Ceduna Keys

Ceduna Keys Marina & Community Centre Development

ENVIRONMENTAL IMPACT STATEMENT

Executive Summary

CONNOR HOLMES

Prepared for

Ceduna Marina Development Company

248 Flinders Street, Adelaide South Australia 5000.

June 2005

LOCATION

Murat Bay

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This document was written by
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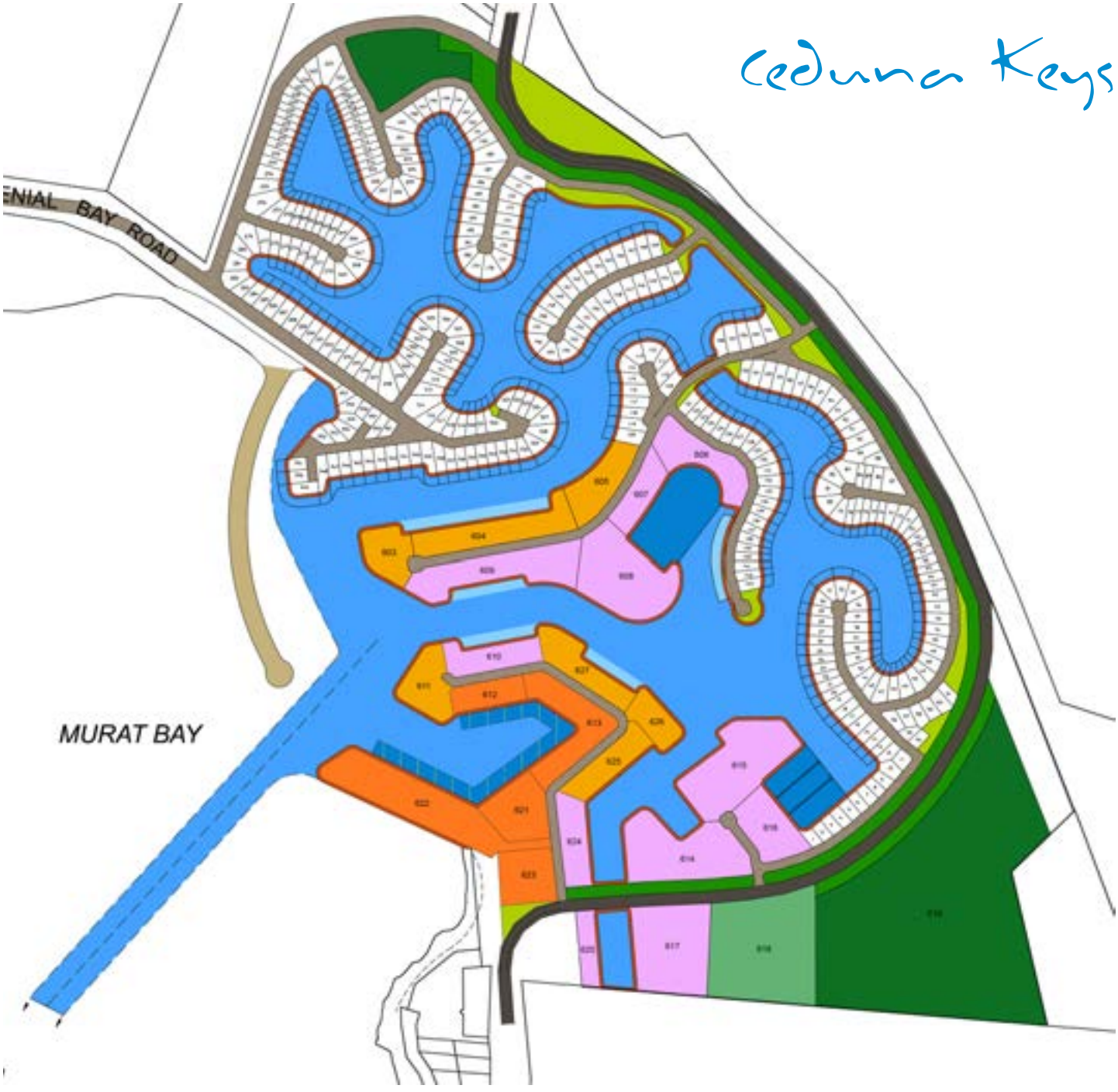
CONCEPT

Plan & Artists Impressions



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PROJECT TEAM

Team Member	*Role*
David Kelsey	Concept Development & Project Initiation
Ceduna Marina Development Company	
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John Chappell	Engineer

CHAIRMAN'S PREFACE

Welcome.

Aerial Photograph of Development Site

The release of this Environmental Impact Statement (EIS) is an important milestone in the creation of the Ceduna Keys Project.

As a result it is the most significant audit ever done on the Ceduna coastal environment.

The project has been developed as a private sector initiative to develop canal and marina living in this desert coastal location.

The project however has a much greater community impact.

- It will expand lifestyle and commercial opportunities in Ceduna and the State of South Australia.
- It will add a Community Centre, including Sporting and Aboriginal cultural interpretive facilities.
- It will aid the development of the vital commercial fishing industry in this area of the state.
- It will encourage the establishment of a Fishing Academy, Tourism and Convention facilities.

The provision of this additional infrastructure goes beyond the scope normally offered by the private sector and will involve negotiation with state and local government bodies to access appropriate grants and assistance.

This will allow Ceduna Keys to achieve its objectives in all parts of this vital multi- faceted project as soon as possible.

I thank the consultants, the Ceduna Council, the Eyre Regional Development Board and the directors of the CMDC Board who have assisted in the preparation of this document and who have worked closely with all agencies to present this EIS for evaluation.

David Kelsey
Chairman CMDC

THIS REPORT

This Report is prepared as an Environmental Impact Statement (EIS) in respect to the Ceduna Keys Marina Development which has been declared as a Major Development by the Minister for Urban Development and Planning under the provisions of Section 46 of the Development Act 1993.

THE PROPOSAL

The proposal is for a coordinated and 'master planned' development comprising a commercial and recreational marina, together with a waterfront residential subdivision comprising some 380 allotments, 250 additional waterfront apartment sites, a community centre providing for a range of cultural, recreational and leisure activities, and tourist facilities including interpretive, accommodation, entertainment and limited retail opportunities focused on convenience shopping.

Whereas the proposal plan initially submitted and the subject of the Issues Paper and EIS Guidelines document showed development along the western peninsula, this component referred to as Release 12 is no longer proposed and is deleted from the plans. This deletion has been in response to matters raised with respect to the environmental sensitivity of this locality and as a result of negotiations in respect of native title.

The proposal also involves the construction of two breakwaters in order to provide shelter to a waterway system via a designated channel, together with the realignment of sections of the Eyre Highway and Denial Bay Road. Extensive infrastructure works are proposed which will include the extension and augmentation of public utilities such as water and electrical power, together with works for stormwater and wastewater collection, treatment and re-use both on the subject land and the adjacent public golf course.

It is proposed to implement the proposed development in 2 main stages over a period of 10 years. The community centre is to be undertaken as part of Stage 1. Negotiations are continuing with relevant stakeholders in order to determine the exact implementation schedule.

Upfront works that are part of the initial stage include the breakwaters, the channel, the waterways, the realignment of roads, the commercial and recreational marinas together with supporting infrastructure services. The first stage of the residential development is to involve the construction and release of 126 allotments plus 180 waterfront apartment sites.

Allotments would be released according to market demand, with initially committed allotments absorbing identified latent demand, with subsequent releases in smaller batches.

COUNCIL'S ROLE & OBJECTIVES

The District Council of Ceduna has taken a leadership role in the economic development of the Far West Coast region of South Australia by initiating and then facilitating a development that would further the burgeoning aquaculture and tourism industries, support the existing fishing industry, respond to the strong demand and preference for waterfront and lifestyle housing and result in a valuable community centre.

The development will provide a focus for significant capital investment in property, industry and public infrastructure.

More specifically, the Council has the following Objectives for this project:

- *to provide a safe haven for the fishing fleet;*
- *to encourage investment in the town and inject vitality into the growing aquaculture and fishing industry;*
- *to capitalise on and encourage further investment of tourism in the area;*
- *to foster self-determination in the areas of cultural interaction and protection;*
- *to strengthen partnerships and further develop and promote the reconciliation process within the community;*
- *to maximise employment and education opportunities for local Aboriginal people and wider community;*
- *to develop appropriate opportunities for industry development in cultural heritage interpretation and cultural tourism.*

Photos of Ceduna Keys Site

SITE SELECTION

In selecting an appropriate site for such a development a range of criteria or tests were applied in order to identify the various cost / benefits of each option. The site selection criteria adopted by the Council sought to identify a site that:

- *was not of high environmental sensitivity or biodiversity conservation value*
- *would enable the restoration of land and minimisation of impacts on the natural environment*
- *was adjacent to or in close proximity to the existing Ceduna township to avoid fragmentation of population and duplication in the provision of goods and services*
- *would maximise the use of existing physical infrastructure and public utilities and assist in the achievement of a 'critical mass' or capacity to increase or improve the current level or standard of provision*
- *would integrate with the existing township of Ceduna in a manner that would enable good access but not compromise the inherent and valued character and amenity of Ceduna*
- *was of a suitable size so as to allow for the provision of a commercial wharf facility, residential development and a community centre in a planned and efficient manner that would not compromise or conflict with existing or future commercial or industrial development*
- *was accessible by the commercial fishing fleet and vessels used in the aquaculture industry, together with recreational craft*

COUNCIL & THE PROPONENT

Following Council's initiation of the proposed development, a preferred Proponent was chosen by Council to proceed with the development subject to various rights and responsibilities as reflected with an initial Heads of Agreement, a Development Agreement, and a Management Maintenance and Monitoring (MMM) Agreement.

The selection of the Proponent was undertaken following a prudential review process pursuant to the provisions set out in Section 48 of the Local Government Act, 1999 for development exceeding $4M in value. The Business Plan arising from this review assessed issues of commercial risk and return.

Council and the Proponent have also negotiated a draft Land Management Agreement (LMA) which will flow on to subsequent purchasers that encumbers the land in respect to the initial construction and management of the development. This LMA is to be prepared as a formally registered Deed Agreement pursuant to Section 57(5) of the Development Act.

In addition to the LMA which is an agreement between the Proponent, the Council and landowners, a Management, Maintenance and Monitoring Agreement is also proposed which shall address a range of matters relating to construction, operational, handover and ongoing obligations. The framework and subject matter for this MMM Agreement is outlined in detail in Section 10 of this report. The MMM Agreement will be formally proposed and affected between parties once approval has been issued for the development.

THE PROCESS

Following declaration of the proposal as a Major Development under Section 46 of the Development Act, the Major Developments Panel (an independent statutory authority) determined the appropriate form of assessment for the development, an EIS in this case. The Panel also issued Guidelines for the preparation of the EIS following the preparation of an Issues Paper which had regard to submissions received as a result of public and Government Agency consultation.

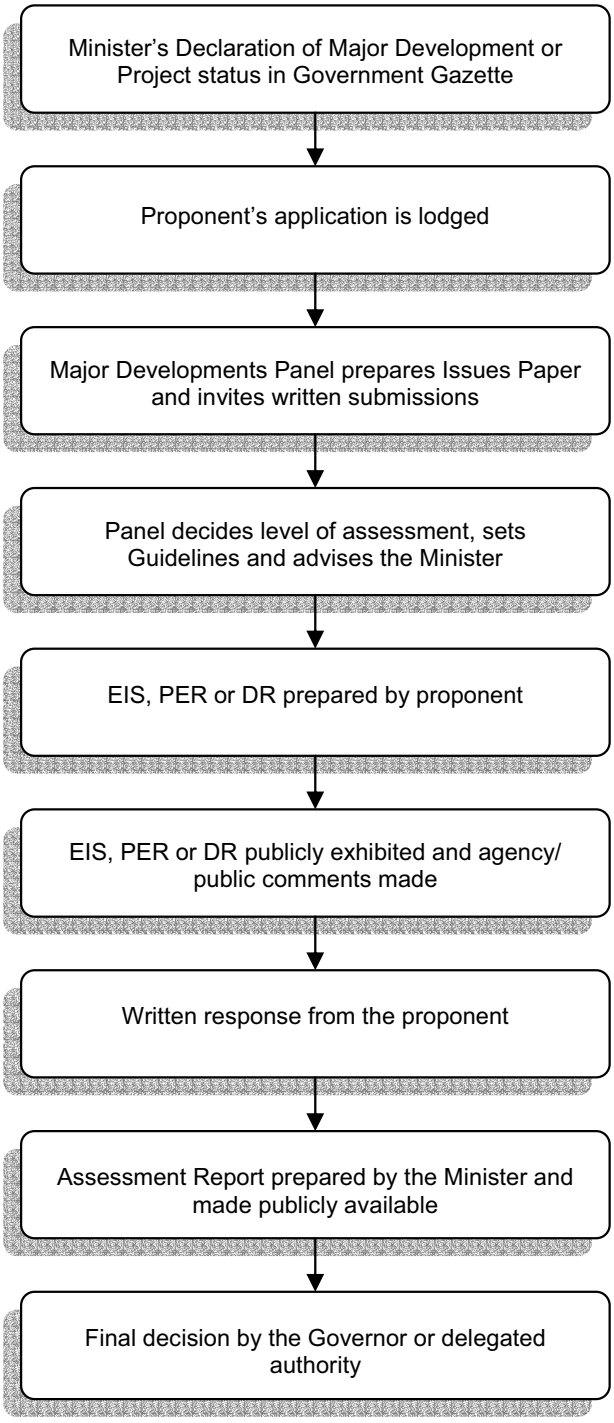
The decision of the Panel to require an EIS (being the most rigorous assessment reporting anticipated under Section 46) was made for the following reasons:

- *The magnitude of the development and the range of activities proposed (including residential, tourism, recreational, commercial and semi-industrial uses);*
- *The general sensitivity of the coastal location;*
- *The potential impacts on coastal processes, the marine environment (including offshore islands) and the community;*
- *Significant infrastructure requirements, especially the provision of an adequate water supply; and*
- *The economic implications and sustainability of the proposal.*

The Guidelines issued by the Major Developments Panel have formed the basis for the preparation of this EIS, which describes what is to be developed, the likely environmental, social and economic effects, and how the project will be managed. A range of other issues in respect to Native Title and Aboriginal Heritage and Government Legislation and Policy are also addressed in this EIS document.

Public Comment is to be called in respect to this EIS via a statutory process conducted by Planning SA. An advertisement is to be placed in State and local newspapers, which will indicate where copies of the EIS are available for inspection and/or purchase. During the nominated exhibition period, written submissions may be made to the Minister for Urban Development and Planning.

The Process



INVESTIGATIONS UNDERTAKEN

In the preparation of this EIS a range of preliminary and supporting investigations have been undertaken by a range of experts in their field. The results of these investigations are presented in the EIS with conclusions drawn as to the likely or anticipated effects arising from this development. The various reports issued by these experts and other supporting documents relied upon in the preparation of this EIS are to be made available as part of the public consultation process.

The following working papers have been relied upon in the preparation of this EIS:

- Engineering Assessment – Dare Sutton Clarke Engineers, August 2004 incorporating Coffey Geosciences Preliminary Geotechnical Investigations
- Preliminary Environmental Assessment – Eco Management Services Pty Ltd, 2004
- Biodiversity Survey, Delta Consulting February, 2005
- An Assessment of Ceduna Keys and Ceduna Coastal Centre Development Plan, Volume 1 & 2 – The South Australian Centre for Economic Studies, February 2001
- Coastal Engineering Study – John Chappell Engineers, 2004

Location of Proposed Development

ENVIRONMENTAL ISSUES

This EIS addresses a range of environmental issues in respect to the construction and management of the proposed development. These issues are

more particularly outlined in some detail under various topics or headings ranging from coastal processes and sea level rise to the management of pest plants and animals.

Significant research has been undertaken and presented in respect to biological processes (marine and terrestrial flora and fauna), water quality in Murat Bay and the waterways, water sensitive urban design and stormwater management, management of wastes and effluent, together with issues of groundwater, effects on land, air quality, noise and energy efficiency.

While the proposed development would have an effect on the natural environment in so far as its physical form and ongoing use is concerned, potential impacts may be successfully avoided, appropriately mitigated and/or suitably managed such that serious environmental harm may not occur. Impacts on and beyond the site of the development are not considered so significant as to not proceed with the development in the form proposed.

In particular the proposed development would:

- suitably accommodate predicted sea level rise with appropriate building levels and engineering responses;
- not result in significant disruption of sand movement and the build up of seagrass such that would impact on the function of Murat Bay and its enjoyment by other users;
- result in some loss of native vegetation, however not of key biodiversity conservation significance;
- result in a relatively minor impact in the context of Murat Bay and the surrounding area in terms of habitat for birds, reptiles and amphibians, mammals and other terrestrial invertebrates;
- not result in significant impact on marine communities beyond the development site in terms of intertidal and subtidal flora and fauna;

COLOUR	ALLOTMENT	AREA	PROPOSED USE	STAGE
	603	5980m²	Medium Density Housing	4 & 5
	604	1.1ha	Medium Density Housing	4 & 5
	605	8100m²	Medium Density Housing	4 & 5
	606	9540m²	Tourist Commercial	4 & 5
	607	5570m²	Tourist Commercial	4 & 5
	608	1.7ha	Tourist Commercial	4 & 5
	609	1.4ha	Tourist Commercial	4 & 5
	610	6770m²	Tourist Commercial	4 & 5
	611	7444m²	Medium Density Housing	4 & 5
	612	5125m²	Marine Commercial	4 & 5
	613	1.2ha	Marine Commercial	4 & 5
	614	1.7ha	Tourist Commercial	4 & 5
	615	1.8ha	Tourist Commercial	4 & 5
	616	8600m²	Tourist Commercial	4 & 5
	617	1.8ha	Tourist Commercial	4 & 5
	618	3.0ha	Sporting and Golf Complex	4 & 5
	619	11.8ha	Future Residential & Sporting	4 & 5
	620	3870m²	Tourist Commercial	4 & 5
	621	8805m²	Marine Commercial	4 & 5
	622	2.0ha	Marine Commercial	4 & 5
	623	7991m²	Marine Commercial	4 & 5
	624	6798m²	Tourist Commercial	4 & 5
	625	6979m²	Medium Density Housing	4 & 5
	626	4904m²	Medium Density Housing	4 & 5
	627	7819m²	Medium Density Housing	4 & 5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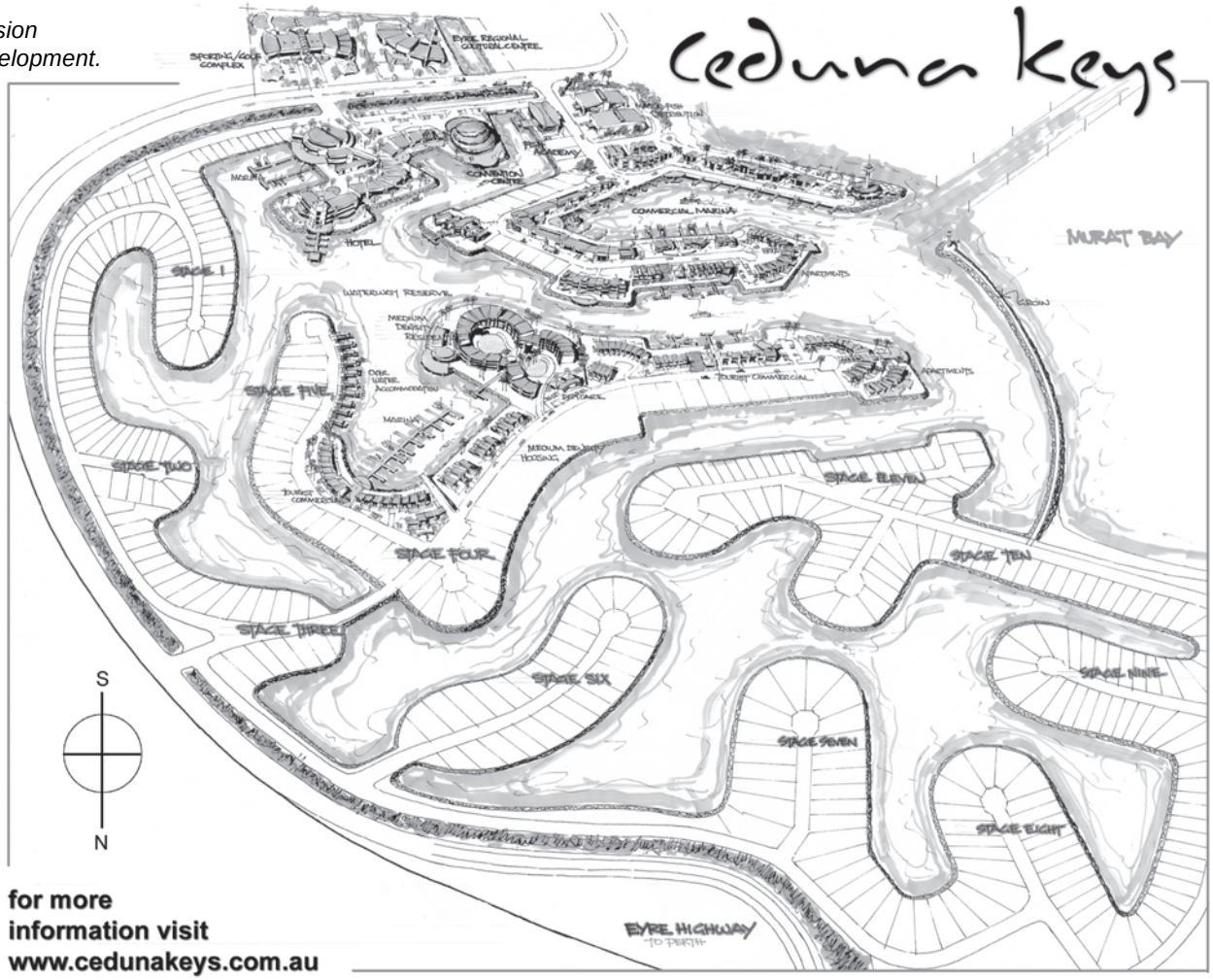
N
STAGE 1
RAILWAY
EYRE HIGHWAY
STAGE 2
STAGE 3
STAGE 4
STAGE 5
STAGE 6
STAGE 7
RECREATIONAL MARINA
RESIDENTIAL MARINA
WATERWAY
RESERVE

- suitably monitor and manage the development of marine biological communities within the marina and waterways of the development;
- achieve and maintain suitable water quality in waterways and Murat Bay via the management of marina activities, with suitable turnover and flushing without mechanical or other artificial intervention;
- suitably manage urban runoff and stormwater with a range of engineering responses including detention basins such that only 20% of total stormwater load in peak periods would be directed to the waterways with such water having passed through gross pollutant traps;
- suitably monitor and protect water quality with a range of management and response measures to be integrated with the South Australian Shellfish Quality Assurance Program (SASQAP);
- implement water sensitive urban design measures including on site water collection and treatment of effluent for reuse;
- not result in the contamination of land or groundwater to the detriment of the natural environment or other users;
- suitably manage waste and effluent both from commercial and recreational vessels within the marina, residential, commercial and tourist uses;
- incorporate suitable landscape planting and revegetation together with management of pest plants and animals within and surrounding the development;
- not result in significant risk in terms of bird strike at the Ceduna Airport;
- seek to limit impacts in respect to air quality and noise both during construction and thereafter; and
- implement energy efficiency approaches in residential, commercial and tourist development.

It is important to consider that the proposed development would not result in a dramatic or unsustainable increase in population within this location. It should be noted that the population anticipated as a result of the proposed development would assist in correcting the decline experienced by Ceduna in recent years.

An Artists impression of the overall development.



SOCIAL ISSUES

As required by the Guidelines document, the EIS addresses the likely social impacts arising from the development on the community both within the development, the town of Ceduna and the surrounding district. Issues ranging from the availability of a construction workforce and impact on local employment, to the effects on existing industries and public infrastructure have been considered and addressed.

More particularly, the proposed development would:

- result in an estimated 130 employees in the first years of the project with a strong representation in terms of semi-skilled operators and labourers;
- assist in increasing employment opportunities for Aboriginal people both in the construction and operational stages of the development;
- change the visual appearance of the locality but nonetheless result in an attractive and pleasant amenity for the enjoyment of all;
- not give rise to operations that may detract from the amenity of the locality in terms of commercial and industrial activities;
- have essentially a residential character typical of a waterway style development with focal points in the marina facilities and other public spaces;
- be integrated with the township of Ceduna via not only the road network proposed but also via linear open space connections that would allow for walking and cycling trails along the coast and through the golf course;
- have a generally positive impact on the lifestyle and character of Ceduna offering increased choice in the housing market and stimulating economic growth;
- suitably manage traffic movements along the Eyre Highway during construction;
- not prejudice nearby communities in terms of access to Ceduna via Denial Bay Road and the rerouted Eyre Highway;
- facilitate the relocation of the Quarantine Station further to the north along the Eyre Highway;
- assist in achieving a scale or critical mass so as to maintain or improve the current level of public and private services offered to the community of Ceduna;
- provide a safe haven for recreational and commercial boating;
- better facilitate the burgeoning tourism industry with an opportunity for a tourism interpretive centre that may act as a hub or focus for visitors;
- not have a deleterious effect on the shellfish industry conducted in Murat Bay given the measures to ensure water quality;
- not frustrate or impact upon the continued use of adjoining land including the Aboriginal homeland settlement at Yarilena;
- provide public access through the development and access to a range of facilities including public open space, sporting and recreational, tourism and community facilities; and

The proposed development will require significant investment in infrastructure such as roads, electrical supply, water supply, sewage treatment and the like. Development of the scale proposed will assist in the delivery of services to the standards expected by the community in terms of contributions towards extensions and augmentation. The proposed development has taken into account the economic feasibility of providing such services and the costs associated with extension and augmentation.

Council is to be protected in terms of the risks associated with long term costs of management and maintenance of the facilities to be developed such as breakwaters, revetment walls and waterways. The Proponent and the Council will enter into a Management, Maintenance and Monitoring Agreement that will identify the standards of repair, frequency of maintenance and appropriate response contingencies for a specified period of time.

