

State Plan target

By 2015, there is an improvement in the ability of groundwater systems to support groundwater dependent ecosystems and designated beneficial uses.

The intent of the target as defined by the Natural Resources Commission (NRC) is to 'ensure that groundwater continues to support ecosystem function, human health and economic activity'.

Background

The target is broad-ranging in terms of the values that it is attempting to improve. The three key areas addressed by the target are outlined below:

Ecosystem function

Ecosystems that are fully or partially reliant on groundwater to maintain ecosystem function are known as groundwater dependent ecosystems (GDEs). These occur across both surface and subsurface landscapes and are highly variable. GDEs have their species composition and natural ecological processes determined by groundwater (ARMCANZ & ANZECC 1996).

A detailed technical report describes the methods used to derive the information contained in this report. At the time of publication of the *State of the catchments (SOC) 2010* reports, the technical reports were being prepared for public release. When complete, they will be available on the NOW website: www.water.nsw.gov.au.

Note: All data on natural resource condition, pressures and management activity included in this SOC report, as well as the technical report, was collected up to January 2009.

GDEs are classified into six broad types:

- karst and caves
- groundwater dependent wetlands
- aquifers
- base flow rivers and streams
- terrestrial vegetation
- estuarine and near-shore marine ecosystems.

Human health

This element of the target refers to the maintenance of beneficial uses of groundwater by preventing deterioration in groundwater quality or contamination by pollutants. Groundwater pollution can take many forms, ranging from saltwater intrusion and the release of such matrix elements as iron and arsenic from over-extraction, to contamination from pollution events (eg chemical spills, leakages, or contaminated runoff into poorly constructed bores).

Economic activity

Maintenance of a range of beneficial uses (as defined by the NRC) is achieved by keeping groundwater extraction at sustainable levels. This provides a level of security of supply and decreases the risk of contamination and ecological harm occurring from over-extraction.

Within the Southern Rivers region there are alluvial, coastal sands, fractured rock and porous rock aquifer province groundwater management areas (GWMAs). Table 1 identifies the GWMAs in the region. The location of the GWMAs is shown in Figure 1.

Table 1 GWMAs in the Southern Rivers region

Alluvial GWMAs	Coastal sands GWMAs	Fractured rock GWMAs	Porous rock GWMAs
Araluen Alluvium	South East Coastal Sands	Lachlan Fold Belt	Sydney Basin–Central
Bega River Alluvium	Metropolitan Coastal Sands	Goulburn Fractured Rock	Sydney Basin
Tuross Alluvium			Sydney Basin–Nepean Sandstone
Towamba Alluvium			Sydney Basin–South

Forty-eight per cent of the Southern Rivers region is national parks and state forest. The southern area of the region is sparsely populated, and the largest GWMA by area – the Lachlan Fold Belt – generally yields low volumes of water. This makes it unsuitable for irrigation or other uses with large water requirements. Its primary use is for stock and domestic purposes. These factors limit the potential for groundwater use, and limit land-use activities that impact on the groundwater aquifers.

The alluvial aquifer systems have a low level of development, with the exception of the Bega River

Alluvium, which is used as a water supply for Bega. There is limited groundwater level monitoring in these GWMA's, with the level of knowledge limited to expert opinion and the current level of entitlement.

There is limited use of the coastal sands aquifer systems. This is mainly due to their small extent. The largest concentration of use is in the vicinity of Tomakin and Mossy Point, where the groundwater is used for domestic purposes. The coastal sands aquifer systems in this area are also used by the Eurobodalla Shire Council as a water supply.

