

WETLANDS GREAT AND SMALL

A guide to the wetland diversity
of the South East of South Australia



Government of South Australia

Department of Environment
and Natural Resources

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40% of the wetlands in the region are less than 1ha in size and 86% are less than 10ha in size.



Brolgas with young - courtesy of Bob McPherson

What is a wetland?

The word 'wetland' is used to describe areas that are either regularly or permanently inundated with water. So what makes a puddle different from a wetland?

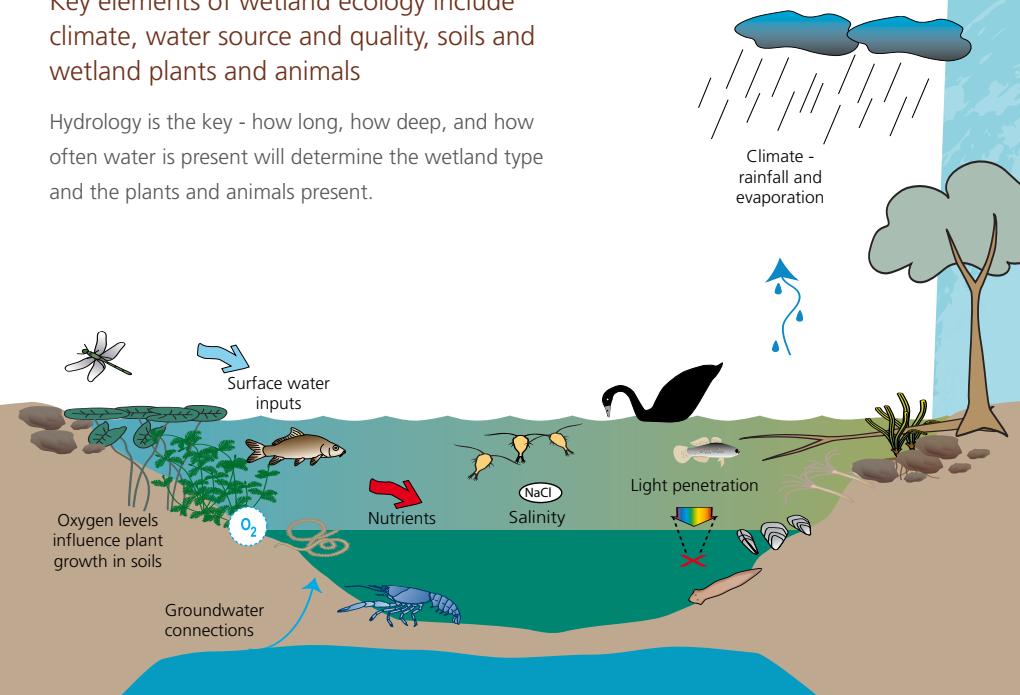
The key indicator of a wetland is that it supports animals and plants that need water to complete all or part of their lifecycle. Many wetlands also contain hydric soils, which are soils that have formed in the presence of water.

Australia is a dry continent and most wetlands in Australia experience a dry phase, some of which can last for years. Because of these changing conditions wetlands tend to be very dynamic and flexible environments that support a wide range of specially adapted plants and animals.

Water is the key to wetlands and patterns of wetting and drying determine what a wetland looks like and what species call it home.

Key elements of wetland ecology include climate, water source and quality, soils and wetland plants and animals

Hydrology is the key - how long, how deep, and how often water is present will determine the wetland type and the plants and animals present.



Wetland Hydrology - Wetting and drying

The presence or absence of water determines how a wetland works – it's the key to everything. In a dry environment like Australia, greater value is often placed on permanent wetlands, assuming they are 'better' than temporary wetlands: that they're bound to have more plants and animals because the water is present all the time.

In fact wetlands in Australia are mainly temporary in nature, a direct result of our dry climate, and our biodiversity has adapted to this.

Wetlands receive water either from rainfall that falls directly on the wetland, as surface water from a larger catchment and/or from groundwater.

Similarly wetlands lose water to evaporation and evapotranspiration (by vegetation) and through 'leakage' to groundwater. Some wetlands also lose water along drainage lines.

