# ENVIRONMENT

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Chapter 3

## NATURAL ENVIRONMENT

### CLIMATE

The Cooper Basin is located in the core of Australia's arid region. Seasonal and diurnal temperatures can vary extensively, averaging 36–39°C in summer and 18–24°C in winter. It is not uncommon for summer temperatures to regularly exceed 38°C in the shade, whilst in winter mean minimum temperatures can drop to 5°C with frosts a common occurrence.

Droughts frequently occur throughout the area with an average rainfall of 100–150 mm per year. Local rainfall is irregular and unreliable with a long spell of dry seasons usually followed by one or two good seasons. The major influence on rainfall is of tropical origin taking the form of thunderstorms, and monsoon depressions. Whilst rain may fall at any time of the year, it tends to be summer dominated with the occasional high winter rainfall.

Extreme rainfall and flooding events are usually as a result of the El Nino effect. Since 1974 there have been five major flooding events within the Cooper Basin (Santos Ltd, pers comm., 1998). These events do not necessarily coincide with local rains but are as a result of annual flows originating from upper catchment rains in Queensland.

Winds prevailing from the south to southeast tend to dominate from September to May exhibiting greater variability in winter (Moss and Low, 1996). The windiest days are from September to December. Southwesterly winds which precede cold fronts have a tendency to carry large amounts of sand resulting in dust storms.

### LANDFORMS

Whilst the Cooper Basin is located in Australia's arid zone it has a diverse number of major landforms including dune field, stony tableland, river channels, floodplain, and undulating plain (Table 3.1; Fig. 3.1). Each of these landforms can be divided into minor landform patterns or environmental units based upon their detailed morphological characteristics such as local geology, soil type, topography, drainage patterns and biota.

#### Dune field

Sand dunes whilst similar in form can vary in both height, spacing and morphology from region to region. The most common dunes in the Cooper Basin are crested parallel sand ridges usually aligned north–south. These can sometimes continue without a break for hundreds of kilometres or converge as Y-junctions. Dunes vary in colour ranging from dark red to pure white and can be either siliceous or clay rich. The amount of clay in a dune can determine its susceptibility to erosion and its ability to restore itself after disturbance.

Dunes can vary in height from 5 to 35 m and densities can range up to 15 dunes per kilometre. The dunes are separated by flat corridors or swales; their soil types can varying from cracking clays to sandy clay loams.

#### Gibber plain and dissected tableland

Gibber plains consist of undulating clay plains and gentle slopes protected by a dense cover of red, highly polished stones called gibber. They are occasionally interspersed with small dunes or silcrete capped mesas and are generally very stable. The gibber is usually embedded in a clayey crust overlying a red duplex soil which is highly susceptible to erosion when disturbed. Dissected tablelands are typified by a complex arrangement of depressions called gilgai and large relatively flat areas with a mantle of gibber interspersed with silcrete capped mesas. The slopes of these mesas are generally composed of red duplex soils and self mulching clays. The steep slopes allow water to attain a high velocity which can result in massive gully erosion where the surface soil has been disturbed.

#### Floodplain

Floodplains adjacent to the Cooper Creek system generally do not become inundated unless river channels overflow their banks; due to the low relief throughout the area, even a small increase in water level can inundate a vast area of floodplains. Floodplains can be very diverse, often occurring in association with the dune fields. As floodwaters advance they wind a path through the dunes slowly filling a system of interdune corridors, swamps and lakes. The soils in the floodplains are generally characterised by self mulching, cracking clays resulting from the deposition of sediments during flooding.

#### Wetlands

The Cooper Creek system forms important wetlands in the Cooper Basin and includes the Coongie Lakes which are of high conservation value. The value of the system is based upon it being an important fresh water source in an arid environment, its habitat diversity and corresponding diversity of flora and faunal species. The system is essentially a series of interconnected river channels containing a string of impermanent shallow lakes and waterholes fed intermittently by the Cooper Creek. Associated with the system are also floodplains, swamps, creeks, claypans and lakes (McLaren *et al.,* 1994). Whilst high local rainfall events contribute to water flows within the Cooper Creek system, the main source of flows are attributed to rivers originating in higher rainfall catchments (e.g. Diamantina and Wilson Rivers).

