Natural Resources Management Act 2004

Water Allocation Plan

for the

Tintinara Coonalpyn Prescribed Wells Area

I, Paul Caica, Minister for Sustainability, Environment and Conservation, hereby adopt this Water Allocation Plan pursuant to section 80(3)(a) of the *Natural Resources Management Act 2004*.

Paul Caica

Date: 23.04.12

Minister for Sustainability, Environment and Conservation

Water Allocation Plan for the Tintinara Coonalpyn Prescribed Wells Area

Prepared by the

South East Natural Resources Management Board

August 2011

Government of South Australia

South East Natural Resources Management Board

Contents

1. The Tintinara Coonalpyn Prescribed Wells Area

1.1 The Tintinara Coonalpyn Prescribed Wells Area

Location

The Tintinara Coonalpyn Prescribed Wells Area (PWA) is located in the Upper South East of South Australia, approximately 200 kilometres south east of Adelaide and covers an area of 3,423 km^2. It includes the Hundreds of Archibald, Carcuma, Coneybeer, Coombe, Lewis, Livingstone, Makin, McCallum and Richards. It incorporates the major towns of Coonalpyn and Tintinara, both of which lie on the main Adelaide-Melbourne highway that runs through the western part of the PWA. The location and boundaries of the Tintinara Coonalpyn PWA are shown in Figure 1 *(Appendix of Figures and Tables)*.

The Tintinara Coonalpyn PWA can be divided by topography into two discrete landforms, the low-lying coastal plain to the west and the highlands of the Mallee to the north and east. Separating the two terrains is the extension of the Marmon Jabuk Scarp.

Climate

The climate in the Tintinara Coonalpyn PWA is typical of the South East; hot, dry summers and cool, wet winters. The average annual rainfall in Tintinara (1900 to 2009) is 462 mm with annual evaporation estimated at 1,670 mm. In Coonalpyn the average rainfall (1887 to 2009) is slightly less at 452 mm (Bureau of Meteorology 2010).

Water Use

A total of 7,885 hectares of crops were irrigated using unconfined aquifer water in the Tintinara Coonalpyn PWA in 2008/09, representing around 2% of the total land area in the PWA. The major irrigated crop in the Tintinara Coonalpyn area is lucerne pasture/hay, covering 3,125 hectares, closely followed by seed production at 2,387 hectares, which is a regionally significant and valuable industry. Other irrigated crops include cereal at 238 hectares, and vegetables, covering 218 hectares. Another significant irrigated crop grown is olives at 957 hectares, which relies on confined aquifer water. Small areas of pasture other than lucerne, and potatoes are also grown in the district (see Figure 2, *Appendix of Figures and Tables*) (Hodge 2009).

Irrigation methods used across the PWA are varied. In 2008/2009, centre pivot and lateral move irrigators accounted for 64% of the irrigated area and flood irrigation accounted for 34% of the irrigated area. The remaining 2% of the irrigated area is watered by fixed sprinklers, travelling irrigators and microsprinklers (see Figure 3, *Appendix of Figures and Tables*) (Hodge 2009).

Underground Water Resources

The underground water of the South East flows through two distinct aquifer systems: a regionally unconfined limestone aquifer and an underlying confined quartz sand aquifer, as shown in Figure 4 *(Appendix of Figures and Tables).* The two aquifers are separated by a low permeability aquitard (or confining bed), which consists of the Ettrick Formation and the Buccleuch Beds. The Ettrick Formation (maximum thickness 31 metres) consists of dark green/grey marl with sand interbeds, is fossiliferous (containing fossils), with minor carbonaceous (containing carbon) clay and occasional thin, cemented limestone and dolomite interbeds. The Buccleuch Beds (maximum known thickness of 40 metres) consist of fossiliferous dark grey to brown carbonaceous clays and quartz sand, with interbeds of limestone (Stadter and Love 1987). The combined thickness of the aquitard is generally more than 20 metres. Vertical recharge to the confined aquifer from the overlying unconfined aquifer is therefore considered to be very low.

Unconfined Aquifer

The unconfined aquifer consists of three limestone units that are hydraulically continuous across the PWA.

Underground water flows through the Murray Group Limestone beneath the Mallee highlands before continuing through to two other minor geological units, the Padthaway and Bridgewater Formations beneath the coastal plain.

The thickness of the unconfined aquifer varies considerably throughout the region but it generally thickens from southwest to northeast towards the centre of the Murray Basin. A schematic east west cross section through the Tintinara Coonalpyn PWA highlights the main geological units in Figure 4 *(Appendix of Figures and Tables)*.

Coastal Plain

Of the two limestone formations, the Padthaway Formation exists only beneath the inter-dunal flats and is the uppermost geological unit. Its maximum recorded thickness is 20 metres in the Hundred of Stirling south of the Tintinara Coonalpyn PWA. Underlying this is the Bridgewater formation that is a fine to coarse shelly quartz sandstone. These two units are hydrogeologically continuous and produce high well yields of up to 300 L/sec.

The current depth to the water table varies from less than five metres below the inter-dunal flats to less than two metres west of Tintinara where dryland salinity occurs. Water level declines of up to 3.5 metres have been observed since 1996 until average rainfall in 2009-10 stabilised the declining trend.

Numerous irrigation wells are showing a rising salinity trend due to the recycling of irrigation drainage water in the shallow aquifer. Salinity rises beneath areas of flood irrigation are typically greater than those beneath pivot irrigation due to the greater volumes of drainage. This can be attributed mainly to the below average rainfall which has, in turn, minimised the leaching of salts from the unsaturated zone.

Mallee Highland

In the eastern highlands area, the main unconfined aquifer is the Murray Group Limestone, which generally consists of bryozoal, and shelly limestone.

The depth to the water table ranges from 25-50 metres reflecting the increasing elevation of the land to the east. There has been a rise in the water table since clearing of the land. This water table is less affected by rainfall compared to the coastal plain due to its elevation. Dry winters have lead to a stabilisation of water levels rather than a decline. Well yields are lower, (up to 60 L/sec) with an average well depth of 100 metres.

Confined Aquifer

The confined aquifer in the Tintinara Coonalpyn PWA consists of the Buccleuch Formation beneath the Coastal Plain landform and the Renmark Group under the Mallee Highlands. In a similar pattern to the overlying aquifer, the confined aquifer thins to the south-west where it wedges out against rising basement rock.

Coastal Plain

Extending across the coastal plain 60 metres below ground level is the Buccleuch formation, a limestone/sand aquifer separated by thin clay layers. The fine grain sand units of this aquifer are difficult to screen and well yields average 20-30 L/sec, much lower than well yields from the unconfined aquifer. The aquifer was historically artesian on the inter-dunal flats, where flowing wells have previously been used for stock water use and domestic water use supplies. The salinity distribution is similar to the unconfined aquifer, with an increase from east to west.

In the Hundreds of Coneybeer, Livingston, and north of the Tintinara Coonalpyn PWA in the Hundreds of Peake and Sherlock, most stock water use and domestic water use wells are completed in the Bryozoal Limestone within the Buccleuch Formation which overlies the Renmark Group.

Mallee Highlands

The confined aquifer in this area comprises the Renmark Group that consists of interbedded sands and clays. North of Tintinara, there are three sub aquifers, named the upper confined aquifer (UCA), middle confined aquifer (MCA) and lower confined aquifer (LCA). These three sub aquifers are separated by clayey units with low permeability. The lower confined aquifer has restricted distribution as it wedges out to basement rock to the west and south of the PWA. The wells completed in the LCA are predominately for irrigation. All remaining wells pump from the MCA and the UCA. While all known stock water use and domestic water use wells pump from the UCA, further surveys may reveal that stock water use and domestic water use wells are accessing water from the MCA.

To the east of Tintinara in the Hundreds of Makin and McCallum (Kynoch Management Area), there are no wells penetrating the Renmark Group confined aquifer. This is due

to the unknown capacity of the aquifer to provide irrigation supplies, the more expensive drilling requirements and the availability of low salinity water in the overlying unconfined limestone aquifer.

Management Areas

The unconfined aquifer in the Tintinara Coonalpyn PWA is divided into four different Management Areas: Coonalpyn, Boothby, Tintinara and Sherwood (Figure 5, *Appendix of Figures and Tables*).

The confined aquifer is divided into three different Management Areas: Tauragat, Tolmer and Kynoch (Figure 6, *Appendix of Figures and Tables*).

1.2 Background

This document is the Water Allocation Plan for the Tintinara Coonalpyn Prescribed Wells Area (the Plan), pursuant to Chapter 4, Part 2, Division 2 of the *Natural Resources Management Act 2004* (the Act). The Act requires the South East Natural Resources Management Board (the Board) to prepare a Water Allocation Plan (WAP) for each of the prescribed water resources in its area.

The Tintinara Coonalpyn Prescribed Wells Area (PWA) was prescribed on 2 November 2000. A period of restriction was implemented from 13 January 1999 to 13 January 2002 and was extended until 30 April 2003. The first Water Allocation Plan (the 2003 Plan) for the PWA was adopted by the Minister for Environment and Conservation, the Honourable John Hill MP, on 22 January 2003 and amended in May 2003. This Plan is the product of a review that is required under the Act every five years.

The purpose of this Plan is to provide criteria by which decisions about the regulation and use of water are made to ensure that water resources are managed sustainably for current and future users and water-dependent ecosystems. The Plan sets out the principles for the allocation, use and transfer of underground water in the Tintinara Coonalpyn PWA. The Plan provides a framework for the issue of permits to control relevant water affecting activities. This Plan complies with the objects and requirements of the Act, assisting in the achievement of ecologically sustainable development in the region.

This Plan replaces the Water Allocation Plan for the Tintinara Coonalpyn PWA that was certified by the Minister for Environment and Conservation on 30 May 2003 as being the WAP for the PWA adopted by him on 22 January 2003 and amended pursuant to section 118 of the *Water Resources Act 1997*.

References

Bureau of Meteorology website, www.bom.gov.au

Hodge, B. (2009). *Water Allocation and Use in the South East 2008-2009 Summary* (Report, DWLBC, Government of South Australia, through Department of Water, Land and Biodiversity Conservation, Mount Gambier).

Stadter, F and Love, A (1987). *Tatiara proclaimed region groundwater assessment*. Department of Mines and Energy (Report Book 87/87)

2. Assessment of the Needs of Underground Water Dependent Ecosystems

As required by section 76(4)(a)(i) of the Act, this section provides an assessment of the quantity and quality of water needed by the ecosystems that depend on the water resources, and the times at which, or the periods during which, these ecosystems need that water.

2.1 Ecosystems Dependent on Underground Water in the Tintinara Coonalpyn PWA

The Tintinara Coonalpyn PWA can be divided into two main land units: the Coastal Plain and the Mallee Highlands. Ecosystems dependent on underground water associated with these land units include wetland depressions and wetland flats, South Australian Blue Gum *(Eucalyptus leucoxylon)* and Pink Gum *(Eucalyptus fasiculosa)* woodlands and dissolution features (caves and holes). It is also likely that the Tintinara Coonalpyn PWA would support hypogean environments.

Coastal Plain Land Unit

Wetlands

The structure of the plant communities in the Coastal Plain wetlands is related to the extent to which the depressions intersect the water table and the salinity of the underground water. In a field assessment conducted in July 2001 (URS 2001), it was found that the structure, vegetation and degradation of wetlands could be classified according to their spatial distribution. Six wetland classes were identified and are described below.

Enclosed Freshwater Wetlands

These relatively fresh wetlands are enclosed basins and are distinguished by the presence of *E. leucoxylon* and Common Reed (*Phragmites australis)* in low lying areas. They occur mainly near the eastern boundary of the Coastal Plain and in the west near Mount Boothby. The soils are generally sandy and support coastal wetland species including *Baumea juncea, Lepidosperma* species, *Acacia farinosa* and *Dianella* species. There is little evidence of stress related to underground water conditions.

Open Intermediate Salinity Wetlands – Limited Stress

Wetlands in this category lie in the eastern most extent of wetlands on the Coastal Plain, between the Dukes Highway south of Coombe and the southern boundary of the PWA. The wetlands are generally open depressions with shallow gradients dominated by *Melaleuca brevifolia* and fringed by *E. fasiculosa*, which continues across the landscape to areas of higher elevation. *Gahnia filum* replaces *M. brevifolia* towards the

base of the depressions, which may indicate a greater water logging and salinity tolerance of this species.

Evidence of salinity and water logging stress in these wetlands is generally limited to the lowest lying parts of the wetlands. Stands of *M. brevifolia* and *G. filum* may become sparse, replaced with Tall Wheat Grass, Samphire and bare ground.

Open Saline Wetlands – Widespread Stress

South of Tintinara around the intersection of Lucas Road and Two Wells Road in a flat area confined by east-west running dunes are a number of open wetland depressions showing widespread signs of salinisation and stress.

The landscape comprises open plains with flat, shallow dunes elevated by one to two metres. Trees are restricted to these low sandy rises and include *E. leucoxylon* and *E. fasiculosa*. Wetland vegetation comprises dense *M. brevifolia* and *M. halmaturorum* growing to more than 2 metres high. The understorey is generally limited to samphire. On sandy rises other wetland species may include *Gahnia filum, Lepidosperma* species and *Baumea juncea,* which grow in dense low sedgelands.

Most wetland remnants in this area are grazed and the impacts of underground water stress are difficult to distinguish from grazing impacts. The widespread death of *Melaleuca* species is a probable indicator of rising underground water salinisation. Grazing may have facilitated the spread of samphire in the understorey but the dominance of this group of plants is also an indicator of saline conditions.

Some depressions have distinct salt scalds, which are not necessarily a sign of stress. Scattered *M. halmaturorum* in these areas are healthy and showing no signs of stress. The health of this species is a useful indicator of changing underground water conditions over the long-term as they are relatively long-lived.

Tree health is poor with death observed in both *E. leucoxylon* and *E. fasiculosa*. The death of *E. leucoxylon* in this area may therefore be an indication of underground water salinisation, as *E. leucoxylon* only occur where underground water is shallow but fresh.

Open Saline Wetlands – Limited Stress

Wetlands in the west appear less saline and form distinct enclosed depressions within the Pink Gum Woodland plain. Wetlands are dominated by *M. halmaturorum* which forms dense closed shrublands. Sandy areas in and around wetland areas may be vegetated with *Baumea juncea* and *Chorizandra enodis* sedgeland, a plant association which is recognised as threatened in the Upper South East Biodiversity Plan (Croft *et al.* 1999).

There is some evidence of increasing salinity stress in low lying areas, with sparse canopies in *M. halmaturorum* and the presence of samphire in place of *Gahnia* species within the understorey. *E. fasiculosa* in this area shows little evidence of stress.

Enclosed Saline Wetlands – Widespread Stress

The south-western corner of the Coastal Plain is characterised by well-defined, enclosed, intermittently-flooded wetland depressions. The largest wetland in this area is Lake Ellen, which is located on the western boundary of the PWA.

The absence of sedges and *Melaleuca* species at the base of these wetlands is indicative of naturally waterlogged and saline conditions. However, there are dead tea trees in the lower parts of many wetlands in this area, indicating a relatively recent change (10 to 30 years) in the underground water conditions. *M. halmaturorum* in the central part of the wetlands are dead or in very poor condition with fringing plants showing sparse canopies. In extreme cases the fringing *E. fasiculosa* in some wetlands are dead. Rising underground water may have caused this change by progressively waterlogging the roots of plants up the elevation gradient of the wetland fringe.

The impact of this trend is particularly severe in wetlands that are grazed. In the long term, a permanent rise in the water table may be accommodated by native vegetation if there is room for populations to migrate up the elevation gradient and become established in new areas, which feature a suitable underground water environment. Where wetlands are grazed, new plants cannot become established, and as vegetation is eliminated at the low elevation end, its spread upwards is prevented. Ultimately, the local population becomes extinct.

Enclosed Intermediate Saline Wetlands – Limited Stress

West of Tintinara, wetland basins are well defined and enclosed. *E. fasiculosa* grows to the edge of wetlands where *M. brevifolia* and *G. filum* become dominant. *Lepidosperma* species are present in wetland areas, indicating relatively fresh underground water conditions.

There are few signs of stress in this area, with the vegetation generally appearing healthy.

A summary of the characteristics of these wetland classes and underground water related impacts is shown in Table 2.1. The greatest impacts to these wetlands are from water table rise due to removal of native vegetation and subsequent increase in salinity and/or waterlogging in some areas.

Table 2.1: Summary of the Characteristics of Wetland Classes

Wetland Class	Structure	Dominant Species	Evidence of Underground Water Impacts
1. Enclosed Freshwater Wetlands- Limited Stress	enclosed depression	*Eucalyptus leucoxylon / Phragmites australis*	Little evidence of stress
2. Open Intermediate Saline Wetlands – Limited Stress	open depression	*Melaleuca brevifolia / Gahnia filum*	Some signs of death in *Melaleuca brevifolia* in base of wetlands, replacement of *Melaleuca brevifolia* and *Gahnia filum* by samphire.
3. Open Saline Wetlands – Widespread Stress	open depression	*Melaleuca brevifolia* / Samphire	Death of *Melaleuca brevifolia* and widespread samphire shrublands.
4. Open Saline Wetlands – Limited Stress	open depression	*Melaleuca brevifolia / Gahnia filum*	Sparse canopies in *Melaleuca brevifolia*, replacement of *Gahnia* filum with Tall Wheat Grass, Samphire and bare ground.
5. Enclosed Saline Wetlands – Widespread Stress	enclosed depression	*Melaleuca brevifolia / Melaleuca halmaturorum*	*Eucalyptus leucoxylon* and *Eucalyptus fasiculosa* dead or in poor condition
6. Enclosed Intermediate Saline Wetlands – Limited Stress	enclosed depression	*Melaleuca brevifolia*	Little evidence of stress.

Phreatophytes

Phreatophytic vegetation is vegetation that exists specifically due to the presence of underground water or episodic flooding that leads to some remnant surface water. Underground water sustains deep-rooted phreatophytic plants in an otherwise dry environment. Phreatophytic vegetation is often closely associated with wetlands.

Scattered trees have been identified as a special habitat throughout the South East region of South Australia. These are important for mammal, bird and invertebrate diversity. *Eucalyptus fasiculosa* (Pink Gum) and *Eucalyptus leucoxylon* (SA Blue Gum) have a high nectar production that is important for nectar feeding birds and insects. Mature trees contain hollows that provide habitat for birds and mammals.

E. leucoxylon ssp. *pruinosa* appears to require shallow underground water (<5 metres) of a low salinity (<3,000 mg/L), growing in heavier soils in the Upper South East. *E. leucoxylon* ssp. *stephaniae* grows in a mallee habit on poor sites in sand dunes to the north east of the coastal plain south of Lake Albert. In these areas the underground water depth is >20 metres so it is unlikely that this subspecies is dependent on underground water.

E. fasiculosa does not appear to be exclusively dependent on underground water. A key factor governing its distribution may be the presence of free draining soil. From the

survey results (conducted in July 2001, (URS 2001)), no clear relationship was observed between existing underground water conditions and tree health. This could mean that *E. fasiculosa* is able to accommodate a wide variety of underground water depths and salinities or it may be a reflection of the lag effect in ecological response and the trees may start to show signs of stress in the future. Figure 7 *(Appendix of Figures and Tables)* illustrates the remaining native vegetation cover in the Tintinara Coonalpyn PWA.

Dissolution Features

There is no information available regarding the ecology of the dissolution features in the Tintinara Coonalpyn PWA. It should be noted however that unusual and possibly endemic aquatic cave fauna have been found in other parts of the South East of South Australia.

Hypogean ecosystems

These macro-invertebrate and microbial ecosystems, where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Coastal Plains Land Unit, however it is possible for these ecosystems to be present in this area.

Rare and threatened species

Rare or threatened species that are associated with the underground water dependent ecosystems of the Coastal Plain are shown in Table 2.2.

Table 2.2: Rare and Threatened Flora and Fauna in the Coastal Plain Associated with Underground Water Dependent Ecosystems. Information from Croft (1999), BDBSA (2011).

Common Name	Scientific Name	Conservation Ratings*	Groundwater Dependent Ecosystems Habitat Requirement	Presence in Coastal Plain
Red Necked Wallaby	*Macropus rufogriseus*	SA (Rare)	Eucalypt woodlands with shrub understorey and tall coastal shrublands	Reported from south east corner of area
Beautiful Firetail	*Stagonopleura bella*	SA (Vulnerable)	*E. leucoxylon*, coastal and sub-coastal *Melaleuca brevifolia, M. halmaturorum*	Reported in remnant vegetation areas across South East
Little Lorikeet	*Glossopsitta pusilla*	SA (Rare)	*E. leucoxylon* / *E. fasiculosa* Woodland and scattered trees	Reported from southern part of area
Mallee Fowl	*Leipoa ocellata*	A (Vulnerable); SA (Endangered)	Large remnants of native vegetation (>1000 ha) including *E. fasiculosa* Woodland	Potential habitat identified
Shy Heathwren	*Hylacola cauta*	SA (Rare)	Mallee over heath	Reported from *E. fasiculosa* woodland south of Coombe
Metallic Sun-orchid	*Thelymitra epipactoides*	A (Endangered); SA (Endangered)	*Eucalyptus leucoxylon* spp *leucoxylon*, Callitris preissii, *Allocasaurina verticillata* Grassy Woodlands or *Eucalyptus diversifolia* Mallee with an understorey of *Kunzea pomifera* and *Lepidosperma carphoides.*	Reported in the Tintinara Scrub and the Tintinara Area School Community Nature Reserve.
Inland Green-comb Spider-orchid	*Caladenia tensa*	A (Endangered); SA (Endangered)	*Eucalyptus diversifolia* Mallee with an understorey of *Kunzea pomifera* and *Lepidosperma carphoides.*	Reported near Tintinara.

*A=Australia, SA = South Australia.

Mallee Highlands Land Unit

Perched Wetlands

Perched wetlands occur in the Mallee Highland Management Area in isolated depressions surrounded by mallee or heathland vegetation. They occur in corridors between dunes where drainage is restricted by shallow underlying clay layers. The soils are highly calcareous and sometimes overlain by freely draining sand. The areas are readily waterlogged following rainfall and are occasionally saline.

Examples of perched wetlands include Bucks Camp Soakage and Rabbit Island Soakage, both of which lie in the south-west area of Ngarkat Conservation Park and feature *Melaleuca lanceolata* low Shrubland. Bucks Camp Soakage lies more than 40 metres above the unconfined water table, but provided sufficient water to warrant construction of a shallow well, which is now abandoned. Other sites within the park have also been identified from remnant vegetation mapping. In the Hundreds of Makin and McCallum typical plant species of perched wetlands are Broad-leaved Box (*Eucalyptus behriana*) and Peppermint Box (*Eucalyptus odorata*).

The area of perched wetlands is generally too small to be identified in the Floristic Vegetation Mapping Database as a distinct plant association and the extent of distribution in the study area is not known.

Shallow clay layers are widespread in the Mallee Highland. Depth to clay data for the Tintinara Coonalpyn PWA has been assessed from 174 drilling logs from wells throughout the area by Leaney (1999). This data indicates that approximately 40% of the Tintinara Coonalpyn PWA is at potential risk of waterlogging (URS 2001).

The dominant species in perched wetlands is *Melaleuca uncinata* (Broombush). This species tolerates a wide range of conditions and also occurs sparsely in vegetation associations, which are independent of underground water. However, when they occur densely they may indicate perched water tables. Where sand is present, *M. lanceolata* (Dryland Tea Tree) may also occur together with various Mallee Eucalypts (Litchfield 1956).