It should also be noted that the proposed development will generate a significant rate basis

NATIVE TITLE & ABORIGINAL HERITAGE

from the property investment that should provide the necessary capacity to undertake works as required. The Development Agreement between Council and the Proponent specifies that a minimum of 15% of rates generated within the proposed development is to be spent within the development.

The facilities to be provided to the fishing and aquaculture industries will significantly enhance the existing operation of these industries and provide the necessary infrastructure to enable the growth and diversification of these industries. In combination with the facilities proposed at Thevenard, Ceduna will reduce the current leakage in economic activity that is occurring as a result of not having suitable facilities.

Such growth in the fishing and aquaculture industries will occur within existing legislative and management regimes put in place by the State in so far as achieving a sustainable use of resources through long term management. These checks and balances will assist in ensuring that the natural resources available within the region continue to be accessed in a sustainable manner.

Based on the fieldwork and research undertaken to date, it would appear that the proposed development would not seriously impact upon designated sites of Aboriginal cultural heritage significance. Notwithstanding these preliminary investigations, a more comprehensive archaeological and anthropological survey and clearance is to be undertaken according to a process chosen by the aboriginal communities.

The District Council of Ceduna and the Proponent have commenced negotiations with the aboriginal community for the progression of the development over portions of the land that are the subject of native title claims. Due process is being observed in pursuing the ability to develop on this land, which has included consideration, by the National Native Title Tribunal, with discussions continued under the Statewide Indigenous Land Use Agreement (ILUA) process.

Parcels subject to Native Title negotiations

LEGISLATION & GOVERNMENT POLICY

From preliminary investigations, the proposed development does not trigger the need for an approval under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 in terms of the proposal being a controlled action.

Some bird species identified within the Biodiversity Survey are identified as species of significance under this Act, albeit that the extent of disturbance resulting from this development in context within which these species are found is considered to be minor. The species referred to within the study are not opercular to the development site and are found more generally within the recorded area of a 1-degree block (approximately 3600 square kilometres).

The proposal is considered to be consistent with and would further the achievements of the State Strategic Plan in terms of having a generally positive outcome in relation to the six key topics:

- Growing prosperity;
- Improving wellbeing;
- Attaining sustainability;
- Fostering creativity;
- Building communities; and
- Expanding opportunities.

The proposal is also considered to be in accord with the objectives and strategies identified within the Planning Strategy for Regional South Australia as addressed in some detail within this EIS. So too, the proposal is considered to be generally in accord with and not seriously at variance with the relevant provisions of the Ceduna (DC) Development Plan.

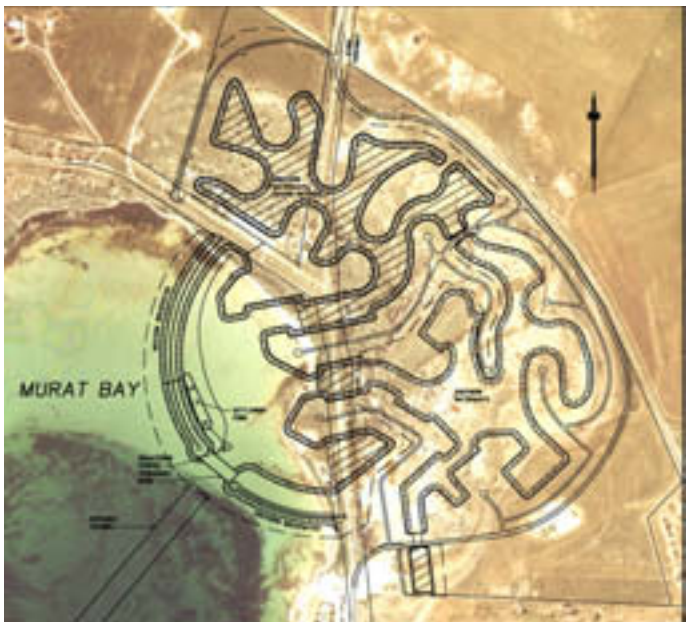
Appropriate changes are also to be pursued to the Development Plan in order to provide a more detailed and clearer framework within which the development may occur over time, including restrictions in terms of the amount of retail floor area allowed outside the Town Centre.

Ceduna Keys Site

Construction Sequence Stage A

Construction Sequence Stage B

Construction Sequence Stage C



Construction Sequence Stage D

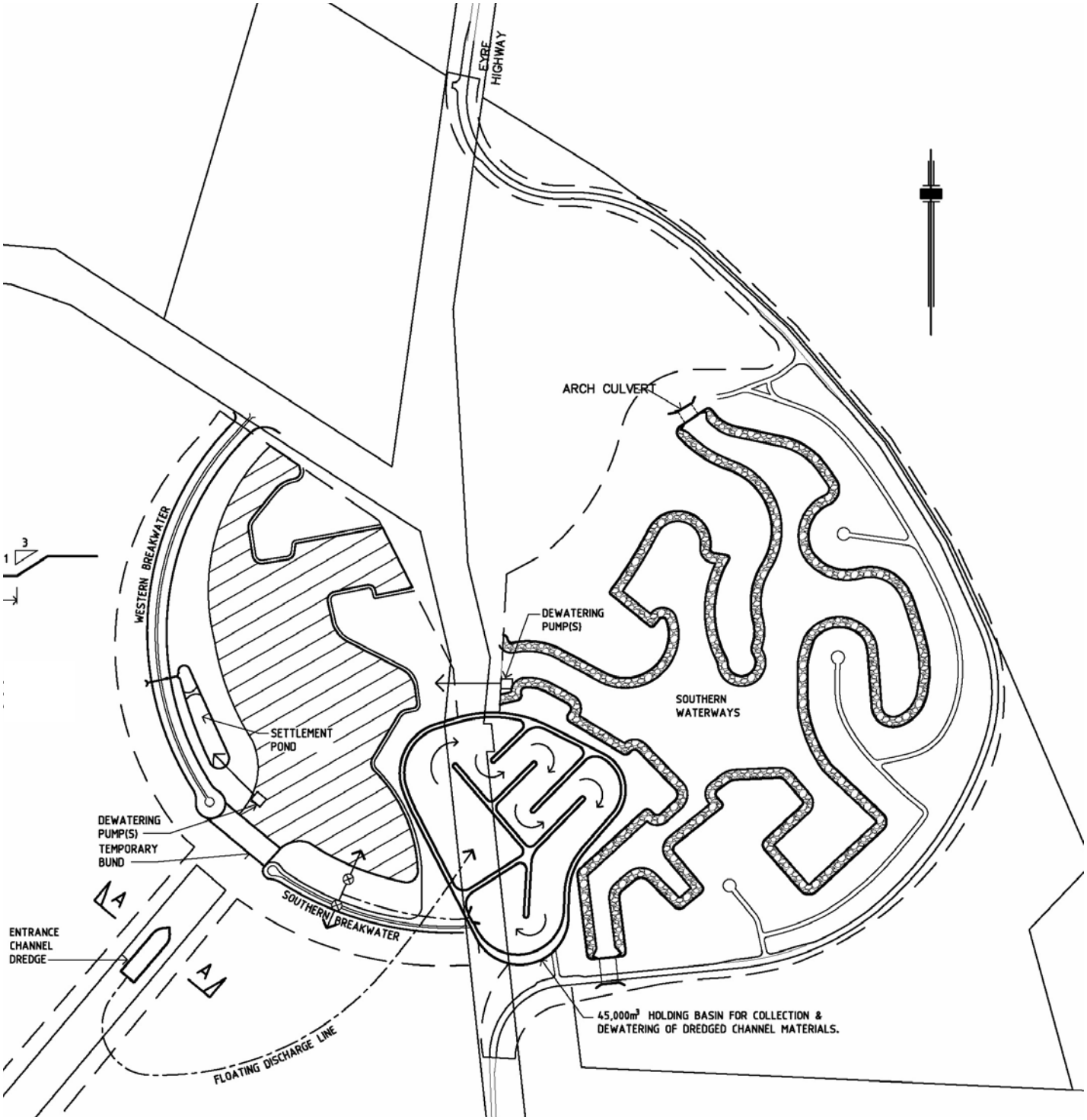
ENVIRONMENTAL MANAGEMENT - CONSTRUCTION & OPERATION

A key component of this Environmental Impact Statement is providing the preliminary structure and details under which the proposal is constructed and thereafter operated.
An Environment Management Plan (EMP) is to be prepared following the EIS which will address in particular detail the manner in which construction will occur and the ongoing operation of the facility including monitoring and management/response contingencies to avoid, manage or mitigate environmental impact.

The Construction component of the EMP will address:

- construction sequence (a four stage construction sequence is proposed);
- soil erosion and drainage management;
- entrance channel & breakwater construction;
- the potential for acid sulphate soils;
- storage and disposal of spoil;
- weed management;
- protection of people and property;
- protection of existing vegetation; and
- monitoring and reporting during construction.

EXTENT OF DREDGING AND LOCATION OF THE ON-SHORE HOLDING AND SEDIMENTATION BASINS



The Operational component of the EMP will address the following:

- infrastructure maintenance;
- spill contingency;
- floating debris;
- vessel speed control;
- terrestrial and marine pest plant and animal control;
- maintenance dredging; and
- management and reporting.

While the general approach and desired outcome or objective is outlined within the EIS, the exact detail in terms of implementation will be more particularly documented within the EMP prior to the call for tenders for construction. The EMP will form an integral component of the project management contract to be observed and satisfied during construction and thereafter.

CONCLUSION

The proposed Ceduna Keys Marina development represents a significant opportunity for Ceduna to be a major focus for economic development and social activity in this Far West Coast region of South Australia.

As the proposal will be centred on the development of a commercial marina and wharf facilities, it will facilitate and support a burgeoning aquaculture industry, the existing fishing industry and a very important tourism industry at the gateway to and from the west coast of South Australia.

In combination with a coordinated waterway residential development and a comprehensive community centre incorporating cultural, recreational and leisure facilities, significant social and economic benefits may be derived in a manner that minimises and manages environmental impacts.

The proposal is a rare opportunity to facilitate a multi facetted development that will, in its final form, satisfy a range of existing and anticipated needs within the community in terms of a living, working, recreational and cultural environment. The economic capacity of a project of this nature provides the necessary vehicle to provide a range of uses and activities that may otherwise not be provided in a town such as Ceduna unless significant public expenditure is committed.

If the opportunity to attract investment and industry in Ceduna is not pursued, there is a significant risk that the fishing and aquaculture industry will be attracted to other regional areas such as Western Australia. Fishing industry representatives have indicated that communities such as Esperance are already actively trying to attract a large proportion of the South Australian fishing fleet to Western Australia. Ceduna, and South Australia simply cannot afford any more leakage in terms of investment and employment particularly, when the industry is making a significant contribution to the State's GDP.

The ability both economically and physically to provide a suitable marina facility for the commercial fishing and aquaculture fleet would be frustrated should this development not proceed. The proposal presents a facility that will meet the existing and future needs of both the fishing and aquaculture industries in a manner that is efficient and effective in providing the necessary safety and convenience to operators. A facility elsewhere may not be able to satisfy identified need to the same extent.

The 'master planned' approach to this proposal will provide the necessary structure and guidance to the staged implementation of this development. In the absence of an overall approval for this development, individual components may be proposed and occur in a less than optimum manner such that the same level of efficiencies and economies, particularly in respect to infrastructure provision, may not be achieved. Approval as a Major Development will provide the necessary certainty and flexibility that will satisfy private, government and in particular, community interests.

WHERE TO FROM HERE?

As provided for by Section 46 of the Development Act, the Major Projects Development Panel as an independent statutory authority, has set Guidelines for the preparation of the EIS following the consideration of public and agency comment in respect to an Issues Paper. The EIS has been prepared in accordance with the Guidelines.

There will be a further opportunity for public comment on the project once the EIS is released for public exhibition. Submissions are to be directed to the Minister for Urban Development and Planning, the Hon. Paul Holloway, MLC. A public meeting will also be held during the exhibition period.

Submissions received during the exhibition period will be provided to the Proponent and a written response invited. The Response Document will then be provided to the Minister together with an Assessment Report, with a recommendation to the Governor for the final decision. The Response Document and the Assessment Report will be made publicly available.

OTHER DOCUMENTS

Ceduna Keys
Marina & Community
Centre Development

Printed

Volume 1 - Environmental Impact Statement. (ISBN: 0-9757783-0-7)

Volume 2 - Working Papers. (ISBN: 0-9757783-1-5)

Digital

CD - Volume 1, Volume 2 and Executive Summary (ISBN: 0-9757783-3-1)

Cedunna Keys

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Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

1. INTRODUCTION

1.1 Overview

The proposed Ceduna Keys Marina development represents a significant opportunity for Ceduna to be a major focus for economic development and social activity in this Far West Coast region of South Australia.

As the proposal will be centred on the development of a commercial marina and wharf facilities, it will facilitate and support a burgeoning aquaculture industry, the existing fishing industry and a very important tourism industry at the gateway to and from the west coast of South Australia.

In combination with a coordinated waterway residential development and a comprehensive community centre incorporating cultural, recreational and leisure facilities, significant social and economic benefits may be derived in a manner that minimises and manages environmental impacts.

A copy of the location plan at Figure 1.1 and the 'master plan' for the proposed development is provided at Figure 1.2 overleaf.

Whereas the proposal plan initially submitted and the subject of the Issues Paper and EIS Guidelines document showed development along the western peninsula, this component referred to as Release 12 is no longer proposed and is deleted from the plans.

This deletion has been in response to matters raised with respect to the environmental sensitivity of this locality and as a result of negotiations in respect of native title.

This report explores the various environmental, economic and social impacts anticipated as a result of this 'Major Development' as set out in the 'Guidelines' document prepared under Section 46 of the Development Act, 1993.

1.2 Declaration as a 'Major Development'

On 23 October 2003, the Minister for Urban Development and Planning ('the Minister') made a declaration in the Government Gazette for the proposed Ceduna Keys Marina and Community Centre proposal to be assessed as a 'Major Development' under the provisions of Section 46 of the Development Act, 1993.

The declaration by the Minister as a Major Development was on the basis of the Project's potentially significant environment, social and economic impacts. The Major Development assessment process enables a more comprehensive analysis of anticipated environment, social and economic implications via a reporting process that, in this case, has warranted an Environmental Impact Statement (EIS).

Further details regarding the steps involved in the Major Development assessment process will be outlined further below, including the steps taken to date, and that ahead, including the release of the EIS for public comment, the conduct of a public meeting, the receipt and response to submissions (including that from public and relevant government bodies), the preparation of a Minister's Assessment Report and a decision by the Governor.

1.3 Need for Flexibility

A development of this magnitude requires extensive investigations, feasibilities and design considerations in order to respond to the numerous opportunities and constraints presented, both physical and statutory in terms of the condition of the land and marine environment, the extent and capacity of infrastructure services and utilities, a range of operational, management and statutory considerations, together with commercial and market realities.

To explore, investigate and document these issues to avoid, mitigate and / or manage possible negative externalities, it is necessary to retain or enable a degree of flexibility in the manner in which the proposal is to be implemented over a designated time period. Accordingly, it will be necessary to put in place contingencies or management responses in order to respond to identified scenarios through the life of the project from the initial excavations to the ongoing management and health of waterways.

The lessons learnt in other like situations have provided a depth of experience and range of capabilities that will assist in the management of risks that may ebb and flow to varying degrees depending on changing circumstances over the life of the project.

It will therefore not be possible to state in categorical terms in all instances as to the manner and outcome of all planned actions. The extent of analyses and investigation undertaken, in particular scientific and engineering does however provide the necessary confidence level in order to proceed to implementation.

1.4 Modifications to proposal since Issues Paper

In response to certain issues raised in the Issues Paper and subsequently as a result of discussions with government agencies and other groups, the proposal has been modified to address such issues. The majority of the changes are minor in nature and seek to make better use of land, avoid or mitigate potential environmental impacts, and improve safety.

Figure 1.3 overleaf indicates the modifications undertaken to the proposal.

The following modifications and the reason for such are outline in the table below.

Table 1.1 Modifications to proposal since Issues Paper

	Modification	Reason
1	Deletion of “Stage 12”	To avoid environmentally sensitive location
2	Creation of Development Lot	To achieve better use of land
3	Reinstate residential marina as waterfront allotments	To achieve better use of land
4	Straighten alignment of channel	To improve navigation
5	Delete Groyne	To achieve a more efficient commercial marina (refer 7)
6	Realignment of intersection	To improve road safety
7	Reconfigure commercial marina	To allow for direct access by commercial fishing vessels

Figure 1.1 **Location of Proposed Development**

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Figure 1.2 – Proposal 'Master Plan'

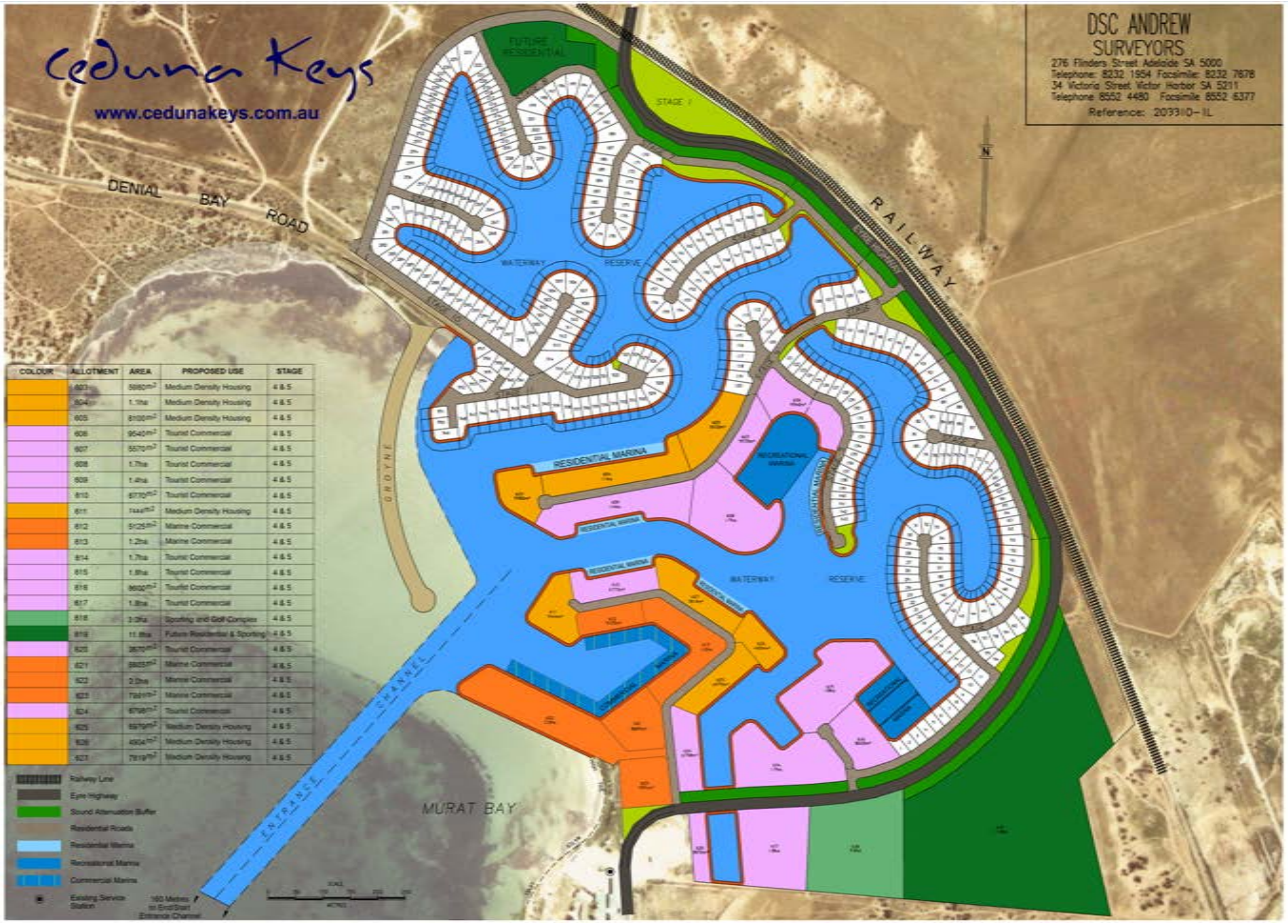

Figure 1.3 **Proposal 'Master Plan' modifications to proposal**

COLOUR	ALLOTMENT	AREA	PROPOSED USE	STAGE
	603	6980m²	Medium Density Housing	4 & 5
	604	1.1ha	Medium Density Housing	4 & 5
	605	8100m²	Medium Density Housing	4 & 5
	606	9540m²	Tourist Commercial	4 & 5
	607	5570m²	Tourist Commercial	4 & 5
	608	1.7ha	Tourist Commercial	4 & 5
	609	1.4ha	Tourist Commercial	4 & 5
	610	2.6ha	Medium Density Housing	1
	611	4600m²	Marine Commercial	1
	612	2.2ha	Marine Commercial	1
	613	1.5ha	Tourist Commercial	1
	614	1.7ha	Tourist Commercial	1
	615	1.8ha	Tourist Commercial	1
	616	8600m²	Tourist Commercial	1
	617	1.8ha	Tourist Commercial	1
	618	3.0ha	Sporting & Golf Complex	3 to 5
	619	11.8ha	Future Residential & Sporting	3 to 5
	620	3870m²	Tourist Commercial	3 to 5


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BACKGROUND

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ENVIRONMENTAL IMPACT STATEMENT

2. BACKGROUND

2.1 Site Selection

The District Council of Ceduna ('the Council') seeks to assume a leading role in the economic development of the region in terms of facilitating the burgeoning aquaculture and tourism industries, supporting the existing fishing industry, responding to the strong demand and preference for waterfront and lifestyle housing opportunities, and achieving a valuable community facility.

In selecting an appropriate site for such a development a range of criteria or tests were applied in order to identify the various cost / benefits of each option. The site selection criteria adopted by the Council effectively addressed the need to identify a site that:

- *was not of high environmental sensitivity or biodiversity conservation value;*
- *would enable the restoration of land and minimisation of impacts on the natural environment;*
- *was adjacent to or in close proximity to the existing Ceduna Township to avoid fragmentation of population and duplication in the provision of goods and services;*
- *would maximise the use of existing physical infrastructure and public utilities and assist in the achievement of a 'critical mass' or capacity to increase or improve the current level or standard of provision;*
- *would integrate with the existing township of Ceduna in a manner that would enable good access but not compromise the inherent and valued character and amenity of Ceduna;*
- *was of a suitable size so as to allow for the provision of a commercial wharf facility, residential development and a community centre in a planned and efficient manner that would not compromise or conflict with existing or future commercial or industrial development; and*
- *was accessible by the commercial fishing fleet and vessels used in the aquaculture industry, together with recreational craft.*

2.2 Councils Role & Objectives - Local Government Act 1999

The proposed Ceduna Keys development represents a significant industry development proposal; specifically for tourism, the aquaculture industry and fishing industry, together with the development of cultural and recreation services. It also demonstrates the strategic foresight and management role of the Council under the Local Government Act 1993.

The Act specifically enables and anticipates that Local Government would assume a leading role in regional economic development, via:

- *services and facilities that benefits its area…and visitors to its area;*
- *to provide infrastructure for its community and for development within its area; and*
- *to promote its area, and to provide an attractive climate and location for the development of business, commerce, industry and tourism.*

The Ceduna Keys Development would support regional, State and National objectives for industry and regional economic development, integrating economic, social and environmental outcomes.

The extent to which the development would further these regional Objectives, as expressed within documents such as *"Directions for Regional South Australia – A Framework for Action"*[1], is set out in further detail within the economic assessment provided by the South Australian Centre for Economic Studies, provided as a source document in relation to this EIS.

This document sets out the response to the State Government to the report of the Regional Development Task Force, with the fundamental goal being "improving the economic, social, cultural and environmental well being of South Australia's regions by assisting regional communities and their people to develop their potential fully."

More specifically, the Council has the following Objectives for this project:

- *to provide a safe haven for the fishing fleet;*
- *to encourage investment in the town and inject vitality into the growing aquaculture and fishing industry;*
- *to capitalise on and encourage further investment of tourism in the community;*
- *to foster self-determination in the areas of cultural interaction and protection;*
- *to strengthen partnerships and further develop and promote the reconciliation process within the community;*
- *to maximise employment and education opportunities for local Aboriginal people and wider community;*
- *to develop appropriate opportunities for industry development in cultural heritage interpretation and cultural tourism.*

2.3 Relationship Between Council and Proponent

As a result of a Registration of Interest Process, the Council chose a preferred developer to which the right associated with this development would be assigned as reflected in a Heads of Agreement, Contract for Sale of Land and a Development Agreement.

In addition to the LMA which is an agreement between the Proponent, the Council and landowners, a Management, Maintenance and Monitoring Agreement is also proposed which shall address a range of matters relating to construction, operational, handover and ongoing obligations. The framework and subject matter for this MMM Agreement is outlined in detail in Section 10 of this report. The MMM Agreement will be formally proposed and affected between parties once approval has been issued for the development.

The selection process was undertaken following a review process to address prudential issues arising from development exceeding $4M in value, pursuant to Section 48 of the Local Government Act, 1999. The Business Plan arising from this Section 48 Review identified amongst other considerations, issues of commercial risk and the business case for the development, in particular the residential component.

A draft Land Management Agreement (LMA) has been prepared between the Council and the Proponent which in turn will flow on and encumber property held by subsequent purchasers. This LMA outlines various obligations, restrictions, powers and processes as a formally registered Deed Agreement pursuant to Section 57(5) of the Development Act 1993, to be registered on each Certificate of Title created as part of the division of land. This LMA will also apply to use of the waterways and marina facilities.

[1] Directions for Regional South Australia – A Framework for Action

A copy of the draft LMA is provided at Appendix B.

