

**A Review of
Yellabinna Regional
Reserve
1990 - 2000**

**Draft
November 1999**

**This review has been prepared and adopted in
pursuance to section 34A of the National Parks
and Wildlife Act, 1972.**

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Front cover photograph of Mount Finke, Yellabinna Regional Reserve, supplied by Ross Allen and reproduced with his permission.

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LIST OF ACRONYMS

ABARE	Australian Bureau of Agricultural and Resource Economics
CARRS	Comprehensive, Adequate and Representative Reserve System
DEF	Declaration of Environmental Factors
DEHAA	Department for Environment, Heritage and Aboriginal Affairs
DENR	Department of Environment and Natural Resources
GSP	Gross State Product
NPWSA	National Parks and Wildlife South Australia
PIRSA	Department of Primary Industries and Resources South Australia
RCD	Rabbit Calicivirus Disease
DELM	Department of Environment and Land Management SA
IUCN	International Union for the Conservation of Nature

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FOREWORD

Yellabinna Regional Reserve was proclaimed in 1990. It was the fourth Regional Reserve to be proclaimed and the second of two regional reserves established in the Far West of South Australia. These two multiple land use reserves in the Far West provide a framework to protect a significant area of natural habitat while allowing use of the natural resources via partnerships with Aboriginal people and the principals involved in mineral exploration.

The Yellabinna dunefield is the largest relatively unaltered mallee community in Australia. This mallee ecosystem which includes salt lakes and granite and quartzite features has high heritage, biodiversity and wilderness values. The geological basins and basement rocks, which underlie the Yellabinna area, were also seen as an important potential resource by mineral explorers. These values were seen in 1990, and continue to be seen, as worthy of good management and safekeeping.

The challenge of managing both nature conservation and the ecologically sustainable use of natural resources has been addressed by the International Union for the Conservation of Nature which recognises a multiple use category of reserve as an 'area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time sustainable flow of natural products and services to meet community needs'.

The objectives of management for this reserve category are:

- To protect and maintain the biological diversity, heritage and other values of the area in the long-term
- To promote sound management practices for sustainable production purposes
- To protect the natural resource base from being alienated for other land-use purposes that would be detrimental to the area's biological diversity; and
- To contribute to regional and national development.

The *National Parks and Wildlife Act 1972* requires a report to be prepared on each regional reserve at intervals of no more than ten years and prescribes the assessment criteria. This report reveals that the biodiversity and landscape values of Yellabinna Regional Reserve have been protected while a substantial amount of mineral exploration has been undertaken and that the reserve has provided a stimulus for improved environmental management. While better data gathering and improvements to management will continue to be a priority, I believe the report demonstrates that management has largely met the objectives of ecologically sustainable use of resources, justifying the original decision to establish the reserve and for its continued existence.

The proclamation of Yellabinna Regional Reserve ten years ago was an important step in a continuing process that has resulted in conservation becoming a legitimate and accepted framework for natural resource utilisation over a significant percentage of the arid zone in South Australia - without the Regional Reserve concept this might not have been the case.

I look forward to the community's support in the future management of this reserve. In accordance with the provisions of Section 34A (5) of the *National Parks and Wildlife Act 1972*, I have much pleasure in presenting this report on the use and management of Yellabinna Regional Reserve to Parliament.

HON DOROTHY KOTZ MP



MINISTER FOR ENVIRONMENT AND HERITAGE
MINISTER FOR ABORIGINAL AFFAIRS



EXECUTIVE SUMMARY

The *National Parks and Wildlife Act 1972* was amended in 1987, creating a regional reserve category, which introduced the concept of multiple use with a conservation function. This category of reserve provided a mechanism to develop cooperative partnerships between the key stakeholders.

This report assesses the outcomes of the 10 years of multiple use at Yellabinna Regional Reserve. It includes

- i. Assessments of the impact of the utilisation of the natural resources on the conservation of the wildlife, natural and historic features of the reserve
- ii. Assessments of the impact or potential impact on the utilisation of the natural resources of the reserve on the economy of the State, and
- iii. Recommendations as to the future status under the *National Parks and Wildlife Act 1972* of the land constituting the reserve.

Yellabinna Regional Reserve is located over 800 kilometres northwest of Adelaide. It lies north and north west of Ceduna and south of the Trans Australia Railway. The reserve is large; at some 2 522 700 hectares and it forms part of a contiguous 4 000 000 hectare area of largely mallee vegetation with high wilderness value. The reserve contains endemic flora and fauna and Endangered, Vulnerable and Rare species.

There are sites of cultural importance. The area contains heritage sites and mythic stories and routes of particular importance to a number of Aboriginal communities.

The dominant land uses of the reserve are conservation of the wildlife, landscape and historic features, mineral exploration, Aboriginal land use, and tourism.

The Exploration Best Practice Working Group composed of officers from the Department for Environment, Heritage and Aboriginal Affairs and Primary Industries and Resources South Australia meet, as required, to discuss management of mineral exploration in the Far West region of South Australia. The Far West Consultative Committee also provides input to the management of reserves of the Far West South Australia region.

Mineral Exploration

Over the period 1990 to 1999 mineral explorers have obtained 58 licences to explore within Yellabinna Regional Reserve. Eight exploration companies have progressed to substantial on-ground exploration. Following a burst of exploration early in the decade, most exploration has occurred since the aeromagnetic surveys conducted by PIRSA in the mid 1990s. Activity has mainly focussed on the base and precious metal, diamond and mineral sands potential of the basement rocks towards the eastern boundary of the reserve and of the stranded beach ridges and paleochannels in the SW and north of the reserve. No significant petroleum exploration has occurred within the reserve in the 1989-1999 period.

Over the review period, mineral exploration within the reserve has contributed over \$7.336 million to the Gross State Product. This expenditure has created household incomes for South Australians of over \$4.121 million and supported the equivalent of 11 jobs per annum. In total, government and mineral companies, in exploring the reserve for potential mineral resources, have invested approximately \$5.883 million over the ten year period.

These activities have been assessed as having a low impact on the landscape features of the reserve (following rehabilitation works) and a low impact on its wildlife and cultural features. The future impacts of mineral exploration and exploitation within the reserve over the next ten years are unknown, but are more likely to be small than great.

It is recommended that at least the current level of protection of wildlife, landscape and Aboriginal heritage features be maintained.

It is recommended that the Exploration Best Practice Working Group develop a Statement of Environmental Objectives for the Far West region, utilising objective criteria to establish benchmark indicators against which to assess exploration and development applications and review compliance and rehabilitation.

It is recommended that PIRSA and DEHAA jointly effect an appropriate level of liaison with mineral explorers to supervise, monitor and develop strategies and experimental procedures to prevent, minimise and rehabilitate the impacts of exploration and extraction activities within the reserve.

Aboriginal Use

The Aboriginal communities of Yalata, Oak Valley, Koonibba and Ceduna are the major users of the reserve and its resources. Their regular use includes travel, hunting and cultural activities. Hunting, primarily for kangaroo, rabbit, wombat and Australian bustard occurs at a level not considered of concern to the viability of the species. Overall, the impacts of Aboriginal resource use upon the landscape values of the reserve are assessed as low, and impacts to wildlife, are assessed as low. The economic impacts of Aboriginal use of the reserve are included in the assessment of tourism impacts.

It is recommended that liaison with and involvement of Aboriginal people in the management of the land currently contained within the Yellabinna Regional Reserve be enhanced and thus build upon the existing partnership arrangements.

Tourism

The visitor use of the reserve is low. However, visitors to Yellabinna Regional Reserve (including Aboriginal people), have contributed \$1.725 million to SA GSP and provided \$853 000 in Household Income, while providing the equivalent of four full time jobs.

Visitors, primarily through vehicle use, can and do impact on playa lakes, rockholes and inselbergs environments within the reserve. While the level of these visitor impacts have not been documented over the review period, they are important and require management consideration.

It is recommended that the plan of management be prepared for the reserve. The plan of management should adequately address the need to provide for site protection facilities and interpretation to enhance visitor experiences and to protect the landscape, wildlife, and cultural features of the reserve.

The plan of management needs to provide for the development, promotion and provision of appropriate visitor facilities and experiential opportunities within the region, which link to reserves adjacent to Yellabinna including Yumbarra C.P., Nullarbor N.P. and Nullarbor Regional Reserve. Facilities need to include signs, campsite locations, car parks and visitor information.

Feral Animals and Biodiversity Monitoring

Rabbit and camel are pests having a moderate but unquantified impact on the landscape and wildlife values of the reserve.

It is recommended that the impact of rabbits on the vegetation of the reserve be monitored.

It is recommended that the population and distribution of camels within the reserve be surveyed in association with surveys on the Nullarbor and that an adequate control program be developed.

Plan of Management

It is **recommended** that a plan of management for Yellabinna Regional Reserve be developed in the near future and that the plan include:

- ecological, wildlife conservation and visitor management objectives and priorities with associated monitoring requirements and performance measures
- provision for convening a broader management working group that includes key land use stakeholder representatives
- clear processes for gathering data and setting performance criteria to be applied over the next ten years for the next review pursuant to section 34A.

Future Review of the Reserve

It is **recommended** that to improve the accuracy and accountability of future reviews, that data including economic data, be collected on tourism, conservation and mineral exploration activities, Aboriginal use of wildlife, reserve management and research.

Reserve Status under the Act

It is the finding of this review that overall, the proclamation of Yellabinna Regional Reserve has resulted in positive environmental and economic outcomes. The benefits of reserve status has included improved environmental management, while the multiple-use management regime has provided for continued mineral exploration and use by local communities.

It is recommended that the Yellabinna Regional Reserve remain a Regional Reserve as classified under the *National Parks and Wildlife Act 1972* at least until the next review to be undertaken within the next ten years.

1 INTRODUCTION

1.1 Regional Reserves

The *National Parks and Wildlife Act 1972* provides for the establishment and management of reserves for public benefit and enjoyment, to provide for the conservation of wildlife in a natural environment, and for other purposes. These reserves fall into five categories namely; National Parks, Conservation Parks, Recreation Parks, Game Reserves and Regional Reserves. The *National Parks and Wildlife Act 1972* applies to all reserves constituted under the Act.

Regional Reserves proclaimed under Section 34A of this Act and managed pursuant to Section 37 Objectives of Management also provide for the conservation of wildlife or the natural or historic features of that land while, at the same time, permitting the utilisation of the natural resources of that land.

1.2 Background to Regional Reserves

Regional Reserves are the direct result of a desire by government to have conservation recognised as a major land use for public land while permitting use of the natural resources of those lands.

The original *National Parks and Wildlife Act* in 1972 provided for reserves with two major roles; conservation of natural and historic features and public benefit and enjoyment. The Act did include provisions to permit mining access in reserves, but prior to 1985, this provision was rarely implemented. Government policy adopted in that year has resulted in virtually all reserves proclaimed since that date having mining access provided.

The *National Parks and Wildlife Act 1972* was amended in 1987 to make provision for multiple-use reserves by creating a new classification of Regional Reserve. The constitution of these reserves provided the government with an opportunity to exercise a management regime that would maximise the conservation of key biodiversity assets while allowing for pre-existing and future land uses such as mining and pastoralism.

Furthermore, it permitted the Government to develop partnerships with the mining and pastoral industries, thereby facilitating improved standards of land management. Quite apart from the projected improvement in the overall management of lands of such reserves, the philosophy behind the regional reserve concept was expected to filter through to the broader management community operating in similar environments. The intention was that, together with the national land care strategy and the establishment of best practice environmental codes of practice by major mining companies, a more sustainable approach to land management generally would ultimately develop in these areas.

It needs to be stressed that the establishment of the Regional Reserve classification was aimed at facilitating the only available and realistic opportunity for establishing conservation as a legitimate land use, to sit at the table alongside mining and pastoralism.

The *National Parks and Wildlife Act 1972* has thus provided a multiple land use management regime within a conservation framework for defined areas that have conservation values but are subject to other legitimate land uses. The Regional Reserve mechanism provides for:

- a conservation focus
- conservation management planning and implementation
- security of tenure for lands reserved under the Act
- managed utilisation of natural resources, and
- Regulation for the management of human activity.

The major challenge for regional reserve management is to establish strategies that successfully integrate the different uses for which a reserve has been set aside.

The *National Parks and Wildlife Act 1972* also provides for agreements between the Minister for Environment and Heritage and Minister of Primary Industries and Energy and holders of mining tenements to prescribe the way in which natural resources will be utilised in regional reserves. These agreements recognise and make provisions for protecting the conservation values of these lands. No agreements of this type have been made in relation to Yellabinna Regional Reserve.

All other provisions of the Act apply to Regional Reserves.

The Regional Reserve classification is not fixed, as it does not prevent all or part of such a reserve from being re-constituted as another class of reserve under the Act at some future date, subject to a resolution of both Houses of Parliament (DELM 1993).

However, it was never intended that the Regional Reserve model could, or would, be used as a vehicle for conservation interests to oust the interests of the other land users. If decisions are to be taken subsequently that result in the discontinuation of one or more land uses, such decisions need to be based on contemporary judgements of prevailing economic, environmental and social considerations.

Regional Reserves are classified as IUCN Category VI Protected Areas, which is defined as '*areas containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs*' (IUCN 1994). The key words here are **sustainable** with respect to production objectives, and **protection and maintenance** with reference to biological diversity.

1.3 Purpose of this Review

This is a Ministerial Review required pursuant to *National Parks and Wildlife Act 1972* Section 34A (5).

The Minister must within ten years of the constitution of a Regional Reserve:

- (a) Prepare a report:
 - (i) Assessing the impact of the utilisation of natural resources on the conservation of the wildlife and the natural and historic features of the reserve
 - (ii) Assessing the impact or the potential impact of the utilisation of the natural resources of the reserve on the economy of the State, and
 - (iii) Making recommendations as to the future status under this Act of the land constituting the reserve, and
- (b) Cause a copy of the report to be laid before each House of Parliament.

1.4 Interpretation

In undertaking the review, it has been necessary to ensure that the requirements of the Act are properly addressed. To facilitate this process, an interpretative analysis of Section 34A of the Act was conducted and is provided in Appendix A. This analysis has been used to guide the conduct of the review. It is also useful in guiding readers of the report.

During the conduct of the review, issues emerged that will need to be addressed in the ongoing management of the reserve. Some of these relate to the scope and quality of baseline data upon which critical analysis of management should rely and which will be essential for the conduct of future Section 34A reviews. Other issues relate directly to the standards and aspects of management that need to be addressed on an ongoing basis, including the setting of performance measures to assess that management.

Recommendations for management, while not a requirement in the context of the Section 34A review, are included in this report for the purposes of identifying those issues that will be need to be addressed in preparing the plan of management for this reserve.

1.5 Scope of this Report

The review of Regional Reserves assesses the impacts of utilisation of natural resources on the wildlife, natural and historic features of these reserves and on the State's economy. The review has been prepared to meet the purposes of Section 34A(5) of the *National Parks and Wildlife Act 1972* (see Appendix A).

The process of consultation and data collection is described below.

Sections of Chapter 2 provide a description of the location, context for management, landscape, wildlife and cultural features of the reserve. Chapter 2 also provides an overview of the mineral exploration work that has occurred within the reserve over the review period.

Chapter 3 provides a discussion and assessment of the impacts of resource utilisation on the natural features of the reserve.

Chapter 4 discusses and assesses the impacts of resource utilisation on the cultural features of the reserve.

Chapter 5 provides a summary of the assessment of the impacts and potential impact of resource utilisation on the economy of the State. The full report and economic assessment prepared by EconSearch Pty Ltd is provided as Attachment 1.

Chapter 6 presents issues raised by individuals, interest groups and stakeholders who provided a submission to this review.

Chapter 7 is a discussion of the implications of the findings of this review.

Chapter 8 presents recommendations regarding the future status and management of the reserve.

Appendix A provides the interpretation used in this review of the provisions of section 34A of the Act.

Appendices B and C provide lists of plant and vertebrate species known to occur within the reserve.

Attachment One is the Economic Assessment of the reserve by EconSearch Pty Ltd.

1.6 Review Process

The data used in compiling this report has been drawn from existing reports and from a database maintained by Biodiversity Branch of the Department for Environment, Heritage and Aboriginal Affairs. Primary Industries and Resources South Australia provided data on mineral exploration activity. Impacts of tourism have been discussed and assessed using the knowledge of National Parks and Wildlife staff, members of the regional community, adventure tour operators and some members of the Aboriginal community.

The impact of the utilisation of the resources of the reserve on the economy of the State was assessed and reported on by EconSearch Pty Ltd.

Stakeholders have been involved in several ways. Letters were sent to over 40 key stakeholders and individuals, seeking their input to the review. An optional questionnaire was attached to the letters. Meetings with key regional stakeholders including local government, Ceduna business and tourism organisations, and Aboriginal community groups, were held during March and April 1999.

2 YELLABINNA REGIONAL RESERVE

2.1 Introduction

Yellabinna Regional Reserve (the reserve) is 2 522 700 hectares in size. It is located in the Far West of the State of South Australia and is bounded to the west by the Nullarbor Regional Reserve. To the north the Trans Australia Railway and the Maralinga Tjarutja Lands occur. Along the southern boundary lies the Yumbarra Conservation Park and the Pureba Conservation Park. In the northeast Yellabinna Regional Reserve adjoins six pastoral properties. (Figures 1 and 2.).

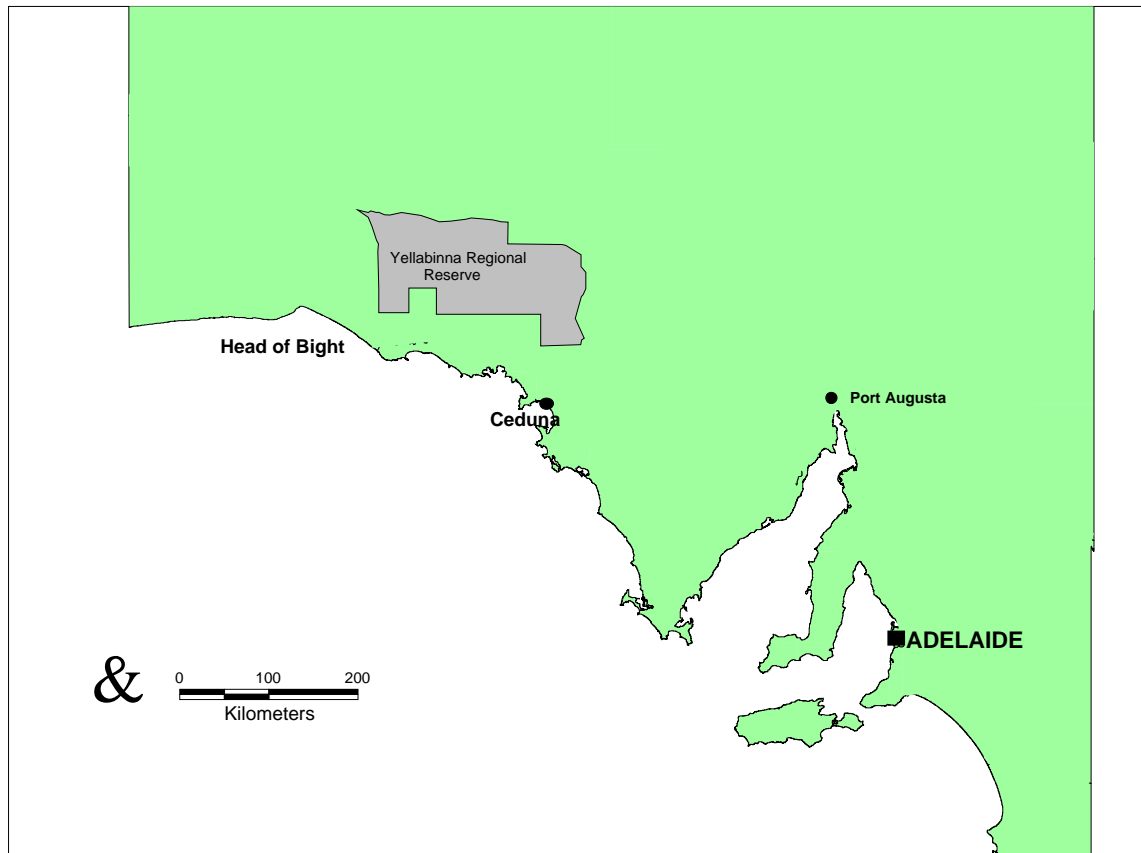


Figure 1. Location of Yellabinna Regional Reserve

Yellabinna Regional Reserve has a semi-arid to arid climate. The reserve experiences hot summers and cold winters. Rainfall is usually low and erratic. In the south of the reserve some sections experience about 250mm of rainfall per year, while the northern and north eastern areas receive less rainfall. Barton Siding, on the northern boundary, has an average annual rainfall of 230 mm per annum while Tarcoola has an annual average of 172mm. Mean monthly maximum temperatures range from 19 degrees Celsius in July through to 33 degrees Celsius in January. Mean monthly minimum temperatures range from six degrees Celsius in July through to 19 degrees Celsius in January.

The extensive area of land contained within the reserve lies within the Great Victoria Desert Environmental Region (Laut *et al* 1977). The reserve is dominated by a southeast extension of the parallel dunefields of the Great Victoria Desert. Predominantly red quartzite dunes, varying in height from 5 to 30 metres are covered with open mallee and porcupine grass formations. Granite outcrops, playa lakes and lunettes occur within this dunefield creating specialised habitats for plants and animals.

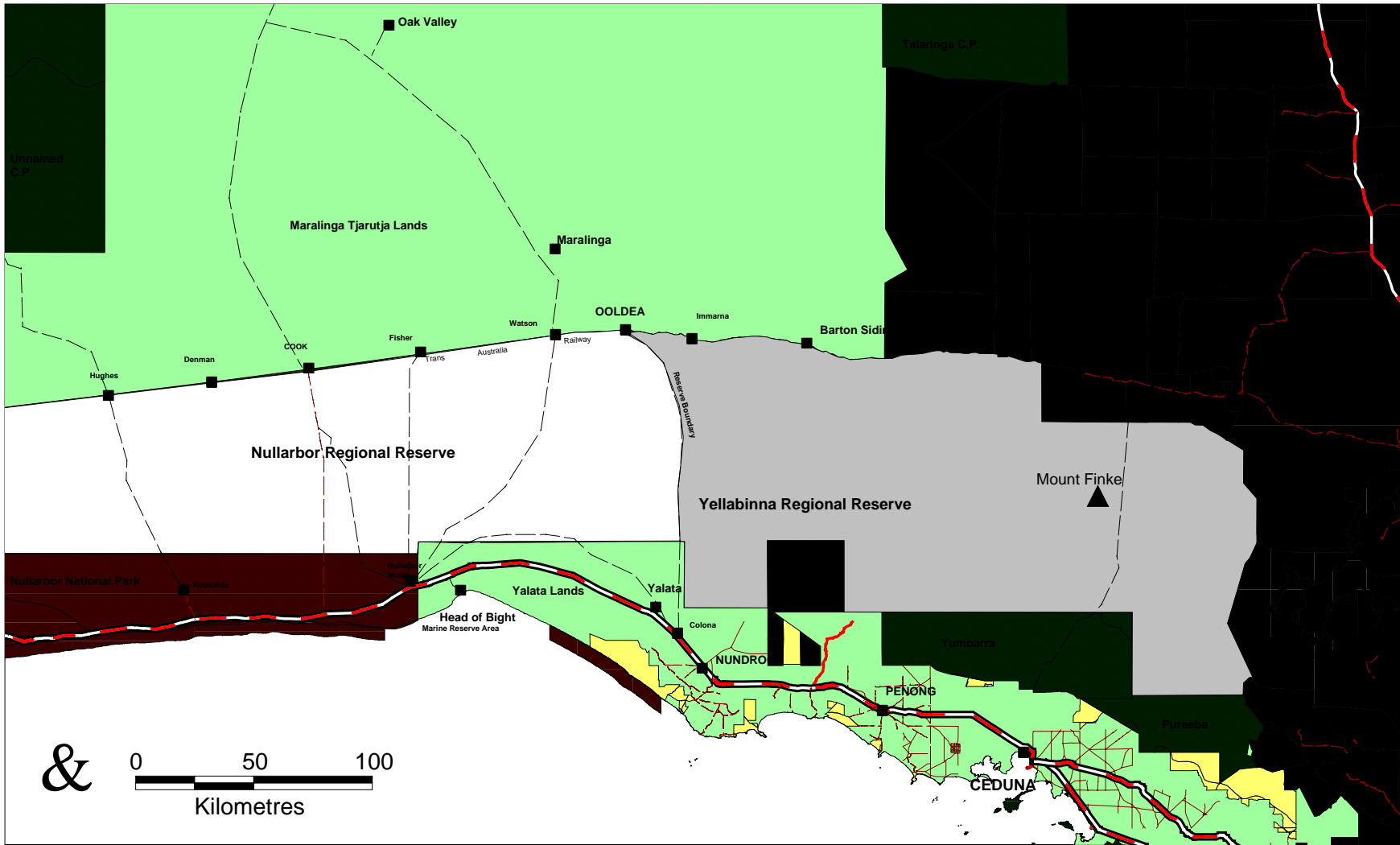


Figure 2. Location and Features of Yellabinna Regional Reserve

Yellabinna Regional Reserve represents the largest, least modified, tract of mallee vegetation in South Australia. It is significant in biogeographic terms as it links the mallee and mulga woodlands of Eyre Peninsula with those of Western Australia.

The reserve is important to a number of Aboriginal groups who are demonstrating an increasing interest in the area. A number of Aboriginal Heritage Sites (*Aboriginal Heritage Act 1988*), and mythic stories occur within the reserve and current surveys are extending this information.

Within the reserve 461 plant species and 200 species of vertebrates including endemic, endangered and vulnerable species have been recorded. The reserve area is not suitable for stock grazing due to the general absence of surface water, highly saline groundwater, and the reserves location outside the dingo proof fence.

The reserve, because of its size, low level of human use, general absence of roads and tracks has a low occurrence of pest plant species and is regarded as possessing significant wilderness value.

Underlying the reserve the rocks of the western Gawler Craton with associated volcanic intrusions and paleo-channels associated with the margins of the Nullarbor Plain are prospective for minerals. These areas are subject to ongoing exploration efforts.

The dominant land uses of the reserve are wildlife conservation, mineral exploration, hunting by Aboriginal people and 4WD vehicle-based tourism.