***Table 3.1*** *Land systems of the Cooper region (after Santos Ltd, 1993).*

| DUNE FIELD | GIBBER PLAIN | TABLELAND | FLOODPLAIN | WETLANDS | SALT LAKE |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| *Photo 45833* | *Photo 45831* | *Photo 45834* | *Photo 45830* | *Photo 43780* | *Photo 45827* |
| **Description**<br>Generally parallel dunes, trending approximately north–south, of red or yellow sands, 5–20 m high and separated by flat interdune corridors or swales. Corridors are sandy, but due to limited internal drainage, often contain claypans; where infiltration is poor salt lakes occur. | An undulating stony plain, sometimes with an occasional small dune or silcrete capped mesa. The highly polished stones or gibbers are usually embedded in a clayey crust, thereby protecting the underlying soil from erosion. | Uplifted and eroded gibber plains that have resulted in the formation of low, but steep silcrete capped hills, escarpments and mesas, and extensive gibber covered footslopes. The tablelands are separated by undulating gibber plains. | Extensive flood-out areas occur adjacent to the Cooper and Strzelecki Creeks, and Wilson and Diamantina Rivers. The floodplains are periodically inundated when the creeks and rivers overflow their banks, depositing a characteristic grey sediment. In places, dunes are either co-dominant or occasionally present. | These comprise the channels, waterholes, swamps and lakes associated with the Cooper and Strzelecki Creeks and Wilson and Diamantina Rivers. Located on or close to the main watercourses these areas are inundated more frequently than the surrounding floodplain. Some of the waterholes always contain water, but the channels, swamps and lakes are frequently dry. | Terminal lakes or pans of varying sizes where evaporation has resulted in the concentration of soluble salts as a surface crust. They are periodically inundated, but are usually dry. |
| **Sub-dominant land systems**<br>Salt lake, floodplain, gibber plain. | Tableland, dune field. | Gibber plain. | Dune field, wetlands, salt lake. | | |
| **Soils**<br>*Dunes:* red or yellow siliceous sands.<br>*Swales:* red massive earths, or grey self-mulching cracking clays. | Crusty red duplex soils. | *Slopes:* crusty red duplex soils and brown self-mulching cracking clays.<br>*Rises:* reddish powdery calcareous loams. | Grey self-mulching cracking clays. | Grey self-mulching cracking clays. | Salt overlying grey self-mulching cracking clays. |
| **Vegetation**<br>*Dunes:* tall shrubland of marpoo, whitewood and hakea, and hummock grassland of spinifex and sandhill canegrass.<br>*Swales:* chenopod shrubland and grassland. | *Plains:* low open shrubland and open grassland of Mitchell grass.<br>*Drainage lines:* low woodland of gidgee and mulga. | *Slopes:* low to tall open shrubland.<br>*Drainage lines:* low woodland of mulga, red mulga and gidgee.<br>*Plains:* low open shrubland and open grassland of Mitchell grass. | Open woodland of river red gum, coolibah and gidgee with an understorey of lignum, chenopod shrubland and grasses. | Open woodland of river red gum and coolibah with an understorey of lignum and chenopod shrubland. | Chenopod shrubland or completely bare. |