Map of the catchment

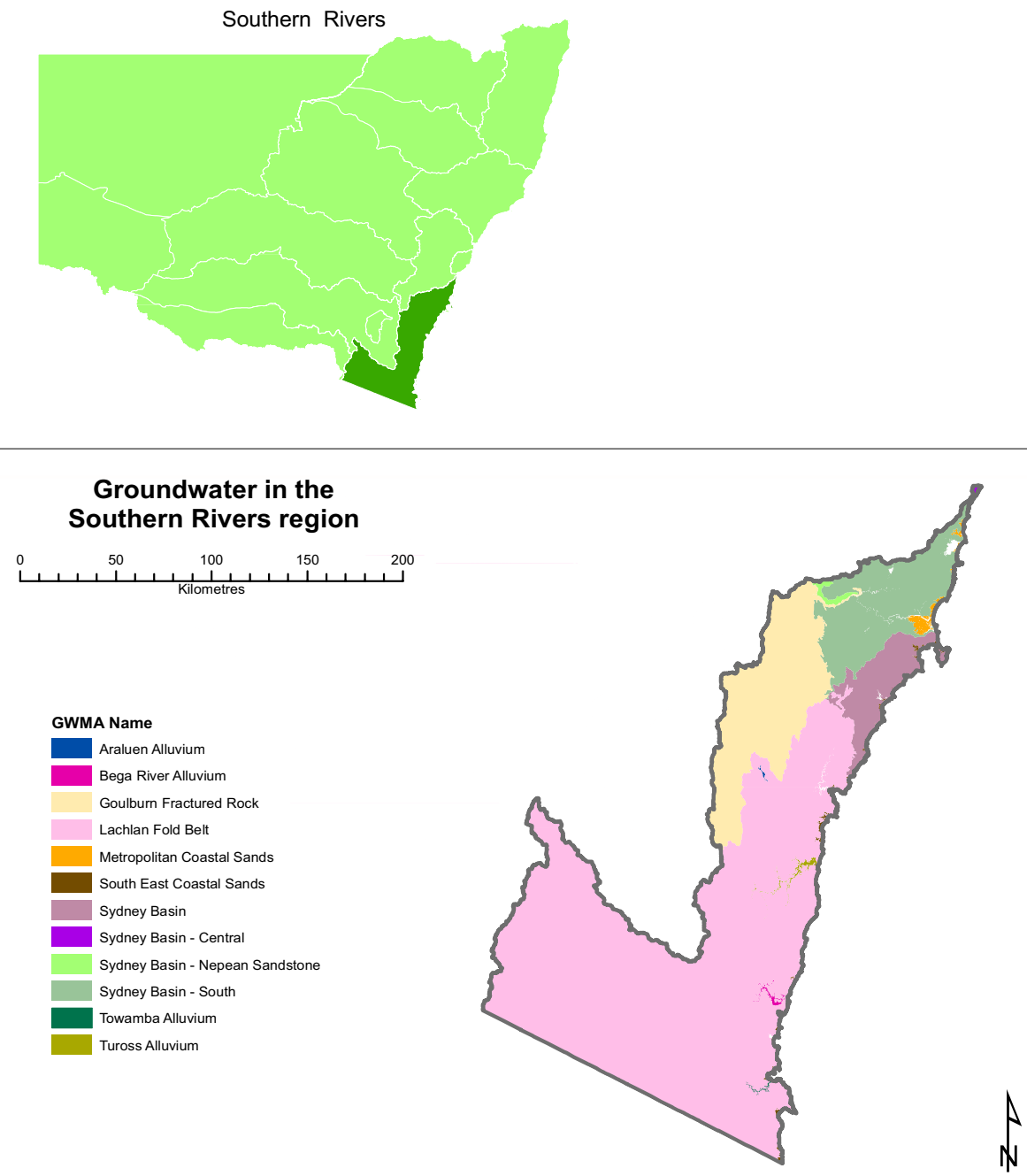


Figure 1 Southern Rivers region groundwater management areas

Assessment

The assessment of condition and pressure for the groundwater aquifers in the region has been based on the GWMA's. The assessment focuses on the whole of each GWMA, including the areas extending beyond the Southern Rivers region.

Monitoring focuses on groundwater levels in areas where there is a concentration of groundwater use for irrigation, mining and urban water supply, and areas where there is a close interaction between groundwater and surface water systems.

The assessment of condition and pressure relative to the target has been based on both available information and expert opinion within the NSW Government. Seven indicators were used to assess both condition and pressure. Of those seven indicators, one was quantifiable for both condition and pressure using available information. The long-term annual average extraction limit (LTAEL) is the proportion of the long-term average annual recharge of water to the groundwater system available for extraction. The condition indicator quantified is the ratio of the amount of groundwater actually extracted and used in a given year compared with the LTAEL. The pressure indicator quantified is the ratio of the total annual entitlements for extraction held by licence holders compared with the LTAEL. Low ratios for these indicators would result in a ranking of 'very good' for condition and 'very low' for pressure.