2.2 Context for Management

The Minister for Environment and Heritage has the control and administration of reserves constituted under the *National Parks and Wildlife Act 1972* (hereafter referred to as the Act), and all reserves are under the management of the Director. Yellabinna Regional Reserve was gazetted as a reserve under the Act in 1990.

The Minister manages the reserve through the Department for Environment, Heritage and Aboriginal Affairs (DEHAA) while the regional and on-ground management is responsibility of National Parks and Wildlife South Australia (NPWSA), a service entity within DEHAA.

The principal land uses within the reserve are: conservation of natural and historic features, mineral exploration, tourism and Aboriginal hunting. These land uses are constrained by a number of instruments:

- Conservation is determined by *National Parks and Wildlife Act 1972*, *Aboriginal Heritage Act 1988* and the *Heritage Act 1993*
- The management of mineral and petroleum exploration activities within Yellabinna Regional Reserve is primarily determined by the *Mining Act 1971*, the *Petroleum Act 1940* and the *National Parks and Wildlife Act 1972*.
- Provisions of the *National Parks and Wildlife Act 1972* also determine management of tourism and Aboriginal hunting within the reserve.

Requirement for a Yellabinna Regional Reserve Management Plan

A plan of management has yet to be prepared and adopted pursuant to Section 38 of the *National Parks and Wildlife Act 1972*, for Yellabinna Regional Reserve. Once such a plan is adopted, the provisions of the plan must be carried out and operations must not be undertaken in relation to the reserve unless they are in accordance with the plan of management.

In managing reserves, and developing the management plan, the Minister is required to have regard for the objectives under section 37 of the Act which in sub-section (j) make special provision for multiple land use:

Section 37:

- a) The preservation and management of wildlife
- b) The preservation of historic sites, objects and structures of historic or scientific interest within reserves
- c) The preservation of features of geographical, natural or scenic interest
- d) The destruction of dangerous weeds and the eradication or control of noxious weeds and exotic plants
- e) The control of vermin and exotic animals
- f) The control and eradication of disease of animals and vegetation
- g) The prevention and suppression of bush fires and other hazards
- h) The encouragement of public use and enjoyment of reserves and education in, and a proper understanding and recognition of, their purpose and significance
- i) Generally the promotion of the public interest and
- j) In relation to managing a regional reserve to permit the utilisation of natural resources while conserving wildlife and the natural or historic features of the land.

The development of a plan of management for Yellabinna Regional Reserve has not been a regional priority for NPWSA. Low rates of visitation, uncertainty relating to the future management of the adjacent Yumbarra C.P., a higher priority need for resources elsewhere in the region and the unresolved legal status of a number of overlapping native title claims which affect the reserve, constitute the key factors behind the regional assessment.

Management and Consultative Structures

The Far West Consultative Committee (FWCC) constituted under the Act provides a forum for stakeholders to become involved in and comment on the management of the reserve. The FWCC has received and passed on comments on reserve management.

The DEHAA/PIRSA Exploration-Best Practice Working Group regularly discusses matters relating to mineral exploration licence applications, supervision of licensees, minimisation of exploration impacts and rehabilitation planning and works.

Achievements in Partnerships

DEHAA and PIRSA have worked together, in association with mineral exploration companies to facilitate the approval, assessment and operation of 58 exploration licences.

Joint field inspections occur between PIRSA and DEHAA officers to ensure a consistent approach to exploration in the region, including exploration assessment.

PIRSA is responsible for environmental audit of mining activities. A 1995 audit of mineral exploration activity was undertaken in Yellabinna Regional Reserve. The findings of this audit have resulted in better coordination between DEHAA and PIRSA over exploration activity within the Regional Reserve.

In partnership with the Far West Consultative Committee and the Far West Friends of Parks, NPWSA has maintained a dialogue with community stakeholders about the Yellabinna Regional Reserve.

DEHAA and Aboriginal Community groups have worked together on a number of projects designed to foster improved working relationships.

2.3 Natural Features

Conservation Values

Yellabinna Regional Reserve represents the largest contiguous area of mallee conserved within the reserve system in South Australia. It is of sufficient size to ensure the long term conservation of self-sustaining ecosystems and species and with a gene pool of this size, to ensure ongoing genetic diversity and the evolution of species (Copley and Kemper 1992).

The reserve, in association with other adjacent blocks of native vegetation, forms a continuous corridor linking mallee and mulga woodlands from Eyre Peninsula with Western Australia. Within this broad arc of self-sustaining communities, individual species often occur at their distribution limits. Yellabinna contains species that are at their north-south or east-west limits of distribution.

The reserve contains species that are endemic to Yellabinna Regional Reserve and plants and animals that are Endangered, Vulnerable or Rare. It also contains a number of Aboriginal Heritage Sites, mythological stories and associations that are important to Aboriginal people.

The South Australian Government is committed to establishing a reserve system that is a comprehensive, adequate and representative. A Reserve System that aims, as far as is possible, to include all South Australian ecosystems. The Yellabinna Regional Reserve is an important element in this strategy.

Wilderness

Australia has approximately 18.5% of the world's warm desert and semi-desert wilderness (McCloskey and Spalding 1989). Australia is however the only developed country with significant wilderness areas in this category (Lessie et al 1987). South Australia has approximately 25% of the developed world's warm desert and semi-desert wilderness and therefore, as part of a developed nation, it can be argued that South Australia has a special responsibility to conserve such areas.

Yellabinna Regional Reserve (2 522 700 ha) is, in one contiguous block, about 17% of the total area of South Australian mallee that existed at the time of colonial settlement and about 9 % of all the area of mallee that existed in Australia in 1788 (adjusted from Graetz et al 1995; quoted in Wilderness Advisory Committee 1995).

Land encompassed within the Yellabinna Regional Reserve has been assessed as having high to very high wilderness quality. This assessment was made as part of the Commonwealth Government's National Wilderness Inventory. The inventory recognises that wilderness quality is part of a continuum of remote and natural conditions that range from pristine to urban. Remoteness and naturalness are the attributes of wilderness, which are measured using four indicators:

- remoteness from access – distance to established access routes
- remoteness from settlement and points of permanent human occupation
- apparent naturalness – the degree to which the landscape is free from the presence of permanent structures of modern technological society
- biophysical naturalness – the degree to which the natural environment is free of disturbance resulting from the influence of modern technological society.

The Inventory recognises that remoteness and naturalness are relative terms and that within Australia almost no land is absolutely remote or natural. The index does provide a guide and criteria against which to assess land for the wilderness qualities intuitively recognised and valued by a growing number of people (Wilderness Advisory Committee 1997). In Australia wilderness is recognised as land that remains relatively unaffected by non-Aboriginal settlement.

Landform

The landscape features of the reserve are marked by the southeast extension of the dune fields of the Great Victoria Desert and the northwest-southeast trending extension of the Ooldea Range. This remnant shoreline, marking the edge of the Nullarbor Plain, is 30-35 million years old. In the north east of the reserve, Mt Finke dominates the landscape. It is about 5km long with an elevation of 369 m AHD, it stands about 270m above the surrounding landscape. Mt Finke is an isolated block of steeply dipping quartzite believed to be part of a landform dating back some 250 Ma. Scattered through the reserve are also a sequence of saline lakebeds composed of gypsum, quartz and clay. Many of these playa lakes have an associated lunette on the eastern and northeastern side. It is believed that the playa lakes and lunettes formed during the last continental arid episode 25 000 to 15 000 years ago.

The landscape of Yellabinna Regional Reserve conserves many ancient features. This is unusual in a world context, where landscape features are usually much younger.

Geology

This section is summarised from Benbow (Benbow quoted in Copley and Kemper 1992) and from material supplied by Minerals Branch PIRSA (Shaw, 1999).

The Yellabinna Regional Reserve is sited on the western margin of the Gawler Craton. This crystalline basement rock is part of a large piece of the earth's crust and underlies about a third of central South Australia. Archaean sediments were highly metamorphosed into granites and gneisses between 2 600 and 2 300 million years ago (Ma). Further deformation and intrusion by granites and granodiorites as a result of volcanic activity in the Gawler Ranges area continued until 1 450 Ma. Outcrops of the Gawler Craton basement occur within the reserve as inselbergs and often mark the occurrence of rockholes.

Within the reserve, the older crystalline rocks of the Gawler Craton are mostly overlain by relatively thin early and middle Tertiary flat lying sands. These sediments are in turn covered by an extensive young dunefield, derived from the underlying unconsolidated sediments during a more arid climatic period.

Interpretation of regional aeromagnetic data by PIRSA Minerals Branch, indicates that the crystalline basement underlying the reserve and outcropping rarely, is predominantly igneous. Study of these aeromagnetic images indicates that these bodies were emplaced over a considerable period. The likely prospectivity for a particular body is dependant on its composition, associated volume of possible mineralised fluid and emplacement history; that is, whether it was emplaced during a period of extension or contraction of the crust.

Explorers are targeting locations within the reserve where plutons of high silica Hiltaba Suite and Gawler Ranges Volcanics occur. These areas are potentially prospective for copper, silver, gold, uranium and lead. Older fractured, altered and deformed igneous rocks intruded by these mineralising bodies are also prospective.

The western part of Yellabinna Regional Reserve is underlain by low silica intrusives with chemical compositions indicating they were derived from the mantle (below 35 km). These locations may be prospective for nickel, chromium, platinoids and diamonds.

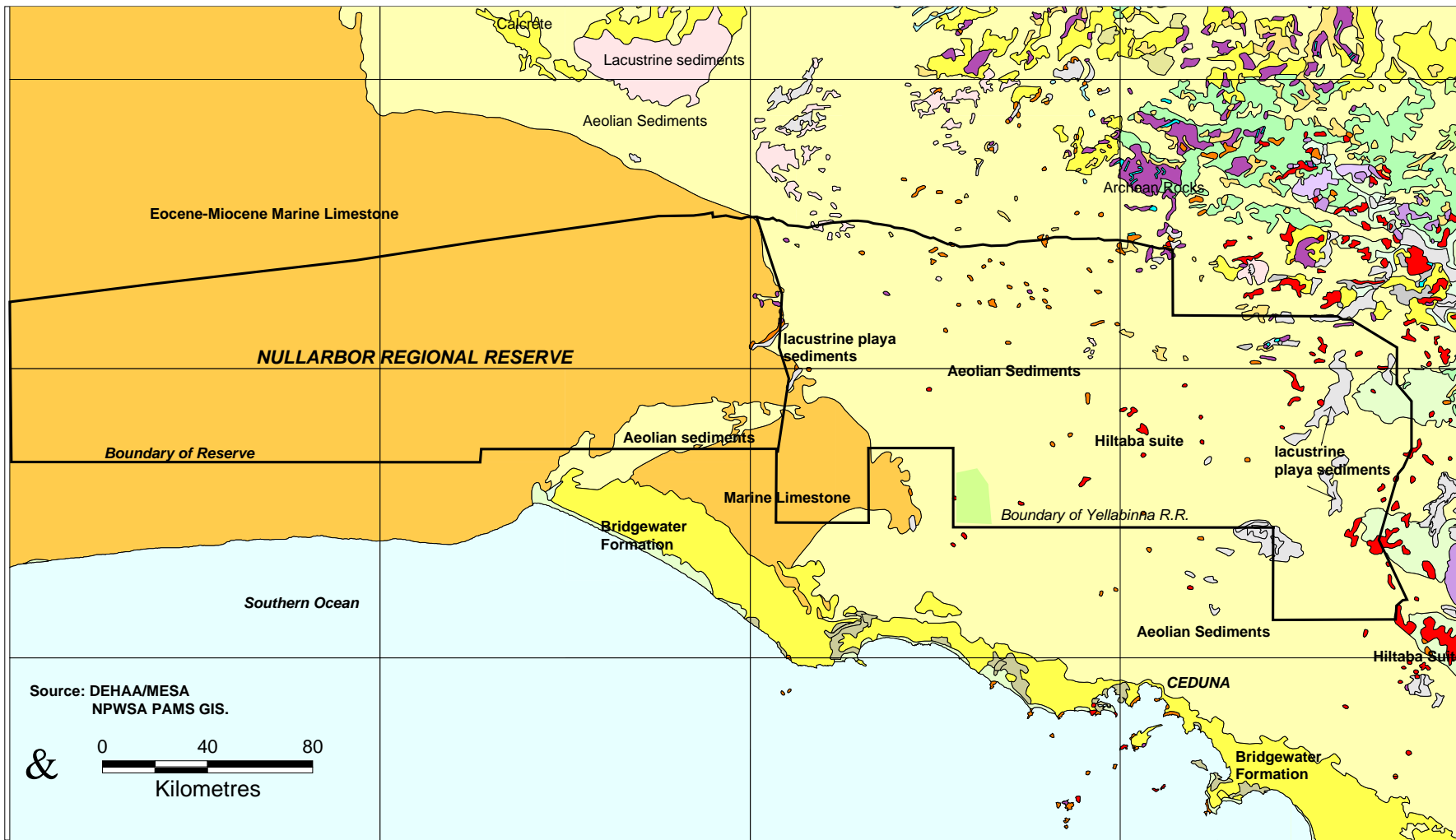


Figure 3. Surface Geology: Yellabinna Regional Reserve

Younger Tertiary sediments that overlie the crystalline basement are prospective for heavy mineral sands. Mineral sands are concentrated within elongate beach ridges that formed marginal to ancient coasts. Extensive early Tertiary river systems (paleo-channels) are also prospective for coal, uranium and placer gold.

Wildlife

The South Australian Biodiversity Database (Robinson et al. 1995) contains records for the reserve. The 1998 data download shows that for Yellabinna Regional Reserve 461 species of vascular plants and 200 species of vertebrate animals have been recorded.

The plant records represent only a sample of the flora of the reserve and were collected from 164 quadrats during the 1987 biological survey (Copley and Kemper 1992). The vertebrates list also includes SA Museum records for the reserve and is based on collections from 854 recordings and quadrats.

South Australian Biodiversity Database species lists are provided in Appendices B and C.

Vegetation

Vegetation surveys of Yellabinna Regional Reserve remain incomplete. While the basic structure of the perennial flora is understood, the extent and diversity of the ephemeral flora requires further study (Copley and Kemper 1992; Owens et al 1995). Vegetation communities appear to be strongly influenced by soil and substrate characteristics, in addition to aridity increasing from south to north. Open shrub and open mallee formations dominated by *Eucalyptus oleosa* in the southern portions of the reserve grade to open shrub and open mallee dominated by *E. socialis* in the north.

The deep quartz sands of the northern dunefields support a broad band of red mallee (*E. socialis*) and porcupine grass (*Triodia scariosa*). Where the normal pattern of parallel dunes gives way to complicated crossover patterns, tall open shrubland of hopbush (*Dodenaea viscosa* ssp. *angustissima*) with horse mulga (*Acacia ramulosa*) occurs.

Further south within the reserve is a broad band of open shrub and open mallee formation, composed of *E. socialis* with *E. yumbarrana* and increasing numbers of *E. oleosa*.

In the southwest of the reserve, the Nullarbor Plain intrudes and a higher level of calcium carbonate occurs in the dune sands. On shallow limestone soils, tussock grasslands of *Stipa drummondii* and *Danthonia caespitosa* and tall open shrubland of *Geijera linearifolia* and *Dodenaea viscosa* ssp. *angustissima* occur.

Confined to the skeletal soils on the quartzite of Mt Finke is an open shrub formation of Victoria spring mallee (*E. trivalvis*) and mulga (*Acacia aneura*) with Ooldea mallee (*E. youngiana*) and porcupine grass (*Triodia irritans*) also present. On the narrow bands of soil around granite rockholes an open herbland of *Scerolaena obliquicuspis* with *Tetragonia eremaea* occurs.

Significant flora

Yellabinna Regional Reserve has a number of flora species of conservation significance. These include endemic, Vulnerable and Rare species. Yellabinna conserves viable populations of species that are remote from other known populations of that species.

Significant plant species that occur in the reserve include the endemic *Grevillea treuriana* from the Mt Finke area and *Lechenaultia aphylla* from the dune systems to the west of Mt Finke. The Vulnerable are *Hibbertia crispula* and *Swainsonia laxa* var. *laxa* and Rare species are Ooldea mallee (*Eucalyptus youngiana*), Victoria spring mallee (*E. trivalvis*), *Swainsonia pyrophila*, *Melaleuca leicarpa*, *Comosperma visidulum* and *Spyridium tricolor*.

Yellabinna Regional Reserve then, is an important reserve for the long-term conservation of mallee plant communities and species of conservation significance.

Mammals

Recorded for the reserve is 24 native species of mammal. They include; the Vulnerable sandhill dunnart (*Sminthopsis psammophila*) and the Rare, kultarr (*Antechinomys laniger*). Other common and widespread species include red kangaroo (*Macropus rufus*), western grey kangaroo (*Macropus fuliginosus*), euro (*Macropus robustus*), Yvonne's ningau (*Ningau yvonneae*), , dingo (*Canis lupus*) and southern hairy-nosed wombat (*Lasiornis latifrons*). Also recorded for the reserve are *Notomys mitchellii*, *Sminthopsis dolichura* and *Sminthopsis crassicaudata*. Bats present include *Chalinolobus gouldii*, *Nyctophilus timoriensis*, *Vespadelus baverstoki* and *Nyctophilus geoffroyi*.

Also present are the introduced mammals; rabbit (*Oryctolagus cuniculus*), fox (*Vulpes vulpes*), cat (*Felis catus*) dog (*Canis familiaris*), house mouse (*Mus domesticus*) and camel (*Camelus dromedarius*).

Birds

Ninety five bird species are recorded on the South Australian Biodiversity Database for Yellabinna Regional Reserve.

The birds of the reserve include the Endangered mallee fowl (*Leipoa ocellata*), the Vulnerable; Australian bustard (*Ardeotis australis*), pink cockatoo (*Cacatua leadbeateri*), rufous tree creeper (*Climacteris rufus*), shy Hylacola (*Hylacola cauta*), yellow tailed pardalote (*Pardalotus xanthopygus*), striated grasswren (*Amytornis striatus*) and chestnut quailthrush (*Cinclosoma castanotum*).

Other species include; the rainbow bird (*Merops ornatus*), mulga parrot (*Psephotus varius*), brown falcon (*Falco berigora*) and peregrine falcon (*Falco peregrinus*).

Reptiles

The reptile fauna of the reserve is extensive; some 71 species of reptile (and two frogs) are recorded for the reserve on the SA Biodiversity Database 1998 download.

The reptile fauna includes dragons, snakes, geckos, skinks, sliders and goannas including; the endemic linga dragon (*Diporiphora linga*) and Fraser's legless lizard (*Delma fraseri*) which is rarely found in South Australia. The reptile fauna of Yellabinna Regional Reserve also includes; the sand goanna (*Varanus gouldii*), mallee black headed snake (*Suta spectabilis*), the thorny devil (*Moloch horridus*), the jewelled gecko (*Strophurus elderi*) and the centralian blind snake (*Ramaphotyphlops endoterus*).

2.4 Cultural Features

Aboriginal

Prior to colonisation, the land now proclaimed as Yellabinna Regional Reserve was occupied by members of the Wirangu and Kokata peoples.

In the western section of the reserve, land east of a line from the Head of Bight to Ooldea was part of the territory of the Wirangu people. Still within the reserve but somewhere to the east of the Wirangu land, was an area occupied by the Kokata (Tindale 1974).

In the northwest corner of the reserve is Ooldea, an important Aboriginal meeting place with a permanent water supply. Ooldea was the focus for Aboriginal trade and ceremony (Gara et al 1988). Ooldea Soak was looked after by the Emu totem of the Kokata people yet the Wirangu also maintained a ceremonial ground there (Bates, Bolam, Maurice and Bernt quoted in Gara et al 1988). In addition to the Wirangu and Kokata people, members of the Mirning people also travelled from Head of Bight to Ooldea and the western desert Pitjantjatjara people also visited Ooldea. This illustrates that drinking water is critical to safe travel in this country. Access to Ooldea from the coast was mainly achieved by skirting the Nullarbor Plain through Pedinga and Euria rockholes but other routes through Yellabinna, with suitable rockholes, were also used (Johnson 1941). Aboriginal people in association with DEHAA are currently documenting the cultural or mythological significance of these routes, the rockholes and other significant features.

Over a period of 100 years from about 1860 Aboriginal people on the west coast have been fragmented and the dislocation and dispersal that has occurred since is substantial. The Mirning dispersed to Eucla and Ceduna, the Wirangu and Kokata contracted to Ceduna and elsewhere in the State. The western desert people, including some Pitjantjatjara people moved south, eventually to Yalata. Most modern west coast Aboriginal communities contain members from several of these groups. West coast Aboriginal people are consequently, to a greater or lesser extent, physically removed from their traditional lands.

In recent times, as a result of complex factors, including an increasing Aboriginal interest in traditional culture, increased access to important places and sites, the granting of the Maralinga Tjarutja Lands, and the advent of native title legislation, Aboriginal groups on the west coast are again re-asserting their traditional associations with the land.

Now Aboriginal people use roads and tracks to travel between communities particularly the road along the western boundary of the reserve and north to Ooldea, Maralinga and Oak Valley. Occasionally, Aboriginal people travel on existing tracks through the centre of the reserve to sites of significance and for other cultural purposes.

The Yellabinna Regional Reserve is subject to four native title claims; the majority of claims overlap one another and all claims are yet to be determined:

- Mirning People WC95/013
- Maralinga Tjarutja SC96/001
- Wirangu No 1. amended SC97/005
- Ted Roberts SC95/005

Non-Aboriginal

In 1626, Francis Thijssen on board the Golden Seahorse was the first European to sight the southern coast of Australia. He mapped the coast from Cape Leeuwin in Western Australia eastwards to St Francis Island near Ceduna. Thijssen was followed by other maritime explorers, D'Entrecasteux (1792), Flinders (1801) and Baudin (1801).

The first overland explorer was Edward John Eyre, who in 1840-1841 led an expedition from Streaky Bay to Albany. Eyre followed a coastal route that permitted him to use water sources from the coastal dunes. In 1861 John McDouall Stuart was the first European known to cross the mallee wilderness of Yellabinna. In 1875 Ernest Giles explored the area from Ooldea Soak to Mount Finke on his way to Beltana in the Flinders Ranges (McKenzie and Robinson 1988).

In 1860 the huge pastoral run named Yalata, was established at Fowlers Bay by W.R Swan and R. Barr-Smith. Other early pastoralists included Dutton and Browne (on Charra Station) and Robert Love, Woolridge and Heath (Faull 1988). From 1888, with the expiration of the original pastoral leases, land south of Yellabinna through to the coast was progressively surveyed and made available for agriculture. The pioneering agriculture of the west coast proved long and hard; water from bores often proved salty and rabbits became a serious pest from the 1890s. The first section of dog fence was erected in 1906 to protect stock from dingoes. The district obtained a rail link in 1915 and the District Council of Murat Bay, which included Ceduna, was established in 1925 (Faull 1988).

The lack of surface water, salty bores, sequential drought and other difficulties constrained agriculture to areas south of Yellabinna on the loamy sands nearer the coast. Pastoral activity was largely confined to the eastern and northern boundaries of the reserve. The Yellabinna dunefields remained largely uncleared, ungrazed and without vehicle tracks into the 1960s.

In the mid 1970s Mr G. Denton, a property owner on the southern boundary of Yumbarra Conservation Park, cleared a track from the southern boundary of Yumbarra northwards through the dunefields of Yellabinna to Mount Finke and on to Malbooma and the Trans Australian Railway. He thereby linked Tarcoola with the west coast community. This track is still present within the reserve, and is called "Denton's" or "Goog's Track".

More recently, a succession of mineral exploration periods has resulted in numerous other tracks being created. Subsequent and continuous third party use of those tracks has resulted in an extensive internal track system.

Yellabinna Regional Reserve receives a small but growing number of tourists who are adventure travellers, using four wheel drive vehicles to see and experience the vast dunefields, salt lakes and rock outcrops of the reserve. At particular times of the year, local west coast residents drive through the reserve enroute to Tarcoola and Glendambo.

2.5 Resource Utilisation

Mineral and Petroleum Exploration

Yellabinna Regional Reserve overlies part of the western Gawler Craton. This area of basement rock has been intruded by volcanic activity that has produced discrete sub-surface features that are likely to be prospective for minerals. In addition, locations around the margin of the Gawler Craton are the site of ancient coastlines and paleochannels that are prospective for mineral sands.

Over the last ten years, exploration within the reserve has been ongoing, with peaks of activity early in the decade and again in the last four years.

Systematic exploration for copper, gold and base metal mineralisation has been in progress within and adjacent to the north-south trending Tunkilla Shear Zone (near the eastern boundary of the reserve). This activity has intensified since the announcement by Helix Resources of significant gold intersections within the altered shear zone. Other shear zones adjacent to granite or volcanics within the reserve are also prospective for gold, copper, silver and base metals.

Exploration has also been undertaken for mineral sands within younger sedimentary cover. A rich deposit was located on the northeastern margin of the Nullarbor Plain by North Exploration. The body (a marginal marine beach ridge) lacked sufficient continuity for economic development. Exploration on the margins of the reserve has been undertaken for coal and uranium also in overlying thin sediments. Other targets sought include ultramafic intrusives that occur in the western part of the reserve. These may contain economic deposits of nickel and chromium. Small ultramafic bodies have been investigated for platinoids and diamonds.

To assist and encourage mineral exploration in South Australia, the Government undertook a high quality aeromagnetic and radiometric survey throughout the State during the 1990s; this included surveying Yellabinna Regional Reserve.

From 1990 to 1999 some 58 Mineral Exploration Licences were issued for periods of 1-4 years within Yellabinna Regional Reserve. These licences occupied areas of between 89 and 2 642 sq kms within the reserve. Of the 58 licences 25 undertook some form of fieldwork within the reserve and 8 companies undertook substantial field based exploration within the reserve. Figure 4. shows the approximate locations areas where mineral exploration was undertaken. The licence holders were:

- North Mining Ltd
- Pima Mining NL (Allender)
- Equinox Resources NL
- BHP Minerals
- Peko Exploration Ltd
- Poseidon Exploration Ltd
- Geopeko Exploration/North Mining Limited (National Mineral Sands (SA) NL.
- Pan Australian Mining Ltd

As at July 1999, there is currently no significant on ground mineral exploration within the reserve.