Appended to the LMA are Design Guidelines and Use Obligations. This document more specifically provides the special meaning of words, specifies land to which the guidelines apply, outlines the application process for approval under the agreement, and a range of specific requirements in respect to the following:

- *Commencement on site*
- *Building controls during construction including management of wastes*
- *Building Design addressing*
  - *Building envelopes*
  - *Set backs to boundaries*
  - *Location of outdoor living areas*
  - *Finished floor levels and building heights*
  - *Materials and finishes*
  - *Roofing styles and materials*
  - *Use of insulation*
  - *Location of air conditioners, solar panels and aerials, antennae, etc*
  - *Specific provisions for medium density housing*
- *Construction and use of jetties and mooring points*
- *Types of vessels permitted and manner in which such must be moored*
- *Fencing*
- *Lighting*
- *Use of rainwater tanks*
- *Landscaping*
- *Swimming pools*
- *Refuse collection*
- *Parking of vehicles*
- *Street front amenity*
- *Signage*
- *Use of land*
- *Use of waterways*
- *Boat maintenance and repair*
- *Maintenance of revetments*
- *Emergency access.*

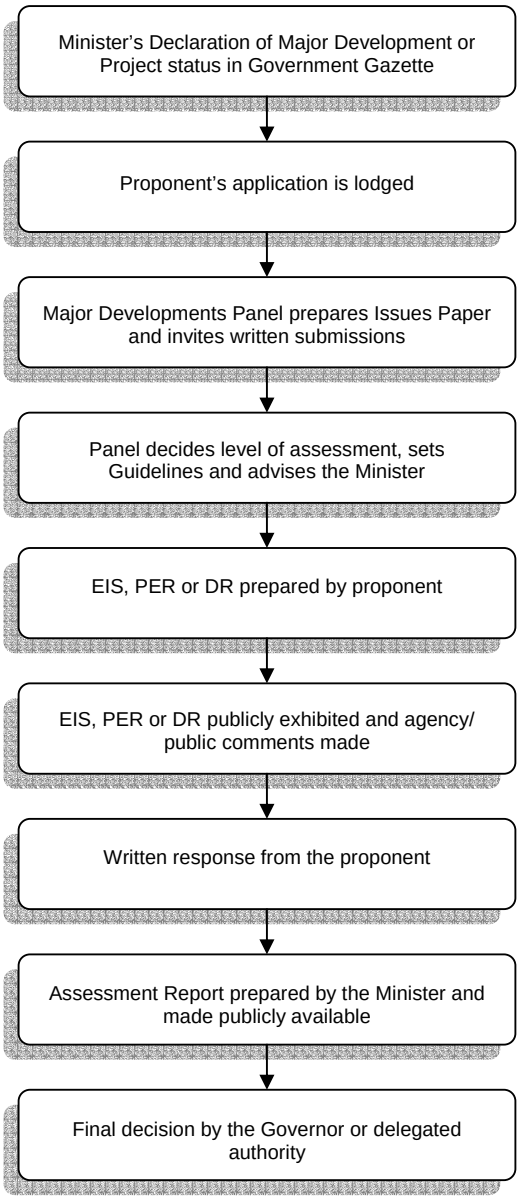
In addition to the LMA which is an agreement between the Proponent, the Council and landowners, a Management, Maintenance and Monitoring Agreement is also proposed which shall address a range of matters relating to construction, operational, handover and ongoing

obligations. The framework and subject matter for this MMM Agreement is outlined in detail in Section 10 of this report. The MMM Agreement will be formally proposed and affected between parties once approval has been issued for the development.

2.4 Major Development Assessment Processes and Decision Making

Section 46 of the Development Act 1993 sets out the procedure by which a 'Major Development' is to be assessed and determined given the project's major environmental, social and economic importance. The following Figure summarises this process in terms of the various steps to be observed.

Figure 2.1 Major Development Process



The Major Developments Panel ('the Panel') referred to in Section 46 is an independent statutory authority that has the task of determining the appropriate form of assessment for a Major Development, and setting Guidelines for the preparation of the required assessment document, in this instance, an Environmental Impact Statement.

To assist in this process the Panel produced an Issues Paper on the proposal and invited public and Government Agency comment. The Guidelines are prepared to assist the Proponent to provide the best level of information needed to assess the proposal, based on the significant issues relating to the development taking into accord the issues raised in the submissions.

This EIS has been prepared in accordance with these Guidelines and describes what is proposed, what environmental effects are anticipated, and how the Proponent plans to manage the project. The issues raised in the Guidelines document have been addressed in detail both within the body of this report and the various supporting documents that contain the more specific and in depth research and analysis. Where appropriate specific reference will be made to these detailed reports.

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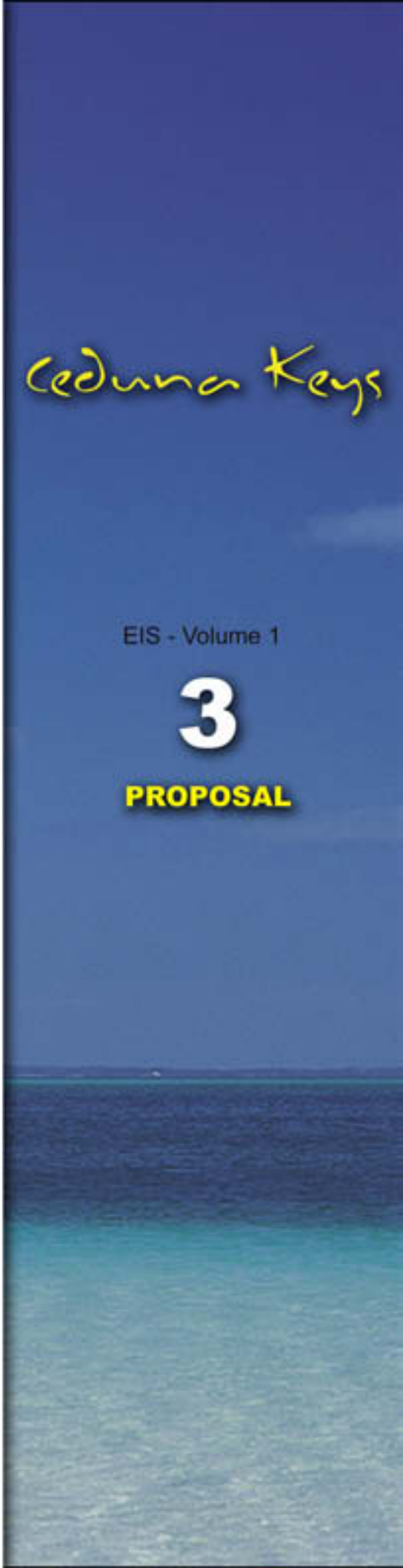
ENVIRONMENTAL IMPACT STATEMENT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PROPOSAL

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3. PROPOSAL

3.1 General Description

The proposal is for a coordinated development comprising a commercial and recreational marina, associated commercial development, together with a water front residential subdivision comprising some 380 allotments, 250 additional waterfront apartment sites, a community centre providing for a range of cultural, recreational and leisure activities, and tourist facilities including interpretive, accommodation, entertainment and limited retail opportunities focussed on convenience shopping. An artist's impression is provided at Figure 3.1.

The proposal also involves the construction of two breakwaters in order to provide shelter to a waterway system via a designated channel, together with the realignment of sections of the Eyre Highway and Denial Bay Road. Extensive infrastructure works are proposed which will include the extension and augmentation of public utilities such as water and electrical power, together with works for stormwater and wastewater collection, treatment and re-use both on the subject land and the adjacent public golf course.

The construction phase of the marina is anticipated to take approximately one year. The full development of the marina will be progressive over 10 years, with various anticipated land releases as shown in Figures 3.1 and 3.2. It should be noted, as previously mentioned above, that which was referred to as Release 12, is no longer part of the proposal.

Land on which the community centre is to be established would be provided to Council as part of the works associated with Stage 1. Upfront works as part of the initial stage include the breakwaters, the channel, the waterways, the realignment of roads, and the commercial and recreational marinas together with supporting infrastructure services.

The releasing sequence of allotments will be according to market demand and take up rates. This approach would allow sequential and logical construction ahead of demand without over supplying the market at any one time. Commercial allotments would be constructed and released according to further market review and analysis during the life of the project.

3.2 Breakwaters, Channel and Marina Waterways

3.2.1 Breakwaters

Two breakwaters are proposed to be constructed in the position indicated on the proposal 'master plan' shown at Figure 1.2. The southern breakwater will be constructed to contain further commercial development.

The breakwaters will consist of a fairly impervious inner core founded on the existing seabed and protected from storm damage by two layers of armour rock. The core will be placed progressively and will be followed immediately by subarmour rock placed on either side to provide protection from waves during construction.

The inner core will consist of a mixture of rock and fine material and will be placed progressively by end tipping starting from the shore and pushing by dozer or loader along the alignment to an initial height just above mean high water level.

The core material needs to have sufficient coarse material to provide stability under water and sufficient fine material to help provide water tightness during dewatering for the harbour excavations.

Excessive leakage through the core will be rectified by trenching through the centre of the core and backfilling with suitable clay.

The sub armour will be tipped onto the core and then placed by moving the rock into place by dozer on the higher sections and by excavator for the lower below sea level sections. A hydraulic excavator fitted with a rock grab attachment will place the final armour rock layer. Placement of these large rocks starts at the lower part of the breakwater and works up towards the top.

The breakwaters are then completed to their final design height without interference from the sea except during high tide events.

Some readjustment to the breakwater shape will occur during large storms. This is beneficial especially if it takes place during construction and helps to bed down the breakwater and minimise future movements.

Core materials will be sourced from a variety of locations including on site excavations in limestone materials, stockpiles of limestone in paddocks resulting from local farmland clearing activities and from local commercial quarries.

All armour rock will be sourced from local quarries. The sub-armour and outer armour will consist of a dark grey, angular, dense, hard and durable rock capable of withstanding the effects of salt water and wave action.

Subject to further investigations and design considerations, the breakwater is anticipated to have a height of in the order of +4.0m AHD at the entrance and on the southern side. The western breakwater can reduce in height as it heads toward the shore, finishing at +3.0m AHD. Access is to be restricted along these breakwaters.

Based on a typical ground level of 0.0 metres AHD the breakwaters will have an average footprint of 30 metres across diminishing to 5 to 6 metres at the top. The breakwaters would have batters of typically 1 in 3. A typical cross section or profile is provided at Figure 3.4.

Culverts or pipes will be incorporated into the northern breakwater, to facilitate the drainage of the intertidal flats. This will minimise the impact on existing drainage patterns and potential adverse effects on benthic species.

3.2.2 Entrance Channel

It will be necessary to connect the marina to deep water by a man-made channel designed to accommodate the expected marina traffic. A minimum water depth of 3.0 metres at the lowest tide (lowest spring water mark) throughout the channel length is proposed with a bottom channel width of 50 metres.

The local Admiralty Charts indicate that the length of channel required to achieve this will be about 800 to 1000 metres.

Due to the slope of the seabed inferred from the Admiralty Charts the depth of excavation for the channel would be a maximum of about 1.5m at the breakwater end grading linearly down to zero at the deep-water end as shown on Figure 3.5. The possible extent of the proposed channel is indicated in Figure 1.1 of this Report.

To provide stability the sides of the channel will be laid back at a batter of 1 vertical to 3 horizontal.

The total width of clearing required for the channel will therefore decrease from a maximum of about 60 metres at the breakwater end to 50 metres at the deep-water end. The total area cleared will be about 55,000 square metres or 5.5 hectares.

Although the materials along the length of the channel have not been probed they have been observed by divers to be sandy on the surface and are of shallow depth. Cutter suction dredging would therefore be an appropriate method to excavate the sandy channel materials. The dredged materials will be pumped to on shore holding and settling basins and the water tested before release back into the bay.

A barge-mounted excavator will remove any material that proves too hard to be excavated by cutter suction dredge.

Figure 3.1 – An Artists impression of the overall development.

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Figure 3.2 – Layout and Design

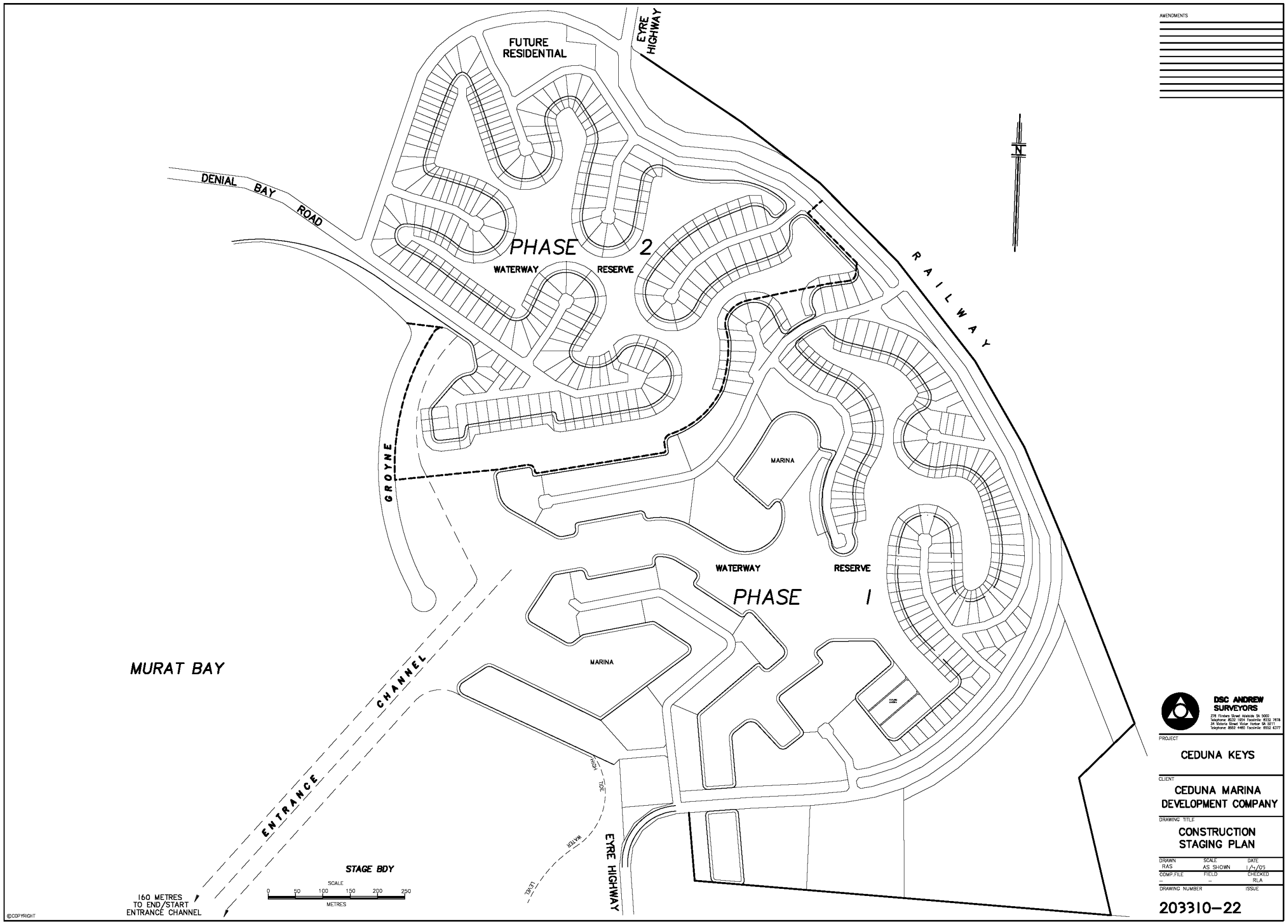

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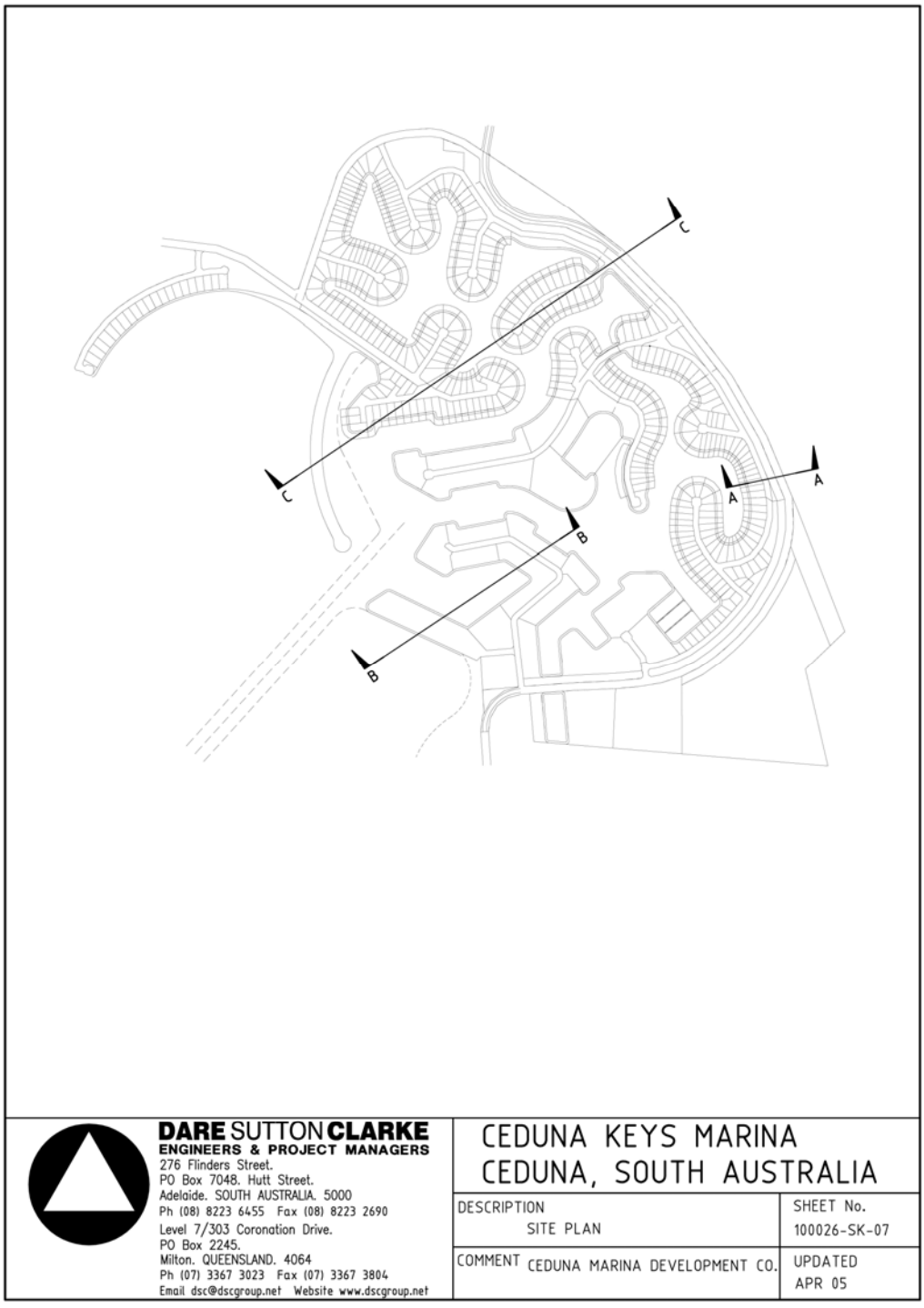
Figure 3.3 Location of Cross Sections



Ceduna Keys

Figure 3.4 – Typical Breakwater Cross Section

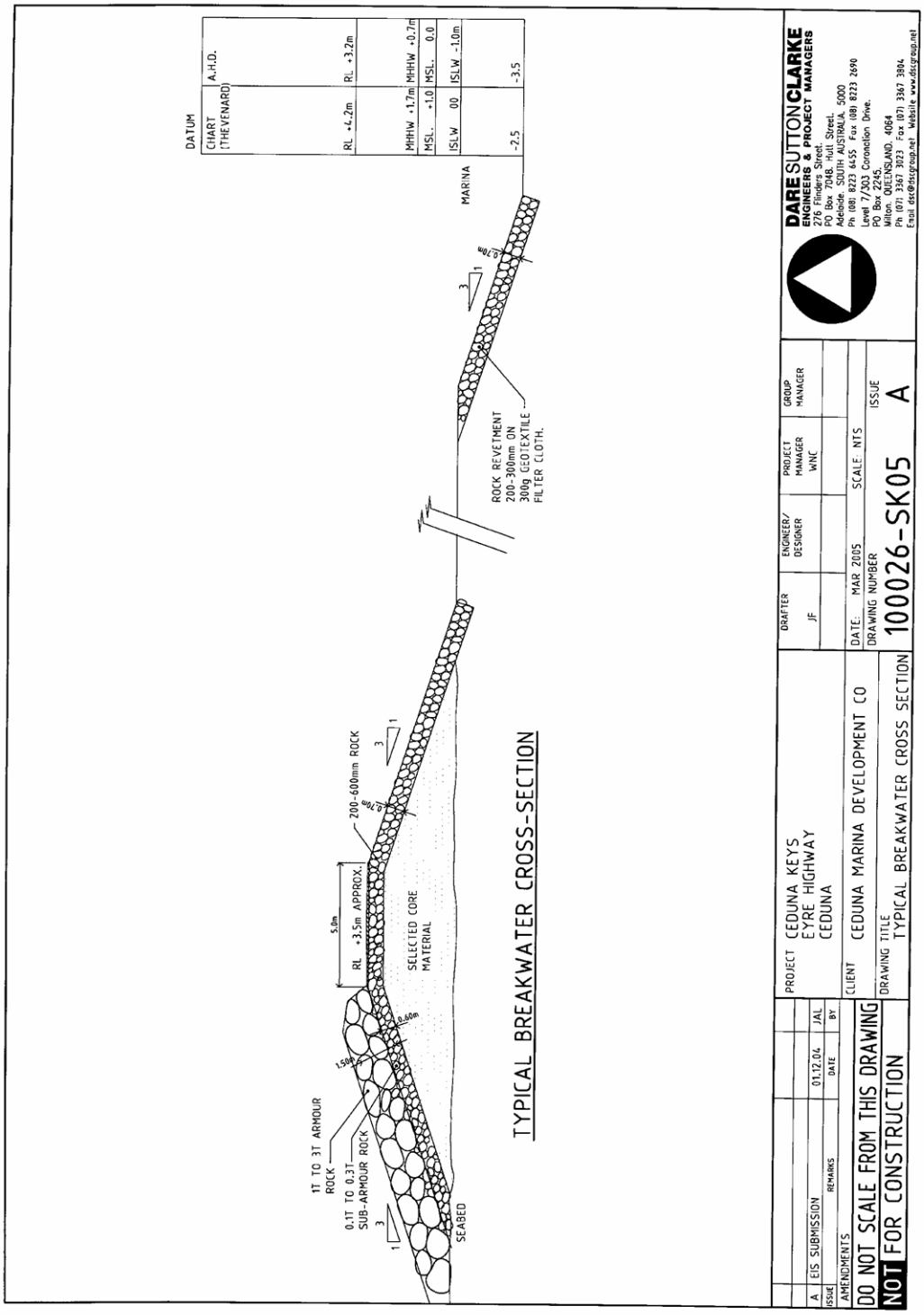


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Figure 3.5 – Channel Long Section