The other six indicators used for assessing condition and pressure were determined using expert opinion, as current monitoring of aquifer systems in NSW does not provide sufficient data for more comprehensive analysis.

Condition

In addition to the quantifiable indicator of extraction vs LTAEL, the six other indicators of condition used to assess each groundwater source within the Southern Rivers region are described in Table 2.

Table 2 Description of condition indicators

Indicator	Description
Extraction vs LTAAEL	The total annual usage compared with the LTAAEL available for extraction
GDE condition	The condition of GDEs in the region, in terms of their access to the amount and quality of groundwater they require
Landscape condition	The condition of the wider landscape in terms of potential changes caused by land-use to groundwater quality and the volume of water available for recharging the aquifer: increased recharge causes groundwater levels to rise, which can have an impact on the productivity of agriculture and the condition of urban infrastructure. Taken together, these measures can be used to make an assessment of landscape condition
Regional groundwater levels	Change in regional groundwater levels from the influence of extraction: where groundwater levels are not monitored, changes in the duration of pumping time that groundwater is available for basic landholder access and other licensed users can be used as a surrogate
Local groundwater levels	Change in local groundwater levels from the influence of extraction
Groundwater quality	Groundwater quality, as measured by the following: <ul style="list-style-type: none"> • groundwater acidity • groundwater salinity • nutrient concentrations • contamination from heavy metals and hydrocarbons • changes in beneficial use category (resulting from groundwater quality changes) • freshwater/saltwater interface (indicated by electrical conductivity)
Aquifer integrity	The integrity of the aquifer matrix, which can be affected by dewatering and compaction with consequent ground subsidence or upsidence, or by various land-use activities

The groundwater aquifer systems are generally in good to very good condition (Table 3). There is assumed to be a low level of use of groundwater, except for town water supply, which is causing some localised influences on the condition of the GWMA.

The assessed condition of the porous rock groundwater sources is poor to very poor. The major cause of this is mining activities, which result in permanent changes to the aquifer systems. The method of underground mining also causes the collapse of the aquifer matrix, which results in impacts such as creek bed cracking and mechanical rock failure.







There is limited information on the condition of GDEs in the region. The GDEs in the Lachlan Fold Belt GWMA have been assessed as being in good condition. The majority of these are located in areas of low groundwater use, national parks or state forest.

A desktop assessment by the former Department of Water and Energy (DWE 2008) identified high

priority GDEs in the region, as shown in Figure 2. The desktop assessment methodology does not currently include terrestrial ecosystems.

Table 3 Groundwater source condition summary

GWMA no. and name	GDE Condition			Landscape Condition			Regional Groundwater Levels			Local Groundwater Levels			Groundwater Quality			Aquifer Integrity			Percentage Use to the LTAAEL			GWMA Condition Index	
	Data Confidence	Trend		Data Confidence	Trend		Data Confidence	Trend		Data Confidence	Trend		Data Confidence	Trend		Data Confidence	Trend		Data Confidence	Trend			
034 Araluen Alluvium				M	↔		H	↔		H	↔		M	↔		H	↔						
039 Bega River Alluvium				H	↔		M	↔		L	↔		L	↔		M	↔						
044 South East Coastal Sands				L	↔		L	↔		L	↔		L	↔		H	↔						
056 Tuross Alluvium				L	↔		L	↔		L	↔		L	↔		L	↔						
061 Towamba Alluvium				L	↔		L	↔		L	↔		L	↔		L	↔						
067 Metropolitan Coastal Sands				M	↔		M	↔		L	↔		L	↔		M	↔						
603 Sydney Basin–Central	M	↓		M	↓		H	↓		M	↓		M	↔		M	↓						
607 Sydney Basin	M	↓		M	↓		H	↓		M	↓		M	↔		M	↓						
603 Sydney Basin–Nepean Sandstone	M	↓		M	↓		H	↓		M	↓		M	↔		M	↓						
616 Sydney Basin–South	M	↓		M	↓		H	↓		M	↓		M	↔		M	↓						
811 Lachlan Fold Belt	L	↔		L	↔		L	↔		L	↔		L	↔		L	↔						
820 Goulburn Fractured Rock	L	↔		L	↔		L	↔		L	↔		L	↔		L	↔						