The area within the Yellabinna Regional Reserve has not been actively explored for hydrocarbons. The nature of the geological strata makes it unlikely that the reserve contains significant hydrocarbon deposits.

Development

During the review period, “first stage” mineral exploration undertaken in the reserve has resulted in the development of 1 059 drill holes and associated pads and ten campsite and storage areas. Sixty-five kilometres of cross-country track, most of it single pass track, were created and rehabilitated. In addition, tracks and drill pads constructed prior to dedication of the reserve were rehabilitated (figure 5).

The nature of the total exploration effort within the reserve included the following methodologies and developments:

- calcrete sampling – access to sites by quad motorbikes or light 4WD vehicles driven cross country. Calcrete samples taken usually by digging a posthole by hand. This survey methodology is considered to have no long-term impact.
- track mounted drilling – cores drilled by track mounted drilling rigs, this technique was used mainly in dune corridors. This methodology is considered to have little impact.
- truck mounted drilling – drill holes usually up to 30 metres deep created by a truck mounted drilling rig. Existing tracks were used wherever possible but some new tracks were created and subsequently required rehabilitation.

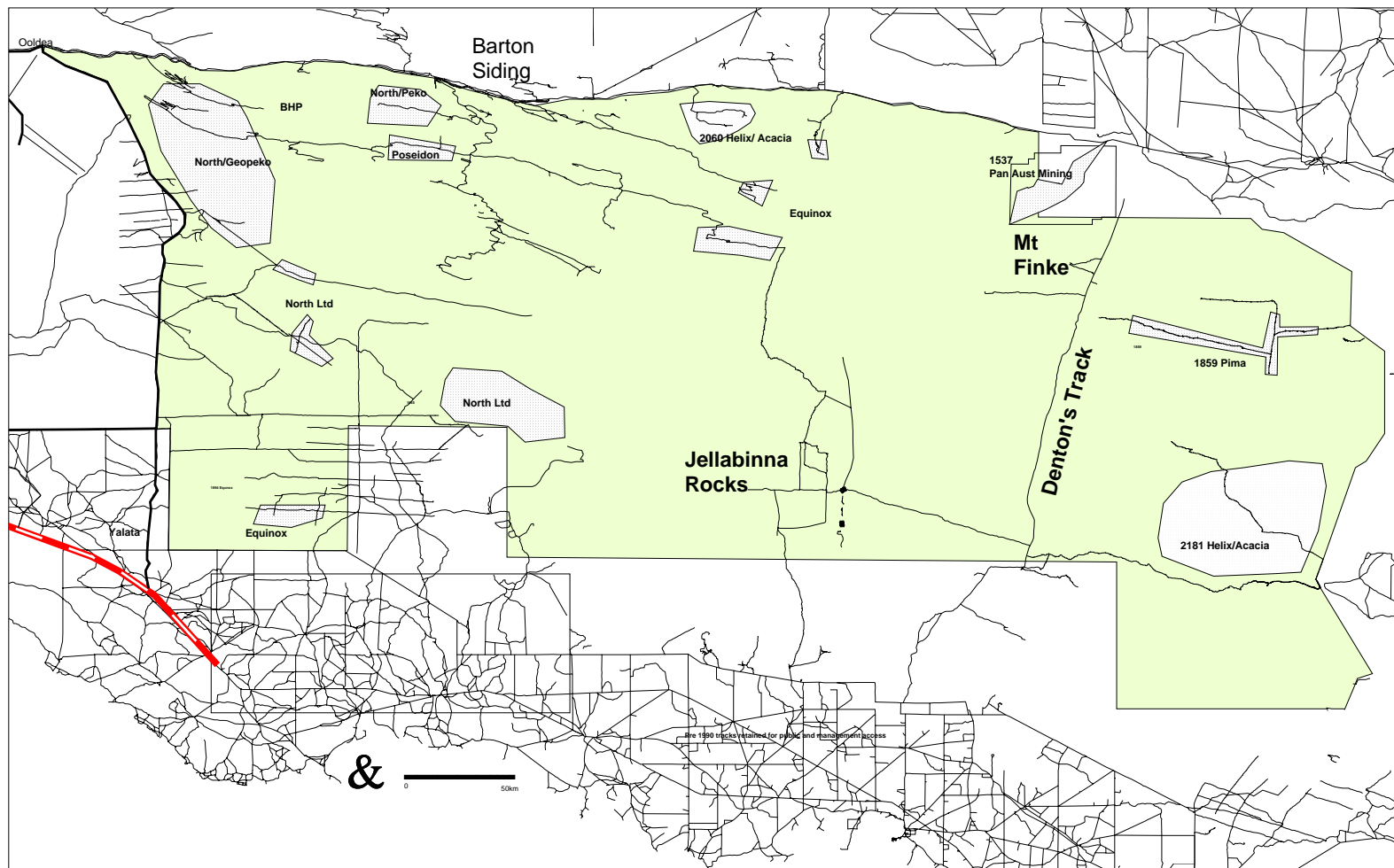
The licensee’s have mainly utilised tracks that existed prior to the proclamation of the reserve. Where access to drill sites was required some distance from existing tracks, explorers drove light 4WD rigs “cross country” to the desired location. Explorers have not utilised earth-moving equipment (dozers or graders) to gain access to sites during the review period.

Aboriginal Land Use

Aboriginal people from a number of groups regard it as important to travel through the reserve, seeing how things are, remembering places and teachings, and talking to their relations and children about the country.

The road from Colona to Ooldea skirts the western boundary of the reserve and provides the major road link between the Yalata and Oak Valley communities and the major supply routes for goods and services from Ceduna to Oak Valley. It is estimated that some 800 vehicles per year cross the reserve travelling to and from Oak Valley (Attachment 1). In addition, Aboriginal people of the Koonibba Community and other Aboriginal people visit sites, rockholes and other places of cultural importance or interest within the reserve.

The major direct use of the resources of the reserve by Aboriginal people is hunting. Aboriginal people hunt for red kangaroo, wombat and Australian bustard. Rabbit has until recently also provided a useful food supply, but with the introduction of RCD the population of rabbit within the region has significantly declined. Hunting by Aboriginal people within the reserve is mostly concentrated in the western boundary areas but may occur anywhere within the reserve. is a legitimate activity, proclaimed under Sections 68 (3) and (4) of the National Parks and Wildlife Act 1972 and gazetted on 24th June 1993.



Source: PIRSA data sets and mapping. Topis data. NPWSA Protected Area Management System GIS. **Note:** Shaded areas do not indicate area of impacts.

Figure 4. General Exploration Areas 1990-1999: Yellabinna Regional Reserve

Tourism

The total number of visitors to the reserve is unknown, as no visitor statistics have been collected. Estimates of visitor activity have been derived from the visitor book on Mount Finke, consultation with commercial operators, Aboriginal communities, 4WD associations and park managers. These sources have indicated that the number of visitors is small but growing. The majority are adventure travellers, usually engaged in a private, 4WD vehicle based, holiday. It is estimated that between 1 500 and 1800 tourists per year, travelling in 600 vehicles cross or enter the reserve (Attachment 1). A few commercial ecotourism operators take tours into the reserve each winter. The winter period is the time of most visitor activity.

There are two apparent patterns of use by visitors who either cross the reserve utilising Denton's Track, or travel along the Trans Australia Railway Line from Tarcoola and enter the reserve from the northern boundary at any one of a number of locations, most of the latter apparently returning to the railway to continue their journey west or east. A small but unknown number of local west coast visitors explore the reserve more comprehensively. Some visitors travel along the western boundary of the reserve to and from Ooldea.

Denton's Track also provides access to Mount Finke, and this site is now utilised for overnight camps and bush walks. A number of visitors (estimated at 10% of all Denton's Track visitors) climb to the top of Mount Finke and sign the visitors book. Seventy five people had signed the book during the 10 year period.

At certain times each year a substantial number of people travel along Denton's Track to attend the Tarcoola Races and other functions at Glendambo.

Reserve Management

National Parks and Wildlife SA management of the reserve during the last 10 years has involved:

- patrols, law enforcement operations and emergency responses.
- opportunistic pest animal control.
- liaison with mineral explorers and local stakeholders
- facilitating research and consultants' fieldwork, including on-ground assessments by archaeologists, anthropologists and other scientists.
- erection and maintenance of signs.
- supply of information to visitors, both from the NPWSA Ceduna Office and through the provision of tourist information brochures to tourism information centres.

The NPWSA District Ranger and other field staff are located in Ceduna.

Friends of the Far West Parks assist with management of the reserve on a voluntary basis.

3 IMPACTS OF RESOURCE UTILISATION ON WILDLIFE AND NATURAL FEATURES

3.1 Mineral and Petroleum Exploration

Most mineral or petroleum exploration activity has a level of environmental impact. Even though these impacts are not considered significant in a landscape context, locally there can be significant visual impacts. Community perceptions of the acceptability of such activities and their impacts change over time. At present, the industry is keeping impacts to within acceptable standards. As community expectations change, management processes and operational procedures will need to adapt to meet new standards.

A Declaration of Environmental Impact (DEF) is a normal requirement before exploration works are permitted within a reserve. DEHAA and PIRSA review and comment on such DEF's before permission is granted to companies to proceed. Companies are required to notify NPWSA before entering the reserve.

Impacts on Landscape Features

The impacts from mineral exploration activity within Yellabinna Regional Reserve during the last ten years have arisen from calcrete sampling, ground magnetic surveys and drilling operations.

These "first stage" exploration activities generally have low visual impact, the major impacts arise from explorers gaining access to sites. The creation and use of access tracks, camp and equipment storage sites, and drilling sites in an arid dunefield landscape, can leave visual scars that last for many years. New tracks, created by exploration companies, if not rehabilitated or disguised, can also be used by other visitors to the area. This may result in a non-planned and possibly inappropriate pattern of use. Moreover, disguising and or rehabilitating such exploration tracks in a mallee dunefield landscape requires special efforts to achieve.

However a discussion of the impacts of mineral exploration on landscape features of the reserve during the last ten years must be set in the context of the impacts that occurred within the reserve area (and adjoining lands) during the previous decade.

During the 1980s and prior to the dedication of the reserve, a significant amount of exploration occurred. This exploration created a legacy of redundant exploration tracks; borrow pits and campsites within the lands that would become Yellabinna Regional Reserve. Some of these tracks and sites were poorly constructed and almost none were rehabilitated. These tracks have subsequently become an access system for third party (visitor) use.

A new round of exploration activity then occurred in the early 1990s. While this exploration was subject to licence conditions and occurred within a framework of Environmental Guidelines concerns were expressed by both DEHAA and PIRSA that the management system appeared not to be delivering quality results, particularly rehabilitation.

During 1995 PIRSA (then Mines and Energy South Australia) commissioned an independent audit of exploration activity within the reserve. That audit (Qest 1995) found that:

- commitments, conditions and guidelines had been well followed except with respect to rehabilitation
- significant adverse impacts on the reserve were associated with access
- existing techniques to discourage third party use were ineffective
- it appeared to make no difference whether guidelines had been developed or made part of the approval conditions, as use and/or compliance with them were random.

The audit made a number of recommendations from which PIRSA and DEHAA have since implemented the following;

- development of a set of management guidelines for mineral exploration activity in South Australia, designed to ensure consistent best practice exploration
- development of a Statement of Environmental Objectives for Mineral Exploration that establishes a minimum set of environmental objectives to be met by all explorers. They include techniques to assist in the environmental management of field operations and the reduction of environmental impacts
- development of a CD-ROM training program on environmental management of exploration activity for use by industry
- various organisational arrangements between PIRSA and DEHAA to improve communication, assessment and management techniques
- audit assessments both during and after exploration programs
- development of environmental information systems and environmental sensitivity maps
- allocation of funds by PIRSA/DEHAA to undertake the rehabilitation of old exploration tracks both inside and outside the reserve
- establishment of the PIRSA/DEHAA Far West Exploration and Best Practice Working Group.

During the review period the impacts from exploration activity on the landscape features of the reserve are:

- vegetation damage and clearance associated with the 65 km of new “wheel rut track.” Some of this is “single pass” track and the rest requiring some form of rehabilitation.
- vegetation damage and clearance associated with the establishment and use of approximately 10 campsite/storage areas that subsequently required rehabilitation.
- vegetation damage and clearance associated with the development of 1 056 drill holes and associated pads.

These developments were subject to field assessment. The field assessment reports record impacts from deep wheel ruts and the creation of bulldust. Additional clean up and rehabilitation of drill sites and tracks was subsequently undertaken. Site rehabilitation included capping drill holes, removal of rubbish and debris, leveled and raking surface soils. Where necessary, impacts from vehicle use were rehabilitated by pulling in windrows, scarifying compacted soils and disguising track entrances to reduce third party access. Compacted campsites were scarified.

PIRSA/DEHAA Rehabilitation Project

During 1998 and 1999 PIRSA conducted a works program to rehabilitate exploration tracks and campsites established in the Yellabinna area prior to the dedication of the reserve. This work has been planned in association with NPWSA to rationalise the total track system and facilitate appropriate visitor and mineral exploration access.

The project aims to deliver quality rehabilitation, regeneration, and establish a manageable track system. The project has ripped tracks, disguised entrances, closed old drill holes, removed rubbish and promoted regeneration. The project includes a number of trials, which are being monitored to assist with refining rehabilitation techniques suitable for the soil and landscape condition of the area.

The extent and distribution of exploration activity and the extent and distribution of the rehabilitation achievements can be seen in figures 4 and 5.

Following the rehabilitation and the additional work undertaken by PIRSA the impact of mineral exploration on the landscape values of the reserve, at the end of the ten-year review period, is assessed as low.

Impacts on Wildlife

Impacts to wildlife from mineral exploration activities within the reserve may arise from:

- disturbance to flora and fauna by track construction
- vegetation damage at drill sites
- third party use of tracks
- spread of weed species.

Disturbance of Flora and Fauna

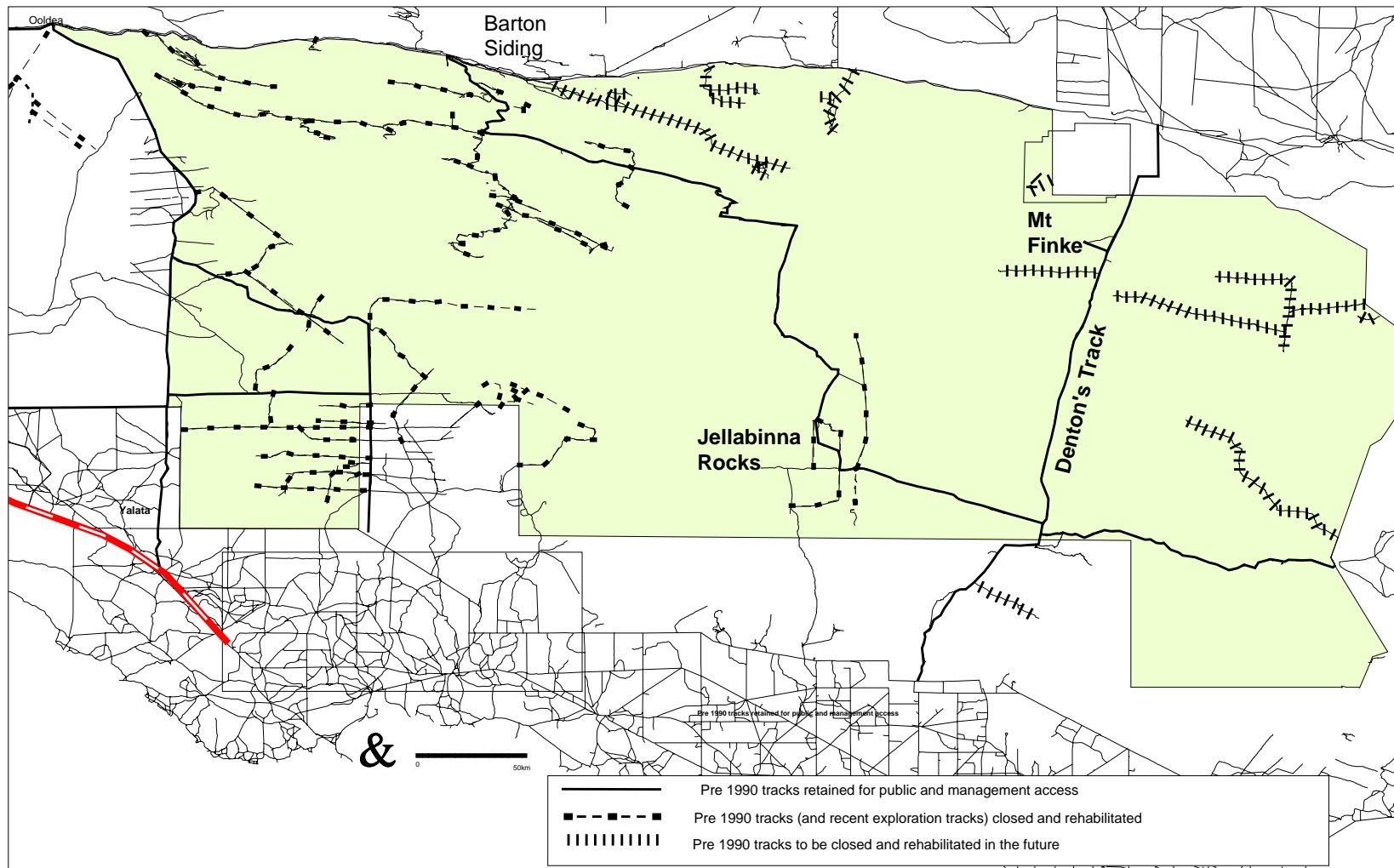
The local impacts to the land surface and biota as a result of vehicular traffic are transient in nature, with natural recovery rates dependent on soil type, rainfall and the construction methods employed.

Variations in soil type and slope, the presence of fine clays and the relative importance of lichens are all important in identifying locations likely to become erosion sites. Localised environmental impacts (such as visibility, flora and soil impacts) from exploratory activities are expected to recover to within natural variability within the medium term (approximately 8-10 years). Some parts of some tracks or drill sites may take longer to become invisible. This is particularly relevant to tracks prepared prior to 1985, when the long-term effects of track construction on the environment were not considered.

Within Yellabinna Regional Reserve, the disturbance to flora has been limited to the areas used for campsites, equipment storage and minor exploration activity. With the minimal creation of new cross-country tracks, the impact of mineral exploration activity on vegetation over the last ten years is regarded as low.

The construction of exploration tracks can interfere with the home range of small mammals, reptiles and invertebrates. Some animals are killed when track construction is occurring, less so with light vehicle units driving “cross country”. As long as construction of tracks and mineral exploration is at a low level and does not occur where small populations of species of conservation significance exist, then the impact is regarded as minimal.

Overall, the impact of mineral exploration activity on the fauna of the Yellabinna Regional Reserve over the last ten years is regarded as low.



Source: PIRSA data set. Topis data set. NPWSA Protected Area Management System GIS
 Figure 5. Yellabinna Regional Reserve: Distribution and Status of Tracks 1999.

Third Party Use of Exploration Access Tracks

Third party use of mineral exploration tracks is considered a more serious longer-term threat to the natural and cultural values of the reserve.

While it is appropriate that visitors have access to an interesting and representative sample of the natural features of the reserve, management of vehicle access needs to ensure that visitors do not gain access to cultural, biological or dangerous sites. This is a critical strategy of reserve management. Tracks created for other land use purposes must be constructed and rehabilitated with a view to minimising third party use where this is contrary to biodiversity conservation and maintenance of the integrity of sites of cultural significance.

With the rehabilitation and disguising of track entrances undertaken by explorers and by PIRSA/DEHAA, no significant difficulties are foreseen from third party use of tracks constructed during the review period.

Pest Plants

Vehicles and exploration equipment, including drilling rigs, can be the vector for the introduction or spread of weed species within a reserve. Attention to vehicle cleaning prior to equipment being brought into the reserve and prior to it leaving can do much to reduce this potential impact.

In the case of Yellabinna Regional Reserve the climatic conditions, soil types and a limited existing distribution of weeds limits the threat of weed invasion and spread. There is little evidence of weed spread resulting from exploration activity within the review period.

Impacts are assessed as low.

3.2 Aboriginal Land Use

The Aboriginal communities of Yalata and Oak Valley are the major users of the western boundary region of the reserve. Their regular use includes travel, hunting and cultural activities although this has not been documented in any detail.

In addition to the major transit routes between Ooldea and Colona, an extensive network of tracks within the Regional Reserve are used for cultural (and to some extent for hunting purposes) by members of other Aboriginal communities.

Hunting, primarily for rabbit, kangaroo, wombat and Australian bustard occurs at a level generally not considered of concern to the viability of the species within the reserve. Hunting pressure is concentrated in the western boundary section of the reserve.

Overall, the impact of Aboriginal hunting on the wildlife resources of the reserve is assessed as low.

Yalata Community Incorporated recognises the need to reduce the total number of tracks and intends to monitor hunting off-take (Yalata Lands Management Plan 1997). DEHAA has expressed a willingness to assist in establishing hunting off-take monitoring and discussions and fieldwork have occurred between Yalata Land Management Team and NPWSA officers. The aforementioned plan of management for the reserve should therefore address the monitoring and management of Aboriginal people's use of the reserve in a constructive and cooperative way. This should be done so that future management decisions take account of Aboriginal knowledge and the aspirations of local Aboriginal communities.

Overall, Aboriginal land use impacts on the landscape values of the reserve are assessed as low.

3.3 Tourism

The impacts from visitor use on the resources of the reserve are not documented but anecdotal information suggests that they are potentially important and require management attention.

Visitor use occurs at relatively low levels. The majority of visitors simply pass through the reserve on their way to some other destination. A few visitors camp at Mt Finke.

Visitors can and do impact on tracks within the reserve. Use of some tracks following heavy rain can cause deterioration in track surface conditions. Use of some dune crossings in late summer can lead to very soft conditions, track “blow-outs” and the risk of visitors becoming bogged. Visitors use their vehicles to explore new tracks and some playa lake areas. Some tracks now lead to rockholes and other cultural sites and visitors’ vehicles can approach and damage some aspects of these sites, perhaps inadvertently.

A proliferation of unmarked tracks leads to impacts on natural, cultural and landscape features. A proliferation of tracks increases the likelihood of visitors getting lost or visiting inappropriate sites.

The production of a plan of management for the reserve that addresses the monitoring and management of visitors, the provision of signage, car parks and information services and the development of safe access to a selection of representative sites would improve the situation.

Overall, the level of impact from tourism activity on the landscape and natural values of the reserve is assessed as low.

3.4 Feral Animals and Pest Plants

Feral animals, particularly rabbits and camels are believed to have a moderate impact within the reserve. Rabbits in particular have a seasonally variable impact; numbers rise in some years and fall away in others.

During the review period the spread into the reserve’s rabbit population of the Rabbit Calicivirus Disease (RCD) and an apparent re-invigoration of myxomatosis, has seen a substantial drop in the rabbit population. Anecdotal evidence from NPWSA field officers and viewing of old monitoring photos indicate that the impact of RCD has led to an appreciable increase in the total biomass of the dunefield communities.

Feral camels are occasionally sighted within the reserve. These animals are shot on an opportunistic basis by NPWSA staff. It is believed that the population may be having an impact on the flora and possibly fauna of the reserve. The camel population requires survey and assessment of impact and a decision taken on suitable control measures. Such an assessment needs to be undertaken with a recognition of Aboriginal cultural sensitivities relating to camels.

Goats have been reported south of the reserve but have not been recorded in the reserve at this stage.

Foxes are recorded for the reserve. It is likely that fox numbers have declined substantially commensurate with the decline in rabbit population, as is known to have occurred in the Flinders Ranges.

Cats, like foxes, have probably declined commensurate with the decline in rabbits.

No inventory or distribution analysis of weed species within the reserve has been undertaken. Weeds recognised as occurring within the reserve are those usually associated with pastoral activity (Appendix B). Grasses and burrs are known to occur in those areas with a slightly deeper soil profile. Pest plants are not considered a major management concern but additional plant inventory work is required to establish the status of pest plants in the reserve.

At present, the extent and intensity of impacts from feral animals cannot be quantified.

A survey of the distribution and abundance of camel to provide data on population and distribution would enable informed decisions on the approaches to control to be made. More consistent monitoring of photopoint sites and rabbit populations would improve knowledge of the impacts of rabbit within the reserve.

4 IMPACTS OF RESOURCE UTILISATION ON CULTURAL FEATURES

4.1 Aboriginal Culture

Mineral Exploration

During the last ten years there have been no known impacts from mineral exploration on cultural values within Yellabinna Regional Reserve. Tracks created prior to the proclamation of the reserve may well have disturbed areas of cultural sensitivity. The Ifould Lakes area (western boundary) in particular is believed to have been a location where cultural sites may have been previously impacted by exploration activities.

Aboriginal Heritage sites and locations of significance do occur within the reserve and a number of sites are recorded on the State Aboriginal Heritage Site Register.

The exploration licence approval system requires licensees to identify the location of heritage sites and to consult with Aboriginal groups prior to works being undertaken.

Under the licence approval system operated by PIRSA/DEHAA if exploration is likely to impact upon sensitive locations the licensee is required to produce a Declaration of Environmental Factors (DEF). The DEF must address cultural and heritage concerns in line with the *Aboriginal Heritage Act 1988*, the *Native title Act* and the *Mining Act* (part 9b) 1971. DEF's are routinely requested for all works proposed within the reserve.

Currently, two separate field surveys are underway in which consultants (Annie Nicholson and Keryn Walshe) are working with Aboriginal people to identify, document and record anthropological and archaeological information about wells, rockholes, historic sites and traditional use and association with the land in Yellabinna and adjacent areas.

Tourism

The impacts of tourism on the conservation of heritage sites has not been monitored or assessed in any detail. The reserve relies upon its remote location and a general absence of public knowledge about site location for protection. This management approach generally works but concerns exist that some rockholes and other sites may be subject to accidental damage from reserve visitors.

Direct physical management of sites with protective measures may be required following assessment. The local Aboriginal communities need to be actively involved in the management of sites which are of significance to them.

Overall the impact of visitors on Aboriginal cultural resources is assessed as low. Proper protection and on site visitor management strategies will be required to limit future impacts on Aboriginal Heritage sites.

4.2 Non-Aboriginal Culture

An inventory of non-Aboriginal heritage sites has not occurred for the reserve. It is believed that few indicators of European settlement exist within the reserve. No known impacts have been recorded.