The source of water and the landscape setting all influence how often water is present, how long it stays around for, how deep the water is and how fresh. These are characteristics of the hydrology of a wetland and hydrology determines how a wetland functions.

Sporadic wetland hydrological patterns have resulted in the development of wetland flora and fauna that are adapted to a constantly changing environment, with many species specially adapted to survive drought and floods. These adaptations to wetting and drying often lead to the natural 'boom and bust cycle' of wetlands where life explodes on the arrival of water and crashes when the water dries up.

Surviving the Dry

Wetland animals

- moving to another wetland which still has water;
or
- having a drought resistant phase, such as laying eggs in the soil as many invertebrates do;
- 'hibernating' for months of years buried in the mud.

Wetland plants:

- 'tuber' roots which are buried deep in the mud
- tough seeds that resist drying out
- growing fast and setting seed fast



The South East - a wet landscape

The South East is basically a very flat plain underlain by porous limestone. On the surface the topography is dominated by parallel bands of 'stranded' dunes, sand dunes that were deposited as the sea receded in the distant past. These dunes are between 25 – 50 metres high, with wide flats in between which are up to 10 kilometres wide. The landscape has low natural drainage and once supported a vast number of wetlands on the interdunal flats and a diverse array of wetland types.

In fact, around 50% of the region was either temporary or permanent wetland habitat prior to European settlement. Unusually, the South east supports very few streams and river, due to the porous nature of the soils and the low relief.

Rainfall falling onto the surface of the South East historically either seeped into the soil or, when the landscape was wet, pooled on the flats and slowly meandered either north to the Coorong or South West to the coast.

This accumulation and movement of surface waters throughout the South East was very important to wetlands and wetland species, transporting minerals, sediments, seeds and animals around the landscape. Regional scale movement of water has been largely interrupted by changes to the landscape in the past two hundred years including clearing, drainage and the creation of roads and other infrastructure.

While surface or local run off provide water to wetlands in the south east many are also connected to the regional groundwater. These wetlands are also known as groundwater dependent ecosystems.

Many of the permanent wetlands of the region are obviously connected to the groundwater including the Blue Lake and the sink holes such as Piccaninnie and Ewens Ponds. However, it is important to realise that even the temporary wetlands of the region are supported by groundwater close to the surface.

The availability of groundwater to wetlands, especially in the porous soils of the South East, is a key factor in the health and permanency of many wetlands.

The interplay of groundwater and surface water throughout the region is primarily responsible for the wide diversity of wetland types in the region. The region continues to support large numbers of wetland (over 16,000) and harbors a diversity of wetland types not found in other temperate regions of Australia.

Over 70% of wetlands in the South East are connected to the groundwater.

Wetlands are a window into our groundwater. A decline in wetland health and extent is the first indicator that groundwater resources are under stress.

Wetland Vegetation

The interaction of surface water and groundwater produces the signature wetting and drying patterns of the different wetlands of the region. The influence of the water regime on wetlands is most clearly seen in the response of water dependent, or aquatic, plants.

Wetland dependent plants range from being fully aquatic - requiring permanent inundation, to amphibious species – which survive quite happily when it is dry, but require the occasional dip in order to complete their life cycle(e.g. River Red Gums).

Vegetation in temporary wetlands is especially resilient. Temporary wetlands that have been dry for years will bloom with characteristic wetland plants once water returns.

How plants get their oxygen can influence where they occur in a wetland. Terrestrial plants get their oxygen from between the soil particles in their root zone and therefore are found on the margins of wetlands.

Aquatic and amphibious species get their oxygen in other ways. Some get it from their leaves, which must be exposed to the air (emergent species), and are therefore restricted to shallow water or the edges of the water.

