licences under the WMA 2000 are granted in perpetuity, providing greater commercial security of water access entitlements. Water sharing plans 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 a water sharing plan, a number of benefits will flow to water users including:

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

Environmental considerations

Water sharing 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 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.

Scope of the plan

The plan covers four surface water catchments, and three groundwater sources within what is known as the Western water management area. Incorporating all of these resources into the one plan recognises their interaction and allows for the development of water sharing rules that are equitable within and between these resources.

The water resources are:

- the four surface water catchments – these cover the north-western corner of NSW (outside the Murray-Darling Basin), and comprise a series of creeks and lakes many of which are terminal within the plan boundary
- the three fractured rock groundwater sources, which underly the surface water catchments.

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

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

The plan area includes only the second of these four categories.

Description of the plan area

The surface area covered by the plan (refer Appendix 1) comprises the NSW portion of the Bulloo Overflow catchment (20,320 square kilometres), the Lake Bancannia catchment (23,276 square kilometres), the NSW portion of the Lake Frome catchment (18,156 square kilometres) and the NSW portion of Coopers Creek catchment (623 square kilometres), in total covering an area of 62,375 square kilometres. The plan is located in the far north-western corner of NSW, outside the Murray-Darling Basin, and includes the localities of Tibooburra, Milparinka, Silverton and Packsaddle. The plan is bounded by the Queensland border to the north, and the South Australian border to the west, the southern and eastern edges front the western borders of the Murray-Darling Basin.

Flow in the catchments is intermittent and when they do flow, they flow towards central Australia and Lake Eyre.

The plan area is made up of semi-arid desert with low lying channels and flood runners. There are limited defined channels along the western and southern areas of the plan, with the Bulloo River Overflow being the most defined water source in the plan.

The plan area also includes fractured rock groundwater in the Adelaide, Lachlan and Kanmantoo Fold Belts below the surface of the ground within NSW, but outside the Murray-Darling Basin.

Land use history

Vegetation comprises mainly saltbush and bluebush with grasses, forbs and copperburrs. Some mulga and other small trees occur on the erosional plains and rises, and Mitchell Grass, saltbush and bluebush appear on the depositional plains. River gums (Eucalyptus camaldulensis) are locally present along larger drainage lines. The entire area is used for low intensity grazing on pastoral leases. The natural vegetation has been significantly affected by the introduction of domestic animals and rabbits.

Prior to European settlement in the mid-1800s, the plan area was occupied by a number of indigenous tribal groups. These included the Karenggappa people who occupied the north-western corner of NSW, in the area where Sturt National Park is located. The Maliangapa people inhabited the lakes area to the south where Tibooburra is now located. The Wiljakali people lived in the area to the south, occupying lands down to around where Broken Hill is located today, and the Barkindji people were located to the east of Broken Hill in the area between Menindee Lakes and Lake Bancannia.

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.

Present information indicates that Aboriginal occupation of the area dates back around 30,000 years. With further research and excavations this may be extended. Populations of these tribes is unknown, however, after the 1919 influenza epidemic, there were only 70 members of the Maliangapa still living in traditional tribal culture in the north-western corner of NSW (the former DECCW, 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 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 far north-western corner of NSW is protected as the Sturt National Park, while a smaller section to the south-east of the Lake Bancannia catchment is protected in Mootwingee National Park.

Climate

The north-western catchments of NSW experience a semi-arid climate characterised by hot dry summers and mild dry winters. Rainfall throughout the catchment ranges from 220 millimetres in the north-western corner to 240 millimetres along the eastern and southern boundaries. There is a slight increase in rainfall in the summer months, although predominantly the monthly averages are within 10 millimetres of each throughout the year.

December and January are generally the hottest months with mean summer maximum temperatures ranging between 33-38°C in the plan area. Winter temperatures can be quite cold, with daily minimums below zero; however, most days see temperatures into the mid to high teens. The mean annual maximum temperature for the area is approximately 27°C, with the mean annual minimum around 14°C.

Groundwater

The plan area overlies a number of groundwater sources, of which the fractured rock component is dealt with in this plan. Adelaide Fold Belt North Western, Lachlan Fold Belt North Western and Kanmantoo Fold Belt North Western are the fractured rock groundwater sources covered by the plan, existing in large parts under the NSW Great Artesian Basin (see Appendix 1).

