Department of Primary Industries
Water

Water Sharing Plan for the South Coast Groundwater Sources

Background document

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More information

Rural Water Planning

www.water.nsw.gov.au

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Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across New South Wales following the introduction of the *Water Management Act 2000* (WMA 2000). These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water.

The first round of water sharing plans commenced on 1 July 2004. The development of these plans resulted in around 80 per cent of the water use in NSW being managed under the WMA 2000. By the end of 2012, over 95 per cent of all water extracted in NSW was covered by a water sharing plan. By the end of 2016 it is anticipated that all extraction in NSW will be covered by a water sharing plan.

Water sharing plans for the unregulated[1] rivers and groundwater systems have been completed using a broad scale 'macro' approach based on whole river catchment or aquifer systems. Each macro plan covers a large river basin rather than a single subcatchment, or in the case of groundwater systems, cover a particular type of aquifer (for example 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 South Coast Groundwater Sources* (the plan) covers three groundwater sources, which extend from the Shoalhaven region along the coast to the Victorian border and inland to the boundary of the Murray Darling Basin.

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

- the *Water Sharing Plan for the South Coast Groundwater Sources* - a legal instrument written in its required statutory format
- Rule summary sheets for each water source detailing the proposed management rules.

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

- *Macro water sharing plans – the approach for groundwater. A report to assist community consultation* – explains the method used to classify and set water sharing rules for groundwater across the state
- *NSW Policy for Managing Access to Buried Water Sources*

[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.

Why are water sharing plans being prepared?

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

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

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

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

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

Benefits for water users

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

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

Environmental considerations

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 tens of thousands of years. Water enters (or recharges) aquifers via rainfall, surface flows from river and lakes or flow from adjacent aquifers.

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

In the Lachlan Fold Belt Coast and the South East Coastal Sands Groundwater Sources, 100% of groundwater storage is reserved as planned environmental water. The Sydney Basin – South Coast Groundwater Source reserves 99.998% of groundwater storage as planned environmental water. The plan defines a proportion of rainfall recharge that is available for extraction and the remainder of recharge is reserved for the environment. Limiting the volume of use to a

proportion of recharge is intended to reduce the risk of unsustainable groundwater extraction in the long term.

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

A water sharing plan for the South Coast groundwater sources

This plan formalises water sharing arrangements in the South Coast Groundwater Sources and provides a consistent approach to managing water across the plan area.

Objectives of the plan

The objectives of the plan are to:

(a) protect, preserve, maintain and enhance the important high-priority groundwater dependent ecosystems of these groundwater sources;

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

(c) protect basic landholder rights;

(d) manage these groundwater sources to ensure equitable sharing between users;

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

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

(g) contribute to the maintenance of water quality;

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

(i) adaptively manage these groundwater sources; and

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

Scope of the plan

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

The *Water Sharing Plan for the South Coast Groundwater Sources* covers three discrete water resources, within what is known as the South Coast groundwater management area (Appendix 1). Incorporating all of these resources into the one plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these water sources.

The three groundwater sources are:

- Lachlan Fold Belt Coast, which is a portion of the Lachlan Fold Belt fractured rock aquifer;
- South East Coastal Sands, which is a combination of geographically discrete coastal sand aquifers; and
- Sydney Basin–South Coast, which is a portion of the Sydney Basin porous rock aquifer

The aquifer types and groundwater sources that occur within the boundaries of the plan and their connectivity characteristics are given in Table 1. The table is based on principles and recommendations in *Towards a National Framework for Managing the Impacts of Groundwater and Surface Water Interaction in Australia* (Sinclair Knight Merz 2006).

Table 1: Connectivity between aquifer types and surface water

Aquifer type	Groundwater source	Level of connection between surface and groundwater	Level of impact on in-stream values	Travel time between groundwater and surface water
Fractured rock	Lachlan Fold Belt Coast	Low - Moderate	Low since not major contributor	Years to decades
Coastal sands	South East Coastal Sands	Significant (tidal section only)	Low due to connection with saline water	Days to months
Porous rock	Sydney Basin – South Coast	Low - Moderate	Low since not major contributor	Years to decades

The plan does not include any of the alluvial aquifers within the plan area. Due to the nature of the connectivity between the alluvial aquifers and the river system, the surface water and groundwater associated with the alluvial aquifers will be managed as a single resource. This also prevents 'double counting' of the same water. Management of the alluvial aquifers within the plan area will occur through the following water sharing plans:

- *Water Sharing Plan for the Towamba River Unregulated and Alluvial Water Sources 2010*
- *Water Sharing Plan for the Murrah – Wallaga Area Unregulated and Alluvial Water Sources 2010*
- *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*
- *Water Sharing Plan for the Bega and Brogo Rivers Area Regulated, Unregulated and Alluvial Water Sources 2011*
- *Water Sharing Plan for the Deua River Unregulated and Alluvial Water Sources 2016*
- *Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016*
- *Water Sharing Plan for the Clyde River Unregulated and Alluvial Water Sources 2016*
- *Water Sharing Plan for the Snowy Genoa Unregulated and Alluvial Water Sources 2016.*

Water management units

Aquifers in water sharing plans can be divided into two hydrological units to provide appropriate management. These are groundwater sources and management zones.

The highest level of management unit described in the plan is the **groundwater source**. There are three groundwater sources established in the plan as described above. They are geographic areas over which long term average annual extraction limits (LTAAELs) and available water determinations (AWDs) can be applied, growth can be assessed and management and water can be traded.

A **management zone**, representing a portion of a groundwater source, may be specified so that more refined implementation of access or trading rules can be applied, if required. This plan does not establish management zones.

Policy and planning framework

Water Management Act 2000

The *Water Management Act 2000* (WMA 2000) was passed by NSW Parliament in December 2000, establishing a new statutory framework for managing water in NSW. The objective of the Act is to ensure the sustainable and integrated management of the State's water for the benefit of both present and future generations.

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

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

The latest copy of the *Water Management Act 2000* is available from the NSW government legislation website.

Access Licence Dealing Principles

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

The Principles specify that dealings must consider:

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

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

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

National Water Initiative

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

Until the end of 2014 the NWI was implemented and monitored by the National Water Commission. Its responsibility for assessing each state's progress with the NWI and providing

independent advice to the Commonwealth Government has now been taken over by the Commonwealth Productivity Commission.

Natural Resource Commission targets

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

As with the National Water Initiative, the NRC's Standard requires 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. In 2013 the NRC reviewed 31 water sharing plans that were due to expire in 2014 and provided advice to the Minister for Primary Industries.

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

Catchment Action Plans

Catchment Action Plans are statutory, non-regulatory plans that were previously prepared by the state's catchment management authorities under the *Catchment Management Authorities Act 2003* (now repealed). In January 2014 the NSW Government established Local Land Services and transferred the functions of catchment management authorities into this new organisation. South East Local Land Services will be responsible for continuing the delivery of natural resource management programs on the south coast.

The South East Catchment Action Plan (South East LLS 2014) brings together the goals and targets of the previous catchment action plans prepared by the former CMAs in the region. It sets the framework for the sustainable use and care of the natural resources of the south coast and Snowy region.

Under the Goal of "*Diverse, healthy, connected and productive natural environments*" the CAP specifies two priority actions relating to the management of surface water, wetland and groundwater assets:

- Implement practices that maintain and improve the condition of priority surface water, wetland and groundwater assets
- Facilitate the equitable sharing of water between people and the environment

The implementation of water sharing plans on the south coast is one of the key activities to be implemented in supporting land and water managers to maintain or improve the condition of surface water, wetland and groundwater assets (South East LLS 2014).

Water planning policies and considerations

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

Managing surface water and groundwater connectivity

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

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

Protecting basic landholder rights

Under the WMA 2000, basic land holder rights (BLR) are made up of domestic and stock rights, harvestable rights and native title rights. Water may be extracted under these rights without the need for a water access licence; although where groundwater is accessed under a domestic and stock right, the bore must still be approved by DPI Water.

The WMA 2000 requires that water sharing must protect BLR. The water sharing plan does this by identifying the requirements for domestic, stock and native title rights at the start of the plan and taking these requirements into consideration when designing the rules for licensed water extraction. As the access rules for licensed extraction do not apply to BLR this provides a higher priority of access for those users.

There are currently no extractions for native title rights, however the water sharing plan allows for these rights should they be activated during the plan's ten year term.

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

Protecting town water supply access

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. Local water utilities such as local councils are issued with local water utility access licences. The WMA 2000 allows for annual trade but not permanent trade of entitlement between local water utility access licences.

Protecting Aboriginal values

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

Water sharing plans recognise the importance of surface and groundwater to Aboriginal cultures. The plan will allow Aboriginal communities to apply for a water access licence for cultural

purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and for cultural and ceremonial purposes. An Aboriginal cultural licence can also be used for drinking, food preparation, washing and watering domestic gardens. These licences are limited to 10 ML per year per application.

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

Buried groundwater sources

Fully buried or partly buried groundwater sources have little or no surface expression (outcrop), and therefore have very little or no water available for extraction based on rainfall recharge. The *NSW Policy for Managing Access to Buried Water Sources* provides access to groundwater held in storage through the granting of supplementary water (subcategory “storage”) access licences. The plan allows the granting of these licences in the Sydney Basin – South Coast Groundwater Source.

Description of the plan area

The area covered by the plan (Appendix 1) comprises the fractured rock, porous rock and coastal sands aquifers of the South Coast of NSW and contains three groundwater sources covering an approximate area of 21,574 km^2. The area includes the major towns of Ulladulla, Batemans Bay, Bega and Jindabyne.

Groundwater sources

Lachlan Fold Belt Coast Groundwater Source

The Lachlan Fold Belt Coast Groundwater Source is the southern coastal section of a folded and fractured rock aquifer, known as the Lachlan Fold Belt, which extends across most of eastern Australia and consists of Cambrian to Lower Carboniferous rock successions. In north-west NSW the Lachlan Fold Belt is overlain by the Great Artesian Basin and in the south-west of NSW it is overlain by the Murray-Darling Basin. On the South Coast of NSW the Lachlan Fold Belt Coast Groundwater Source has an outcropped area of 20,031 km^2. It is overlain in northern parts by the Sydney Basin – South Coast Groundwater Source and in southern parts it is overlain by alluvial sediments along surface water features and by the South East Coastal Sands Groundwater Source.

Water recharges the Lachlan Fold Belt from rainfall and river flows and filters through the rock system at varying speeds depending on its location in the landscape. Bores in this aquifer usually yield smaller amounts of groundwater. The groundwater in these systems support base flows to rivers, wetlands, caves, terrestrial vegetation and hypogean ecosystems, however, travel time of aquifer water to and from streams is relatively slow, being in the order of several years or decades. Therefore this aquifer is not considered to be highly connected to river systems.

Sydney Basin – South Coast Groundwater Source

The Sydney Basin – South Coast Groundwater Source is the southern coastal section of a large sedimentary (porous) rock aquifer, which extends along the east coast of NSW from Newcastle in the north to Batemans Bay in the south and the Blue Mountains in the west. It consists of Permian and Triassic sedimentary rocks which occur as layers of sandstone and shale. These rocks have then been subjected to folding and faulting during the formation of the Great Dividing Range.

The Sydney Basin – South Coast Groundwater Source falls entirely within the Shoalhaven local government area. The groundwater source has an outcropped area of 1,395 km^2 and overlies the Lachlan Fold Belt – Coast Groundwater Source. It is also buried underneath alluvial sediments along surface water features and by the South East Coastal Sands Groundwater Source.

South East Coastal Sands Groundwater Source

The South East Coastal Sands Groundwater Source is a group of geographically non-contiguous coastal sand aquifers located along the southern NSW coastline. These aquifers are located within sand deposits such as paleochannels, dunes or lowland coastal sands. They are typically composed of unconsolidated sediments such as estuarine deposits and beach dunes of Pleistocene/Holocene age. They are mostly unconfined with a high porosity and shallow depth to the water table, although some localised layers of ‘coffee-rock’ (iron-indurated sand) and clays typically create semi-confined aquifers at depth. It has a total outcropped area of 148 km^2.

Groundwater studies and information

Numerous groundwater studies have been undertaken in the Bega Valley including Sundararamayya (1983), Coastal and Marine Geosciences (1999), Russell (1999), Russell (2000), DLWC (2000) and Parsons Brinkerhoff (2004). Apart from a small coastal sand aquifer located at Tathra, the main aquifer in the Bega Valley is the fractured rock of the Lachlan Fold Belt. The most recent review of groundwater resources in the Bega Valley is provided by Pritchard (2004).

The other major area of groundwater investigations on the South Coast has been in the Araluen Valley in the upper reaches of the Deua River catchment. Here groundwater is extracted from the unconsolidated alluvial sediments associated with Araluen Creek. Due to its highly connected nature, the Araluen alluvial groundwater source is included in the *Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016.*

DPI Water monitors groundwater level and quality through its network of groundwater observation bores across NSW. This includes one telemetered bore in the Bega Valley for which data is available on a daily basis, and a number of other bores throughout the region which are monitored on a manual basis.

Land use history

At the time of European contact, the majority of the South Coast region was occupied by the Yuin people. The Dharawal people occupied the area north of the Shoalhaven River extending down to Jervis Bay and the Ngarigo people occupied the Snowy Mountains region.

The higher mountains of the Snowy River region were an important feature of Aboriginal life as tribes gathered together in the summer months for ceremonies and feasting. Traditional ceremonial activities were also conducted around the shores of major lakes and estuaries including Coila and Tuross Lakes in the Eurobodalla region and Cullendulla Creek on the Clyde estuary. Middens, open campsites and ceremonial grounds are associated with these estuaries (Goulding and Waters 2005).