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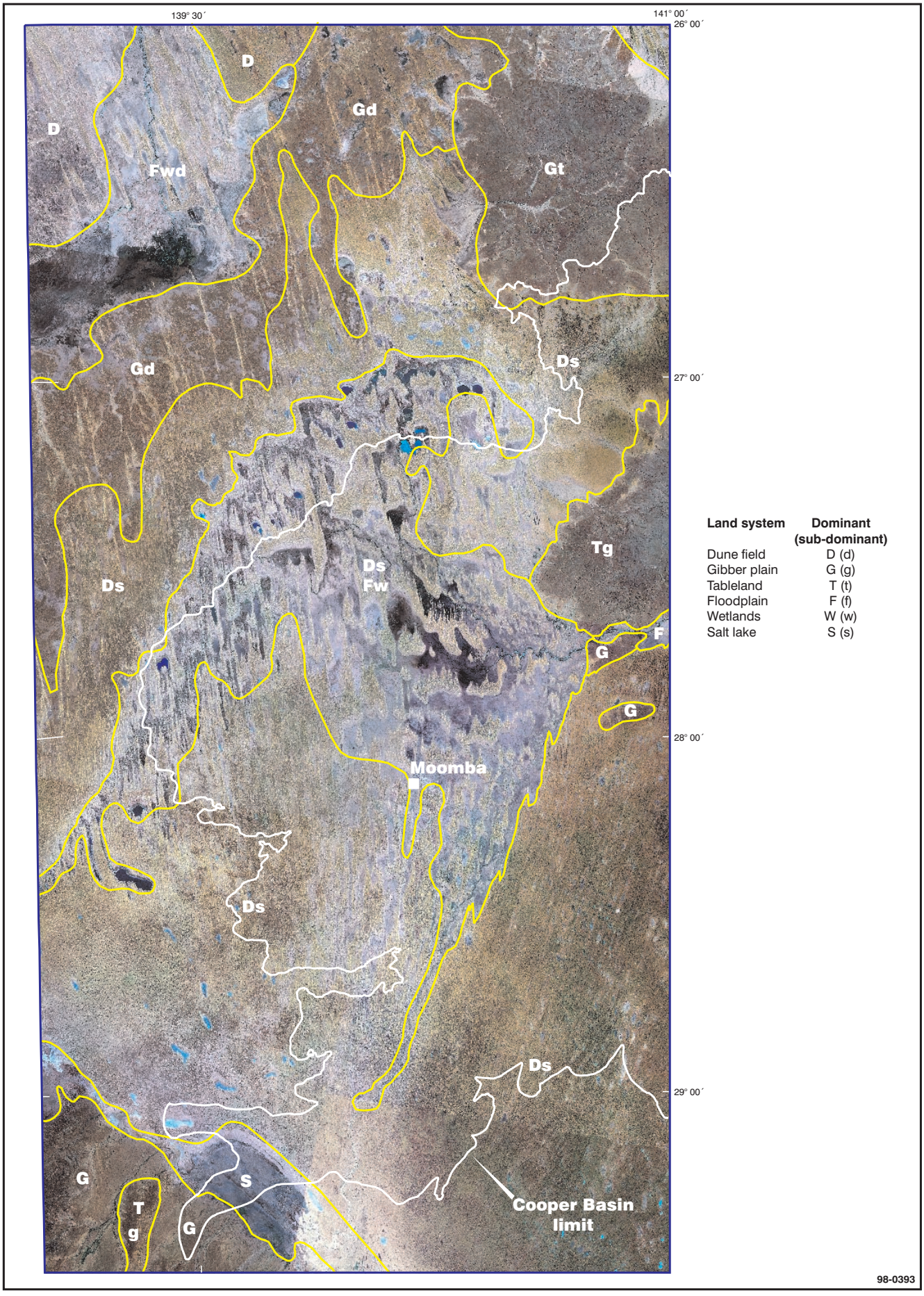


***Fig. 3.1*** *Landsat image and land systems of the Cooper region.*

### Salt lake

Within the Cooper Basin there are numerous ephemeral salt lakes, usually dry, of varying sizes. Due to the high level of evaporation in the region, soluble salts are heavily concentrated in these lakes after episodic flooding during which water levels can fluctuate significantly (Moss and Low, 1996).

## NATIVE VEGETATION

Despite its aridity, the Cooper Basin supports a diverse, if sparse, range of vegetation which is largely influenced by landform, soil and climate. Small differences in habitat such as depressions or drainage lines may produce highly variable micro-ecosystems. As such, local areas may show slightly more growth and a greater variety of species, although during drought periods relatively large areas may often appear quite lifeless and barren.

Due to the low and erratic nature of rainfall and the searing temperatures experienced during summer, most perennial plants within the region must be extremely resilient and able to endure long dry spells. The appearance of herbaceous plants is both episodic and infrequent and depends upon the combination of rainfall and temperature.

### Dune field

Dune crests are usually dominated by perennial, tussocky sandhill cane grass which is an important dune stabilising plant. Depending on seasonal conditions, the flanks of the dunes may be well or sparsely vegetated and are often dominated by an upper storey of low shrubs such as acacia and whitewood with an understorey of grasses and forbs (Sutherland, 1993).

The vegetation on interdune swales can vary considerably depending on the soil type and the level of inundation either from floods or localised runoff or drainage. Interdune swales which have a low level of inundation often support shrubland which can include acacia, hakea and eremophila species (Laut *et al.,* 1977). Where there is sufficient water the swales may support low open woodlands often accompanied by an over-storey of coolibah.

### Gibber plain and dissected tableland

The vegetation on gibber plain and dissected tableland is primarily composed of an ephemeral and biannual cover of Mitchell grass, perennial tussock grassland, annual grasses and low open chenopod shrubland. Vegetation on gibber plains is often short-lived and heavily dependent on the infrequent rainfall events which are required to stimulate both growth and germination. Broad drainage lines and associated outwashes meandering through gibber plain tend to be dominated by low open woodland and composed of species such as dead finish, gidgee and mulga (Tyler *et al.,* 1990).