Adelaide Fold Belt North Western

In NSW and within the Murray-Darling Basin, the Adelaide Fold Belt comprises the Curnamona Province centred about the Curnamona Craton which, in NSW, forms the consolidated basement outcropping as inliers (the Broken Hill and Euriowie blocks). The cratonic units comprise strongly deformed and metamorphosed sedimentary and igneous rocks of Palaeoproterozoic age, termed the Willyama Supergroup hosting the famous silver lead and zinc deposits at Broken Hill. These rocks within the water source accumulated within, or on the edge of, the Proterozoic Australian Craton in continental (including glacial) to shelf marine environments. The Adelaide Fold Belt North Western covers a surface area of 6,533 square kilometres, and a buried area of 4,014 square kilometres under the younger sediment of the Great Artesian Basin.

Kanmantoo Fold Belt North Western

The Kanmantoo Fold Belt is an Early Palaeozoic, orthotectonic orogenic belt containing inliers of strongly deformed Cambrian Strata. In NSW the Kanmantoo Fold Belt occupies the area between the Tasman Line and the Koonenbury Fault zone, and also includes the Morden-Stawell zone farther east, bounded in part by the Olepoloko Suture in the north-east and the by the Avoca Fault and a lineament in its continuation in the south-east. The Kanmantoo Fold Belt North Western covers a surface area of 6,123 square kilometres, and a buried area of 20,026 square kilometres under the younger sediment of the Great Artesian Basin.

Lachlan Fold Belt North Western

The Lachlan Fold Belt consists of Cambrian to Lower Carboniferous rock successions. The north-western margin is largely covered by Cainozoic successions. The oldest geological activity in the Lachlan Fold Belt around the north-western margins of NSW is heavily weathered and contemporaneous; these rocks successions are at depth, covered in the younger sediments of the Great Artesian Basin. The Lachlan Fold Belt North Western covers an area of 27,292 square kilometres (see Appendix 1)

Entitlement and use

There are 143 bore licences in the fractured rock groundwater sources. These licences total 77 megalitres of entitlement, which is divided between stock and domestic usage (42 megalitres) and industrial usage (35 megalitres).

While there are a number of licences in the unregulated North Western Water Source, most of them are for stock and domestic purposes covered by basic landholder rights, and as such there is limited volumetric entitlement. At this stage the total entitlement within this water source is 30 megalitres, for irrigation purposes.

Developing the plan

Project groups

State Interagency Panel

The State Interagency Panel (SIP) has overall responsibility for the state-wide 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 SIP also has the role of making water sharing decisions in cases where the Interagency Regional Panel (IRP), see below, cannot reach agreement or where the issue has state-wide significance.

The SIP 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 the overall project management.

Interagency Regional Panel

The plan rules were developed by the North Western IRP, which comprises representatives from the Office of Water, OEH, the Western CMA, and agriculture, fisheries and aquaculture specialists from the DPI. Appendix two lists the names of panel representatives and their areas of expertise, and also lists their colleagues who they had access to for specific technical and scientific information.

The key responsibilities of the IRP are 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 existing and generic water sharing rules as to their applicability[2]
- make recommendations on the water access and dealing (trading) rules for each water source
- assist the CMA with consultation on the proposed rules
- review submissions, from targeted consultation and public exhibition, and make changes where necessary to the water sharing rules.

The IRP used a consensus decision-making approach.

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 Office of Water and has representatives from the OEH and agriculture, fisheries and aquaculture specialists from the DPI.

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

Policy context

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

National Water Initiative

The NSW Government is a partner to the National Water Initiative (NWI) that 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 and the need to service rural and urban communities. It also recognises that there is a need 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 guidelines, timelines and outcomes 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 NRC state-wide standards and contribute to the relevant state-wide targets such as Targets 5 and 6 (see www.nrc.nsw.gov.au for details) which is a requirement of the NSW State Plan (see www.nsw.gov.au/stateplan). 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 state-wide targets for natural resource management in NSW, which have been embedded in the NSW State Plan. Table 1 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 water sharing plans against this Standard and its associated targets.

Table 1: Contribution of the plan to the relevant NRC state-wide targets

Relevant state-wide target	Contribution by the plan
By 2015 there is an increase in the recovery of threatened species populations and ecological communities (Target 3)	– 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 condition of important wetlands, and the extent of those wetlands is maintained (Target 8)	– trading rules to maintain or reduce entitlement in high conservation value water 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

This plan is consistent with and contributes to the Western Catchment Action Plan (WCAP), January 2007. The WCAP can be found on the Western CMA (WCMA) website www.western.cma.nsw.gov.au in the 'Your Region' section. The WCAP Water Theme has a resource condition target (the Water Catchment Target) for the region's rivers and aquifers which is 'by 2016, river and aquifer condition is improved.'

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

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

One of the CMA's responsibilities is to provide the IRP with advice on the alignment of the proposed classification and extraction limits and rules with the priorities in their WCAP.