5 IMPACTS OR POTENTIAL IMPACTS OF RESOURCE UTILISATION ON THE ECONOMY OF THE STATE

Note: For further details on this section see Attachment 1

5.1 Mineral and Petroleum Exploration

Over the review period, mineral exploration within the reserve has contributed over \$7.336 million to the Gross State Product. This expenditure has created Household Incomes for South Australians of over \$4 021 000 and supported the equivalent of eleven jobs per annum.

Table 1. Illustrates this economic impact for South Australia.

The measures of economic activity used are employment, wage and salary income, and value-added. Value-added represents the difference between the value of the goods or services produced and the cost of materials and supplies used in producing them. Output of one firm often becomes the input of another in the production of a final product. Reporting the impact on output therefore involves considerable double counting. The stated value-added figures contained in this study overcome the double counting problem as they represent the sum of the value added to a product at each stage of the production process.

The direct impact is the impact in terms of employment and incomes of local residents within the production process itself, and in direct suppliers/services to the production. The total impact includes the indirect or flow-on effect as the expenditure circulates within the economy.

Table 1. Estimation of the Economic Impact, 1989 to 1998

	Employment per annum	Income (\$'000)	Value-added (\$'000)
Direct Impact	6	2,694	4,097
Indirect Impact	5	1,327	3,239
Total Impact	11	4,021	7,336

Note: Totals may not tally due to rounding.

Future Prospects

The prospectivity of the Yellabinna Regional Reserve, which includes a significant proportion of the western Gawler Craton, is high. However, although 58 exploration licences for the Yellabinna Regional Reserve have been issued by PIRSA to mineral exploration companies for the period 1990 to 1999 only limited fieldwork and drilling has been undertaken. In total, approximately \$6 million has been invested over the past ten years by Government and mineral exploration companies within the reserve.

Much of the exploratory work was done prior to 1995. In recent years, more effort has been expended on interpretation and analysis of aeromagnetic data that was collected by PIRSA Mineral Resources in 1992-94. These interpretations indicate prospective terrain within Yellabinna Regional Reserve for metallic minerals, industrial minerals and coal. Systematic exploration for gold, copper, silver and other base metals has intensified since the announcement of significant gold findings in the Tunkilla Shear Zone adjacent to the eastern boundary of the reserve.

An increase in exploration activity is expected over the next ten-year period. However, native title issues, costs of exploration (coupled with relatively low commodity prices) and limited infrastructure is generally restricting further exploration and development by mining companies in the short to medium term.

There is no perceived petroleum potential in the Yellabinna Regional Reserve because of the nature of the rock types in the area.

The continuing growth in global minerals and energy supplies, coupled with slower average rates of world economic growth, are expected to constrain world prices for most minerals and energy commodities over most of the period to 2004.

Australia will be an important contributor to the expected growth in global minerals supply, and Australian mine production is forecast to grow significantly as production from recently commissioned new mine developments and others at advanced stages of planning reach full capacity. However, low world prices are restricting exploration and further developments in mining and processing.

Over the medium term, average prices received by Australian minerals and energy exporters are projected to fall by over 12 per cent, sustaining pressures on the industry to further reduce costs of production to maintain its margins and international competitiveness.

While the prospectivity for metallic minerals and mineral sands in the Yellabinna Regional Reserve is high, and there has been increasing interest in further exploration, it is impossible to provide any meaningful quantitative estimates of future levels of activity. As noted above, native title issues, costs of exploration (coupled with relatively low commodity prices) and limited infrastructure is generally restricting further exploration in the short to medium term.

5.2 Tourism

Tourists have been divided into two groups according to their point of entry to the Yellabinna Regional Reserve. The first group are those who travel into and sometimes across the reserve from Ceduna along Goog's Track. The Mt Finke visitors' book indicated an annual average of approximately 70-75 people recording their visit at the top of Mt Finke over the period 1989-1998. On the basis that this would represent around 10 per cent of the visitors actually using Goog's Track and that there is likely to be an average of 2.5 people per vehicle, there was estimated to be approximately 300 vehicles per annum entering the Yellabinna Regional Reserve along Goog's Track. The second group are those who travel along the northern boundary of the reserve or make shorter trips into the reserve for bird watching, etc, without necessarily making a complete crossing. There was estimated to be an average of 6 vehicles per week in this group (ie 300 vehicles per annum).

On the basis of these estimates, it is assumed, for the purpose of this analysis, that there are approximately 600 vehicles per annum crossing, or at least entering, the reserve for recreational purposes. Further, as there is likely to be an average of between 2.5 and 3 people per vehicle, the number of tourists visiting the reserve each year could be between 1,500 and 1,800.

Use by Aboriginal Communities

Travel by members of the Aboriginal community, particularly between Yalata and Oak Valley, is likely to be the highest usage of the reserve by any one group. From discussions with Mr Bob Ware (ATSIC regional manager Ceduna) it was estimated there would be an average of around 10 vehicles per day during the ceremonial times of the year. At other times of the year there would be an average of 10 vehicles per week. In total this equates to approximately 800 vehicles crossing the Yellabinna Regional Reserve each year.

Using industry standard multipliers, Table 2. Illustrates the economic impact of expenditure, as discussed above, for South Australia.

Table 2. Estimation of the Economic Impact of Visitors (a) for the Ten-year Period

	Employment per annum	Income (\$'000)	Value-added (\$'000)
Direct Impact	2	431	777
Indirect Impact	2	422	948
Total Impact	4	853	1,725

(a) Includes expenditures by Aboriginal communities and tourists

Note: Totals may not tally due to rounding.

Over the last ten years tourism and Aboriginal travel through Yellabinna Regional Reserve has contributed almost \$1.725 million to the State's Gross State Product. This expenditure has supported net incomes for South Australians of approximately \$853 000 and underpinned the equivalent of 4 jobs per annum.

Future Prospects

Tourism activity within the Regional Reserve is expected to continue to grow slowly. National and international economic factors may vary this growth.

5.3 Conservation

The economic value of the reserve, derived from its environmental amenities, comprises explicit use benefits as well as implicit non-use benefits. Use benefits are those that accrue from the physical use of the Regional Reserve, such as touring, camping and adventure treks. The implicit non-use values are more aligned with conservation and environmental preservation.

The conservation use of the reserve is, to some extent, associated with the demand for tourism in the area. While some people may travel to the reserve for the simple four wheel drive adventure, it could be argued that it is the environmental qualities of the Yellabinna landscape, the night sky and an area unsullied by human habitation that attracts visitors to this remote region.

To this extent, the economic impact of conservation is included in the economic impact of tourism. There are additional activities directly related to the conservation of the environment of the Regional Reserve that have a measurable impact on the economy. These include the production of documentaries, books and photographs on and about the reserve, which generates greater knowledge of the reserve and an interest in the preservation of that area. Expenditure on research expeditions to the area, and on the management of the reserve necessary to ensure that the conservation values are protected, adds to this economic impact. The economic impact of management of the Regional Reserve and research activity in the area is discussed in Attachment 1.

The economic value of the reserve, however, is greater than that implied by demand for tourism in the area and expenditures on management and research. In a market economy, issues of valuation and choice between conflicting uses are normally resolved by the interaction of consumers and producers trading goods in the market place. This means that the value of minerals, for example, can be based on the market price of the good that is produced and the wealth that it generates in the economy. Determining comparable values of non-market uses, such as conservation is more difficult. These types of "goods", which obviously have a value to society, are not traded in the market place and so do not have an obvious price. They have economic meaning because any thing or action from which individuals gain satisfaction is deemed to be of value. However, because there is no price attached to the "goods", there are no financial transactions incurred in the "consumption" of those goods and hence there is no economic impact that can be measured.

5.4 Conclusion

The economic assessment of the utilisation of natural resources within the Yellabinna Regional Reserve indicates that mineral exploration and tourism (including Aboriginal use) contributed \$9,061, 000 to the Gross State Product (GSP) over the period 1989 to 1999 and produced the equivalent of 15 jobs per annum. South Australia's GSP is currently \$38 billion of which Yellabinna Regional Reserve has contributed 0.002 per cent, on an annual basis.

6 SUBMISSIONS TO THE REVIEW PROCESS

6.1 Submissions Received

Written submissions for the review of the reserve were received from the following groups and individuals:

- Far West Consultative Committee.
- District Council of Ceduna/Ceduna Business and Tourism Association.
- The Wilderness Society.
- Yalata Community Incorporated.
- South Australian Association of Four Wheel Drive Clubs.
- Great Australian Bight Safaris.
- Department of Transport.

The views of Aboriginal people within the region were requested. Letters were sent, phone conversations held and face-to-face meeting arranged and held. All communities were contacted including those with native title claims over Yellabinna Regional Reserve. ATSIC and ALRM were notified and consulted.

Wirangu, Mirning and Maralinga Tjarutja are currently involved in a process of negotiation over their overlapping native title claims. One of the agreed operating procedures for these groups is that they will not make public statements about the merits of their claims while these negotiations are in process. Consequently most Aboriginal groups, while having a keen interest in the reserve, chose not to make submissions to this Review. Yalata Community Incorporated did make a submission in writing.

7 DISCUSSION

The resources of the Yellabinna Regional Reserve have significant ecological, intrinsic, cultural and economic value to the community. The utilisation of resources to date has included mineral exploration, tourism and Aboriginal use. However the utilisation of the resources of the reserve poses some threats to the maintenance of its natural and cultural values and these threats need to be managed and minimised. The success of the regional reserve concept of multiple land use in a conservation context depends on balancing and respecting the needs of users and the various values and uses of the area.

Table 3. Summarises Resource Utilisation Impacts.

7.1 Mineral Exploration

Over the period 1989 to 1998, exploration within the reserve has contributed over \$7.336 million to the Gross State Product. This expenditure has created Household Incomes for South Australians of over \$4.021 million and created 11 jobs per annum. Any significant new mineral discoveries could quickly increase these economic benefits.

Over the last ten years exploration activity has avoided disturbing areas of high cultural or biological significance. The impacts have been temporary modification of the landscape in the course of drilling and “cross country” driving to access those drill sites. While the cumulative impact of this exploration effort has been substantial, rehabilitation efforts by industry and government has ameliorated this impact. Particularly in the final quarter of the review period, impacts have been addressed thoroughly. The findings of this assessment, indicates that ongoing impacts from exploration activity are low (assuming that rehabilitation works prove to have been effective in the longer term).

The management of mineral exploration, the attitudes and practices of explorers and the rehabilitation of impacts within the reserve are all substantially better in 1999 compared with the period before the reserve was proclaimed. In this sense the original purpose of the reserve, to provide a conservation focus for sustainable best practice land use, has been successful.

With more intensive, higher impact secondary or “proving” exploration activity or production, longer term modification of the landscape may occur. A higher level of impact can be anticipated from developments such as roads and production facilities and from increased third party use of tracks.

The Yellabinna Regional Reserve is recognised as having wilderness qualities. It is listed on the National Wilderness Inventory. The landscape and wilderness values of the reserve are vulnerable to potential impacts from future mining or intensive mineral exploration activity. Any activity which occurred in sensitive areas of the reserve or which involved “second stage” exploration activities (intended to prove the commercial viability of a mineral resource), could have a significantly higher impact on wilderness, biological and cultural values. The location of prospective areas associated with volcanic structures, may in the future, be discovered in locations adjacent to sites of significant biological and cultural sensitivity (eg inselberg habitats) such discoveries will fully test the capacity of the regional reserve category to balance competing uses.

The DEHAA and PIRSA Exploration-Best Practice Working Group needs to ensure that a management strategy and suitable rehabilitation techniques are developed prior to any escalation in exploration activity within the reserve.

To ensure that impacts on the landscape, wildlife and cultural features of the reserve are managed at their current levels, it will be necessary for any future mineral exploration and production licence holders to adhere to the objectives for operations developed by the Working Group, and use appropriate technologies. The production of a Statement of Environmental Objectives for exploration within Yellabinna Regional Reserve based upon objective assessment criteria would provide a suitable framework for the management of new or “second stage” exploration activity.

Given that most community concerns over the management of Yellabinna Regional Reserve related to the effectiveness of the total management effort, the regional reserve concept and classification will be bolstered by ensuring that adequate and accountable monitoring and performance assessment of exploration activity, impacts and rehabilitation measures against established criteria do occur.

Field inspections by DEHAA in conjunction with PIRSA of exploration activity and abandoned exploration sites are a necessary role. The inspections can raise environmental awareness, provide explorers with an opportunity to seek advice and ensure that rehabilitation is completed to an appropriate level.

7.2 Aboriginal Use

The communities of Yalata, Oak Valley, Koonibba and Ceduna are the major users of the reserve and its resources. Their regular use includes travel, hunting and cultural activities. The Yalata Community Inc. expressed a need for ongoing effective management of the reserve with better staffing and protection of resources. The Yalata community indicated a desire to be more involved in management of the reserve in the future.

7.3 Tourism

Over the last ten years, tourist expenditure, and expenditure by Aboriginal communities utilising the Yellabinna Regional Reserve has contributed an estimated \$1 725 000 to South Australia's GSP and provided \$853 000 in Household Income, while providing the equivalent of 4 full time jobs per annum.

Low levels of visitors to the reserve are in the absence of on-site supervision and active management, causing some, albeit low, levels of damage to reserve values. The level of impact which has occurred during the review period has not been quantified but is low and increasing. Of particular concern are existing and potential impacts from vehicle traffic in and around playa lakes, rockholes and inselberg vegetation communities. Increasing use of the reserve by 4WD traffic will also increase the probability of collisions over dune crests, the incidence of search and rescue events and the frequency of mechanical breakdowns within the reserve.

7.4 Feral and Pest Animals

The combined effect of RCD and myxomatosis during the latter part of the 10 year Review period, has led to a substantial increase in total biomass of plants within the reserve. The improved health and vigor of mallee understorey communities is the most positive impact that has occurred during the ten year review period but it needs to be monitored and quantified.

Table 3. Summary of Resource Utilisation Impacts at Yellabinna Regional Reserve

	Landscape Features	Wildlife Features	Aboriginal Cultural Features	Non-aboriginal cultural features	Contribution to Economy of State 1989-1998
Exploration	<p>LOW- IMPACT The impact of exploration activities is considered to be significant but following rehabilitation works the overall impact is regarded as low.</p>	<p>LOW IMPACT The overall impact on wildlife features of the reserve through disturbance of flora and fauna and soils from exploration activity is considered relatively low. Impacts are confined to specific sites and “cross country tracks”.</p>	<p>LOW IMPACT The impact of exploration activities on the Aboriginal cultural features of the reserve is considered relatively low. Exploration activities avoid sites of cultural significance. However Aboriginal people are concerned about the impact of track construction on the cultural landscape.</p>	<p>LOW IMPACT Exploration activities avoid sites of cultural significance.</p>	<p>\$ 7.336 million</p>
Tourism	<p>LOW IMPACT The overall impact of visitor activity on the landscape is low. The majority of low-level use is confined to existing tracks and a few sites.</p>	<p>LOW IMPACT The overall impact on wildlife features of the reserve through destruction and disturbance of habitat, vegetation, soils and animals is considered low. Impacts are confined to relatively small areas.</p>	<p>LOW/MODERATE IMPACT The impact of visitor activities on the Aboriginal cultural features of the reserve is considered low/moderate. The accidental damage to heritage sites require a site management program.</p>	<p>LOW IMPACT No known impacts to sites of historic significance have occurred within the reserve.</p>	<p>\$ 1.725 million</p>
Aboriginal Use	<p>LOW IMPACT Aboriginal hunting occurs at low and dispersed levels within the reserve resulting in a low impact to the landscape and natural values</p>	<p>LOW IMPACT The overall impact on wildlife from Aboriginal hunting is considered low. Some reduction in population density of kangaroo and wombat occurs closer to the Yalata Lands. Overall the impact on wildlife is considered low</p>			<p>Aboriginal visitation and use is included in the Tourism estimate above.</p>
Feral Animals and Pest Plants	<p>MODERATE IMPACT The overall impact of feral animals such rabbits and camels on the landscape features and wilderness-like quality of the reserve is considered moderate. The impact of rabbit has reduced over the last 5 years since the introduction of RCD.</p>	<p>MODERATE IMPACT The overall impact on wildlife features of the reserve through destruction and disturbance of habitat by pest animal populations are believed to be moderate This impact of rabbit has reduced over the last 5 years.</p>	<p>LOW IMPACT The impact of feral animals on the Aboriginal cultural features of the reserve is considered low.</p>		

7.5 Community Perceptions

It is important to recognise that the Regional Reserve classification, although strongly supported by some sectors of the community, has not in the past, had the support of the conservation organisations of South Australia. Conservation representatives consistently have argued that the Regional Reserve concept is flawed; that it artificially inflates the area of the State set aside for conservation purposes, and that it puts conservation a poor third behind mining and tourism interests. In the specific case of Yellabinna Regional Reserve an argument is made that South Australia has an international responsibility (and the opportunity) to fully protect a substantial portion of the worlds remaining high quality mallee habitat with wilderness qualities.

The Wilderness Society (in a submission to this Review) again questioned the ability of the classification to deliver true protected area status and advocated the creation of a substantial wilderness area, under legislation, that prohibited mineral exploration activity.

The Regional Reserve concept is however, supported by the community of the Far West region. The majority of concerns expressed to this Review by regional representatives identified that the limited management resources for the reserve were the key issue in its effective management. The economic benefits to the regional community from maintaining the regional reserve classification and supporting exploration and tourism were central to the views expressed in most submissions received from the region.

The Regional Reserve classification has provided a framework to protect a significant area of natural habitat and cultural resources within Yellabinna Regional Reserve, while allowing some limited use of the natural resources of the area to continue. The management of mining exploration, the attitudes and practices of explorers and the rehabilitation of impacts within the reserve are all substantially better in 1999 compared with the period before the reserve was proclaimed.

The framework has facilitated the development of working partnerships between government departments, government and explorers and government and other users of the reserve. The awareness of the reserve's environmental and cultural values has increased over the ten year period for all users of the resources of the reserve.

7.6 Management Structures

The existing DEHAA and PIRSA Exploration-Best Practice Working Group is responsible for liaison with exploration licensees and management of exploration applications, permits, inspections and rehabilitation. This approach to the management of exploration activities on the reserve is considered to be working well.

If the exploration effort increases and moves into "second stage" exploration or even production, then it may be necessary to formalise a broader management group, which includes key land use stakeholders in addition to DEHAA and PIRSA.

The Far West Consultative Committee provides a valuable link to all stakeholders within the community.

The timely development of a Management Plan for the reserve will encourage the development of strategic positions in relation to the staffing and financial resources available to reserves on the far west coast and the Yellabinna Regional Reserve in particular. A plan of management that prescribed the implementation of visitor management systems to protect and interpret reserve values (including the complex suite of values associated with playa lakes, rockholes and inselbergs) would also assist with maximising regional tourism development opportunities.

7.7 Future Review of the Reserve

To improve the accuracy and accountability of the next review of Yellabinna Regional Reserve it is necessary to collect data on tourism, conservation and mineral exploration activities, Aboriginal use of wildlife, reserve management and research.

Tourism

To assess the impacts, both economic and environmental, of tourist use of the reserve information that needs to be collected on a regular basis includes:

- visitor numbers
- length of stay
- expenditure profile
- origin and destination
- purpose of trip
- demand for infrastructure/facilities.

Conservation

Collecting data on the conservation values of the reserve is a more difficult task. Clearly, any such work should be conducted in conjunction with monitoring and assessment of the area's conservation status. Opportunistic recording of ephemeral flora should occur.

Evaluation studies involving the assignment of values to non-market goods and services are notoriously difficult and time consuming. With an on-going worldwide decline in areas of wilderness, wilderness areas such as Yellabinna will become increasingly valuable because of their scarcity value.

Because any significant future resource use conflict in the reserve is likely to involve the conservation value of the area, it is important that resources be devoted to proper assessment of conservation values.

Exploration and Mining

Monitoring of mining activity should be done in conjunction with PIRSA. Data required include:

- production and value of production
- expenditure on exploration, including rehabilitation
- likely timeframes for future exploration
- likely timeframes for future resource extraction

Management and Research

There is currently no management plan in place for the reserve and this would seem to be a fundamental requirement for efficient and effective management of the Regional Reserve. Flowing from the development of a management plan would be the development of systems to provide the necessary information about the resources being used to manage the reserve. The type of information likely to be required would relate to apportioning a share of administration costs, and costs of specific projects, research activities and, rescue and policing.

Aboriginal Use of Wildlife

Arrangements should be made with local Aboriginal people to monitor hunting off-take from the reserve.

8 RECOMMENDATIONS

8.1 Reserve Status under the Act

It is the finding of this review that overall, the proclamation of Yellabinna Regional Reserve has resulted in positive environmental and economic outcomes. The benefits of reserve status has included improved environmental management, while the multiple-use management regime has provided for continued mineral exploration and use by local communities.

It is recommended that the Yellabinna Regional Reserve remain a Regional Reserve as classified under the *National Parks and Wildlife Act 1972* at least until the next review to be undertaken within the next ten years.

8.2 Future Management of Yellabinna Regional Reserve

Reserve Plan of Management

It is **recommended** that a plan of management for Yellabinna Regional Reserve be developed in the near future and that the plan include:

- ecological, wildlife conservation and visitor management objectives and priorities with associated monitoring requirements and performance measures
- provision for convening a broader management working group that includes key land use stakeholder representatives
- clear processes for gathering data and setting performance criteria to be applied over the next ten years for the next review pursuant to section 34A.

Mineral Exploration

Over the period 1990 to 1999 mineral explorers have obtained 58 licences to explore within Yellabinna Regional Reserve. Eight exploration companies have progressed to substantial on-ground exploration. Following a burst of exploration early in the decade, most exploration has occurred since the aeromagnetic surveys conducted by PIRSA in the mid 1990s.

Over the review period, mineral exploration within the reserve has contributed over \$7.336 million to the Gross State Product. This expenditure has created household incomes for South Australians of over \$4.121 million and supported the equivalent of 11 jobs per annum. In total, government and mineral companies, in exploring the reserve for potential mineral resources, have invested approximately \$5.883 million over the ten year period.

These activities have been assessed as having a low impact on the landscape features of the reserve (following rehabilitation works) and a low impact on its wildlife and cultural features. The future impacts of mineral exploration and exploitation within the reserve over the next ten years are unknown, but are more likely to be small than great.

It is recommended that at least the current level of protection of wildlife, landscape and Aboriginal heritage features be maintained.

It is recommended that the Exploration Best Practice Working Group develop a Statement of Environmental Objectives for the Far West region, utilising objective criteria to establish benchmark indicators against which to assess exploration and development applications and review compliance and rehabilitation.

It is recommended that PIRSA and DEHAA jointly effect an appropriate level of liaison with mineral explorers to supervise, monitor and develop strategies and experimental procedures to prevent, minimise and rehabilitate the impacts of exploration and extraction activities within the reserve.

Aboriginal Use

The Aboriginal communities of Yalata, Oak Valley, Koonibba and Ceduna are the major users of the reserve and its resources. Their regular use includes travel, hunting and cultural activities. Hunting, primarily for kangaroo, rabbit, wombat and Australian bustard occurs at a level not considered of concern to the viability of the species. Overall, the impacts of Aboriginal resource use upon the landscape values of the reserve are assessed as low, and impacts to wildlife, are assessed as low. The economic impacts of Aboriginal use of the reserve are included in the assessment of tourism impacts.

It is recommended that liaison with and involvement of Aboriginal people in the management of the land currently contained within the Yellabinna Regional Reserve be enhanced and thus build upon the existing partnership arrangements.

Tourism

The visitor use of the reserve is low. However, visitors to Yellabinna Regional Reserve (including Aboriginal people), have contributed \$1.725 million to SA GSP and provided \$853 000 in Household Income, while providing the equivalent of four full time jobs.

Visitors, primarily through vehicle use, can and do impact on playa lakes, rockholes and inselbergs environments within the reserve. While the level of these visitor impacts have not been documented over the review period, they are important and require management consideration.

It is recommended that the plan of management be prepared for the reserve. The plan of management should adequately address the need to provide for site protection facilities and interpretation to enhance visitor experiences and to protect the landscape, wildlife, and cultural features of the reserve.

The plan of management needs to provide for the development, promotion and provision of appropriate visitor facilities and experiential opportunities within the region, which link to reserves adjacent to Yellabinna including Yumbarra C.P., Nullarbor N.P. and Nullarbor Regional Reserve. Facilities need to include signs, campsite locations, car parks and visitor information.

Feral Animals and Biodiversity Monitoring

Rabbit and camel are pests having a moderate but unquantified impact on the landscape and wildlife values of the reserve.

It is recommended that the impact of rabbits on the vegetation of the reserve be monitored.

It is recommended that the population and distribution of camels within the reserve be surveyed in association with surveys on the Nullarbor and that an adequate control program be developed.

Future Review of the Reserve

It is **recommended that** to improve the accuracy and accountability of future reviews of Yellabinna Regional Reserve, that data including economic data, be collected on tourism, conservation and mineral exploration activities, Aboriginal use of wildlife, reserve management and research.

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Environmental Management for Field Personnel – Dobrzinski I. PIRSA

10 APPENDICES

10.1 Appendix A Interpretation of the Provisions of Section 34A of the Act

(Developed for use with the Innamincka Regional Reserve Review (1998) and reproduced here)

In undertaking the review, it has been necessary to ensure that the requirements of the Act are properly addressed. To facilitate this process, an interpretative analysis of section 34A was conducted and is provided below. This analysis has been used to guide the conduct of the review. It is also useful in guiding readers of the report.

For the purposes of section 34A (5)(a)(i) and (ii), *natural resources* are considered to be:

- native vegetation which is utilised by pastoral stock for feed
- petroleum and any mineralisation that require the process of recovery to be undertaken by operations that take place within the boundaries of the reserve
- native vegetation which is utilised by pastoral stock for feed
- landscapes and natural features including native vegetation, native animals, birds, insects and other small fauna that are of recreational and educational value to visitors to the reserve and which are accessible to visitors in accordance with the management plan for the park, and
- surface and sub surface water recovered from within the boundaries of the reserve.