European settlement of the South Coast commenced in the early 1820s bringing with it activities such as timber-getting, agriculture, fishing and gold mining. In these early times settlement was patchy due to the rugged mountainous nature of the country but slowly increased through the 1830s and 1840s (Goulding and Waters 2005).

In the 1840s timber getting began and sawmills proliferated in the 1860s. With large forested areas lying between valleys along the coast, it provided a valuable resource and continues to do so to this day (Goulding and Waters 2005). There was a dramatic increase in timber getting in the late nineteenth century due to contracts being gained to supply sleepers to develop railway networks across the State (Goulding and Waters. 2005).

In the 1850s alluvial gold was discovered in many of the valleys of the South Coast and the whole region was caught up in the rush to exploit this new resource. Although the miners were a largely transient population, this new phase resulted in significant development of roads and transport within the region and the establishment of new towns to service the growing population.

Primary industries such as dairying, forestry and fishing have historically shaped the settlement of the South Coast region. The productivity of these industries continues to rely on the availability of high quality natural resources as well as defining the character and liveability of the region. Although these industries continue to be important employment sources, the proportion of these jobs in overall employment figures is starting to decline. Tourism based on the spectacular and largely unspoilt coast and mountains is an increasingly important component of the regional economy (DoP 2007).

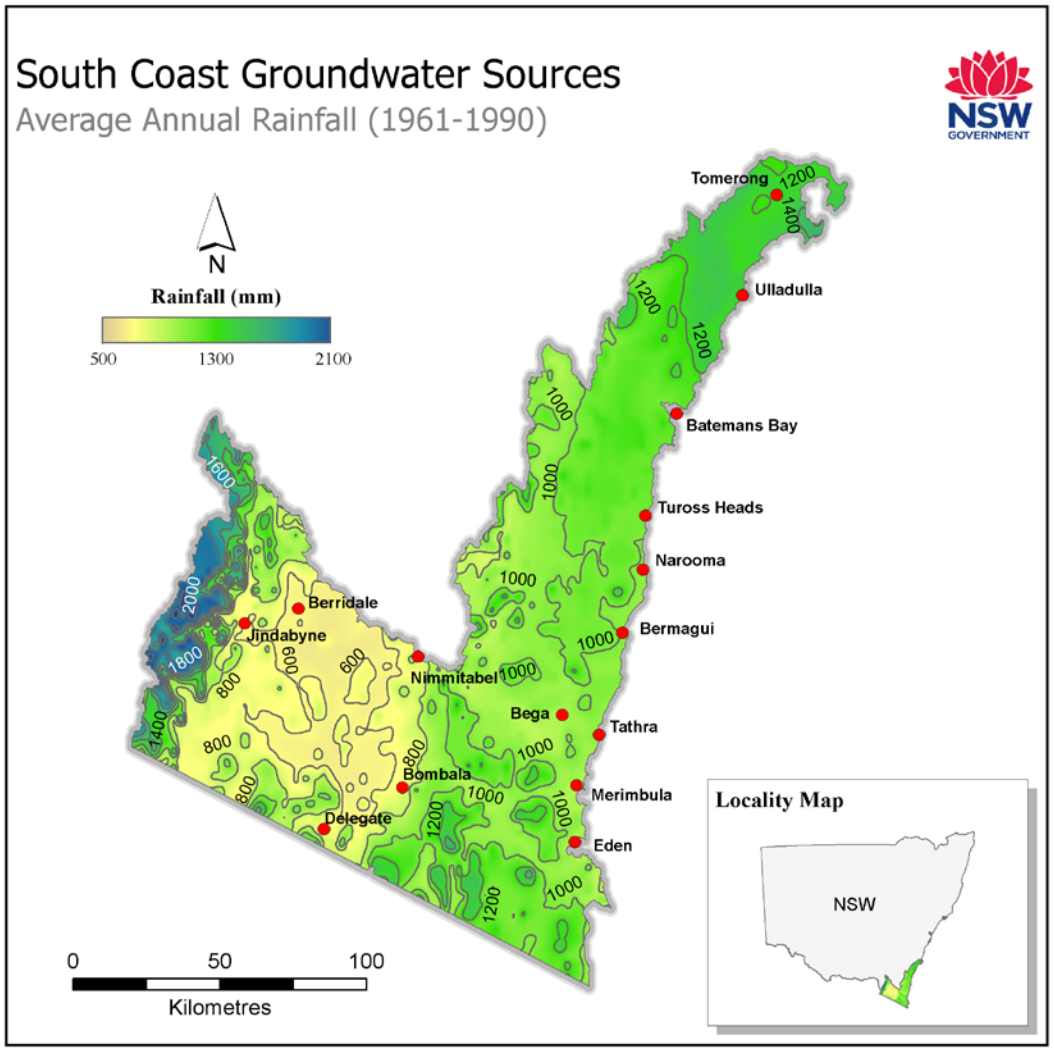
Approximately 44% of the South Coast region, excluding the Snowy Mountain area, is conserved in a range of protected areas including national parks and reserves, forestry reserves and involuntary conservation agreements on private land. Over half of NSW's 91 coastal lakes and lagoons occur in the South Coast region. The region has over 400 significant coastal wetlands, over 60 sensitive estuaries and three large bays: Jervis, Batemans and Twofold.

Climate

The South Coast experiences a mild, warm temperate climate. This climate is particularly suited for today's agricultural activities in dryland agriculture, pasture grazing, fodder crops (lucerne), vineyards and olive production.

Annual rainfall throughout the region (Figure 1) ranges from 1,116 mm along the coast at Ulladulla, to 652 mm further south at Bega and 526 mm inland at Jindabyne. Rainfall is highest during February and March, with Ulladulla on the coast also receiving regular high rainfall during June. Along the coastal strip annual rainfall is highest in the northern part of the region and decreases southwards. The highest rainall is received in the far west of the plan area along the alpine ranges west of Jindabyne. Late winter to spring is usually the driest period and is accompanied by rising evaporation rates. Dry periods with minimal rain can last for several months during this time.

Figure 1: Average annual rainfall over the South Coast region



Rainfall can be erratic as falls can occur in heavy, irregular storms. These storms may occur at any time of year, but are most frequent in late autumn and early winter. Storms on the South Coast are a result of Southern Secondary Lows. These events bring intense rainfall periods and/or very strong winds, resulting in heavy seas, severe coastal erosion, localised or sometimes catchment-wide flooding.

December and January are generally the hottest months with mean summer temperatures ranging between 27°C on the coast and 25°C further inland. However the region can experience days up to 40°C during the summer months. Winter temperatures vary as the region incorporates the coast, with mean winter temperatures of 9°C, and inland to the snowfields temperatures can fall to -3°C at Jindabyne. The coldest months are July and August.

Entitlement and water use

There are approximately 80 groundwater licences in the area covered by the plan, totalling 1,619 ML/year of entitlement (Table 2.). The majority of licences are used for irrigation, with a significant proportion also used for town water supply. The plan assumes full development of all entitlement in setting the extraction limits within the plan.

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

Lachlan Fold Belt Coast Groundwater Source

The fractured rocks of the Lachlan Fold Belt Coast Groundwater Source support the largest number of groundwater licences within the plan area, with 55 licences authorising up to 1,101 ML of entitlement per year. The majority of licences are located within the Bega and Tuross valleys with smaller concentrations of licences in the areas surrounding Moryua, Cobargo, Pambula and the Towamba River. The majority of aquifer licences are used for irrigation purposes.

Sydney Basin – South Coast Groundwater Source

Only a small number of licences extract groundwater from the porous rocks of the Sydney Basin – South Coast Groundwater Source. These licences are located around Sussex Inlet, Sanctuary Point and along Currambene, Wandandian and Conjola Creeks. The majority of aquifer licences are used for irrigation purposes.

South East Coastal Sands Groundwater Source

There are approximately 21 licences that are authorised to extract up to 471 ML per year from coastal sand aquifers within the plan area. The majority of these licences are located around the townships of Batemans Bay, Huskisson, Tomakin and Broulee and are used mainly for industrial purposes.

Table 2: Total entitlement and number of licences by groundwater source

Groundwater Source	Entitlement (ML/year)	Number of licences
Lachlan Fold Belt Coast	1,101	55
Sydney Basin – South Coast	47	4
South East Coastal Sands	471	21
Total	**1,619**	**80**

Local water utility requirements

There are six local water utilities that provide town water supplies in the plan area:

- Shoalhaven Water (part of Shoalhaven City Council)
- Eurobodalla City Council
- Bega Valley Shire Council
- Cooma-Monaro Shire Council
- Snowy River Shire Council
- Bombala Council

The majority of these local water utilities use surface water, with only Cooma-Monaro and Bombala Shires holding entitlements for groundwater as follows:

- Cooma-Monaro Shire – 67.5 ML in Lachlan Fold Belt Coast Water Source
- Bombala Shire – 150 ML in south East Coastal Sands Water Source

The Integrated Water Cycle Management Plan produced by Shoalhaven City Council (SCC 2008) states that "Groundwater resources are not significantly utilised for town water supply. There is some potential for groundwater use. However, at this stage, due to the relatively small resource and likely water quality and environmental issues to be addressed, groundwater is not proposed for further consideration."

During the droughts of the 1980s Eurobodalla Shire Council established a series of bores south of Broulee and north of Moruya to supplement town water supplies. Reasonable yields were obtained from the bores but they were later capped and are no longer used (Eurowater 2007). In 2004 Council sunk five bores adjacent to the Tuross River in 2004 and these are used only for emergency water supplies during drought (Eurowater 2007). These alluvial aquifers are managed through the *Water Sharing Plan for the Tuross River Unregulated and Alluvial Water Sources 2016*.

Other local water utilities on the South Coast have stated that, only during periods of extreme drought would groundwater be used as an alternative supply option to surface water. In these cases, it is most likely to be sourced from the alluvial aquifers not covered by this plan. Eurobodalla Shire Council has also canvassed the option of using highly treated reclaimed water which would be injected back into coastal aquifers (DPWS 2010).

The process of developing the water sharing plan

DPI Water is responsible for implementing the WMA 2000, including developing water sharing plans for the state's water resources. DPI Water has established several interagency panels to assist with the development of water planning policies and water sharing plans. The role of each of these panels is discussed below.

The *Water Sharing Plan for the South Coast Groundwater Sources* was prepared based on:

- the indicative rules generated by a risk and values classification (explained later);
- the deliberations of the South Coast Working Group and the South Coast Interagency Regional Panel; and
- feedback from stakeholders during targeted consultation.

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

This section describes the interagency panels and outlines the process of developing the plan including the risks and values classification, refining the indicative rules, and the specific outcomes of panel deliberations, targeted consultation and public exhibition.

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

Role of the interagency panels

The preparation of the water sharing plan was guided by four technical panels:

- the State Interagency Panel;
- the State Groundwater Panel;
- the South Coast Working Group; and
- the South Coast Interagency Regional Panel.

State Interagency Panel

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

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

State Groundwater Panel

The State Groundwater Panel provides a senior level forum for discussing and resolving a wide range of water planning and policy issues specific to groundwater. The State Groundwater Panel 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 DPI Water and has representatives from OEH and agriculture and fisheries specialists from DPI Agriculture and DPI Fisheries.

South Coast Working Group

The South Coast Working Group (the Working Group) comprises a range of officers representing the various functions of DPI Water such as plan and policy development, licensing and compliance, hydrometrics and environmental protection. The Working Group was responsible for collating information and developing recommendations to be considered by the South Coast Interagency Regional Panel.

South Coast Interagency Regional Panel

Interagency regional panels were established across NSW to develop water sharing plans. The South Coast Interagency Regional Panel (the IRP) comprises representatives from DPI Water, DPI Agriculture, DPI Fisheries, OEH and South East Local Land Services (formerly Southern Rivers Catchment Management Authority) as an observer. Appendix 6 lists the names of IRP representatives and their areas of expertise, and relevant support staff who the IRP had access to for specific technical and scientific information.

The key responsibilities of the IRP are to:

- ensure water sharing rules are consistent with state policy
- review the water management units provided by DPI Water;
- assign economic, social and environmental values and undertake risk and value assessments to classify each groundwater source;
- review existing and generic water sharing rules as to their applicability;
- review future water estimates to inform extraction limits;
- make recommendations on the water access and dealing (trading) rules for each groundwater source; and
- review submissions from targeted consultation and public exhibition and make necessary amendments.

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

Along with the State Groundwater Panel, the IRP played a significant role in relation to the new method for determining the long-term average annual extraction limit that was used in this plan (see section on setting extraction limits).

Water source risk assessment

Water sharing provisions in the plan were developed based on the groundwater macro planning risk assessment process. This is the current approach of DPI Water to developing water sharing rules for less highly-connected groundwater sources and is described in *Macro water sharing plans – the approach for groundwater. A report to assist community consultation*[2].

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 access and distance rules that relate to groundwater extraction. The process uses assessment ratings (‘high’, ‘moderate’ and ‘low’) to indicate different levels of risk. This approach helps 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.

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

Environmental values were weighed up against the socio-economic dependence and consideration was given to the possibility of any actions that could be taken to mitigate the risk to the environmental values.

The aquifer (environmental) risk assessment considers the risk that groundwater extraction places on the groundwater source and its high-priority groundwater dependent ecosystems (GDEs) and identifies risks to ecological, water quality and aquifer integrity assets.

The socio-economic risk assessment looks at the dependence of local communities on groundwater extraction in terms of the risk to financial and sociological assets.

