

Department for Environment and Heritage  
Kangaroo Island  
Natural Resources Management Region



Estuaries Information Package



Government  
of South Australia



Australian Government



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# Overview

The Kangaroo Island Natural Resources Management region (KI NRM region) is one of eight NRM regions within the State (see Figure 1). The region covers an area of 4,370 square kilometres and has 457 kilometres of coastline. Within the region, twenty-five estuaries have been identified. These provide substantial environmental, economic and social values to the community.

## Environment

- All of the estuaries identified in the National Land and Water Resources Audit (NLWRA) are wave dominated.
- The Breakneck River estuary is one of three estuaries within South Australia that has been identified in the NLWRA as near pristine.
- Most estuaries in the region receive flow seasonally with intermittent openings to the sea.
- There are no mangroves and only limited saltmarshes within Kangaroo Island's estuaries.

## Conservation and protection

- All of Kangaroo Island has been identified as a significant site for fish, shorebirds and seabirds.
- Eight estuaries are protected within national parks, conservation parks, wilderness protection areas or aquatic reserves including Breakneck River, Rocky River, Ravine Des Casoars, Waterfall Creek, American River/Pelican Lagoon, South West River, Salt Creek and De Mole River.
- The American River/Pelican Lagoon estuary is part of the American River (Pelican Lagoon) Aquatic Reserve.
- Six estuaries are included in the Directory of Important Wetlands in Australia (DIWA).
- Ten sites located within estuaries are listed on the Register of the National Estate.

## Cultural and socio-economic values

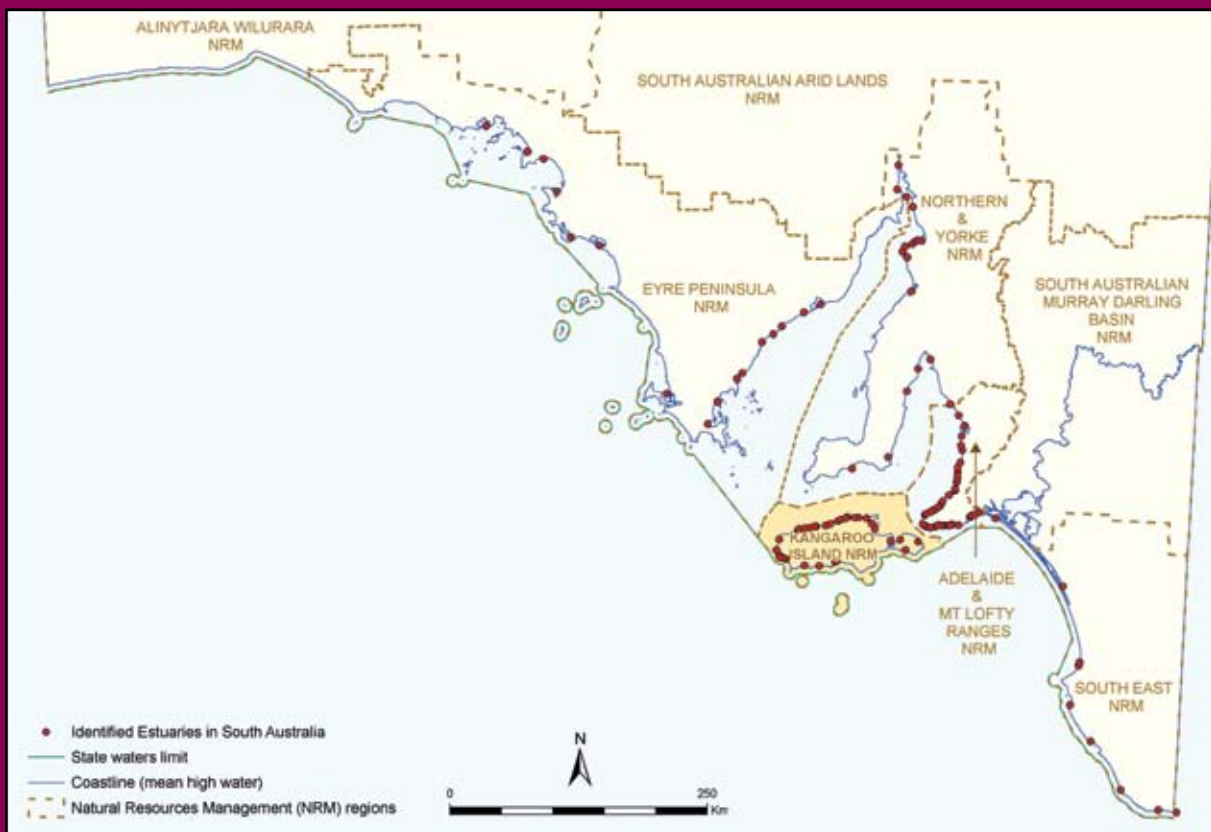
- While there are no Aboriginal communities on Kangaroo Island, Aborigines most likely inhabited Kangaroo Island until about 4,300 years ago.
- Official colonisation of the island began in 1836 and some European heritage sites are associated with estuaries.
- The region's estuaries provide significant economic benefit to the community through eco-tourism, agriculture, aquaculture, commercial fishing and recreational activities.

## Issues and initiatives

- Land clearance, agricultural runoff, altered environmental flows and increasing tourism ventures are impacting on the condition of the estuaries.
- Several initiatives are underway that aim to increase our understanding about the local estuarine systems and to help manage and protect them.



Figure 1. The KI NRM region and identified estuaries in South Australia







# 1. Introduction

The South Australian Department for Environment and Heritage (DEH), with support from the Australian Government's Natural Heritage Trust, has developed this estuaries information package (EIP) for Kangaroo Island (KI) to support natural resources management (NRM) bodies, State and local government and other agencies in undertaking planning and management in estuarine areas.

There are four other EIPs in the series for South Australia: Eyre Peninsula (EP), Northern and Yorke (NY), Adelaide and Mount Lofty Ranges (AMLR) and South East (SE) NRM region EIPs.

Each EIP consists of information collated from various sources relevant to the estuaries within that region. As a result, some key information gaps and potential directions have been included as a guide for management options for South Australia's estuaries.

As part of the *State NRM Plan 2006*, one of the resource condition targets for water is that by 2015, no further net loss of wetlands or estuaries, extent or condition, has occurred compared to 2006.

# 2. What is an estuary?

Estuaries and the land surrounding them are places of transition - where water from the land meets and mixes with the sea. They may be large or small systems, influenced by tidal exchange, stormwater discharge or groundwater intrusion.

Fluctuating salinity levels occur in estuaries. A variety of flora and fauna species have been able to adapt to the conditions and live within estuaries.

Estuaries are generally highly productive systems that are essential for the health and well being of the marine environment. The health of the estuary is very dependent on the catchment-coast-ocean connection. Land management practices and land uses occurring upstream and on the adjacent lands have the potential to affect water quality, animal life and habitats within the estuary.

The *Natural Resources Management Act 2004* defines an estuary as:

'A partially enclosed coastal body of water that is either permanently, periodically, intermittently or occasionally open to the sea within which there is a measurable variation in salinity due to the mixture of seawater with water derived from on or under the land'.

The Act also notes that an estuary may include any ecosystem processes or biodiversity associated with an estuary and estuarine habitats adjacent to an estuary.

## 3. Estuaries of the KI NRM region

### 3.1 Estuary classification

Twenty-five estuaries have been identified for the region (see Figure 2) by an across-agency Estuaries Working Group. All ten of the estuaries included in the National Land and Water Resources Audit (NLWRA) were identified as wave-dominated.

Information on estuary classification, maximum length, perimeter and water area is contained in Table 1; only those estuaries that have been mapped as part of the NLWRA (2001) have been included. Table 2 provides information on catchment size for each estuary.

**Table 1. KI NRM region estuary classification and size**

Estuary	Classification	Sub classification	Approximate size of estuary
			(maximum length, perimeter and water area) L = length (km) P = perimeter (km) A = area (km <sup>2</sup> )
Willson River	Wave dominated	Coastal embayment, coastal creek or channel	L = 1.41 P = 3.05 A = 0.08
Eleanor River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
Harriet River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
Stunsail Boom River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
South West River	Wave dominated	Coastal embayment, coastal creek or channel	L = 0.24 P = 0.75 A = minimal
Western River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
Middle River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
Cygnets River	Wave dominated	Coastal embayment, coastal creek or channel	N/A
American River/ Pelican Lagoon	Wave dominated	Coastal embayment, coastal creek or channel	L = 9.7 P = 43.06 A = 17.96
Chapman River	Wave dominated	Coastal embayment, coastal creek or channel	L = 3.94 P = 15.52 A = 0.96

Note: only those estuaries that have been mapped as part of the NLWRA (2001) have been included.