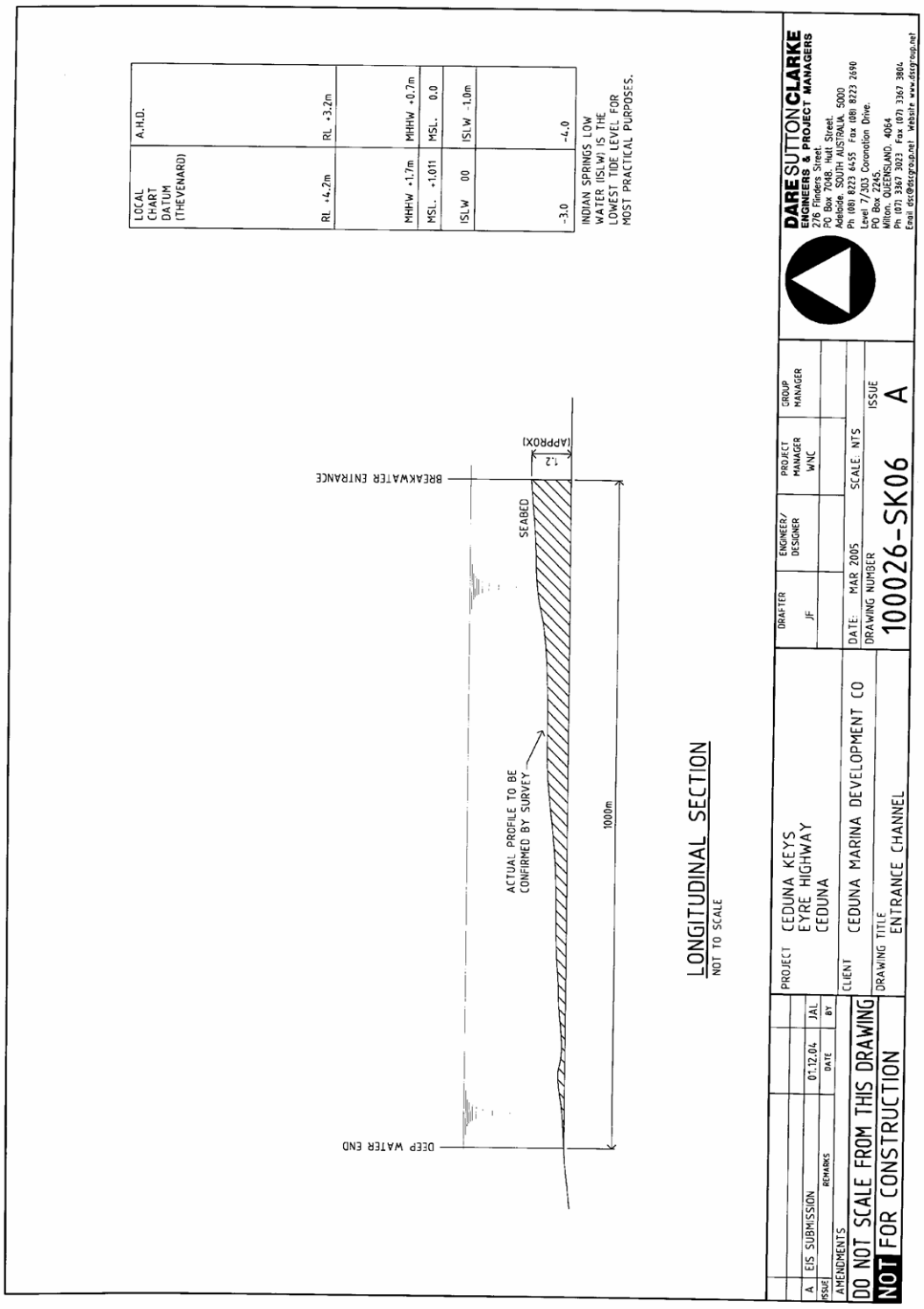

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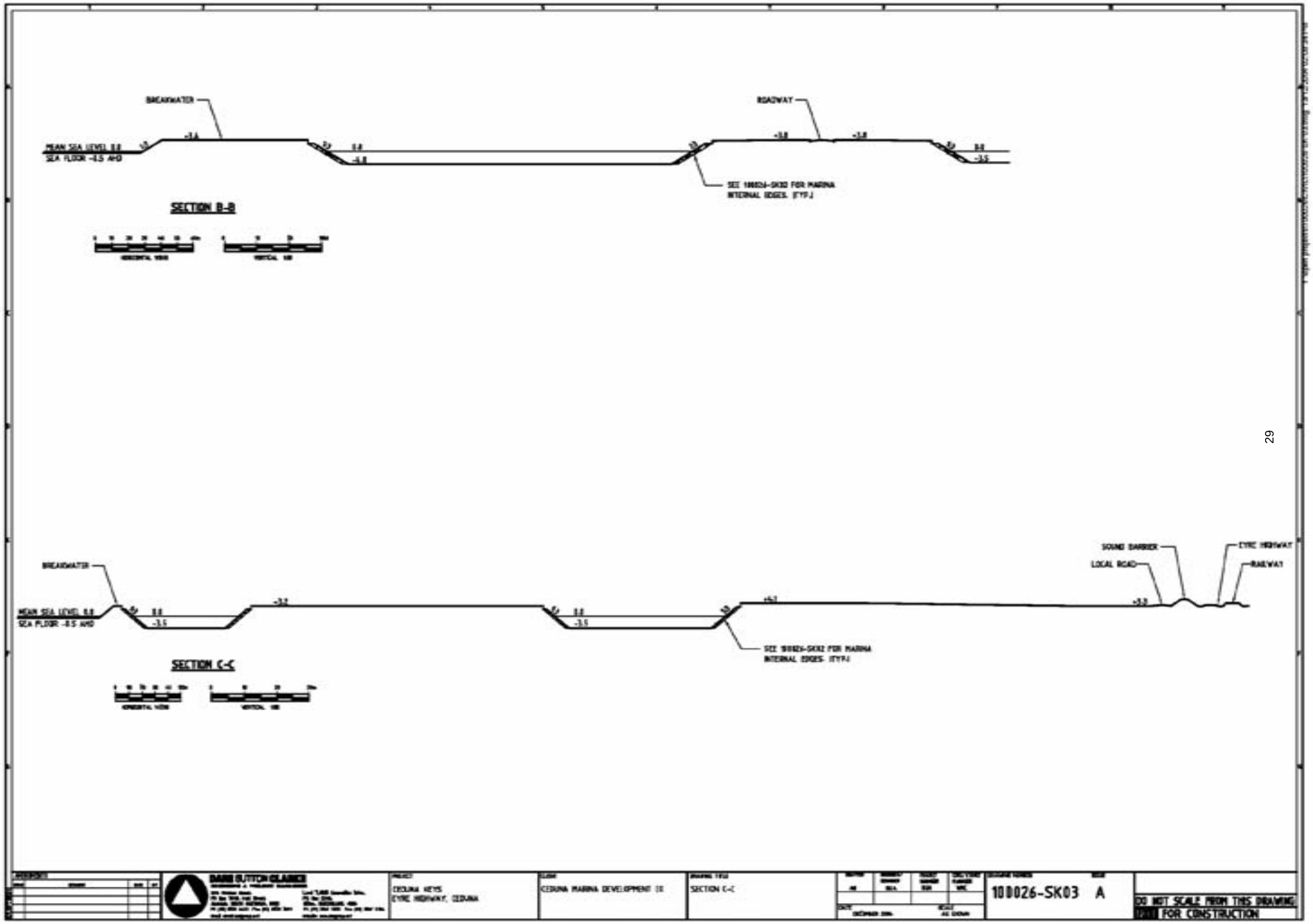
Figure 3.6 - Profile of Channel



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ENVIRONMENTAL IMPACT STATEMENT

3.2.3 Marina Waterways

The waterways are to be excavated in the dry using conventional earthmoving equipment such as hydraulic excavators and dump trucks to dig and cart the materials. After tipping the materials would be spread in layers by bulldozer and/or grader and then compacted to achieve engineered fill status using a vibrating smooth drum roller for sand or vibrating sheepsfoot roller for sandy clays. Refer to section 10 for further details of the construction process.

Preliminary calculations have determined that all material excavated will be used on site. Additional material, in particular rock and aggregates will be sourced from locations on the Eyre Peninsula. Rip rap walls are to be used for waterway edges together with a formed concrete edge similar in profile to that indicated at Figure 3.4. This arrangement will suitably protect edges from wave action and wash from vessels. Where necessary a geo-textile matting will also be used to stabilise this area and avoid erosion through the disbursement of wave energy.

Based on the results of preliminary testing, it is expected that the bulk of the site-excavated material will comprise calcareous sandy soils. This material is considered suitable for reuse as bulk allotment fill providing it is properly engineered. Shell grit, sandy gravel and the upper 100 mm to 300 mm of mud or root bearing material is however considered unsuitable for reuse in engineered fill and should be stock piled and used for other purposes including landscaping.

The edges of the excavated waterways and the entrance channel will be laid back with batters ranging from 1 vertical to 2 or 3 horizontal depending on the materials encountered. The batters will be protected from erosion by dark grey, hard, durable rock (riprap) sourced from the same location as the breakwater armour rock. Preliminary geotechnical investigations have not identified any difficult soils and if these are encountered the affected batters will be stabilised by digging out the soils and replacing with selected stable material. Further details of the final landform, methods and sequence of construction, the protection of batters and edge treatments is provided in section 10.

Based on existing tide data, the total waterway volume between tide levels 0.59 m AHD and –0.61 AHD is 588,000 cu.m. Over a 6-hour tide cycle this represents an inflow or outflow rate of 27.2 cu.m per second through the channel. Assuming an average water depth of 2.5 metres in the channel this flow takes place at a very slow velocity of 0.21 m / second. This basic calculation indicates that there would be an unrestricted exchange of water between Murat Bay and the waterways. It is therefore considered that the exchange of volumes, can for the purposes of assessing water quality in the waterways, be directly related to tidal variations.

Research undertaken indicates that Murat Bay is well protected by the reef and islands at the entrance of the bay from coastal processes that take place seaward of Thevenard. No significant coastal processes such as sand movement are taking place in the vicinity of the proposed development. Sand movement is therefore not anticipated to be a significant issue both during construction and thereafter in terms of maintenance of an effective channel and waterway depth of 2.5 metres at low tide.

3.3 Commercial Marina

The proposal includes a Commercial Marina facility that would accommodate approximately 50 vessels. Vessels would range in size up to 22 metres and generally have a draft not exceeding 3 metres. The type of vessels would include a full range of commercial fishing boats, prawn, tuna and scallop fishing vessels and aquaculture crafts.

The location of the commercial marina in relation to other more sensitive land uses such as residential in terms of the potential for noise nuisance and sleep disturbance, has been

nominated to minimise such potential. The extent of noise would be limited to loading and unloading activities together with the servicing and basic maintenance of vessels and would not extend to repair and overhaul activities that may generate off site impacts in terms of noise nuisance and environmental harm. All 'dirty' port activities would be conducted at designated facilities elsewhere.

The commercial marina facility is to be designed, constructed and operated in accordance with the requirements set out in Planning SA Guidelines for Applicants, Marinas and or Boating Facility (Planning SA, 2004)[2], and the EPA Guidelines for Stormwater Management for Marinas, Boat Sheds and Slipways (EPA, 2004)[3] in so far as activities are concerned that have the potential to impact on water quality within the waterway, such as removal of sewage effluent from boats, refuelling, bilge and ballast water. Boat maintenance, repair work, hull cleaning, painting and antifouling, will not occur within the marina or waterways.

Provision is to be made as part of this development to enable onshore facilities to be constructed in conjunction with and in support of the aquaculture and fishing industries. There is a need to provide not only mooring facilities for vessels but also loading and unloading facilities, storage including cool rooms and preparation areas, refuelling and maintenance together with minor repairs to plant and equipment, administration and office accommodation, together with amenities for crew, including car parking.

The exact arrangement and mix of uses is to be determined following further consultation and involvement with industry representatives. While there will be an opportunity to satisfy some of the needs of these industries, it is acknowledged that the potential for conflict between potentially competing land uses, (i.e. industry and residential) needs to be carefully managed. Onshore facilities will therefore be limited to only those activities that generate no or minimal off site impacts and are of a suitable design and appearance.

3.4 Recreational Marina

It is proposed to provide marina facilities for recreational craft including sail and power craft. In total 100 berths are to be provided in 3 locations within the development. These berths will provide facilities in addition to mooring, including the ability to undertake minor servicing and maintenance, stocking of stores for longer journeys and tourism activities. A range of temporary and permanent berths catering for visitors' and residents' vessels will be provided. As for the commercial marina, boat maintenance activities will not be permitted.

The marina berths are to be constructed in a manner that allows for tidal variations and enables vessels to move in and out of the facility at either high or low tide. As with the channel a minimum depth of 2.5 metres at low tide will provide sufficient draft for the nature of craft attracted. Berths are to be arranged along the pontoons that will be connected to land via an arrangement of ramps at suitable grades. The final detailed design and specification will be undertaken at the engineering stage of the development process. All facilities are to be designed and constructed in accord with the South Australian Coastal Marina Development Strategy for Recreational Boats, Rep. No. 1 Marina Guidelines (DEP, 1991)[4] and the EPA Stormwater Management for Marinas, Boat Sheds and Slipways (EPA, 2004).

Refuelling of recreational vessels will be undertaken in an appropriate manner and occur in a designated location that will enable suitable management and response in the event of a spill or other hazard situation. A combined refuelling area is intended to service both commercial and recreational boats. Fuel storage tanks are to be underground with supply lines to bowsers at the wharf. Bunding and drip trays are to be provided in areas such as around bowsers.

[2] Guide For Applicants – Marina and/or Boating Facilities, Planning SA, July 2004
[3] Stormwater Management for Marinas, Boat Sheds and Slipways, EPA, April 2004
[4] South Australian Coastal Marina Development Strategy for Recreational Boats, Report No. 1 Marina Guidelines' Department of Environment and Planning, 1991 Revised Version

A periodic inspection and ongoing monitoring regime will be undertaken, as part of an operational management plan, for tanks in order to prevent fuel loss to the terrestrial and marine environment. Stormwater from service areas and the commercial area will be diverted to a suitably formed detention basin and will not be discharged into the marina.

A spill contingency plan is to be developed in order to respond to situations so as to minimise the impact and provide for the adequate clean up of any oil / hydrocarbon fuel spillage. Although the risk of contamination is very small given the refuelling facility safe guards outlined above, an oil spill contingency plan will be prepared as part of the Environmental (Operational) Management Plan for the marina. A key element of such a plan would be the deployment of booms at the entrance to the marina together with other containment and absorption measures. Private storage of fuels is to be discouraged.

Major repair works and extensive maintenance including hull cleaning, painting and antifouling activities are not to be allowed within the marina given the potential for environmental impact. Boat owners requiring such activities will need to take their vessel to another location. Potential exists for such a service and maintenance centre within existing industrial areas at Ceduna Industrial Park and Thevenard.

3.5 Residential Development

A total of 382 allotments are proposed for residential living, together with a number of larger sites for up to 250 future medium density residential dwellings. Each of the residential allotments is to accommodate a single dwelling.

A Land Management Agreement is proposed as part of the development, which calls up Design Guidelines and Obligations for owners in respect to a range of planning and management issues including:

- the use of land;
- the limit of one dwelling per allotment;
- siting via the use of building envelopes;
- building form and appearance;
- site and floor levels;
- set backs and heights;
- fixtures such as air conditioners;
- a requirement for solar hot water services and other energy efficiency measures including insulation, installation of plumbed in rainwater tanks (at least 15,000 litres);
- design and construction requirements in respect to jetties and mooring facilities associated with waterfront allotments, landscaping, fencing and swimming pools; and
- Specific provisions in relation to medium and high density residential buildings.

A copy of this draft LMA is provided at Appendix B.

Of the total number of residential allotments, 317 are to be arranged with a waterfront setting allowing direct access to vessels via a jetty and mooring arrangement. On average these allotments are to have a buildable area of approximately 600 square metres and be accessed from a public road to the rear or secondary frontage.

Dwellings are to be set back by a minimum of six (6) metres from the revetment wall of the waterway, and six (6) metres from the property boundary frontage to a public road. Dwellings are to be also set back by 1.2 metres to any side property boundary.

Detached dwellings are to be limited to two storeys in height, with a minimum building level on allotments of 3.2 metres above AHD in order to protect buildings from inundation. Fencing to waterways is to be open 'pool style' fencing of tubular steel or similar, with a maximum of 2.0 metres for fences to rear boundaries and 1.2 metres to side boundaries.

3.6 Community Centre

A key public benefit from the proposed development will be the establishment of a Community Centre that will form an important focus for cultural, recreational and leisure activities for the Ceduna community. Its location to the south of the development site (currently proposed as allotment 617, but subject to negotiation) adjacent to the existing township will assist in the integration of the proposed development with the existing township in both a physical and functional manner. The exact design and layout of the proposed Community Centre will be the subject of a separate development application for building following further investigations and community consultation.

The Community Centre will serve a dual purpose in terms of providing a facility for the local community and visitors to the region. It will comprise elements that address and provide for the interpretation of the coastal and marine environment, the Nullarbor, the Great Australian Bight Marine Park, the Head of the Bight and whale watching and a strong emphasis on Aboriginal culture and history. The Community Centre is also an opportunity for the aquaculture and fishing industries to provide a focus for their promotion, education and interpretation with live displays of fish species and other features of the industry.

3.7 Tourist Accommodation and Related Facilities

Provision is to be made for tourism accommodation and facilities within the proposed development in order to provide a focus for the region's important tourism industry at a strategic gateway to and from South Australia. Ceduna has the potential to further develop its potential as a centre for visitors that are attracted by the natural environment of the Far West Coast and activities, including whale watching, recreational boating and fishing, visiting the off shore islands, active and 'soft' adventure, coastal relaxer and eco-tourism pursuits. A key opportunity is to enable visitors to experience Aboriginal heritage and culture in a manner that assists in greater understanding and respect. This approach provides a significant economic and social opportunity to local indigenous communities in terms of employment, cultural development, education and hopefully reconciliation.

The exact form and arrangement of accommodation facilities will be the subject of future development proposals and will be designed and planned following extensive feasibility and research into target markets and preference for different styles of accommodation. Together with accommodation there will be a need to respond to the needs and expectations of visitors in terms of providing access to facilities such as cafes, restaurants, entertainment and a limited range of retail opportunities that will be focused on convenience shopping and would not duplicate or compete directly with existing retail shopping within the Ceduna township. Such limitations may be introduced via a Plan Amendment Report that may put in place development policy controls to limit scale, range and threshold.

3.8 Public Recreational Facilities

As an adjunct to the proposed Community Centre and tourism facilities it is proposed to make provision for a range of public recreational activities, including:

- Public open space reserves
- Sporting and recreational facilities
- Community and tourist facilities
- Commercial and retail activities

Surplus stormwater not re-used as part of the proposed development is to be directed to the existing public golf course so as to allow the greening of this facility year round. This represents a significant upgrade of a community asset that will dramatically improve the amenity of this space and also provide for extensive tree planting using species endemic to the region.

3.9 Public Infrastructure and Utilities

SA water mains currently extend through the site parallel to the Eyre Highway. Consultation has occurred with SA Water in respect to the provision of mains water to the proposed development. Preliminary indications are that subject to appropriate augmentation and extension charges mains water may be supplied to the proposed development, which would be supplemented with on site water collection, together with stormwater and effluent reuse and other water sensitive urban design measures.

Based on a review of the SA Water Eyre Peninsula Water Supply Master Plan (SA Water, 2003)[5] and discussions with representatives from SA Water, capacity exists within the Todd River Catchment subject to continued efficiencies in use and the continuation of key initiatives such as the desalinisation programs. The proposed development presents an economic capacity via its 'critical mass' to further these initiatives so as to achieve a more efficient and effective use of this resource.

The inclusion of rainwater tanks (as required under the proposed LMA) on each residential allotment is expected to limit the demand of SA Water potable water supply, by as much as 25 to 30% based on investigations undertaken to date. The rationale for this position will be discussed in further detail below when addressing Infrastructure Requirements.

Based on enquiries undertaken to date, SA Water has stated that mains water can be provided to the proposed development subject to some supply augmentation works. More specifically SA Water has identified the following works that may be required:

- the construction of a booster pumping station between Knots Hill and the existing Lock pumping station;
- the construction of an additional 9 ML storage at the existing Bonython Tank site;
- the laying of 11 kilometres of 250 mm main between the Tod Trunk main and the Bonython Tank; and
- Installation of a pressure sustaining valve on the Ceduna supply main.

The work required will also be dependent upon the timing of the construction of other water supply augmentation works on Eyre Peninsula including desalinisation investigations being

[5] Eyre Peninsula Water Supply Master Plan, SA Water, 7 May 2003

undertaken by SA Water. Various scenarios have been investigated ranging from a 2.5 ML/day Plant to a 15 ML/day Plant as outlined in greater detail within the Eyre Peninsula Water Supply Master Plan.

While such would require expenditure in the order of $30 million so as to achieve 5 ML/day in Ceduna, developments such as the Ceduna Marina would assist in improving the business case for pursuing such infrastructure projects that would have wide ranging community benefits beyond that simply associated with the marina site.

In combination with demand management, efficient use and reuse strategies and alternative power projects, a sustainable solution exists to the provision of suitable water for economic developments such as the marina project. The current capacity of the resource should not be a limiting factor in terms of restricting economic development when options for increasing capacity have been identified and are practically achievable.

ETSA Utilities Customer Supply manager for North and Peninsulas has provided advice in respect to a proposed 300 residential allotments, being equivalent to Stage 1 of the proposed development. In the provision of this advice ETSA has made assumptions on both the scope and line route that may be available or suitable, and estimate the project to be in the range of $1.2 to $1.25 million. This advice has been qualified with the statement that “there may also be additional costs to relocate existing infrastructure but until more detailed plans are submitted these costs cannot be determined.”

The Telstra main cable (optic fibre) route currently extends through the development site, nominally along the eastern side of the Eyre Highway road reserve. Major cables also extend along the northern side of the Denial Bay Road. Discussions with Telstra have indicated that sufficient capacity exists within existing infrastructure to accommodate the demands that would be placed by new subscribers associated with the proposed development. Naturally these cables will need to be relocated and incorporated within the development site within appropriately positioned and designed easements or reserves.

3.10 Eyre Highway Realignment

It will be necessary to realign the Eyre Highway adjacent to the Kooniba Thevenard railway line in order to implement the development in the manner proposed. By realigning the highway it will enable a more integrated community within the development by avoiding fragmentation of the land by a major physical form. The proposed arrangement is considered to be the most efficient and effective manner in which to balance the function of this major road transport route and the character, amenity and function of the proposed development.

The design and arrangement of the realigned Eyre Highway would allow for the continued uninterrupted function of this road transport route with minimal disruption and inconvenience to road users. The preliminary or conceptual design for this realignment has been undertaken in consultation with Transport SA and will be the subject of further detailed design and cost estimate investigations prior to implementation. Transport SA has expressed no fundamental objections to the realignment of this section of the highway subject to usual technical and operational requirements being met.

3.11 Acoustic Protection

It is proposed to construct an earth mound having a height of some 3 metres, which is to have a 45-degree batter slope that is to be secured and planted with a range of plants including ground covers and shrubs utilising primarily native species.

The purpose of this mound is to provide a suitable level of acoustic protection to sensitive receivers such as residential dwellings, from noise associated with the gypsum railway and the Eyre Highway.

This approach has been used successfully in like circumstances so as to achieve a suitable noise environment conducive to residential living. The most recent example of such an arrangement is at Mawson Lakes as achieved by Delfin.

The material for this mound will be sourced from the dewatered excavated material resulting from the construction of the waterways, supplemented with suitable aggregate and top soil so as to provide conditions suitable for landscape planting.

3.12 Landscape Character

Given the climatic conditions of the locality, including prevailing wind conditions, and limited annual rainfall, a dry land character is to be pursued within the proposed development in respect to landscape plantings.

This will involve the use of native species, primarily those endemic to the locality, supplemented with taller species so as to provide a degree of shade and visual relief. This approach will reduce water consumption and allow for more efficient maintenance.

This approach has been successfully achieved in arid locations such as Roxby Down and Leigh Creek, and is far more responsible in terms of water consumption, than endeavouring to recreate a leafy green character typical of tropical locations.

Cedunca Keys

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SUBJECT LAND & LOCALITY

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4. SUBJECT LAND AND LOCALITY

4.1 Location

The subject land is located to the north of the township of Ceduna at the north eastern extent of Murat Bay. A locality plan is provided at Figure 4.1

Murat Bay is a shallow bay with depths in the region of the proposed marina being particularly shallow, the deepest area reaching three metres at high tide. The study area is typified by large tidal fluctuations, which cover and expose the intertidal plant communities. Fluctuations reach up to two metres and this tidal change exposes most of the coastal part of the marina site at low tide.

The majority of the site is located on an old coastal estuary that has since been adversely affected by a loss of tidal inundation as a result of the construction of the Eyre Highway. Only a small part of the development extends into Murat Bay.

The township of Ceduna is directly to the south of the subject land and the locality is characterised by human contact with beaches used for recreation such as walking and bathing in summer. The land enjoys a high level of amenity notwithstanding the damage caused by human contact over past years. The aspect to the south provides views back towards the township and out into Murat Bay, which is an attractive outlook and a key opportunity for the proposed development.

To the north are properties that have been cleared of native vegetation for grazing and cropping. A number of dwellings have been constructed on land in this locality, which is at a higher level than that of the subject land. To the northwest is an Aboriginal homeland that is developed with approximately 15 dwelling houses and various outbuildings and other structures. Denial Bay Road passes alongside the land providing access to the hamlet of Denial Bay that supports the oyster farming industry in this area.

The land is traversed by the Eyre Highway – a section of National Highway 1. Denial Bay Road also passes through the subject land and forms one of its boundaries to the north. The land is bounded by the Thevenard Kooniba railway to the east and northeast, and the Ceduna Public Golf Course to the south, which forms a buffer to the existing Ceduna township. The photographs of the land provided at Figures 4.2 and 4.3 overleaf also assist in understanding the current condition.

4.2 Tenure

The subject land predominantly comprises land based allotments held in freehold by the District Council of Ceduna, together with an area within Murat Bay that is Crown Land under the care and control of the Minister for Transport.

In total, the proposed development would occupy land, including waterways, having a total area of approximately 230 hectares. A plan showing the tenure arrangement of the subject land is provided at Figure 4.4

The subject land more particularly comprises the following parcels held in freehold title.

- Allotment 20 in Deposited Plan No 55492 (Freehold land owned by Council)
- Allotment 593 in Filed Plan No 180625 (Freehold land – quarantine station)
- Allotment 22 in Deposited Plan No 53902 (Freehold land owned by Council)
- Part Section 265, Hundred of Bonython (Crown land – Coastal Reserve)
- Part Section 197, Hundred of Bonython (Freehold land – Aboriginal Lands Trust)

Crown Land, which is in the care and control of Transport SA, is the subject of negotiations in order to secure an appropriate interest in the land so as to proceed with the development. This is likely to be in the form of a long term license or lease, and will be subject to appropriate Native Title inquiries and clearances.