From these assessments an overall risk valuation is attained for the groundwater source, which is equal to the highest value attained on any one criterion. The values given can be either 'high', 'moderate' or 'low'. The results of the risk assessments for each of the groundwater sources are shown in Table 3. Further details are provided in Appendix 2.

Table 3: Risk ratings

Groundwater Source	Risk Valuation - Socio Economic	Risk Valuation Aquifer Risk
Lachlan Fold Belt Coast	MODERATE	MODERATE
South East Coastal Sands	HIGH	MODERATE
Sydney Basin - South Coast	LOW	LOW

Consideration was given to mitigation measures that can be applied through rules in the plan to 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 medium if the effect of extraction can be successfully mitigated. None of the groundwater sources in the plan had mitigation measures applied due to the relatively low initial risks.

As a result of the assessment, sustainability indices were determined for each groundwater source, which are shown in Table 4.

Table 4: Sustainability index matrix

Aquifer Risk	**High**	5%	25%	50%
	Moderate	25%	50% **Lachlan Fold Belt Coast**	60% **South East Coastal Sands**
	Low	50% **Sydney Basin – South Coast**	60%	70%
		Low	**Moderate**	**High**
		Socio-Economic Risk		

Consultation and public exhibition

During the development of water sharing plans the risk assessments, proposed extraction limits and recommended rules may undergo targeted consultation with water users and specific interest groups before the plan is drafted. Targeted consultation refers to informal consultation held with key stakeholders to test the suitability of the proposed water sharing rules and provide feedback on the rules potential impacts. As the South Coast Groundwater Sources are relatively low risk with low levels of extraction, targeted consultation was not undertaken during the preparation of this plan.

Public exhibition of draft water sharing plans provide an opportunity for wider public consultation. Public exhibition is the formal exhibition of a draft water sharing plan where the Minister invites submissions on the draft plan and in particular will seek comment on a range of key issues.

DPI Water manages the public consultation process and ensures that all stakeholders and interested parties have opportunities to examine and comment on the proposed water sharing rules. In particular, DPI Water looks for stakeholders to provide:

- local knowledge and expertise, for example, there may be other natural or socio-economic values that have not yet been considered by the IRP;
- feedback on the practical elements of the proposed water sharing rules to ensure they are easily implemented by the licence holders;
- confirmation that there are no unintended outcomes from the plan; and
- specific comments on the Minister's notes included in the draft plan.

Public exhibition of the draft plan was held in the plan area from 23 September 2013 to 08 November 2013, with five public meetings held at Araluen, Ulladulla, Bateman's Bay, Bega and Jindabyne.

The objectives of this consultation were:

- to provide background to stakeholders as to why the plan was being developed, how it had 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 would be implemented; and
- to seek feedback from stakeholders and the general community about the proposed water sharing rules.

Submissions were required to be made in writing and submitted prior to the exhibition closing date. Comments and enquiries made at the public meetings were noted.

Identification of 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.

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. This stage is undertaken by an interagency group with staff from the Office of Environment and Heritage and DPI Water. 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 OEH are added to the GDE schedule for the commencement of the plan.

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

The list of high-priority GDEs compiled during Stage 1 can either be amended after year 5 of the plan as further GDEs are identified or during the life of the plan following approval by the Minister.

Stage 2 - During the life of the plan

Records of other GDEs are collated from interrogating other government databases, GIS records and other studies. Other GDEs in the plan area may also be listed if they have been identified as having high levels of groundwater dependence and/or high conservation value by a technical expert.

Stage 2 occurs during the life of the plan and is a comprehensive assessment of the individual GDEs listed through the collation process above. 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 Macroplanning* (DNR 2006). This involves 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; and
- special features.

Methods for establishing key groundwater figures

The water sharing plan is based on the calculation of a number of key water sharing components including groundwater recharge, risk assessments, planned environmental water, upper extraction limits and long term average annual extraction limits. The following section outlines the methodology behind the various groundwater calculations within the plan.

Groundwater recharge

Recharge is the volume of water that infiltrates into an aquifer each year. In the macro planning method for less highly-connected groundwater sources, only recharge from rainfall is considered when determining extraction limits. The rainfall recharge calculation is the basis for determining the volume of groundwater reserved as planned environmental water and the volume that is potentially available for extraction. An estimate of average annual rainfall recharge for each of the groundwater sources has been calculated based on area, average annual rainfall and infiltration rates (Table 5).

For fractured rock and porous rock groundwater sources, 100% of recharge generated over areas of high environmental value is reserved as planned environmental water, while the recharge from the remainder of the groundwater source (non-high environmental value areas) is available for extraction (based on the sustainability index).

For the coastal sands groundwater source, 95% of recharge generated over areas of high environmental value is reserved as planned environmental water. The remaining 5%, along with a portion of the remainder of the groundwater source (non-high environmental value areas), is potentially made available for extraction (based on the sustainability index).

In addition to the areas used to calculate recharge, it is the policy of DPI Water to exclude an area of 200 m wide centred on constructed drains from rainfall recharge calculations in coastal sands groundwater sources. This is because these drains interfere with the natural infiltration of rainfall.

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.

Table 5: Average annual rainfall recharge

		High environmental value areas			Non-high environmental value areas		
Groundwater source	**Infiltration rate (%)**	**Area (ha)**	**Average annual rainfall (mm/yr)**	**Estimated average annual recharge (ML/yr)**	**Area (ha)**	**Annual average rainfall (mm/yr)**	**Estimated average annual recharge (ML/yr)**
Lachlan Fold Belt Coast	4	732,564	950	278,415	1,270,532	794	403,556
South East Coastal Sands	30	5,141	1,027	15,838	9,607	1,053	30,370*
Sydney Basin – South Coast	6	66,774	1,144	45,862	72,721	1,169	51,040

Average Annual Rainfall Recharge (ML/yr) = Water source area (ha) x mean rainfall (mm/yr) x % Infiltration rate / 100

* Excludes the rainfall recharge generated over a buffer area around constructed drains

Estimating recharge and the resulting extraction limits is not an exact science due to variations in geology, rainfall distribution and varying sources of recharge. In addition, the accurate estimation of the long term average annual extraction limit (LTAAEL) is also difficult due to uncertainty regarding current and future water requirements.

Consequently DPI Water has taken a precautionary approach to calculating recharge and LTAAEL. It is our policy that in coastal groundwater water sharing plans made after 2012, recharge and LTAAEL are rounded to two significant figures. For example 213,824 ML/year becomes 210,000 ML/year and 8,787 ML/year becomes 8,800 ML/year.

The rounded rainfall recharge figures are shown in Table 6.

Table 6: Rounded rainfall recharge

Groundwater source	Estimated average annual rainfall recharge (ML/yr) (rounded)	
	High environmental value areas	Non-high environmental value areas
Lachlan Fold Belt Coast	280,000	400,000
South East Coastal Sands	16,000	30,000
Sydney Basin – South Coast	46,000	51,000

Extraction limits

When the development of groundwater plans for coastal NSW commenced, it became apparent that, in many groundwater sources, current levels of water requirements made up a very small proportion of the LTAAEL as determined by the risk assessment process.

This raised concerns that the significant volumes of unassigned water (LTAAEL minus current water requirements) may raise community expectations that large amounts of water will be released in the future. In addition, the release of significant volumes of unassigned water onto the market could devalue existing entitlement.

Following substantial consultation, a revised approach for determining the LTAAEL was devised to address these concerns. This process has now been applied to all new groundwater sources in coastal NSW (excluding upland alluvial aquifers).

The new process introduces two new concepts. Firstly, what was previously known as the LTAAEL as determined by the risk assessment method is now known as the upper extraction limit and is the maximum volume at which the LTAAEL can be set. Secondly, the revised LTAAEL is determined based on a review of current water requirements and estimated future requirements.

Upper extraction limit

The upper extraction limit (UEL) is determined by summing the percentage of recharge potentially available for extraction generated over non-high environmental value areas (based on sustainability index) and the percentage of recharge potentially available for extraction generated over high environmental value areas (0% for fractured and porous rock and 5% for coastal sands).

In other words, in fractured and porous rock groundwater sources, a sustainability index of 50% allows 50% of the non-high environmental value recharge for extraction and 50% of the non-high environmental value recharge for planned environmental water. Also, 100% of high environmental value recharge would be reserved as planned environmental water.

In coastal sands groundwater sources, there is an additional 5% of recharge from high environmental value areas allocated for extraction. This is because 5% of recharge to the coastal sands is attributed to through-flow. Therefore, only 95% of high environmental value recharge is reserved as planned environmental water.

The upper extraction limits are shown in Table 7.

Table 7: Upper extraction limit

Groundwater Source	High environmental value recharge (ML/yr)	Non-high environmental value recharge (ML/yr)	Sustainability index (%)	Upper extraction limit (ML/yr)
Lachlan Fold Belt Coast	280,000	400,000	50	200,000
South East Coastal Sands	16,000	30,000	60	18,800
Sydney Basin – South Coast	46,000	51,000	50	25,500

Long term average annual extraction limit

As endorsed by the State Groundwater Panel, the revised LTAAELs for coastal groundwater sources are determined after analysing the combination of existing water requirements, estimated future water requirements and an appropriate buffer.

Therefore information relating to future water requirements is required for each groundwater source. This includes estimating volumes for:

- expected increases in BLR (associated with residential developments);
- dewatering associated with potential residential and commercial developments;
- future augmentation of town water supply;
- expected increases in agricultural water requirements; and
- possible future mining and coal seam gas developments and other large scale developments which may require water.

The type and amount of information considered and the level of confidence in the estimated volumes dictates how large an associated buffer will be. For example, if little information is available and confidence in the estimate volume is low, the associated buffer is made relatively large. This will ensure that development in any of the groundwater sources is not restricted by this new process. In the event that a development occurs during the life of the plan that was not considered and that requires water currently unavailable within the determined LTAAEL, there will also be the option to increase the LTAAEL up to the UEL.

Once the future water requirements are estimated, this volume is added to the volume of current water requirements (entitlement plus basic landholder rights). This total volume is then compared to the UEL and the LTAAEL is set based on the following rules.

1. If the volume of current requirements + future requirements + buffer < 10% of the UEL, then LTAAEL = 10% of UEL
2. If the volume of current requirements + future requirements + buffer > 10% of the UEL, then LTAAEL = volume of current requirements + future requirements + buffer
3. If the volume of current requirements + future requirements + buffer > UEL, then LTAAEL = UEL

If the LTAAEL is less than the UEL (scenarios 1 or 2 above), an amendment provision will be included in the plan to allow the LTAAEL to be increased up to the UEL in the event that more water is required. The estimates have considered future developments and are regarded as being generous, thus the likelihood that an increase would be required is minimal. For an amendment to occur sufficient evidence in the form of development applications, new socio-economic information or other growth indicators would be required to warrant any increase.

Current requirements for water

The DPI Water licensing database shows the following current entitlements for the three groundwater sources included in this plan. In addition, an estimate of current BLR based on works approvals is shown. The sum of these gives the total requirements for each groundwater source (Table 8).

Table 8: Current requirements

Groundwater Source	Basic landholder rights (ML/yr)	Town water supply (ML/yr)	All other licensed entitlement (ML/yr)	Total requirements (ML/yr)
Lachlan Fold Belt Coast	2,697.0	67.5	1,033.5	3,798.0
South East Coastal Sands	407.0	150.0	321.0	878.0
Sydney Basin – South Coast	416.0	0	47.0	463.0

Future requirements for water

Basic landholder rights

In order to estimate the future requirements for basic landholder rights, water currently accessed under BLR is multiplied by projected population growth over the 10 year life of the plan (Table 9). Population projections incorporate information from the Australian Bureau of Statistics, Federal Department of Immigration and Citizenship and NSW Health. They are the best indicator of future demographics. It is envisaged that BLR requirements would increase proportionately to population.

Table 9: Estimated future BLR requirement

Groundwater Source	Current BLR (ML/yr)	Population growth (%)	Estimated future BLR requirement (ML/yr)
Lachlan Fold Belt Coast	2,697	11.1	299.0
South East Coastal Sands	416	15.6	64.0
Sydney Basin – South Coast	407	14.8	61.0

Town water supplies

Town water supply requirements are estimated through relevant strategic planning documents provided by local water utilities and endorsed by the IRP. They are assessed in terms of current entitlement, including relevant water sources utilised and any identified sources to be utilised in the event of drought.

It is estimated that future water requirements for town water supply will be:

- 3,500 ML/yr for the Lachlan Fold Belt Coast Groundwater Source;
- 2,500 ML/yr for the South East Coastal Sands Groundwater Source; and
- 0 ML/yr for the Sydney Basin – South Coast.

Dewatering

To determine future requirements for dewatering, the amount of extraction for these activities over the last 10 years is multiplied by projected population growth over the life of the plan (Table 10). It is envisaged that dewatering requirements would increase proportionately to population.

It should be noted that the need to dewater is significantly lower in fractured and porous rock aquifers than in coastal sands aquifers. This is because the water table is expected to be much deeper and it is unlikely that development would need to go this deep, especially in regional areas. In contrast, coastal sands have a much shallower water table and most commercial development would require dewatering. This difference in aquifer types will be evident when considering dewatering requirements over the last 10 years.

Table 10: Estimated future dewatering requirement

Groundwater Source	Dewatering over last 10 years (ML/yr)	Population growth (%)	Estimated future dewatering requirement (ML/yr)
Lachlan Fold Belt Coast	0	11.1	0
South East Coastal Sands	130	15.6	150.0
Sydney Basin – South Coast	0	14.8	0

Mining

Mining requirements are estimated through key industry statistics, including information from the Department of Resources and Energy, and are endorsed by the IRP. It is estimated that future water requirements for mining will be:

- 2,000 ML/yr for the Lachlan Fold Belt Coast Groundwater Source;
- 1,000 ML/yr for the South East Coastal Sands Groundwater Source; and
- 2,000 ML/yr for the Sydney Basin – South Coast Groundwater Source.