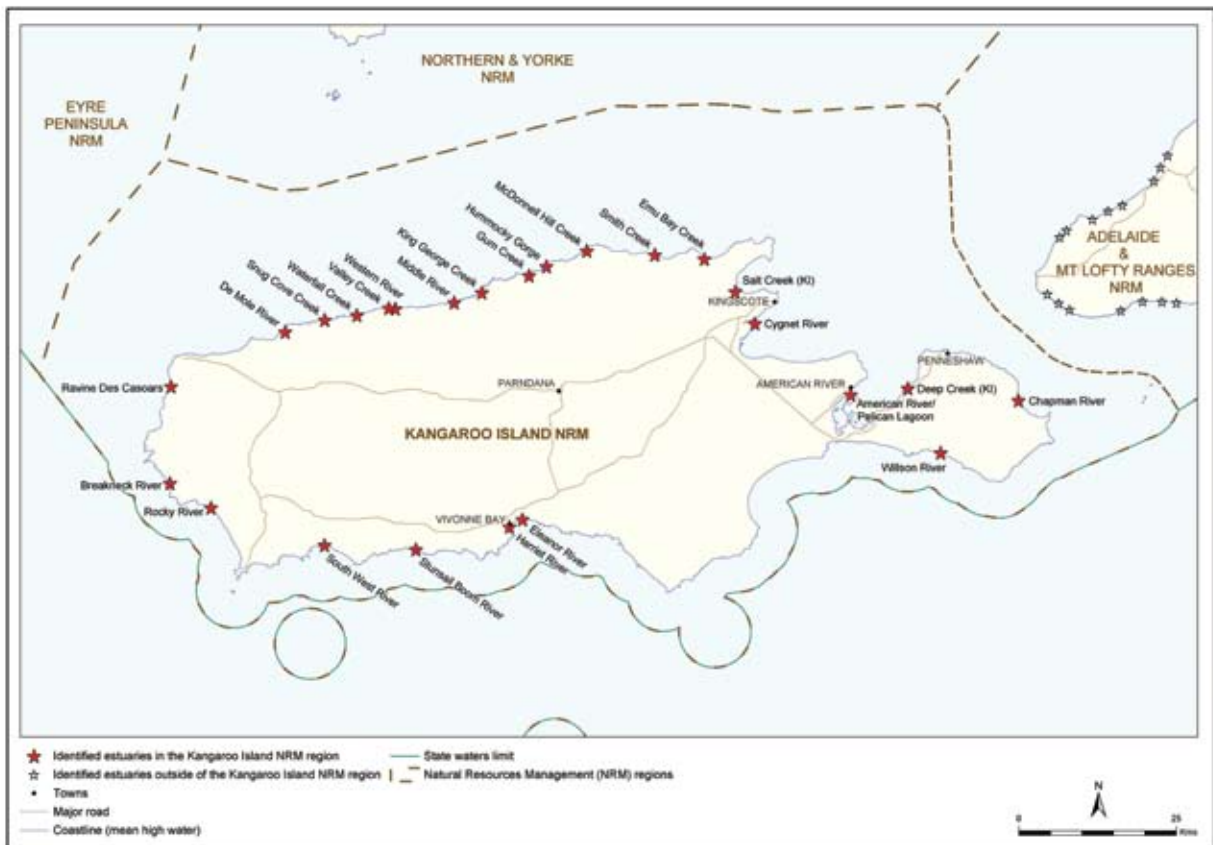
**Table 2. Estuaries and their associated catchment size**

Estuary	Catchment size (km <sup>2</sup> )	Estuary	Catchment size (km <sup>2</sup> )
Willson River	64	Middle River	146
Eleanor River	262	King George Creek	35
Harriet River	152	Gum Creek	33
Stunsail Boom	324	Hummocky Gorge	65
South West River	155	McDonnell Hill Creek	65
Rocky River	216	Smith Creek	34
Breakneck River	92	Emu Bay Creek	30
Ravine Des Casoars	96	Salt Creek (KI)	63
De Mole River	104	Cygnets River	606
Snug Cove Creek	18	American River/Pelican Lagoon	13
Waterfall Creek	13	Deep Creek (KI)	31
Valley Creek	8	Chapman River	73
Western River	88		

Source: Estuaries – Marine Estuarine database – DEH. Compiled 2006.

Note: although every effort has been made to ensure the accuracy of the statistical information provided from the spatial data, errors in the spatial data are possible.

**Figure 2. Estuaries of the KI NRM region**







## 4. Surface water, groundwater and marine areas

### 4.1 Environmental flows

Many estuaries on the island are subject to seasonal flow or have decreased freshwater flow through water extraction from the catchment, primarily for agricultural activities. This has a major consequence for water flows in the Harriet, Eleanor, South West, Middle and Chapman Rivers and Deep Creek (KI) estuaries (Bryars 2003).

### 4.2 Groundwater influence

It is possible that groundwater contributes to stream flow in estuaries in the region, particularly during the Summer months. Groundwater features in the KI NRM region are shown in Figure 3.

### 4.3 Marine bioregions and biounits

A marine bioregion is an area within the marine environment that has distinctive biodiversity and can consist of several smaller biounits. Each biounit is defined primarily on the basis of coastal physiography, topography and major marine physical habitat or seascape features of habitat distributions at a scale of 100 km<sup>2</sup>. For further information see [http://www.environment.sa.gov.au/coasts/marineparks/background/marine\\_bioregions.html](http://www.environment.sa.gov.au/coasts/marineparks/background/marine_bioregions.html).

The KI NRM region covers three marine bioregions and seven marine biounits (see Figure 4). The estuaries from De Mole River in the west to Chapman River in the east are located in the Cassini, Nepean and Backstairs biounits within the Gulf St Vincent bioregion, whilst those from Willson River in the east to Ravine Des Casoars in the west are located in the Gantheaume biounit in the Eyre bioregion. Only a small portion of the Coorong bioregion is located within the KI NRM region boundaries and no estuaries (on Kangaroo Island) are located within this area. Other biounits are located within the region though no estuaries occur within them.

Figure 3. Groundwater watertable depth and groundwater basins

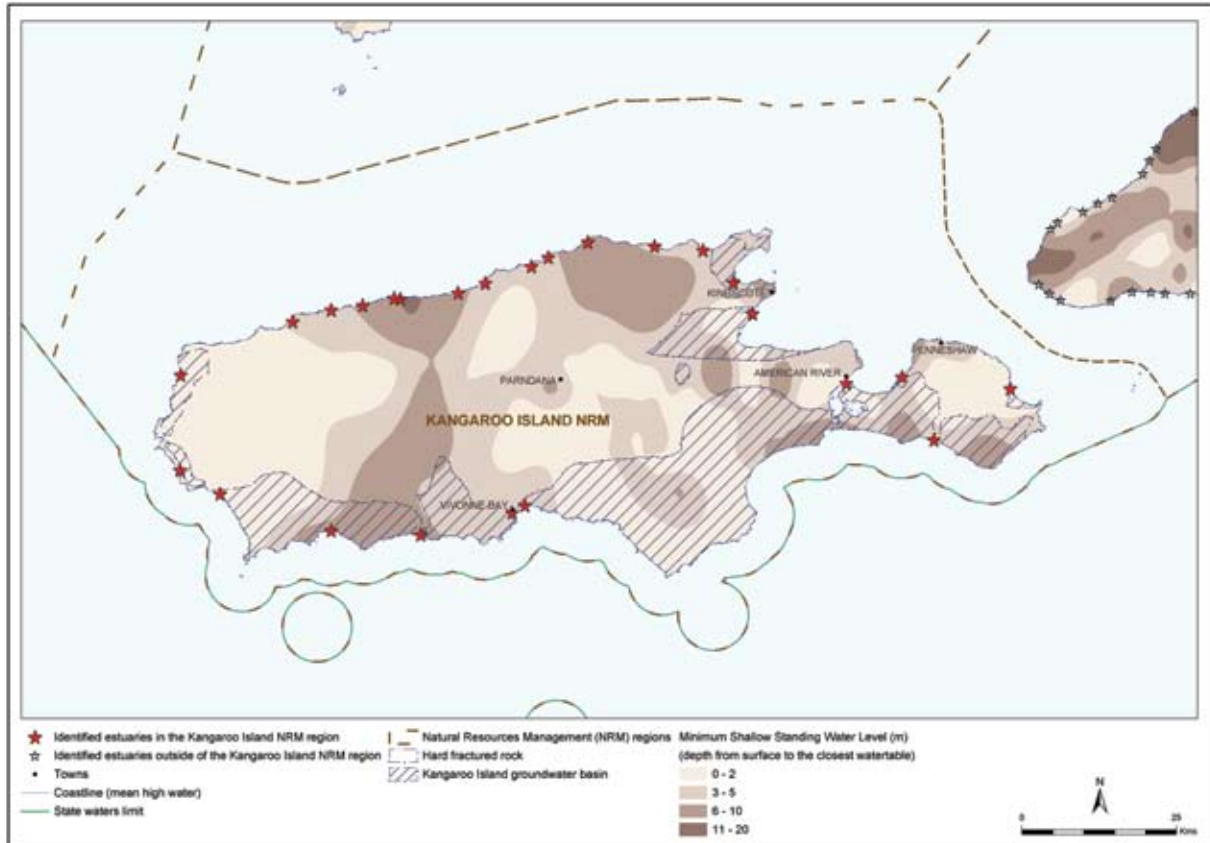


Figure 4. Marine bioregions and marine biounits





## 5. Habitats of the KI NRM region's estuaries

### 5.1 Floodplains

Floodplains can provide valuable habitat and act as a refuge for migratory birds and other animals during the dry season (Turner et al. 2004). Plant species most commonly found in the floodplain include *Melaleuca* species, sedges and grasses.