For the purposes of section 34A (5)(a)(i) and (ii), *utilisation of natural resources* is taken to mean:

- recovery (petroleum), mining, grazing (pastoralism), environmental appreciation and recreation activity (tourism) and water recovery and use (general) and includes the infrastructure necessary to facilitate such utilisation
- recovery and utilisation of water prior to its inflow to the reserve and

where such utilisation is consistent with the specific objective in the Act in relation to the management of regional reserves, that is to say 'to permit the utilisation of natural resources while conserving wildlife and the natural or historic features of the land'. (Section 37j)

For the purposes of section 34A (5)(a)(i), i.e. in the context of conservation, *impact of utilisation* is taken to mean:

- the effects upon the condition of the wildlife and natural features of the reserve and the management strategies that are considered necessary and adequate to sustainably conserve the wildlife and natural features of the reserve, and
- the effect upon the approach taken to managing the wildlife and natural features of the reserve as a response to a regime that provides for land uses other than those characteristics of other classifications of reserve under the Act.

For the purposes of Section 34A (5)(a)(i), *conservation of natural and historical features of the reserve* is to have such a meaning as to be consistent with the relevant objectives for managing reserves as set out in Section 37 of the Act, the relevant objectives being:

- (a) the preservation and management of wildlife
- (b) the preservation of historic sites, objects and structures of historic or scientific interest within reserves
- (c) the preservation of features of geographical, natural or scenic interest

and where such preservation is undertaken in accordance with other objectives of the Act as set out in paragraphs (d) to (g) which address the deleterious impact of weeds and exotic plants, vermin and exotic animals, diseases of animals and vegetation and bush fires and other hazards.

For the purposes of Section 34A (5)(a)(ii), i.e. in the context of the economy of the State, *impact of utilisation* is taken to mean:

- the contribution of utilisation to the economy of the State in dollar terms, and
- any offsets to benefits that might be occasioned by one form of utilisation as a result of another.

For the purposes of section 34A (5)(a)(iii), *the future status under this Act of the land constituting the reserve* is taken to mean the classification of the reserve under Part 3, Divisions 1 - 4 and 4A of the Act, the classifications available being National Park (Division 1), Conservation Park (Division 2), Game Reserve (Division 3), Recreation Park (Division 4) and Regional Reserve (Division 4A).

Further, for the purposes of section 34A (5)(a)(iii), *recommendations as to the future status of the reserve* are taken to relate to recommendations made in consideration of:

- the original intent of the reserve classification in providing for the management of the reserve for the purposes of conserving wildlife and natural features and utilising natural resources, and
- any factors that as a result of the review, significantly appear to work against the purpose of the Regional Reserve classification in providing direction for, and facilitating the management of, the reserve.

While the Act, at section 34A, does not provide for the framing of recommendations regarding the ongoing management of the reserve, section 38 of the Act does provide for the preparation and periodic review of reserve management plans.

During the conduct of the review, issues emerged that will need to be addressed in the ongoing management of the reserve. Some of these issues relate to the scope and quality of baseline data upon which critical analysis of management should rely and which will be essential for the conduct of future section 34A reviews. Other issues relate directly to the standards and aspects of management that need to be addressed on an ongoing basis.

Recommendations for management, therefore, while not a requirement in the context of the section 34A report, are nonetheless included in this report for the purposes of foreshadowing those issues that will need to be addressed in reviewing the plan of management for this reserve.

10.2 Appendix B. A List Of Vascular Plants.

Recorded from site records for Yellabinna Regional Reserve in the South Australian Biodiversity Database July 1998 download. Introduced species are marked with an asterix. State Herbarium records not included. Pitjantjatjara common names are marked with (P).

Adiantaceae	<i>Cheilanthes lasiophylla</i>	woolly cloak-fern
	<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>	narrow rock-fern
Aspleniaceae		
	<i>Pleurosorus rutifolius</i>	blanket fern
Plants 4: Conifers		
Cupressaceae		
	<i>Callitris verrucosa</i>	warty cypress pine
Plants 5: Dicotyledons		
Aizoaceae		
	<i>Disphyma crassifolium</i> ssp. <i>clavellatum</i>	rounded noon-flower
	* <i>Mesembryanthemum aitonis</i>	angled iceplant
	<i>Sarcosoma praecox</i>	sarcosoma
	<i>Tetragonia eremaea</i>	desert spinach
Amaranthaceae		
	<i>Ptilotus decipiens</i>	no common name
	<i>Ptilotus exaltatus</i> var. <i>exaltatus</i>	tall mulla mulla
	<i>Ptilotus gaudichaudii</i> var. <i>gaudichaudii</i>	paper foxtail
	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	white fox-tail
	<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	long-tails
	<i>Ptilotus sessilifolius</i> var. <i>sessilifolius</i>	silver-tails
Anacardiaceae		
	* <i>Schinus areira</i>	pepper-tree
Apocynaceae		
	<i>Alyxia buxifolia</i>	sea box
Asclepiadaceae		
	<i>Marsdenia australis</i>	native pear
	<i>Rhyncharrhena linearis</i>	wintjulanypa
	<i>Sarcostemma viminale</i> ssp. <i>australe</i>	sarcostemma
Boraginaceae		
	<i>Halgania cyanea</i>	rough halgania
	<i>Heliotropium asperimium</i>	rough heliotrope
	<i>Omphalolappula concava</i>	burr stickseed
Campanulaceae		
	<i>Isotoma petraea</i>	rock isotome
	<i>Isotoma scapigera</i>	salt isotome
	<i>Wahlenbergia stricta</i> ssp. <i>stricta</i>	tall bluebell
Caryophyllaceae		
	* <i>Gypsophila tubulosa</i>	annual chalkwort
Casuarinaceae		
	<i>Allocasuarina helmsii</i>	smooth-cone oak-bush
	<i>Casuarina pauper</i>	black oak
Chenopodiaceae		
	<i>Atriplex acutibractea</i> ssp. <i>acutibractea</i>	pointed saltbush
	<i>Atriplex stipitata</i>	mallee saltbush
	<i>Atriplex vesicaria</i> ssp.	iriya
	<i>Chenopodium desertorum</i> ssp. <i>anidiophyllum</i>	mallee goosefoot

	<i>Chenopodium desertorum</i> ssp. <i>desertorum</i>	frosted goosefoot
	<i>Chenopodium desertorum</i> ssp. <i>rectum</i>	erect goosefoot
	<i>Chenopodium gaudichaudianum</i>	scrambling goosefoot
	<i>Chenopodium melanocarpum</i> forma <i>melanocarpum</i>	black-fruit goosefoot
	<i>Dissocarpus latifolius</i>	no common name
	<i>Dissocarpus paradoxus</i>	hard-head saltbush
	<i>Einadia nutans</i> ssp. <i>nutans</i>	nodding saltbush
	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	ruby saltbush
	<i>Eriochiton sclerolaenoides</i>	woolly-fruit bluebush
	<i>Maireana appressa</i>	pale-fruit bluebush
	<i>Maireana brevifolia</i>	small-leaf bluebush
	<i>Maireana campanulata</i>	bell-fruit bluebush
	<i>Maireana erioclada</i>	rosy bluebush
	<i>Maireana georgei</i>	slit-wing bluebush
	<i>Maireana integra</i>	entire-wing bluebush
	<i>Maireana oppositifolia</i>	salt bluebush
	<i>Maireana pentatropis</i>	erect mallee bluebush
	<i>Maireana radiata</i>	radiate bluebush
	<i>Maireana rohrlachii</i>	Rohrlach's bluebush
	<i>Maireana sedifolia</i>	pearl bluebush
	<i>Maireana suaedifolia</i>	lax bluebush
	<i>Maireana trichoptera</i>	spike bluebush
	<i>Maireana triptera</i>	three-wing bluebush
	<i>Maireana turbinata</i>	top-fruit bluebush
	<i>Maireana villosa</i>	silky bluebush
	<i>Rhagodia candolleana</i> ssp. <i>argentea</i>	silver sea-berry saltbush
	<i>Rhagodia candolleana</i> ssp. <i>candolleana</i>	seaberry saltbush
	<i>Rhagodia crassifolia</i>	fleshy saltbush
	<i>Rhagodia eremaea</i>	mukul-mukulpa
	<i>Rhagodia preissii</i> ssp. <i>preissii</i>	mallee saltbush
	<i>Rhagodia spinescens</i>	thorny saltbush
	<i>Rhagodia ulicina</i>	spiny saltbush
	<i>Salsola kali</i>	tumbleweed
	<i>Scerolaena costata</i>	ribbed bindyi
	<i>Scerolaena diacantha</i>	tjilka-tjilka
	<i>Scerolaena eriakantha</i>	silky copperburr
	<i>Scerolaena obliquicuspis</i>	oblique-spined bindyi
	<i>Scerolaena parviflora</i>	small-flower bindyi
	<i>Scerolaena uniflora</i>	small-spine bindyi
	<i>Scerostegia disarticulata</i>	no common name
	<i>Threlkeldia diffusa</i>	coast bonefruit
Chloanthaceae		
	<i>Dicrastylis beveridgei</i> var. <i>lanata</i>	woolly sand-sage
	<i>Dicrastylis lewellinii</i>	purple sand-sage
Compositae		
	<i>Actinobole uliginosum</i>	flannel cudweed
	<i>Angianthus conocephalus</i>	no common name
	<i>Brachycome ciliaris</i> var. <i>ciliaris</i>	variable daisy
	<i>Brachycome iberidifolia</i>	Swan River daisy
	<i>Brachycome lineariloba</i>	hard-head daisy
	<i>Brachycome trachycarpa</i>	smooth daisy
	<i>Calotis cymbacantha</i>	showy burr-daisy
	<i>Calotis erinacea</i>	tangled burr-daisy
	<i>Calotis hispidula</i>	minyirka
	<i>Calotis plumulifera</i>	woolly-headed burr-daisy

* <i>Carthamus lanatus</i>	woolly star-thistle
<i>Cassinia laevis</i>	rosemary bush
<i>Cephalopterum drummondii</i>	pompom head
<i>Ceratogyne obionoides</i>	wingwort
<i>Chrysocephalum apiculatum</i>	common everlasting
<i>Chrysocephalum eremaeum</i>	sand button-bush
<i>Chrysocephalum pterochaetum</i>	shrub everlasting
<i>Chrysocephalum semicalvum ssp. semicalvum</i>	scented button-bush
<i>Cratystylis conocephala</i>	greybush
<i>Euchiton sphaericus</i>	annual cudweed
<i>Gnephosis tenuissima</i>	dwarf golden-tip
<i>Gratwickia monochaeta</i>	no common name
<i>Hyalosperma semisterile</i>	orange sunray
* <i>Hypochoeris glabra</i>	smooth cat's ear
<i>Isoetopsis graminifolia</i>	grass daisy
<i>Lawrenella davenportii</i>	sticky everlasting
<i>Leucochrysum fitzgiibbonii</i>	Fitzgibbon's daisy
<i>Leucochrysum stipitatum</i>	woolly sunray
<i>Microseris lanceolata</i>	yam daisy
<i>Millotia greevesii ssp. kempei var. helmsii</i>	no common name
<i>Millotia myosotidifolia</i>	broad-leaf millotia
<i>Minuria cunninghamii</i>	bush minuria
<i>Minuria leptophylla</i>	minnie daisy
<i>Olearia decurrens</i>	winged daisy-bush
<i>Olearia exiguifolia</i>	small-leaf daisy-bush
<i>Olearia lepidophylla</i>	club-moss daisy-bush
<i>Olearia magniflora</i>	splendid daisy-bush
<i>Olearia muelleri</i>	Mueller's daisy-bush
<i>Olearia stuartii</i>	intiyanu
<i>Olearia subspicata</i>	spiked daisy-bush
<i>Othonna gregorii</i>	fleshy groundsel
<i>Ozothamnus decurrens</i>	ridged everlasting
<i>Podolepis canescens</i>	large copper-wire daisy
<i>Podolepis capillaris</i>	wiry podolepis
<i>Podolepis longipedata</i>	tall copper-wire daisy
<i>Podolepis rugata var. rugata</i>	pleated podolepis
<i>Podotrochea angustifolia</i>	sticky-heads
<i>Polycalymma stuartii</i>	white billybutton
<i>Pycnosorus pleiocephalus</i>	soft billy-buttons
<i>Rhodanthe chlorocephala ssp. rosea</i>	western sunray
<i>Rhodanthe floribunda</i>	white paper-daisy
<i>Rhodanthe haigii</i>	Haig's everlasting
<i>Rhodanthe moschata</i>	musk sunray
<i>Rhodanthe pygmaea</i>	pigmy sunray
<i>Schoenia cassiniana</i>	schoenia
<i>Senecio glossanthus</i>	slender groundsel
<i>Senecio laceratus</i>	cut-leaf groundsel
<i>Senecio lautus</i>	variable groundsel
* <i>Sonchus oleraceus</i>	sow thistle
* <i>Sonchus tenerimus</i>	clammy sow-thistle
<i>Trichanthodium skirrophorum</i>	woolly yellow-heads
<i>Vittadinia cervicalis var. cervicalis</i>	waisted New Holland daisy
<i>Vittadinia eremaea</i>	desert New Holland daisy
<i>Waitzia acuminata var. acuminata</i>	orange immortelle

Convolvulaceae	<i>Convolvulus erubescens</i> <i>Convolvulus eyreanus</i> <i>Convolvulus microsepalus</i> <i>Convolvulus remotus</i>	Australian bindweed silver bindweed small-flower bindweed grassy bindweed
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i> <i>Crassula sieberiana</i> ssp. <i>tetramera</i>	dense stonecrop common crassula
Cruciferae	<i>Arabidella filifolia</i> * <i>Brassica tournefortii</i> * <i>Carrichtera annua</i> <i>Lepidium oxytrichum</i> <i>Lepidium phlebopetalum</i> <i>Phlegmatospermum cochlearinum</i> * <i>Sisymbrium irio</i> * <i>Sisymbrium orientale</i> <i>Stenopetalum lineare</i> <i>Stenopetalum sphaerocarpum</i>	thread-leaf cress wild turnip Ward's weed green peppercress veined peppercress downy cress London rocket wild mustard narrow thread-petal wiry thread-petal
Cucurbitaceae	* <i>Citrullus colocynthis</i>	colocynth
Dilleniaceae	<i>Hibbertia crispula</i>	Ooldea guinea-flower
Euphorbiaceae	<i>Beyeria lechenaultii</i> <i>Beyeria opaca</i> <i>Euphorbia drummondii</i> <i>Euphorbia tannensis</i> ssp. <i>eremophila</i> <i>Poranthera microphylla</i>	saffron bush smooth wallaby-bush mat spurge spurgewort small-leaf poranthera
Frankeniaceae	<i>Frankenia foliosa</i> <i>Frankenia pauciflora</i> var. <i>fruticulosa</i>	leafy sea-heath southern sea-heath
Geraniaceae	* <i>Erodium aureum</i> * <i>Erodium cicutarium</i> <i>Erodium crinitum</i> <i>Erodium cygnorum</i> ssp. <i>cygnorum</i> <i>Erodium cygnorum</i> ssp. <i>glandulosum</i> * <i>Erodium moschatum</i>	no common name cut-leaf stork's-bill blue stork's-bill blue heron's bill heron's bill musky stork's-bill
Goodeniaceae	<i>Brunonia australis</i> <i>Cooperookia strophiolata</i> <i>Dampiera lanceolata</i> var. <i>lanceolata</i> <i>Dampiera rosmarinifolia</i> <i>Goodenia cycloptera</i> <i>Goodenia glabra</i> <i>Goodenia havilandii</i> <i>Goodenia lobata</i> <i>Lechenaultia divaricata</i> <i>Scaevola collina</i> <i>Scaevola spinescens</i> <i>Velleia connata</i> <i>Velleia cynopotamica</i>	blue pincushion sticky cooperookia grooved dampiera wild rosemary serrated goodenia smooth goodenia hill goodenia no common name tangled lechenaultia hill fanflower spiny fanflower stout velleia no common name
Gyrostemonaceae	<i>Gyrostemon ramulosus</i>	bushy wheel fruit

Haloragaceae	<i>Haloragis odontocarpa forma pterocarpa</i>	toothed raspwort
Labiatae	<i>Prostanthera althoferi ssp. longifolia</i> <i>Prostanthera ammophila</i> <i>Prostanthera sericea</i> <i>Westringia rigida</i>	no common name sand mintbush silky mintbush stiff westringia
Lauraceae	<i>Cassythia melantha</i>	mallee strangle-vine
Leguminosae	<i>Acacia acanthoclada</i> <i>Acacia aneura</i> <i>Acacia burkittii</i> <i>Acacia cibaria</i> <i>Acacia colletioides</i> <i>Acacia continua</i> <i>Acacia kenpeana</i> <i>Acacia ligulata</i> <i>Acacia merrallii</i> <i>Acacia murrayana</i> <i>Acacia nyssophylla</i> <i>Acacia oswaldii</i> <i>Acacia papyrocarpa</i> <i>Acacia prainii</i> <i>Acacia ramulosa</i> <i>Acacia rigens</i> <i>Acacia stowardii</i> <i>Acacia tetragynophylla</i> <i>Aotus subspinescens</i> <i>Bossiaea walkeri</i> <i>Daviesia benthamii ssp. humilis</i> <i>Daviesia ulicifolia</i> <i>Dillwynia uncinata</i> <i>Eutaxia microphylla var. microphylla</i> <i>Indigofera australis var. australis</i> <i>Muelleranthus stipularis</i> <i>Ptychosema anomalum</i> <i>Senna artemisioides nothosp. artemisioides</i> <i>Senna artemisioides nothosp. coriacea</i> <i>Senna artemisioides nothosp. sturtii</i> <i>Senna artemisioides ssp. filifolia</i> <i>Senna artemisioides ssp. helmsii</i> <i>Senna artemisioides ssp. petiolaris</i> <i>Senna artemisioides ssp. zygophylla</i> <i>Senna pleurocarpa var. pleurocarpa</i> <i>Swainsona colutooides</i> <i>Swainsona oliveri</i> <i>Swainsona pyrophila</i> <i>Templetonia egna</i>	harrow wattle mulga sandhill wattle umbrella mulga wait-a-while thorn wattle witchetty bush dune wattle Merrall's wattle Murray's wattle wait-a-while umbrella wattle western myall Prain's wattle sand dune mulga needle-bush wattle bastard mulga wakalpuka mallee aotus cactus pea spiny bitter-pea gorse bitter-pea silky parrot-pea mallee bush-pea native indigo sand pea no common name silver senna broad-leaf desert senna punti punti crinkled senna woody cassia twin-leaf desert senna striped-pod cassia rattle-pod swainson-pea no common name yellow swainson-pea wilypinpa
Loganiaceae	<i>Logania nuda</i>	leafless logania
Loranthaceae	<i>Amyema linophyllum ssp. orientale</i> <i>Amyema maidenii ssp. maidenii</i> <i>Amyema miquelii</i>	slender-leaf mistletoe pale-leaf mistletoe box mistletoe

	<i>Amyema miraculosum</i> ssp. <i>boormanii</i>	fleshy mistletoe
	<i>Amyema preissii</i>	wire-leaf mistletoe
	<i>Amyema quandang</i> var. <i>quandang</i>	grey mistletoe
	<i>Lysiana exocarpi</i> ssp. <i>exocarpi</i>	harlequin mistletoe
Malvaceae		
	<i>Abutilon cryptopetalum</i>	hill lantern-bush
	<i>Abutilon fraseri</i>	dwarf lantern-bush
	<i>Abutilon leucopetalum</i>	desert lantern-bush
	<i>Abutilon malvaefolium</i>	scrambling lantern-bush
	<i>Abutilon otocarpum</i>	desert lantern-bush
	<i>Alyogyne pinoniana</i> var. <i>microandra</i>	no common name
	<i>Hibiscus krichauffianus</i>	velvet-leaf hibiscus
	<i>Hibiscus sturtii</i> var. <i>grandiflorus</i>	hill hibiscus
	* <i>Malva parviflora</i>	small-flower marshmallow
	<i>Sida ammophila</i>	sand sida
	<i>Sida ammophila</i>	sand sida
	<i>Sida calyxhymenia</i>	wintu-wintu
	<i>Sida corrugata</i> var. <i>A</i> (N.N.Donner 7573)	no common name
	<i>Sida fibulifera</i>	silver sida
	<i>Sida filiformis</i>	ngau-ngau
	<i>Sida intricata</i>	twiggy sida
	<i>Sida petrophila</i>	rock sida
Myoporaceae		
	<i>Eremophila alternifolia</i>	scented emubush
	<i>Eremophila arachnoides</i> ssp. <i>tenera</i>	spider emubush
	<i>Eremophila crassifolia</i>	trim emubush
	<i>Eremophila deserti</i>	turkey-bush
	<i>Eremophila fallax</i>	no common name
	<i>Eremophila gibsonii</i>	tjalintirri
	<i>Eremophila glabra</i> ssp. <i>glabra</i>	tar bush
	<i>Eremophila latrobei</i> ssp. <i>glabra</i>	crimson emu-bush
	<i>Eremophila latrobei</i> ssp. <i>latrobei</i>	grey leaf crimson bush
	<i>Eremophila maculata</i> var. <i>maculata</i>	spotted fuchsia
	<i>Eremophila paisleyi</i>	warty turpentine-bush
	<i>Eremophila parvifolia</i>	small-leaf emubush
	<i>Eremophila platyhamnos</i>	tjintjirka
	<i>Eremophila scoparia</i>	wax bush
	<i>Eremophila serrulata</i>	toothed fuchsia-bush
	<i>Eremophila weldii</i>	purple emubush
	<i>Eremophila willsii</i>	sandhill emubush
	<i>Myoporum platycarpum</i>	false sandalwood
	<i>Myoporum platycarpum</i> ssp. <i>platycarpum</i>	sugarwood
Myrtaceae		
	<i>Calytrix gypsophila</i>	gypsum fringe-myrtle
	<i>Eucalyptus brachycalyx</i>	gilja
	<i>Eucalyptus ceratocorys</i>	desert ridge-fruited mallee
	<i>Eucalyptus concinna</i>	Victoria Desert mallee
	<i>Eucalyptus eremicola</i>	Vokes Hill mallee
	<i>Eucalyptus foecunda</i>	narrow-leaved mallee
	<i>Eucalyptus gracilis</i>	yorrell
	<i>Eucalyptus leptophylla</i>	narrow-leaf red mallee
	<i>Eucalyptus oleosa</i>	red mallee
	<i>Eucalyptus socialis</i>	summer red mallee
	<i>Eucalyptus striaticalyx</i>	kopi mallee
	<i>Eucalyptus trivalvis</i>	three-valve mallee

	<i>Eucalyptus youngiana</i>	yardlarlba
	<i>Eucalyptus yumbarrana ssp. yumbarrana</i>	Yumbarra mallee
	<i>Leptospermum coriaceum</i>	mallee tea-tree
	<i>Melaleuca eleutherostachya</i>	hummock honey-myrtle
	<i>Melaleuca lanceolata ssp. lanceolata</i>	moonah honey-myrtle
	<i>Melaleuca leiocarpa</i>	pungent honey-myrtle
	<i>Melaleuca pauperiflora</i>	boree
	<i>Thryptomene elliotii</i>	no common name
	<i>Thryptomene maisonneuvei</i>	desert thryptomene
Nyctaginaceae		
	<i>Boerhavia sp.</i>	wituka
Oxalidaceae		
	<i>Oxalis radicata</i>	downy native sorrel
Pittosporaceae		
	<i>Billardiera cymosa</i>	sweet apple-berry
	<i>Pittosporum phylliraeoides var. microcarpa</i>	weeping pittosporum
Plantaginaceae		
	<i>Plantago aff. debilis</i>	shade plantain
	* <i>Plantago bellardii</i>	hairy plantain
	<i>Plantago drummondii</i>	sago weed
Polygalaceae		
	<i>Comesperma scoparium</i>	broom milkwort
	<i>Comesperma viscidulum</i>	varnished milkwort
	<i>Comesperma volubile</i>	twining milkwort
Portulacaceae		
	<i>Calandrinia balonensis</i>	yuratja
	<i>Calandrinia disperma</i>	two-seed purslane
	<i>Calandrinia eremaea</i>	small purslane
	<i>Calandrinia polyandra var. polyandra</i>	parkilypa
	<i>Calandrinia reticulata</i>	no common name
	<i>Portulaca oleracea</i>	munyeroo
Proteaceae		
	<i>Grevillea huegelii</i>	comb spider-flower
	<i>Grevillea juncifolia</i>	yurltukurnpo
	<i>Grevillea nematophylla</i>	water bush
	<i>Grevillea pterosperma</i>	sandhill grevillea
	<i>Grevillea sarissa ssp. umbellifera</i>	wheel grevillea
	<i>Grevillea stenobotrya</i>	rattlepod grevillea
	<i>Grevillea treueriana</i>	scarlet grevillea
	<i>Hakea francisiana</i>	sandhill hakea
Rhamnaceae		
	<i>Cryptandra propinqua</i>	tjilyi-tjilyi
Rosaceae		
	* <i>Prunus dulcis</i>	almond
Rubiaceae		
	<i>Pomax umbellata</i>	pomax
Rutaceae		
	<i>Boronia coerulescens ssp. coerulescens</i>	blue boronia
	<i>Eriostemon linearis</i>	narrow-leaf wax-flower
	<i>Geijera linearifolia</i>	sheep bush
Santalaceae		
	<i>Exocarpos aphyllus</i>	leafless cherry
	<i>Exocarpos sparteus</i>	slender cherry
	<i>Santalum acuminatum</i>	quandong
	<i>Santalum spicatum</i>	sandalwood