Agriculture

Estimated future agricultural requirements are determined by the IRP based on an analysis of current agricultural requirements and local knowledge. As opposed to BLR and dewatering, it was considered that future agricultural requirements would not increase in proportion to population growth. Instead, the potential for subdivisions, existing level of agriculture, aquifer type and current and future socio-economic indicators were considered the best indicators of growth.

It is estimated that future water requirements for agriculture will be:

- 2,184 ML/yr for the Lachlan Fold Belt Coast Groundwater Source;
- 100 ML/yr for the South East Coastal Sands Groundwater Source; and
- 100 ML/yr for the Sydney Basin – South Coast Groundwater Source.

All future water estimates are summarised in Table 11.

Table 11: Estimated future water requirements for South Coast Groundwater Sources

Groundwater Source	BLR (ML/yr)	LWU (ML/yr)	Dewatering (ML/yr)	Mining (ML/yr)	Agriculture (ML/yr)	TOTAL (ML/yr)
Lachlan Fold Belt Coast	299	3,500	0	2,000	2,184	7,983
South East Coastal Sands	64	2,500	150	1,000	100	3,814
Sydney Basin – South Coast	61	0	0	2,000	100	2,161

Although estimates are made for each category, this does not mean that this category is restricted by the volume assigned to it. For example, during the term of the plan dewatering activities may be substantially higher than anticipated whereas mining activities may be less. Overall the purpose of these estimates is to determine an appropriate LTAAEL for each groundwater source.

In considering future water estimates, balance must be given to the accuracy of the projections and the resulting LTAAEL. When defending the rationale for the estimation process, factors and assumptions must be feasible, even likely. However, the resulting LTAAEL should be a value that is unlikely to require amendment during the term of the plan. Estimates should be greater than the biggest possible growth scenario.

The role of a water sharing plan is not to stifle development where water is available, and the LTAAEL should allow development to proceed. Therefore, instead of over-estimating these requirements, it is proposed that a large buffer be included when calculating LTAAEL. A 20% buffer has been applied to all South Coast Groundwater Sources.

Calculating the long term average annual extraction limit

The method for determining LTAAEL compares the UEL; 10% of the UEL; the sum of current requirements, future requirements and a buffer. These values are shown in Table 12 for each of the three groundwater sources.

Table 12: Comparison of values for long term average annual extraction limit determination

Groundwater Source	Current requirements (ML/yr)	Estimated future requirements (ML/yr)	Buffer (%)	Current + Future + Buffer (ML/yr)	Current + Future + Buffer (ML/yr) with rounding	Upper extraction limit (ML/yr)	10% of upper extraction limit (ML/yr)
Lachlan Fold Belt Coast	3,798	7,983	20	14,137.2	14,000	200,000	20,000
South East Coastal Sands	878	3,814	20	5,630.4	5,600	18,800	1,880
Sydney Basin – South Coast	463	2,161	20	3,148.8	3,100	25,500	2,550

For the Lachlan Fold Belt Coast Groundwater Source, 10% of the upper extraction limit has been used to determine the LTAAEL. For the remaining two groundwater sources the LTAAEL is based on current and future requirements (Table 13).

Table 13: Extraction limits

Groundwater Source	Upper extraction limit (ML/yr)	Long term average annual extraction limit (ML/yr)
Lachlan Fold Belt Coast	200,000	20,000
South East Coastal Sands	18,800	5,600
Sydney Basin – South Coast	25,500	3,100

Groundwater storage extraction limit

In addition to the extraction limit set by the LTAAEL, the plan also contains a groundwater storage extraction limit, which is equal to 0.002% of the total groundwater in storage. This water is accessed through the granting of a supplementary water (subcategory "storage") access licence which is issued through a controlled allocation order made under section 65 of the WMA 2000. The plan allows access to this groundwater storage in the Sydney Basin – South Coast Groundwater Source.

A supplementary water (subcategory "storage") access licence is a specific purpose access licence permitting the take of water from ‘fully buried’ or ‘partially buried’ porous rock groundwater sources. These licences will not be made available until all unassigned water has been issued and the total water requirements (entitlement plus an estimate of basic land holder rights) is equal to the LTAAEL.

Water sharing rules

The *Water Sharing Plan for the South Coast Groundwater Sources* establishes a framework for water sharing that defines:

- environmental water provisions;
- requirements for water for basic landholder rights;
- requirements for water for extraction under access licences;
- long-term average annual extraction limits and available water determinations for each groundwater source;
- rules for granting access licences;
- rules for water allocation accounts;
- rules for water supply work approvals; and
- access licence dealing rules to control the trade of water within or into other groundwater sources.

The following section provides further background on each of these components.

Changes to draft rules as a result of public exhibition

Three submissions were received as a result of the public exhibition process, all from local landholders. Two submissions did not raise any concerns with the plan. One submission expressed concern about the size of the Lachlan Fold Belt Coast Groundwater Source and whether it was an appropriate scale for managing groundwater in the Araluen valley, but was supportive of the rules to minimise interference between water supply works.

The IRP reviewed all submissions and the matters raised at the meetings and consequently made no changes to the draft water sharing rules.

However, between the initial endorsement of the draft plan by the IRP and the meeting of the IRP following public exhibition, DPI Water made a number of updates to water sharing policies. These policies, as well as the inclusion of new data, resulted in minor amendments to the plan as outlined below.

Increase of LTAAEL in Lachlan Fold Belt Coast Groundwater Source

During the period of exhibition DPI Water made changes to its water sharing policy such that, for coastal groundwater sources, the LTAAEL is equal to:

1. 10% of the upper extraction limit
   if 10% of the upper extraction limit is greater than the sum of current entitlement + estimated future water requirements + buffer;
2. the sum of current entitlement + estimated future water requirements + buffer
   if the sum of current entitlement + estimated future water requirements + buffer is greater than 10% of the upper extraction limit, but not greater than the upper extraction limit; or
3. the upper extraction limit
   if the sum of current entitlement + estimated future water requirements + buffer is greater than the upper extraction limit

Scenarios 2 and 3 were included in the draft plan. However, the policy position was updated to include scenario 1 in order to avoid unrealistically small LTAAELs in some groundwater sources. These groundwater sources include those in which there is little current entitlement and little to no known future development but where some development is sustainable. The change in policy also affects groundwater sources in which the large surface area results in large rainfall

recharge volumes and upper extraction limits, such as the Lachlan Fold Belt Coast Groundwater Source.

Aboriginal community development access licences

The draft plan included a limit on the granting of aquifer (Aboriginal community development) access licences such that the sum of entitlement in each groundwater source did not exceed 500 ML/yr. This was consistent with DPI Water policy at the time of public exhibition. Policy changes made after the public exhibition period have now removed the volumetric limit on the sum of entitlements for aquifer (Aboriginal community development) access licences in each groundwater source.

Stage 2 groundwater dependent ecosystems

When the draft plan was publically exhibited, the policy position was to include high-priority GDEs that had been identified under both the Stage 1 and Stage 2 identification processes. Stage 2 used modelled buffer distances from existing bores to ensure that extraction would result in no more than 0.1m drawdown.

This method did not adequately consider the application of the policy in a number of different water sharing areas. Therefore, application of the policy has been postponed until further modelling work can be completed. The final plan therefore only includes those high-priority GDEs identified under Stage 1.

Planned environmental water

The plan identifies and protects water for environmental purposes in each groundwater source. This is defined as ‘planned environmental water’ and consists of water that is remaining within the aquifer after water has been taken for BLR and access licences in accordance with the rules of the plan. In groundwater sources, planned environmental water is delivered through two mechanisms:

- reservation of groundwater storage volume; and
- sharing of groundwater recharge.

Groundwater systems can store large volumes of water, often accumulated over thousands, or tens of thousands of years. This is referred to as ‘storage’. For the three groundwater sources covered by this plan, 99 to 100% of groundwater storage is reserved as planned environmental water.

Recharge is the addition of water to a groundwater system expressed as a volume in megalitres per year (ML/year). Recharge usually comes from rainfall and surface water bodies, such as rivers, but may also come from through-flow from adjacent groundwater systems. In most groundwater sources recharge is shared between the environment and extractive users.

The proportion of recharge reserved for the environment has been determined for each water source using the macro risk assessment method outlined previously and is equal to:

- 95% of the long-term average annual rainfall recharge in areas that are not high environmental value areas, 100% of the long-term average annual rainfall recharge in high environmental value areas and 100% of the groundwater in storage for the Lachlan Fold Belt Coast Groundwater Source;
- 81% of the long-term average annual rainfall recharge in areas that are not high environmental value areas, 100% of the long-term average annual rainfall recharge in high environmental value areas and 100% of the groundwater in storage for the South East Coastal Sands Groundwater Source; and
- 50% of the long-term average annual rainfall recharge in areas that are not high environmental value areas, 100% of the long-term average annual rainfall recharge in

high environmental value areas and 99.998% of the groundwater in storage for the Sydney Basin – South Coast Groundwater Source.

For the Lachlan Fold Belt Coast and South East Coastal Sands Groundwater Sources, this volume has the potential to vary over the life of the plan if the LTAAEL were to increase. At the commencement of the plan, the planned environmental water will be at its highest, but may decrease if the LTAAEL increases. The volume of recharge that is conserved as planned environmental water is set out in Table 14.

Table 14: Planned environmental water

Groundwater Source	Planned environmental water from high environmental value areas (ML/yr)*		Planned environmental water from non-high environmental value areas (ML/yr)		Total planned environmental water (ML/yr)**	
	at LTAAEL	at UEL	at LTAAEL	at UEL	at LTAAEL	at UEL
Lachlan Fold Belt Coast	280,000	280,000	380,000	200,000	660,000	480,000
South East Coastal Sands	16,000	15,200	24,300	12,000	30,300	27,200
Sydney Basin – South Coast	38,000	n/a	21,500	n/a	59,500	n/a

Planned environmental water = Non-high conservation value area recharge (ML/year) x (100% - sustainability index) + High conservation value area recharge* (ML/year)

* This value is 100% of rainfall recharge in the Lachlan Fold Belt Coast and Sydney Basin – South Coast Groundwater Sources and 95% of rainfall recharge in the South East Coastal Sands Groundwater Source.

** These values do not include the

Requirements for water

The plan defines all of the licensed and unlicensed requirements for water within the South Coast Groundwater Sources.

Basic landholder rights (comprising domestic and stock and native title rights) must be provided for and protected within a water sharing plan. The plan provides an estimate of the water requirements for domestic and stock rights within each groundwater source. Two methodologies for estimating the groundwater taken for domestic and stock purposes have been developed by DPI Water, taking into account different groundwater usage between coastal and inland regions and urban and rural areas.

BLR estimates for the South East Coastal Sands Groundwater Source have been derived using an area-based estimation approach. BLR estimates for the Lachlan Fold Belt Coast and Sydney Basin – South Coast Groundwater Sources have been derived using a database extraction approach.

Further details of both these methods are included in Appendix 3 of the document *Macro water sharing plans – the approach for groundwater. A report to assist community consultation.* This document is available on the DPI Water website www.water.nsw.gov.au.

At the start of the plan:

- BLR were estimated at 3,520 ML/yr;
- domestic and stock access licences accounted for 0 ML/yr of entitlement;
- local water utility access licences accounted for 217.5 ML/yr; and
- aquifer access licences accounted for 1401.5 unit shares (1 unit share is equivalent to 1 ML in years where 100% of entitlement is allowed to be extracted).

Extraction limits

As above (Tables 13 and 14) the long term average annual extraction limit (LTAAEL) for each of the groundwater sources is as follows:

- Lachlan Fold Belt Coast – 20,000 ML
- South East Coastal Sands – 5,600 ML
- Sydney Basin – South Coast – 3,100 ML

For each of these groundwater sources this volume represents 10% of the upper extraction limit.

Unassigned water

When the sum of entitlements within a groundwater source is less than the LTAAEL, it indicates that this groundwater source has unassigned water. A portion of this unassigned water may be made available for new access licences through a controlled allocation order made under section 65 of the WMA 2000, should a decision be made by the Minister to do so. The unassigned water for this plan is shown in Table 15.

Table 15: Unassigned water

Groundwater Source	Total requirements (ML/yr)	Long term average annual extraction limit (ML/yr)	Unassigned water (ML/yr)
Lachlan Fold Belt Coast	3,798	20,000	16,202
South East Coastal Sands	878	5,600	4,722
Sydney Basin – South Coast	463	3,100	2,637

Granting new access licences

Access licences that can be granted under the WMA 2000 in groundwater sources include:

- aquifer access licences;
- supplementary water access licences;
- major utility access licences;
- local water utility access licences;
- domestic and stock access licences; and.
- salinity and water table management licences

There are a number of different types of ‘specific purpose’ access licences for which applications may be made irrespective of whether or not an embargo on granting additional access licences is in place. In groundwater systems these include:

- local water utility access licences, for the purpose of domestic consumption and commercial activities;
- major water utility access licences;
- a domestic and stock [domestic] access licences, for the purpose of domestic consumption; and
- the following subcategories of an aquifer access licence:
    - ‘town water supply’, for the purpose of supply to communities for domestic consumption and commercial activities;
    - ‘Aboriginal cultural’, for personal, domestic, cultural and spiritual purposes; and

- ‘Aboriginal community development’ for commercial purposes.