Figure 4.1 – Locality Plan

Figure 4.2 Aerial Photograph of Development Site

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Figure 4.3 – Photographs of Development Site

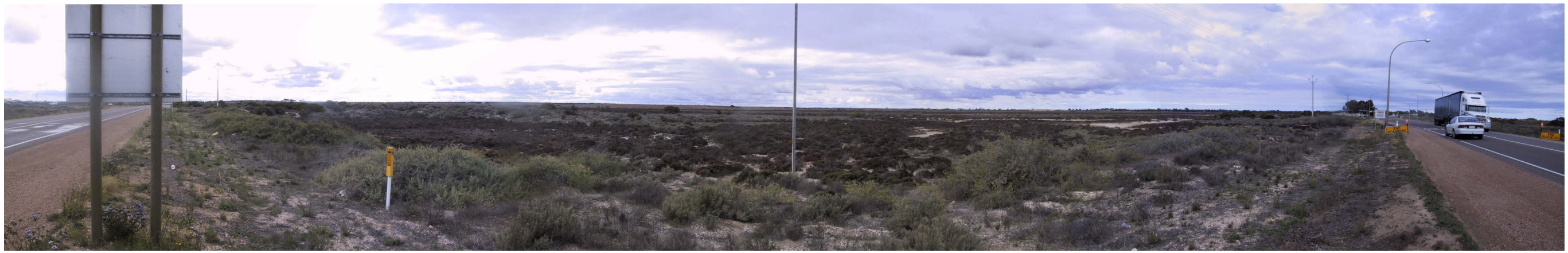

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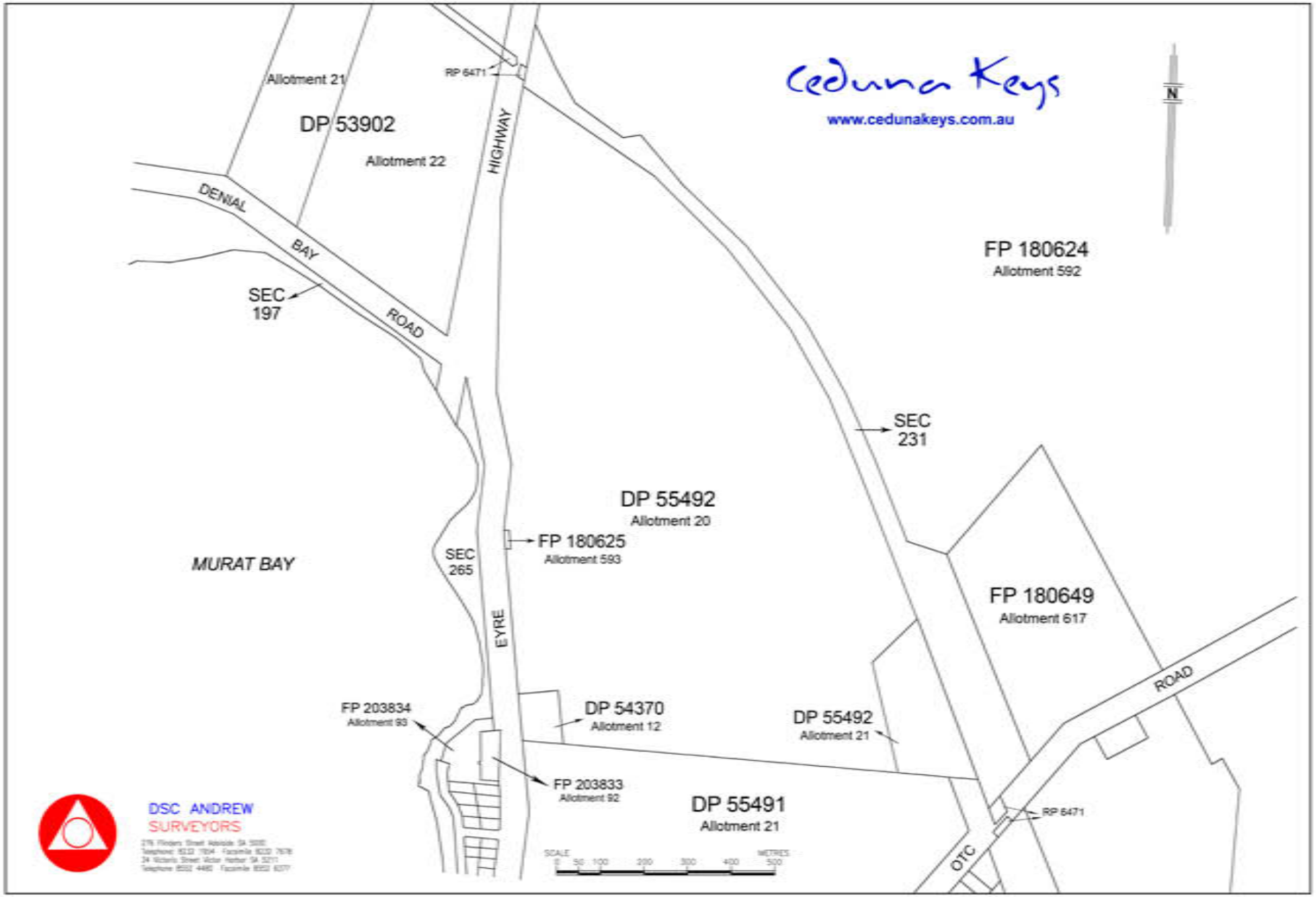
Figure 4.4 **Existing Land Tenure**



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4.3 Geotechnical

Coffey Geosciences has undertaken Preliminary Geotechnical Investigations (see Vol. 2, Working Paper 1)[6] at the development site with a particular focus on the issues surrounding the undertaking of bulk earthworks, dewatering and reuse of spoil, and the ability to secure disturbed areas in terms of erosion and scouring. Where appropriate further testing has been recommended prior to developing and implementing a construction management plan.

According to the Geological Survey of South Australia (1:250 000 Streaky Bay map sheet) the development site would be expected to be predominantly underlain by calcareous sandy soils of the Bridgewater Formation. The Bridgewater Formation was deposited in shallow subtidal beach and coastal dune environments in the Pleistocene period. Calcareous soils have properties that require special consideration, namely:

- they are water soluble under low pH conditions that can occur naturally;
- the particles are weaker than typical siliceous soil particles, and can be crushed at comparatively low stress;
- the carbonate materials act as a cementing agent.

The Bridgewater Foundation typically comprises poorly graded, fine or medium or coarse-grained sand with little of no fines content. The continuity and degree of calcareous cementation can be extremely variable with strengths ranging from uncemented sand to strong rock (calcarenite/ sandstone). The strongly cemented zones often have high voids to solid ratio (porous structure). Calcrete may also be encountered within the soil profile. The calcrete can occur as either poorly graded silty gravel, rubbly layers of cobble to boulder size fragments or massive continuous sheet. The calcrete strength is highly variable, ranging from low to extremely high rock strength.

The majority of the soils encountered in the test pits undertaken by Coffey comprised a mixture of quartz and calcareous sands, containing abundant bivalve mollusc shells in places. Other materials encountered included shell grit and sandy gravel, comprised of fine to course grained gravel-sized marine shells. A dark layer of low plasticity sandy clay was encountered in one test pit, the sandy clay layer was about 100mm thick and was soft to firm in consistency.

The depth of the excavations undertaken by Coffey Geosciences had to be limited due to the inflow of water into the excavation below the water table causing instability of the sides of the excavations. The soils that were encountered were found to be calcareous, providing a neutralising environment unconducive to the formation of acid sulphate soils.

In addition, no peaty or highly organic soils considered likely to generate acid sulphate soil conditions were encountered during the investigations and testing undertaken by Coffey. Medium to high strength calcrete was encountered in three locations, which resulted in refusal of the backhoe used for the test pits.

The key geotechnical issues identified that would need to be addressed by the proposed development are:

- the presence of variable, non-engineered fill to a depth of 0.7 metres in various locations which is considered unsuitable in its present condition as a founding layer for footings or pavements;
- the presence of loose sandy soils that are considered to be potentially vulnerable to liquefaction during an earthquake and will require relatively flat batters to maintain stability, especially close to (or below) the water level;

[6] Ceduna Keys Waterfront and Marina Development Ceduna, Preliminary Geotechincal Investigations, Coffey Geosciences, August 2004

- the presence of shallow ground water, which would require dewatering for excavations below about 0.5 metres AHD.

Reference to the South Australian Coastal Atlas on www.atlas.sa.gov.au indicates that there are two areas marked as Potential ASS (Mangrove) and Potential ASS (intertidal) that lie within the development site. These are located on the coastal side of the Eyre Highway adjacent to the headland that lies to the south of the proposed entrance channel.

Before any development takes place it is proposed that further detailed soil analysis plus surface water and groundwater monitoring be undertaken by a qualified ASS scientist. The analysis will be undertaken in accordance with South Australian Coast Protection Board publication Coastline No 33 January 2003 "A strategy for Implementing CPB Policies on Coastal Acid Sulphate Soils (CASS) in South Australia" (Coast Protection Board, 2003).

A long term CASS Management Plan that includes remedial actions at each stage of the development will also be prepared. The plan will include contingency measures in case unexpected complications arise.

The strategy will not only include deeper and detailed geotechnical investigations to more accurately determine the geotechnical and chemical properties of the soils to be excavated and reused within the site but also the collection of water samples for determination of acidity, soluble iron, aluminium and heavy metal concentrations. These investigations will include further assessment of the potential for generating acid sulphate soil conditions.

Even if not discovered during investigations the environmental management plan will include techniques for identifying, isolating, handling and on site containment of potential acid sulphate soils in case these conditions are encountered during excavations. Particular attention will be paid to sampling and testing surface water and groundwater on a regular basis so that acidic discharges or soluble toxic metals greater than Marine criteria are not discharged into Murat Bay.

These preliminary geotechnical investigations undertaken by Coffey Geosciences Pty Ltd indicate the presence of loose sandy soils, which are considered to be potentially vulnerable to liquefaction during an earthquake. It has therefore been recommended in this report that the further penetration testing of the natural subsurface materials be undertaken prior to design construction in order to assess and respond to the level of risk that earthquake may present to infrastructure and buildings.

Notwithstanding the geological conditions of the site, it should be noted that Earthquake hazard mapping of Australia, as presented in AS1170.4 indicates that Ceduna is located in the lowest risk area with an acceleration coefficient of less than 0.03. This value is noted to have a 10% chance of exceedence in 50 years. Even with a high site factor for soft soils, the required earthquake design categories to AS1170.4 are likely to be low.

4.4 Potential Land Contamination

The site history undertaken by Dare Sutton Clarke, Consulting Engineers, provided as a working paper to this document (see Volume 2, Working Paper 1) has confirmed that the land has predominantly remained undeveloped. Development of portions of the land has included:

- the construction of a section of the Eyre Highway
- farming activities including a slaughterhouse and horse stables
- a quarantine station along the Eyre Highway
- the ‘Oyster Bar’ café on the Eyre Highway

Potential sources of contamination include:

- temporary storage of insecticides at the quarantine station
- diesel fuel storage to power incinerator at quarantine station
- general dumping of rubbish

Potential contaminants associated with the above sources of contamination include:

- organo-chlorine pesticides
- hydrocarbons (petroleum products)
- heavy metals

The conclusions reached by Dare Sutton Clarke state that no significant land uses have been identified for the subject land, and on the basis of the investigations undertaken, it is concluded that the site appears to be suitable for the proposed use.

It is, however, recommended that further investigations be undertaken locally at the rear of the Quarantine station to check for any possible spills of insecticides stored at this location as well as any potential diesel fuel spills from the use of diesel fuel to power the site incinerator. Similarly, localised investigations should occur in the vicinity of dumped materials to the west of the slaughterhouse and near the site southern boundary, particularly for potential of heavy metals and petroleum hydrocarbons. None of these potential issues are significant and if encountered can be easily dealt with.

The areas to be assessed further are relatively small; they fall within a large earthworks project with a mix of residential, commercial and reserved precincts; there is therefore a great deal of flexibility in options for dealing with contamination issues should they arise.

Any remedial works that arise from the environmental assessment will therefore be undertaken in a manner that does not alter the shape or form of the current development proposal.

Due to the lengthy timeframes of such investigations plus auditor review and approvals it is proposed that these environmental assessments commence as soon as development approval has been obtained and proceed in parallel to the further approval processes.

On the basis that Planning SA have indicated that an auditor is required for this project the proposed scope of these further investigations is outlined below.

An environmental soil sampling and testing plan and environmental site assessment will be carried out in accordance with Schedules A and B of the National Environment Protection Measure (NEPM) and in consultation with the Environmental Auditor.

Subject to agreement with the Auditor zones within the overall site, relating specifically to the localised areas as identified in the Environmental Site History Report, will be targeted for further assessment. This would enable clearances, any further investigations and/or remedial works to be managed, without affecting the remainder of the site.

The following process as detailed in the flow chart in Schedule A of the NEPM for assessment of site contamination will be followed:

In consultation with the Environmental Auditor, develop a soil and groundwater sampling and chemical testing program based on the findings of the site history.

Undertake sampling and testing of specific analyses in accordance with procedures that conform to Australian Standard AS4482.Parts 1and 2 (1997) "*Guide to the Sampling and Investigation of Potentially Contaminated Soil"*

Following receipt of the chemical test results, conduct an appraisal of the health, safety and environmental (including water resource) issues for the site and prepare a site assessment report.

- If, in consultation with the Auditor, it is agreed that there is no perceived risk to human health, safety or the environment the assessment is complete, and the Auditor is provided with the Site Assessment Report for review and acceptance.

- Acceptance criteria for the site would be based on the NEPM Health and Environmental Investigation levels (NEPM-1999). The contamination status of any soils to be removed from the site would also be classified in accordance with NEPM Guidelines. Should contamination above the relevant criteria be found, the following additional processes will be undertaken:

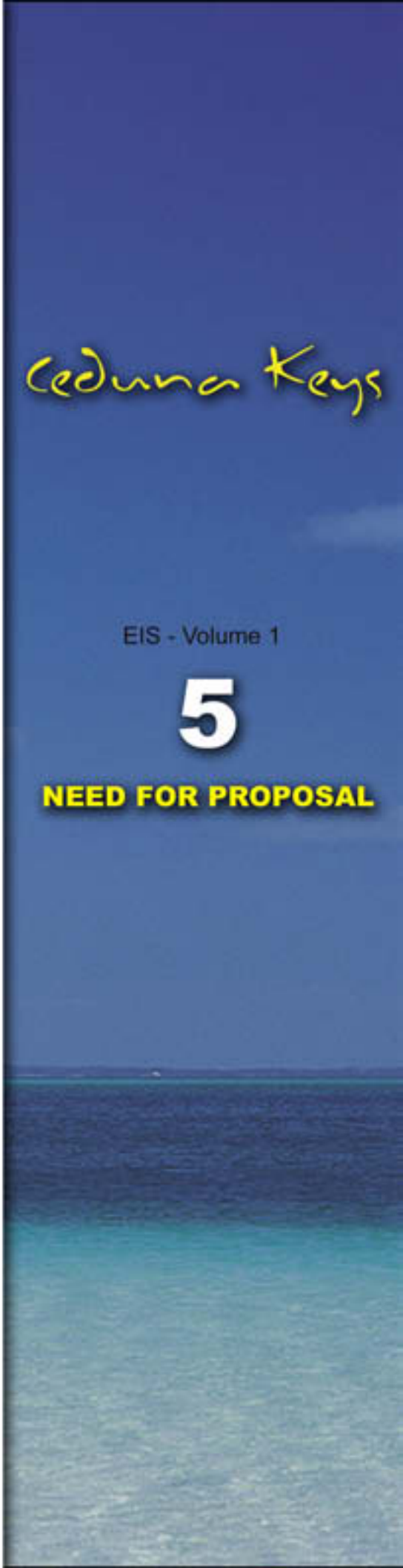
Preparation of a Remediation Action Plan (RAP) together with a site management plan and a remediation validation plan for review and approval by the Environmental Auditor.

Undertake inspections, validation sampling and testing to confirm that the remediation objectives and target clean up levels specified in the RAP are complied with.

Attend to any Auditor or relevant authority queries and requests for further investigation, remediation or validation.

Prepare a site assessment and validation report in accordance with SA EPA requirements and issue to the Auditor for review and sign off.

The objective of the above process is to provide confidence, that in regard to site contamination, the site does not pose unacceptable risks to human health and the environment taking into account the intended end use(s).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NEED FOR PROPOSAL

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

5. NEED FOR PROPOSAL

5.1 Project Objectives

Council has previously articulated the following Objectives for the proposed development in a Review and Business Case undertaken pursuant to Section 48 of the Local Government Act, 1999.

- to provide a safe haven for the fishing fleet;
- to encourage investment in the town and inject vitality into the growing aquaculture and fishing industry;
- to capitalise on and encourage further investment of tourism in the community;
- to foster self determination in the areas of cultural interaction and protection;
- to strengthen partnerships and further develop and promote the reconciliation process within the community;
- maximise employment and education opportunities for local Aboriginal people and wider community;
- develop appropriate opportunities for industry development in cultural heritage interpretation and cultural tourism.

5.2 Social and Economic Need

Ceduna lacks a significant focus for either the community or visitors in terms of an enticing environment and public spaces[7]. The relatively limited amount of promotion together with the inadequate local facilities have not created an environment that will encourage the visitor to stop in the town for a longer period of time. From a strategic perspective Ceduna is important, as it is the key entry point to South Australia from Western Australia.

The existing infrastructure in Ceduna for tourists and residents is relatively tired and dated. Because of this, tourism opportunities are underdeveloped and lacking a strategic focus, while physical infrastructure is insufficient or inadequate to support tourism, other industry sectors, accommodation or community aspirations.[8]

Ceduna is recognised as the gateway to and from the west coast of Australia. The Ceduna Keys project is therefore, not only of regional significance, but strategically important to South Australia. The development is considered a vital link to develop growing industries such as tourism, aquaculture and commercial fishing in the town and region.

Although the regional centre of the far west coast of Eyre Peninsula, over the past eighteen years the town has faced a major decline in population (some 500 people). This has been mainly due to the withdrawal of Government services to the metropolitan areas and subsequent business closures i.e. banks and OTC (Ceduna Satellite Earth Station).

This has had a far-reaching effect on associated industries, services and business in the town. Consequently families and younger people have had to leave the town to find jobs. Unemployment has continued to increase and is significantly high at 15.6% in comparison to other regional areas of Eyre Peninsula and the State. Of this figure the youth unemployment rate

[7] Economic Development Plan for the Communities of Ceduna, Nicholas Clarke, 1996
[8] SA Centre for Economic Studies, An Assessment of Ceduna Keys & Ceduna Coastal Centre Development Plan Volume 1 & 2, February 2001

was recorded at 14.3%. In addition to the youth unemployment numbers, CDEP recipients who are employed for 2 days per week account for a further high number of unemployed indigenous youth in Ceduna. The indigenous population in general has continued to suffer disadvantage in the labour market[9].

With this in mind, the community has been focusing on developing the Ceduna Keys project and the Community Centre to essentially re-vitalise the character and amenity of the town, re-invigorate the social fabric and unique culture and heritage of Ceduna, improve the performance of the local economy, and create an environment which is conducive to investment and job creation.

Because of Ceduna's remoteness the town has limited facilities and services available to locals and visitors alike. What is available is dated, not inviting, nor visually appealing, lacks identity and is desperately in need of change.

From an industry perspective Ceduna is desperately in need of infrastructure, which can adequately support growth industries such as aquaculture, fishing, tourism and mining development.

During 1999, potential sites for the marina were investigated and the current proposed site, located on the coastline of Murat Bay, at the intersection of Denial Bay Road and the Eyre Highway, was selected. A number of key factors led to this location being chosen as the best site for the project:

- its ideal location directly adjacent to National Highway One;
- the site will form a highly visible and attractive gateway to the town and State;
- the site is located directly on the coast and therefore has natural water frontage; and
- there is very little remnant vegetation on the development site and it is considered to be relatively de-graded due to the fact that it has been grazed in years past.

5.3 Market Analysis

The Business Case for the proposed development is clearly outlined in monetary and risk terms within the Business Plan[10] prepared by Collins Anderson for the Council.

This document, arising out of the Section 48 prudential review[11] required under the Local Government Act, addresses the business opportunity, the various development options, risk and presents a profit performance scenario based on a range of investigations including analysis of like facilities within South Australia.

The overall capital investment in the project is estimated at $52.5 million over the term of the project with additional operational expenditure of $7.9 million. Income generated through land and marina berth sales is estimated at $94.9 million.

The Ceduna Keys marina project is, based upon the research undertaken, financially viable with an estimated Net Present Value of $17,460,883 using cost of capital of 6%. The internal rate of return is estimated at 33.93%. Assumptions have been made in respect to an average land price estimate for each of the three stages of the project of $125,000, $75,000 and $100,000 respectively and assume a sale price of $90,000 for each berth.

[9] Community Profile, ABS Census, 2001
[10] Ceduna Keys and Coastal Centre, Business Plan, prepared by Collins Anderson Management & DSC Andrew, June 2003
[11] Ceduna Keys and the Ceduna Coastal Centre, Section 48 Review, prepared by Collins Anderson Management, 2003.

Assuming a 6% discount rate, the Net Present Value of the project remains positive for each stage assuming average price estimates of $75,000, $65,000 and $85,000 respectively and a sale price of $45,000 for each berth. An optimistic scenario for the development assuming average price estimates for Stages 1, 2 and 3 of $180,000, $120,000 and $180,000 respectively and a sale price of $90,000 for each berth has a Net Present Value of $44,429,921.

In terms of the business opportunity, a comprehensive analysis of strengths, weaknesses, opportunities and constraints has been undertaken. The resulting conclusions by Council's independent advisors is that the proposed development presents a potential multi million dollar investment in Ceduna, that would benefit a range of industries including the tourism industry, the fishing industry and the aquaculture industry, resulting in positive flow on effects for all sectors within the community.

There are currently strong trends supporting residential development on Eyre Peninsula. These include an upward trend in residential dwelling approvals and median house prices especially in coastal areas. Land developments close to Ceduna such as Smoky Bay and Streaky Bay have elicited a strong response in recent times suggesting that the West Coast is becoming an increasingly attractive location and that the tyranny of distance appears to be a lesser factor.

Recent marina developments in regional South Australia have encountered significant success especially in terms of current land prices. Marinas on Yorke Peninsula and at Port Lincoln are experiencing land sales for waterfront properties of between $200,000 and $350,000. A marina development at Tumby Bay has had recent land sales between $100,000 and $130,000 whilst a land-based development at Streaky Bay has sold properties for up to $85,000. All of these developments have attracted a range of different buyers including metropolitan and regional South Australia, Western Australia, the Northern Territory and Queensland.

There are existing examples of successfully combining commercial and residential interests at the same marina development site such as Lincoln Cove at Port Lincoln. There is an opportunity for Ceduna to emulate this for the benefit of the town.

Demand for marina facilities has been identified from both commercial and recreational users however this is difficult to quantify. The Ceduna Keys concept has the potential to facilitate expansion of the local fishing and aquaculture industries, which would further enhance demand for the use of the marina including berths and wharf facilities. Other economic activities such as mineral exploration and cruising tourist boats could also be attracted to utilise the marina facilities.

5.4 Consequences of Not Proceeding

To not proceed would be to miss a significant opportunity to address a range of long standing and emerging social and economic issues facing Ceduna and the surrounding region in terms of providing a focus for economic development and activity, financial investment from outside the region, employment creation, upgrade of physical and social infrastructure and the achievement of a critical population mass so as to continue to provide an increased range of goods and services.

The proposal is a rare opportunity to facilitate a multi facetted development that will, in its final form, satisfy a range of existing and anticipated needs within the community in terms of a living, working, recreational and cultural environment. The economic capacity of a project of this nature provides the necessary vehicle to provide a range of uses and activities that may otherwise not be provided in a town such as Ceduna unless significant public expenditure is committed.

Community centres and tourism interpretive facilities are generally provided by the public sector at significant expense in order to stimulate and facilitate economic activity in this important business sector. As the Far West Coast must compete with other regions within South Australia for limited resources, expenditure is invariably prioritised based on volume of existing visitors. This presents emerging regions with a challenge in order to attract the necessary funding in order to reach their full potential.

Ceduna has already experienced a decline in population and this has been due largely, to factors such as; intermittent poor seasonal conditions, the centralisation of services and the drift of youth to larger regional/ metropolitan centres. The drain of the human capital together with some services has brought with it the associated problems of high unemployment and an increase in crime. An improvement of the economic situation within Ceduna may assist in addressing a number of these social problems that are to a large extent brought about by deprivation of opportunities.

If the opportunity to attract investment and industry in Ceduna is not pursued, there is a significant risk that the fishing and aquaculture industry will be attracted to other regional areas such as Western Australia. Fishing industry representatives have indicated that communities such as Esperance are already actively trying to attract a large proportion of the South Australian fishing fleet to Western Australia. Ceduna, and South Australia simply cannot afford any more leakage in terms of investment and employment particularly, when the industry is making a significant contribution to the State's GDP.

The ability both economically and physically to provide a suitable marina facility for the commercial fishing and aquaculture fleet would be frustrated should this development not proceed. The proposal presents a facility that will meet the existing and future needs of both the fishing and aquaculture industries in a manner that is efficient and effective in providing the necessary safety and convenience to operators. A facility elsewhere may not be able to satisfy identified need to the same extent.

The 'master planned' approach to this proposal will provide the necessary structure and guidance to the staged implementation of this development. In the absence of an overall approval for this development, individual components may be proposed and occur in a less than optimum manner such that the same level of efficiencies and economies, particularly in respect to infrastructure provision, may not be achieved. Approval as a Major Development will provide the necessary certainty and flexibility that will satisfy private, government and in particular, community interests.


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6. ENVIRONMENTAL ISSUES

6.1 Introduction

The District Councils of Ceduna, Streaky Bay and Elliston have for a long time been responsible for the management of a large proportion of the coastal areas in the region. Recognising the importance of the ongoing issues along the coast and the adjacent marine waters, the Councils decided to take a pro-active approach and the Great Australian Bight 1000 West Coast Strategy (GAB 1000)[12] was completed in early 2000. The Strategy clearly identified a number of the environmental problems and associated coastal issues in the region. Accordingly, appropriate strategies and recommendations were developed to directly tackle these issues.

The GAB 1000 Strategy was developed as a planning document that not only addressed the major issues, but also provided a strategic management plan for State and Local Government to facilitate and promote ecologically, economically and socially sustainable development. The key aims of the document have been to promote improvements through an integrated and coordinated effort by all with an interest in the region's coastal and marine management.

The Strategy identified that cumulative impacts must be addressed in an area that depends heavily on its natural resource base for its survival. Inadequate management of the West Coast today could therefore produce problems in 10, 15 or 20 years time that may potentially threaten its future economic and social sustainability. The document highlighted the numerous pressures affecting the natural resources of the region these included:

- Conservation of biodiversity;
- Protection of biological values / threatened species management;
- Protection of important marine habitats;
- Marine biodiversity changes / carrying capacity;
- Marine litter;
- Maintenance of water quality / controlling pollution sources;
- Land management;
- Perceived alienation of regional community from the management of the commercial fisheries of the region;
- Competition between commercial and recreational fishers for shared resources;
- Enforcement of fisheries management provisions;
- Over-harvesting of marine fish resources by minority of recreational / illegal fishers;
- Minimising impacts of fishing activities (ie. by catch reduction, reducing impacts and conflicts of accessing coast);
- The process of consultation and public input to the aquaculture resource allocation, planning and approval process;
- Water pollution (preventing shellfish contamination);
- Subdivision, rural housing developments and marine developments
- Sustainable management of coastal tourism and recreation activities (in particular, access and activity impacts);
- Tourism and recreation / tourism infrastructure requirements; and
- Ballast water management / requirement for port studies.

Since its completion the three Councils have employed a co-ordinator to implement the recommendations, monitor progress and evaluate the actions that have been taken to date. It is fair to say that significant progress has been made and Councils have implemented a number of projects and policies that are protecting and enhancing the region's marine environment and coastline.