Rare and threatened species associated with perched underground water ecosystems in the Mallee Highland are presented in Table 2.3. Wilson's Honey Myrtle *(Melaleuca wilsonii),* a plant with a National and South Australian conservation significance, is strongly associated with perched wetlands in the area. Perched wetlands are at risk from possible irrigation drainage causing water logging and or contamination from pesticide or fertiliser run-off.

Table 2.3: Rare and Threatened Flora and Fauna in the Mallee Highland Associated with Underground Water Dependent Ecosystems. Information from Croft (1999), The Nature Conservation Society (2000), Kahrimanis *et al.* (2001), BDBSA (2011).

Common Name	Scientific Name	Conservation Ratings*	GDE Habitat Requirement	Presence in Mallee Highland Management Area
Slender-billed Thornbill	*Acanthiza iredalei hedleyi*	SA (Vulnerable)	*Melaleuca brevifolia* shrublands.	Reported from Ngarkat / Mt Rescue Conservation Parks.
Mallee Fowl	*Leipoa ocellata*	A (Vulnerable); SA (Endangered)	Large remnants of native vegetation (>1000 ha) including *Melaleuca uncinata* Shrubland.	Shrublands linked to known Malleefowl habitat in Ngarkat and Mt Rescue Conservation Parks.
Wilson's Honey-myrtle	*Melaleuca wilsonii*	SA (Rare) SE (Rare)	*Melaleuca uncinata*	Reported from remnants in the region.
Cleland's beard-heath	*Leucopogon clelandii*	SA (Rare) SE(Rare)	*Melaleuca uncinata*	Reported from remnants in the region.
Inland Green-comb Spider-orchid	*Caladenia tensa*	A (Endangered); SA (Endangered)	*Eucalyptus diversifolia* Mallee with an understorey of *Kunzea pomifera* and *Lepidosperma carphoides.*	Reported in the 90 mile desert (1.5 kilometres south of Mount Rescue).
Coast Spider-orchid	*Caladenia conferta*	A (Endangered); SA (Endangered)	*Eucalyptus diversifolia / E. incrassata* Mallee *Melaleuca uncinata* open sites.	Rabbit Island Soak, Ngarkat Conservation Park.

*A = Australia, SA = South Australia, SE = South East of South Australia.

Phreatophytes

The depth to the water table in the Mallee Highlands is generally >20 metres, therefore *E. leucoxylon* and *E. fasiculosa* communities are unlikely to be affected by water table elevation.

The rate of water table elevation in the area between Coonalpyn and the southern boundary of the Mallee Highland zone may have detrimental effects on trees with roots >10 metres. These effects include water logging and salt stress and may occur within 10-50 years.

E. fasiculosa may also be at risk from salinity and water logging in the north east of the Hundred of Coombe due to the relatively shallow underground water.

Elsewhere in the Mallee Highlands land unit, surface vegetation is not expected to be adversely affected by an increase in underground water salinity.

Dissolution Features

In the Coonalpyn area, more than 30 significant holes have been reported which are open at the surface and may extend to the water table. Cavities have also been encountered while drilling wells north of Tintinara. There is no information available regarding the ecology of the dissolution features in the Tintinara Coonalpyn PWA. It should be noted however that unusual and possibly endemic aquatic cave fauna have been found in other parts of the South East.

Hypogean Ecosystems

These macro-invertebrate and microbial ecosystems, where present, occur underground within the water filled pore spaces of the aquifer system. There are no records of such ecosystems within the Mallee Highlands land unit. However, these ecosystems are likely to be present.

2.2 Ecosystem Water Requirements

The water requirements of ecosystems can be defined as the water availability and quality on which ecosystems depend, and must account for the variability inherent in that dependence. The defining of water requirements is complex because the availability and quality of underground water varies spatially and temporally. Water table elevations fluctuate seasonally and according to long-term climatic trends. The proximity of underground water to the surface varies according to topography, vegetation cover and hydraulic gradients. Underground water salinity, a key water quality variable in the Tintinara Coonalpyn PWA, varies across the landscape and according to the proximity of underground water discharge sites such as wetlands.

It is due to these complexities that there has been no definitive determination of the availability and timing of water to ecosystems in the Tintinara Coonalpyn PWA. However, it is possible to define water requirements in terms of the regional processes that create the environment that ecosystems require. In this way, definitions can account for the requirements of all the component species and ecological processes. Whilst this is currently the case, it is acknowledged that this is a knowledge gap that can be addressed in the future as resources become available.

The underground water conditions of the Tintinara Coonalpyn PWA are currently in a state of change. The ecosystems have begun to respond to the change in underground water conditions and some are showing symptoms of stress. However due to the lag effect (i.e. the time lag between a change in underground water condition and the ecosystem response), ecosystems are presently not in equilibrium with current underground water conditions. If underground water conditions were maintained in their current state, ecosystem status would continue to change until they reached a new state of equilibrium.

Preservation of ecosystems in their current state will actually require the restoration of underground water conditions to a previous state. This objective assumes that it is possible to reverse past change in underground water conditions. The optimum water requirement would be the underground water conditions that the ecosystem experienced prior to any post-settlement disturbance.

For the purpose of this assessment, the following definitions have been applied:

The **Minimum Water Requirement** is the quantity and quality of water required to sustain the extent, component species and processes of ecosystems in their current state without further degradation.

The **Optimum Water Requirement** is the quantity and quality of water required to restore the extent, component species and processes of ecosystems to their pre-settlement condition. This is an ideal condition, which may be achievable only to the extent that underground water conditions are reversible and that other degrading factors, such as weed invasion, may be controlled.

Throughout much of the Tintinara Coonalpyn PWA it has not been possible to quantify ecosystem water requirements. This limitation largely relates to the lack of historical water quality and quantity data. Due to lack of quantitative data the needs of dependent ecosystems in the Tintinara Coonalpyn PWA have been expressed in largely qualitative terms. Ongoing monitoring and research is critical to clarify the particular needs of specific ecosystems.

The key threats to ecosystems are rising water tables and increasing underground water salinity. In addition there is a risk of adverse impacts on ecosystems from potential irrigation drainage to perched wetlands in the Mallee Highlands. If these processes are managed appropriately, the water requirements of dependent ecosystems will be provided.

Water requirements for the water dependent ecosystems in the Tintinara Coonalpyn PWA are described in Table 2.4.

Table 2.4: Water Requirements of Water Dependent Ecosystems

Land Unit	Water Dependent Ecosystems	Environmental Water Requirements		
		Description	**Minimum Requirement**	**Optimum Requirement**
Coastal Plain	Wetlands & Phreatophytes (e.g. *E. leucoxylon* and *E. fasiculosa*)	Underground water levels must be maintained such that they do not increase the duration and frequency of water logging beyond the range of natural variability. Salinity levels of underground water must be kept within ecosystem tolerance levels.	Water table at 1-2 metres above the level prior to post-settlement disturbance.	No rise from the water table level prior to post-settlement disturbance.
	Dissolution features and Hypogean environments	Changes in underground water levels and quality must not affect fauna and flora (if present).	Unknown.	No rise from the water table level prior to post-settlement disturbance.
Mallee Highlands	Perched wetlands	Irrigation drainage should not increase duration, frequency or timing of waterlogged conditions beyond the range of natural variability. Irrigation drainage should not increase levels of salinity, agricultural chemicals or other pollutants.	Maintain current water quality and availability conditions.	Conditions prior to post-settlement disturbance.
	Phreatophytes (e.g. *E. leucoxylon*)	Water table must be kept at levels that do not cause water logging and salt stress.	Depth to groundwater no less than 10 metres.	Conditions prior to post-settlement disturbance.
	Dissolution features and Hypogean environments	Changes in underground water levels and quality must not affect fauna and flora (if present).	Unknown.	Conditions prior to post-settlement disturbance.

Underlying all underground water-related threats to ecosystems in the Coastal Plain is rising underground water levels. It is estimated that current water levels are 2-3 metres higher than levels prior to native vegetation clearance. It is estimated that the provision of minimum water requirements would require a reduction in the current average annual elevation of the water table by 1-2 metres (URS 2001).

The requirements of perched wetlands for water quality and availability will vary from site to site. Conditions will also be very dependent on rainfall. It is difficult to quantify water requirements for such a diverse range of conditions. Water requirements have been described in terms of maintaining natural conditions and managing key risks such as irrigation drainage impacts. Reducing the rate of water table rise in the Mallee Highlands would protect phreatophytes at risk of waterlogging and rising salinity.

Maintenance of Ecosystem Water Requirements

In the Tintinara Coonalpyn PWA it is not realistic to implement the optimum water requirements as even a major change in land-use through revegetation may not achieve the required reduction in the elevation of the water table. For example the current water table elevation is higher than the most recent observed steady state condition in the Coastal Plain land unit. To implement the optimum water requirement for the underground water dependent ecosystems of this land unit would require reducing current water table elevations by 2 - 3 metres.

Where possible, management should aim to meet the minimum requirement of dependent ecosystems, in an attempt to ensure that their current condition is not further degraded. The underground water ecosystems at high risk (outlined in Table 2.5) should be given priority when setting management action. However, it is important to consider that the taking and use of water may have little or no part to play in reaching these management targets, particularly where they involve addressing a past increase in water table levels, which has resulted from the broad-scale clearance of native vegetation. In this instance, management actions beyond the scope of this Plan may need to be considered.

Protection of Ecosystem Water Requirements

To provide security to the water needs of water dependent ecosystems on the coastal plain land unit, water levels are monitored on a regular basis. The Plan requires that the development of new allocations or the transfer of existing allocations undergo assessment to ensure that at the proposed point of taking, the extraction of an allocation will not cause a significant drawdown of water levels that would significantly impact underground water dependent ecosystems.

The majority of underground water dependent ecosystems are located in the Boothby Management Area, where there has been no development of the unconfined aquifer to date.

Table 2.5: Summary of Underground Water Trends and Key Ecological Risks for the Ecosystems of Tintinara Coonalpyn PWA

Impacts on Underground Water	Evidence	Enclosed Wetlands	Shallow Wetlands	*E. leucoxylon*	*E. fasiculosa*	Perched Wetlands
Rising Water table	- underground water monitoring trend evident in well no. RIC 002 (See Figure 8, *Appendix of Figures and Tables)* - death of tea tree at the base of wetlands	HIGH RISK - low lying vegetation drowned - migration of fringing vegetation prevented when grazed - waterlogging of fringing trees	LOW RISK - waterlogging of vegetation	HIGH RISK - death of trees	HIGH RISK - death of trees	
Increasing Underground Water Salinity	- poor tree health in open wetlands - presence of samphire in understorey of degraded tea tree - inference from rising underground water	LOW RISK - wetlands are already saline - some risk to perimeter vegetation	HIGH RISK - replacement of tea tree vegetation by samphire	HIGH RISK - death of trees	HIGH RISK - death of trees	
Grazing	- distinct demarcation of vegetation at perimeter of wetlands	HIGH RISK - increased pressure on stressed ecosystems	HIGH RISK - increased pressure on stressed ecosystems	LOW RISK - ringbarking and root compaction	LOW RISK - ringbarking and root compaction	
Irrigation Drainage	- no evidence					HIGH RISK - possible death of *Melaleuca uncinata* and *Eucalyptus fasiculosa*

Identification of Ecosystems of High Ecological Importance

The Plan proposes to protect the underground water dependent ecosystems of high to very high ecological importance in the Tintinara Coonalpyn PWA. Currently, no underground water dependent ecosystems of high to very high importance have been identified within the Tintinara Coonalpyn PWA. However, some important wetlands have been identified adjacent to Boothby Management Area in the Hundreds of Messent and McNamara (Figure 9, *Appendix of Figures and Tables*) and it is possible that some may be identified in the PWA in the future. Protection of these wetlands will occur where the following circumstances apply:

a) the wetland is considered by the relevant authority to demonstrate a level of dependence on underground water;

b) at the date of application for the taking or use of water, the wetland is listed as of high or very high ecological value in the South Australia Wetland Inventory Database (SAWID) for the South East,

c) the proposed underground water extraction point is within 2.25 kilometres of the wetland, as determined by a 16 km^2 circle centred on the proposed point of taking of the allocation intersecting the wetland as mapped in the SAWID; and

d) the wetland is considered by the relevant authority to be under significant or actual threat of degradation identified by, but not limited to, a mean (arithmetic) decrease in underground water levels of greater than 0.05 metres/year (measured over the preceding five years) in the nearest observation well or wells.

The Dependent Ecosystems Equation

In the event that any underground water dependent ecosystems of high or very high ecological value are identified, the Plan proposes to protect the underground water conditions by means of the Dependent Ecosystems (DE) equation.

The DE equation protects underground water availability to underground water dependent ecosystems by requiring that any new wells (or increases in extraction) be located a sufficient distance from the wetland so as to ensure that no localised declines in water tables will occur.

The equation takes into account the distance between the proposed point of taking and the underground water dependent ecosystem (as mapped in the SAWID), the volume of water proposed to be extracted and the local aquifer characteristics, among other parameters, to determine whether the taking or use of water at that point will have a detrimental effect on water levels (identified as a 0.1 metre decline) in the vicinity of the underground water dependent ecosystem. As a result, the minimum setback distance for new wells or a maximum volume that can be extracted from a well can be determined for any point in the vicinity of the wetland.

The Plan requires that this distance is calculated using the DE equation in the case of ecosystems identified for protection from water affecting activities by applying the criteria listed above.

The DE equation is derived from the Theis well equation shown below (REM 2006).

$$s = \frac{Q}{4\pi KD} W(u) \qquad \text{where} \qquad u = \frac{r^2 S}{4KDt}$$

The input parameters for the DE equation are described in Table 2.6 below (REM 2006).

Table 2.6: Input parameters for calculating the required setback distance for underground water extraction in the vicinity of underground water dependent ecosystems identified for protection (REM 2006)

Parameter	Data source
r, distance from pumping well (in metres)	Determined from application for allocation transfer
Q, pumping rate (m^3/day)	As above
KD, aquifer transmissivity (m^2/day) determined as hydraulic conductivity (K, m/day) x aquifer thickness (D,m)	Based on geometric mean of the available data per Management Area or (where available) individual site
S, specific yield	As above (for KD)
t, time over which pumping takes place (days)	Based on length of irrigation seasons in the Upper South East: 66 days(REM 2006)
u, dimensionless parameter of the Theis well function	$= \frac{r^2 S}{4KDt}$
W(u), the Theis well function (known as the exponential integral, E1, in non-hydrogeology literature).	$= -0.5772 - \ln(u)$
s, drawdown at distance *r* from pumping well (in metres)	Maximum drawdown allowed: 0.1 metres

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3. Assessment of the Effects on Other Water Resources

As required by section 76(4)(a)(ii) of the Act, this section provides an assessment as to whether the taking or use of water from the resource will have a detrimental effect on the quantity or quality of water that is available from any other water resource.

This section assesses the potential detrimental impact of taking or using water from the Tintinara Coonalpyn PWA upon the quantity or quality of water from other water resources in the Tintinara Coonalpyn PWA and adjacent PWAs. Within the Tintinara Coonalpyn PWA, this section considers the potential for impacts upon wetlands and the possibility of impacts arising from the relationship between the unconfined and confined aquifers.

Water resources within the Tintinara Coonalpyn PWA other than the unconfined and confined aquifers comprise Coastal Plain wetlands and Mallee Highland perched wetlands.

The potential detrimental impacts that taking, or using, water from the Tintinara Coonalpyn PWA may have on the quantity or quality of water of another resource and vice versa, were considered in the following situations:

a) the impact that taking underground water from both the unconfined and confined aquifers may have on each other; and

b) the impact that taking underground water from both the unconfined and confined aquifers may have on adjacent water resources, prescribed or not.

As the effects of point source recharge to the unconfined aquifer are localised it is unlikely that there would be any impacts across water management boundaries.

There is the potential to contaminate the unconfined aquifer with nutrients including those ions or organic compounds containing nitrogen and phosphorus. These can come from fertilisers or sewage that may be collected by run-off which flows directly into the aquifer. As this type of contamination can also occur through diffuse recharge processes it would be difficult to pinpoint an individual source.

3.1 Coastal Plain Wetlands

The Coastal Plain Wetlands (including enclosed and open freshwater, saline and intermediate wetlands) of the PWA are at risk of rising water tables. Any use of the unconfined aquifer underground water resource that leads to a decline in the water table (a drawdown) will mitigate dryland salinity and may be of benefit to these wetlands. However, where confined aquifer underground water is used, drainage may contribute to the rising water table and increase the risk of water logging the wetland vegetation.

3.2 Mallee Highland Perched Wetlands

A number of perched wetlands exist between the dunes in the Mallee Highlands of Tintinara Coonalpyn PWA. They sit above the unconfined aquifer so they are not at risk of a rising water table but they are at high risk of pesticide or nutrient contamination from irrigation drainage water.

3.3 Impact of Using the Unconfined Aquifer

Impact on the Confined Aquifer

The aquitard which separates the unconfined and confined aquifers in the Tintinara Coonalpyn PWA is generally more than 20 metres thick and has a very low vertical permeability. Where the pressure head in the unconfined aquifer is higher than the pressure head in the confined aquifer (Sherwood Management Area), the low permeability would inhibit downward leakage to the confined aquifer. It is therefore unlikely that any use of or impact on the unconfined aquifer would directly affect the confined aquifer.

Impact on Water Resources Adjacent to the Tintinara Coonalpyn PWA

The underground water has a salinity of over 20,000 mg/L in the western part of the Tintinara Coonalpyn PWA, so there are no known extractions and hence no impacts on resources to the west of the Tintinara Coonalpyn PWA. To the north, there are large areas of uncleared native vegetation and therefore any impacts are inconsequential to other water users in these areas.

There may be small drawdown impacts on adjacent resources if extractions are concentrated close to Tintinara Coonalpyn PWA boundaries to the south and the east (Tatiara PWA). This also applies to the northeast boundary of the Hundred of Carcuma (Mallee PWA).

Because of the east-west underground water movement, extractions in the Tintinara Coonalpyn PWA will not cause any salinity impacts on resources adjacent to the PWA. However if the drawdowns become extensive, a reversal of the underground water movement may result causing saline water from the west to flow into the PWA.

3.4 Impact of Using the Confined Aquifer

Impact on Unconfined aquifer

As discussed in section 3.3 above, it is unlikely that extraction from the confined aquifer would directly impact on the unconfined aquifer because of the low permeability aquitard.

However, there is a possibility of an indirect impact on shallow water tables beneath areas irrigated from the confined aquifer west of Tintinara. To date there is no evidence of water table mounding occurring beneath these areas.

In the Tauragat Management Area there is some evidence (Leaney 2000) to suggest that irrigation could be accelerating the flushing of salt from the unsaturated zone down to the water table, with the long term potential to increase the salinity of the unconfined aquifer. Over most of the area, however, the unconfined aquifer is already too saline for irrigation use.

Impact on Water Resources Adjacent to the Tintinara Coonalpyn PWA

Like the unconfined aquifer, there will be no impacts to the west of the Tintinara Coonalpyn PWA as due to the high salinity in the confined aquifer there are no

licensed extractions. There will be no impact to the east and north of Kynoch Management Area due to there being no extractions from the confined aquifer in Kynoch Management Area.

There may be drawdown impacts to the south of the Tintinara Coonalpyn PWA caused by extraction within the PWA. These will be inconsequential because there are only small volumes extracted for industrial purposes and no allocations have been granted for irrigation purposes from the confined aquifer in the Tatiara PWA.

Olive irrigation in the Tauragat Management Area does not currently, but may in the future, cause drawdowns to extend across the PWA boundary to the north in the Hundred of Peake, in the Peake, Roby and Sherlock PWA. However, drawdowns in the Hundred of Peake are more likely to be caused by developments within that Hundred. This development and associated drawdowns may be addressed in the future Water Allocation Plan for the Peake, Roby and Sherlock PWA. Several small irrigated olive developments already occur in the area, causing a small drawdown.

References

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4. Capacity of the Resource to Meet Demands

As required by section 76(4)(d) of the Act, this section provides an assessment of the capacity of the resource to meet the demands for water on a continuing basis. Additionally, section 76(4)(c) of the Act stipulates that this Plan must, in providing for the allocation of water, take into account the present and future needs of the occupiers of land in relation to the existing requirements and future capacity of the land, and the likely effect of those provisions on the value of the land.

4.1 Demands

The future water use requirements in the Tintinara Coonalpyn PWA are unlikely to substantially increase over the long term as most Management Areas are close to or are fully allocated. However, due to climatic variability the annual water use in the PWA is highly variable, with the timing and volume of rainfall playing a large role in determining the volumes of water extracted for irrigation in any given year. There are currently two Management Areas in the Tintinara Coonalpyn PWA that are over allocated, being Tintinara and Tolmer. Licences in these Management Areas will be required to be reduced over the life of the Plan so that the resource is managed sustainably. There is also a provision in this Plan that if resource conditions continue to deteriorate (for example, due to a greater reliance on the underground water resource as a result of drier conditions), licences in Tintinara and Tolmer Management Areas can be further reduced until the implementation of a new amended WAP.

Environmental

The Tintinara Coonalpyn PWA has a range of ecosystems that have different requirements in regard to underground water. The major threat to these ecosystems is rising underground water levels and salinity due to the historical clearance of native vegetation in the region. In the south west of the PWA underground water levels are significantly higher compared to the water levels prior to post settlement disturbance. The rise in underground water levels has resulted in many of the remaining ecosystems in the PWA being threatened by water logging and or increasing underground water salinity levels.

The minimum water requirements of the underground water dependent ecosystems on the Coastal Plain is a decrease in underground water levels of 1 - 2 metres. To achieve a decrease in underground water levels, policy and action outside of the Water Allocation Plan is required. The Tintinara-Coonalpyn Land and Water Management Plan (Tintinara-Coonalpyn LWMP Committee 2006) outlines strategies to be undertaken to minimise underground water recharge in the region. Projects are being carried out in the region to increase the use of perennial pastures and clay spreading to reduce recharge under dryland farming.

To ensure that the water levels of the unconfined aquifer in the future are not lowered beyond the level required by the underground water dependent ecosystems, a depth to water level trigger (as described in principle 38, section 6) has been included in this Plan.

Water needs of Aboriginal people for social, cultural and spiritual purposes

Access to, and use of, water from prescribed water resources by Aboriginal people for the purpose of social, cultural or spiritual use is exempt from licensing, provided that the taking does not involve stopping, impeding or diverting the flow of water for the purpose of collecting the water, or diverting the flow of water from water resources.

The traditional owners of the land that is now the Tintinara Coonalpyn PWA are the Ngarkat and Ngarrindjeri people. The underground water soaks and rock holes within the Tintinara Coonalpyn PWA were traditionally used as water sources, with middens providing evidence of regular use. The water soaks and surrounding areas are of cultural significance to the traditional owners of the land along with the wetlands and native vegetation that relies on underground water. To ensure that these areas are protected both now and in the future it is important to ensure that the use of underground water in the Tintinara Coonalpyn PWA does not significantly impact upon these areas, and that continued monitoring identifies any future threats.

The current and future needs for water by Aboriginal people have not been identified or quantified at this time. Representatives of all traditional owners in the South East region are working closely with the South East Natural Resources Management Board through the South East Aboriginal Focus Group to identify and quantify these needs.

Stock Water Use and Domestic Water Use

It has been estimated that stock water use and domestic water use in the Tintinara Coonalpyn PWA is 1,500 ML for both the confined and unconfined aquifers. These figures are based on stock numbers for the 1996/97 season from the Australian Bureau of Statistics, multiplied by the average daily stock water consumption figures from the New South Wales Department of Agriculture. There is no data on domestic underground water use, but the extensive use of rainwater tanks would suggest this component is a very small fraction of the overall water budget. Stock water use and domestic water use is provided for in the calculation of the Target Management Level (TML) for the PWA to ensure that water resource is managed appropriately.