Aboriginal cultural access licences

An Aboriginal cultural access licence of up to 10 ML/yr may be granted to an Aboriginal person or Aboriginal community for any personal, domestic or communal purpose such as drinking, washing, gardening, making traditional artefacts, or for recreation or ceremonial purposes. The plan allows for the granting of these licences in all three groundwater sources.

Aboriginal community development access licences

An aquifer (Aboriginal community development) access licence may be granted to an Aboriginal person or Aboriginal community for commercial purposes in all three groundwater sources covered by the plan. Originally a total volumetric limit of 500 ML/yr was proposed but as none of the groundwater sources in the plan are heavily committed, the IRP agreed to remove the volumetric limit. Aboriginal community development licences are a specific purpose access licence and can only be the subject of limited trade that is consistent with the purpose for which the licence was granted.

Water allocation accounts

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

The AWD for groundwater access licences in these groundwater sources will be 1 ML per unit share, unless a growth in use response is required. The AWD is used to manage growth in extractions above the long-term average annual extraction limit. If growth is assessed to have occurred, then the AWD will be reduced to less than 1 ML/unit share. If the average of the annual extractions for the preceding three years has exceeded the LTAAEL for that groundwater source by greater than 5%, then the Minister may make an AWD of a lesser amount to bring extractions back in line with the extraction limit.

In some groundwater sources unused water allocation may be carried over from one water year to the next. Carryover of unused water is permitted at the end of each water year in the Sydney Basin – South Coast Groundwater Source (up to 25% of entitlement) and the Lachlan Fold Belt Coast Groundwater Source (up to 10% of entitlement). No carryover of entitlement from one year to the next is allowed in the South East Coastal Sands Groundwater Source. This is because this groundwater source contains many discrete, non-geographically-connected aquifers with small storages and because AWDs are unlikely to be less than 1ML/unit share in this groundwater source.

The maximum amount of water permitted to be taken from these groundwater sources in any one water year, is the water allocation accrued in the water access licence account for that water year (Table 16).

Table 16: Account management

Groundwater Source	Carryover permitted	Account limit
Lachlan Fold Belt Coast	10%	110% of share component + trades
South East Coastal Sands	0%	100% of share component + trades
Sydney Basin – South Coast	25%	125% of share component + trades

Water supply works approvals

In accordance with the principles of the WMA 2000, protection for environmental assets is also provided through distance rules that are applied when granting or amending water supply works approvals and managing existing works. These rules take into account local impacts on other water users, environmental features, contaminated sites, GDEs and groundwater dependent culturally significant sites. The rules are intended to prevent unacceptable or damaging levels of drawdown of water occurring in the local vicinity of other water users and significant sites.

The distance rules apply to new or replacement bores by defining a buffer zone around environmental assets. Existing bores are not affected by the buffer zones and are able to continue operating within the existing conditions of their access licences.

Standard distance rules were developed for groundwater macro plans by the Regional and State panels which included regional groundwater experts and representatives from NSW DPI and 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 dryland salinity studies until the late 1990s. A consistent set of rules for common groundwater aquifer types (fractured rock, porous rock, alluvium and coastal sands) was 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 was used to calculate water balances and also provide water table drawdowns 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 regional panels 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 are implemented. For high-priority GDEs such as Karst GDEs, the distances were set so that overall ecosystem health would remain the same and any 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 were submitted to the State Groundwater Panel for approval. When negotiating the final rules, the State Groundwater Panel 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 for the macro plans through the development of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*.

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. 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 distances to protect GDEs may be reduced if the proponent provides hydrological evidence that no drawdown of water will occur at the outside edge of the perimeter of any high-priority GDE listed in a water sharing plan.

This process has resulted in consistent rules across aquifer types and is considered the most current thinking in terms of managing local impacts of extraction and protecting GDEs. However, the plan development process allows for changes to the rules to cater for local conditions. The distance criteria may be altered due to a number of different factors, such as lot size where property sizes may lead to different interference distance criteria, aspects of the local hydrology and groundwater dependence of town water.

For the *Water Sharing Plan for the South Coast Groundwater Sources* regional staff made draft recommendations for rules which were then compared against the standard rules. The IRP made the final decision as to which rule would be adopted, striving to remain consistent with the

standard rules where possible while being sensitive to any unique attributes of the South Coast Groundwater Sources.

For new/replacement works the plan includes rules to:

- minimise interference between neighbouring works;
- locate works away from contaminated sites;
- protect water levels in GDEs;
- protect groundwater dependent culturally significant sites;
- manage surface and groundwater connectivity; and
- manage temporary local impacts that may affect water levels, water quality and aquifer integrity.

For existing works there are also rules to:

- protect water levels in GDEs;
- manage surface and groundwater connectivity;
- manage works near contaminated sites; and
- manage temporary local impacts that may affect water levels, water quality and aquifer integrity.

For further details about the distance rules for each groundwater source covered by the plan, refer to Appendix 3.

Access licence dealing rules

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

In most groundwater sources trading is allowed within the groundwater source, but no trading is allowed into or out of the groundwater source. This is to ensure that any groundwater source cannot be degraded as a result of trading into that source.

The plan prohibits trading between groundwater sources based on a lack of hydrologic connection. Trading within the groundwater sources is permitted; however each trade application will be subject to a minimal harm assessment.

Rules relating to groundwater dependent ecosystems

The plan sets out a schedule of high-priority (high-conservation value) GDEs. The location of high-priority GDEs within the plan area is shown in Appendix 4. The GDE schedule may be updated after gazettal of the plan. Further ecosystems may be identified as high priority after a valuation which includes assessment of:

- current condition within the GDE environment (i.e. protection requirements);
- rarity within the groundwater source;
- diversity within the groundwater source; and
- special features within the groundwater source.

The policy for the inclusion of Stage 2 GDEs is still under development. Therefore, only GDEs identified under Stage 1 will be included in the plan. A list of included GDEs is in Appendix 5.

Aquifer interference

Activities which intersect or '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 dewatering, and the water extracted is often referred to as 'incidental groundwater'; and
- 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, require a licence under the WMA 2000. Operators of these activities are required to hold sufficient account volume to account for incidental water taken. They are also required to comply with the *NSW Aquifer Interference Policy*, which was released in September 2012.

Adaptive management

Adaptive management refers to the practice of change in response to new information that is received during the life of a water sharing plan. This may include data collection and monitoring or some other improvement in understanding. Such information could include socio-economic studies, hydrological modelling, ecological studies and information about Aboriginal cultural sites.

Amendment provisions

Adaptive management is a requirement of both the WMA 2000 and the National Water Initiative, and has been allowed for during the life of this plan through the inclusion of amendment provisions. These provisions allow some aspects of the plan to be changed within defined limits.

The plan includes amendment provisions that allow for:

- the modification or addition of groundwater sources or management zones;
- variation to the amount of recharge reserved as planned environmental water;
- increases in the long term annual extraction limit (up to a specified volume for each groundwater source);
- the establishment of rules for managing major water utility access licences or other aquifer access licences;
- add, remove or modify distance rules in relation to groundwater works; and
- amendments to the map of groundwater dependent ecosystems.

Monitoring, evaluation and reporting

Monitoring, evaluation and reporting are key components to adaptive management. DPI Water is developing a Monitoring, Evaluation and Reporting Framework in collaboration with key stakeholders. The framework conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates an adaptive management approach to water planning required under the principles of the WMA 2000.

The evaluation framework aims to inform the community of the outcomes of water sharing plans, and to collate the results of various legislatively required evaluations and relevant knowledge to inform the review of the water sharing plans. The framework will assess the inputs, outputs and outcomes of the water sharing plans and their operations. The assessment will consider:

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

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

- assessment of performance indicators;
- an audit of plans; and
- review of each plan at the end of its 10 year term.

Performance indicators

Part 2 of the plan includes a number of performance indicators that will be monitored over its life. These include groundwater extraction, water quality and ecological condition of groundwater sources. It is not practicable to monitor all issues in all groundwater sources. Monitoring will be undertaken for specific issues in key groundwater sources. The actual procedure for monitoring each indicator may change over the period of the plan as improved methods are developed.

Audit

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

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

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

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

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

Plan review

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

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

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

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

Glossary

Many of the terms in this document are defined in the *Water Management Act 2000* or in the plan and are therefore not redefined here. Some terms are defined in these documents and are redefined here in plain English. In addition, there are some terms that are not defined in these documents and have therefore been defined below to assist with understanding the plan and this background document.

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.

Connectivity: The capacity of in-stream biota to move longitudinally in a river system and not be impeded by barriers (e.g. weirs, dams, culverts). Connectivity is important for in-stream aquatic processes and biota and the conservation of natural riverine systems.

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: 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.

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

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

Upper extraction limit: The maximum annual volume to which the LTAAEL can be raised.

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

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

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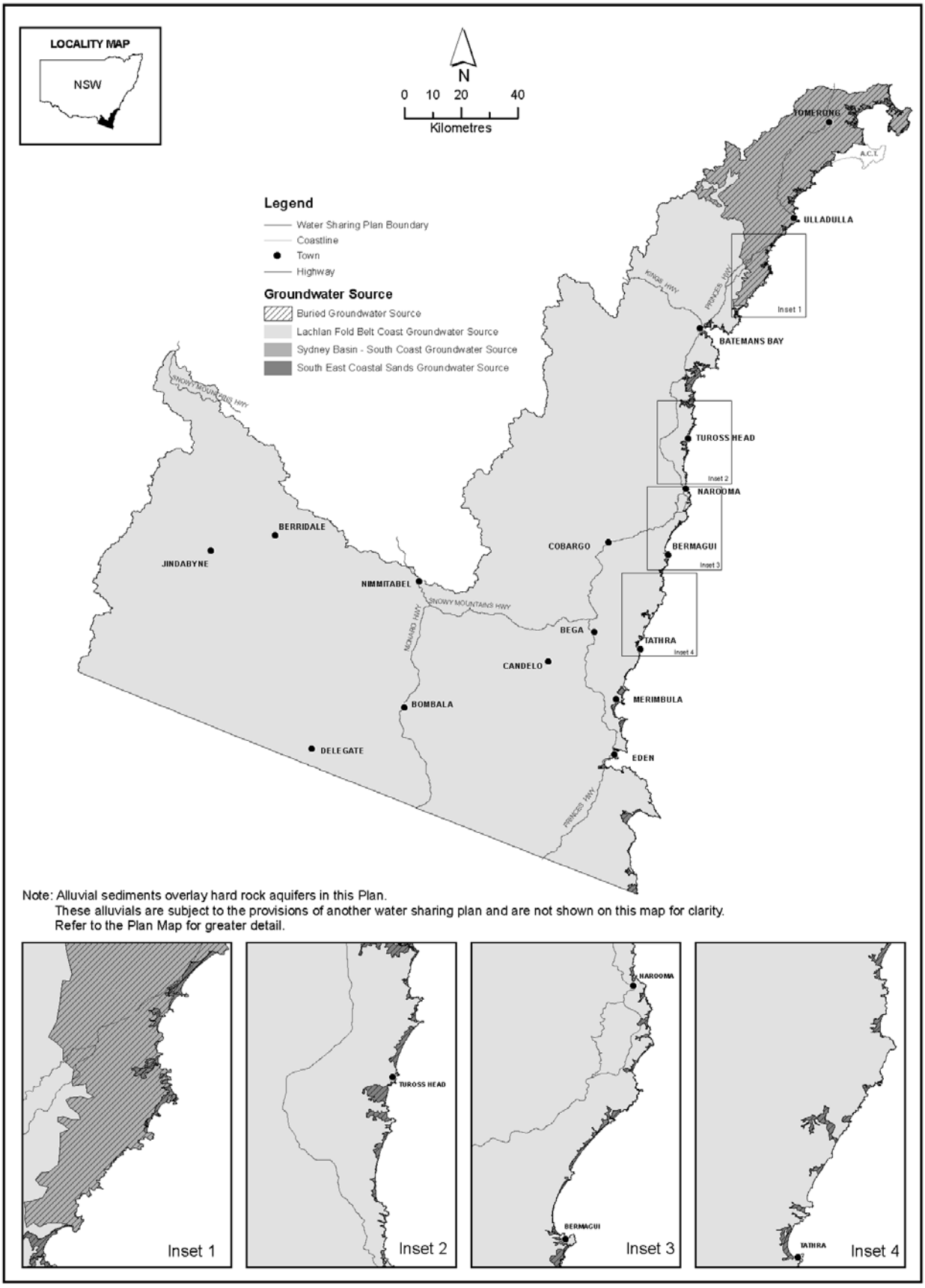
Appendices

Appendix 1. Water sharing plan map



Appendix 2: Risk assessments

Table 2A: Socio-economic risk assessment guidelines

	Risk			Method and source	Mitigation action	Relevant WSP rules
	High	**Moderate**	**Low**			
Financial asset						
What is the risk to security of access from extraction	**No options** for alternative water supply (sources)	**Limited options** for alternative water supply (sources)	**Alternative** water supply source readily available (i.e able to extract all entitlement at all times of the year)	Check DIPNR LAS database, Council maps. Other sources include reticulated, surface water		
What is the risk to ongoing groundwater usage.	Large volume of groundwater extracted in proportion to total licensed (i.e. >70%)	Average volume of groundwater extracted in proportion to total licensed extraction (30-70%)	Small volume of groundwater extracted in proportion to total licensed extraction (<30%)	Use DIPNR metered or card entry data where available.	Ensure metering installed and monitored	
What is the risk to dependence on Town Water Supply	Large volume of groundwater licensed for TWS in proportion to total licensed extraction (i.e. >70%)	Average volume licensed for TWS in proportion to total licensed (30-70%)	Small volume licensed for TWS in proportion to total licensed (<30%)	Check DIPNR LAS database, DEUS and State Water data	Allow for population growth during term of plan. Identify planning needs in Strategy document	
What is the risk to dependence on groundwater related activities (irrigation, industry)	Large volume of groundwater extracted in proportion to total licensed (i.e. >70%)	Average volume of groundwater extracted in proportion to total licensed (30-70%)	Small volume of groundwater extracted in proportion to total licensed (<30%)	Check DIPNR LAS database. NSW DPI advice	Define public irrigation district if growth envisaged during plan term	
What is the risk to investment in agriculture/industry	Significant investment in activities requiring groundwater (% GDP of Council area)	Moderate investment in activities requiring groundwater (% GDP of Council area)	Little investment in activities requiring groundwater (% GDP of Council area)	Bureau of Statistics census data. NSW DPI advice	Define public irrigation district if growth envisaged during plan term	