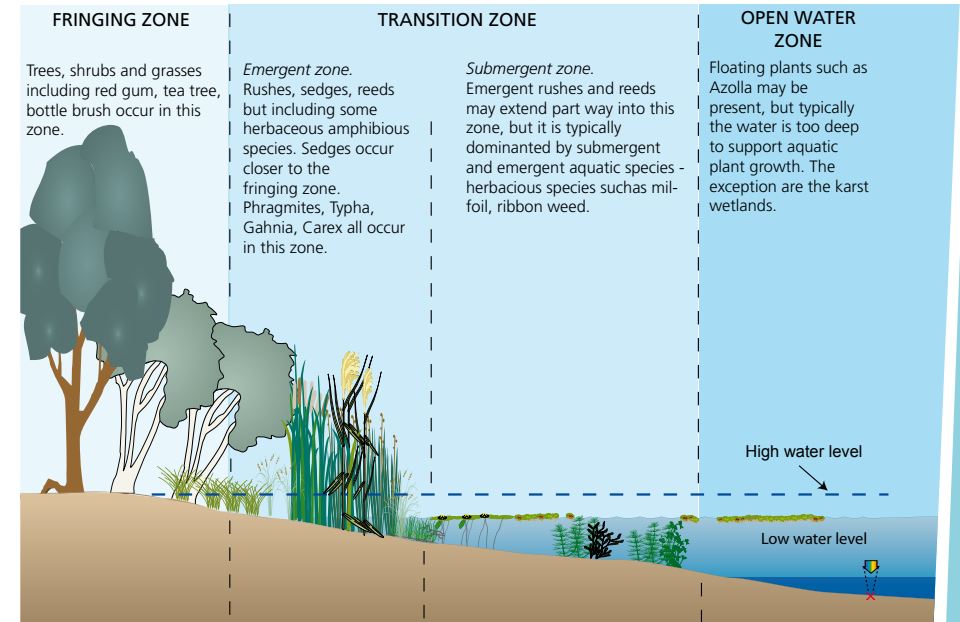
Fully aquatic species (submergent and floating) are adapted to getting oxygen out of the water. The depth to which aquatic species occur is limited by the amount of light they receive.

Wetland plants provide food, habitat, improve water quality, bank and soil stabilisation, removal of nutrients from the water column, and shading in the riparian zone.

Types of wetland plants:

- Emergent plants are those which have a large part, if not all of the stem and leave out of the water but are rooted in waterlogged soils.
- Submergent plants are those which occur underwater with some leaves and flowers floating on the water surface.
- Floating plants are those which drift on the surface of the water with their roots in the water column.

Piccaninnie Ponds and Ewens Pond have extraordinary beds of aquatic plants as the water clarity allows light to penetrate to unusual depths.



Example of aquatic vegetation zonation in a South East wetland

Fringing zone
Melaleuca, Swamp gum, and Blackwood

Transition zone
sedge and grasses-Phragmites

Open water zone
herbs and aquatic plants



Wetland Types found in the South East

There are a number of easy things to look for when attempting to work out what type of wetland you have. Firstly, how long is the water present and is the water fresh, brackish or salty? Secondly, where in the region does it occur, many of the wetland types of the region are found in specific areas.

The types of wetlands found in the South East have been broken down into temporary, permanent, fresh, brackish and saline below. However several types of wetlands fall across these boundaries – like all natural systems wetlands vary and change over time, and can fall in more than one grouping. This can make it a bit more difficult to pin down the actual wetland type.

For example the distinction between a grass sedge wetland in a dry year where the wetland has little water and a freshwater meadow may be difficult to call.

Understanding how often water is present can help determine the type of wetland. Again it's all about the water and how long, how much and how frequently it's present.



Types of wetlands found

	Types of wetlands found		
	Fresh	Brackish	Saline
Temporary	• Freshwater meadows • Grass sedge wetlands • Soaks and springs • Terminal Lakes	• Grass sedge wetlands • Inland interdunal wetlands • Soaks and springs • Terminal Lakes • Saline swamps	• Saline swamps • Salt lakes
Permanent	• Grass sedge wetlands • Karst wetlands • Peat swamp • Permanent freshwater lake • Soaks and springs	• Dune Lakes • Grass sedge wetlands • Karst wetlands • Soaks and springs	• Salt lakes

Where different wetland types occur

	Where different wetland types occur		
	Upper South East	Lower South East	Coastal
Temporary	• Inland interdunal wetlands • Saline swamps • Salt lakes	• Terminal Lakes • Dune Lakes • Grass sedge wetlands • Freshwater meadows • Soaks and springs • Salt lakes • Permanent freshwater lakes	• Saline swamps • Salt lakes • Soaks and springs • Dune lakes
Permanent	• Soaks and springs	• Dune Lakes • Grass sedge wetlands • Karst wetlands • Soaks and springs • Salt lakes • Peat swamps	• Karst wetlands • Soaks and springs • Dune lakes • Peat swamps

Freshwater Meadows

Freshwater meadows are very shallow (20-30 cm deep), often very small, temporary wetlands that are common in the inland parts of the region extending over the border into Victoria. They are the common 'puddles in paddocks' seen around the region.