The future demand for stock water use and domestic water use in the PWA is not expected to vary much from current use. However demand will fluctuate on a yearly basis with seasonal and market conditions. The variation in stock water use and domestic water use will have a small effect on the relative magnitude of underground water use.

Pressure levels in the confined aquifer have reduced over recent years. This increase in the depth to water has impacted on stock water use and domestic water use wells, and has prevented some artesian wells from flowing. The reduction of pressure has also made accessing water from the confined aquifer more difficult especially from two-inch diameter wells that are possibly too small to be fitted with a pump. The reduction of pressure in the confined aquifer is not a threat to the sustainable use of the water resource, however the impact of a reduction to pressure levels can be significant for stock and domestic users and can result in wells having to be deepened, widened or pumps replaced.

Irrigation

Irrigation is by far the biggest water use in the Tintinara Coonalpyn PWA. A total of 6,928 hectares of irrigated crops were grown in the Tintinara Coonalpyn PWA in 2008/09. The major irrigated crop in the PWA is lucerne pasture with other irrigated crops including pasture/seed, olives and vegetables.

There will be no further water allocations granted from the confined or unconfined aquifers during the life of the Plan with the exception of water from the Boothby Management Area, where the Minister may make 20,000 ML available for allocation.

An area limiting policy has been in place in the PWA since the adoption of the 2003 Tintinara Coonalpyn WAP. The policy provided that water may only be used to irrigate an area no greater than the area which formed the basis for determining the allocation endorsed on the corresponding licence. The area limiting policy will be removed once allocations have been reduced in accordance with the Plan.

The demand for irrigation water has the potential to increase with the removal of the area limiting policy in the Tintinara and Tolmer Management Areas. There also is the opportunity for an increase in irrigation extraction in other Management Areas in the PWA as allocations are currently not fully utilised and extraction as a percentage of licensed allocation over the previous five years ranges from 57 to 80%.

There may also be an increase in demand for allocations from the confined aquifer over the next decade or so as salinities rise in the overlying unconfined aquifer, especially in the Tolmer Management Area (Hundreds of Coombe and Archibald). This potential increase in extraction would cause confined aquifer drawdowns to increase if new allocations were approved in the future.

To ensure that the use of water from the confined and unconfined aquifers in the Tintinara Coonalpyn PWA do not have a significant impact on the condition of the underground water resources, total allocations in the Tintinara and Tolmer Management Areas will be reduced during the life of this Plan prior to the removal of area limiting policy.

Industry and Recreation

The aggregate allocation for industry, aquaculture and recreational facilities from both the confined and unconfined aquifers totals 472 ML. Demand for water for industrial or recreational purposes may increase in the future, however it is difficult to predict the level of expansion that may occur.

Water for industrial and recreational use is also available from the River Murray via the Tailem Bend to Keith pipeline, however potential future restrictions on use of this water may be an incentive to source allocations from the unconfined and confined aquifers of the Tintinara Coonalpyn PWA.

4.2 Capacity of the Unconfined Aquifer

The Tintinara Coonalpyn PWA is divided into four unconfined aquifer Management Areas based on factors such as hydrogeology, topography, underground water usage and administration (Figure 5, *Appendix of Figures and Tables*). The following is an overview of the capacity of the unconfined aquifer to meet demand in each separate Management Area.

A set of triggers (resource condition, salinity and water level) have been designed to act as an early warning system with the intent of protecting the resource from degradation. Triggers are deemed to be exceeded when a certain resource, salinity or water level condition reaches a predetermined level or is changing at a certain rate that is deemed to have potential degrading effects on the resource.

New wells in the unconfined aquifer for all purposes other than industry, energy generation and public water supply must be located at least 2 kilometres from any other well. This buffer zone around existing irrigation developments is recommended to manage salinity, by allowing better throughflow of underground water by minimising drawdown, and to allow some dilution of underground water by recharge and dispersion (Barnett 2002).

Tintinara Management Area

The Tintinara Management Area comprises most of the Hundred of Coombe and parts of the Hundreds of Archibald, Coneybeer and Lewis. The depth to the Quaternary Limestone Aquifer ranges from 15 metres below the ground surface to less than one metre in areas of dryland salinisation.

Underground water extractions have generally stabilised between the years 2000 and 2005 at about 15,000 ML/year. Extraction decreased to just over 10,000 ML in 2005/06 due to the very wet spring delaying the commencement of irrigation. However, extraction increased to 28,458 ML in 2007/08 due to dry conditions.

Water level monitoring in the Management Area has shown a declining trend in water levels over the past 5 years in response to irrigation extraction and below average rainfall. The water level resource condition trigger of a mean (arithmetic) net change in underground water levels of 0.1 metres/year measured over the preceding five years, has been exceeded by all of the eighteen observation wells within the Management Area. The average rate of decline for the ten observation wells located in irrigation areas was 0.22 metres/yr over the past 5 years. In comparison, the eight observation wells drilled under the National Action Plan vegetation health project, which are located some distance from irrigated areas, registered an average water level decline of 0.25 metres/year over the past five years. The water level decline in the observation wells situated away from irrigation extraction indicates a significant climatic contribution to the decline in water levels.

Irrigation wells have shown that salinity trends in the Management Area are quite variable. In the eastern margins of the irrigation area salinity trends have been decreasing. This is most likely due to an inflow of lower salinity underground water from the east. Other salinity monitoring wells that have previously shown an increasing trend have now stabilised. Others are maintaining a slow rising trend. Regular sampling has shown that the salinity trigger of a mean increase in salinity of 2% over the preceding five years, has been exceeded by only four out of the twenty-six irrigation wells. There has been an overall average increase of 0.75%.

Underground water monitoring has indicated that at current levels of extraction the resource can meet demand. However, if extraction rates were to increase and the current below average rainfall were to continue it would be unlikely that the resource could meet demand (Barnett 2007).

Currently, there is a large gap between allocation and extraction in the Management Area which is caused by initial allocations being granted using theoretical information

available at the time. The Management Area is over allocated, but licensees are not extracting their entire allocation. This gap could make it difficult to implement future management strategies that may be required due to continued below average rainfall and climate change.

To ensure that the water resource is managed within sustainable limits, the TML for the Tintinara Management Area will be reduced by approximately 12,000 ML over the life of the Plan.

Coonalpyn Management Area

The Coonalpyn Management Area comprises the Hundred of Livingstone plus most of Carcuma, Coneybeer, Lewis and Archibald. The Murray Group Limestone Aquifer ranges from 15 to 60 metres below the ground surface with a current level of extraction from the aquifer just under 6,000 ML/year, which is well below the TML of 19,650 ML/year.

Water table monitoring across the Management Area shows that the rising trend in water levels observed since monitoring began in the 1980s is stabilising or falling slightly due to the lack of high recharge events since 1996. The water level resource condition trigger of a mean net change in underground water levels of 0.1 metres/year measured over the preceding five years has been exceeded by two of the seven observation wells. These two wells are located very close to the boundary within the Tintinara Management Area and have been affected by extractions from the adjacent Management Area.

The salinity trigger of a mean increase in salinity of 2% over the preceding five years was not exceeded by any of the five wells that are unaffected by irrigation, however the trigger was exceeded by two of the six irrigation wells sampled. Regular sampling of irrigation wells over the next five years will enable a better interpretation of salinity trends.

The main sustainability issue in the Management Area is the flushing of unsaturated zone salts down into the aquifer which contains low salinity underground water. The current management regime is to use a 2 kilometre buffer around existing areas of irrigation in order to minimise the increased flushing of salts observed under irrigation. Currently the capacity of the resource is considered to be sufficient to meet demand up to the TML.

Sherwood Management Area

The Sherwood Management Area is made up of the Hundreds of McCallum and Makin. The Management Area is bordered by the Ngarkat Conservation Park, the Mallee Prescribed Wells Area to the north and the Tatiara PWA to the south. The Murray Group Limestone Aquifer lies between 25-50 metres below the ground and is utilised for the centre pivot irrigation of lucerne and vegetables, and the drip irrigation of olives.

Monitoring of the observation wells across the Management Area is showing that water levels are relatively stable away from the impacts of irrigation, despite several years of below average rainfall. Monitoring wells closer to irrigation are showing gradual water level declines of 0.05 metres/year since 2000. The water level trigger of a mean decline of 0.1 metres/year over the preceding five years has not been exceeded by any of the twelve observation wells.

The salinity trigger of a mean increase greater than 1% per year was exceeded by two of the five observation wells. The salinity measurements in the two wells that have exceeded triggers are showing anomalous rises, and an examination of longer term trends shows that salinity levels are mainly stable. None of the recorded trends have adverse resource implications and more regular sampling is required over the next five years to enable a better interpretation of salinity trends.

The monitoring of the unconfined aquifer in the Sherwood Management Area to date has shown very little impact on the resource from current levels of extraction. New developments and transfers are limited by a 2 kilometre buffer around existing irrigation which will minimise future impacts. Given the predicted long term decline in the resource due to the flushing of salts from the unsaturated zone, it is considered that development of allocations up to the TML is well within the capacity of the resource.

Boothby Management Area

The Boothby Management Area comprises most of the Hundred of Richards as well as parts of Coombe and Coneybeer, to the west of Tintinara. The depth to water table is either at surface level or just below for much of the Management Area, with underground water salinities ranging from 8,000 mg/L to over 35,000 mg/L in areas of dryland salinisation. Currently there is no water allocated in the Management Area, however a TML nominally based on a recharge of 20,000 ML is available for allocation for innovative purposes in the future.

Table 4.1: Licensed allocations and unlicensed use for the unconfined aquifer in Tintinara Coonalpyn PWA (all in ML/year)

Management Area	Management Area Description	Stock & Domestic (ML/year)	TML (ML/year)	Licensed Allocations 2008/09 (ML/year)
Boothby	Includes most of Hundred of Richards and parts of Coombe and Coneybeer.	0	20,000	0
Coonalpyn	Hundred of Livingstone plus most of Carcuma, Coneybeer, Lewis and Archibald.	150	19,650	16,840
Sherwood	Hundreds of Makin and McCallum.	350	16,350	15,999
Tintinara	Includes most of the Hundred of Coombe and	500	26,500	32,376
	parts of Coneybeer, Lewis and Archibald.			
TOTAL		**1,000**	**82,500**	**65,215**

4.3 Capacity of the Confined Aquifer

The confined aquifer for the Tintinara Coonalpyn PWA has been divided into three Management Areas based on factors such as hydrogeology, topography, underground water usage and administration (Figure 6, *Appendix of Figures and Tables*). The following is an overview of the capacity of the confined aquifer to meet demand in each separate Management Area.

Tolmer Management Area

Tolmer Management Area is comprised of the Hundreds of Richards, Coombe and Archibald and parts of Coneybeer and Lewis. The confined aquifer in the Tolmer Management Area lies at a depth of about 60 metres below the surface and is the only water source suitable for irrigation west of Tintinara. The extraction of water from the confined aquifer has caused a reduction of pressure which has prevented some artesian stock water use and domestic water use wells from flowing. Due to the reduced pressure levels, accessing the water has become more difficult especially in two-inch diameter wells that are possibly too small to be equipped by a pump.

There are two processes that are affecting the pressure level in the confined aquifer: hydrostatic loading and underground water extraction, as detailed in Barnett (2007):

- *Hydrostatic loading* can be identified in areas where there is minimal underground water extraction from the confined aquifer. In these areas the trends in confined aquifer water levels closely follow the trends in overlaying unconfined water levels. This phenomenon is due to the weight of water in the unconfined aquifer pressing down on the confining layer, which in turn increases the pressure level of the confined aquifer.
- *Underground water extraction* levels have increased in recent years to 5,400 ML during the drought years of 2006 and 2007, which is approximately 70% of the TML, however the peak drawdown has since stabilised to about 5 metres.

Salinity monitoring of the confined aquifer in the Tolmer Management Area is showing that levels are relatively stable with a number of wells showing a slight decreasing trend which is possibly due to the inflow of lower salinity water from the east during peak drawdowns of water levels.

The main sustainability issue for the confined aquifer in the Tolmer Management Area is the prevention of excessive drawdown that could lead to inflows of higher salinity water from the west. The impact of drawdowns on other users (e.g. dryland farmers) and their pumping infrastructure is a separate issue which is not related to the sustainability of the underground water resource. The capacity of the resource to

meet demand is dependent on whether any adverse impacts on the water resource itself occur due to drawdown (Barnett 2007).

Currently there is no evidence to suggest that the resource cannot meet demand, however if use was to increase above current levels, and hydrostatic loading were to decrease, drawdown levels could increase to unsustainable levels. To ensure that drawdowns do not greatly increase, the TML for the Management Area has been reduced to 6,350 ML. The reduction to allocations will also ensure that the removal of the area limiting policy will not cause unsustainable levels of irrigated development to occur.

Tauragat Management Area

The Tauragat Management Area is in the northern section of the PWA and covers the Hundreds of Livingston, Carcuma, Coneybeer and Lewis. The confined aquifer in the Management Area is made up of three confined sub aquifers, the upper, middle and lower.

Water extracted from the confined aquifer in the Management Area is predominantly used for the irrigation of olive plantations, with most of the water sourced from the lower confined aquifer. Almost all water extracted for irrigation in the Management Area is extracted from the middle and lower sub aquifers, while the upper confined aquifer is used predominantly for stock water use and domestic water use.

Currently extraction from the confined aquifer is approximately 50% of the TML for the Management Area, with extraction slowly increasing as a result of the maturing olive trees.

Water levels in the three confined sub aquifers are monitored using the few available monitoring, irrigation and stock water use and domestic water use wells that have been completed in the three aquifers.

Observation well LVG 004 (See Figure 8, *Appendix of Figures and Tables)* is completed in the upper aquifer and is located 3 kilometres west of the olive plantations. The pressure level in this observation well has only fallen one metre since the irrigation of olives began. This implies that extraction from the lower and middle confined sub aquifers has little if any impact on underground water users reliant on the upper aquifer.

Observation well LEW 013 (See Figure 8, *Appendix of Figures and Tables)* is thought to intersect the middle confined sub aquifer and is located 7 kilometres south of the olive plantations. A drawdown of 10 metres has been recorded since irrigation of the olive plantations commenced.

The lower confined sub aquifer is monitored using well number 6926-00535 (See Figure 8, *Appendix of Figures and Tables)*, which is an unequipped irrigation well. A seasonal drawdown of 10 metres is apparent with a downward trend due to increasing extractions.

The current level of underground water extraction from these three sub aquifers is deemed to be within the sustainable limits of the resource, with none of the drawdown trigger levels exceeded over the previous five years. However expansion of one of the olive plantations has commenced with an increase in water demand toward full allocation levels. The development of the allocations from the upper, middle and lower sub aquifers will continue to be monitored and modelled over the next five years to ensure the resource is managed sustainably.

Kynoch Management Area

Currently there is no extraction from the confined aquifer in this Management Area as the unconfined aquifer is of high enough quality and quantity to satisfy current and future demands. There is no TML set for the Management Area currently as there are no observation or extraction wells in the area and the characteristics of the confined aquifer are unknown.

Table 4.2: Licensed allocations and unlicensed use for the Confined Aquifer in Tintinara Coonalpyn PWA (all in ML/year)

Management Area	Management Area Description	Stock & Domestic (ML/year)	TML (ML/year)	Current Licensed Allocations (ML/year)
Kynoch	Hundreds of Makin and McCallum.	0	0	0
Tauragat	Hundred of Livingston plus most of Carcuma, Coneybeer and Lewis.	150	11,150	11,000
Tolmer	Hundreds of Richards, Coombe and Archibald and parts of Coneybeer and Lewis.	350	6,350	7,435
	TOTAL	**500**	**17,500**	**18,435**

4.4 Climate Change

Climate change presents a significant challenge to South Australia.

While the water policy decisions included in this Plan were based on the most recent meteorological, hydrological and hydrogeological information and trends, the effects of climate change are not yet clearly understood and therefore it is difficult to know the consequences for future water allocation demand.

Since 1960 the mean temperature in Australia has increased by about 0.7^{o}C, with some areas experiencing warming of 1.5 - 2^{o}C in the last 50 years, with 2000 to 2009 the hottest decade on record. Australian average temperatures are projected to rise by 0.6 to 1.5^{o}C by 2030, and, if greenhouse emissions continue at current levels, by 2.2 to 5.0^{o}C by 2070. Warming is projected to result in an increase in the number of hot days (Bureau of Meteorology 2010).

While total rainfall on the Australian continent has been relatively stable, the geographic distribution of rainfall has changed significantly over the past 50 years,

with rainfall decreasing in south west and south east Australia (Bureau of Meteorology 2010).

In the South East region climate modeling has indicated a significant variation from the current weather pattern. Predicted changes include a continuation of the increasing trend in annual average temperatures and an overall decreasing annual rainfall (but with higher intensity rainfall events) most significantly in spring. Annual decreases in rainfall of up to 5% are predicted by 2030 and up to 40% by 2070 (CSIRO 2007).

Increasing temperatures and lower frequency, but higher intensity rainfall predictions are expected to lead to an increased demand for water and an associated increased length of irrigation seasons, potentially placing additional stresses on underground water resources. Therefore ongoing monitoring and technical investigations during the life of this Plan will be critical to reviewing the future sustainability of the underground water resource.

It is critical that water policy decision-makers apply precaution with effective risk and adaptive management and planning. Underground water resource condition triggers for both water level and salinity will enable adaptive management in the event that climate change is having an unforeseen adverse impact on the resource. This can be achieved in the future once a numerical underground water flow model has been developed for this area.

Management may lead to a change in planting seasons for annual crops to adjust and utilise the change in rainfall pattern. There may also be a demand for alternative crops to better suit the changed climatic conditions. Desirable characteristics of alternative crops are disease resistance, heat tolerance and lower water use.

References

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Bureau of Meteorology (2010). *State of the Climate,* www.bom.gov.au

CSIRO (2007). *Climate Change in Australia – technical report.*

Tintinara-Coonalpyn LWMP Committee (2006). *Tintinara-Coonalpyn Land and Water Management Plan.* South East Natural Resources Management Board, Mount Gambier, South Australia.

5. Definitions

Any terms used in this Plan that are defined in the Act have the definitions in that Act. In addition, for the purposes of this Plan, the following terms have the definitions set out below:

"Act" means the *Natural Resources Management Act 2004*.

"**Adjacent Management Area**" includes all Management Areas that adjoin the Management Area in which the allocation or licence was initially granted, including those that may lie within an adjoining Prescribed Wells Area.

"Adjoins" or **"Adjoining**" in relation to an allotment or Management Area means any part of the allotment or Management Area, that is contiguous with another allotment or Management Area and includes allotments or Management Areas that are separated only by a road, street, footpath, railway or thoroughfare.

"Adoption date or date of adoption" means the date that the Minister adopts this Plan.

"Allotment" means:

(a) the whole of the land comprised in a certificate of title including a community or development lot or common property within the meaning of the *Community Titles Act 1996* or a unit or common property within the meaning of the *Strata Titles Act 1988*;

(b) the whole of the land comprised in a registered conveyance of land that has not been brought under the provisions of the *Real Property Act 1886*;

(c) a separately defined piece of land that is delineated on a public map and separately identified by a number or letter (not being a piece of land that is identified in a Treasury receipt, certificate or other document or instrument of title as being part only of an allotment);

(d) two or more separately defined pieces of land that are delineated on a public map and that are identified in a Treasury receipt, certificate or other document or instrument of title as forming one allotment for the purposes of the *Real Property Act 1886*;

(e) a separately defined piece of land delineated on a plan of division for the purpose of enabling the separate ownership in fee simple of that land;

(f) a separately defined piece of land identified as an allotment for the purposes of the *Real Property Act 1886* in a plan prepared by the Registrar-General and accepted for filing in the Lands Titles Registration Office;

(g) where a primary plan of community division has been cancelled under Part 7 Division 3 of the *Community Titles Act 1996* or a strata plan has been cancelled under Part 2 Division 7 of the *Strata Titles Act 1988* – the land comprising the former community parcel or site shown on the plan.

"Ambient underground water" means the underground water (as that term is defined in the Act) that exists in the relevant aquifer, without any impact from recharged water (see definition of recharged water).

"Annual allocation" means the sum of the tradeable component and any delivery supplement, but does not include carry-overs or additional water transferred in temporarily for the purposes of managing seasonal variability.

"Annual water use report" means a report produced by a licensee and submitted to the DFW, Mount Gambier office, by 5 p.m., 31 July each year, in accordance with section 11 (*Monitoring*) of this Plan.

"Aquaculture" means the farming of aquatic organisms of any species, including their reproductive products and body parts, for trade, business or research purposes, but does not include an activity declared by regulation not to be aquaculture for the purposes of the *Aquaculture Act 2001*.

"Aquifer" means a rock or sedimentary layer that is sufficiently permeable to conduct groundwater to a well or spring.

"Aquifer storage and recovery" means a form of managed aquifer recharge in which water is stored in aquifers for subsequent recovery. Managed aquifer storage is the process of drainage or discharge of water directly or indirectly to a well for the purposes of refilling or replenishing the aquifer or for the purposes of aquifer storage and recovery.

"Aquitard" means a saturated but poorly permeable bed, formation, or group of formations that does not yield water freely to a well or a spring. An aquitard retards, but does not prevent, the flow of water to or from an adjacent aquifer.

"Base Allocation" means the volume of water issued under the 2003 Tintinara Coonalpyn WAP, excluding any delivery component.

"the Board" means the South East Natural Resources Management Board.

"Bryozoal" means the small fragments of fossilised coral (Bryozoa) that form the limestone aquifer.

"Cone of depression" means the radial decline of potentiometric levels or underground water levels around a point of water extraction from an aquifer.

"Confined Aquifer" means the saturated limestone sands and gravels of the Renmark Group Formation in the Murray Basin or any other aquifer located beneath these aquifers.

"Dam" means an excavation, wall or other structure designed to hold water diverted or pumped from a watercourse, a drainage path, aquifer or other source, and includes clay pits.

"Date of adoption" see **"Adoption date"**.

"Delivery Component" means a volume of water allocated in addition to a base allocation, expressed as a percentage of the base allocation.

"Delivery Supplement" means the volume of water in addition to the tradeable component that eligible flood irrigators are allowed to extract, subject to application, from the aquifer and which is assumed to return to the aquifer.

"Designated Area" means the area designated by the *Groundwater (Border Agreement) Act 1985.* This is a 40 kilometre wide strip bisected by, and extending the full length of, the border of South Australia and Victoria. It is divided in to 22 management zones. The Designated Area is adjacent to the Tintinara Coonalpyn PWA.

"Dissolution feature" means a cavity or cave formed by the dissolution of limestone by naturally occurring acids.

"Domestic water use" means the taking of water for ordinary household purposes, and includes the watering of land in conjunction with a dwelling not exceeding 0.4 hectares.

"Drawdown" means the occasional, seasonal or permanent lowering of the water table or reduction in pressure (head) of an aquifer resulting from the extraction of underground water.

"Ecosystem" means a community of organisms, which may include humans, interacting with one another and including the physical, chemical and biological processes inherent in their interaction and the environment in which they live.

"Enclosed wetland" means a wetland with a distinct boundary that lies in enclosed depressions.

"Environmental water requirement" means the water regime needed to sustain the ecological values of aquatic ecosystems, including their processes and biological diversity, at a low level of risk.