Sapindaceae	<i>Alectryon oleifolius ssp. canescens</i>	cattle bush
	<i>Dodonaea bursariifolia</i>	small hop-bush
	<i>Dodonaea ptarmicaefolia</i>	no common name
	<i>Dodonaea stenozyga</i>	desert hop-bush
	<i>Dodonaea viscosa ssp. angustissima</i>	tjininyapa
Solanaceae	<i>Duboisia hopwoodii</i>	walkalpa
	<i>Grammosolen truncatus</i>	shrubby ray-flower
	<i>Lycium australe</i>	Australian boxthorn
	<i>Nicotiana goodspeedii</i>	smooth-flower tobacco
	<i>Nicotiana rosulata ssp.</i>	no common name
	<i>Nicotiana rosulata ssp. rosulata</i>	no common name
	<i>Nicotiana velutina</i>	velvet tobacco
	<i>Solanum affin. centrale</i>	no common name
	<i>Solanum cleistogamum</i>	wirin-wirinypa
	<i>Solanum coactiliferum</i>	western nightshade
	<i>Solanum ellipticum</i>	wangki
<i>Solanum hystrix</i>	prickly potato weed	
* <i>Solanum nigrum</i>	black-berry nightshade	
<i>Solanum orbiculatum ssp. orbiculatum</i>		
Stackhousiaceae	<i>Stackhousia megaloptera</i>	dune candles
	<i>Stackhousia muricata</i>	yellow candles
Thymelaeaceae	<i>Pimelea microcephala ssp.</i>	shrubby riceflower
	<i>Pimelea microcephala ssp. microcephala</i>	shrubby riceflower
	<i>Pimelea simplex ssp. simplex</i>	desert riceflower
Umbelliferae	* <i>Bupleurum semicompositum</i>	hare's ear
	<i>Daucus glochidiatus</i>	native carrot
	<i>Trachymene glaucafolia</i>	wild parsnip
	<i>Trachymene ornata var. ornata</i>	sponge-fruit trachymene
Urticaceae	<i>Parietaria debilis</i>	soft nettle
	* <i>Urtica urens</i>	stinging nettle
Zygophyllaceae	* <i>Tribulus terrestris</i>	yellow vine
	<i>Zygophyllum apiculatum</i>	pointed twinleaf
	<i>Zygophyllum aurantiacum</i>	shrubby twinleaf
	<i>Zygophyllum eremaicum</i>	pale-flower twin-leaf
	<i>Zygophyllum ovatum</i>	dwarf twinleaf
Plants 6: Monocotyledons		
Cyperaceae	<i>Gahnia lanigera</i>	desert saw-sedge
	<i>Lepidosperma carphoides</i>	black rapier-sedge
	<i>Lepidosperma viscidum</i>	sticky sword-sedge
	<i>Schoenus subaphyllus</i>	desert bog-sedge
Gramineae	<i>Agrostis avenacea var. avenacea</i>	fairy grass
	<i>Amphipogon caricinus var. caricinus</i>	long grey-beard grass
	<i>Aristida contorta</i>	wind grass
	<i>Aristida holathera var. holathera</i>	tall kerosene grass
	<i>Bromus arenarius</i>	sand brome
	<i>Cymbopogon obtectus</i>	silky-heads

	* <i>Cynodon dactylon</i>	couch-grass
	<i>Danthonia caespitosa</i>	white-top
	<i>Danthonia setacea</i> var. <i>setacea</i>	small-flower wallaby-grass
	<i>Digitaria brownii</i>	
	<i>Enneapogon avenaceus</i>	oat nineawn
	<i>Enneapogon caerulescens</i> var. <i>caerulescens</i>	blue nineawn
	<i>Enneapogon polyphyllus</i>	limestone bottle-washers
	<i>Eragrostis eriopoda</i>	woollybutt
	<i>Eriachne helmsii</i>	woollybutt wanderrie
	<i>Eriachne mucronata</i>	mountain wanderrie grass
	<i>Monachather paradoxa</i>	
	<i>Paractaenum novae-hollandiae</i> ssp. <i>reversum</i>	reverse grass
	<i>Paspalidium basicladum</i>	no common name
	<i>Paspalidium constrictum</i>	knotty-butt paspalidium
	* <i>Rostraria pumila</i>	tiny bristle-grass
	* <i>Schismus barbatus</i>	mulga grass
	<i>Stipa acrocliata</i>	graceful spear-grass
	<i>Stipa drummondii</i>	cottony spear-grass
	<i>Stipa elegantissima</i>	feather spear-grass
	<i>Stipa eremophila</i>	rusty spear-grass
	<i>Stipa nitida</i>	Balcarra spear-grass
	<i>Stipa platychaeta</i>	flat-awn spear-grass
	<i>Stipa plumigera</i>	no common name
	<i>Stipa scabra</i> ssp. <i>scabra</i>	rough spear-grass
	<i>Thyridolepis mitchelliana</i>	window mulga-grass
	<i>Tragus australianus</i>	small burr-grass
	<i>Triodia irritans</i>	tjanpi
	<i>Triodia lanata</i>	woolly spinifex
	<i>Triodia scariosa</i> ssp. <i>scariosa</i>	tjiri
	<i>Tripogon loliiformis</i>	rye beetle-grass
Juncaginaceae		
	<i>Triglochin calcitrapum</i>	spurred arrowgrass
Liliaceae		
	<i>Bulbine semibarbata</i>	small leek-lily
	<i>Corynotheca licrota</i>	sand lily
	<i>Dianella brevicaulis/revoluta</i> var.	spreading flax-lily
	<i>Dianella revoluta</i> var. <i>revoluta</i>	spreading flax-lily
	<i>Lomandra effusa</i>	scented mat-rush
	<i>Lomandra leucocephala</i> ssp. <i>robusta</i>	woolly-head mat-rush
	<i>Murchisonia volubilis</i>	no common name
	<i>Wurmbea dioica</i> ssp. <i>dioica</i>	early star-lily

10.3 Appendix C List of Vertebrates

Recorded from site records for Yellabinna Regional Reserve in the South Australian Biodiversity Database July 1998 download. Includes Biological Survey quadrats and SA Museum records.

01 : Amphibians

Leptodactylidae

<i>Neobatrachus centralis</i>	Trilling Frog
<i>Neobatrachus pictus</i>	Painted Frog

02 : Reptiles

Agamidae

<i>Ctenophorus cristatus</i>	Crested Dragon
<i>Ctenophorus fionni</i>	Peninsula Dragon
<i>Ctenophorus fordi</i>	Mallee Dragon
<i>Ctenophorus isolepis</i>	Military Dragon
<i>Ctenophorus mckenziei</i>	McKenzie's Dragon
<i>Ctenophorus pictus</i>	Painted Dragon
<i>Diporiphora linga</i>	Linga Dragon
<i>Moloch horridus</i>	Thorny Devil
<i>Pogona minor</i>	Dwarf Bearded Dragon
<i>Tympanocryptis adalaidensis</i>	Prickly Dragon
<i>Tympanocryptis lineata</i>	Five-lined Earless Dragon

Boidae

<i>Morelia spilota</i>	Carpet Python
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Elapidae

<i>Demansia reticulata</i>	Desert Whipsnake
<i>Pseudechis australis</i>	Mulga Snake
<i>Pseudonaja inframacula</i>	Peninsula Brown Snake
<i>Pseudonaja modesta</i>	Five-ringed Snake
<i>Simoselaps bertholdi</i>	Desert Banded Snake
<i>Suta spectabilis</i>	Mallee Black-headed Snake

Gekkonidae

<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko
<i>Diplodactylus damaeus</i>	Beaded Gecko
<i>Diplodactylus granariensis</i>	Western Stone Gecko
<i>Diplodactylus stenodactylus</i>	Sandplain Gecko
<i>Gehyra variegata</i>	Tree Dtella
<i>Heteronotia binoei</i>	Bynoe's Gecko
<i>Nephurus laevis</i>	Pale Knob-tailed Gecko
<i>Nephurus levis</i>	Smooth Knob-tailed Gecko
<i>Nephurus milii</i>	Thick-tailed Gecko
<i>Nephurus stellatus</i>	Starred Knob-tailed Gecko
<i>Rhynchoedura ornata</i>	Beaked Gecko
<i>Strophurus assimilis</i>	Thorn-tailed Gecko
<i>Strophurus elderi</i>	Jewelled Gecko
<i>Strophurus intermedius</i>	Southern Spiny-tailed Gecko

Pygopodidae

<i>Delma australis</i>	Barred Snake-lizard
<i>Delma butleri</i>	Spinifex Snake-lizard
<i>Delma fraseri</i>	Fraser's Snake-lizard
<i>Lialis burtonis</i>	Burton's Legless Lizard
<i>Pygopus lepidopodus</i>	Common Scaly-foot

Scincidae

<i>Cryptoblepharus plagiocephalus</i>	Desert Wall Skink
<i>Ctenotus atlas</i>	Southern Spinifex Ctenotus
<i>Ctenotus brooksi</i>	Sandhill Ctenotus

	<i>Ctenotus leae</i>	Centralian Coppertail
	<i>Ctenotus pantherinus</i>	Leopard Skink
	<i>Ctenotus regius</i>	Eastern Desert Ctenotus
	<i>Ctenotus schomburgkii</i>	Sandplain Ctenotus
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Bluetongue
	<i>Egernia inornata</i>	Desert Skink
	<i>Eremiascincus richardsonii</i>	Broad-banded Sandswimmer
	<i>Hemiernis initialis</i>	Western Earless Skink
	<i>Hemiernis peronii</i>	Four-toed Earless Skink
	<i>Lerista arenicola</i>	Beach Slider
	<i>Lerista desertorum</i>	Great Desert Slider
	<i>Lerista dorsalis</i>	Southern Four-toed Slider
	<i>Lerista edwardsae</i>	Myall Slider
	<i>Lerista labialis</i>	Eastern Two-toed Slider
	<i>Lerista muelleri</i>	Dwarf Three-toed Slider
	<i>Lerista picturata</i>	Yellow-bellied Slider
	<i>Lerista taeniata</i>	Ribbon Slider
	<i>Lerista xanthura</i>	Yellow-tailed Slider
	<i>Menetia greyii</i>	Dwarf Skink
	<i>Morethia adelaidensis</i>	Adelaide Snake-eye
	<i>Morethia boulengeri</i>	Common Snake-eye
	<i>Morethia butleri</i>	Butler's Snake-eye
	<i>Morethia obscura</i>	Mallee Snake-eye
	<i>Scincidae sp.</i>	no common name
	<i>Tiliqua occipitalis</i>	Western Bluetongue
	<i>Tiliqua rugosa</i>	Sleepy Lizard
Typhlopidae		
	<i>Ramphotyphlops australis</i>	Southern Blind Snake
	<i>Ramphotyphlops bituberculatus</i>	Rough-nosed Blind Snake
	<i>Ramphotyphlops endoterus</i>	Centralian Blind Snake
Varanidae		
	<i>Varanus gouldii</i>	Sand Goanna
04 : Birds		
Accipitridae		
	<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Circus approximans</i>	Swamp (Marsh) Harrier
	<i>Hieraetus morphnoides</i>	Little Eagle
Aegothelidae		
	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
Alcedinidae		
	<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher
Casuariidae		
	<i>Dromaius novaehollandiae</i>	Emu
Charadriidae		
	<i>Vanellus tricolor</i>	Banded Plover
Climacteridae		
	<i>Climacteris affinis</i>	White-browed Treecreeper
	<i>Climacteris rufa</i>	Rufous Treecreeper
Columbidae		
	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Phaps chalcoptera</i>	Common Bronzewing
Corvidae		
	<i>Artamus cinereus</i>	Black-faced Woodswallow

	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Artamus minor</i>	Little Woodswallow
	<i>Artamus personatus</i>	Masked Woodswallow
	<i>Cinclosoma castanotum</i>	Chestnut Quailthrush
	<i>Colluricincla harmonica</i>	Grey Shrikethrush
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
	<i>Corvus bennetti</i>	Little Crow
	<i>Corvus coronoides</i>	Australian Raven
	<i>Corvus mellori</i>	Little Raven
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Gymnorhina tibicen</i>	Black-backed Magpie
	<i>Lalage sueurii</i>	White-winged Triller
	<i>Oreoica gutturalis</i>	Crested Bellbird
	<i>Pachycephala inornata</i>	Gilbert's Whistler
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Pteropodocys maxima</i>	Ground Cuckooshrike
	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Strepera versicolor</i>	Grey Currawong
Cuculidae		
	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-cuckoo
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo
	<i>Cuculus pallidus</i>	Pallid Cuckoo
Eopsaltriidae		
	<i>Daphoenositta chrysoptera</i>	Varied Sittella
	<i>Drymodes brunneopygia</i>	Southern Scrub-robin
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin
	<i>Melanodryas cucullata</i>	Hooded Robin
	<i>Microeca leucophaea</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
Falconidae		
	<i>Falco berigora</i>	Brown Hawk (Brown Falcon)
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco peregrinus</i>	Peregrine Falcon
Hirundinidae		
	<i>Cheramoeca leucosternum</i>	White-backed Swallow
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Hirundo nigricans</i>	Tree Martin
Maluridae		
	<i>Amytornis striatus</i>	Striated Grasswren
	<i>Malurus lamberti</i>	Variegated Wren
	<i>Malurus leucopterus</i>	White-winged Wren
	<i>Malurus splendens</i>	Splendid Wren
Megapodiidae		
E	<i>Leipoa ocellata</i>	Malleefowl
Meliphagidae		
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Epthianura aurifrons</i>	Orange Chat
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Lichenostomus leucotis</i>	White-eared Honeyeater
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater
	<i>Lichenostomus plumula</i>	Grey-fronted Honeyeater
	<i>Lichenostomus virescens</i>	Singing Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner

	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
	<i>Phylidonyris albifrons</i>	White-fronted Honeyeater
Meropidae		
	<i>Merops ornatus</i>	Rainbow Bird
Nectariniidae		
	<i>Dicaeum hirundinaceum</i>	Mistletoe Bird
Otididae		
	<i>Ardeotis australis</i>	Australian Bustard
Pardalotidae		
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza iredalei</i>	Slender-billed Thornbill
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
	<i>Calamanthus fuliginosus</i>	Eastern Fieldwren
	<i>Hylacola cauta</i>	Shy Hylacola
	<i>Pardalotus striatus</i>	Striated Pardalote
	<i>Pardalotus xanthopygus</i>	Yellow-tailed Pardalote
	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Smicronis brevirostris</i>	Weebill
Passeridae		
	<i>Anthus novaeseelandiae</i>	Richard's Pipit
	<i>Poephila guttata</i>	Zebra Finch
Phasianidae		
	<i>Coturnix pectoralis</i>	Stubble Quail
Podargidae		
	<i>Podargus strigoides</i>	Tawny Frogmouth
Pomatostomidae		
	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Psittacidae		
	<i>Barnardius zonarius</i>	Twenty-eight Parrot
	<i>Cacatua leadbeateri</i>	Pink Cockatoo
	<i>Cacatua roseicapilla</i>	Galah
	<i>Melopsittacus undulatus</i>	Budgerigar
	<i>Northiella haematogaster</i>	Yellow-vented Blue Bonnet
	<i>Psephotus varius</i>	Mulga Parrot
Strigidae		
	<i>Ninox novaeseelandiae</i>	Southern Boobook
Sylviidae		
	<i>Cinctoramphus cruralis</i>	Brown Songlark
Turnicidae		
	<i>Turnix velox</i>	Little Quail
05 : Mammals		
Burramyidae		
	<i>Cercartetus concinnus</i>	Western Pygmy-possum
Camelidae		
	* <i>Camelus dromedarius</i>	Dromedary (feral)
Canidae		
	* <i>Canis lupus</i>	Dog
	* <i>Vulpes vulpes</i>	Fox (Red Fox)
Dasyuridae		
	<i>Antechinomys laniger</i>	Kultarr
V	<i>Dasyercus cristicauda</i>	Mulgara
	<i>Ningui yvonneae</i>	Yvonne's Ningui
	<i>Sminthopsis crassicauda</i>	Fat-tailed Dunnart

	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart
V	<i>Sminthopsis psammophila</i>	Sandhill Dunnart
Felidae	* <i>Felis catus</i>	Cat (feral)
Leporidae	* <i>Oryctolagus cuniculus</i>	Rabbit
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo
	<i>Macropus robustus</i>	Wallaroo
	<i>Macropus rufus</i>	Red Kangaroo
Molossidae	<i>Nyctinomus australis</i>	White-striped Mastiff-Bat
Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat
	* <i>Mus domesticus</i>	House Mouse
	<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse
Notoryctidae	<i>Notoryctes typhlops</i>	Marsupial Mole
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
	<i>Nyctophilus timoriensis</i>	Greater Long-eared Bat
	<i>Vespadelus baverstoki</i>	Inland Eptesicus
	<i>Vespadelus regulus</i>	King River Eptesicus
Vombatidae	<i>Lasiorhinus latifrons</i>	Southern Hairy-nosed Wombat

ATTACHMENT ONE
YELLABINNA REGIONAL RESERVE
ECONOMIC ASSESSMENT

Economic Assessment of the Yellabinna Regional Reserve

A report prepared for
Department of Environment, Heritage and Aboriginal Affairs

Prepared by

EconSearch Pty Ltd
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1. Introduction

1.1 Background

The *National Parks and Wildlife Act, 1972* was amended in 1987 to provide for a classification of reserve known as “Regional Reserve”. This classification allows the Government to manage land for conservation of wildlife, and natural and historic features while permitting utilisation of natural resources, thereby enabling multiple land use of the reserve.

The regional reserve mechanism provides for:

- a conservation focus;
- conservation management planning and implementation;
- security of tenure for lands reserved under the Act; and
- regulation for the management of human activity.

Major objectives for regional reserve management are to establish strategies that successfully integrate the different uses for which the reserve has been proclaimed.

The purpose of this review is to meet the requirements under the *National Parks and Wildlife Act 1972* (Section 34A (5)). These requirements are that within ten years of the constitution of Yellabinna Regional Reserve, a report must be laid before each House of Parliament which:

- assesses the impact of the utilisation of natural resources on the conservation of the wildlife and the natural and historic features of the reserve;
- assesses the impact or the potential impact of the utilisation of the natural resources of the reserve on the economy of the State; and
- makes recommendations as to the future status under the Act of the land constituting the reserve.

EconSearch Pty Ltd, in association with World Wide Project Management Services Pty Ltd, was commissioned to provide an assessment of the impact and potential impact of the utilisation of the natural resources of the Yellabinna Regional Reserve on the local economy and the economy of the State. Department of Environment, Heritage and Aboriginal Affairs commissioned the study.

There is particular interest in “resource constraints” and some of the “potential incompatibilities in land use” such as tourism/mining/environment conflicts (water, land, skills, investment dollars).

An important aspect of the project has been the development of a data collection and collation process. A major outcome is a set of recommendations as to how data should be collected to streamline future regional reserve ten year reviews.

1.2 Terms of Reference

The terms of reference of the consultancy required that the following tasks be undertaken.

1. Assess the impact or potential impact of the utilisation of the natural resources of the Yellabinna Regional Reserve on the economy of the State.
2. Determine the actual, relative and potential importance on the State's economy of each of the major industries utilising the resources of the reserve.
3. Include gross state product including direct and indirect cost and benefits, employment and occupations and changes in occupation.
4. Make recommendations as to how data should be collected to stream line future regional reserve ten year reviews.

1.3 Outline of the Report

The following sections of this report provide:

- a description of the approach to the conduct of the study (Section 2);
- details of the socio-economic profile of the region (Section 3);
- a brief description of the industries utilising the resources of the reserve (Section 4);
- a report on the economic impact of industries utilising the resources of the reserve (Section 5);
- a discussion of resource use conflicts and the impact of development initiatives (Section 6);
- a statement on economic outlook in the context of the industries utilising the resources of the reserve (Section 7);
- recommendations on data requirements and analytical frameworks for future ten-year reviews of regional reserves (Section 8).

2. Method of Analysis

2.1 Data Collection

This involved five main steps:

1. There was information provided by the client to the consultant including:
 - basic information on the region from industry and government agencies which operate within the Yellabinna Regional Reserve;
 - existing information (published or unpublished) of relevance to the project that is readily available (including maps); and
 - specific information on the possible future developments within the region.
2. Population census data were obtained from the Australian Bureau of Statistics (ABS) at a collectors district level (population, age distribution, education, employment by industry, occupation, family income, etc.). The data were provided in the form of 'Community Profiles' from the ABS and were obtained for four collectors districts, which cover or are adjacent to the Yellabinna Regional Reserve.
3. Other social and economic data for the broader region, the West Coast Statistical Sub-Division, was collected (regional employment by industry (4 digit ANZSIC), industry output/turnover, wages and salaries, household consumption, etc.).
4. Consultation was undertaken with representatives from industry and government which operate within the Yellabinna Regional Reserve to establish information about trade flows to and from the region, the source of inputs to the reserve, future development potential in the region and current and potential resource conflicts in the reserve.
5. A review of existing literature on resource valuation was undertaken.

2.2 Regional Input-Output Table

There are two models that were prepared as part of this task:

1. Data collected as described in Section 2.1 were used to generate an input-output table for the West Coast Statistical Subdivision (a region smaller than this would not be meaningful in an economic sense). The West Coast Statistical Subdivision includes the District Councils of Ceduna and Streaky Bay and the Unincorporated West Coast. Details of the input-output methodology and its application are provided in Attachment 1.
2. EconSearch had already developed an input-output table for the State as a whole. This model was available for use in the study to measure economic impacts at the State level to complement the regional level impact assessment. Some relatively minor adjustments were made to the existing State model to enable the assessment of Yellabinna Regional Reserve economic impacts.

2.3 Socio-Economic Profile of the Region

The collection of base data and the construction of a regional input-output table enabled the preparation of a socio-economic profile of the local area. The combined data sets allowed preparation of information on:

- output and employment by industry;
- trade flows to and from the region;
- demographic details;
- the contribution of the reserve to the State economy; and
- sources of inputs to the reserve.

2.4 Economic Impact of Industries Utilising the Resources of the Reserve

The input-output models (local and State) were used to assess the economic significance of industries utilising the resources of the Yellabinna Regional Reserve. On an industry by industry basis, major social and economic indicators were provided, namely:

- value added (gross state product);
- business turnover;
- employment (including industry and occupation aspects); and
- household income.

The data collected as described in Section 2.1 indicated the direct significance of the industries utilising the resources of the reserve. The input-output models were used to estimate the indirect significance (multiplier effects) of these industries.

As well as the impact of the existing utilisation of the resources of the reserve, the consultation and data gathering process was used to bring together information about likely future levels of utilisation of the resources of the reserve. This information was incorporated into the local and State input-output models to estimate the potential economic impacts of future utilisation of the resources of the reserve.

2.5 Resource Use Conflicts and the Impact of Development Initiatives

The data collected through the proposed consultation process and as described in 2.1 (4) and (5) enabled the clear identification of resource conflicts in the current and potential future utilisation of the natural resources of the reserve.

As noted under 2.1 (5), a review of existing literature on resource valuation was undertaken.

This literature review allowed the consultants to provide a broad indication of the value of the natural resources of the reserve. With information about likely future levels of utilisation of the resources of the reserve it was possible to make an assessment of the effect that possible development initiatives will have on the value of the natural resources of the reserve.

2.6 Economic Outlook

There are many external factors that have the potential to impact upon the future level of activities that utilise the resources of the Yellabinna Regional Reserve. To gain an overview of the general economic outlook for the State, a review was made of current position and forecasting papers prepared by both public and private sector agencies (eg *South Australian Economic Indicators* - ABS, monthly; *Trends: A Bulletin of Economic Development in South Australia* - Bank SA, quarterly). In addition, consultation was made with key representatives of Government agencies and industry in the sectors where future development is likely to occur (eg, South Australian Tourism Commission, Primary Industries and Resources South Australia (PIRSA)).

The review and consultation process outlined above enabled the preparation of an economic outlook which:

- reviewed economic factors external to the reserve that may influence the growth of economic activity and employment for SA;
- advised on the macro-economic position;
- established growth prospects generally;
- provided a general forecast of economic activity and employment for South Australia; and
- related this to the impact on the reserve.

2.7 Reporting Results

This project report provides:

- a description of the consultation process and models used;
- comments on the strengths and weaknesses of the process and models;
- the outcomes of the data collection and analysis; and
- recommendations on data requirements and analytical frameworks for future ten year reviews of regional reserves.

The report was provided as a draft to the client for review and comment. This final report was then prepared.

3. Socio-economic Profile of the Region

3.1 Where People Live

Within the Yellabinna Regional Reserve there is no permanent human habitation and even in the surrounding areas the population is sparse. From the Population Census conducted by the ABS in 1996, it is possible to collate information about residents in the districts adjacent to the reserve.

The smallest geographic unit for which census data are collected is known as a collector's district (CD). There are four CDs relevant to this study, 4013101, 4013102, 4022101, and 4022102. For the purpose of this study these are referred to as 'Nullarbor', 'Yellabinna', 'Koonalda' and 'Yalata' respectively.

On Census night, there were almost 740 people resident in the four CDs in aggregate, 131 in Nullarbor, 107 in Yellabinna, 226 in Koonalda and 273 in Yalata (Table 1). One-third of the total population is Aboriginal, in contrast to the Yalata population which is 88 per cent Aboriginal. A majority of the population in all districts was born in Australia with only 7 per cent having been born overseas.

Table 1 Population and Place of Birth

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					Male	Female	Persons
	(Total Persons)						
Total persons	131	107	226	273	432	305	737
Aged 15 years and over	100	95	209	181	354	231	585
Aboriginal	26	0	8	239	133	140	273
Torres Strait Islander	0	0	0	0	0	0	0
Both Aboriginal/Torres Strait Islander(b)	3	0	0	0	0	3	3
Australian born	112	86	185	266	374	275	649
Born Overseas:							
Canada, Ireland, NZ, RSA, UK(c) & USA	9	9	13	4	25	10	35
Other country(d)	3	3	9	3	5	13	18
Total Born Overseas	12	12	22	7	30	23	53

- (a) Overseas visitors are included in these categories. All other categories exclude overseas visitors.
 (b) Applicable to persons who are of both Aboriginal and Torres Strait Islander origin.
 (c) Comprises England, Scotland, Wales, Nth'n Ireland, Channel Islands, Isle of Man & UK/Ireland n.f.d.
 (d) Includes 'inadequately described', 'at sea', and 'not elsewhere classified'.
 (e) Includes 'non-verbal so described' and 'inadequately described'.
 (f) Applicable to persons aged 15 years and over.
 (g) Applicable to persons aged 5 years and over.

The data provided in Table 1 relate to the population resident in the area on Census night. In areas with relatively small populations and large visitor numbers, the Census data can distort the real picture. For example, Table 2 shows that while there was a small number of visitors to Yalata on Census night, over half (52 per cent) of the population counted in Nullarbor, Yellabinna and Koonalda was usually resident elsewhere in South Australia or interstate.