In June 2002 the District Council of Ceduna submitted an application to Environment Australia for decision whether or not approval was needed under Chapter 4 of the EPBC Act 1999 for the

[12] Great Australian Bight 1000 West Coast Strategy (GAB 1000)

Ceduna Keys development. The referral was considered under the EPBC Act and it was decided that the action would not be a controlled action. Approval has therefore not been needed under Part 9 of the Act before the action can proceed. A key part of the EPBC Act referral process involved an assessment of the potential impact that the Ceduna Keys proposal could have on migratory waders and other waterbird species.

The listed migratory species include those listed in:

- the appendices to the Bonn Convention for which Australia is a Range State under the Convention;
- the Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CHAMBA);
- the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- any native species identified in an international agreement approved by the Commonwealth Environment Minister.

This has meant that no further approval from Environment Australia has been necessary under the EPBC Act, and the project has been able to proceed. A copy of this correspondence is provided at Appendix C

Statements issued by the South Australian Environment Protection Authority in June 2004 under Section 7 of the Land and Business (Sale and Conveyancing) Act 1994 have not identified any existing environmental issues in respect to the subject land.

For the proposed development, key environmental issues have been identified which are outlined below. The design of the marina, its location, environmental management during construction and ongoing management of the marina (see Section 10.) aim to minimise potential environmental impacts in order to be consistent with the GAB 1000 Strategy and meet the requirements of various State and Commonwealth legislation.

COASTAL

6.2 Sea Level Rise

For an open waterway system compliance with the Coastal Protection Board (CPB) policy has been assessed as follows.

Table 6.1 Sea Level Rise Criteria

Protection Criteria	Tidal Waterways	
	Piled buildings over waterways	**Areas capable of future protection**
100 year storm tide (Thevenard)	2.32m AHD	2.32m AHD
Wave set up	0.20m	0.20m
Freeboard	0.25m	0.25m
Sea Level Rise		
- 50 Year	N/A	0.35m
- 100 Year	1.00m	N/A
Minimum building floor level	3.77m AHD	3.12m AHD

Due to the fact that there will be a surplus of material excavated from the waterways a minimum general fill level of 3.20m AHD has been adopted in order to comply with the above requirement.

The 100-year storm tide of 2.32 m above mean sea level was based on advice provided by The National Tidal Centre (Bureau of Meteorology). Their advice was based on the results of a study undertaken in 1989 for Thevenard.

6.3 Sand Movement and Seagrass/algal Debris Accumulation

Murat Bay does not experience coastal systems that result in large volumes of sand moving up or down the coast. The dynamics of Murat Bay are such that sand and sediment are not anticipated to be a significant factor in terms of maintaining a channel depth of the minimum required. Moreover, no significant build up or loss of sand is anticipated either side of the proposed breakwaters.

The condition of the existing marine environment is documented more comprehensively within the Preliminary Environmental Assessment prepared by Eco Management Services Pty Ltd (see Volume 2, Working Paper 3)[13] used as a source for this report. Moreover specific details in respect to engineering approaches to be employed in order to minimise damage to seagrass is provided within the Engineering Assessment by Dare Sutton Clarke Engineers (see Volume 2, Working Paper 1)[14].

In addition to these bodies of work, the Proponent has commissioned John Chappell Engineers to undertake an assessment of coastal systems in order to better understand the extent to which the proposed development may alter or impact on such systems, and measures that may be used to avoid, manage or mitigate the effects of such impacts. In particular the report by John Chappell Engineers (2004) (see Volume 2, Working Paper 5)[15] addresses breakwater location and height, sand and seagrass/algal debris movements and entrance channel stability.

This report provides the following recommendations in respect to the abovementioned issues:

- *the breakwater entrance to be relocated past the junction of the sand and seagrass by approximately 30 metres in order to reduce the potential for disturbance of sand at low tides;*
- *this could be achieved by moving the breakwater seaward or by extending training walls alongside the channel for the specified distance;*
- *the breakwater height at the entrance channel which is subject to the largest wave action will require a RL of +4.0 metres as such relate to AHD, and this may be reduced in height as it approaches the shore to +3.0 metres AHD;*
- *the breakwater is to achieve a 1 in 3 slope in order to achieve long term stability in the areas most exposed to wave action such as the sea facing slopes of the structure at the seaward end;*
- *based on Admiralty Chart soundings the channel will need to extend out approximately a further 1000 metres from the end of the training walls;*
- *training walls would be of similar construction to the breakwater with the top level lower at +3.0 metres AHD, with slopes on both faces of 1 in 3 with appropriate armouring rock on both sides and top;*

[13] Environmental Assessment, Eco Management Services Pty Ltd, 2004
[14] Ceduna Keys Engineering Assessment, Dare Sutton Clarke Engineers, August 2004
[15] Coastal Engineering Study – Ceduna Keys, Preliminary Study of Breakwater Location Height, Sand and Seagrass Movements and Entrance Channel Stability, John Chappell Engineers, 2004.

- *training walls will have a further advantage in so far as they tend to cause sand or seagrass to be trapped in the re-entrant corners where they join the breakwater rather than this material moving into the entrance and the marina basin itself;*

- *accumulation at these corners would be more accessible for periodic removal by land based equipment;*

- *should rock be encountered at the time of excavation, the side slopes could be quite steep (1 vertical 2 horizontal) and if the material turns out to be fine sand then flatter slopes would be needed and most likely rock protection to prevent sideways erosion of the sea floor due to wash from vessels. It is now intended to have 1:3 slopes along the channel, with protection of the batters inshore to prevent erosion;*

- *an alternative to rock protection may be sand filled sacks or a geotextile container which would also allow for seagrass to repopulate the side slopes; and*

- *conditions inside the waterway are anticipated to be most favourable with very bad conditions anticipated to occur infrequently, with wave action entering the waterways past the breakwater with energy dissipating.*

This report also recommends that the following further investigations be undertaken in order to prepare a more detailed design and construction procedure:

- surroundings of the area covering the entrance channel;

- penetrometer survey of the sea floor for preliminary determination of material and depth of sand; and

- tube sampling along the line of the channel to detect changes in material.

6.4 Recreational and Commercial Boating

The primary potential for impact by recreational and commercial boating would arise from the number of vessels using the channel in and out from the marina and associated waterways, together with the speed at which such occurs.

The combination of the two have the potential to result in turbidity of water that may effect water quality and the condition of the marine environment, in particular, within and surrounding the channel.

Other potential impacts arise from the discharge of bilge and ballast waters, refuelling, removal of sewage effluent, maintenance, repair work, hull cleaning, painting and antifouling, the latter of which are to be disallowed within this facility.

The use of vessels is to be managed via the Land Management Agreement (LMA) proposed for the development in terms of:

- the design and use of jetties and other mooring facilities
- the type of vessels that may be moored
- activities associated with the use and maintenance of vessels
- living on board
- disposal of refuse
- disturbance and disorderly behaviour

In addition to the provisions of the LMA the Management Maintenance and Monitoring Agreement will address the following matters:

- appointment of a marina manager
- safe navigability
- design, construction, maintenance and use of mooring facilities
- waste management
- administration of by laws under the Plan of Community Division
- removal of sunken vessels
- entrance of foreign vessels
- use of berths by commercial fishing boats
- management of spills and pollutants
- fire
- loading and unloading
- refuelling
- repairs and maintenance
- toilet pump out and treatment

It should be noted that the level of boating activity facilitated by the proposed facilities is not anticipated to be significantly greater than that presently experienced as a result of recreational fishing and charter operations that utilise the public boat ramp facilities provided by the Council.

In terms of the potential impacts that an increase in boating activity may have on off shore islands and fish stocks, it should also be noted that there are other legislative and regulatory requirements that must be observed in terms of bag limits and access to these islands which are designated as National Park.

It is acknowledged that the increase in activity does increase the risk of impact on these environments, however no more so than if additional boat ramp facilities were to be installed for larger vessels. The proposed development is therefore not in itself anticipated to have a direct impact on these environments.

BIOLOGICAL

6.5 Introduction

A Preliminary Environmental Assessment of the proposal was undertaken in 2000 (EMS 2001). As part of the assessment an examination was undertaken of:

- The marine subtidal communities
- The marine intertidal communities
- The terrestrial environment, mainly a general description of flora habitat

Since this preliminary work was reported changes have been made to the proposal, particularly the extent of the marina structure (breakwaters) seawards. The earlier report has been updated to reflect these changes, although no additional marine subtidal work was undertaken (see EMS 2004).

In addition Dare, Sutton and Clarke have prepared an Engineering Assessment of the proposal, giving information on environmental issues, including stormwater and effluent management and reuse. This document is provided as a Working Paper – Refer Working Paper 1

The proposed site of the marina extends out approximately 200 m from the beach. For the marine subtidal studies of EMS (2001), the study site was extended out to 2.5km to accommodate a buffer zone for any potential impacts. This document is included in Volume 2, Working Paper 2.

Recently a more detailed assessment of the terrestrial flora and fauna has been undertaken by Delta Environmental Consulting (2005). This document is included in Volume 2, Working Paper 3. These studies are summarised in relation to key environmental issues in the following sections.

Murat Bay is shown in Figure 6.1. The proposed site of the marina is located just north of the Ceduna township in the north-eastern corner of the bay.

For the detailed assessment of the terrestrial flora and fauna undertaken by Delta Environmental Consulting (2005) and the preliminary assessment of EMS 2001, the study area is largely restricted to the site of the marina-residential area.

6.6 Terrestrial Vegetation

6.6.1 Existing Vegetation

The following extracts from the more substantive report prepared by Delta Environmental Consulting are provided below for ease of reference. The entire report is provided as a resource to be read in conjunction with this EIS.

The site has several morphological terrestrial vegetation units that occur from the landward edge of the intertidal zone, through salt pans, dunes and cheniers. The more 'marine' of the intertidal vegetation units will be addressed in a separate section on intertidal marine vegetation, while this section only includes the more 'coastal' of the intertidal vegetation units. The unit definitions are based on McDonald *et al* (1990).

The plant associations in the surveyed morphological units are:

- **C1D:** Closed dwarf chenopod shrubland in the intertidal area, dominated by *Sarcocornia quinqueflora* and *Suaeda australis*.
- **C2M:** Mid-dense low chenopod shrubland dominated by *Halosarcia pruinosa, H. pergranulata*, and *H. halocnemoides* often with *Hemichroa diandra* as a sub-dominant.
- **C3S:** Open mid-high chenopod shrubland dominated by *Atriplex* spp., *Maireana* spp. and/or *Frankenia* spp. often with an understorey of *Hemichroa diandra*.
- **C4D:** Closed tall chenopod shrubland in the supratidal area, dominated by *Sclerostegia arbuscula.*
- **D3M:** Mid-dense tall sod grassland dominated by anthropogenic grasses.
- **F2S:** Open mid-high forbland dominated by Ward's weed interspersed with scattered chenopods (*Sclerolaena* spp.and *Salsola* kali).
- **G2S:** Open tussock grassland dominated by *Austrostipa* spp. and *Danthonia setacea*.
- **S3S:** Open mid-high shrubland on dunes and shelly ridges with *Geijera linearifolia, Olearia* spp., *Acacia* spp. and *Pittosporum phylliraeiodes*. Isolated tall shrubs may occur in patches.
- **S3V:** Sparse mid-high shrubland dominated by *Olearia* spp., *Geijera linearifolia, Maireana* and *Cratystylis conocephala*.

- **S41:** Isolated tall shrubs, usually *Melaleuca* spp. or *Acacia* spp.
- **S4D:** Closed coastal dune tall shrubland dominated by *Nitraria billardierei, Atriplex vesicaria* and *Cakile maritima*.
- **T4V:** Open low mangrove woodland in the intertidal area (*Avicennia marina*) with a poor understorey except where the woodland is prograding across the neighbouring low chenopod shrubbery.
- **Y4L:** Isolated clumps of tall mallee shrub or other tall shrubs, usually *Eucalyptus gracilis*, *Eucalyptus calcareana* or *Melaleuca* spp.

Figure 6.1 – Murat Bay

A supervised classification of the various plant associations shown above in the 1995 aerial photography.

Table 6.2 Percentage cover of each habitat type within surveyed area

Habitat code	% of site	Area covered (Hectares)
C1D: Closed dwarf chenopod shrubland (intertidal)	1.3	2.4
C2M: Mid-dense low chenopod shrubland (extratidal)	19.1	34.5
C3S: Open mid-high chenopod shrubland (extratidal)	11.2	20.1
C4D: Closed tall chenopod shrubland (supratidal)	0.4	0.6
D3M: Mid-dense tall sod grassland	6.6	12.0
F2S: Open mid-high forland	3.1	5.6
G2S: Open tussock grassland	11.2	20.3
S3S: Open mid-high shrubland (dunes, berms)	8.4	15.1
S3V: Sparse mid-high shrubland (dunes, ridges)	4.2	7.5
S41: Isolated tall shrubs	3.9	7.1
S4D: Closed coastal dune tall shrubland (primary dune)	2.5	4.4
T4V: Open low mangrove woodland (intertidal)	0.9	1.6
Y4L: Isolated clumps of tall mallee shrub or other tall shrubs	2.0	3.6
Bare soil	23.9	43.0
Rocky reef	1.5	2.7
Total	100.0	180.4

Studies by Young (1988) broke the vegetation of the coastal strip along this stretch of the South Australian coast into three broader categories:

- Beach/dune vegetation – cover includes species such as *Olearia axillaris, Nitraria billardierei, Spinifex seriaceus* and other salt-tolerant species.
- Coastal heath vegetation – cover includes *Alyxia buxifolia, Melaleuca lanceolata, Beyeria lechenaultii*, on soils varying from calcareous sands to thin sands overlying calcarenite.
- Sub-coastal scrub – *Melaleuca lanceolata* (coastwards) and *Melaleuca pauperiflora* (inland) with occasional *Eucalyptus oleosa* (*E. gracilis, E. yalatensis, E. calcareana*) and an understorey of *Atriplex paludosa* (coastwards) or *Atriplex vesicaria* (inland).

The study site contains all three of Young's habitats, plus the area of stranded salt marsh.

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Figure 6.2 Terrestrial vegetation associations

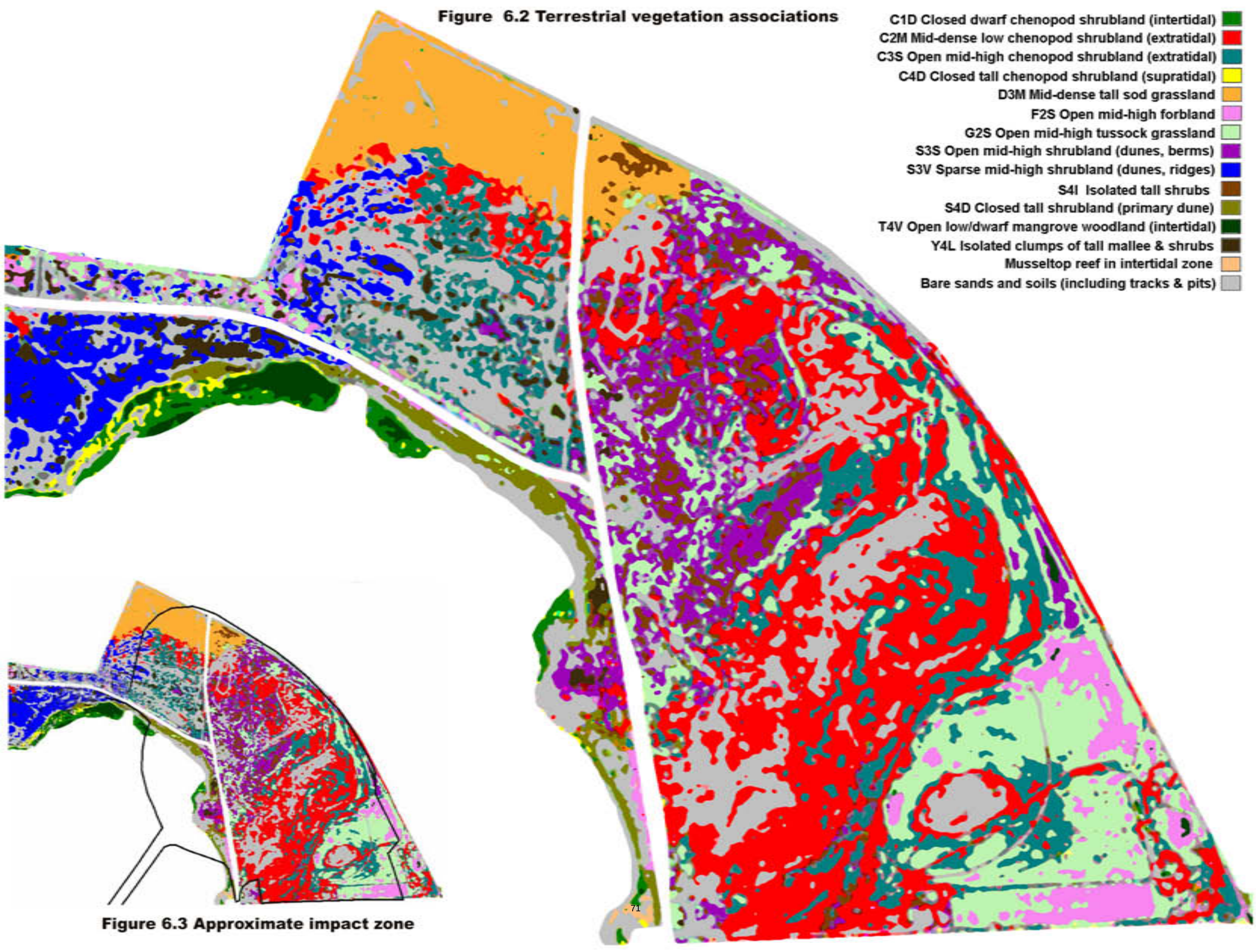

Figure 6.3 Approximate impact zone

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ENVIRONMENTAL IMPACT STATEMENT

6.6.2 Impact Area

For the area, Table 6.1 details the existing percentages and areas of the site covered by each habitat type. It was reported by Delta Environmental Consulting (2004), refer Working Papers in Vol 2, that the direct impact area of the proposed development, shown in Figure 6.3 above, covered 81% of the site, with no area of the study site being more than 200m from the direct impact site.

This has now changed with the development on the coastal strip to the west (referred to as release 12) no longer part of the development. Except for the excluded western coastal strip, those habitats occurring inside the outline are likely to be removed completely by residential development or the development of waterways.

The terrestrial habitats adjacent to the development could be impacted by weeds. A weed management plan is therefore a part of the landscaping plan to be developed for the project and part of ongoing management (refer Section 10).

6.6.3 Plant Species

A survey was undertaken involving a series of quadrats (radii 30 m) during November 2004. Full details of the methodology are included in the report by Delta Environmental Consulting which is provided as a resource document to be read in conjunction with this EIS Report.

Quadrat locations are shown on Figure 6.4 located overleaf.

There were eighty-six (86) indigenous species and forty-three (43) alien species, one hundred and twenty-nine (129) species in all, encountered and collected during the site visit. The species recorded are listed in Table 6.2, and statistically summarised in Table 6.3.

Table 6.3 Species list of plants occurring on the site

Family	*Species*	Common name	Exotic	Conservation status
Agavaceae	*Agave americana*	Century plant	*	
Aizoaceae	*Carpobrotus rossii*	Karkalla or Ross' noonflower		
Aizoaceae	*Disphyma crassifolium*	Round leaf pigface		
Aizoaceae	*Galenia secunda*	Blanket weed	*	
Aizoaceae	*Mesembryanthemum aitonis*	Angled iceplant	*	
Aizoaceae	*Mesembryanthemum nodosum*	Slender iceplant	*	
Aizoaceae	*Mesembryanthum crystallinum*	Common iceplant	*	
Aizoaceae	*Tetragonia implexicoma*	Bower spinach		
Amaranthaceae	*Hemichroa diandra*	Mallee hemichroa		
Amaranthaceae	*Ptilotus obovatus* var *obovatus*	Silver mulla mulla		
Avicenniaceae	*Avicennia marina*	Grey mangrove		
Boraginaceae	*Heliotropium europaeum*	Potato weed	*	
Caryophyllaceae	*Silene gallica*	French catchfly	*	
Caryophyllaceae	*Silene nocturna*	Mediterranean catchfly	*	
Caryophyllaceae	*Spergularia marina*	Salt sand-spurry	*	

Family	*Species*	Common name	Exotic	Conservation status
Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak		
Chenopodiaceae	*Atriplex acutibractea*	A saltbush		
Chenopodiaceae	*Atriplex cinerea*	Coast saltbush		
Chenopodiaceae	*Atriplex paludosa* ssp. *cordata*	Marsh saltbush		
Chenopodiaceae	*Atriplex vesicaria*	Bladder saltbush		
Chenopodiaceae	*Atriplex vesicaria* var *variablis*	Bladder saltbush		
Chenopodiaceae	*Beta vulgaris*	Beet	*	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush		
Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
Chenopodiaceae	*Halosarcia pergranulata* var *pergranulata*	Black seed samphire		
Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
Chenopodiaceae	*Maireana appressa/radiata*	A cotton bush with no fruit		
Chenopodiaceae	*Maireana brevifolia*	Small-leaved bluebush		
Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
Chenopodiaceae	*Maireana erioclada/pentatropis*	A maireana with no fruit		
Chenopodiaceae	*Maireana oppositifolia*	Heathy bluebush		
Chenopodiaceae	*Maireana scleroptera*	A maireana		
Chenopodiaceae	*Maireana trichoptera*	A bluebush		
Chenopodiaceae	*Rhagodia candolleana*	Seaberry saltbush		
Chenopodiaceae	*Rhagodia crassifolia*	Fleshy saltbush		
Chenopodiaceae	*Salsola kali*	Buckbush rolypoly	*	
Chenopodiaceae	*Sarcoconia quinqueflora*	Bearded glasswort		
Chenopodiaceae	*Sclerolaena brevifolia* poss. hybrid with *S. obliquicuspis*	A copperburr or bindyii		
Chenopodiaceae	*Sclerolaena uniflora*	Bassia		
Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
Chenopodiaceae	*Suaeda australis*	Austral sea-blite		
Chenopodiaceae	*Threlkeldia diffusa*	Coast bone fruit		
Compositae	*Angianthus tomentosus*	Hairy cup flower		
Compositae	*Arctotheca calendula*	Cape weed	*	
Compositae	*Centaurea melitensis*	Maltese cockspur	*	
Compositae	*Conyza bonariensis*	Flaxleaf fleabane	*	
Compositae	*Cratystylis conocephala*	Bluebush daisy		
Compositae	*Gazania linearis*	Gazania	*	
Compositae	*Hedypnois rhagadioloides*	Cretan weed	*	
Compositae	*Helianthus annuus*	Common sunflower	*	
Compositae	*Ixiolaena pluriseta*	A plover daisy		Rare in SA, Unknown for EP
Compositae	*Kippistia suaedifolia*	Kippistia		Rare in EP

Family	*Species*	Common name	Exotic	Conservation status
Compositae	*Olearia axillaris*	Coast daisy bush		
Compositae	*Olearia exiguifolia*	Small-leaved daisy-bush		
Compositae	*Reichardia tingitana*	False sow thistle	*	
Compositae	*Senecio lautus*	Variable groundsel		
Compositae	*Sonchus oleraceus*	Common sow thistle	*	
Compositae	*Vittadinia cervicularis*	Fuzzweed		
Compositae	*Vittadinia cuneata*	Fuzzweed		
Compositae	*Vittadinia eremaea*	A vittadinia		
Crassulaceae	*Crassula sieberana* var *tetramera*	Austral stonecrop		
Cruciferae	*Brassica tournefortii*	Long fruited wild turnip	*	
Cruciferae	*Cakile maritima*	Sea rocket	*	
Cruciferae	*Carrichtera annua*	Ward's weed or duck-bill burr	*	
Cruciferae	*Diplotaxis tenuifolia*	Lincoln weed	*	
Epacridaceae	*Acrotriche patula*	Shiny ground berry		
Euphorbiaceae	*Euphorbia terracina*	Carnation weed, false caper	*	
Frankeniaceae	*Frankenia pauciflora*	Sea heath		
Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
Gentianaceae	*Centaurium tenuiflorum*	A centaury		
Goodeniaceae	*Scaevola spinescens*	Spiny fanflower		
Gramineae	*Austrostipa drummondii*	Cottony speargrass		
Gramineae	*Austrostipa elegantissima*	Feather speargrass		
Gramineae	*Austrostipa eremophila*	Desert spear-grass		
Gramineae	*Austrostipa flavescens*	A spear-grass		
Gramineae	*Avena barbata*	Bearded oat	*	
Gramineae	*Bromus catharticus*	Prairie grass	*	
Gramineae	*Bromus rigidus*	Rigid brome	*	
Gramineae	*Critesion murinum*	Barley grass	*	
Gramineae	*Cynodon dactylon*	Couch grass		
Gramineae	*Danthonia setacea* var *setacea*	Bristly, or small flowered, or mulga wallaby grass		
Gramineae	*Festuca littoralis*	Coastal fescue		
Gramineae	*Lolium perenne*	Perennial ryegrass	*	
Gramineae	*Parafolis incurva*	Curly rye	*	
Gramineae	*Polypogon monspeliensis*	Annual beard-grass	*	
Gramineae	*Tribolium acutiflora*	Desmazeria	*	
Iridaceae	*Gynandriris setifolia*	Thread Iris	*	
Iridaceae	*Romulea minutiflora*	Guildford grass	*	
Labiatae	*Marrubium vulgare*	Horehound	*	
Labiatae	*Westringia rigida*	Stiff westringia		
Leguminosae	*Acacia anceps*	Port Lincoln wattle		

Family	*Species*	Common name	Exotic	Conservation status
Leguminosae	*Acacia cyclops*	Western coastal wattle		
Leguminosae	*Acacia hakeoides*	Hakea wattle		
Leguminosae	*Medicago polymorpha*	Burr medic	*	
Leguminosae	*Senna artemesiodes*	Desert cassia		
Leguminosae	*Templetonia retusa*	Cockie's tongue		
Liliaceae	*Asphodelus fistulosus*	Onion weed	*	
Liliaceae	*Dianella brevicaulis*	Short fruited black anther flax- lily		
Liliaceae	*Dianella revoluta*	Black anther flax lily		
Liliaceae	*Lomandra collina*	Fibrous mat-rush		
Liliaceae	*Thysanotus baueri*	Mallee fringe lily		
Limoniaceae	*Limonium companyonis*	Sea lavender	*	
Limoniaceae	*Limonium sinuatum*	Notch leaved perennial sea lavender	*	
Loranthaceae	*Amyema melaleucae*	A mistletoe		
Malvaceae	*Lawrencia squamata*	Thorny lawrencia		
Myoporaceae	*Eremophila glabra*	Tar bush		
Myoporaceae	*Eremophila weldii*	Purple emubush		
Myoporaceae	*Myoporum brevipes*	Warty myoporum		
Myoporaceae	*Myoporum insulare*	Boobialla		
Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
Myrtaceae	*Eucalyptus gracilis*	White mallee		
Myrtaceae	*Eucalyptus stoatei*	Scarlet pear gum		
Myrtaceae	*Melaleuca lanceolata*	Moonah		
Myrtaceae	*Melaleuca pauperiflora*	Boree		
Pittosporaceae	*Pittosporum phylliraeoides*	Native apricot		
Primulaceae	*Anagallis arvensis*	Blue flowered pimpernel	*	
Proteaceae	*Hakea rugosa*	Dwarf hakea		
Rutaceae	*Geijera linearifolia*	Sheepbush, oil bush or wilga		
Santalaceae	*Exocarpos aphyllus*	Leafless cherry		
Santalaceae	*Santalum acuminatum*	Quandong		
Sapindaceae	*Dodonaea stenozyga*	Desert hopbush		
Solanaceae	*Lycium australe*	Australian boxthorn		
Solanaceae	*Lycium ferocissimum*	African boxthorn	*	
Solanaceae	*Solanum hystrix*	Afghan thistle		
Umbelliferae	*Bupleurum semicompositum*	Bupleurum	*	
Umbelliferae	*Foeniculum vulgare*	Fennel	*	
Zygophyllaceae	*Nitraria billardierei*	Dillon berry or nitre bush		
Zygophyllaceae	*Zygophyllum aurantiacum*	Shrubby twinleaf		
Zygophyllaceae	*Zygophyllum billardierei*	Coast twinleaf		

Figure 6.4 Locations sampled during the survey (aerial photography from Mapland, 2003)

Table 6.4 Biodiversity information

Statistics	
Total species	129
Species exotic to Australia	43
Australian indigenous species	86
Eyre Peninsula indigenous species	84
Exotics as percentage of biodiversity	35%
Species of conservation significance	2

No single survey can capture all species found on a site, and this survey was conducted in late spring / early summer, so it may under-represent the winter and spring flowering annuals, orchids and some of the more ephemeral grasses. However the survey would adequately confirm the presence of perennials and the later flowering annuals. In order to address any shortcomings of this survey, a comparison was made between the species found in this survey and those found in surveys of nearby areas, or those conducted previously on the site.