### 5.2 Saltmarshes

Although limited saltmarshes occur on Kangaroo Island, some plant communities are present around the Cygnet River mouth, Salt Creek, within American River/Pelican Lagoon (Willoughby et al. 2001) and around Stunsail Boom and Middle and Chapman River estuaries (NLWRA 2001)(see Table 3 and Figure 5).

Saltmarshes are under threat from inappropriate use of off-road vehicles, which has resulted in networks of informal tracks, as well as from illegal dumping of rubbish. Projected sea level rise resulting from climate change will likely cause habitat retreat and have secondary impacts on fish and many other species dependent on saltmarsh habitat for survival.

**Table 3. Saltmarshes, mudflats and seagrasses mapped in the National Land and Water Resources Audit**

Estuary	Saltmarsh area (km <sup>2</sup> )	Saltmarsh species	Mudflat area (km <sup>2</sup> )	Seagrass areas (km <sup>2</sup> )	Seagrass species
Harriet River		<ul style="list-style-type: none"> <li>• <i>Sclerostegia arbuscula</i></li> <li>• <i>Sarcocornia quinqueflora</i></li> <li>• <i>Sarcocornia blackiana</i></li> <li>• <i>Maireana oppositifolia</i></li> <li>• <i>Halosarcia</i> spp.</li> </ul>	0.1		<ul style="list-style-type: none"> <li>• <i>Heterzostera tasmanica</i></li> <li>• <i>Amphibolis antarctica</i></li> <li>• <i>Amphibolis griffithii</i></li> </ul>
Stunsail Boom River	0.1		0.1		
South West			0.1		
Western River			0.01		
Middle River	0.02		0.02		
Cygnet River	1.8		0.1	0.6	
Chapman River	0.2		0.04	0.1	
American River/ Pelican Lagoon	1.5		0.4	16.6	

Sources: NLWRA (2001), Willoughby et al. (2001)



### 5.3 Intertidal mudflats

Mudflats in several of the estuaries within the region have been mapped as part of the NLWRA (2001) (see Table 3).

Mudflats are home to a range of invertebrate species such as polychaete worms, amphipods, molluscs and crustaceans. The tidal cycle increases the use of the mudflats by other animals (eg crabs) and provides feeding sites for migratory shorebirds.

### 5.4 Mangrove communities

There are no mangroves present on Kangaroo Island.

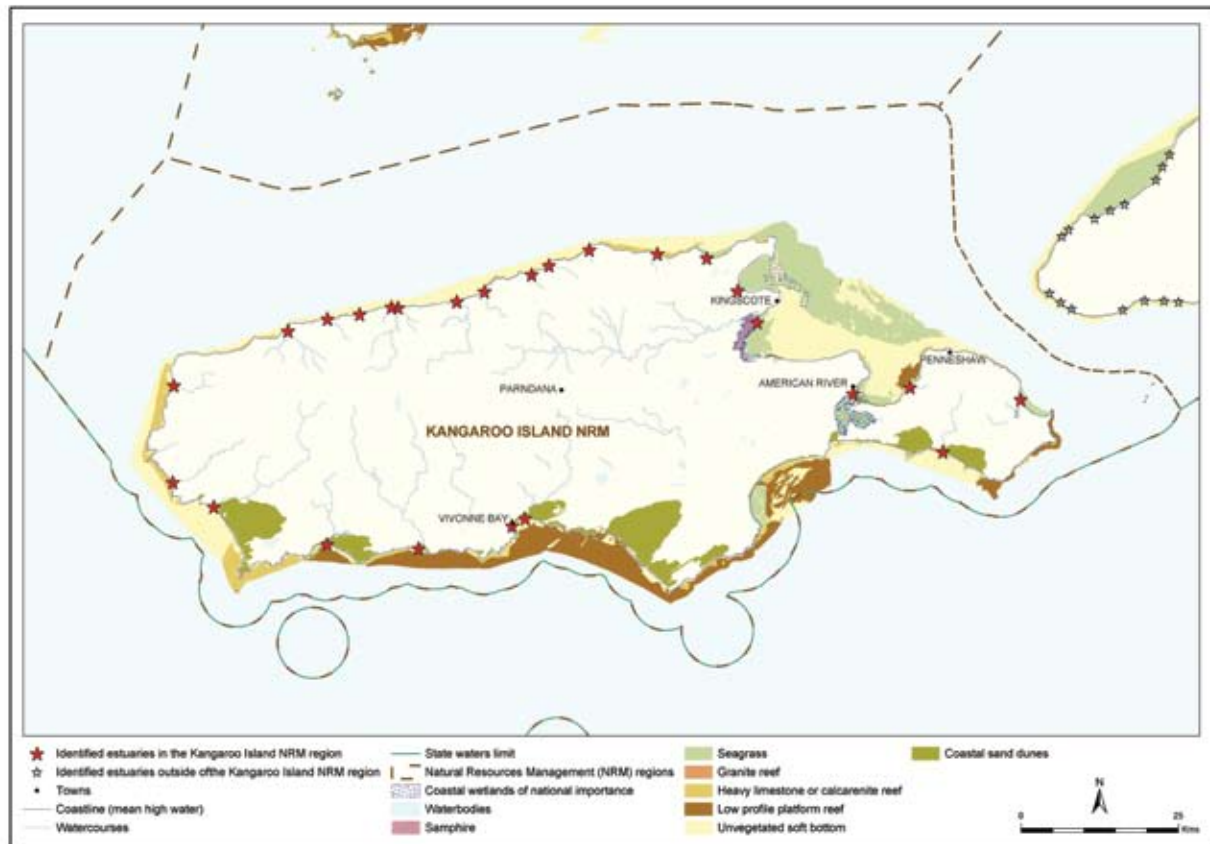
### 5.5 Seagrass communities

Nepean Bay, which includes the Bay of Shoals (Salt Creek estuary), Western Cove (Cygnet River estuary) and Eastern Cove (American River/Pelican Lagoon estuary) support the most extensive areas of seagrasses (Willoughby et al. 2001). Dense seagrass beds are also located around Emu Bay Creek and Chapman River estuaries (see Figure 5).

Seagrass communities provide habitat for a range of fish species, including those important to commercial and recreational fisheries and those endemic to Kangaroo Island.

Seagrasses in the region are under pressure from catchment inputs, both through surface runoff and groundwater. Seagrass loss (2,700 ha) has occurred in Nepean Bay (around Eastern Cove and American River areas) and, to a lesser extent, around Western Cove (Cygnet River estuary) (Baker 2004).

**Figure 5. Habitats within and surrounding estuaries**





## 6. Internationally and nationally protected bird species

Kangaroo Island is identified as an important site for shorebirds in South Australia, with six internationally and eight nationally important species (*Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and international treaties) (Watkins 1993).

The estuaries of Kangaroo Island support abundant bird life (see Appendix 1). American River/Pelican Lagoon supports 56 bird species, Cygnet River has 53 species recorded and Chapman River has 35 species recorded. The hooded plover *Charadrius cucullatus* (EPBC Act 1999, National Parks and Wildlife (NPW) Act 1972), eastern reef egret *Ardea sacra* (EPBC Act 1999, NPW Act 1972), osprey *Pandion haliaetus* (EPBC Act 1999, NPW Act 1972), caspian tern *Hydropogone caspia* (EPBC Act 1999), red-capped dotterel *Charadrius ruficapillus* (EPBC Act 1999) and the pied oystercatcher *Haematopus longirostris* have been recorded around several estuaries in the region (eg American River/Pelican Lagoon, Breakneck River and Rocky River) (EA 2001). In addition, the Australasian shoveler *Anas rhynchos* (NPW Act 1972), Cape Barren goose *Cereopsis novaehollandiae* (EPBC Act 1999, NPW Act 1972) and musk duck *Biziura lobata* (EPBC Act 1999, NPW Act 1972) are thought to breed around the Cygnet River estuary (Baker 2004).

Important seabird sites, for example, for the white-bellied sea eagle *Haliaeetus leucogaster* (EPBC Act 1999, NPW Act 1972) and the little penguin *Eudyptula minor* (EPBC Act 1999), are also located around Chapman River, American River/Pelican Lagoon, Cygnet River and Salt Creek<sup>1</sup>.

A full list of birds recorded on Kangaroo Island and American River/Pelican Lagoon can be sourced from the *Biodiversity Plan for Kangaroo Island* (Willoughby et al. 2001) and the *Conservation Parks of Kangaroo Island Management Plan* (DEP 1987) respectively.