Other considerations

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

Protecting basic landholder rights

Under the WMA 2000, extraction of water for **basic landholder rights** (BLR) does not require a licence, although in the case of accessing groundwater under BLR the bore must still be approved by the NSW Office of Water. BLR include water for domestic and stock purposes extracted from a water source fronting a landholder's property or from any aquifer underlying the land, harvestable rights and for native title rights.

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

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

Domestic and stock rights can be restricted by the Minister to protect the environment or public health, or to preserve existing basic landholder rights. These restrictions are outside the framework of the plan. 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 BLR for the plan area 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 take and use of water under domestic and stock rights (under development). 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 guidelines and a consequent volume determined by applying the stock consumption allowance (megalitres/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/'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 town's licence. Towns may be able to sell part of their annual account water to other towns but, unlike commercial users, will not be able to sell the licence outright.

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 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.

Rules for the unregulated water source

Water sharing rules

Water sharing rules comprise:

- access rules – which determine at what river flow level, gauge height, proportion of full capacity of a pool, and/or times extraction can occur
- dealing rules – that 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 – that set the total volume of water that can be extracted on a long-term average annual basis from the water source or water management zone
- rules for granting new entitlement – that determine the types of access licences that may be granted
- rules for granting works approvals – that determines the types of set back conditions required

The IRP used local knowledge and expertise in developing the water sharing rules. There are 34 surface water licences in the North Western Water Source, most of which pertain to by-wash dams on lower order streams. There are two flow gauging stations, which cover only 400 square kilometres of the 62,375 square kilometres of the plan area. Water extraction for these types of licences relies on a visible flow at the bywash channel point, and therefore the IRP decided that a 'no visible flow at this point' is a logical basis for the cease to pump rule for these water sources.

Defining the long-term average annual extraction limit

In other inland areas in the state the LTAAEL for unregulated water sources is based on the sum of estimated annual extraction of water averaged over a specified period (Murray-Darling Basin Ministerial Council Cap figures), which is generally less than entitlement, plus an estimate of basic landholder rights. The North Western Water Source is not within the Murray-Darling Basin and is therefore not subject to the Murray-Darling Basin Ministerial Council Cap.

The current licensed entitlement for the North Western Water Source is 30 megalitres. The North Western Interagency Regional Panel (NWIRP) wanted to establish a non-zero LTAAEL, in order to provide some scope for small scale development such as tourism, in the water source. North-western NSW does not contribute to Murray-Darling Basin flows, rather it contributes to flows in Central Australia (Lake Eyre) and any small increase in use allowed for under the LTAAEL will not affect flows at the Murray mouth.

A figure of 28,069 megalitres was calculated as being the modelled run-off in the north-western catchments. The NWIRP decided that 10 per cent of runoff (consistent with the harvestable rights policy principles), equating to 2807 megalitres, would be an acceptable LTAAEL. The LTAAEL therefore comprises 1,037 megalitres (estimate of basic landholder rights), 30 megalitres in licensed extraction and some 1,740 megalitres in unassigned water.

Unassigned water

Unassigned water is the water potentially available for extraction under the LTAAEL that is not yet allocated to an access licence and not estimated to be required to meet current and potential future requirements for extraction such as basic landholder rights extraction, extractions by specific purpose access licences. For example major and local utilities (town and urban water supply) and water for Aboriginal cultural use, or water from exemptions under the WMA 2000.

A staged process for any release of new entitlements has been developed for those systems that have a defined volume of unassigned water. There will be no unassigned water made available through the controlled allocation process where entitlements plus BLR equal 90 per cent or more of the LTAAEL. The current and potential future priority requirements for extraction must be accounted for (including an estimate for growth) before defining the amount that could be released as a controlled allocation. Any increase in these priority requirements over and above the LTAAEL must be met through a reduction in available water determinations to aquifer access licences. Estimating and reserving water to meet future priority requirements before releasing water through any controlled allocation will prevent over-allocation or sending misleading signals to the water market.

In water sources that, after consideration of current and future priority requirements, have unassigned water, only a percentage of this volume may be released through the controlled allocation process before a review is initiated. Unassigned water allocated before the review is considered a low risk of creating unsustainable levels of licensed entitlement. Controlled allocation above the trigger is a more uncertain risk of over-allocation and a review will therefore be undertaken before additional controlled allocations are made.

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 to 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 pool water level at the point where there is no visible flow into and 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.

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 overflowed from the main channel of a stream 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
- capture of floodplain flows originating from outside of irrigated areas using works built for purposes other than floodplain harvesting
- 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, measurement and long-term limits 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.