Typically they have water for up to four months. They fill from storms and local run off in winter and spring, then start to dry out. They can be very large, but most are less than a hectare in size.

These wetlands are important to waterbirds and it's a common sight to see a pair of Brolgas, swans or ducks nesting in these wetlands.

They are often havens for frogs as many are rainfall fed and lack fish, resulting in good breeding habitat for frog species which use rainfall as breeding cues.

When dry, freshwater meadows may support no obvious wetland features and are often under-valued for this reason. However, when they are wet the soils and water have a high organic content.

Hydrological characteristics

Depth	20-30 cm
How long does it stay wet for?	3 – 4 months
When is it wet?	Winter/Spring
How often does it get wet?	Most years
Water Source	Local run off

Management considerations

- Avoid ploughing, draining or otherwise disturbing the bed of these wetlands (even when they are dry) as this destroy the seed and egg banks of significant wetland species.
- Avoid spraying over wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when nesting birds are present.
- Control the impact of stock (especially cattle) on damp wetlands as pugging can lead to loss of wetland species and turbidity.

Plants you may find

Running marsh flower (<i>Villarsia reniformis</i>)	White purslane (<i>Montia australasica</i>)
Southern water-ribbons (<i>Triglochin species</i>)	Cutting grass (<i>Gahnia species</i>)
Twig rushes (<i>Baumea species</i>)	Often fringed with River Red gums (<i>Eucalyptus camaldulensis</i>)

Examples in region

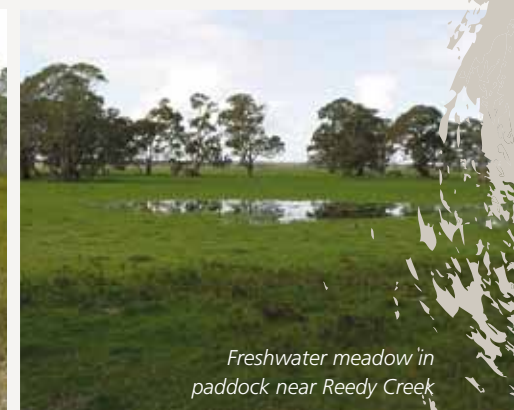
Temporary wetlands of the Nangwarry, Penola and Dismal swamp areas, shallow wetlands of the Topperwein Native Forest Reserve, wetlands of Mary Seymour and Big Heath Conservation Parks.



Dismal Swamp



Dry freshwater meadow in
Topperwein Native forest reserve



Freshwater meadow in
paddock near Reedy Creek



Typical grass sedge wetland



Lake Hawdon South



Typical grass sedge wetland



Mt McIntyre wetland



The Marshes native forest reserve

Grass Sedge Wetlands

Grass sedge wetlands may be temporary or permanent. As the name suggests they are characterised by the presence of grasses and sedges across the wetland and they typically have very little open water.

The temporary grass sedge wetlands can have water for 6 to 8 months of the year, whilst the permanent grass sedge wetlands may only dry down around the edges. Groundwater is an important source of water for the permanent grass sedge wetlands in the South East.

Grass sedge wetlands support a range of flora and fauna and provide good nesting habitat for brolgas, ducks, swans and other water birds. Being temporary wetlands, or having fluctuating edges, promotes diversity and abundance in the invertebrates, thus providing a good food supply for water birds. Permanent examples provide good fish habitat.

Hydrological characteristics

Depth	50 - 100 cm
How long does it stay wet for?	6-8 months or permanently
When is it wet?	Winter/Spring
How often does it get wet?	Most years
Water Source	Local run off, groundwater inflow

Management considerations

- Avoid spraying over wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when nesting birds are present.
- Maintain healthy buffer of native vegetation to filter surface water inflows.