Condition		Trend		Data confidence	
	Very good	↑	Improving	H	High
	Good	↔	No change	M	Medium
	Fair	↓	Declining	L	Low
	Poor	?	Unknown		
	Very poor				
	No data				

Southern Rivers region high priority groundwater dependent ecosystems

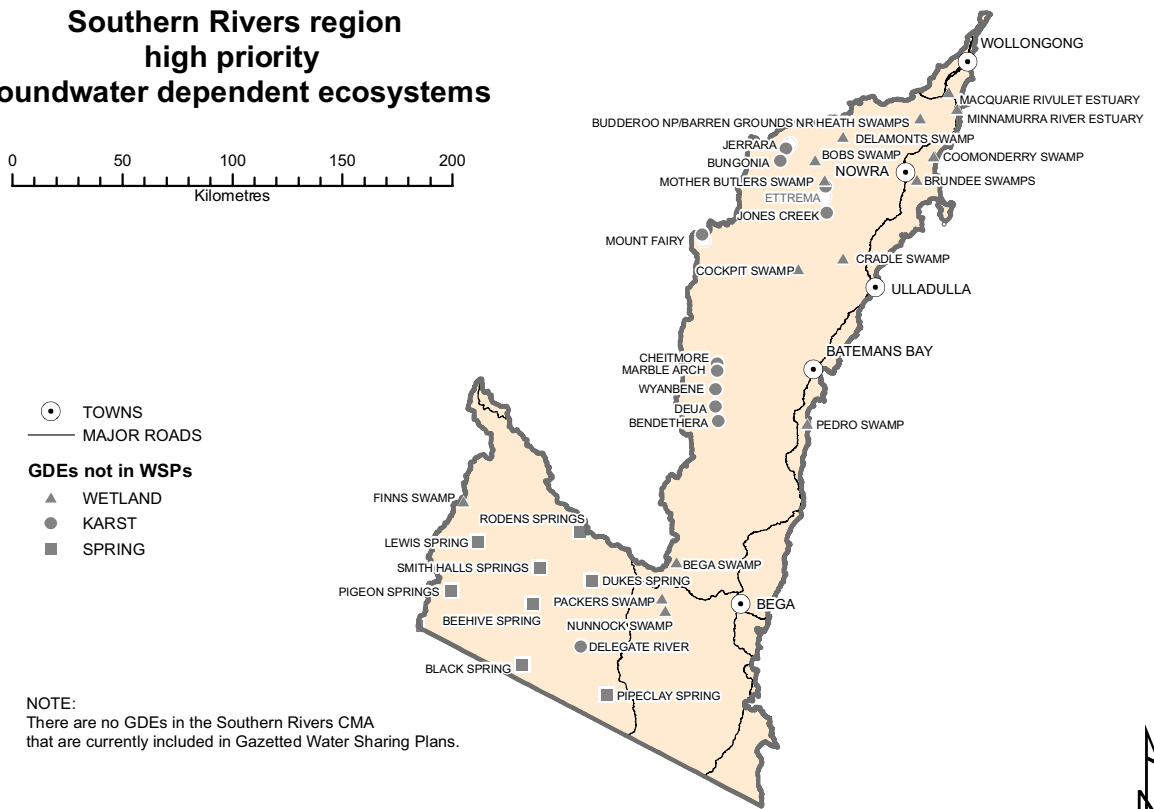


Figure 2 High priority identified GDEs

Pressures

‘Pressures’ in this report refers to the potential impacts of human activity on the groundwater system. (NB: This is different from the ‘pressure’ term as used in the discipline of hydrogeology.)

In addition to the quantifiable indicator of entitlements vs LTAEL, the six other indicators of pressure used to assess each groundwater source within the Southern Rivers region are described in Table 4.