Granting Aboriginal community development access licences

For the plan area, applications for Aboriginal community development licences will be considered in the North Western Water Source.

Rules for the fractured rock groundwater sources

The plan was developed based on the groundwater 'macro planning' risk assessment process. This is the current approach of the NOW to developing water sharing plans for less highly connected groundwater sources and is described in *Macro water sharing plans – the approach for groundwater. A report to assist community consultation*[3]. The macro approach is a risk-based approach based on best available information that gives a relative assessment for groundwater sources and provides the basis for rules for water access and for managing water supply works that relate to groundwater extraction. The process used assessments ('high', 'moderate' and 'low') to indicate different levels of risk. The adopted approach helped to clarify a range of values and risks, indicating where an optimal balance might be between extraction and retention of groundwater recharge in an aquifer to meet environmental needs. In some areas, natural assets need strong protection; in others there is more socio-economic reliance on groundwater for extraction. The broad scale relative assessments allowed the most appropriate provisions to be developed for inclusion in water sharing plans.

The environmental values of the fractured rock groundwater sources were weighed up against the socio-economic dependence and consideration was given to the possibility of any actions that could be taken to reduce (mitigate) the risk to the environmental values. As a result, a 'sustainability index' was determined for each of these groundwater sources. This factor then went towards determining the volume of average annual recharge to each aquifer which is reserved as environmental water and the volume which may be available for extraction.

Recharge calculations

Recharge is the water that infiltrates into an aquifer. It is expressed as a volume in megalitres per year. Recharge usually comes from rainfall and from surface water, such as river flows. The recharge calculations for the fractured rock groundwater sources are based on rainfall recharge only i.e. the calculation does not include other forms of recharge such as river recharge, side slope or upward recharge. It is calculated based on a percentage of infiltration of average annual rainfall over the surface outcrop of the groundwater source area. This approach is precautionary and goes towards the determination of the volume of groundwater reserved as planned environmental water and the volume that is potentially available for extraction in each groundwater source.

The average annual rainfall recharge volumes for the fractured rock groundwater sources are displayed in Table 2. The recharge figure for high conservation value areas within each of the groundwater sources is treated separately from the rest of the recharge in that 100 per cent of this recharge is reserved as planned environmental water, while the percentage of the recharge for the remainder of the water source that is reserved as environmental water is determined by the sustainability factor.

Note that for the purposes of defining recharge, high environmental value areas include national parks, nature reserves, historic sites, Aboriginal sites, state conservation areas and karst conservation areas.

Note also that as recharge calculations are based on surface outcrop areas of groundwater sources only, no calculations were performed for the Lachlan Fold Belt North Western, as this source is completely buried by the Great Artesian Basin and therefore receives no direct rainfall recharge in the plan area.

[3] This report is available for viewing or downloading from the Office of Water website at www.water.nsw.gov.au

Table 2: Recharge for the North Western fractured rock groundwater sources

Water source	Outcrop area (km^2)	Average annual rainfall (mm/yr)	Infiltration (%)	Estimated average annual rainfall recharge (ML/yr)#
Kanmantoo Fold Belt North Western	6,123	211	4	51,695
Adelaide Fold Belt North Western	6,533	194	4	50,635
Total	**12,657**			**102,330**

Average annual rainfall recharge (ML/yr) = [{water source area (ha) x mean rainfall (mm)}/100] x % infiltration rate.

Risk assessment

The aquifer risk assessment considered the risk that groundwater extraction placed on the groundwater source and its high priority groundwater dependent ecosystems and identified risks to ecological, water quality and aquifer integrity assets. The socio-economic risk assessment looked at the dependence of local communities on groundwater extraction in terms of the risk to financial and sociological assets. An overall risk valuation was attained for the groundwater source, which is equal to the highest value attained on any criterion, less any mitigation measures.

Mitigation measures, applied through rules in the water sharing plan, can reduce the impact of extraction on a groundwater source. For example, a groundwater source which is at high environmental risk may have its risk reduced to moderate if the effect of extraction can be successfully mitigated. Mitigation measures were not applied to any of the groundwater sources.

For more detailed descriptions of the risk assessments refer to the report *Macro water sharing plans – the approach for groundwater. A report to assist community consultation.*

Sustainability factor

The recharge volume calculated for the area outside the high environmental value areas of each groundwater source is split between the environment and water potentially available for extraction. The sustainability factor was based on a matrix and determined the percentage of recharge in these parts of each groundwater source that was reserved as planned environmental water. The remaining percentage in the non-high conservation area was included in the long-term average annual extraction limit (LTAAEL) i.e. the volume potentially available for extraction. The sustainability factors for the groundwater sources covered by the plan are in Table 3.