"Extenuating circumstances" means the death or serious illness of or serious injury to the licensee or, where the licence is held by a company, partnership or incorporated body, the death or serious illness or injury to a director, partner or office holder respectively, that prevents the licensee from using the allocation with the minimum of delay and in any case within 3 years of the date of the granting of the allocation.

"Farming" means the business of agriculture, pasturage, horticulture, viticulture, animal farming or any other business consisting of the cultivation of soils, the production of crops or the rearing of livestock and **"farmed"** has a corresponding meaning.

"Flood irrigation" (also known as 'lasered flood', 'surface irrigation' or 'border-check'), means any irrigation in which underground water is pumped or directed onto an irrigation bay or levelled land and flows uniformly across the bay or the land without the aid of sprinklers, drippers or other infrastructure.

"Groundwater" see **"Underground water"**.

"Groundwater dependent ecosystem" see **"Underground Water Dependent Ecosystem".**

"Habit" means the method of growth or general appearance of a plant.

"Hydraulic gradient" means the spatial variation in the effective elevation of the water table, which drives lateral flow in underground water.

"Hypogean Ecosystem" means the macro-invertebrate and microbial communities that occur within the water filled pore spaces of the saturated zone.

"Imported water" means water which has been brought into a Management Area by means of a pipe or other channel, and the water (including surface water) has been extracted and piped, or directed into a channel, under licence or permit under the Act, the *South Eastern Water Conservation and Drainage Act 1992* or the *Groundwater (Border Agreement) Act 1985* from the originating Management Area or

zones within the Designated Area. Imported water excludes water that would have, prior to diversion, formed part of the water balance of the prescribed resource.

"Industry" means the carrying on, in the course of a trade or business, of any purposes for, or incidental to:

(a) the making of any article (or part thereof);

(b) the altering, repairing, ornamenting, finishing, assembling, cleaning, washing, packing, bottling, canning or adapting for sale, or the breaking up or demolition of any article;

(c) the getting, dressing or treatment of materials;

(d) the keeping or husbandry of animals in a broiler shed, chicken hatchery, feedlot, kennel, piggery, poultry battery or other like circumstances, but not horse keeping; or

(e) the growing of plants in a greenhouse, by hydroponics or in a nursery.

"Invertebrate" means an organism with an external skeleton.

"Irrigation system type" means the specific type of irrigation system used to irrigate, for example flood irrigation, drip irrigation (sub-surface drip; micro-sprinklers; trickle; micro-jet) or spray irrigation (pivots – mobile, fixed, lateral move; sprinklers – overhead, under-tree, pop-up, fixed, portable; travellers – wheel line, mobile gun/spray).

"Licensee" means a person or entity who holds a water licence pursuant to section 146 of the Act

"Macro-invertebrate" means an invertebrate greater than 0.5 mm in length.

"Managed aquifer recharge" means the purposeful and actively managed recharge of water to aquifers for subsequent recovery and use or environmental benefit (see also: aquifer storage and recovery).

"Management Area" means the areas indicated as Management Areas:

- for the unconfined aquifer, a part of the Prescribed Wells Area as shown in Figure 5 *(Appendix of Figures and Tables)*; and
- for the confined aquifer, a part of the Prescribed Wells Area as shown in Figure 6 *(Appendix of Figures and Tables)*.

"Megalitre (ML)" means one million litres or 1,000 cubic metres.

"Microbial" means organisms that are invisible to the naked eye and includes, but is not limited to, bacteria, fungi etc.

"the Minister" means the Minister to whom administration of the *Natural Resources Management Act 2004* is committed.

"Open wetland" means wetlands with open depressions and shallow gradients with less of a defined boundary compared to an enclosed wetland.

"Over-allocated" means that the total loss (i.e. sum of tradeable components and stock water use and domestic water use requirements, but not delivery supplements or carry-overs), exceeds the Target Management Level (TML) for that Management Area.

"Peak Drawdown" means the maximum drawdown for the year that occurs during the water use year.

"Phreatophyte" means a plant that is dependent on underground water.

"the/this Plan" means this Water Allocation Plan for the Tintinara Coonalpyn Prescribed Wells Area.

"the 2003 Plan" means the 2003 Water Allocation Plan for the Tintinara Coonalpyn Prescribed Wells Area that was certified by the Minister for Environment and Conservation on 30th May 2003 as being the WAP for the PWA adopted by him on 22 January 2003.

"Pollution" includes any solid, liquid, gas or thermal influence (or any combination thereof) that directly or indirectly causes or has the potential to cause harm to the environment, structures, persons or organisms.

"Potentiometric level", "potentiometric surface" or **"potentiometric head"** means the level to which water rises in a well due to water pressure in the aquifer.

"Public water supply" means the supply of water by reticulation primarily for domestic purposes.

"Recharge" means water that replenishes the aquifer by infiltration or percolation from the land surface.

"Recharged Water" means water which has been drained or discharged directly or indirectly into a well in accordance with a permit granted under the Act.

"Recreational use" means the use of water for the irrigation of parks, gardens and sports grounds of greater than 0.4 hectares, whether publicly or privately owned.

"Residual (fully rested) drawdown" means the drawdown for the year that occurs when the aquifer is fully rested after it has recovered from the water use year.

"Rotational crop" means a crop or plantation of a species/cultivar that produces one harvest per planting and requires an inter-rotational break period of three years or greater from the date of the previous planting before the same crop or plantation can be replanted at the same location.

"Saturated zone" means the zone in which voids within soils and rocks are completely filled with water, also known as the phreatic zone.

"Specific yield" means the ratio of the volume of water a rock or soil will yield by gravity drainage, to the volume of the rock or soil.

"Stock water use" means the taking of water to provide drinking water for stock other than stock subject to intensive farming (as defined by the Act).

"Target Management Level (TML)" means the maximum annual volume of underground water that can be potentially extracted from an aquifer in a water use year to ensure the water resource is managed sustainably. The TML is the limit for all water (holding) and tradeable components of water (taking) allocations, including irrigation, industry, public water supply, aquaculture and recreational use, as well as provisions for unlicensed stock water use and domestic water use requirements, but not including allocations for seasonal carry-over or delivery supplement. The TML for each Management Area is listed in Table 1 (Appendix of Figures and Tables).

"Tradeable component" means the component of a water allocation that can permissibly be traded.

"Unconfined Aquifer" means the saturated sequence of rocks occurring above the aquitard on top of the Dilwyn Formation or the Mepunga Formation in the Otway Basin, or the Renmark Group in the Murray Basin, whether occurring within the Gambier Limestone of the Otway Basin, the Murray Group Limestone of the Murray Basin, or some other younger geological unit.

"Underground water" means –

a) water occurring naturally below ground level as distinct from surface water;

b) water pumped, diverted or released into a well for storage underground.

"Underground Water Access Trench (UWAT)" means a well or shallow trench of up to 2.5 metres in depth, excavated into the aquifer for the purpose of providing direct access to underground water, for stock watering or other purposes.

"Underground Water Dependent Ecosystem (UWDE)" means an ecosystem that relies either wholly or partially on underground water to sustain it for some portion of the year.

"Underground Water Resource Condition" means a condition of the resource that has been identified in the Water Allocation Plan to act as an early warning system and to protect the resource from further degradation.

"Unsaturated zone" means the region above the water table through which recharge infiltrates, also known as the 'vadose zone'.

"Water Development Management Plan (WDMP)" means the plan that must accompany an application to DFW for a new water allocation from the Minister or the conversion of a water (holding) allocation to a water (taking) allocation. The WDMP must outline the timeframe for the development of the allocation within 3 years.

"Water (holding) allocation" means an allocation which does not authorise the taking of water but enables the holder of the licence to make a request to the Minister to convert the allocation to a water allocation which may be taken.

"Water table" means the upper surface of saturation in the unconfined aquifer.

"Water (taking) allocation" means a water allocation that may be taken.

"Water use year" means a period of 12 months commencing on the 1 July in any year and ending 30 June of the following year.

"Well" means:

a) an opening in the ground excavated for the purpose of obtaining access to underground water;

b) an opening in the ground excavated for some other purpose but that gives access to underground water;

c) a natural opening in the ground that gives access to underground water.

"Wild flooding" means flood irrigation where no adequate system such as land levelling or irrigation bays is used to ensure a controlled distribution of water

Abbreviations

The following abbreviations shall have the meanings set out below.

"DFW" Department for Water

"DENR" Department of Environment and Natural Resources

"DWLBC" Department of Water, Land, Biodiversity and Conservation (now Department for Water)

"PWA" Prescribed Wells Area

"**NRM"** Natural Resources Management

"**TML"** Target Management Level

"WAP" Water Allocation Plan

Measurements

km^2	square kilometre(s)
m	metres
mg/L	milligram(s) per litre
ML	megalitre(s)
TDS	Total dissolved solids – usually expressed as mg/L

6. Allocation Criteria - Unconfined Aquifer

6.1 Objectives

The objectives of the allocation criteria for the unconfined aquifer are:

a. To manage the underground water resource of the unconfined aquifer so that it may continue to be available for the social, economic and environmental needs of current and future generations.

b. To protect the resource locally, throughout each Management Area and the entire prescribed wells area (PWA).

c. To provide flexibility and equity in access to the underground water resources of the unconfined aquifer.

d. To maintain the availability of underground water to ecosystems dependent on underground water.

e. To protect the environment generally by ensuring that the taking and use of underground water from the unconfined aquifer does not cause significant degradation of any other resource such as soils or other water resources.

f. To provide principles for water management so that water allocations are available to sustain economic development.

g. To promote the active and efficient use of water allocations according to current industry best practice standards.

h. To bring over-allocated or at risk Management Areas to environmentally sustainable levels of allocation.

6.2 Principles

Limit to total allocation

1. No new water shall be allocated from the unconfined aquifer for the life of this Plan.
2. Notwithstanding Principle 1, water may be allocated during the life of this Plan for the following purposes:
    a) To allocate water in the Boothby Management Area in accordance with principle 8;

    b) to convert a water (taking) allocation to a water (holding) allocation;

    c) to convert a water (holding) allocation to a water (taking) allocation;

    d) to temporarily or permanently transfer an allocation according to Section 7 of this Plan (*Transfer Criteria – Unconfined Aquifer*);

e) to give effect to a whole of licence transfer where the allocation will continue to be taken and used on the same allotment/s and for the same purposes as was the case prior to the transfer;

f) to give effect to the allocation of water drained or discharged according to principles 69 - 73 (*Basis of allocation of water drained or discharged into a well*);

g) to give effect to delivery supplements issued in accordance with principles 12 - 20 (*Delivery Supplements*);

h) to allow a water (taking) allocation to be taken from another Management Area in accordance with principles 58 - 61 (*Rotational crops*);

i) to give effect to the transfer (including the surrender and reissue of a water (taking) allocation) from the confined aquifer to the unconfined aquifer according to principles 76 *(Transfer of Water Allocations – Unconfined Aquifer)* and 145 *(Transfer of Water Allocations – Confined Aquifers)*;

j) to give effect to the transfer (including the surrender and reissue of a water (taking) allocation) from an over-allocated Management Area to a Management Area that is not fully allocated, according to principle 77(c) *(Transfers of Water Allocations)*;

k) to give effect to the allocation of carry-over volumes according to principle 21 (*Seasonal variability - carry-over and temporary trade volumes*); and

l) to give effect to the recalculation of volumetric licences in existence at the date of adoption according to principles 10 and 11 *(Tradeable Component)*.

Protection of ecosystems dependent on underground water

3. Water shall not be allocated pursuant to principles 2(a), (c), (d), (f), (g), (h), (i), (j) or (k) if to do so may create or contribute to a significant adverse effect on ecosystems dependent on underground water.

4. For the purposes of principle 3, in assessing the likelihood of a significant adverse effect upon an underground water dependent ecosystem, consideration shall be given to:

   a) if, at the date of application, a wetland is listed on the Department for Environment and Natural Resources' South Australian Wetland Inventory Database (SAWID) for the South East of South Australia, as a wetland of high or very high conservation value - whether any part of the wetland as mapped in the SAWID falls within a 16 km^2 circle centred on the proposed point of taking of the allocation;

   b) whether the wetland identified in principle 4(a) is considered by the Minister to:

      i. demonstrate a level of dependence on underground water; and

      ii. be under significant or actual threat of degradation (identified by, but not limited to, a mean (arithmetic) decrease in underground water

levels of greater than 0.05 metres/year (measured over the preceding 5 years) in a representative observation well within the 16 km^2 circle specified in principle 4(a) above or, in the absence of a representative well within that radius, in the nearest representative observation well or wells as determined by the Minister);

c) the current demand for underground water (determined by the level of allocation within the Management Area);

d) the volume of water proposed to be taken; and

e) any other relevant environmental matter.

5. For any underground water dependent ecosystem identified for protection under principle 4 above, the set-back distance for any new wells shall be calculated using the DE equation described in Section 2 *(Assessment of the Needs of Underground Water Dependent Ecosystems)*.

Basis of allocation

6. Water shall be allocated by volume.

7. Until such time as all required reductions in allocations have been completed or formally suspended in accordance with principles 62 - 67 *(Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated)* water in the Tintinara Management Area may only be used to irrigate an area no greater than the area endorsed on the corresponding licence.

Unallocated Water

8. The Minister may make the unallocated water in the Boothby Management Area available for allocation if he/she is satisfied that there is sufficient demand for water in the Management Area. Any water that may be allocated by the Minister must not result in the TML for this Management Area being exceeded (see Table 1).

Volumetric Allocations

9. After the date of adoption, existing licences endorsed with a volumetric allocation will consist of a tradeable component, any carry-over and temporary transfers and, where eligible, a delivery supplement.

Tradeable component

10. A tradeable component is the component of a water allocation which may be permissibly traded.

11. The tradeable component is:

a) in the case of a water (holding) allocation - the entire volume expressed as a water (holding) allocation;

b) in the case of a water (taking) allocation:

i. for licences in the Sherwood and Coonalpyn Management Areas - the total allocation endorsed on the licence under the 2003 Plan, minus:

(1) any carry-overs; and / or,

(2) any temporary transfers;

ii. for licences in the Tintinara Management Area - the sum of the base allocation issued under the 2003 Plan and the delivery component contained in Table 2 *(Appendix of Figures and Tables*) for the corresponding irrigation system type;

iii. for licences in the Boothby Management Area:

(1) for the purposes of public water supply - the total volume allocated at date of adoption; and

(2) for new allocations - a volume allocated according to principle 8.

Delivery Supplements

12. No new Delivery Supplements will be issued for the life of the Plan.

13. Notwithstanding principle 12, a licensee in the Tintinara Management Area may make a written request to the Minister for a delivery supplement. The Minister, in his absolute discretion, may grant such a request if satisfied that the licensed allocation has been used for flood irrigation prior to the date of adoption.

14. The delivery supplement issued under principle 13 shall be calculated as 85% of the tradeable component of the relevant licence.

15. A delivery supplement shall only be allocated for the life of the Plan.

16. Where a licence is endorsed with a delivery supplement for flood irrigation, the delivery supplement may not be used for any irrigation system type other than flood irrigation.

17. A licensee must notify the Minister in writing of any conversion of any part of an existing irrigation system to a different irrigation system type, prior to applying any water through the different irrigation system type.

18. Where a licensee is using more than one irrigation system type per licence, any corresponding delivery supplement shall be:

a) calculated based on the proportional split of irrigation systems in place reported in the licensee's Annual Water Use Report for the 2008/09 water use year; or

b) in the absence of an Annual Water Use Report for the 2008/09 water use year, on the proportional split of irrigation systems in place reported in the licensee's Annual Water Use Report for the 2007/08 water use year; or

c) in the absence of an Annual Water Use Report for the 2008/09 and 2007/08 water use year, on the proportional split of irrigation systems in place reported in the licensee's Annual Water Use Report for the 2006/07 water use year; and

d) issued for the proportion of tradeable component associated with each eligible system type identified in any Annual Water Use Reports for the 2006/07, 2007/08 and/or 2008/09 water use years received by the Department for Water by 31 July 2009, as the maximum proportional split via irrigation system type at 30 June 2008 or 30 June 2009, whichever is the greater.

19. For the purposes of principle 18, the proportional split of irrigation system types, shall be calculated by:

    a) multiplying the net irrigation requirement for each crop (see Table 3, *Appendix of Figures and Tables*) by the area (ha) of each crop grown in the water use year identified in principle 18 as the year with the maximum area under flood irrigation, for each irrigation system type; and

    b) summing the net irrigation requirement for each system type to determine the licensee's total net irrigation requirement for the licence; then

    c) determining the proportional split of each irrigation system type by dividing the net irrigation requirement for system type by the total net irrigation requirement for the licence.

20. The Minister will not consider:

    a) any request under principle 13 received after 5 pm on the nearest business day following six months after date of adoption of this Plan;

    b) for the purposes of principles 18 and 19:

        i. any request received after 5 pm on the nearest business day following six months after date of adoption of this plan; and

        ii. where no Annual Water Use Report for any of the 2006/07, 2007/08 or 2008/09 water use years was received by DFW by 31 July 2009;

    instead the licensee will be considered to have carried out no flood irrigation during the 2006/07, 2007/08 and 2008/09 water use years.

Seasonal variability – carry-over and temporary trade volumes

21. Where:

    a) a licence is endorsed with a water (taking) allocation for the purposes of irrigation, recreation, industry or public water supply; and

    b) DFW has received an Annual Water Use Report for the preceding water use year by 5 p.m. on 31 July of the current water use year; and

    c) the water allocation at the end of the preceding water use year has not been fully used;

    the licensee will be entitled to take, in addition to their annual allocation, a volume of water known as carry-over, being the unused volume of allocation at the end of the preceding water use year or 25% of the licensee's annual allocation for the preceding year, whichever is the lesser amount.

22. Where a licence is endorsed with a water (taking) allocation for the purposes of irrigation, the licensee will be entitled to take a volume of water in addition to their

annual allocation known as a temporary trade volume, subject to principles 88 and 89 (*Temporary transfers to manage seasonal variability)*.

23. No allocation granted according to principles 21 - 22 shall result in the total volume available for use in any one water year exceeding 140% of the licensee's annual allocation.

24. For the purpose of principle 21(c), a licensee is deemed to use the components of their water allocation in the following order:

    a) carry-over;

    b) temporary trade volume (including any associated delivery supplement);

    c) annual allocation.

25. For the purposes of principles 21 - 24, annual allocation comprises the sum of the tradeable component and any delivery supplement, but does not comprise carry-overs or additional water transferred in temporarily under principles 88 and 89 (*Temporary transfers to manage seasonal variability)*.

Water (holding) allocations

26. Water licences may be endorsed with water (holding) allocations.

27. A licence endorsed with a water (holding) allocation shall specify the Management Area from which the water (holding) allocation is sourced.

28. The purpose of a water (holding) allocation is to preserve the right (subject to the Act) of the licensee to obtain a water (taking) allocation in respect of the quantity of water allocated by the water (holding) allocation.

29. The quantity of water allocated from the unconfined aquifer by a water (holding) allocation is reserved for the time when the water (holding) allocation is converted under principles 31 and 32 (*Conversion of a water (holding) allocation to a water (taking) allocation).*

30. After the date of adoption, new water (holding) allocations shall be endorsed on a licence only where:

    a) a water (holding) allocation was already endorsed on the licence prior to the date of adoption; or

    b) a water (taking) allocation is converted to a water (holding) allocation at the licensee's request.

Conversion of a water (holding) allocation to a water (taking) allocation

31. A water (holding) allocation may be converted to a tradeable component of a water (taking) allocation of the same volume, subject to the following:

    a) where the conversion is from a water (holding) allocation to a tradeable component of a water (taking) allocation and where the proposed point of taking is located in the same Management Area, the conversion will be subject to:

        i. principles 3 - 5 (*Protection of ecosystems dependent on underground water)*;

ii. principles 36 - 38 (*Hydrogeological effects and assessment*); and

iii. principles 62 - 67 (*Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated*).

b) where the conversion is from a water (holding) allocation from one Management Area to a tradeable component of a water (taking) allocation in another Management Area, the conversion will be subject to:

i. principles 3 - 5 (*Protection of ecosystems dependent on underground water)*

ii. principles 36 - 38 (*Hydrogeological effects and assessment*);

iii. principles 62 - 67 (*Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated*); and

iv. the transfer principles set out in Section 7.

32. Where a water (holding) allocation has been converted to a water (taking) allocation, the licensee is not eligible to apply for a delivery supplement.

Conversion of a water (taking) allocation to a water (holding) allocation

33. Where a water (taking) allocation is converted to a water (holding) allocation:

a) only the tradeable component of the water (taking) allocation shall be considered to have become the volume of the water (holding) allocation;

b) any carry-over or delivery supplement that formed part of the water (taking) allocation shall be forfeited to the Minister; and

c) any subsequent conversion of the water (holding) allocation back to a water (taking) allocation will be subject to principles 31 and 32 (*Conversion of a water (holding) allocation to a water (taking) allocation*).

Returned water

34. Where all or part of a water allocation endorsed on a licence is surrendered or otherwise forfeited to the Minister, that returned water will not be available for allocation except where:

a. the returned water is from the Boothby Management Area; and

b. the allocation of the returned water will not cause the TML in the Boothby Management Area to be exceeded, as set out in Table 1 (*Appendix of Figures and Tables*) and principle 77(c).

35. For the purposes of principle 34, with respect to the TMLs set out in Table 1 (*Appendix of Figures and Tables*):

a) where a tradeable component is forfeited, this will be considered to constitute a reduction in the level of allocation in that Management Area; and

b) where a delivery supplement is forfeited, the returned volume shall not be regarded as a reduction in the level of allocation for that Management Area.

Hydrogeological effects and assessment

36. The allocation of water for all purposes other than industry, energy generation and public water supply, shall only be granted if the proposed point of extraction is at least 2 kilometres from any well endorsed on a licence and from which water can be lawfully taken.

37. No allocation shall be made which appears, in the opinion of the Minister, to have potential to cause:

    a) a significant adverse effect on the structural integrity of the aquifer;

    b) a significant adverse effect on any other water resource, both within and beyond the Tintinara Coonalpyn PWA;

    c) an enduring rise in the water table which in turn may cause a significant adverse effect to ecosystems that depend on the underground water or may cause dryland salinity; or

    d) a significant adverse effect on the quality of water in the unconfined aquifer, and in particular shall not cause or contribute to a significant increase in salinity.

38. No allocation shall be made where, in the opinion of the Minister, one or more of the following resource condition triggers have been exceeded:

    a) a mean (arithmetic) net change in underground water levels of greater than 0.1 metres per year (measured over the preceding 5 years) in a representative observation well within a 16 km^2 circle centred over the point of taking or, in the absence of any representative wells within the 16 km^2 circle, in the nearest representative well or wells as determined by the Minister; or

    b) a mean (arithmetic) increase in salinity of the underground water resource greater than 2% per year in Boothby, Tintinara and Coonalpyn Management Areas and 1% per year in Sherwood Management Area, (measured over the preceding 5 years) in a representative observation well within a 16 km^2 circle centred over the point of use or, in the absence of any representative wells within the 16 km^2 circle, in a representative observation well or wells as determined by the Minister.

Hydrogeological assessment for allocations resulting from temporary transfers to manage seasonal variability

39. The granting of a water allocation resulting from principles 21 - 25 (*Seasonal variability - carry-over and temporary trade volumes)* is exempt from principles 36 - 38.

Hydrogeological assessment for the allocation of water for the purposes of industry, energy generation or public water supply

40. The allocation of water for industry, energy generation or public water supply shall be subject to principle 37.

Efficient use of water

41. Water shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstances for which the water is to be used in accordance with current industry best practice standards, as determined by the Minister.