Plants you may find

Cutting Grasses (<i>Gahnia species</i>)	Cumbungi (<i>Typha species</i>)
Common Reed (<i>Phragmites australis</i>)	Running Marsh Flower (<i>Villarsia reniformis</i>)
Twig rushes (<i>Baumea species</i>)	Milfoil (<i>Myriophyllum species</i>)
Prickly Tea tree (<i>Leptospermum continentale</i>)	Water Ribbons (<i>Triglochin procerum</i>)

Examples in region

Deadman Swamp, wetlands of Honans complex, the Marshes, Lake Hawdon North and South, Lake Frome

Soaks, Springs and Peat Swamps

Soaks, springs and peat swamps have developed where groundwater seeps out of the ground under pressure. They are some of the most unique wetlands of the region.

Wetlands of this type are found largely along the coast but do occasionally occur inland. These wetlands are typically less than 100 ha and may take the form of small pools or larger swampy areas.

Soaks, springs and peat swamps may be fresh to brackish depending on where they are found. They may be permanent or seasonal depending on how variable groundwater conditions are at the site and the impact of local run off on the water regime of the site. Peat swamps, which are rare around the world, are lined with peat which is formed when the constant groundwater discharge leads to a decreased rate of decay of organic material. Peat soils often feel spongy underfoot.

In general the vegetation is dense; species richness is high and can include many damp loving terrestrial species on the margins of the wetlands. Silky tea tree (*Leptospermum lanigerum*) is commonly associated with this wetland type in the lower south east.

Hydrological characteristics

Depth	0 - variable cm
How long does it stay wet for?	6-8 months or permanently
When is it wet?	Winter/Spring/Summer
How often does it get wet?	Most years or permanently
Water Source	Groundwater inflow with local run off influence

Management considerations

- Avoid ploughing, draining or otherwise disturbing the bed of peat wetlands as this exposes the peat to the air and destroys the ability of the wetland to hold water.
- Avoid spraying over wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when nesting birds are present.
- These wetland types support fragile plant species easily trampled or eaten by stock.

Plants you may find

Bottlebrush tea tree (<i>Melaleuca squarrosa</i>)	Silky tea tree (<i>Leptospermum lanigerum</i>)
Common Reed (<i>Phragmites australis</i>)	Twig rushes (<i>Baumea species</i>)

Examples in region

Parts of Picks Swamp and Middlepoint (Pascoes) swamp, beach springs, springs of Mosquito creek catchment, swamps on the break of the Woakwine and other dune ranges of the region.





Butchers Lake



Twig Rush Lagoon



Salt Lake

Saline Swamps and Salt Lakes

Key characteristics of saline wetlands are the presence of salt, the dominance of low growing salt tolerant vegetation and a lack of trees. Saline wetlands are more common in the upper south east and are generally found near the coast. They do, however, also occur in the lower south east and some of these are the largest wetlands in the region.

Saline wetlands are often assumed to have low biodiversity values, however despite having generally lower species richness, the species that do occur in saline systems can occur in huge numbers. Testament to this fact is the high usage of saline wetlands by waterbirds, who use these wetlands as feeding grounds.

Saline swamps are characterised by having saline to hypersaline water (>10,000 mg/L). They are generally shallow and temporary and are often unvegetated when wet, although the bed of the wetland may be vegetated when dry.

Salt lakes are some of the largest wetlands of the region and are primarily found in the lower south east. They have hypersaline water and are unvegetated. Fluctuating water levels supports exposed mud flats that provide good feeding habitat for wading waterbirds.

Hydrological characteristics

Depth	0 - 80 cm
How long does it stay wet for?	6-8 months or permanently
When is it wet?	Winter/Spring/Summer
How often does it get wet?	Most years or permanently
Water Source	Local run off with groundwater influence

Management considerations

- Avoid spraying over wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when water birds are present
- Manage stock grazing to reduce impacts on vegetation.
- Avoid altering the salinity (by diverting fresh or saline water).

Plants you may find

Samphire (*Halosarcia species*)

Glassworts (*Sarcocornia species*)

Tassel grass (*Ruppia species*) which is an important food and shelter source for waterbirds, invertebrates and fish.

Examples in region

Salt Lake, Butchers Lake, Lake Eliza, George and St Claire.