Mesas located in dissected tableland tend to have a light scattered cover of shrubs such as dead finish and emu bush with an understorey of saltbush species and annual grasses. Isolated trees may occasionally be found on the slopes.

### Floodplain

Most of the floodplains carry sparse low ephemeral or perennial short-lived species, the composition of which is often variable, determined by the season during which rain falls (Laut *et al.,* 1977). Claypans can carry a wide variety of vegetation including samphire, chenopod shrubland, lignum and cane grass.

Along the outer edges of the floodplains or scattered across dry lake beds is sparse coolibah woodland. The coolibah is probably the tree that is most characteristic of the area as a whole, because it is long lived and can withstand long periods of drought and extensive flooding.

The woodland may alternate with shrubland, grassland and sedgeland. Lignum shrubland can often be found in swampy areas, floodplains and creek banks ranging in density from sparse to almost impenetrable (Wiltshire and Schmidt, 1997). The lignum may sometimes occur in association with acacia and saltbush species.

### Wetlands

The vegetation of the Cooper Creek, Coongie Lakes and associated floodplains varies considerably with over 350 plant species recorded in the area, including the recently discovered endemic daisy *Brachycome coongiensis*. Vegetation fringing the Cooper Creek channel is generally composed of tall mixed woodland and can include river red gum, coolibah, acacia and eremophila species (Badman *et al.,* 1991).

## NATIVE FAUNA

The Cooper Basin supports a rich avifauna population of more than 250 species of water and land birds (Badman *et al.,* 1991). The types of landforms within the region largely influence bird distributions and whilst many birds are generalists and can occur in a wide variety of environments, certain species are restricted to specific areas due to habitat preferences. Many birds that occur in the region are also migratory or opportunistic, taking advantage of favourable seasonal conditions such as high rainfall events or flooding.

Whilst water courses and wetlands are the main focus of bird activity, the more arid environments such as gibber plains and dune fields also support a wide range of species. Many of these birds are ground breeding and therefore very susceptible to habitat disturbance and attack from introduced predators.

The diverse range of habitats in the Cooper Basin support a number of mammal species including rodents, bats and macropods (e.g. kangaroos). For many species watercourse habitats are key focal points. These habitats literally act as oases in an otherwise inhospitable environment. Whilst up to 46 mammal species have been recorded in the region, at least ten are now believed to be either locally or entirely extinct (Sutherland, 1993).

Approximately six amphibian species can be found in the region. These species are mainly located around water courses and surrounding areas, pending favourable seasonal conditions. Although it is not known how many reptile species are in the region it is possible that up to 25 species could exist. Fish fauna is abundant in the Coongie Lakes and Cooper Creek system, which comprises ~23 species of fish. However, the introduction of exotic fish, increased pressure from tourism and the introduction of diseases is having a detrimental effect on the native fish population.

A number of feral animals have become established in the area including rabbits, cats, pigs, camels and the common house mouse. It is believed that many of the introduced species have had adverse effects on the native fauna population either directly or indirectly.

# LAND ACCESS

## Regional Parks and Reserves

There are two regional reserves located within the Cooper Basin, namely the Innamincka Regional Reserve and the Strzelecki Regional Reserve (Fig. 3.2). These were created to conserve the best examples of vegetation and landform in the region (O'Neil, 1995). Regional reserves are constituted under the *National Parks and Wildlife Act 1972* and operate under multiple use concepts whereby the wildlife, natural and historic features of reserves are conserved whilst at the same time permitting the utilisation of the natural resources of the land. Exploration and production are permitted in the reserves under arrangements administered by PIRSA.