Restrictions on use

42. Water taken pursuant to this Plan shall not be used for the purposes of wild flooding.

43. Water taken from the unconfined aquifer shall not be used for a purpose that produces tail water, unless:

    a) the volume of tail water produced for disposal will not exceed an amount reasonably produced according to industry best practice at the time of assessment of the application, as determined by the Minister;

    b) the disposal of tail water will not cause an increase (above seasonal fluctuations) in:

        i. underground water levels in the unconfined aquifer; or

        ii. the potentiometric pressure in the confined aquifer;

    at the boundary of the allotment where the tail water is disposed of, or at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal;

    c) the disposal of tail water will not cause:

        i. an acceleration in salinity increase in either aquifer; or

        ii. pollution of either aquifer by the tail water; or

        iii. pollution of either aquifer by any other substance; and

    d) the ponds, tanks, vessels or other places used for the keeping of any water for that purpose have no significant hydraulic connection with either aquifer.

44. For the purpose of principle 43, tail water is water that flows out of a system once it has flowed through any ponds, tanks, vessels or other places, including places for the keeping of farmed aquatic species.

Active and expeditious use of water

45. Water (taking) allocations granted after 22 January 2003 and prior to the adoption of this Plan, excluding those obtained through transfers, must be developed in accordance with the associated Water Development Management Plan or Irrigation Development Management Plan.

46. For the purposes of principle 45, development of an allocation means the development of sufficient facilities, land or equipment to a capacity that enables the water (taking) allocation to be utilised at its maximum lawful annual rate.

47. Where the licensee can demonstrate to the Minister that extenuating circumstances apply, the maximum period for the application of principles 45 and 46 may be increased to 4 years.

48. Where:

    a) an allocation is not the result of the conversion of a water (holding) allocation to a water (taking) allocation; and

    b) active and expeditious use principles have not been fulfilled for the allocation;

    the undeveloped portion shall be forfeited to the Minister as returned water and the returned volume shall be managed according to principles 34 and 35 (*Returned water)*.

Piping of water for a distance greater than two kilometres

49. Where water from the unconfined aquifer is to be taken from one point to be used at another point at least 2 kilometres from the point of taking:

    a) the water must be transported by pipe or other enclosed vessel; and

    b) with the exception of public water supply:

        i. the taking and use of water shall comply with principles 37 - 38 (*Hydrogeological effects and assessment*); and

        ii. notwithstanding principle 49(b)(i), principle 36 (*Hydrogeological effects and assessment*) shall apply only at the point of taking.

Use of imported water

50. Unconfined aquifer water may only be brought into a Management Area from another Management Area or PWA:

    a) by means of a pipe or other enclosed vessel; and

    b) if at a rate greater than 1 ML/year, use of the water must comply with principles 200 - 202 of the Plan.

51. Notwithstanding principle 50, principle 49 does not apply where an allotment is, or two or more adjoining allotments held by the same owner are, divided by a Management Area or a PWA boundary, but a water allocation is held in only one of the Management Areas or PWAs.

Divided Allotments and allotments held in adjacent Management Areas

52. Where an allotment is, or two or more adjoining allotments held by the same owner are, divided by a Management Area or a PWA boundary, but a water allocation is held in only one of the Management Areas or PWA, the allocation may be taken and used anywhere throughout the allotment or adjoining allotments, provided that:

    a) the allocation remains referenced to, and accounted for, in the originating Management Area and PWA;

    b) the taking and use of water complies with principles 3 - 5 (*Protection of ecosystems dependent on underground water*) and principles 36 - 38 (*Hydrogeological effects and assessment*).

    c) the point of extraction and/or use is not moved more than 2 kilometres into an adjacent Management Area or PWA (unless it can be demonstrated that the allocation (or part thereof) was being extracted or used at that location prior to 22 January 2003); and

    d) an allocation from the Sherwood Management Area is not taken in the Designated Area unless it can be demonstrated that the allocation (or part thereof) was being taken at the current location in a zone within the Designated Area prior to 22 January 2003.

53. The allocation referred to in principle 52 will not be available for further transfer within the receiving Management Area, PWA or zone within the Designated Area.

Endorsement of Certificates of Title on licences

54. An additional allotment may only be endorsed on a licence where the licensee can demonstrate to the Minister's satisfaction that the licensee is able to physically extract and use the allocation endorsed on the water licence on the relevant allotment and is not prevented from doing so by the presence of, for example, but not limited to, native vegetation, plantations, roadways or structures.

55. Where a licensee is not the registered proprietor of, or does not have legal access to, an allotment endorsed on a water licence prior to the date of adoption, the endorsement of that allotment on the licence will be removed unless by 5 pm on the nearest business day following 6 months from the date of adoption of the Plan, the licensee provides to the Minister a statutory declaration made by the registered proprietor of the allotment confirming their consent to the endorsement.

56. On or after the date of adoption, a licence endorsed with a water (taking) allocation may not be varied to enable the water to be used on additional allotments, unless:

    a) the subject land is owned by the applicant; or

    b) the licensee has made an application to the Minister for such a variation, accompanied by a statutory declaration made by the registered proprietor of the land consenting to the variation.

57. For the purposes of principles 54 - 56, where the licensee is not the registered proprietor of the land, the relevant Certificate(s) of Title will only be endorsed on the water licence for a maximum of 5 years unless otherwise specified in the statutory declaration.

Rotational crops

58. A licensee may apply in writing to the Minister to vary a water licence for the purposes of irrigating a rotational crop, subject to principles 36 - 38 (*Hydrogeological effects and assessment)* and principles 3 - 5 (*Protection of ecosystems dependent on underground water)*.

59. An allocation of water may be taken from another Management Area to irrigate a rotational crop for a maximum period of 5 years.

60. Notwithstanding principle 59, water may not be taken from another Management Area to irrigate a rotational crop, where the proposed point of taking lies within the Designated Area.

61. Where:

    a) the proposed point of taking lies within a Management Area that is fully allocated on date of adoption; or

    b) the taking of water to irrigate a rotational crop causes the sum total of water (holding) allocations and the tradeable components in the Management Area to exceed the relevant TML as set out in Table 1 (*Appendix of Figures and Tables*);

    the Minister may grant a variation for a maximum of 12 months, if the level of water extracted in the form of tradeable components from the unconfined aquifer in the Management Area of the proposed point of taking in the preceding water use year did not exceed 90% of the TML as set out in Table 1 (*Appendix of Figures and Tables*).

Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated

62. Where a Management Area is over-allocated at the date of adoption and/or a resource condition trigger (as described in principle 38 (*Hydrogeological effects and assessment*)) was exceeded at December 2006 (being the Tintinara Management Area), water (holding) allocations and the tradeable components of water taking allocations shall be reduced so that the sum of water (holding) allocations and the tradeable components of water taking allocations plus stock water use and domestic water use does not exceed the TML as set out in Table 1 *(Appendix of Figures and Tables*) by 1 July 2015 in the following manner:

    a) all allocations will first be subject to principles 9 – 11 *(Volumetric Allocations* and *Tradeable Component)*; and

    b) any component of a licensed allocation that was issued under the 2003 Plan for the purposes of:

        i. flood irrigation; or

        ii. had a delivery component of less than 30%;

will be reduced by the same percentage so that the aggregate of all water (holding) allocations and the tradeable components of water (taking) allocations in the Tintinara Management Area plus stock water use and domestic water use does not exceed the TML by 1 July 2015.

63. For the purposes of principle 62, 25% of the required reduction will occur at the commencement of the next water use year following the date of adoption, and the remaining reductions will occur in 3 equal steps at the commencement of each subsequent water use year.

64. Notwithstanding principles 62 – 63, if the review of the TML undertaken prior to 1 July 2014 determines that the level of allocation at December 2013 is sustainable, the schedule of reductions may be discontinued, as determined by the Minister.

65. Notwithstanding principles 62 – 64, where the Minister identifies that the sustainable level of allocation is greater than the specified allocation limit, water (holding) allocations and the tradeable components of water (taking) allocations affected by principles 62 – 64 shall be increased proportionately so that the level of allocation equals the sustainable level identified by the Minister.

66. Following reductions of water allocations at 1 July 2015, if the resource condition trigger is exceeded at December 2016, water (holding) allocations and the tradeable components of water (taking) allocations shall be reduced in 3 equal annual steps so that the level of allocation is no greater than the sustainable level as identified by the Minister.

67. For the purposes of principles 62 – 66, any associated delivery supplement shall be proportionately reduced or increased by the Minister at the same rate as the tradeable component.

Exemption from reductions

68. Notwithstanding principles 62 – 67, allocations for the purposes of public water supply, industry and recreation in existence at the date of adoption, are exempt from reductions.

Basis of allocation of water drained or discharged into a well – Managed Aquifer Recharge

69. Water that is drained or discharged into a well under principles 70 – 73 will not be available for allocation where it is considered that it would have contributed to the natural vertical recharge of the unconfined or confined aquifer systems.

70. Water that is drained or discharged into a well consistent with a permit granted pursuant to section 127(3)(c) of the Act will only be available for allocation where the drainage or discharge has been metered and a meter reading has been taken by the Minister, and:

    a) the water has been taken under a licence issued under the provisions of the Act and treated by a desalination plant; or

b) water that has been imported for the purposes of drainage and discharging into a well has been taken under a licence issued under the provisions of the Act as required.

71. An allocation of water drained or discharged into a well must be taken and used within a period of 3 years calculated from 1 July in the year in which the water was drained or discharged.

72. An allocation of water drained or discharged into a well shall only be taken from the original well used to drain or discharge the imported water to the aquifer, or from a well within a radius of 500 metres of the original well.

73. Subject to principles 69 – 72:

    a) if the water drained and discharged is a product of a desalination process, a maximum of 100% of the volume drained or discharged may be allocated to the permit holder;

    b) if the water drained and discharged is not the product of a desalination process, a maximum of 80% of the volume drained or discharged may be allocated to the permit holder.

7. Transfer Criteria – Unconfined Aquifer

7.1 Objectives

The objectives of the transfer criteria for the unconfined aquifer are:

a) To manage the underground water resources of the unconfined aquifer so that it may continue to be available for the social, economic and environmental needs of current and future generations.

b) To protect the environment generally by ensuring that the taking and use of underground water from the unconfined aquifer does not cause significant degradation of any other resources such as soils or other water resources.

c) To maintain the availability of underground water to ecosystems dependent on underground water.

d) To provide flexibility and equity in access to the underground water resource of the unconfined aquifer.

e) To minimise constraints on transfers of water allocations so that these are available to sustain economic development.

f) To promote the active and efficient use of water according to industry best practice standards.

g) To ensure that allocations resulting from transfers remain within the sustainable limits of the unconfined aquifer in the relevant Management Area.

h) To provide for the transfer of volumetric allocations from the unconfined aquifer.

7.2 Principles

Transfers of water allocations

74. All transfers of unconfined aquifer water (holding) allocations and unconfined aquifer water (taking) allocations are subject to the allocation principles set out in section 6 of the Plan.

75. An allocation from the unconfined aquifer may not be transferred to the confined aquifer.

76. Where a licensee has an allocation in the confined aquifer, the licensee may forfeit the allocation and be reissued an allocation of the same value in the unconfined aquifer, subject to principle 2 *(Limit to total allocation)*, and providing that the reissue of the allocation does not cause the receiving unconfined Management Area to become over-allocated.

77. The whole or part of an allocation from the unconfined aquifer endorsed on a licence may be:

    a) transferred within the same Management Area temporarily or permanently;

b) transferred for a maximum of 5 years into an adjacent Management Area which is not fully or over-allocated within or outside the Tintinara Coonalpyn PWA, provided the transfer does not cause the receiving Management Area to become over-allocated;

c) transferred permanently from an over-allocated Management Area into an under-allocated Management Area within the Tintinara Coonalpyn PWA, provided the transfer does not cause the receiving Management Area to become over-allocated.

78. Notwithstanding principle 77, no allocations may be transferred into the Designated Area.

79. For the purposes of principle 77(b), an "adjacent Management Area" includes all Management Areas that adjoin the Management Area from which the allocation or licence was initially granted.

80. Where water is temporarily transferred into another Management Area pursuant to principle 77(b):

    a) that water will not be available for subsequent transfer into other adjacent Management Areas;

    b) the allocation must be accounted for in both the originating and receiving Management Areas; and

    c) the corresponding endorsement of an allotment must be removed from the licence upon the expiry of the transfer period.

81. Where a water allocation from the unconfined aquifer is transferred:

    a) any delivery supplement associated with a tradeable component shall be forfeited to the Minister, and only re-issued as a temporary allocation to the transferee if the Minister is satisfied that the tradeable component will continue to be used for the purposes of flood irrigation;

    b) in the case of a temporary transfer, any delivery supplement associated with the tradeable component that has been forfeited to the Minister and reissued to the transferee according to principle 81(a), shall be forfeited by the transferee at the end of the temporary transfer and reissued to the transferor; and

    c) no seasonal carry-over will be transferred, unless:

        i. the licence or allocation is transferred in its entirety; and

        ii. the Minister is satisfied that the water is to be taken and used on the same allotment(s) and for the same purpose.

82. If only part of an allocation is transferred, any delivery supplement that relates to the allocation not transferred will be reduced proportionately.

83. The taking and use of allocations transferred from the unconfined aquifer to another PWA shall be consistent with the relevant Water Allocation Plan for the receiving Management Area.

Transfers in Management Areas subject to allocation reductions

84. In Management Areas subject to reductions in allocations, a licensee may apply in writing to the Minister to transfer an allocation from within the same Management Area exempt from principles 36 - 38 (*Hydrogeological effects and assessment*).

85. Notwithstanding principle 84, only transfers of a volume less than or equal to 75% of the extent of the reduction to the licensee's allocation are exempt from principle 36 - 38 (*Hydrogeological effects and assessment*).

86. For the purposes of principles 84 and 85, the maximum total allocation that can be transferred by a licensee under these principles from the date of adoption shall not exceed 75% of the total combined reduction of allocation resulting from implementation of principles 10 and 11 (*Tradeable component*) and reductions to TML implemented by 1 July 2015.

87. The Minister will not consider any application under principle 84 made after 30 June 2016.

Temporary transfers to manage seasonal variability

88. A licensee who holds an unconfined aquifer water (taking) allocation for irrigation purposes may apply in writing to the Minister for the transfer in of additional water for the purpose of managing seasonal variability, subject to the following:

    a) a licensee may only apply for such transfers in three of every five consecutive years;

    b) the application must be for a transfer in of a tradeable component unused in the current water use year within the same Management Area;

    c) the quantity of water transferred in cannot exceed 15% of the transferee's annual allocation (which for this purpose will be taken to be the tradeable component but does not include delivery supplement, carry-overs or additional water transferred in temporarily);

    d) the transfer shall expire at the end of the water use year in which the application was made; and

    e) the transfer is exempt from principles 36 - 38 (*Hydrogeological effects and assessment*) and principles 3 - 5 (*Protection of ecosystems dependent on underground water*).

89. Where a transfer occurs pursuant to principle 88:

    a) any delivery supplement associated with a tradeable component unused in the current water use year and which is proposed to be transferred will be forfeited to the Minister, and only re-issued to the transferee if the Minister is satisfied that it will continue to be used for the purposes of flood irrigation; and

    b) any delivery supplement issued as a result of the transfer shall expire at the end of the water use year in which the transfer was made.

Applications to transfer water (taking) allocations – development of allocation before transfer

90. Where a licence granted by the Minister includes a condition(s) requiring the expeditious use of water (including a requirement that the equipment by which, or land on which, the water is used must be developed within a certain time period), the following applies:

    a) the allocation (or part thereof) or licence may be transferred where the equipment or land has been fully developed to allow use of the water at its maximum lawful rate;

    b) where the expeditious use conditions have not been fully satisfied, only the portion of the allocation that may be used in accordance with the extent of development at the date of receipt by the Minister of the application to transfer may be transferred; or

    c) where the licence or allocation is to be transferred in its entirety to a new landholder, but will be taken and used on the same allotment(s), it may be transferred whether or not the land or equipment has been fully developed in accordance with the condition(s), provided that the new landholder fully develops the land and equipment to allow use of the allocation at its maximum lawful rate, in accordance with the original condition(s).

Applications to transfer water (taking) allocations – piping of water more than 2 kilometres

91. Where a transfer application requires water from the unconfined aquifer to be taken from one point and to be used at another point at least 2 kilometres from the point of taking:

    a) the water must be transported by pipe or other enclosed vessel; and

    b) with the exception of public water supply, both the taking and use of water shall comply with principles 36 - 38 (Hydrogeological assessment).

92. Notwithstanding principle 91, where the proposed point of taking and point of use are the same as those utilised prior to transfer, the proposed transfer of water shall be deemed to have complied with principles 36 - 38 (*Hydrogeological effects and assessment)* at both the extraction and discharge sites without further assessment.

Endorsement of Certificates of Title on licences

93. If an unconfined aquifer water (taking) allocation is transferred, any allotment(s) corresponding to the land to which the water is proposed to be applied and/or the proposed point of taking shall only be endorsed on a water licence, if the Minister is satisfied that the applicant is able to physically extract and use the allocation endorsed on the water licence on the allotment, and is not prevented

from doing so by the presence of (for example, but not limited to) native vegetation, plantations, roadways or structures.

94. In the case of a temporary transfer, upon expiry of the agreed transfer period, both the allocation temporarily transferred and any allotment(s) endorsed as a consequence of the transfer, shall be removed from the transferee's licence.

Applications to transfer water allocated on the basis of water drained or discharged

95. Water drained and discharged into the unconfined aquifer according to principles 69 - 73 (*Basis of allocation of water drained or discharged into a well – Managed Aquifer Recharge)* may only be transferred if the Minister is satisfied that the transferred water will be taken from:

    a) the same point of extraction; or

    b) a proposed extraction well within a 500 metre radius of the point where the imported water was drained or discharged.

Hydrogeological effects and assessment

96. An unconfined aquifer transfer application shall be deemed to have complied with principle 36 - 38 (*Hydrogeological effects and assessment)* without further assessment if:

    a) the application is to transfer a licence endorsed with a water (taking) allocation, or the whole or part of a water (taking) allocation, where the transferred water is to be used on the same allotment(s) and:

        i. the transferred water will continue to be taken from the same well; or

        ii. the transferred water will be taken from a replacement well within 1 kilometre of the original well; or

    b) the application is to renew a temporary transfer (of the same quantity), where:

        i. the transferred water is to be taken from the same well (or a well that replaces the original well but lies within 100 metres of the original well);

        ii. the transferred water is to be used on the same allotment(s); and

        iii. the application to renew is received and processed prior to the date and time of expiry of the original temporary transfer.

97. Notwithstanding principle 96, the renewal of a temporary transfer of an allocation which has been in place for 5 years or greater, is subject to principles 36 - 38 (*Hydrogeological effects and assessment*).

98. Notwithstanding principle 96 – 97, if one or more of the resource condition triggers for the unconfined aquifer specified in principle 38 have been exceeded, the transfer application may still be approved if:

a) the resource condition triggers for both underground water salinity and water table levels at the destination are exceeded at a lesser rate than at the point of origin; and

b) approval would not cause, in the opinion of the Minister, the resource condition triggers at the destination to exceed those existing at the origin prior to transfer.

8. Allocation Criteria - Confined Aquifers

8.1 Objectives

The objectives of the allocation criteria for the confined aquifer are:

a) To cautiously manage the confined aquifer, an ancient resource with limited recharge.

b) To manage the underground water resource of the confined aquifer so that it may continue to be available for the social, economic and environmental needs of current and future generations.

c) To protect the resource locally, throughout each Management Area, and throughout the entire PWA.

d) To protect the environment generally by ensuring that the taking and use of underground water from the confined aquifer does not cause significant degradation of any other resource, including soils and other water resources.

e) To promote the active and efficient use of water allocations to drive best practice water use.

f) To reduce over-allocated or at-risk Management Areas to environmentally sustainable levels of allocation.

8.2 Principles

Limit to total allocation

99. No new water shall be allocated from the confined aquifer for the life of this Plan.

100. Notwithstanding principle 99, water from the confined aquifer may be allocated during the life of this Plan for the following purposes:

    a) to give effect to the allocation of water for the purpose of public water supply in accordance with principle 118 (*Allocations for the purpose of public water supply*);

    b) to convert a water (holding) allocation to a water (taking) allocation;

    c) to convert a water (taking) allocation to a water (holding) allocation;

    d) to temporarily or permanently transfer an allocation pursuant to Section 9 (*Transfer criteria - Confined Aquifers*);

    e) to give effect to a whole of licence transfer, where the allocation will continue to be taken and used on the same allotment(s) and for the same purposes as was the case prior to the transfer; or

    f) to give effect to the recalculation of volumetric licences in existence at the date of adoption according to principles 104 - 105 *(Tradeable component)*; and

    g) to give effect to carry-over volumes according to principle 106 *(Seasonal variability - carry-over and temporary trade volumes).*

Basis of allocation

101. Water shall be allocated by volume.

102. Until such time as all required reductions in allocations have been completed or formally suspended in accordance with principles 134 - 138 *(Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated)* water in the Tolmer Management Area may only be used to irrigate an area no greater than the area endorsed on the corresponding licence.

Volumetric Allocations

103. After the date of adoption, existing licences endorsed with a volumetric allocation will consist of a tradeable component only.

Tradeable component

104. A tradeable component is the component of a water allocation which may be permissibly traded.

105. The tradeable component is:

    a) in the case of a water (holding) allocation, the entire volume expressed as a water (holding) allocation;

    b) in the case of a water (taking) allocation:

        i. for licences in Tauragat Management Area, the volume endorsed on the licence, excluding:

            (1) any carry-overs; and

            (2) any temporary transfers;

        ii. for licences in the Tolmer Management Area, the sum of the base allocation endorsed on the licence and the delivery component contained in Table 2 (*Appendix of Figures and Tables*) for the corresponding irrigation system type.

Seasonal variability – carry-over and temporary trade volumes

106. Where:

    a) a licence is endorsed with a volumetric water (taking) allocation for the purposes of irrigation, recreation, industry or public water supply; and

    b) DFW has received an Annual Water Use Report for the preceding water use year by 5 p.m. on 31 July of the current water use year; and

    c) at the end of the preceding water use year the water allocation has not been fully used;

    the licensee will be entitled to take, in addition to their annual allocation, a volume of water known as carry-over, being the unused volume of allocation at the end of the preceding water use year or 25% of the licensee's annual allocation for the preceding year, whichever is the lesser amount.

107. Where a licence is endorsed with a volumetric water (taking) allocation for the purposes of irrigation, the licensee will be entitled to take a volume of water in addition to their annual allocation known as a temporary trade volume, subject to principle 155 (*Temporary transfers to manage seasonal variability).*

108. No allocation granted according to principles 106 - 107 shall result in the total volume available for use in any one water year exceeding 140% of the licensee's annual allocation.

109. For the purpose of principle 106(c), a licensee is deemed to use the components of their water allocation in the following order:

    a) carry-over;

    b) temporary trade volume (including any associated delivery supplement);

    c) annual allocation.

110. For the purposes of principles 106 - 109, annual allocation comprises the tradeable component only.

Water (holding) allocations

111. Water licences may be endorsed with water (holding) allocations.

112. A licence endorsed with a water (holding) allocation shall specify the Management Area from which the water (holding) allocation is sourced.

113. The purpose of a water (holding) allocation is to preserve the right (subject to the Act) of the licensee to obtain a water (taking) allocation in respect of the quantity of water allocated by the water (holding) allocation.