Sociological asset						
What is the risk to employment in agriculture or industry	Majority of local population employed in associated activities (i.e. >70%)	Average proportion of local population employed in associated activities (30-70%)	Minor proportion of local population employed in associated activities (<30%)	Check NSW DPI data sources and Bureau of Statistics census data.		
Risk valuation						

Risk	***High, Moderate or Low***

Table 2B: Aquifer risk assessment guidelines

	Risk			Method and source	Mitigation action	Relevant WSP rules
	High	Moderate	Low			
Ecological asset						
What will be the risk of a change in groundwater levels on GDE's.	Reduction in groundwater level(s) or piezometric pressure beyond established trigger levels or seasonal variation, resulting in **permanent loss** of defined habitat type.	Reduction in groundwater level(s) or piezometric pressure beyond established trigger levels or seasonal variation, resulting in **temporary loss** of defined habitat type.	No change to habitat type.	Check DIPNR GDS database. Use hydrographs if available or point source data	i.e. Hots spots modelling	
What will be the risk of a change in the timing of groundwater level fluctuations on GDE's.	Fluctuation in groundwater level(s) or piezometric pressure beyond established trigger levels or seasonal variation, resulting in **permanent loss** of defined habitat type.	Fluctuation in groundwater level(s) or piezometric pressure beyond established trigger levels or seasonal variation, resulting in **temporary loss** of defined habitat type.	No change to habitat type.	Check DIPNR GDS database. Use hydrographs if available or point source data	i.e. Hots spots modelling	
What will be the risk of changing base flow conditions on GDE's.	**Permanent reversal** of base flow conditions.	**Temporary reversal** of base flow conditions exceeding seasonal variation.	No change to habitat type.	Check DIPNR GDS database. Use hydrographs if available or point source data	i.e. Hots spots modelling	
Water quality asset						
What is the risk of changing the chemical conditions of the water source.	**Permanent change** in pH, temperature and/or turbidity	**Temporary change** in pH, temperature and/or turbidity	Negligible change (<5%)	Check DIPNR's contaminated sites and Triton databases.	i.e. local impact rules	

What is the risk on the water source by a change in the freshwater/salt water interface.	**Permanent change** in location or gradient of salt/freshwater interface	**Temporary change** in location or gradient of salt/freshwater interface	No change or not applicable	Check DIPNR's Triton database.	i.e. local impact rules	
What is the likelihood of a change in beneficial use of the water source.	Reduction in water quality **beyond designated BU** category (for identified trigger parameters)	Reduction in water quality **within designated BU** category (for identified trigger parameters)	Negligible change for identified triggers (<5%)	Check DIPNR's contaminated sites and Triton databases.	i.e. local impact rules	
Aquifer integrity asset						
What is the risk of substrate compaction	**Permanent destruction** the of aquifer matrix	**Temporary adjustment** to the aquifer matrix	No change	Check DMR data sources	i.e groundwater modelling	
Risk valuation						
Mitigation effect on sustainability factor						

Risk	***High, Moderate or Low***

Table 2C: Lachlan Fold Belt Coast socio-economic risk assessment

Groundwater Source: Lachlan Fold Belt Coast	Risk			Method and source of analysis	Other management tools	Relevant WSP rules
	High	Moderate	Low			
Financial asset						
What is the risk to security of access from extraction?		×		variable alternate water supplies due to distance from river		
What is the risk to groundwater usage?			×	low yield bores, <30% of gw extracted in proportion to total licensed extraction		
What is the risk to dependence on Town Water Supply?			×	no TWS		
What is the risk to dependence on groundwater related activities (irrigation, industry)?			×	<30% of gw extracted in proportion to total licensed entitlement		
What is the risk to investment in agriculture/industry?			×	little investment in activities requiring groundwater		
Sociological asset						
What is the risk to employment in agriculture or industry?			×	<30% of local population employed in accociated activities		
Risk valuation		×				

Risk	***Moderate***

Table 2D: Lachlan Fold Belt Coast aquifer risk assessment

Groundwater Source: Lachlan Fold Belt Coast	Risk			Method and source	Mitigation/ management action	Relevant WSP rules
	High	Moderate	Low			
Ecological asset						
What will be the risk of a change in groundwater levels on GDE's.		×		temporary loss of habitat		
What will be the risk to a change in the timing of groundwater level fluctuations on GDE's.		×		large drawdowns due to relatively low permeability and water levels fall at a more rapid rate than natural		
What will be the risk to changing base flow conditions on GDE's.		×		temporary reversal of base flow conditions exceeding seasonal variations		
Water quality asset						
What is the risk to changing the chemical conditions of the water source.			×	negligible		
What is the risk to the water source by a change in the freshwater/salt water interface.			×	negligible		
What is the risk to a change in beneficial use of the water source.			×	negligible		
Aquifer integrity asset						
What is the risk to substrate compaction			×	negligible		
Risk valuation		×				
Mitigation effect on sustainability factor		×		no mitigation warranted		

Risk	***Moderate***

Table 2E: Sydney Basin – South Coast socio-economic risk assessment

Groundwater Source: Sydney Basin – South Coast	Risk			Method and source of analysis	Other management tools	Relevant WSP rules
	High	Moderate	Low			
Financial asset						
What is the risk to security of access from extraction?			×	sufficient alternate water supplies		
What is the risk to groundwater usage?			×	low yield bores, <30% of gw extracted in proportion to total licensed extraction		
What is the risk to dependence on Town Water Supply?			×	no TWS		
What is the risk to dependence on groundwater related activities (irrigation, industry)?			×	<30% of gw extracted in proportion to total licensed entitlement		
What is the risk to investment in agriculture/industry?			×	little investment in activities requiring gw		
Sociological asset						
What is the risk to employment in agriculture or industry?			×	<30% of local population employed in accociated activities		
Risk valuation			×			

Risk	***Low***

Table 2F: Sydney Basin – South Coast aquifer risk assessment

Groundwater Source: Sydney Basin – South Coast	Risk			Method and source	Mitigation/ management action	Relevant WSP rules
	High	Moderate	Low			
Ecological asset						
What will be the risk of a change in groundwater levels on GDE's.			×	no change to habitat type		
What will be the risk to a change in the timing of groundwater level fluctuations on GDE's.			×	no change to habitat type		
What will be the risk to changing base flow conditions on GDE's.			×	no change to habitat type		
Water quality asset						
What is the risk to changing the chemical conditions of the water source.			×	negligible		
What is the risk to the water source by a change in the freshwater/salt water interface.			×	negligible		
What is the risk to a change in beneficial use of the water source.			×	negligible		
Aquifer integrity asset						
What is the risk to substrate compaction			×	no change		
Risk valuation			×			
Mitigation effect on sustainability factor			×			

Risk	***Low***

Table 2G: South East Coastal Sands socio-economic risk assessment

Groundwater Source: South East Coastal Sands	Risk			Method and source of analysis	Other management tools	Relevant WSP rules
	High	Moderate	Low			
Financial asset						
What is the risk to security of access from extraction?	×			rainwater tanks might be only other option		
What is the risk to groundwater usage?			×	small development spread across areas		
What is the risk to dependence on Town Water Supply?			×	no TWS, but potential exists		
What is the risk to dependence on groundwater related activities (irrigation, industry)?			×	limited areas		
What is the risk to investment in agriculture/industry?			×	poor potential for agricultural development		
Sociological asset						
What is the risk to employment in agriculture or industry?			×	minimal development		
Risk valuation	×					

Risk	***High***

Table 2H: South East Coastal Sands aquifer risk assessment

Groundwater Source: South East Coastal Sands	Risk			Method and source	Mitigation/ management action	Relevant WSP rules
	High	Moderate	Low			
Ecological asset						
What will be the risk of a change in groundwater levels on GDE's.		×		already variable levels, timing and flow, tidal influences		
What will be the risk to a change in the timing of groundwater level fluctuations on GDE's.		×		already variable levels, timing and flow, tidal influences		
What will be the risk to changing base flow conditions on GDE's.			×	providing only limited base flow, generally to lower estuary		
Water quality asset						
What is the risk to changing the chemical conditions of the water source.			×	inert sediments limited changes only		
What is the risk to the water source by a change in the freshwater/salt water interface.		×		temporary tidal influences, overpumping, flushing mechanisms		
What is the risk to a change in beneficial use of the water source.			×			
Aquifer integrity asset						
What is the risk to substrate compaction			×	unlikely		
Risk valuation		×				
Mitigation effect on sustainability factor		×		no mitigation warranted		

Risk	***Moderate***

Appendix 3: Minimum distances for water supply works approvals

Table 3A: Rules to minimise interference between bores

These rules apply to new bores not existing or replacement bores. These rules do not apply to works that are used only to extract basic rights

	Lachlan Fold Belt Coast Groundwater Source	Sydney Basin – South Coast Groundwater Source	South East Coastal Sands Groundwater Source
1. New bores not to be located within the following distances (metres) of an existing bore that is nominated on an access licence (not used for basic rights)			
distance (m)	- 400 (for bores >20 ML/yr) - 200 (for bores <20 ML/yr)	400	200
2. New bores not to be located within the following distances (metres) of an existing bore that is used to extract basic rights			
distance (m)	200	100	50
3. New bores not to be located within the following distances (metres) from the boundary of the property (unless consent gained from neighbour)			
distance (m)	200	200	100
4. New bores not to be located within the following distances (metres) from a bore nominating a local or major water utility access licence			
distance (m)	500	1000	300
5. New bores not to be located within the following distances (metres) from a bore used by the dept for monitoring purposes			
distance (m)	400	200	200
• The above distance restrictions do not apply if: the bore is used solely for BLR; the bore is a replacement bore; the bore is used for monitoring, environmental management or remedial works; or the Minister is satisfied that the location of the bore would result in no more than minimal impact on existing extractions within the water source.			

Table 3B: Rules to protect environmentally sensitive areas

These rules apply to new bores not existing or replacement bores

	Lachlan Fold Belt Coast Groundwater Source	Sydney Basin – South Coast Groundwater Source	South East Coastal Sands Groundwater Source
1. Distance bores used for extracting basic rights to be located from high-priority GDEs			
distance (m)	100	100	100
2. Distance bores not used for extracting basic rights to be located from high-priority GDEs			
distance (m)	200	200	100 (bores < 20 ML/yr) 400 (bores 20-100 ML/yr) 800 (bores > 100 ML/yr)
	The above distance restrictions do not apply where the bore is constructed and maintained using an impermeable pressure cement plug from the surface of the land to a minimum depth of 30m, or other greater depth as determined by the Minister.		The above distance restrictions do not apply where the bore is constructed and maintained using an impermeable pressure cement plug from the surface of the land to a depth as determined by the Minister.
3. Distance bores not used for extracting basic rights to be located from high-priority karsts			
distance (m)	500	500	n/a
4. Distance bores not used for extracting basic rights to be located from a river or stream (1st, 2nd or 3rd order)			
distance (m)	40	40	40
5. Distance bores not used for extracting basic rights to be located from escarpments			
SGP default (m)	100	100	n/a
• These rules do not apply to water supply works (bores) used for monitoring, environmental management purposes or remedial work. • The distances from GDEs may be varied for an applicant if a hydrogeological study is undertaken which demonstrates no drawdown of the groundwater at the outside edge of the GDE listed in the plan. • These specified distances may be amended, or high-priority GDEs identified within the plan may be added or removed, based on further studies of groundwater ecosystem dependency undertaken by the Minister.			

Table 3C: Rules to protect groundwater dependent culturally significant sites

These rules apply to new bores not existing or replacement bores

Distance bores to be located from groundwater dependent culturally significant sites
- 100 m for a bores used only to take water for basic rights
- 200 m for a water supply work not used only to take water for basic rights.
• Where a culturally significant site is also a high-priority GDE, the more restrictive distance restriction applies to the granting or amendment of a water supply work approval.
• These distances restrictions do not apply if: the bore is used for monitoring, environmental management or remedial works, the bore is sealed off to the nearest impervious layer above the slotted interval of the work with an impermeable seal constructed within the bore as specified by the Minister, or if the Minister is satisfied that the location of the bore at a lesser distance would result in no greater impact on the water source and its groundwater dependent culturally significant sites.