Table 2 State of Usual Residence

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					Male	Female	Persons
Counted at home	77	53	95	239	241	223	464
Visitors From:							
Same local area	4	4	0	21	20	9	29
Different local area in:							
New South Wales	0	3	21	0	13	11	24
Victoria	6	0	20	0	17	9	26
Queensland	0	0	11	0	6	5	11
South Australia	37	40	52	9	110	28	138
Western Australia	0	9	20	4	15	18	33
Tasmania	0	0	3	0	3	0	3
Northern Territory	3	0	6	0	6	3	9
Aust Capital Territory	0	0	0	0	0	0	0
Other Territories	0	0	0	0	0	0	0
Total	50	56	133	34	190	83	273
Overseas visitor	0	0	0	0	0	0	0
Total	127	109	228	273	431	306	737

The high number of visitors as a proportion of the total population in Nullarbor, Yellabinna and Koonalda is verified in Table 3 which shows that 38 per cent of the occupied dwellings on Census night were either caravans, cabins, improvised homes or tents.

Table 3 Number of Occupied Private Dwellings by Dwelling Structure

	Nullarbor	Yellabinna	Koonalda	Yalata	Total
Separate house	21	19	29	28	97
Semi-detached, row or terrace house, townhouse etc.	3	0	0	0	3
Flat , unit or apartment:	0	0	0	0	0
Caravan , cabin, houseboat	3	0	29	0	32
Improvised home, tent, sleepers out	3	4	5	12	24
House or flat attached to a shop, office, etc.	0	3	0	0	3
Not stated	0	0	3	19	22
Total	30	26	66	59	181

3.2 Demographic Characteristics

In Table 4, the age distribution of the four districts is compared with that of Australia. While Koonalda has a slightly older age profile than that of Australia, the age profiles of Nullarbor, Yellabinna and Yalata are much younger. For example, Koonalda's older age profile is illustrated by the fact that only 41 per cent of its population was under 40 years of age at the time of the 1996 Population Census, compared with a figure of 59 per cent for Australia as a whole. By contrast, the younger age profiles of Nullarbor, Yellabinna and Yalata are shown by the fact that the percentage of the population under 40 in each district was 73, 72 and 80 per cent, respectively.

Table 4 Age Distribution of the Population

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region			Australia		
					(Total Persons)	M	F	Total	M	F
0-9	17%	13%	4%	19%	7%	6%	14%	7%	7%	14%
10-19	14%	7%	3%	24%	7%	7%	14%	7%	7%	14%
20-29	21%	21%	16%	23%	13%	8%	20%	8%	8%	15%
30-39	21%	31%	18%	14%	12%	6%	19%	8%	8%	16%
40-49	16%	16%	12%	13%	9%	5%	14%	7%	7%	14%
50-59	7%	9%	22%	3%	6%	5%	10%	5%	5%	10%
60-69	2%	3%	19%	2%	4%	3%	7%	4%	4%	8%
70-79	2%	0%	5%	1%	1%	1%	2%	3%	3%	6%
80+	0%	0%	0%	0%	0%	0%	0%	1%	2%	3%
Total (a)	100%	100%	100%	100%	59%	41%	100%	50%	50%	100%

(a) Excludes overseas visitors

The languages spoken at home by the population (over 5 years old) of the four districts are detailed in Table 5. Almost the entire population (over 90 per cent) in Nullarbor, Yellabinna and Koonalda speak English only. By contrast, in Yalata only a third of the population speaks English only, while some two-thirds speak an Australian indigenous language.

Table 5 Language spoken at Home (persons aged 5 years and over)

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					(Total Persons)	Male	Female
Speaks English only	115	92	197	77	302	179	481
Speaks language other than English							
Australian Indigenous	0	0	0	148	74	74	148
Asian Languages	0	0	0	0	0	0	0
Europeans Languages	3	0	0	0	3	0	3
Other (a)	0	3	0	0	3	0	3
Total other language	3	3	0	148	110	28	138
Not Stated	4	6	12	23	27	18	45
Total (b)	122	101	209	248	412	271	683

(a) Includes 'inadequately described' and 'non-verbal so described'.

(b) Excludes overseas visitors.

In Table 6, the highest qualification level for persons over 15 years is detailed. Of the four districts, Yalata had the lowest proportion of the population over 15 of age holding a qualification (19 per cent), and Yellabinna had the highest (58 per cent). In all four districts, most of the qualifications held were of a skilled vocational nature.

Table 6 Highest Level of Qualification, Persons over 15 years with a Qualification

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					Male	Female	Persons
	(Total Persons)						
Higher degree	0	0	0	0	0	0	0
Graduate diploma	0	0	0	3	0	3	3
Post-bachelor deg.	6	13	6	8	13	20	33
Under-graduate dip.	3	9	6	3	6	15	21
Associate diploma	6	3	0	3	9	3	12
Skilled vocational	20	6	29	9	61	3	64
Basic vocational	3	3	6	6	9	9	18
Inadequately described	0	0	0	0	0	0	0
Not stated	8	21	31	3	40	23	63
Total pop over 15 yrs with qualification	46	55	78	35	138	76	214
Total pop over 15yrs	100	95	209	181	354	231	585
% of population over 15 years with qual.	46%	58%	37%	19%	39%	33%	37%

3.3 Who Provides the Jobs

The summary labour force position for the region is provided in Table 7. Of all districts, Koonalda had the highest rate of unemployment at 5.8 per cent, and Yalata, at 3.4 per cent, had the lowest. However, in spite of having the lowest unemployment rate, Yalata was the only district to have fewer people in the labour force than out of it.

Table 7 Summary Labour Force Statistics

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					Male	Female	Persons
	(Total Persons)						
Unemployed(f)	3	3	7	3	10	6	16
Employed(f)	83	75	113	86	255	102	357
In the labour force(f)	86	78	120	89	265	108	373
Not in labour force(f)	11	8	83	91	75	118	193
Unemployment Rate(f)	3.5%	3.8%	5.8%	3.4%	3.8%	5.9%	4.3%

See notes to Table 1.

Employment by industry in the region is detailed in Tables 8 and 9. Table 8 shows the numbers of people employed in various industries, and Table 9 compares the proportions of people employed in different industries in the four districts with the corresponding figure for Australia.

Over half of those employed in Yellabinna, were working in the primary sector. Similarly, this sector was an important source of employment in Nullarbor and Koonalda, where it accounted for a quarter and a fifth of all jobs, respectively. Also, the construction industry was an important source of employment in Nullarbor, accounting for a further quarter of all employment in the district. In Koonalda, another important source of work was in the accommodation, cafe and restaurant sector, which provided approximately a quarter of all jobs in that district. By contrast, in Yalata, 77 per cent of all jobs were in the provision of health and community services, and 15 per cent were in education.

Table 8 Employment by Industry (no. of persons, 1996)

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region		
					Male	Female	Persons
	(Total Persons)						
Ag, Forestry & Fishing	12	21	19	0	37	15	52
Mining	9	26	3	0	35	3	38
Manufacturing	0	0	0	0	0	0	0
Elect, Gas and Water	0	0	3	0	3	0	3
Construction	22	4	11	0	37	0	37
Wholesale Trade	0	0	0	0	0	0	0
Retail Trade	0	3	12	0	15	0	15
Accom, Cafes & Rest	9	0	25	0	22	12	34
Transport and Storage	10	15	0	0	19	6	25
Comm Services	0	0	0	0	0	0	0
Finance and Insurance	0	0	0	0	0	0	0
Property & Bus Services	5	3	3	0	5	6	11
Gov Admin & Defence	3	3	3	0	6	3	9
Education	3	0	10	12	3	22	25
Health & Com Services	0	3	3	63	45	24	69
Cult & Recreat Services	0	0	3	0	0	3	3
Pers & Other Services	3	0	3	3	6	3	9
Other	6	6	6	3	18	3	21
Total	82	84	104	81	251	100	351

1. Ag - Agriculture; Elect - Electricity; Accom - Accommodation; Rest - Restaurants; Comm - Communication; Bus - Business; Gov - Government; Admin - Administration; Com - Community; Cult - Cultural; Recreat - Recreational; Pers - Personal.

2. Rounding errors occur.

Not surprisingly, a comparison of employment in the total region with employment for all Australia reveals that the proportion of people working in the primary sector, construction, accommodation, cafes and restaurants, and in health and community services in the total region is higher than that found nationwide.

Table 9 Employment by Industry in Percentage Terms (1996)

	Nullarbor Yellabinna Koonalda Yalata				Total Region			Australia		
	(Total Persons)				M	F	Total	M	F	Total
Ag, Forestry & Fishing	15%	25%	18%	0%	15%	15%	15%	5%	3%	4%
Mining	11%	31%	3%	0%	14%	3%	11%	2%	0%	1%
Manufacturing	0%	0%	0%	0%	0%	0%	0%	16%	8%	13%
Elect, Gas & Water	0%	0%	3%	0%	1%	0%	1%	1%	0%	1%
Construction	27%	5%	11%	0%	15%	0%	11%	10%	2%	6%
Wholesale Trade	0%	0%	0%	0%	0%	0%	0%	7%	4%	6%
Retail Trade	0%	4%	12%	0%	6%	0%	4%	12%	16%	14%
Accom, Cafes & Rest	11%	0%	24%	0%	9%	12%	10%	4%	6%	5%
Transport & Storage	12%	18%	0%	0%	8%	6%	7%	6%	2%	4%
Comm Services	0%	0%	0%	0%	0%	0%	0%	2%	1%	2%
Finance & Insurance	0%	0%	0%	0%	0%	0%	0%	3%	5%	4%
Property & Bus Serv.	6%	4%	3%	0%	2%	6%	3%	10%	10%	10%
Gov Admin & Defence	4%	4%	3%	0%	2%	3%	3%	5%	4%	5%
Education	4%	0%	10%	15%	1%	22%	7%	4%	11%	7%
Health & Com Serv.	0%	4%	3%	78%	18%	24%	20%	4%	17%	9%
Cult & Recreat Serv.	0%	0%	3%	0%	0%	3%	1%	2%	3%	2%
Pers & Other Services	4%	0%	3%	4%	2%	3%	3%	3%	4%	4%
Other	7%	7%	6%	4%	7%	3%	6%	3%	3%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

(a) Ag - Agriculture; Elect - Electricity; Accom - Accommodation; Rest - Restaurants; Comm - Communication; Bus - Business; Gov - Government; Admin - Administration; Com - Community; Cult - Cultural; Recreat - Recreational; Pers - Personal.

(b) Rounding errors occur.

Care needs to be taken when interpreting these types of data for small population districts. First, errors by survey respondents can distort the results to a relatively large degree. Second, in isolated areas most businesses, particularly those in the service industries, provide more than one service and these services are not necessarily in the same industry sector. A roadhouse, for example, may be a restaurant, grocery retailer, post office, and accommodation provider as well as a provider of motor vehicle spare parts and repairs.

Household income for the four districts is provided in Table 10. The data are presented as the percentage of households in different income categories. Nullarbor was the district with the smallest proportion of households in the three lowest income brackets (15 per cent), whilst over three quarters (78 per cent) of all Yalata households fell into this bracket. Similarly, Nullarbor was the district with the highest proportion of households in the three highest income brackets (25 per cent), whilst only 4 per cent of Yalata households fell into this bracket. Nearly half of all Yellabinna and Koonalda households fell into the middle three income brackets.

Table 10 Weekly Household Income

	Nullarbor	Yellabinna	Koonalda	Yalata	Total Region	Australia
Negative/Nil Income	0%	3%	3%	15%	6%	1%
\$1 - \$119	9%	5%	6%	35%	15%	1%
\$120 - \$299	6%	24%	30%	28%	24%	18%
\$300 - \$499	21%	19%	27%	7%	18%	16%
\$500 - \$699	19%	12%	11%	7%	11%	13%
\$700 - \$999	19%	16%	9%	5%	11%	16%
\$1,000 - \$1,499	13%	5%	0%	2%	4%	14%
\$1,500 or more	6%	5%	3%	0%	3%	5%
Income not stated (a)	6%	11%	7%	2%	6%	8%
Total	100%	100%	100%	100%	100%	100%

(a) Comprises households where at least one, but not necessarily all, member(s) aged 15 years and over did not state an income and/or at least one spouse, child or co-tenant was temporarily absent.

4. Activities Utilising the Resources of the Reserve

The “use” of the Yellabinna Regional Reserve can be classified into five broad categories: tourism; conservation; mining; Aboriginal communities; and management and research, each of which are briefly described in this section. Clearly the five categories are not independent activities as there are strong interactions between them. Tourism activity is partly dependent on the ecological and cultural amenity of the reserve. Tourism, conservation and mining activities are all affected by the management of the reserve and the various on-going research programs.

4.1 Visitors

4.1.1 Tourists

Although travellers using the Eyre Highway rarely depart from the main road to visit the natural features of the Yellabinna area, the north-south track (known as Goog’s Track’ or ‘Denton’s Track’) across the dunes between Malbooma and Ceduna and the track adjacent to the transcontinental railway provide the basic infrastructure for recreational access to the Yellabinna Regional Reserve.

During the 1970s, with increased leisure time, higher disposable incomes, improved vehicle technology and availability (eg easier access to four wheel drive vehicles) and greater exposure to the attractions of the desert, tourism into the outback started to grow.

Accessibility to the Yellabinna area has increased further over the past two decades with continued improvements in the four factors mentioned above: leisure time, disposable income, four wheel drive vehicle technology and comfort, and knowledge about and interest in the parks of the region, namely the Yumbarra Conservation Park, the Pureba Conservation Park and the Yellabinna Regional Reserve.

Tourism has become an increasing although still low-level activity in the reserve and the surrounding desert areas, despite the remoteness of the area and inhospitable environment. Indeed, it is these very characteristics that attract visitors to the reserve, which provides an experience of wilderness and a sense of adventure and isolation.

4.1.2 Aboriginal Communities

There are two principal uses of the resources of the Yellabinna Regional Reserve by local Aboriginal communities. One is the limited hunting activity in the area for food (predominantly wombats). The other is the use of the tracks in the reserve, particularly for travel between Yalata and the Oak Valley community, north-west of Maralinga. Part of the track between Yalata and Ooldea forms the boundary between the Yellabinna and Nullarbor Regional Reserves.

In addition to these functional uses, the area of the reserve contains a number of cultural sites important to Aboriginal communities. The Ooldea Soak located on the sand-ridge plain just to the west of the reserve is a site of cultural importance. It was used both as a permanent source of drinking water and a ceremonial and trading centre. With the building of the transcontinental railway, Ooldea became a permanent settlement for workers and Aboriginal people (McKenzie and Robinson 1987). Another site of cultural importance is Mt Finke, which is also a focal point for tourists visiting the Yellabinna area.

4.2 Conservation

Scientific studies over the past 30 years have shown there is considerable ecological variation in flora and fauna throughout the Yellabinna area. The Yellabinna Regional Reserve provides habitats for a range of flora and fauna superbly adapted to their arid environment.

There is much to justify the ecological and cultural importance of the Yellabinna Regional Reserve, as well as its eminence as one of Australia's great wilderness areas. The reserve has a conservation value in addition to the benefits derived by visitors who appreciate its ecological and cultural amenity. The conservation "use" of the Yellabinna Regional Reserve and its attendant value to society is significant in its own right.

4.3 Mining

Fifty-eight exploration licences for the Yellabinna Regional Reserve have been issued by Primary Industries and Resources South Australia (PIRSA) to mining companies for the period 1990-1999. There was a relatively large amount of exploratory work undertaken at the start of the 1990s and then, following the collection of high-resolution aeromagnetic data by PIRSA Mineral Resources in 1992-93, there was increased activity in the mid to late part of the decade.

4.4 Management and Research

To enable appropriate utilisation of the Yellabinna Regional Reserve consistent with the legislation (*National Parks and Wildlife Act, 1972*) for both commercial and conservation purposes requires on-going management of the reserve. Management of the reserve rests with the Department of Environment, Heritage and Aboriginal Affairs (DEHAA).

As noted in the introduction to this report, the regional reserve mechanism provides for:

- a conservation focus;
- conservation management planning and implementation;
- security of tenure for lands reserved under the Act; and
- regulation for the management of human activity.

Major objectives for regional reserve management are to establish strategies that successfully integrate the different uses for which the reserve has been proclaimed. In practical terms, management of the reserve involves maintenance of public services, infrastructure and facilities (including roads, signs, emergency search, rescue and medical services and other policing capabilities).

An important dimension associated with the management of Yellabinna Regional Reserve is the conduct of research into the reserve's flora, fauna and land systems, as well as its Aboriginal and European history. There is ongoing monitoring and research by DEHAA and specific research projects being undertaken by individuals representing various organisations around the country.

5. Economic Impact of Industries Utilising the Reserve

The brief for this study specified that the economic impact of activities utilising the Yellabinna Regional Reserve be measured using an input-output analysis framework. This implies that expenditures associated with each of the uses of the reserve need to be estimated. These estimates can then be incorporated into the input-output models to estimate regional and state wide economic impacts. A drawback of this approach arises when there are uses of the reserve (eg, conservation use) for which there are no financial transactions and therefore no quantifiable economic impacts.

An important component of this economic assessment task is measuring impacts at the regional level. The relevant economic region is much larger than the area defined by the Yellabinna Regional Reserve and incorporates the towns and rural locations in the districts adjacent to the reserve. For this study the regional economy is defined as the West Coast statistical subdivision (a region smaller than this would not be meaningful in an economic sense). The West Coast statistical subdivision includes the District Councils of Ceduna and Streaky Bay and the Unincorporated West Coast. It is the economy of this region that is directly impacted by the activities utilising the resources of the Yellabinna Regional Reserve.

5.1 Visitors

The economic impact of tourism on a “host” economy can be measured through the quantification of expenditure by visitors to the region. In principle, the nature and size of the impacts depend on the needs and wants of the tourist, the structure and size of the local economy and the types of interactions between the tourist and the host economy.

Tourist demand can be represented by demand profiles (expenditure on vehicles, fuel, daily provisions, accommodation, guided tours, etc) while the structure of a regional economy can be represented by an input-output table. Using a classification based on the type of tourist, the total demand for goods and services can be split into demand for specific goods and services by each type of tourist. Although for other tourist destinations a range of types of tourists is often relevant (day trippers, visiting friends and relatives, getaway, business, education, etc.), visitors to the Yellabinna Regional Reserve are relatively homogeneous in terms of their needs or demand for goods and services.

There are two components of expenditure that are relevant for the analysis, expenditure in the economic region of the reserve (namely the West Coast statistical subdivision) and expenditure elsewhere in South Australia that can be attributed to visits to the reserve.

For most of the people entering the reserve, the visit is not the sole purpose of their trip. Consequently, it is not appropriate to attribute total trip expenditure to the impact of the reserve. It is assumed that, on average, in getting to the reserve at least one day's travelling in South Australia (including an overnight stay) would be involved and that the associated expenditure could be attributed to the reserve.

5.1.1 Number of Visitors to the Yellabinna Regional Reserve

From discussions with business and tourism facility operators in Ceduna and along the Eyre Highway, a profile of tourism expenditure was estimated for visitors to the Yellabinna Regional Reserve. From similar discussions and other sources an estimate was made of the number of visitors to the Yellabinna Regional Reserve. Because expenditures have been estimated on a per vehicle basis, the number of vehicles crossing the Yellabinna Regional Reserve is more relevant for the economic analysis than the actual number of people.

Because no data are collected on the number of vehicles entering the Yellabinna Regional Reserve, it is necessary to estimate the figure from related information and perceptions of those working in the area.

Tourists

Tourists have been divided into two groups according to their point of entry to the Yellabinna Regional Reserve. The first group are those who travel into and sometimes across the reserve from Ceduna along Goog's Track. The Mt Finke visitors' book indicated an annual average of approximately 70-75 people recording their visit at the top of Mt Finke over the period 1989-1998. On the basis that this would represent around 10 per cent of the visitors actually using Goog's Track and that there is likely to be an average of 2.5 people per vehicle, there was estimated to be approximately 300 vehicles per annum entering the Yellabinna Regional Reserve along Goog's Track. The second group are those who travel along the northern boundary of the reserve or make shorter trips into the reserve for bird watching, etc, without necessarily making a complete crossing. There was estimated to be an average of 6 vehicles per week in this group (ie 300 vehicles per annum).

On the basis of these estimates, it is assumed, for the purpose of this analysis, that there are approximately 600 vehicles per annum crossing, or at least entering, the reserve for recreational purposes. Further, as there is likely to be an average of between 2.5 and 3 people per vehicle, the number of tourists visiting the reserve each year could be between 1,500 and 1,800.

Use by Aboriginal Communities

Travel by members of the Aboriginal community, particularly between Yalata and Oak Valley, is likely to be the highest usage of the reserve by any one group. From discussions with Mr Bob Ware it was estimated there would be an average of around 10 vehicles per day during the ceremonial times of the year. At other times of the year there would be an average of 10 vehicles per week. In total this equates to approximately 800 vehicles crossing the Yellabinna Regional Reserve each year. Note that because the track used to cross the Yellabinna Regional Reserve forms the border with the Nullarbor Regional Reserve, the same estimated impacts were used in the assessment for the 10-year review of the Nullarbor Regional Reserve (EconSearch 1999). Any future studies considering the aggregate economic impact of the Yellabinna and Nullarbor Regional Reserves would need to ensure that double counting of this impact did not occur.

5.1.2 Expenditure Profile of Visitors to the Yellabinna Regional Reserve

As with deriving an estimate of visitor numbers, discussions with business and tourism facility operators on the Eyre Highway and Ceduna provided the basis for estimating a profile of tourism expenditure for visitors to the reserve. These estimates are detailed in Table 11.

Table 11 Estimated Expenditure by all Yellabinna Regional Reserve Visitors, 1997/98

Expenditure Item	West Coast Region			Total SA(a)		
	Expenditure per Vehicle (\$)		Total Annual Exp. (b)	Expenditure per Vehicle (\$)		Total Annual Exp. (b)
	Tourists	Aboriginal Communities	(\$'000)	Tourists	Aboriginal Communities	(\$'000)
Fuel	80	40	80	140	40	116
Mechanical repairs	20	10	20	30	10	26
Tyres	30	5	22	40	5	28
Accommodation	50		30	80		48
Food, grocery items	40		24	60		36
Drinks	10		6	20		12
Souvenirs, film, etc.	10		6	20		12
Total	240	55	188	390	55	278

(a) Expenditure in South Australia (including the West Coast region) attributable to visits to the Yellabinna Regional Reserve

(b) Based on 600 tourist vehicles per annum and 800 Aboriginal community vehicles per annum.

The expenditure estimates are presented as expenditure per vehicle and total expenditure. They are provided for both the West Coast region and for South Australia as a whole (including the West Coast region). Tourist expenditure attributable to travel in the Yellabinna Regional Reserve is estimated to be \$240 per vehicle, which in aggregate equates to \$144,000 per year (assuming 600 vehicles entering the reserve per annum). Clearly, expenditure per vehicle by some visitors will be significantly higher than the estimates provided in Table 11, particularly those groups spending more than two days in the reserve. However, the aim has been to provide an estimate of the expenditure profile of the typical or average visitor.

5.1.3 Economic Impact of Visitors

Table 11 provides the estimated profile of final expenditure by visitors (both Aboriginal communities and tourists) to the reserve at both the regional and state levels. With appropriate adjustments, these data can be incorporated into regional (West Coast) and State input-output tables to derive estimates of the economic impact on the regional and State economies. Given the growth of the visitor activity over the 10-year period, impacts can be estimated for that time. The estimated impacts are provided in Tables 12 and 13.

The impacts on the regional economy are reported in Table 12. Expenditures in the West Coast region were incorporated into the regional input-output table. Expenditure by visitors has generated an estimated 2 jobs per annum (direct and indirect) over the 10 year period. These jobs in turn have provided an estimated \$418,000 in household income (1998 dollars).

Table 12 Economic Impact of Yellabinna Regional Reserve Visitors ^(a) on the West Coast Region Economy (direct plus indirect effects), 1989 to 1998

Sector	Employment per annum	Household Income (\$'000)	Value Added (\$'000)
Direct Impact	1	254	495
Indirect Impact	1	115	262
Total Impact	2	369	757

(a) Includes expenditures by Aboriginal communities and tourists.

Note: Totals may not tally due to rounding

Associated with tourist expenditure is value added. Value added is calculated as the value of output less the cost of goods and services used in producing the output. Value added is consistent with standard measures of economic activity, such as gross domestic product and gross state product, and it provides an assessment of the net contribution to regional economic growth of a particular enterprise or activity. Expenditure by visitors to the reserve has added an estimated \$757,000 to the regional economy over the 10 year period.

The economic impact detailed in Table 12 at the regional level was also estimated at the state level. For two reasons the state level impacts are significantly higher. First, some of the expenditures that occur locally (eg fuel and drinks) are on goods that are imported to the region from elsewhere in the State. While there is a partial impact locally through the retailing of the good, the manufacture of the good and its transport to the region are undertaken by businesses outside the region. Second, as discussed at the beginning of Section 5.1, at least one day's travel in South Australia (including an overnight stay) would be involved, on average, in getting to the Yellabinna Regional Reserve. The associated expenditure can be attributed to tourists visiting the reserve but, clearly, this expenditure will occur within South Australia, outside the local region.

The interpretation of results provided in Table 13 is identical to that for Table 12.

Table 13 Economic Impact of Yellabinna Regional Reserve Visitors ^(a) on the South Australian Economy (direct plus indirect effects), 1989 to 1998

Sector	Employment per annum	Household Income (\$'000)	Value Added (\$'000)
Direct Impact	2	431	777
Indirect Impact	2	422	948
Total Impact	4	853	1,725

(a) Includes expenditures by Aboriginal communities and tourists.

5.2 Conservation

The economic value of the Yellabinna Regional Reserve, derived from its environmental amenities, comprises explicit use benefits as well as implicit non-use benefits. Use benefits are those that accrue from the physical use of the reserve, such as touring, camping and adventure treks. The implicit non-use values are more aligned with conservation and environmental preservation.

The conservation use of the reserve is, to some extent, associated with the demand for tourism in the area. While some people may travel to the Yellabinna Regional Reserve for the simple four wheel drive adventure, it could be argued that it is the environmental qualities of the landscape, the night sky and an area unsullied by human habitation that attracts visitors to this remote region.

To this extent, the economic impact of conservation is included in the economic impact of tourism (Section 5.1). There are additional activities directly related to the conservation of the environment of the reserve that have a measurable impact on the economy. These include the production of documentaries, books and photographs on and about the reserve that generates greater knowledge of the reserve and an interest in the preservation of that area. Expenditure on research expeditions to the area, and on the management of the reserve necessary to ensure that the conservation values are protected, adds to this economic impact. The economic impact of management of the reserve and research activity in the area is discussed in Section 5.4.