114. The quantity of water allocated from the confined aquifer by a water (holding) allocation is reserved for the time when the water (holding) allocation is converted under principle 116 (*Conversion of a water (holding) allocation to a water (taking) allocation).*

115. After the date of adoption, new water (holding) allocations from the confined aquifer shall be endorsed on a licence only where:

    a) a water (taking) allocation is converted to a water (holding) allocation at the licensee's request; or

    b) a water (holding) allocation was converted to a water (taking) allocation and any condition(s) of active and expeditious use remained unfulfilled at the end of the timeframe specified in the Water Development Management Plan or Irrigation Development Management Plan, in which case all or part of the water (taking) allocation will be converted back to a water (holding) allocation based upon the level of fulfilment of the condition(s).

Conversion of a water (holding) allocation to a water (taking) allocation

116. A water (holding) allocation from the confined aquifer may be converted to a tradeable component of a water (taking) allocation in the same Management Area and of the same volume of water, subject to:

    a) principles 120 - 121 (*Hydrogeological effects and assessment);*

    b) principles 134 - 138 (*Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated*)*;*

    c) whether the water (holding) allocation was initially the result of the conversion of a water (taking) allocation for the purposes of public water supply or industry, and if so, then the resulting water (taking) allocation will only be for the purposes of public water supply or industry.

Conversion of a water (taking) allocation to a water (holding) allocation

117. Where a water (taking) allocation is converted to a water (holding) allocation:

    a) only the tradeable component of the water (taking) allocation shall be considered to have become the volume of the water (holding) allocation;

    b) any carry-over that formed part of the water (taking) allocation shall be forfeited to the Minister; and

    c) any subsequent conversion of the water (holding) allocation back to a water (taking) allocation will be subject to principle 116 (*Conversion of a water (holding) allocation to a water (taking) allocation*).

Allocations for the purpose of public water supply

118. Water from the confined aquifer may be allocated upon application in writing to the Minister for the purpose of public water supply, subject to the following:

    a) no water will be allocated above the TML for the relevant Management Area at the time of application;

    b) allocations, if granted, will be granted in order of receipt of applications;

    c) allocations shall be issued as temporary allocations for 3 years;

    d) after the expiry of the 3 year temporary allocation, the allocation will be reissued as a permanent allocation only in respect of the portion of the allocation that has met principles 126 - 129 (*Active and expeditious use of water*).

Returned water

119. Where all or part of a water allocation from the confined aquifer is surrendered or otherwise forfeited to the Minister, that water will not be available for allocation, except where principle 118 applies (*Allocations for the purpose of public water supply*).

Hydrogeological Effects and Assessment

120. No allocation of water from the confined aquifer shall be made which appears, in the opinion of the Minister, to have potential to:

a) adversely affect to a significant extent the quality of water in the confined aquifer, and in particular shall not cause or contribute to a significant increase in salinity;

b) adversely affect to a significant extent, or have the potential to adversely affect to a significant extent, the structural integrity of the aquifer;

c) adversely affect to a significant extent any other water resource inside or outside the Tintinara Coonalpyn PWA;

d) cause a rise in the water level of the unconfined aquifer which results in waterlogging of the soil or localised underground water mounding; or

e) adversely affect to a significant extent ecosystems dependent on underground water.

121. Notwithstanding principle 120, no allocation of water from the confined aquifer shall be made if, in the opinion of the Minister, one or more of the following underground water resource condition triggers have been exceeded or are likely to be exceeded:

a) a mean (arithmetic) net increase in the unconfined water table of greater than 0.2 metres per year (measured over the preceding 5 years) within the vicinity of the point of taking (including neighbouring properties) and the nearest underground water level monitoring well as determined by the Minister, or within the relevant Management Area;

b) a mean (arithmetic) increase in the salinity of the confined aquifer greater than 2% in Tolmer or Tauragat Management Areas (measured over the preceding 5 years) within 2 kilometres of the western boundary of the relevant Management Area or in the monitoring wells nearest to the western boundary of the relevant Management Area as determined by the Minister; and

c) a drawdown of potentiometric surface in the confined aquifers of the following scale;

i. Tolmer Management Area

Peak Drawdown of greater than 10 metres.

Residual (fully rested) drawdown of greater than 2.5 metres.

ii. Tauragat Management Area

Peak Drawdown

Upper confined aquifer – 4.5 metres at the centre of the **cone of depression**, or 3 metres at a distance of 4 kilometres from the centre of the cone of depression.

Middle confined aquifer – 45 metres at the centre of the cone of depression, or 25 metres at a distance of 4 kilometres from the

centre of the cone of depression, or 10 metres at a distance of 10 kilometres from the centre of the cone of depression.

Lower confined aquifer – 65 metres at the centre of the cone of depression, or 25 metres at a distance of 4 kilometres to the north of the centre of the cone of depression.

Residual (fully rested) Drawdown

Upper confined aquifer – 2 metres at the centre of the cone of depression, or 1.5 metres at a distance of 4 kilometres from the centre of the cone of depression.

Middle confined aquifer – 9 metres at the centre of the cone of depression, or 7 metres at a distance of 4 kilometres from the centre of the cone of depression or 3 metres at a distance of 10 kilometres from the centre of the cone of depression.

Lower confined aquifer – 10 metres at the centre of the cone of depression, or 6 metres at a distance of 4 kilometres to the north of the centre of the cone of depression.

Quantity of allocation

122. Where an allocation is granted for purposes other than irrigation, the allocation shall not exceed the amount reasonably required for the purpose proposed in accordance with current industry best practice standards, as determined by the Minister.

Efficient use of water

123. Water from the confined aquifer shall be used and applied using water efficient technologies and techniques appropriate for the particular purpose and circumstances for which the water is to be used in accordance with industry best practice standards, as determined by the Minister.

Restrictions on use

124. Water taken from the confined aquifer pursuant to this Plan shall not be used for the purpose of:

    a) flood irrigation; or

    b) any practice that produces tail water, unless:

        i. the volume of tail water produced for disposal will not exceed an amount reasonably produced according to industry best practice at the time of assessment of the application, as determined by the Minister;

        ii. the disposal of tail water will not cause an increase (above seasonal fluctuations) in:

            (1) underground water levels in the unconfined aquifer; or

            (2) the potentiometric pressure in the confined aquifer;

at the boundary of the allotment where the tail water is disposed of, or at the boundary of any adjoining allotment held by the same owner, whichever is the greater distance from the point of disposal;

iii. the disposal of tail water will not cause:

(1) an acceleration in salinity increase in either aquifer;

(2) pollution of either aquifer by the tail water; or

(3) pollution of either aquifer by any other substance; and

iv. the ponds, tanks, vessels or other places used for the keeping of any water for that purpose have no significant hydraulic connection with either aquifer.

125. For the purpose of principle 124(b), tail water is the water that flows out of a system once it has flowed through any ponds, tanks, vessels or other places, including places for the keeping of farmed aquatic species.

Active and expeditious use of water

126. Water (taking) allocations from the confined aquifer granted after 22 January 2003 and prior to the adoption of the Plan, excluding those obtained through transfers, must be developed in accordance with the associated Water Development Management Plan or Irrigation Development Management Plan.

127. For the purposes of principle 126, development of an allocation means the development of sufficient facilities, land or equipment to a capacity that enables the water (taking) allocation to be utilised at its maximum lawful annual rate.

128. Where the licensee can demonstrate to the Minister that extenuating circumstances apply, the maximum period for the application of principles 126 and 127 may be increased from 3 years to 4 years.

129. Where:

a) an allocation is not the result of the conversion of a water (holding) allocation to a water (taking) allocation; and

b) active and expeditious use principles have not been fulfilled in accordance with principles 126 - 128;

the undeveloped portion shall be forfeited to the Minister as returned water and the returned volume shall be managed according to principle 119 (*Returned water*).

Endorsement of Certificates of Title on licences

130. An additional allotment may only be endorsed on a licence where the licensee can demonstrate to the Minister's satisfaction that the licensee is able to physically extract and use the allocation endorsed on the water licence on the relevant allotment and is not prevented from doing so by the presence of, for example, but not limited to, native vegetation, plantations, roadways or structures.

131. Where a licensee is not the registered proprietor of, or does not have legal access to, an allotment endorsed on a water licence prior to the date of adoption, the endorsement of that allotment on the licence will be removed unless by 5 pm on the nearest business day following 6 months from date of adoption of the Plan, the licensee provides to the Minister a statutory declaration made by the registered proprietor of the allotment confirming their consent to the endorsement.

132. On or after the date of adoption, a licence endorsed with a water (taking) allocation may not be varied to enable the water to be used on additional allotments, unless:

    a) the subject land is owned by the applicant; or

    b) the licensee has made an application to the Minister for such a variation, accompanied by a statutory declaration made by the registered proprietor of the land consenting to the variation.

133. For the purposes of principles 130 - 132, where the licensee is not the registered proprietor of the land, the relevant Certificate(s) of Title will only be endorsed on a water licence for a maximum of 5 years unless otherwise specified in the statutory declaration.

Addressing Management Areas where a resource condition trigger is being exceeded and/or which are over-allocated

134. Where a Management Area is over-allocated at the date of adoption and/or a resource condition trigger (as described in principle 120 - 121 (*Hydrogeological effects and assessment))* was exceeded at December 2006 (being the Tolmer Management Area), water (holding) allocations and the tradeable components of water (taking) allocations shall be reduced so that the sum of water (holding) allocations and the tradeable components of water (taking) allocations plus stock water use and domestic water use does not exceed the TML as set out in Table 1 *(Appendix of Figures and Tables*) in the following manner:

    a) all allocations will first be subject to principles 103 - 105 (*Volumetric Allocations* and *Tradeable component)*;

    b) any component of a licensed allocation that was issued under the 2003 Plan that had a delivery component of less than 30% will be reduced by the same percentage so that the aggregate of all water (holding) allocations and the tradeable components of water (taking) allocations in the Tolmer Management Area plus stock water use and domestic water use does not exceed the TML by 1 July 2015.

135. For the purposes of principle 134, 25% of the required reduction will occur at the commencement of the next water use year following the date of adoption, and the remaining reductions will occur in 3 equal steps at the commencement of each subsequent water use year.

136. Notwithstanding principles 134 and 135, if the review of the TML undertaken prior to 1 July 2014 determines that the level of allocation at December 2013 is sustainable, the schedule of reductions may be discontinued, as determined by the Minister.

137. Notwithstanding principles 134 - 136, where the Minister identifies that the sustainable level of allocation is greater than the specified allocation limit, water (holding) allocations and the tradeable components of water (taking) allocations affected by principles 134 and 135 shall be increased proportionately so that the level of allocation equals the sustainable level identified by the Minister.

138. Following reductions of water allocations at 1 July 2015, if a resource condition trigger is exceeded at December 2016, water (holding) allocations and the tradeable components of water (taking) allocations shall be reduced in 3 equal annual steps so that the level of allocation is no greater than the sustainable level as identified by the Minister.

Exemption from reductions

139. Notwithstanding principles 134 - 138, allocations for the purposes of public water supply, industry and recreation in existence at the date of adoption, are exempt from reductions.

Piping of water

140. Where water from the confined aquifer is to be taken from one point to be used at another point:

    a) the water must be transported by pipe or other enclosed vessel;

    b) the taking of water shall comply with principle 120 and 121 (*Hydrogeological effects and assessment*); and

    c) the use of water shall comply with principle 120 (a)(c)(d) and (e).

Use of imported water

141. Confined aquifer water may only be brought into a Management Area from another Management Area or PWA:

    a) by means of a pipe or other enclosed vessel; and

    b) if at a rate greater than 1 ML/year, its use must comply with principles 200 – 202 (*Importation of Water*).

Divided Allotments and allotments held in adjacent Management Areas

142. Where an allotment is, or two or more adjoining allotments held by the same owner are, divided by a Management Area or a PWA boundary, but a water allocation is held in only one of the Management Areas or PWAs, the allocation may be taken and used anywhere throughout the allotment or adjoining allotments, provided that:

    a) the allocation remains referenced to, and accounted for, in the originating Management Area and PWA;

    b) the taking and use of water complies with principles 3 - 5 (*Protection of ecosystems dependent on underground water*) and principles 120 - 121 (*Hydrogeological effects and assessment*);

c) the point of extraction and/or use is not moved more than 2 kilometres into an adjacent Management Area or PWA (unless it can be demonstrated that the allocation (or part thereof) was being extracted or used at that location prior to 22 January 2003).

143. The allocation will not be available for further transfer within the receiving Management Area, PWA or zone within the Designated Area.

9. Transfer Criteria – Confined Aquifers

9.1 Objectives

The objectives of the transfer criteria for the confined aquifer are:

a) To cautiously manage the confined aquifer, an ancient resource with limited recharge.

b) To protect the environment generally, by ensuring that the taking and use of underground water from the confined aquifer does not cause significant degradation of any other resources, such as soils and other water resources.

c) To maintain and/or improve the availability of underground water for ecosystems dependent on underground water.

d) To provide flexibility and equity in access to the underground water resource of the confined aquifer.

e) To provide for the transfer of confined aquifer volumetric allocations.

9.2 Principles

Transfer of water allocations

144. All transfers of confined aquifer water (holding) allocations and confined aquifer water (taking) allocations are subject to the allocation principles set out in Section 8 of this Plan.

145. An allocation from the confined aquifer may be transferred to the unconfined aquifer subject to the principles set out in Sections 6 and 7 of this Plan.

146. Notwithstanding principle 145, a licence authorising the taking of water from the confined aquifer in the Tauragat Management Area may only be transferred within the same aquifer or sub-aquifer in which it was granted.

147. A licence endorsed with a water (holding) allocation, or the whole or a part of a water (holding) allocation, may be transferred to any person or legal entity, but will continue to be recognised by the Minister as being held from the same Management Area from which the allocation was originally granted.

148. A licence endorsed with a water (taking) allocation or the whole or a part of a water (taking) allocation may only be transferred within the same Management Area, either permanently or temporarily.

149. Where a water allocation from the confined aquifer is transferred, no seasonal carry-overs will be transferred unless:

    a) the licence or allocation is transferred in its entirety; and

    b) the licence or allocation is to be taken and used on the same allotment(s) for the same purpose(s).

Transfers in Management Areas subject to allocation reductions

150. In Management Areas subject to reductions in allocations, a licensee may apply in writing to the Minister to transfer in an allocation from the same Management Area exempt from principles 120 and 121 (*Hydrogeological effects and assessment*).

151. Notwithstanding principle 150, only transfers of a volume less than or equal to 75% of the extent of the reduction to the licensee's allocation are exempt from principles 120 – 121 (*Hydrogeological effects and assessment*).

152. For the purposes of principles 150 and 151, the maximum total allocation that can be transferred by a licensee under these principles from the date of adoption shall not exceed 75% of the total combined reduction of allocation resulting from implementation of principles 104 and 105 (*Tradeable component*) and reductions to TML implemented by 1 July 2015.

153. The Minister will not consider any application under principle 150 made after 30 June 2016.

Purpose of use

154. A water (taking) allocation from the confined aquifer for purposes of public water supply or industry may only be transferred and used for the purposes of industry or public water supply.

Temporary transfers to manage seasonal variability

155. A licensee who holds a confined aquifer water (taking) allocation for irrigation purposes may apply in writing to the Minister for the transfer in of additional water for the purpose of managing seasonal variability, subject to the following:

    a) a licensee may only apply for such transfers in three of every five consecutive years;

    b) the application must be for a transfer in of a tradeable component unused in the current water use year within the same Management Area;

    c) the quantity of water transferred in cannot exceed 15% of the transferee's annual allocation (which for this purpose will be the tradeable component, but does not include carry-overs or additional water transferred in temporarily);

    d) the transfer shall expire at the end of the water use year in which the application was made; and

    e) the transfer is exempt from principles 120 and 121 (*Hydrogeological effects and assessment*).

Endorsement of Certificates of Title on licences

156. If a confined aquifer water (taking) allocation is transferred, any allotment(s) corresponding to the land to which the water is proposed to be applied and/or the proposed point of taking, shall only be endorsed on a water licence if the Minister is satisfied that the applicant is able to physically extract and use the allocation endorsed on the water licence on the allotment, and is not prevented

from doing so by the presence of (for example, but not limited to) native vegetation, plantations, roadways or structures.

157. In the case of a temporary transfer, upon expiry of the agreed transfer period, both the allocation temporarily transferred and any Certificate(s) of Title endorsed as a consequence of the transfer, shall be removed from the transferee's licence.

Hydrogeological effects and assessment

158. A confined aquifer transfer application shall be deemed to have complied with principles 120 and 121 (*Hydrogeological effects and assessment*) without further assessment if:

    a) the application is to transfer a licence endorsed with a water (taking) allocation or the whole or a part of a water (taking) allocation, where the transferred water is to be used on the same allotment(s) and:

        i. the transferred water will continue to be taken from the same well; or

        ii. the transferred water will be taken from a replacement well within 100 metres of the original well; or

    b) the application is to renew a temporary transfer (of the same quantity), where:

        i. the transferred water is to be taken from the same well (or a well that replaces the original well but lies within 100 metres of the original well);

        ii. the transferred water is to be used on the same allotment(s); and

        iii. the application to renew is received prior to the date and time of expiry of the original temporary transfer.

159. Notwithstanding principle 158, the renewal of a temporary transfer of an allocation which has been in place for 5 years or greater, is subject to principles 120 and 121 (*Hydrogeological effects and assessment*).

Applications to transfer water (taking) allocations – piping of water more than 2 km

160. Transfer applications that propose transporting confined aquifer water from the point of taking by means of an open channel shall not be granted.

161. Where a transfer application requires water to be taken from one point and transported to be used at another point at least 2 kilometres from the point of taking:

    a) the taking of water shall comply with principles 120 and 121 (*Hydrogeological effects and assessment*);

    b) the use of the water shall comply with principle 120(a)(c)(d) and (e); and

    c) if the transported water crosses a Management Area boundary or a PWA boundary, the transfer must comply with Section 10.6 (*Importation of Water)*.

162. Notwithstanding principle 161, where the proposed point of taking and point of use are the same as those utilised prior to transfer, the proposed transfer of water shall be deemed to have complied with principles 120 and 121 (*Hydrogeological effects and assessment*) at both the extraction and discharge sites without further assessment.

Applications to transfer water (taking) allocations – development of allocation before transfer

163. Where a licence granted by the Minister includes a condition requiring the expeditious use of water, or a requirement that equipment by which, or land on which, the water is used must be developed within a certain time period:

    a) the licence may be transferred where the conditions and requirements have been fully satisfied by the date of the receipt of the transfer application;

    b) the licence may be transferred if, despite the conditions and requirements not being fully satisfied by the date of the receipt of the transfer application:

        i. the licence and its allocation are to be transferred in their entirety;

        ii. the allocation will be taken and used on the same allotment; and

        iii. the new landholder is required to satisfy the original conditions and requirements; or

    c) where the conditions and requirements have not been fully satisfied by the date of the transfer application, only the portion of the allocation that may be used in accordance with the extent of development may be transferred.

10. Permits

An activity of the kind listed in this section can only be undertaken if authorised by a water licence or permit granted by the relevant authority.

Permits will only be granted if the activity complies with the relevant objectives and principles of this section.

In some cases a permit may not be required because:

a) section 129 of the Act removes the requirement; or

b) the activity is the construction of drainage works licensed under the *South Eastern Water Conservation and Drainage Act 1992* or the *Upper South East Dryland Salinity and Flood Management Act 2002*.

Relevant authority

The relevant authority in relation to a permit means the authority that is for the time being the relevant authority under Section 126 of the Act for the purpose of granting or refusing the application for a permit of that kind.

10.1 Permit Objectives

The following objectives apply to all water affecting activities within the boundaries of the Tintinara Coonalpyn PWA. They apply in addition to the objectives set out in the relevant NRM plan.

a) To protect the quantity and quality of the water resources.

b) To maintain natural hydrological systems and environmental flows.

c) To prevent deterioration in the quality of surface water, underground water or water in watercourses or lakes.

d) To protect the ecological functions of water resources and dependent biological diversity.

e) To ensure the application of imported water in a manner that does not adversely impact on the quality and quantity of water resources in a Prescribed Wells Area or Prescribed Surface Water Area, downstream areas, water dependent ecosystems or the productive capacity of the land.

f) To ensure any water discharged to the environment is of suitable quality to:

   i. sustain the existing uses of the water; and

   ii. protect ecosystems dependent on these resources.

10.2 Well siting, construction and maintenance

A permit is required for the drilling, plugging, backfilling, or sealing of a well and for the repairing, replacing or altering of the casing, lining or screen of a well, pursuant to section 127(3) (a) & (b) of the Act respectively.

The objectives and principles that follow apply specifically to an activity under section 127(3)(a) and (b) of the Act. They are additional to those expressed for all water

affecting activities, and are intended to apply only to wells of a depth equal to or greater than 2.5 metres.

Objectives

a) To ensure the drilling, plugging, backfilling or sealing of a well occurs in a manner that will protect the quality of the surface water, underground water resources and underground water dependent ecosystems.

b) To minimise the impact of repair, replacement or alteration of the casing, lining or screen of wells on the surface water and underground water resources and underground water dependent ecosystems.

c) To protect the surface water and underground water resources and groundwater dependent ecosystems from pollution, deterioration and undue depletion.

d) To ensure the integrity of the headworks of wells is maintained.

e) To ensure that wells are constructed in the correct aquifer system.

Principles

164. The relevant authority shall not grant a permit for the construction of a new or replacement well that may create or may contribute to a significant adverse effect on ecosystems that depend on underground water.

165. For the purposes of principle 164, in assessing the likelihood of significant adverse effects, consideration shall be given to:

    a) if at the date of application, a wetland is listed on the Department of Environment and Natural Resources South Australian Wetland Inventory Database (SAWID) for the South East of South Australia, as a wetland of high or very high conservation value – whether any part of the wetland as mapped in the SAWID falls within a 16 km^2 circle centred on the proposed point of taking of the allocation;

    b) whether the wetland identified in principle 165(a) is considered by the Minister to:

        i. demonstrate a level of dependence on underground water; and

        ii. be under significant or actual threat of degradation (identified by, but not limited to, a mean (arithmetic) decrease in underground water levels of greater than 0.05 metres/year (measured over the preceding five years) in a representative observation well within the 16 km^2 circle specified in principle 165(a) or, in the absence of any representative wells within that radius, in the nearest representative observation well or wells as determined by the Minister);

    c) the current demand for underground water (determined by the level of allocation within the Management Area);

    d) the volume of water proposed to be taken; and

    e) any other relevant matter.

166. For any underground water dependent ecosystem identified for protection under principle 165 above, the set-back distance for any new wells shall be calculated using the DE equation described in Section 2 (*Assessment of the Needs of Underground Water Dependent Ecosystems)*.

167. Notwithstanding principles 164 and 165, a permit for the construction of a replacement well shall be granted if the location of the replacement well is no closer to the wetland than the original well.

168. The equipment, materials and method used in the drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well, shall not have the potential to adversely impact on the quality of the surface water and underground water resources and water dependent ecosystems.

169. The drilling, plugging, backfilling or sealing of a well, or the replacement or alteration of the casing, lining or screen of a well shall not adversely impact aquifers, surface water flows and water dependent ecosystems.

170. Where a well passes, or will pass through two or more aquifers, an impervious seal shall be made and maintained between such aquifers.

171. The head-works of a well from which water is authorised to be taken shall be constructed so that the extraction of water from the well can be metered without interference.

172. The head-works of a well for the drainage or discharge of water (artificial recharge) for the purpose of taking and use according to Section 6 of this Plan shall be constructed so that the draining or discharge operations and extraction can be metered without interference.