Table 3D: Rules for proposed bores near contamination sites

These rules apply to new bores and replacement bores

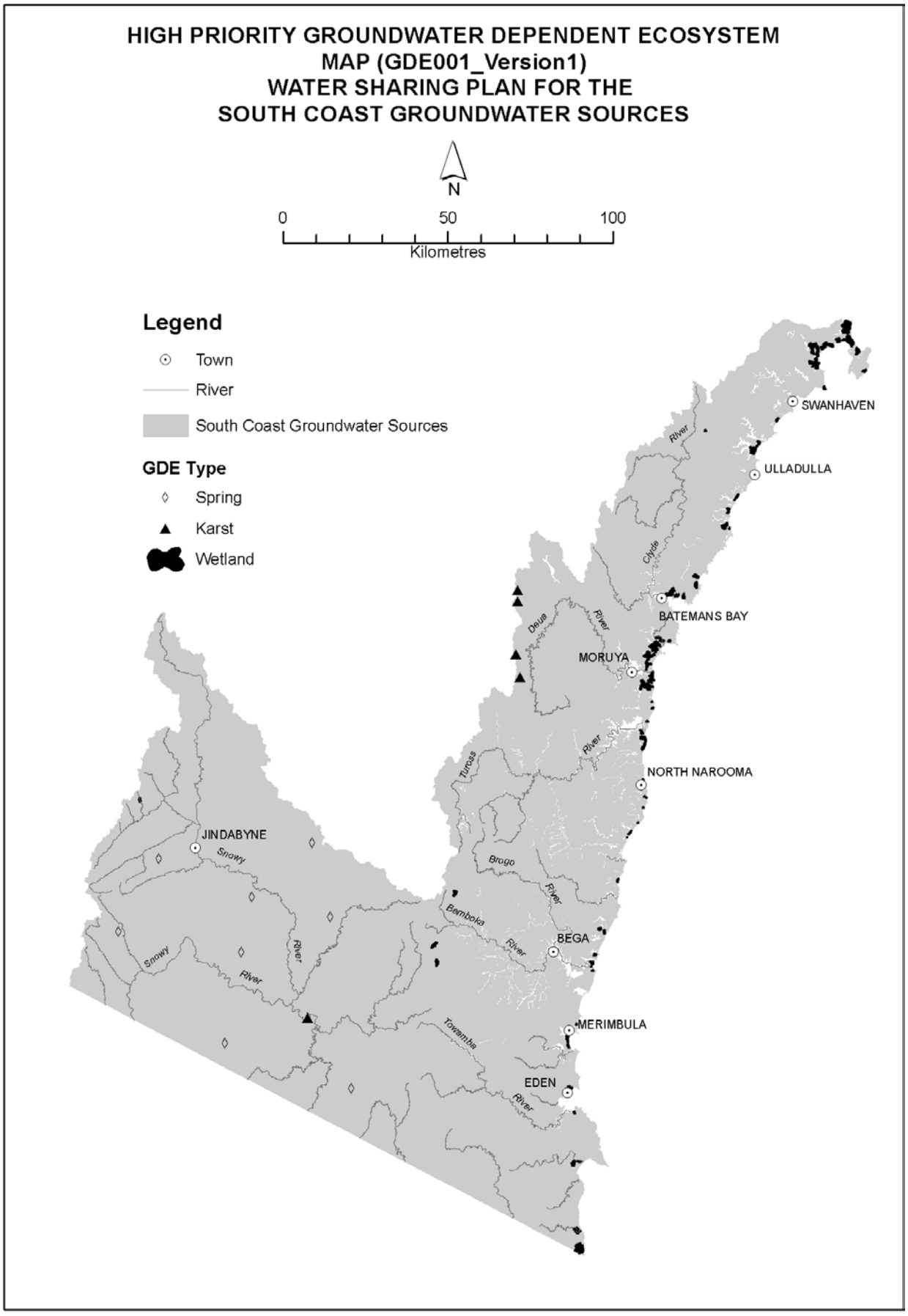
A water supply work shall not be granted or amended
- Within 250 metres of the plume associated with a contamination source[3]
- Between 250 metres and 500 metres of the plume associated with a contamination source o unless the Minister is satisfied that no drawdown of water will occur within 250 metres of the plume associated with the contamination source.
- More than 500 metres from the plume associated with the contamination source o if the Minister has determined that it is necessary to protect the water source, the environment or public health or safety
• These distances may be varied if an applicant can demonstrate that the distance is adequate to protect the water source, its dependent ecosystems and public health and safety. These distances do not apply if the bore is used for monitoring, environmental management or remedial works.

[3] The distance of 250m is the distance recommended for on-site sewage systems in the NSW Government report Environment and health protection guidelines. On-site sewage management for single households.

Table 3E: Rules for amending water supply work approvals for replacement groundwater works

Standard rules for replacement groundwater works
The existing water supply work must have a water supply work approval • the replacement groundwater work must be constructed to extract water from the same water source as the existing water supply work • the replacement groundwater work must be constructed to extract water from: o the same depth as the existing water supply work; or o a different depth if the Minister is satisfied that doing so will result in no greater impact on a water source or its dependent ecosystems • the replacement groundwater work must be located: o within 20 metres of the existing water supply work; or o a distance greater than 20 metres of the existing water supply work if the Minister is satisfied that doing so will result in no greater impact on a water source or its dependent ecosystems • if the existing water supply wok is located within 40 metres of the high bank of a river, the replacement groundwater work must be located: o within 20 metres of the existing water supply work but no closer to the high bank of the river; or o more than 20 metres of the existing water supply work, but no closer to the high bank of the river, if the Minister is satisfied that doing so will result in no greater impact on a water source or its dependent ecosystems • the replacement groundwater work must not have a greater internal diameter or excavation footprint than the existing water supply work, except where the internal diameter of the casing of the existing water supply work is no longer manufactured, in which case the internal diameter of the replacement groundwater work is to be no greater than 110 per cent of the internal diameter of the existing water supply work it replaces.