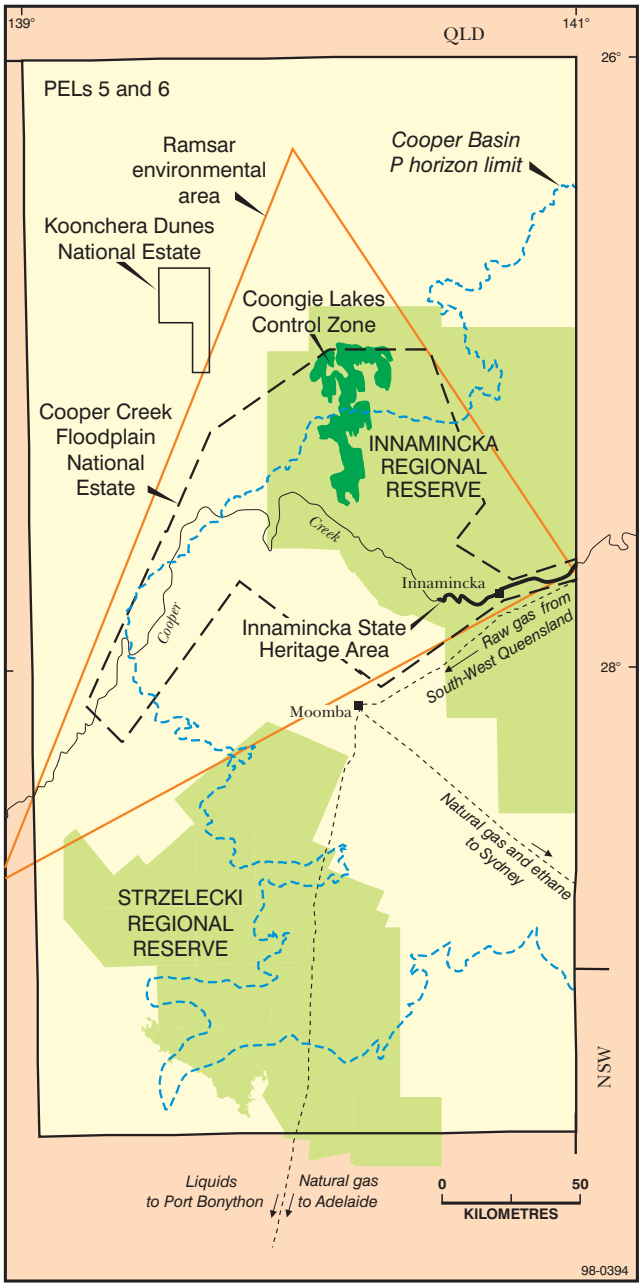


***Fig. 3.2*** *Conservation areas within the Cooper region.*

An area defined as the Coongie Lakes Control Zone is located within the Innamincka Regional Reserve and has been identified as a significant arid wetlands requiring special management. Exploration and production activities in this zone are subject to administrative and management procedures agreed to by PIRSA, the Department of Environment, Heritage and Aboriginal Affairs and exploration companies.

## Pastoral lands

Access to pastoral land (Fig. 2.4) requires notice be given to the landowner. The most common issues are the repair of any damaged tracks, fences or gates, and in some circumstances, vehicle and equipment hygiene to avoid the spread of weeds. There are standard techniques for managing such issues and landholders generally accept exploration and production activities.

## National Estate

The Coongie Lakes and the Cooper Creek floodplain are included in the Register of the National Estate. This is a listing of places which relate to the *Australian Heritage Commission Act 1975* and provides an indication of the heritage value of the places which it includes. Such listing may affect operations approved by federal agencies, but does not directly affect petroleum exploration or development except in so far as heritage issues must be taken into account in planning and undertaking activities.

## Ramsar Convention

Australia is a signatory to the Ramsar Convention which was established in 1971 to conserve significant wetlands habitats. The Cooper Creek, including Coongie Lakes, has been identified as a wetlands of international importance under this Convention. The broad objectives of the Convention aim to promote the wise use of wetlands and to maintain their ecological character. South Australia's obligations are to manage the wetlands wisely to maintain their ecological character. Such use does not necessarily restrict exploration access.

# HUMAN ENVIRONMENT

## Aboriginal heritage

Aboriginal history is discussed in Chapter 2. In South Australia it is an offence to disturb or destroy Aboriginal sites, objects or remains (*Aboriginal Heritage Act 1988*). Standard procedures for determining the presence of Aboriginal heritage in South Australia, prior to the commencement of activities, have been determined. These involve consulting with the relevant Aboriginal organisation and maintaining a watch for sites, objects or remains during exploration. These sites are generally no larger than a few hundred square metres and are easily avoided. PIRSA can provide advice to companies on Aboriginal heritage.

## European heritage

Sites of European heritage significance such as historic buildings, graves and geological monuments are found in

the Cooper Basin. These are indicated on environmental sensitivity maps held by PIRSA. The majority of sites are small and easily avoided during exploration and production activities.