## 7. Fish and other marine life

More than 230 species of fish have been recorded around the inshore coastal waters of Kangaroo Island (KI NRB 2003), with 13 species unique to the region (Rowntree 2004). More specifically, the Chapman and Cygnet River estuaries provide important habitats for the black bream *Acanthopagrus butcheri* (Baker 2004), and American River/Pelican Lagoon provides valuable nursery habitat for the King George whiting *Sillagnodes punctata*, southern sea garfish *Hyporhamphus melanochir*, yellow-eyed mullet *Aldrichetta forsteri*, tommy ruff *Arripis georgiana* and Western Australian salmon *Arripis truttacea*. Non-commercial fish species such as the blue spot goby *Pseudogobius olorum*, small-mouthed hardyhead *Atherinosoma microstoma* and the common jollytail *Galaxias maculatus* frequent the Harriet, Middle, Breakneck, Rocky and the Eleanor River estuaries (see Appendix 2).

Eelblennies *Peronedys anguillaris* have been recorded amongst seagrass roots in American River/Pelican Lagoon. The deep water elephant shark *Callorhynchus milii* is believed to migrate to the shallow waters of American River during spawning season. Other sharks, eagle rays and stingrays, the bottlenose dolphin *Tursiops* spp., crustaceans such as the western king prawn *Penaeus latissulcatus*, the sand crab *Ovalipes australiensis* and scallops (eg *Pecten fumatus*) have also been recorded around Kangaroo Island estuaries (Baker 2004).

<sup>1</sup> Data is from Biological Survey and Monitoring, DEH, Status of Seabirds, based on the report by Copley, 1996.



## 8. Protection arrangements for KI NRM region's estuaries

### 8.1 Parks and reserves

Several estuaries in the region are managed within national or conservation parks and wilderness protection areas (see Table 4 and Figure 6). Only American River/Pelican Lagoon is located within an aquatic reserve (ie American River (Pelican Lagoon) Aquatic Reserve).

The Breakneck River, Rocky River, Ravine Des Casoars and South West River estuaries are referred to in the *Flinders Chase National Park, Kelly Hill Conservation Park, Ravine Des Casoars Wilderness Protection Area and Cape Bouguer Wilderness Protection Area Management Plans* (DEHAA 1999). The Waterfall Creek and De Mole River estuaries are included in the *Conservation Parks of Kangaroo Island Management Plan* (DEP 1987).

**Table 4. Protection arrangements for estuaries**

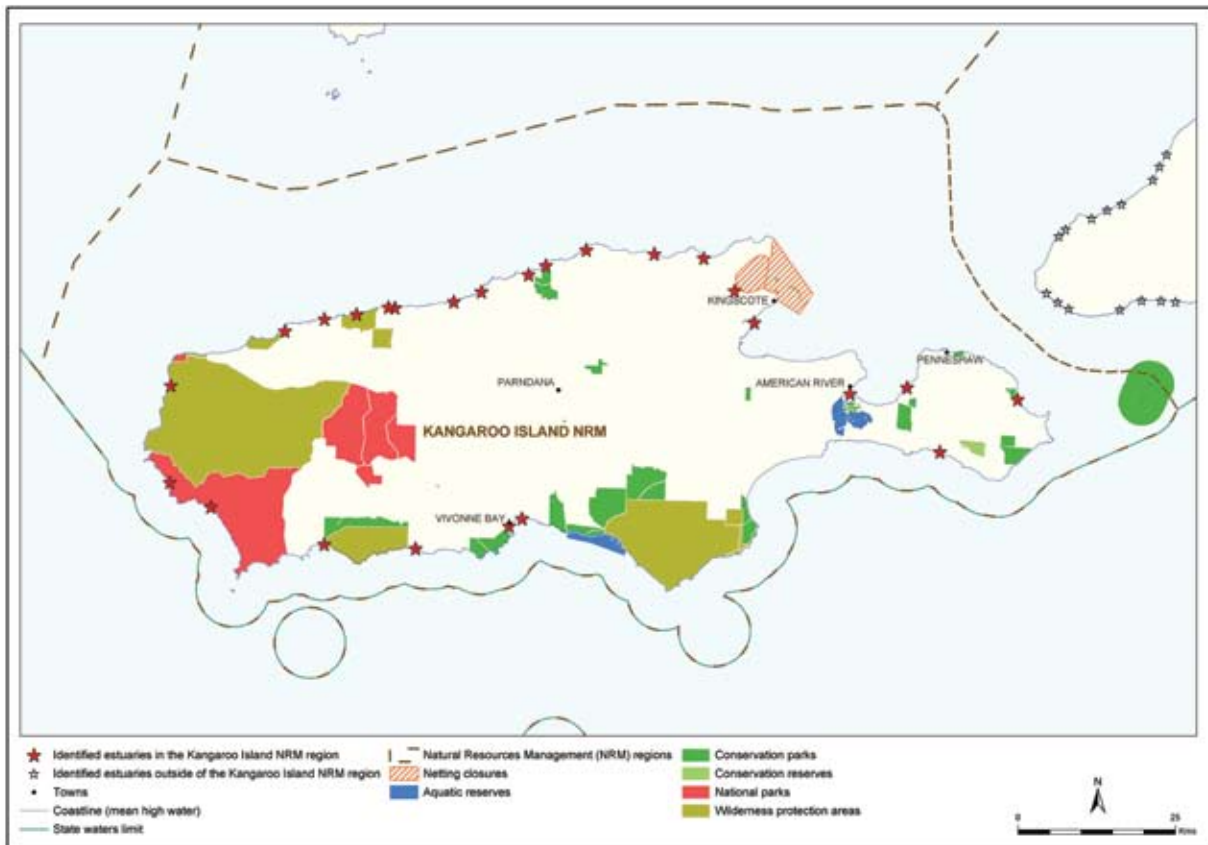
Estuary	National park/conservation park/wilderness protection area
Breakneck River	<ul style="list-style-type: none"> <li>• Flinders Chase National Park</li> <li>• Ravine Des Casoars Wilderness Protection Area</li> </ul>
Rocky River	<ul style="list-style-type: none"> <li>• Flinders Chase National Park</li> <li>• Ravine Des Casoars Wilderness Protection Area</li> </ul>
Ravine Des Casoars	<ul style="list-style-type: none"> <li>• Ravine Des Casoars Wilderness Protection Area</li> </ul>
Waterfall Creek	<ul style="list-style-type: none"> <li>• Western River Conservation Park</li> <li>• Western River Wilderness Protection Area</li> </ul>
American River/Pelican Lagoon	<ul style="list-style-type: none"> <li>• Pelican Lagoon Conservation Park</li> </ul>
South West River	<ul style="list-style-type: none"> <li>• Cape Bouguer Wilderness Protection Area</li> <li>• Kelly Hill Conservation Park*</li> </ul>
Salt Creek (KI)	<ul style="list-style-type: none"> <li>• Busby Islet Conservation Park *</li> </ul>
De Mole River	<ul style="list-style-type: none"> <li>• Cape Torrens Conservation Park*</li> <li>• Cape Torrens Wilderness Protection Area*</li> </ul>

\* These estuaries may not necessarily fall within NPWSA reserve boundaries as actual estuary boundaries have not been defined.

Note: the Minister for Environment and Conservation is responsible for the management of national parks, conservation parks and wilderness protection areas under the *NPW Act 1972* and the *Wilderness Protection Act 1992*.



**Figure 6. Conservation areas and aquatic reserves including estuaries**



## 8.2 Directory of Important Wetlands

Six estuaries in the KI NRM region have been included in the Directory of Important Wetlands in Australia (DIWA) (see Table 5 and Figure 5). The criteria for inclusion are shown in Appendix 3.

**Table 5. Estuaries included in the Directory of Important Wetlands in Australia**

Estuary	DIWA name	Criteria for inclusion
American River/Pelican Lagoon	American River Wetland System	1, 3, 5, 6
Breakneck River Rocky River	Flinders Chase River Systems	1, 2, 3, 5
Chapman River	Lashmar Lagoon and Chapman River	1, 3, 5
Cygnets River	a) Cygnets estuary b) Cygnets River and Duck Lagoon	a) 1, 2, 3, 5 b) 1, 2, 3
Salt Creek (KI)	Busby and Beatrice Islets wetland	3
South West River	Grassdale Lagoons	1, 3, 5

## 8.3 Register of the National Estate

Many sites associated with estuaries across the KI NRM region are included on the Register of the National Estate (<http://www.ahc.gov.au/register/>) (see Table 6).