Table 4 Description of pressure indicators

Indicator	Description
Entitlements vs LTAAEL	The total annual entitlements compared with the LTAAEL available for extraction
GDE groundwater availability	The pressure on GDEs from long-term and seasonal changes in groundwater levels, including the influence of changes in groundwater levels in highly connected systems
Land-use pressures	The pressure of land-use on aquifer systems: the indicator also identifies the pressure that shallow groundwater levels place on productive land or urban areas (eg the creation of salinity issues), and combines both these measures into a single indicator
Regional impacts	The extent to which current groundwater extraction could potentially affect regional groundwater levels
Localised impacts	The extent to which current groundwater extraction could potentially affect localised groundwater levels
Groundwater quality impacts	Potential contamination of groundwater from: <ul style="list-style-type: none"> • various discrete or dispersed sources • migration of water of a lower quality • acidification from exposure of acid sulfate soils through the lowering of groundwater levels • changes to seawater and groundwater interfaces from extraction in coastal sand aquifers
Aquifer structure pressures	The effect on groundwater flow systems from compaction, or changes to aquifer material through groundwater extraction and from the removal of aquifers in mining or quarrying activities

The groundwater aquifer systems are generally experiencing low to moderate overall pressure (see Table 5). The exception is the Bega Alluvium, which is experiencing pressures from land-use and groundwater use (for the Bega town water supply and irrigation).

The major pressures on the GWMA are land-use changes, including mining, agriculture, urbanisation and the construction of levee banks, which reduce the frequency of flood events. In the porous rock aquifers, the main pressure is mining.

Overuse of groundwater from the alluvial and coastal sands aquifer systems has the potential to cause acidification of the water in areas identified by the acid sulfate soil risk maps (DLWC 1998). There is also the potential for nutrients to enter the alluvial aquifer systems through the overuse of fertilisers on gardens in urban areas.

Table 5 Groundwater source pressure summary

GWMA no. and name	GDE Groundwater Availability		Land-use Pressures		Regional Impacts		Localised Impacts		Groundwater Quality Impacts		Aquifer Structure Pressures		Entitlement/Share Component to the LTAAEL		GWMA Pressure Index
	Data Confidence	Trend	Data Confidence	Trend	Data Confidence	Trend	Data Confidence	Trend	Data Confidence	Trend	Data Confidence	Trend	Data Confidence	Trend	
034 Araluen Alluvium	L ?	?	L ?	?	H ↔	↔	M ↔	↔	H ?	↔	L ?	↔	H ↔	↔	↔
039 Bega River Alluvium	L ?	↔	H ↔	↔	M ↔	↔	H ↔	↔	L ?	↔	M ?	↔	H ↔	↔	↔
044 South East Coastal Sands	L ?	↔	L ?	↔	M ↔	↔	L ?	↔	L ?	↔	H ?	↔	H ↔	↔	↔
056 Tuross Alluvium			L ↔	↔	M ↔	↔	H ↔	↔	L ?	↔	M ?	↔	H ↔	↔	↔
061 Towamba Alluvium			L ↔	↔	L ↔	↔	L ↔	↔	L ↔	↔	L ↔	↔	H ↔	↔	↔
067 Metropolitan Coastal Sands	H ↔	↔	H ↑	↔	H ↔	↔	M ↔	↔	H ↔	↔	H ↔	↔	H ↔	↔	↔
603 Sydney Basin–Central	M ↓	↓	H ↓	↓	H ↓	↓	H ↓	↓	H ↔	↔	H ↓	↓	H ↔	↔	↔
603 Sydney Basin	M ↓	↓	H ↓	↓	H ↓	↓	H ↓	↓	H ↔	↔	H ↓	↓	H ↔	↔	↔
607 Sydney Basin–Nepean Sandstone	M ↓	↓	H ↓	↓	H ↓	↓	H ↓	↓	H ↔	↔	H ↓	↓	H ↔	↔	↔
616 Sydney Basin–South	M ↓	↓	H ↓	↓	H ↓	↓	H ↓	↓	H ↔	↔	H ↓	↓	H ↔	↔	↔
811 Lachlan Fold Belt	L ?	?	L ?	?	M ?	?	M ?	?	L ?	?	H ?	?	H ↔	↔	↔
820 Goulburn Fractured Rock	L ?	?	L ?	?	M ?	?	M ?	?	L ?	?	H ?	?	H ↔	↔	↔