10.3 Underground water access trenches (wedgeholes)

Principles 173 - 177 have no force or effect unless a regulation provides that wells of this class require a permit.

173. Any underground water access trench exceeding a depth of 2.5 metres shall be governed by principles 164 - 172.

174. The maximum surface area of an underground water access trench shall not exceed the area recommended by the relevant authority, for the area where the underground water access trench is to be constructed.

175. An underground water access trench must be, and must remain:

    a) fenced sufficiently to prevent stock access; and

    b) bunded or surrounded by an earthen levee at least 500 millimetres high.

176. All new underground water access trenches shall be maintained so as to prevent contamination of the water resources.

177. Completion of an underground water access trench must be reported within 30 days to the relevant authority, for inspection to ensure compliance with principles 173 – 176.

10.4 Draining or discharging of water into a well

The following objectives and principles apply to permits required for the draining or discharging of water directly or indirectly into a well ("artificial recharge") (section 127(3)(c) of the Act). These objectives are additional to those expressed for all water affecting activities.

Objectives

a) To protect the underground water resource from waste or pollutants (as defined in the *Environment Protection (Water Quality) Policy 2003* under the *Environment Protection Act 1993*, or its replacement document), to the receiving underground water resource during the draining or discharging of water into a well.

b) To provide for the draining or discharging (artificial recharge) of water directly or indirectly into a well in a manner that does not have the potential to adversely affect:

   i. the quality of surface water and underground water resources;

   ii. the integrity of the relevant aquifer (including, but not limited to, the ability of the aquifer to transmit water);

   iii. water tables (particularly where the adverse effect might include water logging, land salinisation or damage to infrastructure (roads, buildings, foundations etc.));

   iv. any water dependent ecosystem or ecologically sensitive area that depends on the underground water resource;

   v. the ability of other persons to lawfully take from that underground water;

   vi. the longevity of the drainage or discharge operations; and

   vii. the sustainable operation and management of aquifer storage and recovery schemes.

Principles

178. In addition to any permit required to drain or discharge water directly or indirectly into a well, additional authorisations may be required under the *Environment Protection Act 1993.*

179. Water drained or discharged into a well must comply with the *Environment Protection Act 1993* and any associated policy.

180. The salinity of drained or discharged water must not exceed:

   a) 1500 mg/L TDS; or

   b) the ambient background underground water salinity level (where the ambient background underground water salinity levels are less than 1500 mg/L TDS).

181. A permit to drain or discharge water into a well will not be issued unless a risk assessment is undertaken to the satisfaction of the Minister.

182. The risk assessment must be consistent with the *National Water Quality Management Strategy – Australian Guidelines for Water Recycling: Managing Health & Environmental Risks, Phase 1 2006*, and any subsequent guidelines, and any associated policy, and must include:

    a) an investigation into the suitability of the draining or discharging site, including but not limited to tests for transmissivity, effective porosity and storage coefficient, maximum injection pressures and calculated likely impacts on the integrity of the well and confining layers, and impacts of potentiometric head changes to other underground water users;

    b) an appropriate operation or management plan demonstrating that operational procedures are in place to protect the integrity of the aquifer on an ongoing basis;

    c) a water quality assessment which identifies hazards in the water being drained or discharged; and

    d) a report on the consequences and impacts to the ambient underground water resource where the water quality characteristics (salinity and chemistry composition) of the water to be discharged differ from that of the native underground water.

183. Water drained or discharged into a well by means of gravity of less than 20 ML/year is exempt from principle 182(a).

184. Roof runoff (surface water) drained or discharged into a well via a closed system of capture and transport is exempt from principles 182 (a), (c) and (d), provided that the system is equipped with a mechanism to divert first flush water.

185. Paddock runoff (surface water) that would have contributed to the natural vertical recharge of the unconfined or confined aquifer systems within the Management Area, and that is drained or discharged into a well, is exempt from principles 182 (a), (c) and (d) provided reasonable and practicable measures have been applied to protect water quality.

186. The granting of a permit for draining and discharge requires the submission to the relevant authority of an annual report that addresses the impacts to the ambient underground water at the draining and discharge site.

187. Roof runoff captured in a closed system and then drained or discharged into a well is exempt from principle 186.

188. For the purposes of principles 186 and 187, the relevant concentrations, levels or amounts shall be measured in sufficient representative samples of:

    a) the water to be drained or discharged; and

    b) ambient underground water collected from the proposed point of injection, or as near as possible to the proposed point of injection.

189. For the purposes of principle 188, “sufficient representative samples” means suitable samples, collected with equipment appropriate for the substance, material or characteristic to be measured and taken at suitable locations and times to accurately represent the quality of the relevant water.

190. For the purposes of principles 188 and 189, the term “ambient underground water” means the underground water (as defined in the Act) that exists in the relevant aquifer absent of any such water drained or discharged to that aquifer by artificial means.

191. The draining or discharging of water directly or indirectly into a well must not detrimentally affect the ability of other persons to lawfully take from that underground water, or degrade ecosystems dependent on the underground water.

192. The headworks for the draining or discharge of water shall be constructed so that extraction and draining and discharge operations can be metered without interference.

193. The headworks for the draining and discharge of water shall be constructed so that water cannot leak if the well becomes clogged.

194. For the purposes of principles 192 and 193, the term “headworks” means any assembly on top of a well located between the well casing and the water delivery system.

195. Wells constructed for the draining or discharge of water at pressures greater than gravity, must (in addition to all other requirements for well construction) be pressure cemented along the full length of the casing.

10.5 Managed Aquifer Recharge: aquifer storage and recovery

196. Managed aquifer recharge, including activities comprising aquifer storage and recovery developments, are subject to principles 178 – 195 (*Draining or discharging of water into a well*).

197. Any water licence granted for the recovery component of an aquifer storage and recovery development, must be consistent with principles 69 - 73 (*Basis of allocation of water drained or discharged into a well – Managed Aquifer Recharge*).

198. The recovery of discharged water from a well other than the discharge well must be consistent with principle 95 (*Applications to transfer water allocated on the basis of water drained or discharged*).

199. Any aquifer storage and recovery development must (subject to any authorisation to the contrary) be operated in a manner consistent with the *Environment Protection (Water Quality) Policy 2003* under the *Environment Protection Act 1993* or its replacement document.

10.6 Importation of Water

The following objectives and principles apply to permits required for using water in the course of carrying on a business (other than public water supply) at a rate that exceeds 1 ML/year where the water has been brought into the NRM region by any means (“use of imported water”), or from a water resource in some other part of the NRM region (prescribed by regulation pursuant to sections 127(5)(i) and 127(5)(k) of the Act).

The principles in this section are additional to those expressed for all water affecting activities.

Objective

a) To ensure that the application of imported water does not adversely impact on the quality and quantity of water resources in the PWA or surface water resources, or downstream areas, water dependent ecosystems or the productive capacity of the land.

Principles

200. The use of imported water:

   a) shall not cause a rise in the underground water level that is sufficient to detrimentally affect ecosystems or structures (including, but not limited to, any building, fence or wall);

   b) shall not have the potential to adversely affect the quality of the prescribed underground water resource;

   c) shall not adversely affect the productive capacity of the land by causing salinity, water-logging, perched water tables or other impacts.

201. For the purposes of principle 200, the total dissolved solids (TDS) in the imported water must not exceed:

   a) 1500 mg/L TDS; or

   b) the ambient background underground water salinity level (where the ambient background underground water salinity levels are less than 1500 mg/L TDS).

202. Notwithstanding principle 201, water can be imported for the purpose of being treated by a desalination process if the resultant treated water does not exceed 1500 mg/L TDS.

11. Monitoring

Section 76(4)(d) of the Act requires the Plan to assess the capacity of the resource to meet the demands for water on a continuing basis and provide for regular monitoring of the capacity of the resource to meet those demands.

Monitoring, evaluation and reporting is part of the systematic process of optimising performance, through measurements against an agreed reference point. For this Plan, the reference points relate to effectiveness of policies and the health of the underground water resource.

There is therefore a need to monitor and evaluate the effectiveness of the Plan's policies and the health and sustainability of the underground water resource.

A comprehensive monitoring program that considers the ecological and hydrogeological performance of the PWA is recommended to compare desired management objectives with actual performance, and to evaluate the effectiveness and efficiency of water provisions.

A detailed program to monitor the parameters listed below will be formulated and implemented through an investigations program detailed in the NRM Plan for the South East Natural Resources Management Region.

11.1 Monitoring Objectives

The monitoring strategy set out in this Plan aims to ensure:

a) That sufficient data is available to assess the capacity and health of the underground water resource and dependent ecosystems;

b) The timely evaluation and reporting of monitoring data;

c) The sustainable use of underground water resources; and

d) The adequate protection of underground water dependent ecosystems.

11.2 Monitoring the capacity of the underground water resource – The Water Level and Salinity Monitoring Network

DFW and its predecessors have been monitoring underground water levels in the Tintinara Coonalpyn PWA since 1983 when concerns were first expressed about falling water tables. Salinity monitoring began in the Mallee Highlands area in 1987 to monitor the impacts of land clearing. Whilst this monitoring has so far been concentrated in areas of better quality underground water where irrigation is occurring, the network has been expanded to include areas of saline underground water where the relationship between vegetation health and underground water depth and salinity was investigated under the National Action Plan for Salinity and Water Quality.

Unconfined Aquifer

Water Level Monitoring Network

The network has been constantly upgraded and expanded to monitor increases in irrigation development and is measured approximately quarterly (March, June, September and December) or at appropriate times to monitor the beginning and end of the irrigation season. This is carried out by the DFW and contractors.

The number of water level monitoring wells in the network is currently considered adequate for the Tintinara Coonalpyn PWA, with the recent addition of new observation wells in areas of concentrated pumping in the Tintinara Management Area helping to confirm the presence or otherwise of flow reversal during the irrigation season. Data loggers have been installed in the Tintinara Management Area to observe any variations in drawdown over the irrigation season.

Salinity Monitoring Network

The current salinity monitoring network in the Tintinara Coonalpyn PWA monitors both the salinity impacts of land clearing beneath the Mallee Highlands and any salinity effects of underground water recycling in the shallow unconfined aquifer.

A program to sample all private irrigation wells has begun, initially on the Coastal Plain. It is recommended that irrigators be required to supply at least one water sample a year at the end of the irrigation season.

Confined Aquifer

Water Level Monitoring Network

There are a number of water level observation wells monitoring the confined aquifer in the Tolmer Management Area, one of which is equipped with a data logger for continuous readings. There is also a sufficient number of observation wells located in the Tauragat Management Area to monitor drawdowns due to the irrigation extractions for olive plantations (three with data loggers). All available wells intersecting the middle and lower confined aquifers are being monitored. The network can only be expanded by drilling new observation wells at considerable expense.

The only monitoring well in the Mallee Highlands is to the east of the Tintinara Coonalpyn PWA and is SHG 6 (see Figure 8, *Appendix of Figures and Tables*) which lies just outside the eastern boundary of the PWA.

Salinity Monitoring Network

Underground water salinity in the Tolmer Management Area is currently monitored using monitoring wells (including irrigation wells) that will provide early warning for any increases in salinity due to reversal of underground water flow caused by drawdown.

There is one new salinity observation well in the middle confined aquifer in the Tauragat Management Area,

The network is able to be expanded if licence holders provide an annual sample.

DFW will endeavour to undertake monitoring in accordance with Table 11.1.

Table 11.1: Underground Water Monitoring

What	Where	When
Underground water levels in the unconfined aquifer	Unconfined aquifer water level monitoring network locations in the Prescribed Wells Area	At least 6 monthly
Underground water salinity in the unconfined aquifer	Unconfined aquifer salinity level monitoring network in the Prescribed Wells Area	Annually
Underground water level/pressure in the confined aquifer	Confined aquifer water level monitoring network locations in the Prescribed Wells Area	At least 6 monthly
Underground water salinity in the confined aquifer	Confined aquifer water salinity monitoring wells on the western margin of the Prescribed Wells Area	Annually

11.3 The strategy for regular monitoring of demands placed on the underground water resource

The strategy for regular monitoring of the demands placed on the underground water resource is provided below. The monitoring program will include:

Annual Water Use Report

203. An Annual Water Use Report must be prepared by each licensee and submitted to the DFW (or future equivalent organisation), Mount Gambier office, by 5 p.m. on 31 July each year.

204. Each licensee must provide the following information in the Annual Water Use Report:

    a) the volume of water allocated on the licence;

    b) the volume of water actually used by the licensee and recorded on each meter during the water use year (i.e. opening and closing meter readings);

    c) the period of water use (i.e. start date and end date of irrigation for the season);

    d) the purpose for which water has been taken;

    e) the salinity reading, date and well number of any underground water salinity measurements taken during the water use year;

    f) the total amount of imported water recharged for each meter for the purpose of Managed Aquifer Recharge in the water use year (where applicable); and

    g) where the water taken by the licensee is used for irrigation:

        i. the irrigation method;

        ii. a sketch plan showing the location of each area irrigated, a description of the equipment type used, and the area and location of each irrigation method and equipment type;

iii. the area of each crop irrigated;

iv. the number of irrigations; and

v. the nature of services used to schedule when irrigation is required (e.g. neutron probes, external irrigation scheduling service, tensiometer, etc).

Evaluation of the demands on the resource and the capacity of the resource to meet demands

205. DFW will endeavour to prepare an annual summary of the patterns in use of underground water.

206. By the end of the third operational year of the Plan, the Board will endeavour to commence a review of the Plan and the condition of the underground water resource in the Tintinara Coonalpyn PWA including:

a) trends in underground water level salinity;

b) trends in underground water table levels; and

c) levels of underground water extraction.

The data collected will be used to determine whether any changes are required to the TML.

11.4 Monitoring of the Water Needs of Ecosystems Dependent on Underground Water

The water needs of the ecosystems dependent on underground water are described in Table 2.4. Monitoring arrangements must be established to evaluate whether the policies in the Plan protect the water needs that have been identified.

This requires monitoring of critical hydrogeological and ecosystem parameters that can be used for this evaluation. These parameters include:

- mean underground water levels;
- seasonal underground water level fluctuations;
- underground water salinity
- species composition and abundance;
- species recruitment; and
- specific vegetation health measures such as death of tea tree in wetlands or disease in trees.

Subject to regional priorities and budget availability, a detailed program to monitor the parameters listed above will be formulated and implemented prior to the review of this Plan.

Other monitoring investigations required include:

a) dependency of *E. fasiculosa* on underground water within the Coastal Plain;

b) location and ecology of dissolution features;

c) hypogean ecosystems within the Coastal Plains and Mallee Highlands;

d) the risk of irrigation drainage causing water logging and contamination of perched wetlands in the Mallee Highlands;
e) water requirements of dependent ecosystems.

Identification of knowledge gaps and further research required

Current knowledge gaps with respect to the needs of water dependent ecosystems include:

1. A gap in baseline knowledge of underground water dependent ecosystems, underground water/surface water interaction and dependency including:
   a) water level and quality thresholds; and
   b) long term implications of climate change.

2. A regional integrated approach for the collection and interpretation of monitoring data, including:
   a) defining roles and responsibilities; and
   b) establishing reporting mechanisms.

3. Definition of the threatening processes, the risks they pose and the consequences of not addressing them, including:
   a) development of shallow and deep drains; and
   b) land use change (including cross-border issues).

4. A gap in baseline knowledge of cause-and-effect relationships, and the development of effective management tools to address the following issues:
   a) declining underground water discharge due to interception of recharge in inland areas by high water use crops and industrial plantation forestry;
   b) declining underground water discharge due to lowering of the water table as a result of climatic trends;
   c) increasing salinity due to landward migration of the boundary between fresh underground water (associated with declining water table elevations in the unconfined regional aquifer); and
   d) contamination of the aquifer, particularly with nitrates.

5. The development of environmental response functions (ERFs) for individual ecosystems dependent on underground water is required to better inform the determination of environmental protection policy. ERFs describe the relationship between ecosystem function and water regimes in which the ecosystems exist (e.g. depth to water table fluctuations, soil water content, soil water and underground water salinity). The types of investigations undertaken should be consistent with those conducted during 2006 (Ecological Associates 2006). In addition to the parameters listed above, at the more local scale (Underground Water Dependent Ecosystems of high ecological importance), monitoring programs should focus on the following:
   a) intra-annual underground water level and salinity trends, to assist in assessing whether the unconfined aquifer is responding to management

(this will require appropriately constructed monitoring wells within the protected Underground Water Dependent Ecosystems to provide representative data);

b) proximity of the pumping wells or to underground water dependent ecosystems, to assist in assessing whether the set back distances are adequate; and

c) the amount of existing underground water pumping occurring.

11.5 Evaluation

The evaluation of monitoring data will need to focus on assessing the effectiveness of the policies of this Plan in maintaining the ecological function of ecosystems dependent on underground water as entered on the South Australian Wetlands Inventory Database for the South East region.

Evaluation of monitoring data should be undertaken in a manner that considers underground water and ecosystem condition trends, primarily in relation to the proximity of water affecting activities in the vicinity of underground water dependent ecosystems, but also recognising that other factors such as climate variability and land management may be contributing to observed ecosystem condition.

In the case of all high ecological value underground water dependent ecosystems identified for protection through the Plan, evaluation and reporting of monitoring data should be undertaken annually. The Board in association with State Government agencies will need to determine who is best placed to undertake the evaluation of monitoring data.

References

Ecological Associates (2006). *Environmental water requirements of underground water dependent ecosystems in the South East PWA – field studies to support new and amended policy.* Prepared for REM.

12. Consistency with other plans and legislation

In preparing this Water Allocation Plan, the Board has had regard to the issues set out in section 7 of the *Natural Resources Management Act 2004, the Groundwater (Border Agreement) Act 1985,* the *South Eastern Water Conservation and Drainage Act 1992*, the *Upper South East Dryland Salinity and Flood Management Act 2002* and the *Native Vegetation Act 1991.*

The Plan also shows consistency with the following plans and policies:

a) Relevant management plans under the *Coast Protection Act 1972*;
b) Relevant Development Plans under the *Development Act 1993*;
c) The *Environment Protection Act 1993* and any associated policies;
d) Relevant plans of management under the *National Parks and Wildlife Act 1972*;
e) The South East Regional NRM Plan 2010;
f) The State Natural Resources Management Plan;
g) An Intergovernmental Agreement on a National Water Initiative 2004; and
h) South Australia's Strategic Plan 2011.

13. Appendix of Figures and Tables

Table 1: **Target Management Levels for Management Areas in the Tintinara Coonalpyn Prescribed Wells Area**

Management Area	Aquifer	Target Management Level (ML per Year)[1]	Target Management Level minus stock water use and domestic water use (ML per Year)[2]
Tintinara	Unconfined	26,500	26,000
Sherwood	Unconfined	16,350	16,000
Coonalpyn	Unconfined	19,650	19,500
Boothby	Unconfined	20,000	20,000
Tauragat	Confined	11,150	11,000
Tolmer	Confined	6,350	6,000
Kynoch	Confined	0	0

[1] The Target Management Level (TML) is the maximum annual volume of underground water that can be potentially extracted within a Management Area in a water use year. The TML is the sustainable limit for the relevant Management Area. The total tradeable components of allocations for irrigation, industry, public water supply, aquaculture and recreational use as well as provisions for unlicensed stock water use and domestic water use requirements must be managed to within the TML. Allocations in the form of seasonal carry-over and/or delivery supplements are not managed within the TML.

[2] Target Management Level (TML) minus unlicensed stock water use and domestic water use is the maximum annual volume of underground water that can be potentially extracted from an aquifer in a water use year for licensed purposes. Water (holding) licences and the tradeable components of water (taking) allocations in the Tintinara and Tolmer Management Areas will be reduced to the respective TML minus stock water use and domestic water use over the life of the Plan, as detailed in sections 6 and 8 of this Plan.

Table 2: Delivery components by system type for use in calculating Tradeable Components in the Tintinara and Tolmer Management Areas. The delivery component is expressed as a percentage of the base allocation and is allocated in addition to the base allocation.

System Type	Delivery Component percentage
Flood	18
Pivot/Spray	18
Traveller	18
Drip	11

Table 3: Net Irrigation Requirement for crops in the Tintinara Coonalpyn PWA*

Crop	Net Irrigation Requirement (ML/ha)
Cucumber	4.49
Geraldton Wax	8.47
Lawn/Turf	7.19
Lucerne	6.04
Maize (Oct)	6.73
Olive (Fresh)	4.58
Olive (Oil)	4.11
Onion (Sep)	7.21
Pasture/Dairy	7.69
Potato (Nov)	5.24
Potato ("Nadine")	6.55
Pumpkin (Nov)	5.31
Rock Melon (Nov)	5.70
Sweet Corn (Nov)	4.47
Tomato (Nov)	7.17
Water Melon (Nov)	5.02
Winegrapes	1.81

*Source: Rural Solutions SA (2002). *Working Document on Irrigation Requirements for the Tintinara Coonalpyn Prescribed Wells Area Version 3: September 2002*. Report to the Department of Water, Land and Biodiversity Conservation.

Figure 1: Prescribed Wells Areas of the South East Natural Resources Management Region

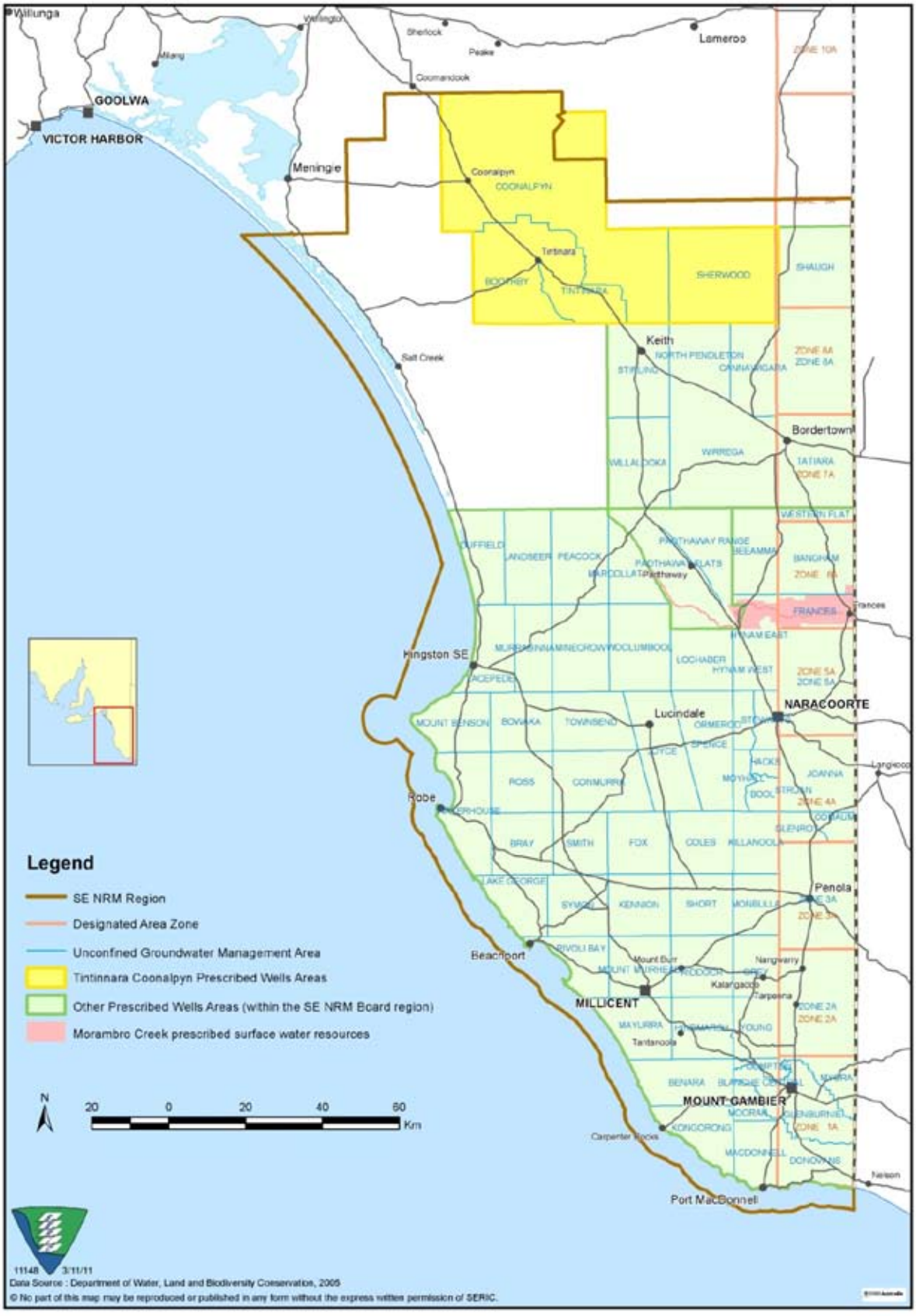

Figure 2: Area of crop (hectares) irrigated in Tintinara Coonalpyn PWA 2008/09.