**Table 6. Sites including or associated with estuaries in the Register of the National Estate**

Place on register <sup>2</sup>	Estuary	Significance
False Cape area (natural)	Willson River	This is a breeding area for several bird species and provides one of the remaining areas of remnant scrub of its type on Kangaroo Island.
Kelly Hill Conservation Park (natural)	South West River	Kelly Hill Conservation Park contains an example of southern Kangaroo Island coastal vegetation that supports a diversity of protected shorebird species.
Flinders Chase National Park (natural)	Rocky River Breakneck River Ravine Des Casoars	The area supports relatively undisturbed habitat and includes an example of a near pristine estuarine environment within South Australia (as identified in the NLWRA 2001).
Western River Wilderness Protection Area (natural)	Waterfall Creek	This area has unique vegetation communities with a large number of bird species, outstanding natural features and significant indigenous cultural values.
Western River Conservation Park (natural)	Waterfall Creek	This area has outstanding natural features including coastal cliffs, a waterfall, and many protected bird species such as the glossy black cockatoo <i>Calyptorhynchus lathami</i> and the white-bellied sea eagle <i>Haliaeetus leucogaster</i> . This site has also been identified to have indigenous value of national estate significance.
Cape Torrens Conservation Park (natural)	De Mole River	This area provides an important habitat for the endangered glossy black cockatoo <i>Calyptorhynchus lathami halmaturinus</i> (EPBC 1999, NPW Act 1972) and the bush stone-curlew <i>Burhinus grallarius</i> (NPW Act 1972).
Busby Islet Conservation Park (natural)	Salt Creek (KI)	An offshore sand spit provides feeding and roosting habitat for seabirds including a breeding colony of the Australian pelican <i>Pelecanus conspicillatus</i> .
Cygnets River estuary and marshes (natural)	Cygnets River	This area is an important feeding and breeding area for shorebirds including numerous species protected under international agreements (eg EPBC Act 1999 and international treaties).
American River marine and coastal area (natural)	American River/ Pelican Lagoon	This area provides a breeding area for many species of invertebrates and fish, as well as providing habitat for a large number of waterbirds and the Australian sea lion <i>Neophoca cinerea</i> .
Memorial plaque and anchor (historic)	American River/ Pelican Lagoon	The anchor is a relic from an early American whaling vessel, whilst the plaque is a memorial to the crew of the American brig union that built a schooner on Kangaroo Island.
Pelican Lagoon Conservation Park, American River (natural)	American River/ Pelican Lagoon	This area provides an important shorebird habitat and refuge.

Source: Estuaries – Marine Estuarine database – DEH, NPWSA reserves, National Estate. Compiled July 2006. Australian Heritage Directory. See: <http://www.heritage.gov.au/datalists.html>.

<sup>2</sup> Sites may not necessarily fall within actual estuary boundaries as the estuary boundaries have not been defined.



## 9. Cultural assets

During the early 1800s, at the time of the first European settlement, no Aboriginal people were living on Kangaroo Island (KI NRB 2003). Even so, it is likely that Aboriginal people inhabited Kangaroo Island up until about 4,300 years ago. This early connection with the Kurna and Ngarrindjeri people is apparent from mythology, and various cultural artefacts remain today (KI NRB 2003, Kinhill Pty Ltd. 2000a and Kinhill Pty Ltd. 2000b).

There are many Aboriginal sites of cultural significance associated with the estuaries in the region. Currently, only one site of indigenous significance, the Western River Conservation Park, has been recorded on the Register of the National Estate. This site has primarily been listed for its conservation value but the Australian Heritage Commission has also recognised the indigenous value of the site. Aboriginal heritage sites are also recorded with the Department of Premier and Cabinet, Aboriginal Affairs and Reconciliation Division.

All Aboriginal sites, objects and remains of significance in South Australia are protected under the *Aboriginal Heritage Act 1988*.

The *Aboriginal Heritage Act 1988* provides protection for Aboriginal sites, objects, anthropology, history and tradition.

NOTE: Pursuant to section 23 of the *Aboriginal Heritage Act 1988 (SA)*, a person must not, without the authority of the Minister [for Aboriginal Affairs and Reconciliation] -

- (a) damage, disturb or interfere with any Aboriginal site; or
- (b) damage any Aboriginal object; or
- (c) where any Aboriginal object or remains are found -
  - (i) disturb or interfere with the object or remains; or
  - (ii) remove the object or remains.

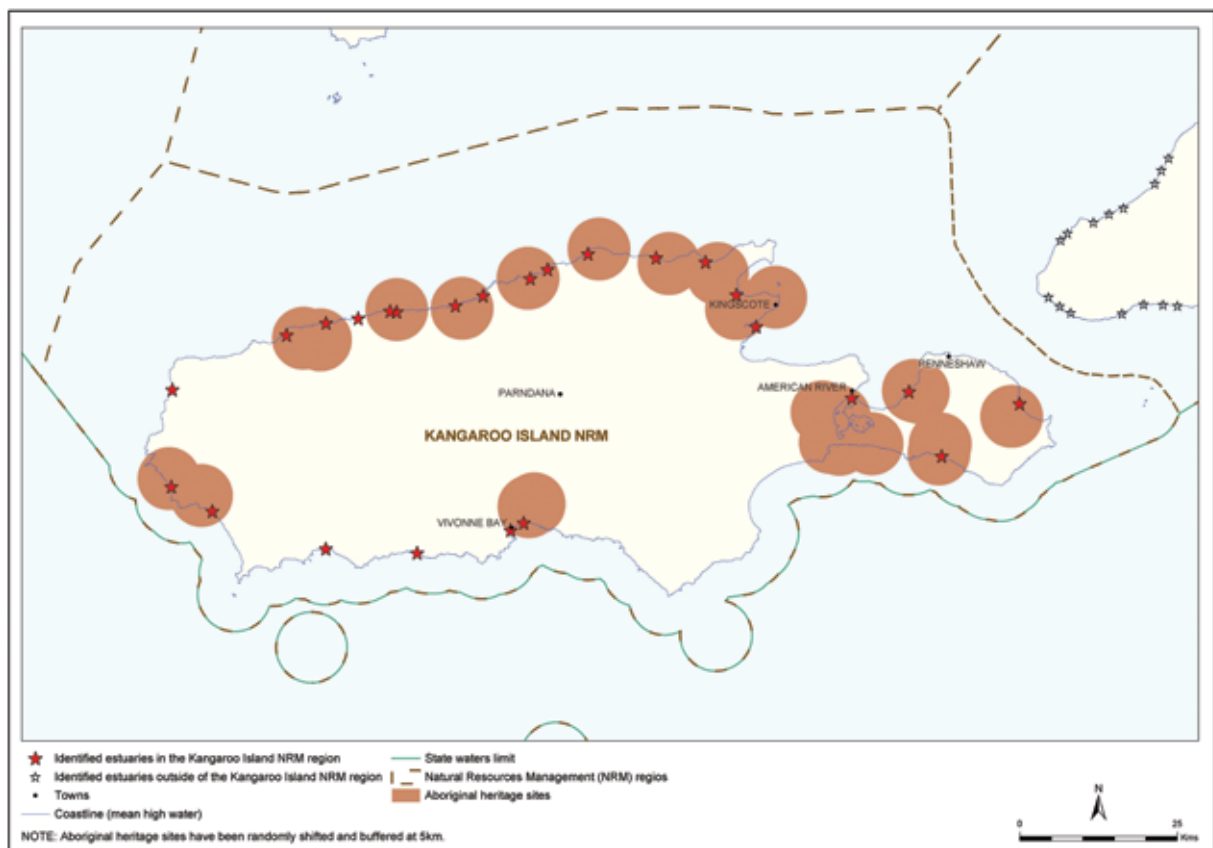
Official colonisation of Kangaroo Island began in 1836, with sealing and whaling expeditions and agricultural activities. European heritage sites can be found on the State Heritage Register (<http://www.heritage.gov.au/ahpi/index.html>) and also on the Register of the National Estate. State Heritage Register sites associated with estuaries include:

- D'Estrees Bay whaling site, Cape Gantheaume Conservation Park
- Threshing floor, Pelican Lagoon Conservation Park
- Rocky River homestead, Flinders Chase National Park
- Cape d'Estaing to Point Marsden coastline.





Figure 7. Aboriginal heritage sites associated with estuaries



# 10. Economic and social regional importance

Much of the economic development within the region is linked to the local environment including the estuarine areas. Economic drivers for the region include:

## • Tourism

Kangaroo Island is the most internationally recognised South Australian tourist region outside of Adelaide, with 150,000 visitors annually and tourism expenditure valued at \$53 million (KIDB 2004). There has been considerable growth in the industry, with the region experiencing an average growth rate of 4.7% in visitor numbers per year (2001-2004) (TOMM 2004). Of note is that 84% of people who visit the Island go to Flinders Chase National Park (CBRS 2005). Additionally, tourism provides several flow-on effects to many other industries such as the retail sector.

## • Agricultural practices, eg cropping and sheep and cattle grazing

Agricultural industries have been valued at \$69 million, with significant growth in the cropping industry from 8,000 ha in 1997 to 23,000 ha in 2003 (KIDB 2004).

## • Industry, eg commercial fishing, aquaculture and exports

There are 21 licensed marine-scale fishers around American River, Kingscote and Penneshaw, with the main catch including salmon (eg *Aripis truttacea*) (77%), King George whiting *Sillagnodes punctata* (10.3%) and southern sea garfish *Hyporhamphus melanochir* (4.3%). Aquaculture is a growing industry on Kangaroo Island. In 2003, \$17 million was invested in aquaculture development, with a further \$5 million increase expected (KIDB 2004). The total annual production of oysters (eg the pacific oyster *Crassostrea gigas*) was around 13,500 individuals (2003) (KIDB 2004). Regional exports for 2001/2002 were valued at \$114 million (KIDB 2004).