Plate 1 ***Silver mulla mulla***

Plate 2 ***Hemichroa diandra***

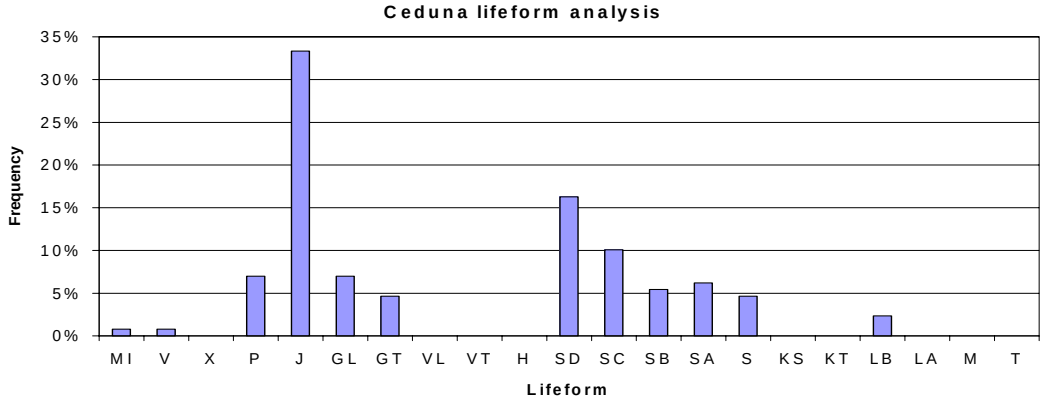
6.6.4 Dune and Clifftop Vegetation

The first quadrat (No. 1) of this survey was located on a clifftop area on the western extremity of the study site. It was a similar quadrat to those reported by Oppermann (1999) in *A Biological Survey of the South Australian Coastal Dune and Clifftop Vegetation*, making it a useful site for comparative purposes.

There were thirty-seven (37) distinct species found in this quadrat, of which eight (8) were exotic species. Oppermann records that the median number of species for clifftop locations in Eyre Peninsula West is twenty (20), with a maximum of forty (40) and a minimum of five (5).

Similar statistics for the next region westward (Head of Bight) are lower, with the median number of species being thirteen (13), the maximum twenty-two (22) and the minimum three (3). From this comparison, it would appear that quadrat 1 represents the higher end of biodiversity for clifftop sites in the region.

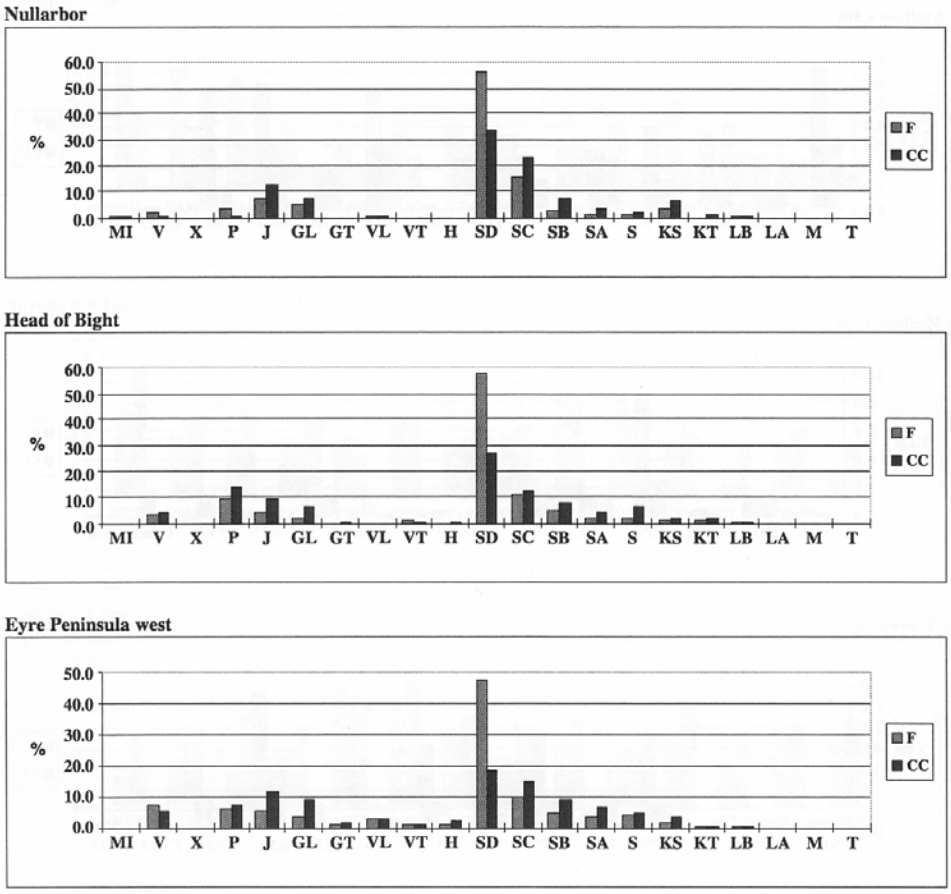
Figure 6.5 Lifeform analysis of the Ceduna site



Note: MI: Mistletoes, V: Vines and twiners, X: Ferns, P: Mat plants, J: Herbaceous plants, GL: Grasses <0.5m, GT: Grasses >0.5m, VL: Sedges <0.5m, VT: Sedges >0.5m, H: Hummock grass, SD: Shrubs<0.5m, SC: Shrubs 0.5-1m, SB: Shrubs 1-1.5m, SA: Shrubs 1.5-2m, S: Shrubs >2m, KS: Low mallee <3m, KT: Mallee >3m, LB: Trees <5m, LA: Trees 5-10m, M: Trees 10-30m, T: Trees >30m

Oppermann (1999) conducted lifeform analyses along the coastline, using amalgamated data for all sites in each region. Such analysis may be presented as frequency (percentage of species present) or abundance (area of cover) data and Oppermann presented both. The current survey only produced frequency data, so this is all that may be compared. All species located on the study site were classified according to their lifeform, and the frequency graphed.

Figure 6.6 Lifeform analyses, Eyre Peninsula West to Nullabor (Oppermann, 1999)



In all three of Oppermann's graphs, the dominant lifeforms are the low shrubs, followed by the taller shrubs, forbs, grasses and mat plants. The current survey site contains a much larger percentage of forbs than Oppermann's sites, however the overall lifeform classes and relative distributions are similar to her findings, with a complete lack of large trees, and a paucity of sedges, hummock grasses and ferns, and with the dwarf shrubbery providing the larger variety than the taller shrubbery. The difference may be explained by Oppermann mainly reporting perennial species, which would have resulted in an under representation in her graphs of annuals – these would have occurred largely in the forbs, mat plants and grasses classes.

The comparison above suggests that the dune and clifftop is relatively representative of the vegetation that is normally found in similar sites of the region, even though some of the site has been grazed extensively in the past.

A review of historic aerial photography suggests that only the northern extremity and south-eastern extremity of the site have been cleared. The remainder of the site has been grazed to varying extents. Many of the shrubs along the western edge of the coastal strip north of the existing service station have been in existence for at least fifty years. The large dune itself has become steadily more vegetated over that time, but at least one large mallee is still in evidence today that predates the earliest photograph.

The long sloping hill at the south-eastern corner of the study area was cleared prior to 1950, and has been mined for sand or gravel. This block has excellent quantities of *Danthonia setacea* and several types of *Austrostipa* still existing between a heavy infestation of noxious and other weeds. While much of the north-western block has been cleared, the southern portion of the northern block contains many large shrubs and mallees that can be identified in the 1968 photograph.

The small dune east of the highway, just north of the border checking station has seen considerable growth of native vegetation in the denuded patch, however there are some older shrubs that are in evidence in early photographs – particularly towards the north of the dune and along its eastern boundary.

The trees currently growing along the road reserve on the north-western boundary of the north eastern block are only just in evidence in the 1968 photograph, however the band of tall shrubs and low mallees located along the southerly base of the slope were already mature. The effects of off-road vehicles and mining are clearly visible in the centre of the more recent photograph. This impact is limited in area, with the dunes along the eastern boundary of the block being in good condition. Many of the larger shrubs on these dunes are visible in the early photograph.

6.6.5 Saltmarsh

Much of the published data for the coastal zone vegetation of the West Coast concentrates on dune and clifftop vegetation. Saltmarsh vegetation is largely unstudied. Unpublished data is available on request from the Department for Environment and Heritage. Departmental staff (Fotheringham, pers.comm.) have recorded plants found in saltmarsh areas at Laura Bay, Tourville Bay, Acraman Creek and Cape Missiessy. Thirteen individual site records are available for the four sites and Table 6.5 below is a compilation of the species recorded across all the sites.

Table 6.5 West Coast intertidal salt marsh species (DEH data, Fotheringham, 2004)

Species	Common name	Distribution
*Bupleurum semicompositum	Hare's Ear	<5%
*Hymenolobus procumbens	Oval Purse	sparsely present
*Parapholis incurve	Curly Ryegrass	<5%
*Spergularia diandra	Lesser Sand-spurrey	sparsely present
Atriplex paludosa ssp. cordata	Marsh Saltbush	5-25%
Calandrinia eremaea	Dryland Purslane	sparsely present
Carpobrotus rossi	Native Pigface	<5%
Crassula sieberiana ssp. tetramera	Australian Stonecrop	<5%
Disphyma crassifolium	Round-leaf Pigface	<5%
Frankenia pauciflora var. fruticulosa	Southern Sea-heath	<5%
Frankenia sessilis	Small-leaf Sea-heath	sparsely present
Geijera linearifolia	Sheep Bush	sparsely present
Halosarcia flabelliformis	Bead Samphire	5-25%
Halosarcia halocnemoides	Grey Samphire	5-25%
Halosarcia indica ssp. leiostachya	Brown-head Samphire	25-50%
Hemichroa diandra	Mallee Hemichroa	<5%
Lawrencia squamata	Thorny Lawrencia	5-25%
Maireana oppositifolia	Salt Bluebush	5-25%
Nitraria billardierei	Nitre-bush	sparsely present
Poa fax	Scaly Poa	sparsely present
Rhagodia candolleana	Sea-berry Saltbush	sparsely present
Samolus repens	Creeping Brookweed	sparsely present
Sarcocornia blackiana	Thick-head Samphire	sparsely present
Sarcocornia quinqueflora	Beaded Samphire	5-25%
Sclerostegia arbuscula	Shrubby Samphire	>75%
Senecio glossanthus	Annual Groundsel	sparsely present

Species	Common name	Distribution
Senecio lautus	Variable Groundsel	<5%
Stipa drummondii	Cottony Spear-grass	sparsely present
Suaeda australis	Austral Seablite	5-25%
Threlkeldia diffusa	Coast Bonefruit	sparsely present
Triglochin sp.	Arrowgrass/Water-ribbons	<5%
Wilsonia humilis var. humilis	Silky Wilsonia	sparsely present
Zygophyllum billardierei	Coast Twinleaf	<5%

When compared to the salt marsh species found in the current survey, 64% of the species recorded on the Department's regional list were present on the Ceduna study site. Of the twelve species that were not recorded, the majority were specialist plants that would be expected only in specific habitats. For example, *Samolus repens, Sarcocornia blackiana* and some *Triglochin* species are found where there is an input of fresh or brackish waters, while *Halosarcia flabelliformis* has very specific soil and hydrological requirements that are not yet completely understood.

The vegetation association map also displays about 43 hectares of bare earth (either in the pan sections of the stranded saltmarsh or denuded areas of sand in the dunes and ridges), and some small patches of intertidal reef.

The coastal strip shows the gradual expansion of mangrove trees. The oldest mangroves are still in evidence in the earlier photographs, but the woodland is now both denser and more extensive than it was 36 years ago, as it is prograding across the intertidal saltmarsh.

Dense *Sclerostegia arbuscula* mark the drainage channels through the stranded salt marsh. Although these shrubs do not attain great stature, they are a long lived species, making it quite possible that the individual shrubs present today have survived the changed conditions since the highway cut off tidal flushing.

6.6.6 Conservation Status of Indigenous Flora Species

Conservation significance of plants occurring on the study site was determined at a regional level using the report "Biodiversity Plan for Eyre Peninsula", Department for Environment and Heritage (2002), at a State level using the *National Parks and Wildlife Act 1972 of South Australia*, Schedules 7-9, and at a National level using Briggs and Leigh (1996). The latter document forms the basis for listing plants under the Federal *Environment Protection and Biodiversity Conservation Act 1999 of Australia*.

Two species present on the study site, *Ixiolaena pluriseta* and *Kippistia suaedifolia*, have conservation ratings.

Ixiolaena pluriseta (a plover daisy), found in Quadrat 1, located on the western coastal strip as shown on Figure 6.4, has a rating of Rare for the State, and a status of Unknown for the Eyre Peninsula. According to Jessop and Toelken (1986) this species has only been collected from Smoky Bay to Fowler Bay, on the Nuyts Archipelago and one specimen from Nullabor Homestead. The plant is found principally on the calcareous sands of low coastal cliffs and the adjacent dunes. The specimens found in this survey (sampling quadrat 1), were on sands overlying a low rocky clifftop. This area will not be impacted by the development, particularly as this area has now been excluded from the project.

Kippistia suaedifolia (fleshy miniura) has a rating of Rare for the Eyre Peninsula. It prefers to grow on sandhills, claypans, limestone and gypsum, and was recorded during this survey in quadrat 20, on the crest of the sandpit and within the pit itself. This location is within the area of the development.

Previous surveys (EMS, 2004) reported several other species with conservation significance or interest. *Maireana aphylla*, with conservation interest due to its status of

Uncommon on the Eyre Peninsula, was not recorded during this survey, although seven other species of *Maireana* were found. The EMS survey noted that these plants were mainly located in the golf course roughs, and this more recent survey did not visit the golf course.

Trailing hemichroa (*Hemichroa pentandra*) with a rating of Rare for the Eyre Peninsula was not recorded in this survey, although its close relative *Hemichroa diandra* was a co-dominant in many of the quadrats surveyed. The EMS survey noted that the plants were not flowering during their survey. As the two species can be separated most reliably by examining the anthers of the flowers, it is possible that the earlier records were an estimate of the species, rather than a determination.

The *Environment Protection and Biodiversity Conservation Act 1999 of Australia* includes no South Australian ecological communities at present. Regionally, tussock grasslands are considered to be threatened on the Eyre Peninsula (DEH, 2002).

Thirty-five percent (35%) of the species found on the site were weed species. This is a low infestation of weeds in comparison to metropolitan coastal sites, which typically average sixty-five percent (65%) exotics as a percentage of biodiversity. Many of the weeds were present in the dunal areas, while the salt marsh areas (dominated by samphires) tended to have a lower percentage of exotics. This is usual, and surveys of other salt marsh areas in the vicinity suggest that in salt marsh areas the weed infestation is likely to be around twelve percent (12%) of the biodiversity.

Acacia cyclops (the western coastal wattle) tends to provoke debate on whether its status is indigenous or a regional weed. The Biodiversity Plan for Eyre Peninsula states that this species has “a strong western distribution becoming more dominant to the west.”

Another regional aberration was the presence of *Eucalyptus stoatei* (Scarlet pear gum) in the sand pit. This species of marlock has a very restricted distribution east and north-east of Ravensthorpe in Western Australia. The tree was quite possibly planted in its current location.

6.7 Birds

6.7.1 Bird Species and Conservation Status

During the site visits in late November 2004, opportunistic sightings of birds and a 20-minute point observation were recorded. The species are listed below, in Table 6.6. The days of the field trip were abnormally hot and windy, so the species observed were limited. Terrestrial birds were generally found hiding in vegetation, and water birds were usually out into the water as far as they could manage, or hidden in the mangroves until after sunset, where upon they came back onto the mudflat to feed during the cooler weather.

The species diversity of this general region is indicated by the bird species observed by members of Birds Australia. The 128 species of birds recorded within the 1-degree block (approximately 3600 square kilometres) surrounding the site are provided in Table 6.7.

Table 6.6 Bird sightings in late November 2004 (Delta staff)

Species	Common name
Anthus novaeseelandiae	Richard's pipit
Calidris canutus	Red knot
Certhionyx niger	Black honey eater
Charadrius ruficapillus	Red capped dotterel
Chlidonias hybrida	Whiskered tern
Corvus spp.	Ravens

Cygnus atratus	Black swan
Falco cenchroides	Nankeen kestrel
Haematopus fuliginosus	Sooty oystercatcher
Haematopus longirostris	Pied oystercatcher
Larus novaehollandiae	Silver gull
Larus pacificus	Pacific gull
Limosa limosa	Bar-tailed godwit
Malurus spp.	Wrens (female)
Milvus migrans	Black kite
*Passer domesticus**	Sparrow
Pelecanus conspicillatus	Australian pelican
Phalacrocorax varius	Pied cormorant
Pomatostomus superciliosus	White browed babbler
Rhipidura leucophrys	Willie wagtail
Sterna bergii	Crested tern
Sterna caspia	Caspian tern
*Sturnus vulgaris**	Starling
Threskiornis molucca	Sacred ibis
Tringa nebularia	Greenshank
Tringa spp.	Sandpipers

As indicated earlier in Section 6.6 the habitat diversity remains, and the dune/cliff areas, particularly in the west of the study area, are in good condition. Most of the species would likely occur in or visit the study area.

Red knots were seen working the northern reefs for food, while red capped dotterels (plovers) were common along the sandy beaches. Sandpipers and greenshanks foraged across the sand flats, following the tide out.

The common birds one would expect to find on the site are ravens, crows and introduced species. All other birds occurring on the study area and adjacent blocks are protected under State and Federal legislation. The conservation significance of each species is given in the table below, which shows all species recorded by Birds Australia within one degree of the study site.

Table 6.7 Birds Australia records of birds within 1-degree block that includes study site

Family	Common Name	*Species name*	Conservation Interest
Phasianidae	Stubble Quail	*Coturnix pectoralis*	
Anatidae	Blue-billed Duck	*Oxyura australis*	Rare (SA NP&WS), EPBC Act, rare EP
Anatidae	Musk Duck	*Biziura lobata*	Rare (SA NP&WS), EPBC Act
Anatidae	Black Swan	*Cygnus atratus*	EPBC Act
Anatidae	Grey Teal	*Anas gracilis*	EPBC Act
Anatidae	Chestnut Teal	*Anas castanea*	EPBC Act
Anatidae	Hardhead	*Anthya australis*	EPBC Act
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	
Podicipedidae	Hoary-headed Grebe	*Poliocephalus poliocephalus*	
Sulidae	Australasian Gannet	*Morus serrator*	
Anhingidae	Darter	*Anhinga melanogaster*	
Phalacrocoracidae	Little Pied Cormorant	*Phalacrocorax melanoleucos*	
Phalacrocoracidae	Black-faced Cormorant	*Phalacrocorax fuscescens*	

Family	Common Name	*Species name*	Conservation Interest
Phalacrocoracidae	Pied Cormorant	*Phalacrocorax varius*	
Phalacrocoracidae	Little Black Cormorant	*Phalacrocorax sulcirostris*	
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	
Phalacrocoracidae	Australian Pelican	*Pelecanus conspicillatus*	
Ardeidae	White-faced Heron	*Egretta novaehollandiae*	
Ardeidae	Little Egret	*Egretta garzetta*	Rare SA
Ardeidae	Eastern Reef Egret	*Egretta sacra*	Rare (SA NP&WS), EPBC Act, rare EP
Ardeidae	Great Egret	*Egretta alba*	EPBC Act
Plataleidae	Royal Spoonbill	*Platalea regia*	
Pandionidae	Osprey	*Pandion haliaetus*	Rare (SA NP&WS), EPBC Act, rare EP
Accipitridae	Black-shouldered Kite	*Elanus axillaris*	EPBC Act
Accipitridae	Black Kite	*Milvus migrans*	EPBC Act
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Accipitridae	Spotted Harrier	*Circus assimilis*	EPBC Act
Accipitridae	Swamp Harrier	*Circus approximans*	EPBC Act
Accipitridae	Wedge-tailed Eagle	*Aquila audax*	EPBC Act
Falconidae	Brown Falcon	*Falco berigora*	EPBC Act
Falconidae	Nankeen Kestrel	*Falco cenchroides*	EPBC Act
Turnicidae	Little Button-quail	*Turnix velox*	
Scolopacidae	Bar-tailed Godwit	*Limosa limosa*	EPBC Act
Scolopacidae	Whimbrel	*Numenius phaeopus*	EPBC Act
Scolopacidae	Eastern Curlew	*Numenius madagascariensis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	EPBC Act
Scolopacidae	Common Greenshank	*Tringa nebularia*	EPBC Act
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	EPBC Act
Scolopacidae	Grey-tailed Tattler	*Heteroscelis brevipes*	EPBC Act
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Scolopacidae	Great Knot	*Calidris tenuirostris*	EPBC Act
Scolopacidae	Red Knot	*Calidris canutus*	EPBC Act
Scolopacidae	Sanderling	*Calidris alba*	EPBC Act
Scolopacidae	Little Stint	*Calidris minuta*	EPBC Act
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	EPBC Act
Scolopacidae	Sharp-tailed Sandpiper	*Calidris acuminata*	EPBC Act
Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	EPBC Act
Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	
Haematopodidae	Sooty Oystercatcher	*Haematopus fuliginosus*	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	EPBC Act
Recurvirostridae	Banded Stilt	*Cladorhynchus leucocephalus*	EPBC Act
Charadriidae	Pacific Golden Plover	*Pluvialis dominica*	EPBC Act
Charadriidae	Grey Plover	*Pluvialis squatarola*	Site of national importance according to National Plan for shorebird Conservation

Family	Common Name	*Species name*	Conservation Interest
			(Watkins, D.) EPBC Act
Charadriidae	Red-capped Plover	*Charadrius ruficapillus*	EPBC Act
Charadriidae	Double-banded Plover	*Charadrius bicinctus*	EPBC Act
Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	EPBC Act
Charadriidae	Greater Sand Plover	*Charadrius leschenaultii*	EPBC Act
Charadriidae	Inland Dotterel	*Charadrius australis*	EPBC Act
Charadriidae	Hooded Plover	*Thinornis rubricollis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Charadriidae	Banded Lapwing	*Vanellus ticolor*	EPBC Act
Charadriidae	Masked Lapwing	*Vanellus miles*	EPBC Act
Laridae	Pacific Gull	*Larus pacificus*	
Laridae	Silver Gull	*Larus novaehollandiae*	
Laridae	Caspian Tern	*Sterna caspia*	
Laridae	Crested Tern	*Sterna bergii*	
Laridae	Fairy Tern	*Sterna nereis*	Vulnerable (SA NP&WS), ssp nereis vulnerable EP
Laridae	Whiskered Tern	*Chlidonias hybrida*	
Columbidae	Rock Dove	*Columba livia**	
Columbidae	Common Bronzewing	*Phaps chalocoptera*	
Columbidae	Brush Bronzewing	*Phaps elegans*	
Columbidae	Crested Pigeon	*Ocyphaps lophotes*	
Columbidae	Peaceful Dove	*Geopelia striata*	Rare EP
Cacatuidae	Galah	*Eolophus roseicapilla*	
Psittacidae	Australian Ringneck	*Barnardius zonarius race zonarius*	
Psittacidae	Mulga Parrot	*Psephotus varius*	
Psittacidae	Rock Parrot	*Neophema petrophila*	Rare (SA NP&WS), rare EP
Cuculidae	Pallid Cuckoo	*Cuculus pallidus*	
Cuculidae	Fan-tailed Cuckoo	*Cuculus flabelliformis*	
Cuculidae	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	
Tytonidae	Barn Owl	*Tyto alba*	
Apodidae	Fork-tailed Swift	*Apus pacificus*	EPBC Act
Maluridae	Variegated Fairy-wren	*Malurus lamberti*	
Pardalotidae	Striated Pardalote	*Pardalotus striatus*	
Pardalotidae	White-browed Scrubwren	*Sericornis frontalis*	
Pardalotidae	Weebill	*Smicrornis brevirostris race brevirostris*	
Pardalotidae	Inland Thornbill	*Acanthiza apicalis*	
Pardalotidae	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	
Pardalotidae	Southern Whiteface	*Aphelocephala leucopsis race maculatus*	
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*	
Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	
Meliphagidae	Yellow-throated Miner	*Manorina flavigula*	
Meliphagidae	Singing Honeyeater	*Lichenostomus virescens*	
Meliphagidae	Purple-gaped Honeyeater	*Lichenostomus cratitius*	
Meliphagidae	White-fronted Honeyeater	*Phylidonyris albifrons*	
Meliphagidae	Crimson Chat	*Epthianura tricolor*	
Meliphagidae	White-fronted Chat	*Epthianura albifrons*	

Family	Common Name	*Species name*	Conservation Interest
Petroicidae	Jacky Winter	*Microeca fascinans*	
Petroicidae	Red-capped Robin	*Petroica goodenovii*	
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	
Pachycephalidae	Gilbert's Whistler	*Pachycephala inornata*	Rare EP
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*	
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	
Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	
Dicruridae	Magpie-Lark	*Grallina cyanoleuca*	
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*	
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*	
Campephagidae	Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	
Campephagidae	White-winged Triller	*Lalage sueurii*	
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*	
Artamidae	Grey Butcherbird	*Cracticus torquatus*	
Artamidae	Australian Magpie	*Gymnorhina tibicen*	
Corvidae	Australian Raven	*Corvus coronoides*	
Corvidae	Little Raven	*Corvus mellori*	
Corvidae	Little Crow	*Corvus bennetti*	
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Vulnerable EP
Motacillidae	Richard's Pipit	*Anthus novaeseelandiae*	
Passeridae	House Sparrow	*Passer domesticus**	
Hirundinidae	White-backed Swallow	*Cheramoeca leucosternus*	
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	
Hirundinidae	Tree Martin	*Hirundo nigricans*	
Sylviidae	Little Grassbird	*Megalurus gramineus*	EPBC Act
Alaudidae	Rufous Songlark	*Cincloramphus mathewsi*	
Alaudidae	Brown Songlark	*Cincloramphus cruralis*	
Zosteropidae	Silvereye	*Zosterops lateralis*	
Muscicapidae	Common Blackbird	*Turdus merula**	
Sturnidae	Common Starling	*Sturnus vulgaris**	

A point of interest is the Sooty Oystercatcher numbers. It was notable during the November 2004 site visit that while both Sooty Oystercatchers and Pied Oystercatchers were sighted foraging in the study area, only the Pied Oystercatcher was located further south, at Shelly Beach. This may be explained by the Sooty Oystercatcher's preference for reefs, which are present at both extremities of the study area. Watkins (1993) lists Murat Bay, the full extent of which is shown in Figure 6.1, as a site of international importance for the conservation of this species.