Dune Lakes

Dune lakes occur within the coastal dunes. They range from small to medium in size and are may be fresh or brackish. Dune lakes may be permanent or temporary and, like all lakes, support large areas of open water.

Dune Lakes are all groundwater dependent, although temporary lakes may be more influenced by local run off and surface water inputs.

These lakes all occur within the lower south east.

Hydrological characteristics

Depth	shallow – very deep
How long does it stay wet for?	6 - 8 months or permanently
When is it wet?	Every year or permanently
How often does it get wet?	Most years
Water Source	Groundwater and local run off

Management considerations

- Fence to manage stock grazing to reduce impacts on fringing vegetation.
- Water regional groundwater levels to maintain groundwater input to sites

Plants you may find

Running marsh flower (<i>Villarsia reniformis</i>)	White purslane (<i>Montia australasica</i>)
Southern water-ribbons (<i>Triglochin species</i>)	Cutting grass (<i>Gahnia species</i>)
Twig rushes (<i>Baumea species</i>)	Often fringed with River Red gums (<i>Eucalyptus camaldulensis</i>)

Examples in region

Lake Robe, Lake Robe, Little Dip, various wetlands around Nora Creina



Lake Wooley



Sea Lake



Ewans Ponds



Death Hole



Piccaninnie Ponds

Karst Wetlands

Karst related wetlands are very rare around the world and yet are a notable wetland type of the South East. Many of the regions most iconic wetlands are karst wetlands. Karst wetlands are so named because they are formed in holes created by dissolution of the limestone that underlies the region.

This group of wetlands includes the sink holes such as Little Blue Lake and Piccaninnie and Ewens Ponds as well as underground systems. They are found only in the Lower South East and south and west of Mount Gambier.

Karst wetlands are characterised by having open permanent water habitat with direct connection to subterranean habitat, and are very deep and very fresh. These wetlands are notable for the clarity of their water and may support impressive stands of submerged aquatic vegetation at great depths.

Karst wetlands are completely dependent on groundwater and provide a window into how regional groundwater levels are changing over time. Karst pools often discharge water to create substantial swamps and peat wetlands. These wetlands provide significant habitat for native fish species.

Hydrological characteristics

Depth	Very deep
How long does it stay wet for?	Permanently
Water Source	Groundwater and local run off

Management considerations

- Fence to manage stock grazing to reduce impacts on fringing vegetation.
- Maintain regional groundwater levels to maintain groundwater discharge at sites
- Ensure local runoff is not contaminated with nutrients, pesticides and suspended solids as these can impact on water quality at these sites. This is a key threat where these wetlands occur near dairy farming areas.

Plants you may find

Common Reed (*Phragmites australis*) fringing Cumbungi (*Typha species*) fringing
 Silky tea tree (*Leptospermum lanigerum*) fringing
 Submerged aquatics such as *Chara* and *Nitella* species

Examples in region

Ewens ponds, Piccaninnie Ponds, Crescent pond, Death Hole, Stratmans pond.

Inland Interdunal Wetlands

Inland interdunal wetlands form in basins in the lowest part of the flats between dune systems and are fed by local water runoff and surface water from the catchment. Historically these wetlands were semi-permanent and were connected by wide floodplains through which water meandered north in wet years. Nowadays they are almost all seasonal, filling annually or every few years.

They typically occur in the upper south east. And are fresh to brackish. These wetlands are shallow (generally less than 1 m deep although there may be deeper basins) and emergent wetland vegetation grows across the wetland basin when it is wet.

As these wetlands act as evaporation basins they progressively become more salty as water evaporates, but are not truly saline.

These wetlands provide large areas of shallow habitat suitable for a range of fauna species including large numbers of waterbirds, fish and frog species.

Hydrological characteristics

Depth	0-100 cm (deeper pools may be present)
How long does it stay wet for?	4-6 months
When is it wet?	Winter/Spring
How often does it get wet?	1 in five years
Water Source	Surface water (from catchment) and local run off

Management considerations

- Avoid spraying near wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when water birds are present.
- Manage stock grazing to reduce impacts on wetland bed and vegetation when dry.
- Maintain connectivity with other wetlands and catchment to ensure freshwater supply.
- Maintain a buffer zone of fringing vegetation.