Pressure		Trend		Data confidence
	Very low	↑	Increasing	H High
	Low	↔	No change	M Medium
	Moderate	↓	Decreasing	L Low
	High	?	Unknown	
	Very high			
	No data			

Management activity

Regional initiatives

The State Plan natural resource management targets are being addressed through state, regional and local partnerships. The catchment action plans (CAPs) and the investment programs that support the CAPs are the key documents that coordinate targeted projects for the improvement of natural resources across NSW. The CAPs describe the whole-of-Government approach, and specify regional targets and activities that contribute to the achievement of the state-wide targets. The Southern Rivers CAP can be found at www.southern.cma.nsw.gov.au/news_publications-plans_strategies.php.

Land-use planning in the region is primarily achieved through local environmental plans (LEPs). All LEPs in the state are currently being reviewed by local governments in consultation with NSW Government agencies and the local community. The plans aim to ensure that appropriate development occurs in the landscape with consideration of future population demands,

economic issues and the protection of natural resources and environmental assets in the area. LEPs are statutory controls against which development proposals are assessed. With respect to groundwater, LEPs ensure that development is prevented or restricted in locations where there is a high likelihood of groundwater contamination or the potential for development to increase salinity within the landscape.

Land-use pressures

Groundwater systems in the Southern Rivers region are influenced by land-use activities such as the regulation of the Bega River, coal mining in the porous rock areas and land clearing. These activities are reducing groundwater recharge in various locations by removing the aquifer systems. In other areas, increased groundwater recharge and saline aquifers leaking water into fresh aquifers are causing salinity issues and affecting groundwater quality.

Groundwater use and entitlement

The groundwater target is being addressed at the state level through water sharing plans (WSP) for groundwater sources where there is over-allocation of entitlements or a need to protect high value ecosystems. The implementation of WSPs, which are plans to ensure the equitable and sustainable sharing of water, will ensure long-term water level management for GDEs and other beneficial uses. However, some groundwater systems in NSW will remain under stress until current processes to reduce use to sustainable levels are complete. Key initiatives to meet this challenge include:

- expanding the existing groundwater level monitoring network through capital funding by the NSW Government
- adjusting future WSPs where necessary to account for climate change impacts
- effectively implementing the monitoring, evaluation and reporting strategy.

A number of activities are being implemented to better understand groundwater systems, including:

- the expansion of the existing groundwater level monitoring network
- the implementation of telemetered time series groundwater level monitoring sites in the inland alluvial water sharing plan areas.

Groundwater dependent ecosystems

There are a number of activities being implemented around NSW to better understand GDEs, including:

- a trial remote sensing project to identify terrestrial GDEs in the Lower Macquarie GWMA
- staged spatial mapping of potential GDEs across NSW
- assessment of groundwater flow systems in the Capertee and Warragamba areas by the Southern Rivers Catchment Management Authority (CMA), Sydney Metropolitan CMA and DECCW, which will assist with the development of management options for reducing salinity outbreaks and identifying GDEs at risk.

The Southern Rivers CMA is addressing the groundwater targets through the goodwill, energy and enthusiasm of land managers, community groups, voluntary organisations and local government.

Southern Rivers CMA supports the community consultation processes for the development of

WSPs. These plans are expected to lead to the sustainable management of highly connected alluvial groundwater systems. Southern Rivers CMA oversees the South Coast regional panel that makes decisions on WSPs. The CMA also assists with the public exhibition of the WSPs.

Southern Rivers CMA is not running projects that are directly targeting the improvement of groundwater systems, although related projects aimed at improving farm nutrient management, land capability and land management will help minimise potential groundwater contamination.

Further reading

ARMCANZ & ANZECC 1996, *National Principles for the Provision of Water for Ecosystems*, Occasional Paper SWR No. 3, Sustainable Land and Water Resource Management Committee, Subcommittee on Water Resources, Canberra.

DLWC 1998, *Acid Sulfate Risk Maps*, Department of Land and Water Conservation, Parramatta.

DWE 2008, *Process to Identify Potential and Known High Priority Groundwater Dependent Ecosystems*, Department of Water and Energy, Armidale, unpublished.

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