## • Recreational activities, eg fishing, boating, camping

There is increasing importance being placed on healthy lifestyles (SATC 2002a). Activities for which Kangaroo Island has a higher participation rate than any other South Australian region include visiting national parks, bushwalking and visiting wildlife parks (SATC 2004). In addition, fishing, going to the beach and visiting tourist attractions rate highly in participation rates by visitors (SATC 2004). The tourism and retail industries both receive flow-on effects from these activities.

Social values associated with all the above activities are varied. In a community attitudes survey completed in 2001 for the development of the South Australian Tourism Plan, the community indicated that tourism is more important to community prosperity and quality of life than agriculture, manufacturing, mining, wine or information technology (SATC 2002a, SATC 2002b). Of particular value is the Eastern Cove area near American River/Pelican Lagoon, which provides local residents and holidaymakers with a range of recreational opportunities, eg boating and swimming and potential flow-on effects in other areas (Baker 2004).

Commercial and recreational fishing activities particularly in coastal areas are highly valued by South Australian communities where employment, flow-on activities to other industries and health and lifestyle benefits are more prominent (Schirmer and Pickworth 2005). In response, most fishers also feel a strong attachment to their local community and indicate that their community is an extremely good place to live (Schirmer and Pickworth 2005).

Concerns over increasing tourism ventures combined with the negative aspects associated with a large tourism industry (eg a loss of biodiversity) has led to the Tourism Optimisation Management Model (TOMM) to be trialled on the Island (see <http://www.tomm.info/>). The TOMM is a community-based monitoring initiative aimed at assessing indicators for the health of the environment, the Kangaroo Island community and the economy, as well as the type of experience for visitors.



## 11. Activities and pressures associated with estuaries of the region

Of the ten estuaries included in the NLWRA (2001), only the Cygnet River and American River/Pelican Lagoon estuaries were identified as being in a modified condition<sup>3</sup> and under high to very high pressure. Most of the remaining estuaries were assessed as being largely unmodified, under low to moderate pressure, and thus considered to be in good condition. These included Chapman River, Middle River, Western River, South West River, Stunsail Boom, Eleanor River and Willson River. The Breakneck River estuary was one of only three examples of a near-pristine estuary within South Australia (NLWRA 2001).

Modifications to estuaries have occurred over time to support human settlement, economic development and to provide recreational opportunities to the community. Each of these is linked to a range of activities occurring in and on the land surrounding the estuaries. These include:

- agricultural practices (eg grazing)
- tourism
- recreational pursuits (eg fishing, boating, camping)
- aquaculture
- commercial fishing
- mineral exploration.

(See Figure 8 and Figure 9).

Some of the infrastructure and issues related to these activities are given in Table 7. Of particular note for the region is the prominence of commercial fisheries, aquaculture, and tourism ventures, as well as the potential for impacts arising from climate change.

<sup>3</sup> Modified estuaries have some problems due to impacts on the catchment, waterway and estuary. Largely unmodified estuaries are generally recognised and documented as being in good condition, but with some catchment and estuary use. Near-pristine estuaries are generally in excellent condition, with management activities focused on protecting their natural values (NLWRA 2001).



Figure 8. Activities occurring in and around estuaries

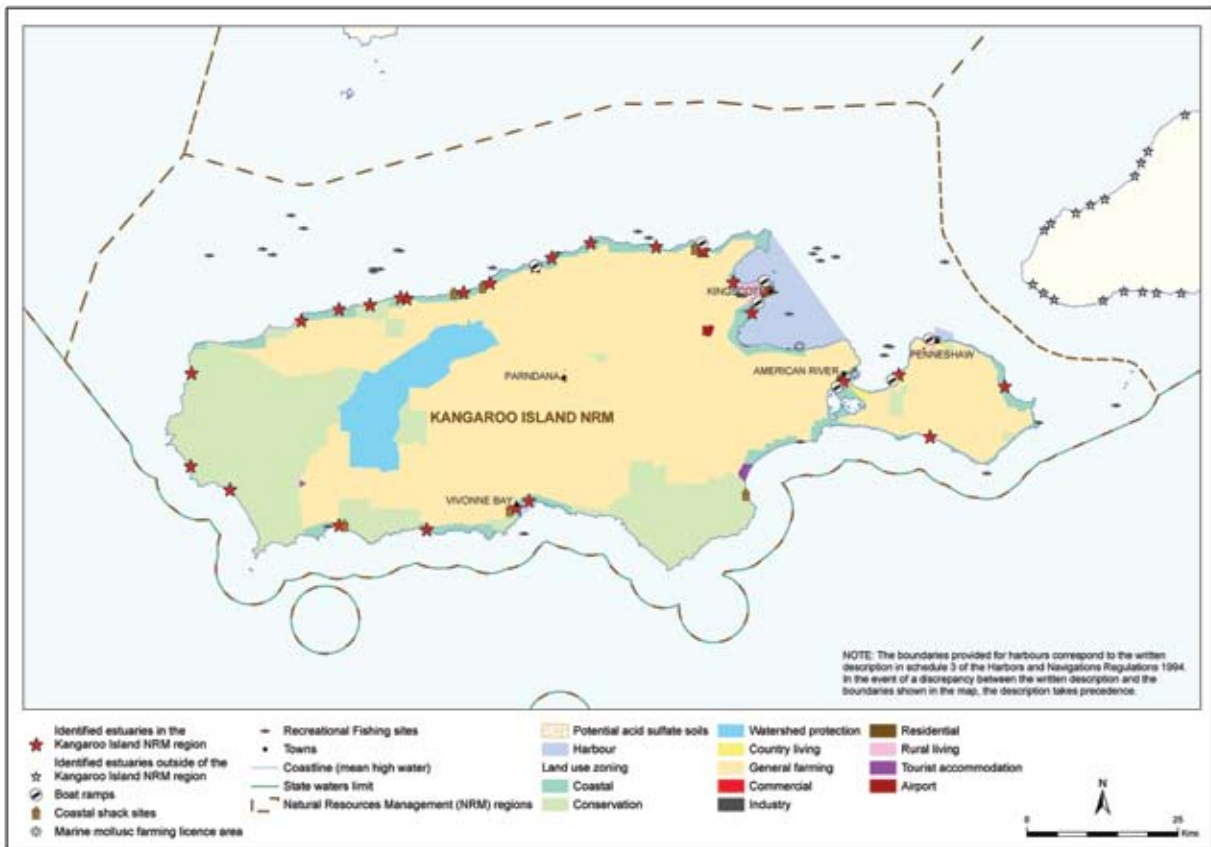
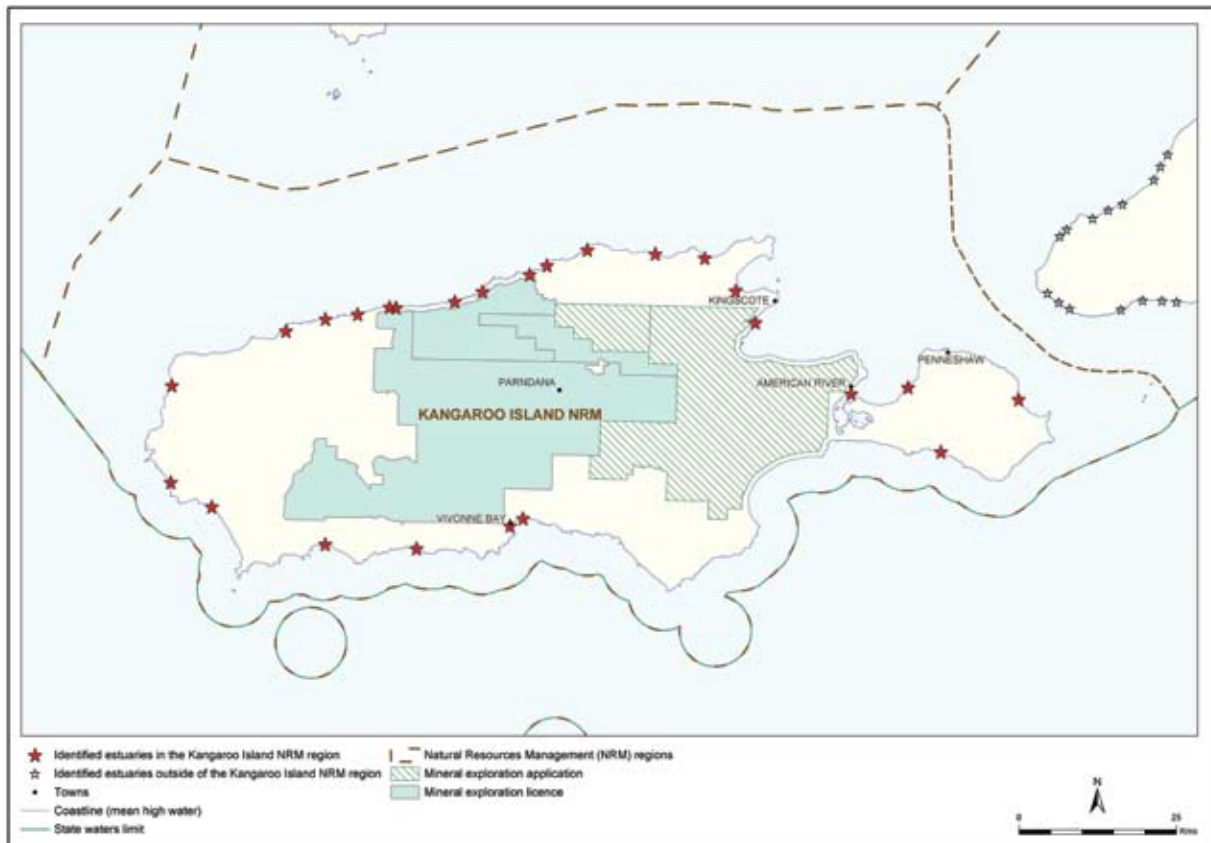