Table 3: Sustainability factors for the North Western fractured rock groundwater sources

High environmental risk	**5%**	**25%**	**50%**
Moderate environmental risk	**25%**	**50%**	**60%**
Low environmental risk	**50%**	**60%** Kanmantoo Fold Belt North Western Adelaide Fold Belt North Western	**70%**
	Low socio-economic risk	**Moderate socio-economic risk**	**High socio-economic risk**

* Note that the Sustainability Index Value is calculated after mitigation has occurred.

Defining planned environmental water

Planned environmental water is derived from the average annual rainfall recharge volumes. A percentage of this rainfall recharge from the high environmental value areas (either 95 per cent or 100 per cent) has been added to a percentage of rainfall recharge from the non-high environmental value areas (dependent on the sustainability factor) for each water source. Details of the planned environmental water reserved for each water source in the plan are in Table 4.

Table 4: Planned environmental water for the North Western fractured rock groundwater sources

Water source	High environmental value areas Average annual rainfall recharge (ML/yr)	% of average annual rainfall recharge from high environmental value areas reserved for the environment	Non-high environmental value areas Average annual rainfall recharge (ML/yr)	% of average annual rainfall recharge from non-high environmental value areas reserved for the environment	Planned environmental water (ML/yr)
Kanmantoo Fold Belt North Western	5,145	100	46,550	40	23,765
Adelaide Fold Belt North Western	0	100	50,635	40	20,254
Total	**5,145**		**97,185**		**44,019**

Annual rainfall recharge reserved in high environmental value areas

Groundwater extraction is generally not permitted in areas such as national parks and reserves to ensure protection of groundwater dependent ecosystems. The approach to restrict extraction and reserve the annual rainfall recharge volumes as planned environmental water in these high environmental value areas is consistent with the precautionary principle. This means that volumes made available for licensed use are limited until the groundwater system is further assessed and the effect of groundwater extraction is better known.

Annual rainfall recharge reserved in non-high environmental value areas

Following the results of the risk assessment each groundwater source was placed in the sustainability matrix to provide the percentage of recharge in the non-high environmental value areas to be reserved as planned environmental water. This percentage is 100 minus the sustainability factor percentage.

A minimum 30 per cent to a maximum 95 per cent of the long term average annual rainfall recharge volume in the non-high environmental value area of each groundwater source may be reserved as planned environmental water for a groundwater source depending on the outcomes of the risk assessment. This builds on the original NSW Groundwater Dependent Ecosystem Policy (2002) which recommended a minimum of 30 per cent.

In the plan a minimum of 30 per cent and a maximum of 50 per cent of the rainfall recharge has been reserved as planned environmental water in the non-high environmental value areas.

Defining the long-term average annual extraction limit

The percentage of water potentially available for extraction is called the long-term average annual extraction limit (LTAAEL) and is expressed in megalitres per year (megalitres/year); this is the estimated sustainable limit for each of the water sources. The LTAAEL for the groundwater sources in the plan area is as expressed in Table 5. The LTAAEL was calculated by applying the sustainability factor derived from the risk assessment process, which determined the percentage of the average annual rainfall recharge over the non-high environmental areas that can be potentially made available for extraction. Also added to this figure is 5 per cent of the recharge from the high environmental value areas where applicable.

Table 5: LTAAEL for the North Western fractured rock groundwater sources

Water source	**High environmental value areas** **Average annual rainfall recharge** **(ML/yr)**	**% of average annual rainfall recharge from high environmental value areas made available for possible extraction**	**Non-high environmental value areas** **Average annual rainfall recharge** **(ML/yr)**	**Sustainability factor** (% of average annual rainfall recharge non-high environmental value areas made available for possible extraction)	**LTAAEL (ML/year)**
Kanmantoo Fold Belt North Western	5,145	0	46,550	60	27,930
Adelaide Fold Belt North Western	0	0	50,635	60	30,381
Lachlan Fold Belt North Western	0	0	0.00	0	0
Total	**5,145**		**97,185**		**58,311**

Water sharing rules

Unassigned water

The plan includes a provision for review of recharge and LTAAELs during the fifth year of the plan. Unassigned water is the water potentially available for extraction under the LTAAEL that is not yet allocated to an access licence and not estimated to be required to meet current and potential future requirements for extraction such as basic landholder rights extraction, extractions by specific purpose access licences e.g. major and local utilities (town and urban water supply) and water for Aboriginal cultural use or from exemptions under the WMA 2000.