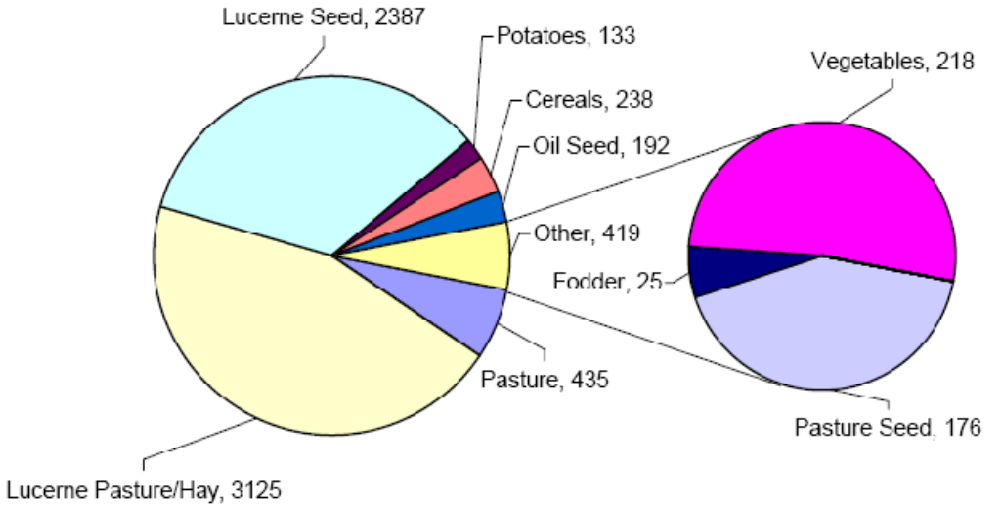

Figure 3: Megalitres of water applied by system type in the Tintinara Coonalpyn PWA as a proportion of the total water use 2008/09.

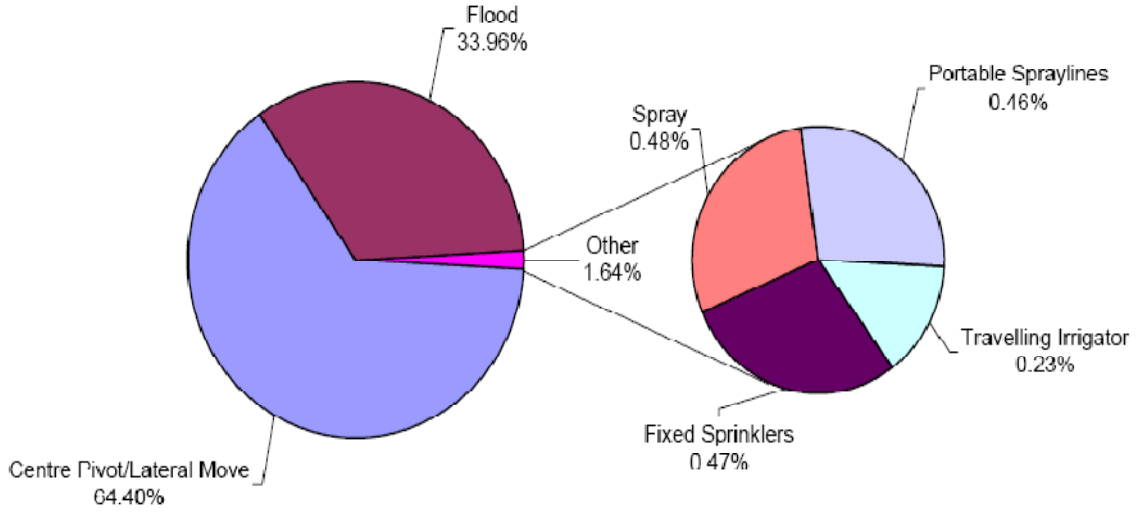

Figure 4: East-west schematic cross section through the Tintinara Coonalpyn PWA

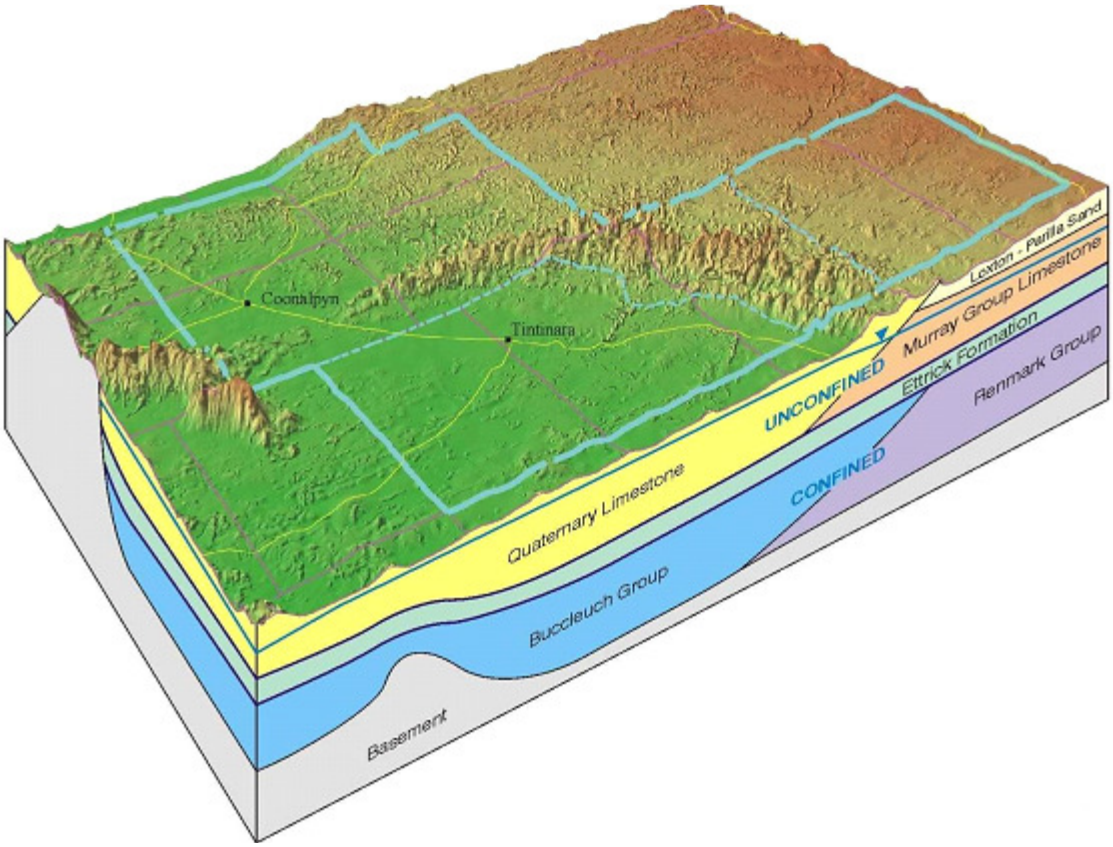

Figure 5: Unconfined Aquifer Management Areas in the Tintinara Coonalpyn PWA

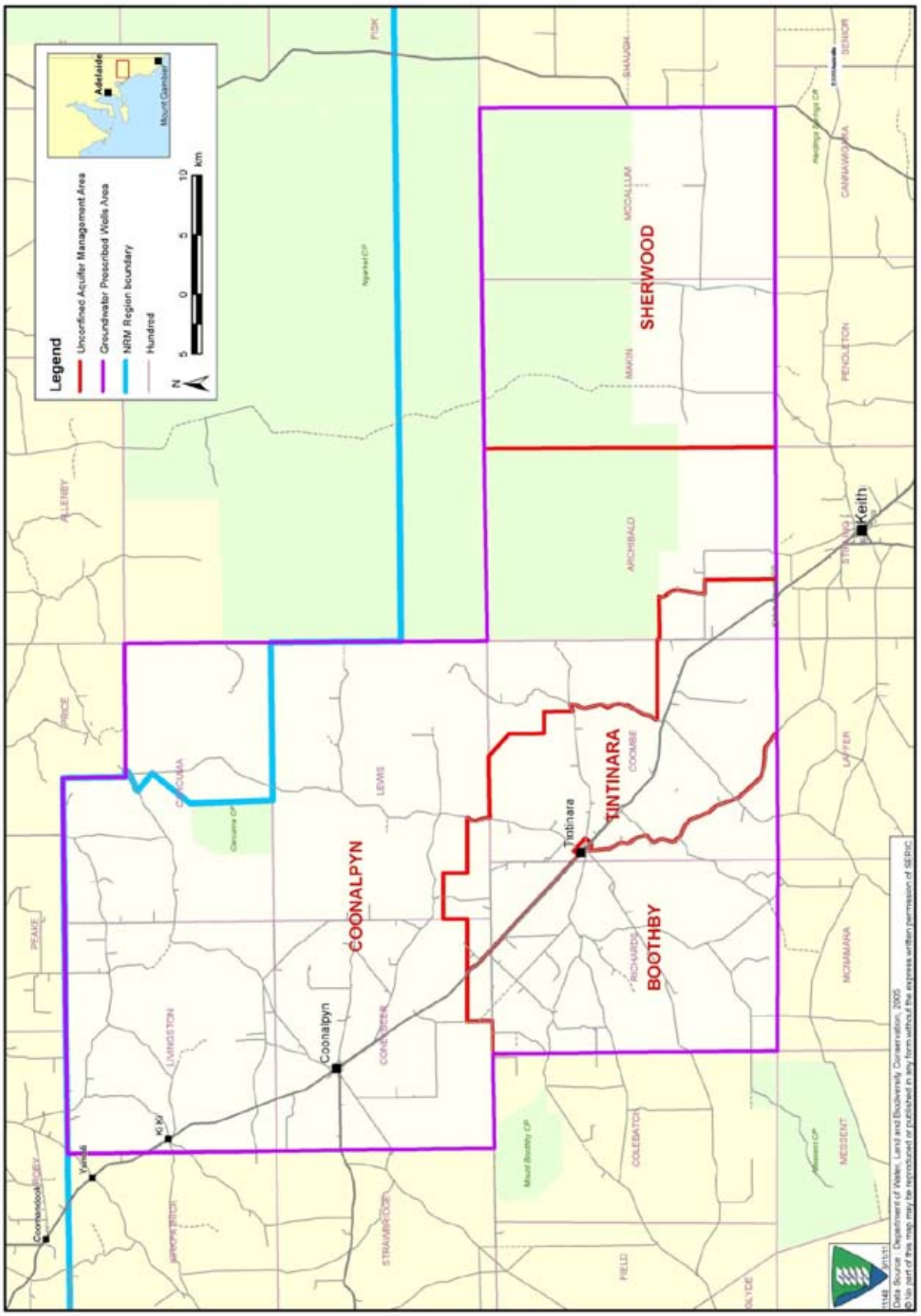

Figure 6: Confined Aquifer Management Areas in the Tintinara Coonalpyn PWA

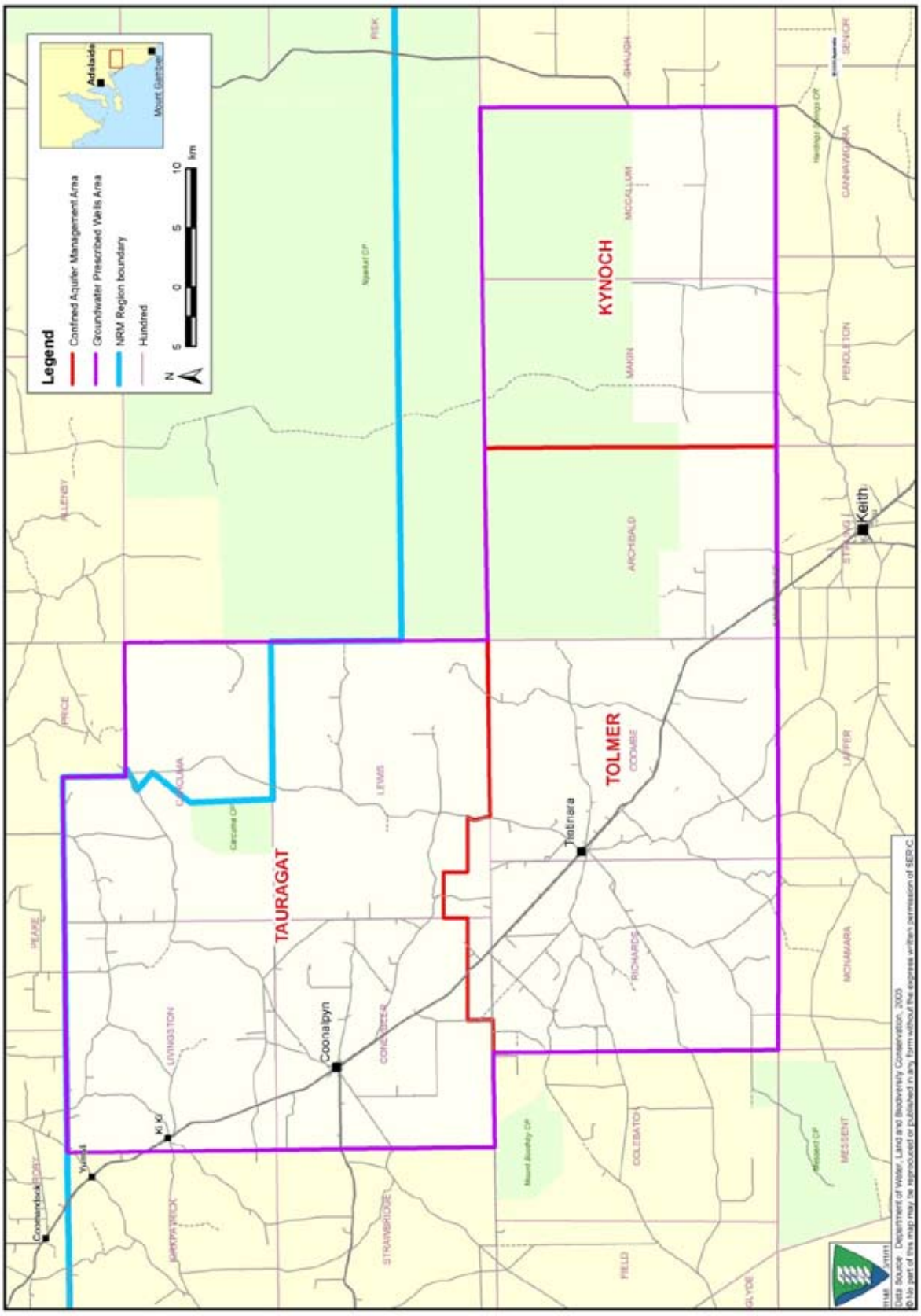

Figure 7: Native vegetation cover in the Tintinara Coonalpyn PWA

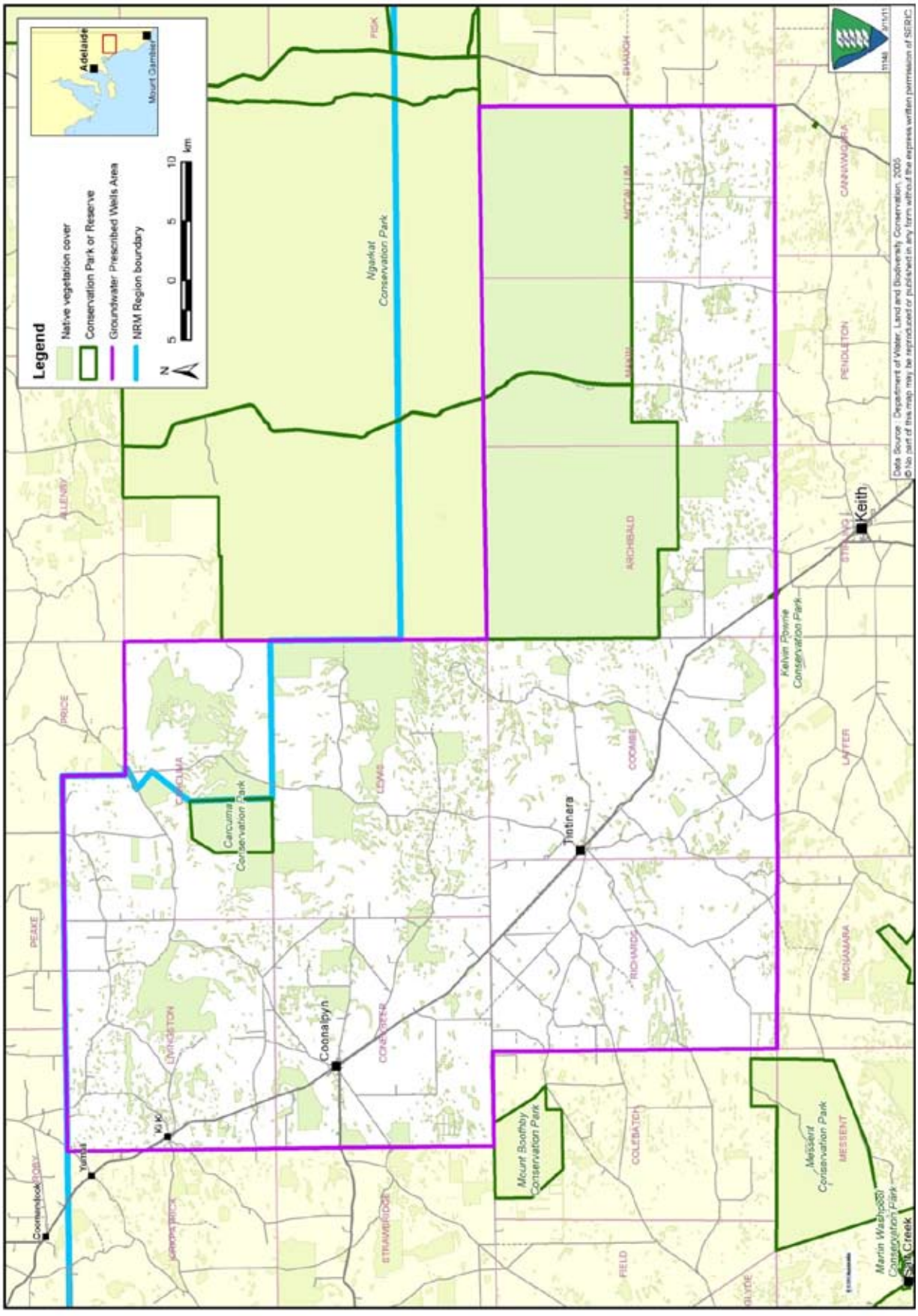

Figure 8: Location of wells referred to in the Plan

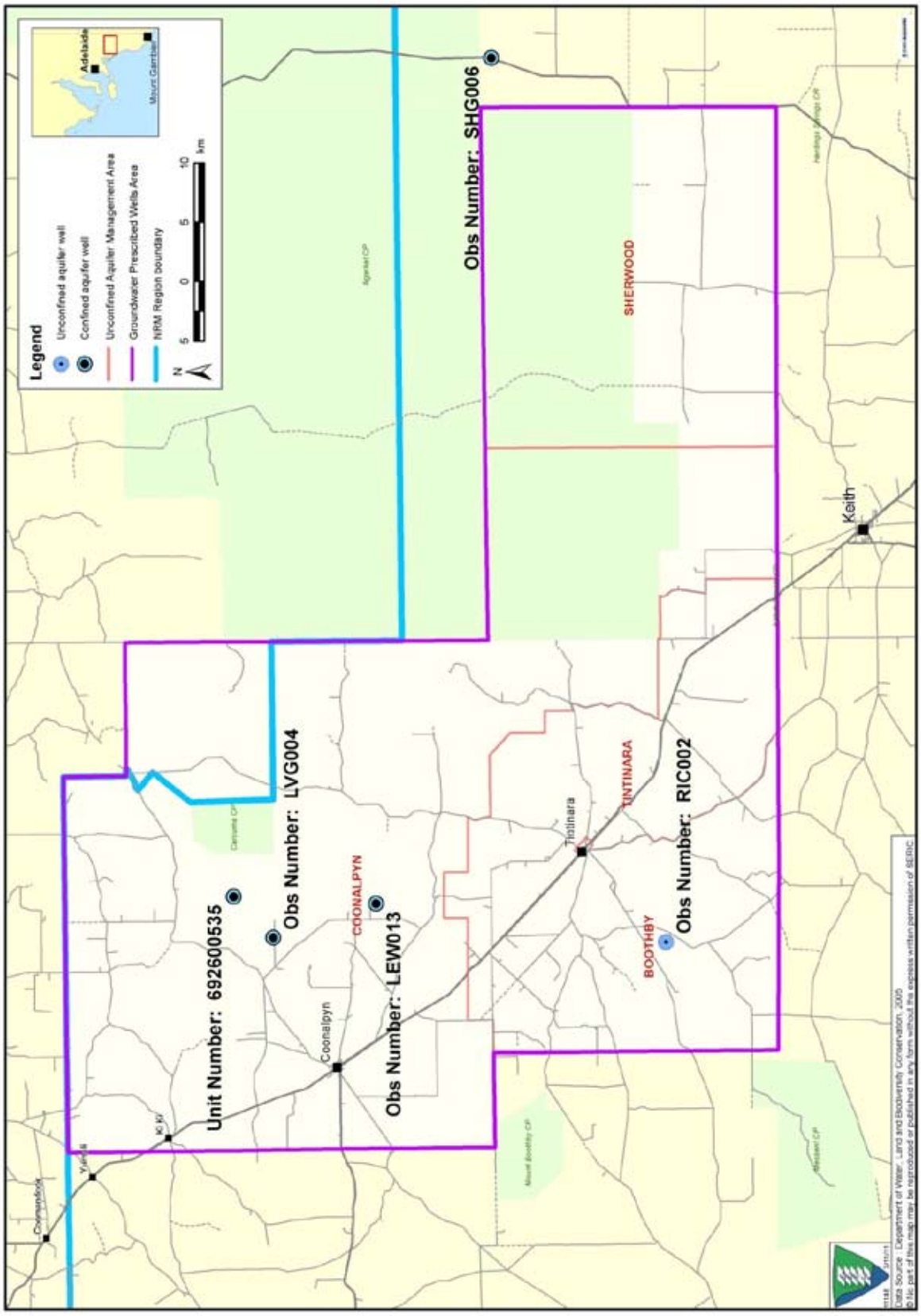

Figure 9: Wetlands in the Tintinara Coonalpyn PWA