Figure 9. Mineral exploration licences and applications



**Table 7. Some of the infrastructure, activities and issues within estuaries**

	Feature	Location
Infrastructure	Boat ramps	<ul style="list-style-type: none"> <li>• 1 at Shoal Bay</li> <li>• 1 at Brownlow beach</li> <li>• 1 at Stokes Bay</li> <li>• 2 at American River/Pelican Lagoon</li> </ul>
	Moorings	<ul style="list-style-type: none"> <li>• Vivonne Bay - commercial and recreational</li> <li>• Beare Point</li> <li>• Bay of Shoals – commercial</li> <li>• American River/Pelican Lagoon</li> </ul>
	Harbours	<ul style="list-style-type: none"> <li>• Kingscote Harbor</li> <li>• Vivonne Bay Harbor</li> <li>• American River Harbor</li> </ul>
	Wastewater treatment systems	<ul style="list-style-type: none"> <li>• Kingscote has a sewage treatment effluent disposal scheme, with all other areas using septic tanks or approved disposal systems.</li> </ul>
	Electricity plant	<ul style="list-style-type: none"> <li>• Electricity is sourced from the mainland grid network, with backup diesel generators located near Kingscote.</li> </ul>
	Water supply	<ul style="list-style-type: none"> <li>• The reticulated water supply is sourced from Middle River dam and is available to Kingscote, Cygnet River and Parndana townships.</li> <li>• A desalination plant also has been built at Penneshaw and supplies the township with freshwater.</li> </ul>
Activity	Industry	<ul style="list-style-type: none"> <li>• 21 commercial marine-scale fishers</li> <li>• marine and land-based farming of oysters</li> <li>• viticulture (dams on rivers extracting water for irrigation)</li> <li>• property development</li> <li>• eco-tourism operators</li> </ul>
	Aquaculture	<ul style="list-style-type: none"> <li>• oyster (eg pacific oyster <i>Crassostrea gigas</i>), scallop (eg <i>Pecten fumatus</i>), abalone (eg greenlip abalone <i>Haliotis laevis</i>) leases located around American River (3)</li> <li>• oyster leases located around Western Cove (4)</li> </ul>
Issue	Climate change	<ul style="list-style-type: none"> <li>• Possible sea level rise, increase in water temperature and CO<sub>2</sub> absorption, and likelihood of more frequent storm events. One of the impacts of climate change will be habitat retreat, particularly for saltmarshes.</li> </ul>
	Coastal acid sulfate soils <sup>4</sup>	<ul style="list-style-type: none"> <li>• Cygnet River – low to moderate risk of potential acid sulfate soils (PASS) in the samphire, nil to low risk of PASS in other areas</li> <li>• Pelican Lagoon – nil to low risk of PASS in marine soils</li> <li>• Salt Creek – nil to low risk of PASS in marine soils</li> <li>• Middle River – low to moderate risk of PASS in the supra-tidal paperbark trees <i>Melaleuca</i> sp. zone, low to moderate risk of PASS in the samphire.</li> <li>• No PASS in other areas.</li> </ul>
	Netting closures	<ul style="list-style-type: none"> <li>• Bay of Shoals (seasonal closure Jan 1st – March 31st)</li> <li>• Kangaroo Island – Kingscote Spit (waters &lt;5 metres)</li> <li>• American River/Pelican Lagoon – Eastern Cove (waters &lt;5 metres)</li> </ul>

Sources:

Topography - boat ramps – DEH, Coast Protection Branch

Aquaculture licences and lease boundaries – PIRSA

Acid sulfate soils – Coast maps, Government of SA

Moorings – DEH

Netting closures - PIRSA

Note: although every effort has been made to ensure the accuracy of the statistical information provided from spatial data, errors in the spatial data are possible.

<sup>4</sup> Coastal acid sulfate soils are soils that generate sulfuric acid when exposed to oxygen.



## 12. Case study

As with many of the region's estuaries, American River/Pelican Lagoon is valued environmentally, socially and economically for the benefits it provides to the community. This estuary is under threat from a range of influences, with further planning, management and action necessary to ensure its health is sustained. Further information on this estuary is given in the following case study.

### Case study: American River/Pelican Lagoon

This area comprises a wetland system of permanently shallow lagoons that are connected to the open sea by a narrow channel known as American River. Pelican Lagoon contains islets and shorelines, including shelly beaches and tidal mud and sand flats.

The environs of American River/Pelican Lagoon are ecologically, socially and economically significant. The estuary is home to abundant bird life, with many internationally and nationally protected bird species (eg Cape Barren goose *Cereopsis novaehollandiae* which is protected under the EPBC Act 1999 and NPW Act 1972). The area is also an important nursery and feeding area for many fish species as well as sharks, rays, bottlenose dolphins *Tursiops* spp. and the western king prawn *Penaeus latissulcatus* (Baker 2004).

The area is used for holidays and recreation, with many facilities developed to support these activities. Tourism is an essential part of the American River economy and has provided many other opportunities for growth in other industries.

Additionally, the site is part of the Pelican Lagoon Conservation Park, as well as part of the American River (Pelican Lagoon) Aquatic Reserve system. It is a nationally important wetland and is listed on the Register of the National Estate.

The threats facing American River/Pelican Lagoon include:

- potential for increasing development around the lagoon
- increased nutrient loading, which places pressure on seagrass populations
- land clearance and residential development around the river and lagoon
- lack of waste disposal facilities including dumping of sewerage from boats
- high recreation use.



## 13. Current management initiatives

Table 8 indicates those projects currently underway in the KI NRM region's estuaries. Many agencies, local government and community groups are responsible for the management and protection of these estuaries. There is also scope for other research, monitoring, education and awareness raising and on-ground activities.

**Table 8. Current management initiatives**

Initiative	Agency/group involved	Estuaries included in the project	Contact details
Finalise and implement domestic ballast water management arrangements as part of the National Ballast Water Framework and the National System for the Prevention and Management of Marine Pest Incursions.	PIRSA	Estuaries that have ports and marinas	PIRSA Fisheries Management Biosecurity Program Ph.(08) 8226 2874
Development of Coastal Marina Strategy and Guidelines	Chaired by Planning SA (DPC-AARD, DEH, DTEI, DWLBC, EPA, OLG, PIRSA, SATC)	SA coast	Planning SA (Strategic and Social Planning) <a href="http://www.planning.sa.gov.au">http://www.planning.sa.gov.au</a> Ph.(08) 8854 5055
Kangaroo Island Water Resource Assessment Project – identify and quantify nutrient loads within the Cygnet River catchment.	DEH/ DWLBC/ EPA/ KI NRM Board	Cygnet River	DEH Kangaroo Island office Ph.(08) 8553 2381
Variation of fish assemblages in estuaries within and among regions of temperate Australia	University of Adelaide	Selected estuaries	School of Earth and Environmental Sciences University of Adelaide Ph.(08) 8303 3999
Fish in open and closed estuaries of Kangaroo Island	University of Adelaide	Selected estuaries	School of Earth and Environmental Sciences University of Adelaide Ph.(08) 8303 3999
Ambient water quality monitoring program (measures basic water quality indicators)	EPA	Cygnet River, Rocky River	EPA Ph.(08) 8204 2000
Catch, tag and release bream project	Kangaroo Island Community Education (KICE) (all 3 campuses of Kangaroo Island schools), KI NRM Board	Western River, Middle River, Harriet River, Chapman River	Tony Bartram/Judith Wingate C/ KICE campus Ph.(08) 8553 2074
Establishment of estuarine monitoring program	KI NRM Board	Selected estuaries	Coast & Marine Programs KI NRM Board Ph.(08) 8553 4980
Saltmarsh habitat mapping	Coast Protection Branch – DEH, Environmental Information - DEH	Cygnet River	Coastal Protection Branch Ph.(08) 8124 4700



## 14. Potential directions

There are several information gaps that could be addressed to improve the management of estuaries in the KI NRM region. Information gaps and potential directions for management include:

- develop a regional inventory of estuaries
- refine regional targets for healthy estuarine ecosystems and describe ecosystem services
- identify potential climate change impacts for estuaries and their adjacent habitats
- identify environmental flow requirements
- identify groundwater influences and uses within estuaries (including whether salinity levels are rising and impacting estuarine condition, flora and fauna)
- develop and implement an estuarine monitoring program for priority estuaries (including biogeochemical, water quality and water quantity, habitat assessment and species diversity, presence and abundance), to monitor trends in the condition of estuaries
- determine whether the artificial opening of entrances to estuaries is an issue, and develop management strategies where required
- determine the impacts of stormwater and urban encroachment on estuaries and amend the council development plan accordingly
- investigate and address other potential sources of pollution to the estuarine environment
- develop targeted education programs and activities to engage landholders, tourists, industry and other estuary users, and the broader community to build capacity for the management of estuaries.