Appendix 4: Location of high-priority groundwater dependent ecosystems



Appendix 5: High-priority groundwater dependent ecosystems

Table 5A: High-priority groundwater dependent ecosystems

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
Cormorant Beach	Wetland	-35.5109	150.3934	South East Coastal Sands
Cockpit Swamp	Wetland	-35.2983	150.0847	Lachlan Fold Belt Coast
Black Spring	Spring	-36.9483	148.7344	Lachlan Fold Belt Coast
Cradle Swamp	Wetland	-35.2483	150.3050	Sydney Basin — South Coast
Pedro Swamp	Wetland	-35.9317	150.1525	South East Coastal Sands
Deua	Karst	-35.8719	149.6889	Lachlan Fold Belt Coast
Marble Arch	Karst	-35.7260	149.6907	Lachlan Fold Belt Coast
Cheitmore	Karst	-35.6956	149.6897	Lachlan Fold Belt Coast
Bendethera	Karst	-35.9340	149.7056	Lachlan Fold Belt Coast
Beehive Spring	Spring	-36.6983	148.7844	Lachlan Fold Belt Coast
Nunnock Swamp	Wetland	-36.7150	149.4575	Lachlan Fold Belt Coast
Packers Swamp	Wetland	-36.6650	149.4406	Lachlan Fold Belt Coast
Bega Swamp	Wetland	-36.5150	149.5083	Lachlan Fold Belt Coast
Dukes Spring	Spring	-36.5983	149.0844	Lachlan Fold Belt Coast
Rodens Springs	Spring	-36.3983	149.0178	Lachlan Fold Belt Coast
Smith Halls Springs	Spring	-36.5483	148.8178	Lachlan Fold Belt Coast
Wollumboola Lake	Lake	-34.9516	150.7619	Sydney Basin — South Coast
Finns Swamp	Wetland	-36.2817	148.4236	Lachlan Fold Belt Coast
Lewis Spring	Spring	-36.4483	148.5011	Lachlan Fold Belt Coast
Pigeon Springs	Spring	-36.6483	148.3678	Lachlan Fold Belt Coast
Delegate River	Karst	-36.8749	149.0134	Lachlan Fold Belt Coast
Pipeclay Spring	Spring	-37.0650	149.1678	Lachlan Fold Belt Coast
197	Coastal Wetlands	-35.8236	150.2036	South East Coastal Sands
262	Coastal Wetlands	-35.5032	150.3822	South East Coastal Sands
169a	Coastal Wetlands	-35.9475	150.1427	South East Coastal Sands
366c	Coastal Wetlands	-35.0669	150.8312	South East Coastal Sands
135	Coastal Wetlands	-36.1077	150.1317	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
7	Coastal Wetlands	-37.4405	149.9538	South East Coastal Sands
215	Coastal Wetlands	-35.6912	150.2058	South East Coastal Sands
184	Coastal Wetlands	-35.8639	150.1339	South East Coastal Sands
43	Coastal Wetlands	-36.9127	149.8984	South East Coastal Sands
185	Coastal Wetlands	-35.8476	150.1570	South East Coastal Sands
182a	Coastal Wetlands	-35.9035	150.1297	South East Coastal Sands
116	Coastal Wetlands	-36.3487	150.0911	South East Coastal Sands
328c	Coastal Wetlands	-35.0209	150.6704	South East Coastal Sands
328c	Coastal Wetlands	-35.0110	150.6670	South East Coastal Sands
214	Coastal Wetlands	-35.6970	150.1897	South East Coastal Sands
169a	Coastal Wetlands	-35.9497	150.1509	South East Coastal Sands
122A	Coastal Wetlands	-36.2803	150.1330	South East Coastal Sands
166	Coastal Wetlands	-35.9547	150.1380	South East Coastal Sands
69	Coastal Wetlands	-36.7081	149.9728	South East Coastal Sands
139	Coastal Wetlands	-36.0767	150.1218	South East Coastal Sands
301	Coastal Wetlands	-35.2072	150.5445	South East Coastal Sands
330	Coastal Wetlands	-35.0100	150.6501	South East Coastal Sands
215b	Coastal Wetlands	-35.6443	150.2866	South East Coastal Sands
1	Coastal Wetlands	-37.4884	149.9551	South East Coastal Sands
293	Coastal Wetlands	-35.2854	150.4757	South East Coastal Sands
140	Coastal Wetlands	-36.0724	150.1197	South East Coastal Sands
29	Coastal Wetlands	-37.0462	149.9102	South East Coastal Sands
168	Coastal Wetlands	-35.9429	150.1175	South East Coastal Sands
190	Coastal Wetlands	-35.8136	150.1718	South East Coastal Sands
329	Coastal Wetlands	-35.0223	150.6515	South East Coastal Sands
186	Coastal Wetlands	-35.8359	150.1549	South East Coastal Sands
193	Coastal Wetlands	-35.8149	150.1626	South East Coastal Sands
169	Coastal Wetlands	-35.9327	150.1472	South East Coastal Sands
325	Coastal Wetlands	-35.0523	150.6582	South East Coastal Sands
326	Coastal Wetlands	-35.0529	150.6708	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
134	Coastal Wetlands	-36.1178	150.1258	South East Coastal Sands
365	Coastal Wetlands	-34.9396	150.7734	South East Coastal Sands
366c	Coastal Wetlands	-35.0708	150.8208	South East Coastal Sands
164	Coastal Wetlands	-36.0080	150.1546	South East Coastal Sands
261	Coastal Wetlands	-35.5056	150.3730	South East Coastal Sands
44	Coastal Wetlands	-36.9055	149.9007	South East Coastal Sands
3	Coastal Wetlands	-37.4864	149.9702	South East Coastal Sands
366c	Coastal Wetlands	-35.0689	150.8265	South East Coastal Sands
171	Coastal Wetlands	-35.9160	150.1513	South East Coastal Sands
171	Coastal Wetlands	-35.9097	150.1517	South East Coastal Sands
366c	Coastal Wetlands	-35.0695	150.8277	South East Coastal Sands
4	Coastal Wetlands	-37.4793	149.9666	South East Coastal Sands
1	Coastal Wetlands	-37.4774	149.9539	South East Coastal Sands
327	Coastal Wetlands	-35.0295	150.6689	South East Coastal Sands
170	Coastal Wetlands	-35.9211	150.1478	South East Coastal Sands
266	Coastal Wetlands	-35.4678	150.3876	South East Coastal Sands
333	Coastal Wetlands	-35.0031	150.6499	South East Coastal Sands
289	Coastal Wetlands	-35.3037	150.4589	South East Coastal Sands
41	Coastal Wetlands	-36.9333	149.9018	South East Coastal Sands
215a	Coastal Wetlands	-35.6672	150.2879	South East Coastal Sands
292	Coastal Wetlands	-35.2911	150.4689	South East Coastal Sands
290	Coastal Wetlands	-35.2922	150.4574	South East Coastal Sands
336	Coastal Wetlands	-34.9918	150.7328	South East Coastal Sands
336	Coastal Wetlands	-34.9871	150.7320	South East Coastal Sands
366c	Coastal Wetlands	-35.0724	150.8260	South East Coastal Sands
170a	Coastal Wetlands	-35.9166	150.1495	South East Coastal Sands
96	Coastal Wetlands	-36.4802	150.0545	South East Coastal Sands
9	Coastal Wetlands	-37.2491	149.9482	South East Coastal Sands
217	Coastal Wetlands	-35.7008	150.2471	South East Coastal Sands
167	Coastal Wetlands	-35.9470	150.1248	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
31	Coastal Wetlands	-37.0480	149.9081	South East Coastal Sands
121a	Coastal Wetlands	-36.3210	150.1156	South East Coastal Sands
169a	Coastal Wetlands	-35.9423	150.1318	South East Coastal Sands
317	Coastal Wetlands	-35.1191	150.6950	South East Coastal Sands
337	Coastal Wetlands	-34.9867	150.7389	South East Coastal Sands
80	Coastal Wetlands	-36.6211	150.0139	South East Coastal Sands
70	Coastal Wetlands	-36.7065	149.9776	South East Coastal Sands
287	Coastal Wetlands	-35.3038	150.4669	South East Coastal Sands
165	Coastal Wetlands	-35.9913	150.1512	South East Coastal Sands
188	Coastal Wetlands	-35.8242	150.1827	South East Coastal Sands
76	Coastal Wetlands	-36.6854	149.9840	South East Coastal Sands
136	Coastal Wetlands	-36.0987	150.1340	South East Coastal Sands
183	Coastal Wetlands	-35.8761	150.1343	South East Coastal Sands
272	Coastal Wetlands	-35.4329	150.4078	South East Coastal Sands
260	Coastal Wetlands	-35.5089	150.3776	South East Coastal Sands
270	Coastal Wetlands	-35.4586	150.3881	South East Coastal Sands
291	Coastal Wetlands	-35.2885	150.4554	South East Coastal Sands
366	Coastal Wetlands	-34.9883	150.7738	South East Coastal Sands
32	Coastal Wetlands	-37.0482	149.9094	South East Coastal Sands
169a	Coastal Wetlands	-35.9451	150.1384	South East Coastal Sands
189	Coastal Wetlands	-35.8203	150.1742	South East Coastal Sands
271	Coastal Wetlands	-35.4572	150.3846	South East Coastal Sands
141	Coastal Wetlands	-36.0691	150.1145	South East Coastal Sands
294	Coastal Wetlands	-35.2741	150.4816	South East Coastal Sands
42	Coastal Wetlands	-36.9218	149.8999	South East Coastal Sands
172	Coastal Wetlands	-35.9100	150.1493	South East Coastal Sands
80a	Coastal Wetlands	-36.6137	149.9974	South East Coastal Sands
216	Coastal Wetlands	-35.6987	150.2241	South East Coastal Sands
335	Coastal Wetlands	-35.0009	150.7008	South East Coastal Sands
8	Coastal Wetlands	-37.4357	149.9494	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
8	Coastal Wetlands	-37.4339	149.9434	South East Coastal Sands
23	Coastal Wetlands	-37.1178	149.9311	South East Coastal Sands
23	Coastal Wetlands	-37.1153	149.9289	South East Coastal Sands
30	Coastal Wetlands	-37.0466	149.9070	South East Coastal Sands
30	Coastal Wetlands	-37.0463	149.9071	South East Coastal Sands
58	Coastal Wetlands	-36.7283	149.9776	South East Coastal Sands
138	Coastal Wetlands	-36.0936	150.1239	South East Coastal Sands
299	Coastal Wetlands	-35.2137	150.5389	South East Coastal Sands
328	Coastal Wetlands	-35.0275	150.6657	South East Coastal Sands
259	Coastal Wetlands	-35.5110	150.3936	South East Coastal Sands
182	Coastal Wetlands	-35.8887	150.1341	South East Coastal Sands
10	Coastal Wetlands	-37.2556	149.9305	South East Coastal Sands
274	Coastal Wetlands	-35.4230	150.4158	South East Coastal Sands
28	Coastal Wetlands	-37.0496	149.9167	South East Coastal Sands
328a	Coastal Wetlands	-35.0230	150.6687	South East Coastal Sands
130	Coastal Wetlands	-36.2044	150.1297	South East Coastal Sands
137	Coastal Wetlands	-36.0899	150.1245	South East Coastal Sands
263	Coastal Wetlands	-35.4985	150.3824	South East Coastal Sands
124	Coastal Wetlands	-36.2492	150.1358	South East Coastal Sands
169a	Coastal Wetlands	-35.9485	150.1441	South East Coastal Sands
146c	Coastal Wetlands	-36.0446	150.1384	South East Coastal Sands
27	Coastal Wetlands	-37.0539	149.9119	South East Coastal Sands
122	Coastal Wetlands	-36.2528	150.1426	South East Coastal Sands
324	Coastal Wetlands	-35.0643	150.6678	South East Coastal Sands
2	Coastal Wetlands	-37.4944	149.9666	South East Coastal Sands
48a	Coastal Wetlands	-36.8753	149.9281	South East Coastal Sands
288	Coastal Wetlands	-35.2985	150.4651	South East Coastal Sands
288	Coastal Wetlands	-35.3038	150.4621	South East Coastal Sands
334	Coastal Wetlands	-35.0099	150.6841	South East Coastal Sands
300	Coastal Wetlands	-35.2101	150.5410	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
366a	Coastal Wetlands	-35.0150	150.8009	South East Coastal Sands
7	Coastal Wetlands	-37.4392	149.9542	South East Coastal Sands
7	Coastal Wetlands	-37.4386	149.9547	South East Coastal Sands
7	Coastal Wetlands	-37.4384	149.9548	South East Coastal Sands
7	Coastal Wetlands	-37.4383	149.9549	South East Coastal Sands
215	Coastal Wetlands	-35.6968	150.2092	South East Coastal Sands
215	Coastal Wetlands	-35.6929	150.2051	South East Coastal Sands
215	Coastal Wetlands	-35.6925	150.2086	South East Coastal Sands
215	Coastal Wetlands	-35.6888	150.2084	South East Coastal Sands
328c	Coastal Wetlands	-35.0209	150.6678	South East Coastal Sands
328c	Coastal Wetlands	-35.0200	150.6706	South East Coastal Sands
328c	Coastal Wetlands	-35.0198	150.6707	South East Coastal Sands
328c	Coastal Wetlands	-35.0213	150.6659	South East Coastal Sands
328c	Coastal Wetlands	-35.0190	150.6712	South East Coastal Sands
328c	Coastal Wetlands	-35.0182	150.6714	South East Coastal Sands
328c	Coastal Wetlands	-35.0150	150.6707	South East Coastal Sands
328c	Coastal Wetlands	-35.0091	150.6681	South East Coastal Sands
328c	Coastal Wetlands	-35.0078	150.6648	South East Coastal Sands
328c	Coastal Wetlands	-35.0065	150.6683	South East Coastal Sands
169a	Coastal Wetlands	-35.9490	150.1525	South East Coastal Sands
169a	Coastal Wetlands	-35.9489	150.1523	South East Coastal Sands
69	Coastal Wetlands	-36.7049	149.9696	South East Coastal Sands
69	Coastal Wetlands	-36.7040	149.9732	South East Coastal Sands
69	Coastal Wetlands	-36.7040	149.9739	South East Coastal Sands
69	Coastal Wetlands	-36.7040	149.9736	South East Coastal Sands
69	Coastal Wetlands	-36.7040	149.9740	South East Coastal Sands
139	Coastal Wetlands	-36.0775	150.1241	South East Coastal Sands
139	Coastal Wetlands	-36.0765	150.1235	South East Coastal Sands
301	Coastal Wetlands	-35.2066	150.5458	South East Coastal Sands
301	Coastal Wetlands	-35.2066	150.5458	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
215b	Coastal Wetlands	-35.6455	150.2921	South East Coastal Sands
215b	Coastal Wetlands	-35.6415	150.2813	South East Coastal Sands
186	Coastal Wetlands	-35.8342	150.1672	South East Coastal Sands
186	Coastal Wetlands	-35.8331	150.1661	South East Coastal Sands
186	Coastal Wetlands	-35.8326	150.1657	South East Coastal Sands
193	Coastal Wetlands	-35.8145	150.1683	South East Coastal Sands
193	Coastal Wetlands	-35.8121	150.1663	South East Coastal Sands
325	Coastal Wetlands	-35.0538	150.6703	South East Coastal Sands
325	Coastal Wetlands	-35.0520	150.6742	South East Coastal Sands
325	Coastal Wetlands	-35.0526	150.6658	South East Coastal Sands
326	Coastal Wetlands	-35.0527	150.6679	South East Coastal Sands
261	Coastal Wetlands	-35.5077	150.3733	South East Coastal Sands
327	Coastal Wetlands	-35.0338	150.6690	South East Coastal Sands
327	Coastal Wetlands	-35.0334	150.6701	South East Coastal Sands
327	Coastal Wetlands	-35.0270	150.6696	South East Coastal Sands
333	Coastal Wetlands	-35.0049	150.6447	South East Coastal Sands
290	Coastal Wetlands	-35.2944	150.4610	South East Coastal Sands
31	Coastal Wetlands	-37.0480	149.9081	South East Coastal Sands
70	Coastal Wetlands	-36.7049	149.9771	South East Coastal Sands
70	Coastal Wetlands	-36.7034	149.9779	South East Coastal Sands
188	Coastal Wetlands	-35.8258	150.1798	South East Coastal Sands
188	Coastal Wetlands	-35.8254	150.1786	South East Coastal Sands
188	Coastal Wetlands	-35.8248	150.1832	South East Coastal Sands
188	Coastal Wetlands	-35.8244	150.1832	South East Coastal Sands
260	Coastal Wetlands	-35.5083	150.3761	South East Coastal Sands
260	Coastal Wetlands	-35.5047	150.3797	South East Coastal Sands
260	Coastal Wetlands	-35.5045	150.3801	South East Coastal Sands
291	Coastal Wetlands	-35.2866	150.4543	South East Coastal Sands
366	Coastal Wetlands	-34.9978	150.7833	South East Coastal Sands
366	Coastal Wetlands	-34.9976	150.7844	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
366	Coastal Wetlands	-34.9934	150.7867	South East Coastal Sands
366	Coastal Wetlands	-34.9881	150.7712	South East Coastal Sands
32	Coastal Wetlands	-37.0489	149.9101	South East Coastal Sands
32	Coastal Wetlands	-37.0489	149.9090	South East Coastal Sands
141	Coastal Wetlands	-36.0695	150.1143	South East Coastal Sands
23	Coastal Wetlands	-37.1147	149.9288	South East Coastal Sands
30	Coastal Wetlands	-37.0473	149.9089	South East Coastal Sands
30	Coastal Wetlands	-37.0462	149.9062	South East Coastal Sands
328a	Coastal Wetlands	-35.0211	150.6697	South East Coastal Sands
137	Coastal Wetlands	-36.0902	150.1179	South East Coastal Sands
137	Coastal Wetlands	-36.0895	150.1200	South East Coastal Sands
137	Coastal Wetlands	-36.0885	150.1195	South East Coastal Sands
137	Coastal Wetlands	-36.0873	150.1199	South East Coastal Sands
146c	Coastal Wetlands	-36.0456	150.1375	South East Coastal Sands
146c	Coastal Wetlands	-36.0455	150.1379	South East Coastal Sands
146c	Coastal Wetlands	-36.0455	150.1399	South East Coastal Sands
146c	Coastal Wetlands	-36.0452	150.1364	South East Coastal Sands
146c	Coastal Wetlands	-36.0452	150.1385	South East Coastal Sands
146c	Coastal Wetlands	-36.0449	150.1378	South East Coastal Sands
146c	Coastal Wetlands	-36.0447	150.1389	South East Coastal Sands
146c	Coastal Wetlands	-36.0448	150.1379	South East Coastal Sands
146c	Coastal Wetlands	-36.0445	150.1361	South East Coastal Sands
27	Coastal Wetlands	-37.0517	149.9128	South East Coastal Sands
122	Coastal Wetlands	-36.2528	150.1426	South East Coastal Sands
288	Coastal Wetlands	-35.3016	150.4639	South East Coastal Sands
288	Coastal Wetlands	-35.3010	150.4664	South East Coastal Sands
288	Coastal Wetlands	-35.3036	150.4623	South East Coastal Sands
300	Coastal Wetlands	-35.2076	150.5404	South East Coastal Sands
300	Coastal Wetlands	-35.2074	150.5409	South East Coastal Sands
300	Coastal Wetlands	-35.2075	150.5403	South East Coastal Sands

High-priority groundwater dependent ecosystem	GDE type	Latitude	Longitude	Groundwater Source
300	Coastal Wetlands	-35.2073	150.5408	South East Coastal Sands
300	Coastal Wetlands	-35.2073	150.5409	South East Coastal Sands
300	Coastal Wetlands	-35.2073	150.5410	South East Coastal Sands
300	Coastal Wetlands	-35.2071	150.5408	South East Coastal Sands
300	Coastal Wetlands	-35.2077	150.5405	South East Coastal Sands

Appendix 6: Interagency Regional Panel and support staff

Table 6A: Interagency Regional Panel membership and expertise

Name	Agency	Role	Expertise
Tracey Brownbill	DPI Water	Agency representative	Natural resource management and water management
Anne Muir	NSW DPI	Agency representative	NSW DPI regional input to water reforms, agriculture, catchment management and landuse / strategic planning.
John O'Connor	NSW DPI	Agency representative	Catchment management, local knowledge, agriculture
Daniel Wiececk	OEH	Agency representative	OEH regional input to water reforms, conservation issues
Gavin Whiteley	LLS	Observer	Catchment management, local knowledge

Table 6B: Support staff membership and expertise

Name	Agency	Role	Expertise
Kristanne Mahony	DPI Water	Lead planner	Groundwater management, facilitation and consultation
Dayle Green	DPI Water	Plan support	Facilitation and consultation
Frances Guest	DPI Water	Plan writer	Water planning and policy
Adam Wiggins	DPI Water	Hydrometric support	Local hydrometrics knowledge
Bob Britten	DPI Water	Hydrogeological support	Groundwater analysis and hydrology
Craig Jones	DPI Water	Compliance	Water licensing and monitoring
Greg Russell	DPI Water	Hydrogeological support	Groundwater management
John Williams	DPI Water	Hydrogeological support	Groundwater management
Richard Green	DPI Water	Hydrogeological support	Groundwater management
Georgina Spencer	DPI Water	GIS support	Map production

Appendix 7: Interagency Regional Panel reference materials

Office data sets

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

Regional Groundwater Monitoring Network – DPI 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 for each water source.

Regional Geographic Information Systems – DPI Water land use and topographic information

Central data sets

Index of Social Disadvantage – Australian Bureau of Statistics.

Employment in Agriculture - Australian Bureau of Statistics

Other agency data

National Parks and Wildlife (OEH) State-wide atlas – State-wide flora and fauna database

Other reference material

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

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