With no other constraints, the unassigned water component in some groundwater sources could theoretically become fully assigned to new entitlements by the fifth year of the plan. To avoid this occurring, a staged process for any release of new entitlements has been developed for those systems that have a defined volume of unassigned water.

There will be no unassigned water made available through the controlled allocation process where entitlements plus basic landholders' rights equal 90 per cent or more of the LTAAEL. In groundwater sources where total entitlement plus basic landholder rights is less than 90 per cent there may be trading in existing water entitlement. However, in these water sources there is also the potential for the Minister to issue new entitlement through a controlled allocations order under the WMA 2000.

The current and potential future priority requirements for extraction must be accounted for (including an estimate for growth) before defining the amount that could be released as a controlled allocation. Any increase in these priority requirements over and above the LTAAEL must be met through a reduction in available water determinations to aquifer access licences. Estimating and reserving water to meet future priority requirements before releasing water through any controlled allocation will prevent over-allocation or sending misleading signals to the water market.

In water sources that, after consideration of current and future priority requirements, have unassigned water only a percentage of this volume may be released through the controlled allocation process before a review is initiated. The trigger for the review is based on the sustainability factor determined through the risk assessment for each water source. The review required will be a review of recharge, environmental needs and priority extraction requirements. That is, the percentage of unassigned water that can be allocated under a controlled allocation before a review is equal to the sustainability factor for that water source. Unassigned water allocated below the trigger is considered a low risk of controlled allocation creating unsustainable levels of licensed entitlement. Controlled allocation above the trigger is a more uncertain risk of over-allocation and a review will therefore be undertaken before additional controlled allocations are made.

Aquifer interference

Activities which intersect ('interfere with') an aquifer may involve:

- the extraction of groundwater that flows into a void to allow the activity to operate safely. This is often called de-watering, and the water extracted is often referred to as 'incidental groundwater'
- other impacts resulting from the intersection of the aquifer, such as changes to groundwater flow paths and gradients, subsidence, compaction of the aquifer structure, and artificial aquifer recharge.

Volumes of water incidentally taken in the course of aquifer interference activities, such as the water intercepted during mining operations, have in the past required a licence under the *Water Act 1912*.

Operators of these activities will continue to be required to hold an access licence under the WMA 2000 and sufficient account volume to account for incidental water taken. This includes activities where extraction associated with aquifer interference activity was occurring at the commencement of the plan.

Protecting environmental values and groundwater dependent ecosystems

The groundwater reserved for the environment, or 'planned environmental water' has been detailed above in the section titled *'Defining planned environmental water'*. This is part of the defined environmental water in the plan. All aquifer storage volumes in each groundwater source are also reserved for the environment.

The plan also includes a number of additional provisions that protect environmental assets. These include the identification of high priority (high conservation value) groundwater dependent ecosystems (GDEs). These GDEs are listed in schedules to the plan. The GDE lists were developed through an interagency expert panel, which included karst, wetlands, vegetation and groundwater experts (see Appendix 4).

The GDE schedules may be updated after the making of the plan. Additional protection for these identified GDEs and for protecting base flow in connected rivers is afforded through specific rules for granting or amending water supply works approvals. See section titled *'Water supply works approvals'* for detail. The distance rules cover new or replacement works such as bores, and stipulate a minimum distance these works are required to be located from high priority GDEs or the associated river.

There are also powers in section 324 of the WMA 2000 for managing the environmental impacts of existing works within these groundwater sources e.g. on high priority GDEs.

Water supply works approvals

The plan contains rules for granting or amending water supply work approvals and the management of existing works for groundwater sources. These rules determine where water supply works can be located and how existing works may be managed where they are already within the distance restriction. For new and replacement works there are rules to:

- minimise interference between neighbouring works
- locate works away from contaminated sites
- protect water levels for high priority GDEs
- protect groundwater dependent culturally significant sites
- manage surface and groundwater connectivity.

Note also that powers in section 324 of the WMA 2000 can be used to manage temporary local impacts on new and existing works.

The plan also contains rules to manage existing works where the work is located close to the river. These rules are described below in '*Managing connectivity and access rules*'. This is to limit any additional potential impacts on the adjacent river.

The development of rules for the granting or amending of water supply works and management of existing works has followed a two-stage process:

- Stage 1: regional staff identified recommendations for rules
- Stage 2: the State Groundwater Panel reviewed the regional recommendations and recommended rules which were consistent across groundwater aquifers in the state. Note that while there is a need for consistency across aquifer types, a change to the rules may have been warranted to cater for local conditions.

This work was reviewed and reconsidered in light of the significant progress made on rules development by the State Groundwater Panel, as a result of the development of water sharing plans in other areas of the state.