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Estuaries Management and Planning  
<http://www.environment.sa.gov.au/coasts/estuaries.html> (viewed March 28th 2007)

Kangaroo Island Council  
<http://www.kangarooisland.sa.gov.au> (viewed 28th March 2007)

Kangaroo Island Development Board  
<http://www.kangarooisland.org/> (viewed 28th March 2007)

National Land and Water Resources Audit  
<http://www.nlwra.gov.au/> (viewed 28th March 2007)

Protecting Waterways Manual  
[http://www.transport.sa.gov.au/pdfs/environment/waterway\\_pdfs/all\\_chapters.pdf](http://www.transport.sa.gov.au/pdfs/environment/waterway_pdfs/all_chapters.pdf) (viewed 28th March 2007)

Register of the National Estate  
<http://ahc.gov.au/register/> (viewed on March 28th 2007)

## Relevant legislation

*Aboriginal Heritage Act 1988*  
<http://www.legislation.sa.gov.au/> (viewed 28th March 2007)

*Environment Protection Act 1993*  
<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed 28th March 2007)

*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (viewed 28th March 2007)  
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*Fisheries Management Act 2007*  
<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed 28th March 2007)

*Heritage Places Act 1993*  
<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed June 15th 2007)

*Mining Act 1971*  
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*National Parks and Wildlife Act 1972*  
<http://www.legislation.sa.gov.au/> (viewed 28th March 2007)

*Native Vegetation Act 1991*  
<http://www.legislation.sa.gov.au/> (viewed 28th March 2007)

*Natural Resources Management Act 2004*  
<http://www.legislation.sa.gov.au/> (viewed 28th March 2007)

## Relevant legislation continued

*Petroleum Act 2000*

<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed 28th March 2007)

*Petroleum (Submerged Lands) Act 1982*

<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed 28th March 2007)

*Wilderness Protection Act 1992*

<http://www.legislation.sa.gov.au/browseActs.aspx> (viewed 14th May 2007)

## Abbreviations

<b>AARD</b>	Aboriginal Affairs and Reconciliation Division
<b>DEH</b>	Department for Environment and Heritage
<b>DIWA</b>	Directory of Important Wetlands in Australia
<b>DPC</b>	Department of Premier and Cabinet
<b>DTEI</b>	Department for Transport, Energy and Infrastructure
<b>DWLBC</b>	Department of Water, Land and Biodiversity Conservation
<b>EPA</b>	Environment Protection Authority
<b>ha</b>	Hectare
<b>KIDB</b>	Kangaroo Island Development Board
<b>KINRB</b>	Kangaroo Island Natural Resources Board
<b>KI NR</b>	Kangaroo Island Natural Resources
<b>KI NRM</b>	Kangaroo Island Natural Resources Management
<b>NLWRA</b>	National Land and Water Resources Audit
<b>NRM</b>	Natural Resources Management
<b>OLG</b>	Office of Local Government
<b>PASS</b>	Potential acid sulfate soils
<b>PIRSA</b>	Primary Industries and Resources, South Australia
<b>SARDI</b>	South Australian Research and Development Institute
<b>SATC</b>	South Australian Tourism Commission

# Appendices

## Appendix 1. A sample of bird species associated with the KI NRM region's estuaries

	Rocky River	Breakneck River	Cygnets River	American River/ Pelican Lagoon	Chapman River
Australian pelican				•	
Australian shelduck				•	
Australian white ibis	•	•	•		
Australasian grebe			•		
Australasian shoveler			•	•	•
Ballion's crane	•	•			•
banded stilt				•	
bar-tailed godwit				•	
black-faced shag				•	
black swan			•	•	•
buff-banded rail					•
Cape Barren goose	•	•	•	•	
caspian tern				•	
cattle egret				•	
chestnut teal				•	
common greenshank	•	•		•	•
common sandpiper					•
crested tern	•	•		•	
curlew sandpiper	•	•	•	•	•
eastern curlew				•	
eastern reef egret				•	
eurasion coot	•	•			
fairy tern	•	•		•	
freckled duck			•		•
great cormorant	•	•		•	
grey plover				•	
hoary-headed grebe			•	•	
hooded plover	•	•		•	•
Latham's snipe	•	•			
lesser sand plover				•	•
Lewin's rail	•	•			•
little egret				•	•
little black cormorant	•	•		•	•
little musk duck			•		

table continued



Appendix 1. A sample of bird species associated with the KI NRM region's estuaries continued

	Rocky River	Breakneck River	Cygnets River	American River/ Pelican Lagoon	Chapman River
little pied cormorant	●	●		●	●
marsh sandpiper					●
musk duck	●	●		●	●
osprey	●	●		●	
pacific black duck				●	
pacific golden plover				●	
pied cormorant	●	●		●	
pied oystercatcher			●	●	
red-capped dotterel					●
red-capped plover	●	●		●	
red knot				●	
red-necked stint	●	●	●	●	●
ruddy turnstone	●	●		●	
sacred ibis				●	
sanderling				●	
sharp-tailed sandpiper	●	●	●	●	●
silver gull	●	●		●	
sooty oystercatcher			●	●	
spotless crane	●	●	●		●
straw-necked ibis			●		
whimbrel				●	
white-bellied sea eagle	●	●		●	
white-faced heron	●	●		●	●
white ibis			●		
yellow-billed spoonbill	●	●	●		

Sources: EA (2001), DEP (1987), DEH (2004a), DEH (2001b).

## Appendix 2. A sample of fish species recorded in the KI NRM region's estuaries

	Eleanor River	Harriet River	Stunsail Boom	South West River	Rocky River	Breakneck River	Middle River	Cygnets River	American River/ Pelican Lagoon	Deep Creek (KI)	Chapman River
<b>Commercial fish species</b>											
black bream	●	●	●	●			●	●		●	●
flathead								●	●		●
King George whiting								●	●		
sand flathead									●		
school whiting									●		
southern sea garfish									●		
tommy ruff									●		
trevally									●		
Western Australian salmon*	●	●	●	●			●	●	●		●
yellow-eyed mullet	●	●	●	●				●	●	●	●
<b>Non-commercial fish species</b>											
blue rock whiting									●		
bluespot goby		●			●		●	●	●		●
bridled goby								●			●
common galaxias		●			●	●					●
deepbody pipefish									●		
eelblenny									●		
elongate hardyhead		●					●				
girdled goby									●		
Glover's tasman goby									●		
greenback flounder								●	●		
lagoon goby				●							
little rock pipefish									●		
longfin goby								●	●		●
Milward's weedfish									●		
pikehead hardyhead								●	●		
Port Phillip pipefish									●		
pugnose pipefish								●	●		
small-mouthed hardyhead	●	●	●	●			●	●	●		●
soldierfish									●		
southern crested weedfish									●		
speckled sand goby									●		
spinytail leatherjacket									●		
tamar goby							●	●	●		●

Sources: Bryars (2003), EA (2001), Hammer (Native Fish Australia (South Australia)) (in prep), Jones (personal records), Rowntree (2004).

Note: the data in this table is limited, not all estuaries in the region have been included and fish lists are not extensive.

Also note that there are several diadromous species such as common galaxias, climbing galaxias, short-finned eels and lampreys that have been recorded upstream in catchments and migrate through estuaries at certain times.



### **Appendix 3. Criteria for determining important wetlands in Australia**

A wetland may be considered nationally important if it meets at least one of the following criteria (EA 2001):

1. It is a good example of a wetland type occurring within a bio-geographic region in Australia.
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa.
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level.
6. The wetland is of outstanding historical or cultural significance.

**Maps produced by**

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**Map Source**

Topographic data, NPWSA reserves, boat ramps, harbours, coastal shack sites, CASS data, saltmarsh mapping, coastal sand dune mapping, recreational fishing sites  
Estuaries - NLWRA and DEH  
Marine bioregions, marine biounits - DEH and SARDI, PIRSA  
Coastal wetlands data from 'A Directory of Important Wetlands in Australia, 3rd ed., 2001'  
Benthic habitat mapping - CSIRO, DEH and SARDI, PIRSA  
Aquatic reserves, netting closures, aquaculture licenses, mining data - PIRSA  
Water catchment boundaries, NRM boundaries, groundwater basins, shallow standing water level data - DWLBC  
Land use zoning - Planning SA, PIRSA  
Aboriginal heritage sites - AARD, DPC  
Maritime boundaries - Geoscience Australia



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