The economic value of the Yellabinna Regional Reserve, however, is greater than that implied by demand for tourism in the area and expenditures on management and research. In a market economy, issues of valuation and choice between conflicting uses are normally resolved by the interaction of consumers and producers trading goods in the market place. This means that the value of minerals, for example, can be based on the market price of the good that is produced and the wealth that it generates in the economy. However, determining comparable values of non-market uses, such as conservation (including the value of the harmful consequences on these uses from resource utilisation activity) is more difficult.

These types of “goods”, which obviously have a value to society, are not traded in the market place and so do not have an obvious price. They have economic meaning because any thing or action from which individuals gain satisfaction is deemed to be of value. However, because there is no price attached to the “goods”, there are no financial transactions incurred in the “consumption” of those goods and hence there is no economic impact that can be measured.

5.3 Mining

As noted in Section 4.3, mining industry activity over the ten-year period in the Yellabinna Regional Reserve has been limited to exploration activity. Fifty-eight exploration licences for the reserve have been issued by PIRSA to mining companies for the period 1989-1999.

Exploration expenditures were provided by PIRSA, Mineral Resources. The estimates were provided on an expenditure item basis as well as an estimate of expenditures that were made in the region adjacent to the Yellabinna Regional Reserve (ie the West Coast) and those made elsewhere in South Australia. Table 14 provides a summary of that information.

Table 14 Estimated Exploration Related Expenditure in Yellabinna Regional Reserve by Mining Companies and PIRSA/MESA 1990 to 1999 (1998 dollars)

	West Coast Region (\$'000)	South Australia (\$'000)
Fuel	65	294
Accommodation	129	588
Contractors	647	2,941
Wages/salaries	453	2,059
Total	1,294	5,883

The impacts of these expenditures were estimated at both the regional and state levels and are provided in Tables 15 and 16 respectively. Just over 20 per cent of total expenditures are estimated to occur in the regional economy. Consequently the local impacts are relatively small. At the state level (Table 16) exploration activity is estimated to generate the equivalent of 11 jobs per annum and, over the 10 year period, has generated over \$4 million in household income and \$7.3 million in value added.

Table 15 Economic Impact of Mineral Exploration on the West Coast Region Economy (direct plus indirect effects), 1990 to 1999 (1998 dollars)

Sector	Employment per annum	Household Income (\$'000)	Value Added (\$'000)
Direct Impact	2	829	969
Indirect Impact	1	222	520
Total Impact	3	1,051	1,489

Note: Totals may not tally due to rounding

Table 16 Economic Impact of Mineral Exploration on the South Australian Economy (direct plus indirect effects), 1989 to 1998 (1998 dollars)

Sector	Employment per annum	Household Income (\$'000)	Value Added (\$'000)
Direct Impact	6	2,694	4,097
Indirect Impact	5	1,327	3,239
Total Impact	11	4,021	7,336

Note: Totals may not tally due to rounding

5.4 Management and Research

Although management and research may facilitate current and future utilisation of the resources of the Yellabinna Regional Reserve, the direct economic impacts of management and research arise from the expenditures incurred in undertaking these activities.

As well as expenditure on research there are also associated expenditures on the maintenance of public services, infrastructure and facilities (including roads, signs, emergency search, rescue and medical services and other policing capabilities).

Information was sought from various sources on these different categories of expenditure. Generally, the data could only be provided as an estimate as expenditure has not been recorded in a way consistent with the boundaries of the reserve.

Table 17 Management and Research Activity in the Yellabinna Regional Reserve

Activity	Source	Notes
Cost of management of the Yellabinna Regional Reserve	Ross Allen, DEHAA	Proportion of costs attributable to the reserve has been approximately 20% of the total costs associated with managing the western parks and regional reserves, ie \$45,000 in 1998.
Expenditure for the Insurance Risk Management Fund	Maureen Skinner, DEHAA	Over the ten years to December 1998 no expenditure could be directly attributable to the Yellabinna Regional Reserve.
Research Activity	Mark Wilson DEHAA	Biological survey conducted prior to the proclamation of the reserve. No expenditure could be attributable to the Yellabinna Regional Reserve.

Based on the information presented in Table 17, it is clear that expenditure on management and research activity in the Yellabinna Regional Reserve is very small and has a negligible impact on the economies of both the region and the State.

5.5 Aggregate Economic Impact of Industries Utilising the Resources of the Yellabinna Regional Reserve

As noted in the sections above, it is the visitor and mineral exploration activities only that are currently generating quantifiable economic impacts. These estimated impacts are summarised in Table 18, where impacts at the regional level and the rest of the State are specified for each of the three economic indicators, these being value added (gross state product), employment and household income.

Table 18 Economic Impact of Activities Utilising the Resources of the Yellabinna Regional Reserve (direct plus indirect effects), 1989 – 1998

	Employment per annum	Household Income (\$'000)	Value Added (\$'000)
West Coast	8	3,125	4,874
Elsewhere in SA	7	1,749	4,187
Total SA	15	4,874	9,061

Annual Gross State Product (GSP) in South Australia is currently more than \$38 billion. Based on the data in Table 18, the economic activity of the Yellabinna Regional Reserve has contributed approximately 0.002 per cent of GSP on an annual basis.

6. Resource Use Conflicts and the Impact of Development Initiatives

There are currently low-level resource use conflicts in the Yellabinna Regional Reserve. There is a minor threat to the conservation values of the reserve resulting from the increasing use for adventure tourism, and the growing interest and prospectivity for mining.

The areas of potential future conflict can be summarised as follows:

- Mining and tourism - this conflict is likely to arise only to the extent that demand for tourism in the area is linked to the conservation value of the regional reserve (see “mining and conservation” below). Other aspects of mining industry activity, particularly road building and maintenance, may increase the total level of tourism activity.
- Mining and conservation – although there has been no mining activity in the area over the past 10 years there has been notable exploration activity. Some 1,059 drill holes and associated pads and 65 km of cross-country track were constructed and rehabilitated over the 10-year period. The disturbance to flora has been limited to the areas used for campsites, equipment storage and minor exploration activity. The construction of exploration tracks can interfere with the home range of small mammals, reptiles and invertebrates. Although there is potential for future mining industry activity in the reserve, it will almost certainly be restricted to geographic areas extremely small in size relative to the total area of the reserve. As long as construction of tracks and mineral exploration is at a low level and does not occur where small populations of species of conservation significance exist, then the impact should remain minimal. For this reason future mining industry activity is likely to detract little from the conservation value of the reserve.
- Tourism and conservation – as noted above there may be a threat to conservation values resulting from the increasing use of the reserve for adventure tourism. There does exist the possibility for future conflict between tourism and conservation as vehicle accessibility to the reserve improves and as the demand for the wilderness experience increases. The South Australian Tourism Commission has identified the attributes of “unspoilt nature”, “heritage and culture” and “accessibility” as three of the four key strengths of tourism that this State has to offer. Areas like the Yellabinna Regional Reserve are likely to be promoted as tourism destinations that offer these attractions. However, the results of this type of promotion could conflict with the attribute of “unspoiled nature” if access and tourism behaviour were not properly managed.
- Other likely conflict areas relate to tourism, mining and the “heritage and custom” attribute of the reserve. Currently, the Yellabinna Regional Reserve is subject to overlapping Native Title claims. If any of these claims were successful, tourism access and mining related activities would have to coexist with an increased Aboriginal interest.

It has been beyond the scope and resources of this study to determine the full economic value of the conservation attributes of the Yellabinna Regional Reserve. While the measurement of tourism and mining use values are relatively straightforward, the estimation of conservation values is more problematic. Nevertheless, it is important to keep in mind the possible need to include such assessments in future reviews of the reserve. This is particularly so should tourism increase to such an extent that the conservation values of the reserve are compromised, or if alternative industries, such as mining, are developed in the region which conflict with current uses of the reserve. The issues of future assessment are taken up in Section 8.

7. Economic Outlook

Recent economic indicators for South Australia (*South Australian Economic Indicators - ABS; Trends: A Bulletin of Economic Development in South Australia - Bank SA*) reveal steady growth in the State's economy, as measured by output and final demand. However, the rate of increase in these indicators is declining and below national trends. The growth in final demand through the year to the December quarter 1998 was 1.5 per cent compared with the national rate of 4.5 per cent. Over the last decade, South Australian output has risen by an average of about 1.0 per cent per annum, significantly below the national average.

However, the short- to medium-term outlook for the State and National economies is not as bright. As reported in the Reserve Bank Bulletin (August 1998), growth in output of the Australian economy is now slowing from the solid pace recorded during 1997 and into the early part of 1998. There have been a number of signs that the economy is easing back to a more moderate pace of growth. According to the national accounts, there was a sharp slowing in private spending in the March quarter (despite the increase in South Australia), while an unusually large volume of output was absorbed by stockbuilding. The major dampening influence on growth has been the turnaround in the external sector, evident in weakening export volumes and declining commodity prices. The deteriorating external influence, set to continue with the downturn in Japan, has also had an adverse impact on business and consumer confidence. The Australian economy is likely to experience a period of below-trend growth while these factors remain in place.

These general macroeconomic conditions are likely to have an influence on the economic activity associated with the resources of the Yellabinna Regional Reserve. As well there are industry and sector specific issues that are also likely to influence future utilisation of the resources of the reserve. In Sections 7.1 to 7.3 these issues are discussed in turn for tourism, conservation and mining industry uses.

7.1 Tourism

The 1992 Arthur D. Little Economic Development Strategy Study highlighted the importance of tourism to South Australia. The report stated: "The tourism industry in South Australia is a major contributor to the economy – in terms of dollars spent by tourists, the exports that expenditure represents and the jobs that it creates. As such, it deserves a central place in the State's future economic development strategy".

The tourism industry in South Australia, however, is dependent on the growth and development of the State's economy, of the National economy and the economic activity of overseas countries. As noted above, recent strong growth in the national and State economies is set to decline over the medium-term.

Expenditure on recreation is closely linked to income levels, with an estimated 30 per cent of the recreation budget spent on holidays. Wages have continued their steady growth, rising 4.1 per cent nationally and 6.5 per cent locally for the year ending 31 December 1998. Tourism accommodation figures for 1997-98 show an improvement in room occupancy rates for South Australia of 3.6 per cent on the previous year, with an average local occupancy rate of 56.2 per cent.

The issues of employment and job security remain strong influences over domestic tourism growth prospects. As well, the South Australian tourism industry is responsive to changes in the Victorian and New South Wales economies, with these two states being the major source of interstate visitors to South Australia.

The medium-term outlook for the recreational services sector is likely to be volatile with major influences coming from the decline in Asian tourism as a result of the economic crisis in that region, the recent decline in the value of the Australian dollar, and the forthcoming Sydney Olympics.

The South Australian Tourism Commission, in their 1998/99 Marketing Plan, believes that the Asian impact on tourism in South Australia is likely to be relatively light due to the low proportion of Asian visitors to this State. They will be targeting Europe and the United States where the affordability of Australia as a destination will increase due to the relatively low value of the Australian dollar.

As noted in Section 4.1, there are a few key factors that will lead to increased demand for remote area travel to places like the Yellabinna Regional Reserve. These include:

- greater leisure time;
- improving disposable income;
- advances in four wheel drive vehicle technology and comfort;
- improving infrastructure and vehicular access to the Region; and
- increasing knowledge about and interest in the area.

The first two factors, at least, are likely to be directly influenced by the prevailing economic conditions in South Australia and the nation as a whole, while the latter three factors may be affected indirectly by the general economic climate.

7.2 Conservation

Increased awareness of the unique geological characteristics of the Nullarbor and Yellabinna environment, together with a world wide trend of increasing natural areas lost or degraded through economic development and growth, means there will be an increasing demand for the conservation amenities of areas such as the Yellabinna Regional Reserve. These remote wilderness areas provide a sanctuary for many native species of flora and fauna. While the demand for conservation amenities will be reflected partly in the tourism activity to the Reserve, the conservation value will also manifest as non-use benefits, as described in Section 5. These are the benefits individuals may obtain from environmental resources without directly using or visiting them. They are normally classified into five types (Commonwealth of Australia, 1995):

1. Existence values – the welfare obtained from the knowledge that an environmental resource exists. The concept may also include the benefits obtained from knowing culturally important resources and native flora and fauna are protected.
2. Vicarious values – the welfare obtained from the indirect consumption of an environmental resource through books and other media.
3. Option value – the welfare obtained by retaining the option to use an environmental resource at some future date. Option value stems from the combination of the individual's uncertainty about future demand for the resource and uncertainty about its future availability.

4. Quasi-option value – the welfare obtained from the opportunity to get better information by delaying a decision that may result in irreversible environmental loss. This kind of value may be obtained when future technologies or knowledge enhance the value of the natural resource.
5. Bequest value – the welfare that the current generation obtains from preserving the environment for future generations.

Each of these values is relevant for the Yellabinna Regional Reserve, and not only applies to the demand for conservation, but some (eg options values) could apply to other development initiatives such as petroleum exploration and mining.

7.3 Mining

The prospectivity of the Yellabinna Regional Reserve, which includes a significant proportion of the western Gawler Craton, is high. However, although fifty-eight exploration licences for the Yellabinna Regional Reserve have been issued by PIRSA to mining companies for the period 1989-1999, only limited fieldwork and drilling has been undertaken. In total, Government and mining companies in exploring the reserve for potential mineral resources have invested approximately \$6 million over the past ten years.

Most of the exploratory work was done prior to 1995. In recent years, more effort is being expended on interpretation and analysis of aeromagnetic data that was collected by PIRSA Mineral Resources in 1992-94. These interpretations indicate prospective terrain within the Yellabinna Regional Reserve for metallic minerals (including copper, gold, silver, lead, zinc, nickel, and chromium), industrial minerals (mineral sands) and coal. Systematic exploration for gold, copper, silver and other base metals has intensified since the announcement of significant gold findings in the Tunkilla Shear Zone adjacent to the eastern boundary of the reserve.

An increase in exploration activity is expected over the next ten-year period. However, native title issues, costs of exploration (coupled with relatively low commodity prices) and limited infrastructure is generally restricting further exploration and development by mining companies in the short to medium term.

There is no perceived petroleum potential by industry in the Yellabinna Regional Reserve because of the nature of the rock types in the area.

The continuing growth in global minerals and energy supplies, coupled with slower average rates of world economic growth, are expected to constrain world prices for most minerals and energy commodities over most of the period to 2004.

Australia will be an important contributor to the expected growth in global minerals supply, and Australian mine production is forecast to grow significantly as production from recently commissioned new mine developments and others at advanced stages of planning reach full capacity. However, low world prices are restricting exploration and further developments in mining and processing.

Over the medium term, average prices received by Australian minerals and energy exporters are projected to fall by over 12 per cent, sustaining pressures on the industry to further reduce costs of production to maintain its margins and international competitiveness.

7.4 Summary

While the prospectivity for metallic minerals and mineral sands in the Yellabinna Regional Reserve is high, and there has been increasing interest in further exploration, it is impossible to provide any meaningful quantitative estimates of future levels of activity. As noted above, Native Title issues, costs of exploration (coupled with relatively low commodity prices) and limited infrastructure is generally restricting further exploration in the short to medium term.

There are no indications that resources for management of the Yellabinna Regional Reserve are likely to increase substantially above present low levels. There are two implications from this. First, economic impacts from expenditures associated with management and research in the reserve are unlikely to increase significantly in the short to medium term. Second, expansion of tourist activity in the reserve is partly dependent on increased resources for the management and infrastructure in the region. Without such resources, tourism activity is unlikely to increase at more than its current low rate of growth.

8. Recommendations on Data Requirements and Analytical Frameworks for Future Ten-Year Reviews of Regional Reserves

8.1 Data Requirements

8.1.1 Tourism

Some of the basic information that needs to be collected on a regular basis includes:

- Visitor numbers
- Length of stay
- Expenditure profile
- Origin and destination
- Purpose of trip
- Demand for infrastructure/facilities

8.1.2 Conservation

Collecting data on the conservation values of the Yellabinna Regional Reserve is a far more difficult task. Clearly, any such work should be conducted in conjunction with monitoring and assessment of area's conservation status.

Evaluation studies involving the assignment of values to non-market goods and services are notoriously difficult and time consuming. With an on-going world-wide decline in areas of wilderness, wilderness areas such as that found in the Yellabinna Regional Reserve will become increasingly valuable because of their scarcity value.

Because any significant future resource use conflict in the Yellabinna Regional Reserve is likely to involve the conservation value of the area, it is important that resources be devoted to proper assessment of conservation values.

8.1.3 Mining

Monitoring of mining activity should be done in conjunction with PIRSA. Data required include:

- Production and value of production
- Expenditure on exploration, including rehabilitation
- Likely timeframes for future exploration
- Likely timeframes for future resource extraction

8.1.4 Management and Research

There is currently no management plan in place for the Yellabinna Regional Reserve and this would seem to be a fundamental requirement for efficient and effective management of the reserve. Flowing from the development of a management plan would be the development of systems to provide the necessary information about the resources being used to manage the reserve. The type of information likely to be required would relate to:

- Share of administration costs
- Specific projects
- Research activity
- Rescue, policing

8.2 Analytical Framework for Future Ten-Year Reviews

8.2.1 Preferred Analytical Framework

Current legislation requires that economic assessment of the regional reserves provide a statement of the economic impact of utilisation of the resources of the reserve. Although this is of intrinsic interest, it only tells part of the story.

In particular, an assessment framework is needed that has direct application to the management decision-making environment. Such a framework would enable the comparison of costs and benefits (to society) of alternative management scenarios, ie existing management regime against possible alternatives. As described in Section 8.2.2, it is important to include environmental valuation in the analytical framework.

The analytical framework would require the following types of outcomes:

- The current economic contribution to the State of the regional reserve under current management arrangements. This information could be provided in terms of the type of economic indicators presented in this review, although careful identification of the costs and benefits of each activity would be needed.
- The future economic contribution to the State of the regional reserve under current management arrangements. Forecasts of future utilisation of the regional reserve could be made to give a profile of activity over a certain number of years (say 10 or 20) under current management arrangements.
- The future economic contribution to the State of the regional reserve under alternative management arrangements. A time profile of activity over a certain number of years (say 10 or 20) under alternative management arrangements could be estimated and then comparisons made with the current arrangements.

8.2.2 Importance of Recognising Environmental Values

To measure the economic impact of an industry utilising the Yellabinna Regional Reserve, it is necessary to quantify the changes in the financial wealth and employment that the resource use generates in the economy. However, it is also important to account for changes in environmental qualities that constitute part of the wealth enjoyed by a community.

In many instances, this value may only become apparent when the environmental qualities are lost or degraded. Air or water pollution for example, could impose large costs on society in financial terms due to health costs and avoidance costs. Human activities ultimately depend to a certain extent on the environment and this includes the production of market goods and services encountered in everyday life. The economic consequences of changes in environmental qualities are usually very complex and difficult to measure.

Where there are conflicting uses of the resources of the reserve, such as mining, tourism or conservation, it is important to measure the relative values that these uses derive for society. Despite the difficulties in quantifying environmental and tourism benefits, there are methods that are used to estimate and express these in monetary terms so that they can be used in decision-making. Such values can be revealed by an individual's willingness to pay to obtain those goods and services, or willingness to accept compensation for the loss of goods and services. There are a number of well developed techniques that estimate society's willingness to pay for some environmental benefit and are described in various publications, including Commonwealth of Australia (1995) and Smith (1996). A number of examples and references of such techniques being applied in valuing Australian natural areas are cited in NSW Environment Protection Authority (1995).

An example pertinent to the Yellabinna Regional Reserve is described in Delforce *et al* (1986) in which the economic values of two conflicting land uses of the Flinders Ranges in South Australia were measured and compared. The tourism value of the area was measured in terms of actual expenditure and a willingness to pay for access through some of the pastoral leases. This was compared to the perceived production losses and other costs due to tourism to identify the socially optimum policy for the area. It was concluded that greater control over tourism through the pastoral leases was economically desirable.

The need to determine economic values of the environmental amenities and the conservation benefits of the reserve only arises if there are conflicting uses of the region and decisions have to be made on who should use the environmental resources, and how, where and when they are to be used.

If the effects of human activity on the natural environment are ignored and the values that people place on conservation and such uses are overlooked, then there is a danger that decisions regarding the allocation and use of the resource will not be in the best interest of society.

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Attachment 1 Regional Input-output Table

1. Overview of Input-Output Analysis

Input-output analysis provides a comprehensive economic framework extremely useful in the resource planning process. Broadly, there are two ways in which the input-output method can be used.

First, the input-output table provides a numerical picture of the size and shape of the economy and its essential features. The input-output transactions table can be used to describe some of the important features of an economy, the interrelationships between sectors, and the relative importance of the individual sectors.

Second, input-output analysis provides a standard approach for the estimation of the economic impact of a particular activity. The input-output model is used to calculate industry multipliers that can then be applied to various development scenarios.

2. Model Development

The input-output table for the West Coast was constructed using the GRIT (Generation of Regional Input-output Tables) method supplemented by data gathered from a variety of other sources. A research group at the University of Queensland developed the so-called GRIT method, appropriately termed a "hybrid" method which utilises local data and computer methods to generate tables. It allows the analyst to exercise judgement as to how much "hard" data are needed to construct a suitable table. In addition, analysts can focus resources on the important elements or sectors of the economy. This method has come to dominate the construction of regional input-output tables in Australia. An input-output table had already been constructed by EconSearch for the State of South Australia and was made available for this study.

The preliminary West Coast table was developed applying the GRIT procedure and subsequently refined applying various adjustment procedures. The computer program to make these adjustments is 'Input-Output Analysis Version 7.1', developed by West (1993). This software was also used to calculate industry multipliers and estimate the impacts of the various Yellabinna Regional Reserve activities at the regional level.

As noted earlier, data for the model were collected from existing sources such as Australian Bureau of Statistics, PIRSA, ABARE, DEHAA, industry reports, industry associations, etc.

The input-output model provides a consistent base to present the available economic data for the region and allows the significance of activities utilising the resources of the Yellabinna Regional Reserve to be compared with each other and with other sectors in the regional economy.

2.1 Linkages Between Sectors

The standard approach for the estimation of the regional economic impact of a particular activity, such as agriculture, is to employ *input-output analysis*. The input-output model conceives the economy of the region as being divided up into a number of sectors, and this allows the analyst to trace expenditure flows. To illustrate this, consider the example of a large dairy farm which, in the course of its operation, purchases goods and services (such as fertiliser, feedstuffs, animal health products, building requisites) from other sectors and employs its own labour force. The direct

employment created is regarded in the model as an expenditure flow into the household sector, which is one of several non-industrial sectors recognised in the input-output model.

Upon receiving expenditure by the dairy, the other sectors in the regional economy engage in their own expenditures. For example, as a consequence of winning a contract for work at a dairy, a local construction company buys materials from its suppliers, and labour from its own employees. Suppliers and employees in turn engage in further expenditure, and so on. These *indirect effects*, as they are called, are part of the impact of the dairy on the regional economy. They must be added to the *direct effects* (which are expenditures made in immediate support of the dairy activity itself) in order to arrive at a measure of the total impact of the irrigated dairy development.

Unfortunately, these indirect effects do not go on indefinitely due to the presence of *leakages*. In the context of the impact on a *regional* economy, often that of a relatively small region, an important leakage is expenditure on imports, that is, that originate from *outside the local region*.

Thus some of the local expenditure for imports to the local region is lost to the local economy. Consequently, the indirect effects get smaller and smaller in successive expenditure rounds, due to this and other leakages. Hence the total expenditure created in the local economy is limited in amount, and so (in principle) it can be measured.

The performance of the input-output analysis calculations requires a great deal of information. The analyst needs to know the magnitude of irrigated agriculture expenditures and where they occur. Also needed is information on how the sectors that receive this expenditure share *their* expenditures among the various sectors from whom they buy, and so on for the further expenditure rounds.

In applying the input-output model, the standard procedure is to determine the direct or first-round expenditures only. No attempt is made to pursue such inquiries on expenditure in subsequent rounds, not even (for example) to trace the effects in the local economy on household expenditures by dairy farm employees on food, clothing, entertainment, and so on. It is impracticable to measure these effects for an individual case, here the dairy enterprise.

The input-output model is instead based on a set of assumptions about constant and uniform proportions of expenditure. If households in general in the local economy spend (say) 13.3 per cent of their income on food and non-alcoholic beverages, it is assumed that those working in the dairy industry do likewise. Indeed, the effects of all expenditure rounds after the first are calculated by using such standard proportions (*multiplier* calculations).

2.2 Multipliers

Multipliers are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. As well, they can be used to estimate the impact of a change in that particular sector on the rest of the economy. As noted above, detailed explanations on calculating input-output multipliers (and the underlying assumptions) are provided in any regional economics or input-output analysis text book (see for example Hewings (1985), Jensen and West (1986), Midmore and Harrison-Mayfield (1996), Powell et al. (1985), and West (1993)). Suffice to note that they are calculated through a routine set of mathematical operations based on coefficients derived from the input-output transactions table.

2.3 Input-output Transactions Table

The structure and linkages of a local economy can be described with the aid of input-output analysis. Input-output analysis as an accounting system of inter-industry transactions, is based on the notion that no industry exists in isolation.

This assumes within any economy each firm depends on the existence of other firms to purchase inputs from, or sell products to for further processing. The firms also depend on final consumers of the product and labour inputs to production. An input-output transaction table is a convenient way to illustrate the purchases and sales of goods and services taking place in an economy at a given time.

The input-output table for the West Coast provides a numerical picture of the size and shape of the economy and its essential features. Products produced in the economy are aggregated into a number of groups of industries and the transactions between them recorded in the transactions table. The rows and columns of the input-output table can be interpreted in the following way:

- The rows of the input-output table illustrate sales for intermediate usage (to other firms) and for final demand (consumers, exports, capital formation).
- The columns show the origin of the inputs and hence the purchases made at that time (labour, capital and intermediate inputs).
- Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

In summary, the input-output transactions table can be used to describe some of the important features of a regional economy, the interrelationships between sectors, and the relative importance of the individual sectors. The table is also used for the calculation of sector multipliers and the estimation of economic impacts arising from some change in the local economy.