For details about the proposed rules for water supply works approvals for each groundwater source covered by the plan, refer to individual summary sheets or the plan document.

Available water determinations

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

Available water determinations are primarily used to credit water into a licences water allocation account. The AWD for groundwater access licences in all the groundwater sources in the plan is 1 megalitre per unit share, i.e. 100 per cent of entitlement, unless a growth in use response is required.

Carryover and water accounts

Water allocation remaining in a water allocation account of an access licence in the groundwater sources cannot be carried over from one water year to the next.

Trading of access entitlement

Trades are not permitted into any groundwater source. However licences can be traded within each groundwater source.

Consultation

Public exhibition of the water sharing plan was held from the 6 December 2010 for a period of seven weeks until the 31 January 2011 in the plan area. The objectives of this consultation were:

- to provide background to stakeholders as to why the water sharing plan was being developed, how it has been developed to date, what rules were proposed in the various areas and how stakeholders could provide feedback
- to formally consult with a broad range of stakeholders to explain the proposed water sharing rules and how they will be implemented
- to seek feedback from stakeholders and the general community about the proposed water sharing rules.

A public meeting for the plan was held in Broken Hill on 17 January 2011; which explained the methodology and requirements of the plan. Submissions from the public were invited during the public exhibition period, and all licence holders within the plan area were informed in writing of the plan being on public display. No formal submissions were received during the public exhibition period.

Monitoring plan performance

The Office of Water is 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 NRC and the NWC. The intention is that the framework can be applied to existing plans and macro 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 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 WMA 2000, the NRC is required to undertake a review of this 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.
- An audit of the plan by the NRC to assess to what extent the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the relevant catchment management area. The NRC will call for public submissions when undertaking its review.
- An annual review of Implementation Programs.
- The application of information from the relevant monitoring and evaluation programs to inform progress against the relevant state-wide targets and requirements of the NWC under the NWI.

Implementation

Implementation programs

An Implementation Program may be established that sets out the means by which the objectives of this 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 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. 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 or other forms of monitoring devices fitted to approved works, or via alternative monitoring systems, in order to provide water extraction estimates. 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.

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

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

Compliance

The 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 (refer to the Office of Water website at www.water.nsw.gov.au)

Glossary

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

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

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

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.

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.

Extraction of water: Taking of water from a water source.

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

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 high water mark.

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 (MZ): 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 (MZ) is more likely to be designated where local dealing restrictions are in place or where 'Cease to Pump' (CtP) 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.

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

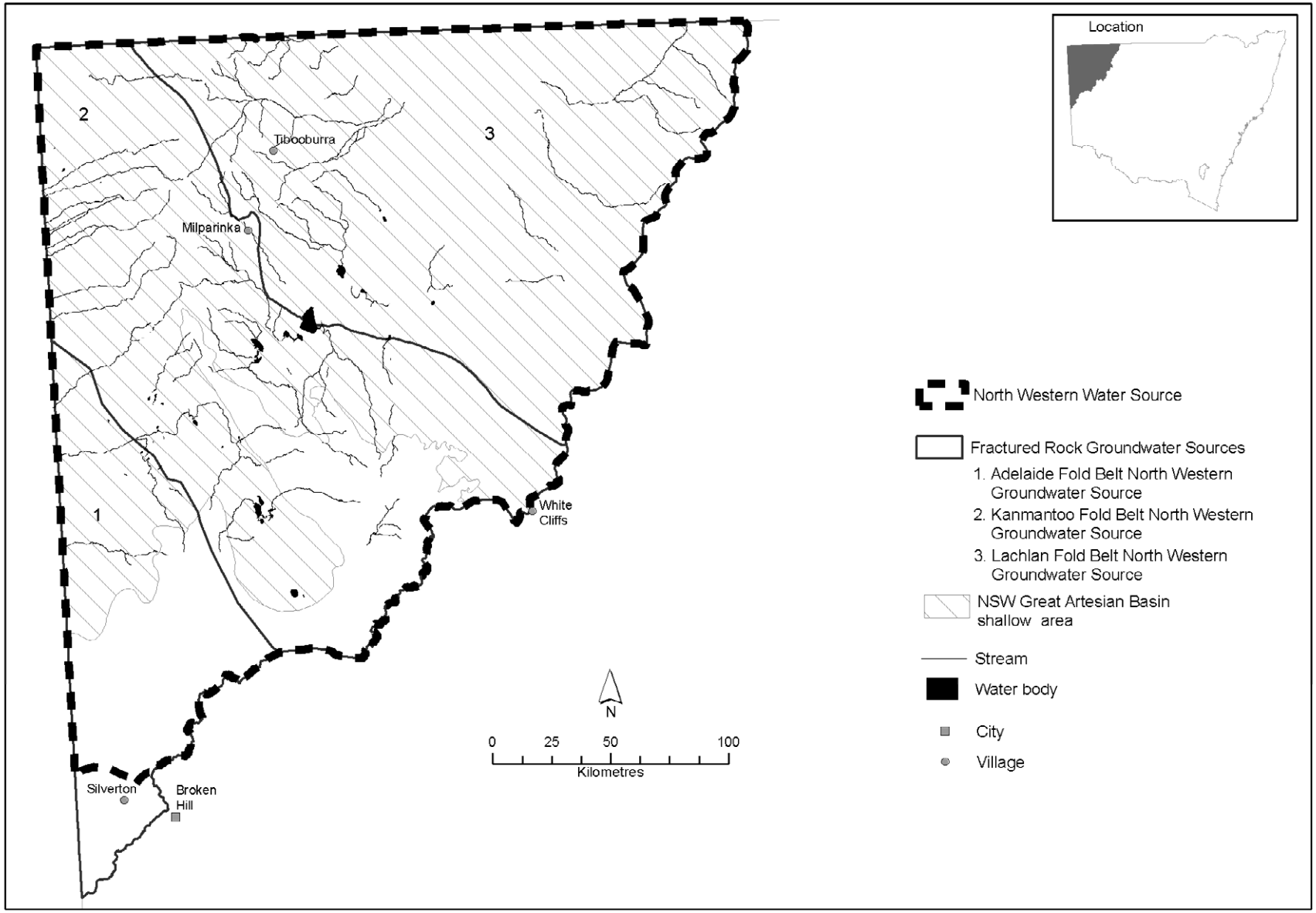
Security: The legal status and tenure of a right to access water. This includes the level and assurance that a water access entitlement will provide that which it specifies. Security thus includes the reliability of supply. The range of water access entitlement characteristics detailed in the NWI contributes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