Plants you may find

Water ribbons (<i>Triglochin</i> sp)	Sea rush (<i>Juncus kraussii</i>)
Common Reed (<i>Phragmites australis</i>)	Twig rushes (<i>Baumea</i> species)
Salt paperbark (<i>Melaleuca halmaturorum</i>)	River Red Gum (<i>Eucalyptus camaldulensis</i>) fringing on floodplain.

Examples in region

West Avenue wetlands, Tilley Swamp wetlands



Rocky Swamp



Henry Creek



West Avenue Floodplain



Cockatoo Lake



Bool Lagoon

Terminal Lakes

Terminal lakes are the basins at the bottom of a river or creek. Naturally water sits in the basin until it evaporates, possibly overflowing into other wetland depressions in extreme wet years.

These wetlands are typically fresh to brackish and are fed by surface water delivered from an upstream catchment area. Terminal lakes are typically large, often being greater than 100 hectares, and shallow.

Terminal lakes are relatively rare. In the South East they are found mainly associated with the creeks that cross the Victorian border.

Terminal lakes are temporary in nature, however depending on capacity, may retain water for several years following a filling event. They provide good habitat for waterbird breeding and many are also important for frog and fish species.

Hydrological characteristics

Depth	0-100 cm (deeper pools may be present)
How long does it stay wet for?	4-6 months
When is it wet?	Winter/Spring
How often does it get wet?	1 in five years
Water Source	Surface water (from streams and creeks) and local run off. Supported by groundwater close to the surface.

Management considerations

- Avoid spraying near wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food source for waterbirds.
- Control foxes when water birds are present.
- Manage stock grazing to reduce impacts on wetland bed and watercourse.
- Rehabilitate and fence riparian areas of watercourses that deliver water to the lake to improve water quality.
- Maintain a buffer zone of fringing vegetation.

Plants you may find

Water ribbons (<i>Triglochin</i> sp)	River eel grass (<i>Vallisneria americana</i>)
Common Reed (<i>Phragmites australis</i>)	Twig rushes (<i>Baumea</i> species)
Lignum (<i>Muehlenbeckia florulenta</i>)	River Red Gum (<i>Eucalyptus camaldulensis</i>) fringing (some examples)

Examples in region

Bool Lagoon, Cockatoo Lake

Permanent Freshwater Lakes

Permanent freshwater lakes have water all year round, although they may partially or completely dry up during long droughts. Most are more than two metres deep. They may be quite large and always support open water.

There are relatively few permanent freshwater lakes in Australia but the south east supports several.

The margins of permanent freshwater lakes often support aquatic plants, both submergent and emergent species; however there are rarely aquatic plants that extend to depths beyond one metre.

Permanent freshwater lakes are important refuges for animal and plant species during dry periods and provide the opportunity for these species to repopulate temporary wetlands after drought. They are particularly important sites for frog and fish species.

Hydrological characteristics

Depth	100 cm - any depth
How long does it stay wet for?	Permanently
Water Source	Ground water is the primary water source for permanent freshwater lakes although they do receive significant inputs from surface water (from streams and creeks) and local run off.

Management considerations

- Avoid spraying near wetland areas (particularly when wet) with pesticides or herbicides as these will kill many wetland plants as well as the beneficial invertebrates that are a food sources for waterbirds.
- Control foxes when water birds are present.
- Manage stock grazing to reduce impacts on wetland.
- Maintain a buffer zone of fringing vegetation to filter surface water entering the wetland.

Plants you may find

Water ribbons (<i>Triglochin</i> sp)	Ribbonweed (<i>Vallisneria americana</i>)
Common Reed (<i>Phragmites australis</i>)	Twig rushes (<i>Baumea</i> species)
Lignum (<i>Muehlenbeckia florulenta</i>)	River Red Gum (<i>Eucalyptus camaldulensis</i>) fringing (some examples)

Examples in region

Blue Lake, Valley Lake, Lake Edward, Lake Leake



Lake Leake



Lake Bonney



**Government
of South Australia**

Department of Environment
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SKM (2009). Classification of groundwater-surface water interactions for water dependent ecosystems in the South East, South Australia.

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