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

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

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

Appendix 1: Water sharing plan area



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	NSW Department of Primary Industries	Agency representative	Thirty year experience in the State Dept of Agriculture including five years a District Officer at Bourke, 15 years as Regional Director with Primary Industries in the western region. Involved in developing water sharing plans in the regulated and groundwater systems of the Macquarie and Lachlan Valleys.
Peter Terrill	NSW Office of Environment and Heritage	Agency representative	Peter has worked as a water management and water environmental specialist since 1987. He has held 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, plan development and implementation, facilitation and project management.
Richard Wheatley	NSW Office of Water	Plan support	Senior Licensing Officer, extensive local knowledge of surface and groundwater water issues, users, WUAs, local access arrangements and reference points.
Dave Miller	NSW Office of Water	Plan support	Water planning/administration/policy. Geomorphology. Riparian management. Stream ecology/restoration.
Emily Turner	NSW Office of Water	Plan support	Water planning / support documentation.
Mark Harris	NSW Office of Water	Plan support	Water policy/administration/planning.

Appendix 3: Interagency regional panel reference materials

Office data sets

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

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

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

Volumetric Conversion Database (VOLCON) – used to help determine the peak daily demand (PDD) for each water source.

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

Central data sets

Stressed rivers reports – used as the basis for identifying where there are in-stream barriers.

Threatened species (fish) – Data supplied by the former I&I NSW.

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

Index of Social Disadvantage – Australian Bureau of Statistics.

Employment in Agriculture – Australian Bureau of Statistics

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

Other agency data

National Parks and Wildlife (part of the the former DECCW) state-wide atlas – State-wide flora and fauna database

NSW Fisheries (part of the former I&I NSW) modelled data sets (Fish Community Index, Fish Community Vulnerability).

NSW Fisheries (part of the former I&I NSW) freshwater and saltwater recreational fishing database.

Other projects/reference material

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

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

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

NSW DPI Agriculture web site for crop gross margins: http://www.agric.nsw.gov.au/reader/budget.

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

Appendix 4: Identified high priority groundwater dependent ecosystems

Identified high priority groundwater dependent ecosystems in the North Western groundwater sources.

Name	GDE type	Groundwater Source	Easting (GDA 94 zone 54)	Northing (GDA 94 zone 54)
Torrowangee	Karst	Adelaide Fold Belt North Western		
Mutawintji	Karst	Kanmantoo Fold Belt North Western		
Tarrawingee Springs	Spring	Adelaide Fold Belt North Western	542196.51	6518931.09
Corona Springs	Spring	Adelaide Fold Belt North Western	546712.07	6525469.68