Table 6.8 Bird Australia wader counts in Murat Bay, 1984 & 2000

Common Name	***Species name***	**Murat Bay Wader Count (2000)**	**Murat Bay species of significance identified during Wader Count (1984)**	**Conservation Interest**
Bar-tailed Godwit	*Limosa limosa*	26		EPBC Act
Eastern Curlew	*Numenius madagascariensis*	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP

Common Greenshank	*Tringa nebularia*	46		EPBC Act
Common Sandpiper	*Actitis hypoleucos*	3		EPBC Act
Grey-tailed Tattler	*Heteroscelis brevipes*	6		EPBC Act
Ruddy Turnstone	*Arenaria interpres*	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red Knot	*Calidris canutus*	38		EPBC Act
Red-necked Stint	*Calidris ruficollis*	913		EPBC Act
Sharp-tailed Sandpiper	*Calidris acuminata*	271		EPBC Act
Curlew Sandpiper	*Calidris ferruginea*	144		EPBC Act
Pied Oystercatcher	*Haematopus longirostris*	29		
Sooty Oystercatcher	*Haematopus fuliginosus*	107	163	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Grey Plover	*Pluvialis squatarola*	81	123	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red-capped Plover	*Charadrius ruficapillus*	79		EPBC Act
Banded Lapwing	*Vanellus ticolor*	238		EPBC Act
Masked Lapwing	*Vanellus miles*	6		EPBC Act

6.7.2 Possible Impacts on Bird Life

Although there are large intertidal flats and reef areas elsewhere in Murat Bay, and south of Thevenard in Bosanquet Bay, it is important to minimise hydrological impacts on the intertidal flats in the immediate vicinity of the marina. To minimise this potential impact during the detailed design plans, it is intended to place either pipes or culverts in the northern breakwater.

This would allow water to freely drain from the sediments at low tide, maintaining the current equilibrium. The construction of solid breakwaters, without any culverts/pipes, and channel may have altered the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, while other areas may have drained less well (the newly formed 'pockets' where the groynes meet the beach) and therefore may have become hypoxic.

Maintaining the drainage pattern is important for the species of invertebrate present, which has implications on the availability of appropriate food sources for migratory waders. Waders harvest food from the tidal flats. Each bird species has a particular preference – those with heavy beaks, such as Oystercatchers, can split open bivalve shells and would use the mussel top reefs as their major food source. Others, with more slender beaks, probe the sand flats for polychaete worms, sipunculids or small crustaceans. Those with longer beaks are able to obtain organisms that move deep within the sand, while the shorter beaked birds are restricted to those organisms that live close to the surface.

The increased usage of the sand flats as boats enter and leave the marina may disturb the more sensitive species of birds in the vicinity. The usage of the intertidal flats by boats will be limited by depth. Obviously no boats will be present at very low tides or when exposed, when birds are likely to be foraging. From a distance boats and noise may not be perceived as threat by birds, as predatory animal shapes are.

The *Sclerostegia arbuscula* chenopod shrubland present in the stranded dissected saltmarsh currently provides habitat for many small birds such as Thornbills and Chats, and these birds do not utilise deep waterways as habitat. The main area of this habitat is on the western coastal strip, which is now excluded from the development.

6.7.3 Interaction with Airport

The proposed development is located on a site that varies from between 2 and 4 kilometres from the Ceduna airport. Birds can pose a flight hazard near airports, and some sorts of developments may attract large numbers of birds. The twenty most dangerous birds, according to the Australian Transport Safety Bureau (2002) are the following:

Table 6.9 Bird Strike Hazards (ASTB, 2002)

Species	Number of strikes (1991-2001)	% resulting in damage to aircraft	% having effect on planned flight	Composite hazard ranking
Eagle	38	55.3	13.2	1
Ibis	39	41.0	17.9	2
Duck	52	26.9	19.2	3
Bat	72	25.0	13.9	4
Galah	154	17.5	14.9	5
Gull	136	15.4	3.7	6
Kite	90	14.4	4.4	7
Hawk	156	12.8	5.1	8
Pigeon	53	16.9	0	9
Owl	19	5.3	10.5	10
Lark	16	12.5	0	11
Starling	17	11.8	0	12
Magpie	117	5.1	5.9	13
Plover	143	6.9	2.8	14
Curlew	31	9.7	0	15
Peewee	18	0	5.6	16
Falcon	18	0	5.6	17
Swallow	66	4.6	0	18
Kestrel	92	1.1	0	19
Sparrow	38	0	0	20

N.B. Due to the nature of birdstrike reporting, general terms are often used to identify the species of bird struck. Therefore, a number of sub-species may be listed under the one common generic name.

The main hazard appears to be confined to those larger birds that fly in open areas, or that flock. Developments that encourage the presence of ibis, ducks, galahs and gulls would appear to be the most likely to increase the risk of bird strike at an airport.

The existing site is a major wader site, and the proposed marina is not likely to increase the numbers of these birds. However, changed land use may attract other species in larger numbers. The elimination of the proposed development on the western coastal strip (release 12) will reduce the potential impact on the intertidal flats.

Open areas of fresh and brackish (as opposed to saline) wetlands are likely to attract birds such as ducks, ibis and egrets. The evaporation rate at Ceduna is unlikely to permit the development of fresh to brackish wetlands in anywhere other than soaks or in infrastructure areas such as sewage treatment facilities. At Ceduna the town's sewage effluent ponds are located between the development and the airport, and increased numbers of houses and businesses will result in increased capacity requirements for the WWTP works. As outlined in Section 6.25, it is most likely that upgrading the capacity of the lagoons will be deepening rather than increasing the area. As a result, there will be no increase, which might otherwise increase numbers of Ibis, ducks and egrets.

Galahs may be attracted to open parks and gardens if the grasses include weed species such as guildford grasses (*Romulea* spp.) and *Erodium* sp. (crane's and stork's bills). They also prefer areas where cover is kept less than 15 cm tall.

Open flat areas may provide roosting areas for gulls. Gulls are a particular problem as they are scavengers, and will move to new developments to scavenge from parks, bins, the outside of food processing plants and shopping centres. Gulls tend to be attracted to fishing vessels, and may be attracted to the marina if it is developed as a commercial

fishing centre. Besides being attracted to the development itself, gulls may be attracted to the local support infrastructure. At Ceduna the rubbish tip is located between the proposed development and the airport, and increased numbers of houses and businesses will result in increased usage of the tip. Unless the expansion of the tip is managed carefully, larger exposures of waste may occur, and these may attract gulls. The rubbish tip is managed by Council and it would be appropriate that management practices are reviewed to ensure that there is daily coverage of material, reducing food availability and therefore risk.

6.8 Reptiles and Amphibians

The sandy areas (dunes and ridges) of the site contained large numbers of small painted dragons (*Ctenophorus pictus*) that ran rapidly for shelter under thorny bushes as they were approached. In the early morning the sandy sections of the site showed tracks of small snakes and lizards. As well as the live lizards noted in the following table, a jaw of a sleepy lizard was found, several lizard holes were noted and a scat from a large lizard that contained plant materials, beetle elytra and white snails was recorded.

Table 6.10 Lizards sighted

Common name	Family: *Species*
Painted dragons	Agamidae: *Ctenophorus pictus*
Sleepy lizards	Scincidae: *Tachydosaurus rugosus*
Small skinks	Scincidae

No amphibians were sighted or heard during the site visit. This is not surprising given the salty and dry nature of much of the site. It is possible that some amphibians may occur in winter in the area near the BP service station where a soak apparently exists. The soak was not evident to the consultants who undertook this visit.

6.9 Mammals

During the site visit a fox (*Vulpes vulpe*s) was sighted and fox tracks and a hole were located. Several rabbits (*Oryctolagus cuniculus*) were seen, a scrape was located and their dung was widespread. The remains of a sheep (*Ovis aries*) and quantities of old sheep dung suggest that it may be some time since sheep were grazed on the site. Fresh horse tracks (*Equus caballus*) were also recorded.

Wallaby tracks were found on the rocky headland to the northwest of the site.

Conservation reserves in the district support populations of spinifex hopping mice (*Notomys mitchelli*) and echidnas (*Tachyglossus acculeatus*). It is possible that the dunal elements to the north and north west of the site may support these species. Other mammals that may possibly be found in the less disturbed portions of the site include the fat tailed dunnart (*Sminthopsis crassicaudata*), little long tailed dunnart (*Sminthopsis dolichura*), western pygmy possum (*Cercatetus concinnus*), western grey kangaroo (*Macropus fuliinosus*), and several species of bats. Strahan (1995) suggests that the area marks the western extremity of the eastern population of the southern forest bat, *Vespadelus regulus*.

6.10 Terrestrial Invertebrates

During the vegetation survey, any invertebrates that were present were noted. Several sweeps were also made during the late morning, in a sunny period with a light to moderate wind. Additionally a nighttime light trap was used to determine the range of nocturnal insects present.

The weather during the site visit was hot, with a northerly wind blowing. In the daytime the small bush flies (*Musca vetustimma*) were in pestilential proportions, and at night they were replaced by

the flying stages of termites in similar proportions. The other insect attracted to the light trap at night in large numbers was a small grey and white moth, probably *Protolechia* sp. Many small wasps were visible in the day time, and spiders were harvesting these in webs strung across the samphires and smaller shrubs.

Invertebrates are not protected under the *National Parks and Wildlife Act 1972 of South Australia*. However, some South Australian butterfly species are listed under the federal government's Action Plan for Butterflies (Sands and New, 2002), a document developed under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999 of Australia*. According to the *Biodiversity Plan for Eyre Peninsula* (DEH, 2002) the butterfly groups most likely to contain threatened members are the Skippers, Coppers and Blues. The latter two groups require the attendance of specific plant species as well as habitat containing their food, making them particularly vulnerable to ecological disturbance.

The Dinosaur ant (*Nothomyrmecia macrops*) does not have protection under legislation but is only known from seventeen sites on the Eyre Peninsula. It inhabits patchy stands of mallee, including *Eucalyptus gracilis* (present on the site). While no dinosaur ants were observed, this was expected as the ant is nocturnal. No honey trapping was conducted, as the nighttime temperatures were too high. The ants only forage when the temperature drops to less than 15-18^{o}C (DEH, 2002).

Table 6.11 Terrestrial invertebrates recorded on the site

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Insects			
Black longicorn beetles	Coleoptera: Cerambycidae	x	
Ladybirds	Coleoptera: Cocinellidae	x	
Brown scarab beetles (many)	Coleoptera: Scarabaeidae		x
Dragonflies (large grey blue)	Odonata: Libellulidae: poss. *Orthetrum* sp.	x	
Wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus plexippus*	x	
Lesser wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus chrysippus*	x	
Orange/brown butterfly	Lepidoptera: Nymphalidae	x	
Caper white butterfly	Lepidoptera: Pieridae: *Anaphaeis java*	x	
Skipper butterflies	Lepidoptera: Hesperiidae	x	
Blue butterflies on melaleucas	Lepidoptera: Lycaenidae	x	
Case moth	Lepidoptera: Psychidae:poss *Hylarcta* sp.	x	
Feather wing moths	Lepidoptera: Cosmopterigidae		x
Small grey/white moths (many)	Lepidoptera: Gelechiidae: prob *Protolechia* sp.		x
Termites (winged queens) (many)	Isoptera:		x
Green tree hopper	Hemiptera: Membracidae: *Sextius virescens*	x	
Brown & white bugs	Hemiptera: Lygaeidae		x
Stink bug	Hemiptera: Pentatomidae		x
Burrowing bug	Hemiptera: Cydnidae		x
Cotton cushion scale	Hemiptera: Margarodidae	x	
Native bee with blue stripes	Hymenoptera: poss Anthophoridae	x	
Meat ants	Hymenoptera: Formicidae: *Iridomyrmex* sp.	x	
Large inch ant black rear, red body and yellow jaws	Hymenoptera: Formicidae: *Myrmecia* sp.	x	
Flying ant	Hymenoptera: Formicidae		x
Large black/orange heavy built potter wasp	Hymenoptera: Vespidae	x	
Iridescent green small wasps	Hymenoptera	x	

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Small yellow wasps	Hymenoptera	x	
Almost microscopic wasps	Hymenoptera: poss Diapriidae		x
Hoverflies	Diptera: Syrphidae	x	
Wait-a-while flies (bush flies, eye flies)	Diptera: Muscidae: *Musca vetustimma*	x	x
Big blue-bottle flies	Diptera: Calliphoridae	x	
Long-leg flies	Diptera: Dolchopodidae		x
Black biting flies	Diptera: Tabanidae	x	
Eucalyptus gall midges	Diptera: Cecidomyidae	x	
Antlions	Neuroptera: Myrmeliontidae	x	
Bush crickets	Orthoptera: Gryllidae	x	
Spiders			
Mexican hat spiders	Araneae: prob Stiphiidae	x	
Sac spider	Araneae: Miturgidae	x	
Garden orb, or wheel weaver spider	Araneae: Araneidae: *Eriophora transmarina*	x	
Green jumping spider	Araneae: Salticidae	x	
Flower spider	Araneae: Thomisidae	x	
Other arthropods			
Small red mites	Acarina	x	
Scorpion hole	Scorpionida	x	
Gastropods			
White snails	Molluca: Helicidae: *Cernuella vestita**	x	
Small snails	Molluca: Helicidae: *Cochlicella acuta**	x	

6.11 Marine Biological Communities

6.11.1 Intertidal Flora and Fauna

Murat Bay is a sheltered, calm water coast, and the majority of the bay coastline is taken up by wide sand flats, with rocky platforms, as can be identified in the aerial photograph (refer Figure 6.1). A series of observations was recorded for the intertidal zone within the study area. The locations of these observations are shown in Figure 6.7.

The study area, located in the northeastern corner of the bay consists of an intertidal flat, but with rocky platforms confined to the northwest area of the study site. The rocky portions of the site are dominated by *Hormosira banksii*, with small quantities of other brown macroalgae. The tubeworm *Galeolaria* is often present on these rocky sections, along with ribbed top shells, conniwinks and beaked mussels. Musseltop reefs, formed by the growth of beaked mussels over limestone or coffee-rock, project out from the shore towards the sandy flats. These are sometimes edged with *Hormosira banksii* and *Enteromorpha intestinalis*.

The sand flats themselves vary. There are firm areas of bare sand, large zones of soft sand with beds of *Zostera* and *Ruppia*, and some firm sand areas supporting *Hormosira* beds. The tidal flat version of *Hormosira* has larger, spherical vesicles (Womersley, 1984) when compared to the same alga growing on the reefs. Few other plants are present.

Evidence of sand snails and benthic worms is common. Some areas appear to contain slightly hypoxic sediments, evidenced by the greyish colouration of the underlying sands, but these areas also contain evidence of worm habitation, suggesting that these zones may be organically enriched. Where clean sand occurs in rear reef pools, *Pinna bicolor* can be found.

Figure 6.7 Observation points in the intertidal zone

Figure 6.8 Benthic quadrat and core locations

To obtain baseline information on the inhabitants of the sand flats, a transect was laid across the intertidal zone. At twenty (20) locations a quadrat was placed, and a record was made of the numbers of wormholes, snail trails, vegetation or visible animals. Details of the locations and methodology are given in the Delta Environmental Consulting Report provided as a working paper (refer Working Paper 3).

At each observation point notes were made of the species present and any geomorphological features. The presence of slightly hypoxic sediments was linked to apparently larger numbers of wormholes. The largest numbers of worm holes were located in quadrats nearer the centre of the sampling transects, while snail trails were located towards the edges of the transect.

At each site benthic cores (500 cm^3) were also taken. The benthic cores confirmed the surface observations, returning greater numbers of organisms in those cores taken from the centre of the transect line. The majority of the organisms were polychaete worms and peanut worms (sipunculids), however the cores also contained numbers of gastropods, bivalves, crustaceans and ribbon worms.

The northwestern extremity of the site contains several reefs that form fish traps. From the headland it was possible to observe fish in these areas as the tide went out. Mullet, whiting and black finned rays were sighted in the shallows.

Amalgamated lists of all recorded fauna and flora of the intertidal zone, as well as notes on their ecological preferences, are provided below in Tables 6.12 and 6.13 respectively.

Table 6.12 Intertidal fauna list, with ecological preferences

Group	Species	Common name	Ecological preferences (MacPherson & Gabriel (1962), Shepherd & Thomas (1989), Hale (1976))
Polychaete worms	*Australonereis ehlersi*	Bait worm	Estuarine conditions, hunts from shelter of tough but limp sandy tube
	Galeolaria caespitosa	Tubeworms	On hard substrates such as coffee-rock and limestone
	Nephtys australiensis	A polychaete	Prefers muddy sand, burrows actively using pharynx, associated with seagrass beds
	Olganereis edmondsi	A polychaete	Lives in intertidal sandy areas in a gelatinous sandy tube, only recorded in SA
Gastropods	*Austrocochlea constricta*	Ribbed top shell	Variety of habitats on low to medium energy coastlines
	Batillaria sp.	Mud whelk	Sand and mud flats, feeds by crawling just under the surface
	Bembicium melanostomum	Dark mouthed conniwink	Prefers sheltered bays and mangrove swamps
	Cerithiopsidae	Little creeper	Almost microscopic small shells, no ecological details
	Clanculus plebejus	A clanculus	Littoral reefs in calm waters
	Cymatiella leseuri	Leseur's sand whelk	Intertidal reefs, eats anemones and ascidians
	Diloma sp.	A periwinkle	Rocks and weeds in littoral pools
	Lepsiella flindersi	Flinder's lepsiella	Found in association with *Galeolaria*, mussels and barnacles, its food source, on littoral reefs
	Mitrella lincolnensis	Dove shell	Found on algae or crawling on the surface in the shallows
	Nerita atramentosa	Black nerite	Littoral and supralittoral reefs
	Salinator sp.	Air breather, sand snail	Samphire and mangrove flats as well as back dune swamps
Bivalves	*Brachiodontes rostratus*	Beaked mussel	On "mussel-top" reefs in upper and mid littoral zone, small bivalve *Kellia australis* **always** associated (not observed)
	Katelysia scalarina	Stepped venerid	Sandy shores, lower littoral
	Ostrea sp.	Oyster	On rocky reefs, mid littoral

Group	Species	Common name	Ecological preferences (MacPherson & Gabriel (1962), Shepherd & Thomas (1989), Hale (1976))
	Pinna bicolor	Razorfish	In soft sand
	Solemya australis	Southern date shell	Burrows in mud or sand in sublittoral zone
Sipunculids	*Phascolosoma noduliferum*	A peanut worm	In sand or embedded in *Galeolaria* colonies
	Themiste sp.	A peanut worm	Gut contents: sand, shell particles and marine plant detritus
Crustaceans	Callianassidae sp. unk	Sand borer shrimp	Muddy sand flats
	Gammaridea sp. unk (1)	Sea louse	Intertidal sand, detrital feeders
	Gammaridea sp. unk (2)	Sea louse	Intertidal sand, detrital feeders
	Philyra laevis	Pebble crab	Amongst brown algae in shallow pools
Nemertean worms	Nemertea sp. unk	Ribbon worm	Burrows in soft sediments of intertidal zone
Bryozoans	Unknown sp	Lace coral	In shallow back-reef pools

Table 6.13 Intertidal flora list, with ecological preferences

Phyla	Order	Family	Species	Common name	Comments
Cyanophyta			*Rivularia* sp.	Blue green colonies	Attached to rocks
Phaeophyta	Fucales	Cystoseiraceae	*Cystoseira trinodis*		Common in estuaries and sheltered rear-reef pools
			Scaberia agardhi		Cast specimen from deeper water
		Sargasaceae	prob *Sargassum verruculosum*		In sheltered rear-reef pools
Hormosira banksii forma *banksii*		Hormosiraceae		Neptune's necklace	On sheltered platforms or musseltop reefs in sandy/muddy tidal flats
	Ectocarpales	Ectocarpaceae	Unknown species		In sheltered rear-reef pools
Rhodophyta	Cryptonemiales	Corallinaceae	Unknown species of coralline algae		On other macroalgae
Chlorophyta	Ulvales	Ulvaceae	*Enteromorpha intestinalis*	Green guts	On reefs and platforms
Magnoliophyta	Potamogetonales	Zosteraceae	*Zostera mucronata*	Eel grass	Sandy/muddy intertidal flats
			Zostera muelleri	Eel grass	Sandy/muddy intertidal flats
		Potamogetonaceae	*Ruppia tuberosa*	Sea tassels	Sandy/muddy intertidal flats

6.11.2 Possible Impacts in the Intertidal Zone

This issue has already been addressed in Section 6.7.2, in relation to the usage of the intertidal flats by birds. More specifically in relation to the species inhabiting the sediments:

- The construction of a boating channel and breakwaters may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, drier and better oxygenated. The texture of the sand flats is quite likely a determining factor in which species of

invertebrates inhabit the benthos, so this type of habitat change could be reflected by a change in the species of invertebrates occupying the benthos.

- Where breakwaters meet the beach the newly formed 'pockets' may drain less well, and may accumulate seaweed and seagrass wrack. This could result in the sediments becoming softer, organically enriched and more hypoxic. If accumulation is minor, the benthos may become dominated by species that can tolerate such conditions. If accumulation is major, the rotting organics could produce hydrogen sulphide gases. This has ecological effects as H_2S can cause the death of benthic organisms, and aesthetic / health effects on air quality.

To prevent the above potential problems, as indicated in Section 6.7.2, in the detailed design it is intended to minimise potential changes by the provision of culverts or pipes in the northern breakwater in order to maintain adequate drainage of the surface sediments.

6.11.3 Subtidal Flora and Fauna

Few previous studies of the marine system in this area have been undertaken. An assessment of the marine environment in South Australia was carried out by Edyvane (1999). This study classified the Murat Bay area as being within the "Streaky" biounit. Features typical of this biounit area are sheltered bays with rocky headlands interspersed by sandy beaches as indicated in Figure 6.1. Samphire and mangrove habitats line the shore and limestone reefs are common.

There have been no areas identified as having significant biological value in the bay area, or in close proximity to the proposed marina. The closest region considered to have significant environmental value is Tourville Bay (Davenport Creek), which has been identified as a wetland of national importance (Edyvane 1999).

The township of Ceduna is directly south of the study site and consequently there are many associated human uses of the area. The beach is used by many people for recreation such as walking and bathing in warmer weather. Fishing is also popular in this area and boats commonly come close in shore to fish. Evidence of people having harvested oysters from the intertidal area is also present. Pacific Oysters, a non-native species are farmed in Murat Bay, at the town of Denial Bay, 10km west of Ceduna.

A series of dives were undertaken during April 2000 to generally describe the subtidal marine community. Table 6.14 contains a summary of the findings in the marine survey. The full details of the findings are included in EMS (2004). The information gained in the marine survey has also been transposed onto a map of the area in Figure 6.9.

There were four main habitat types in the study area; sandy bottom (sometimes with small patches of *Posidonia* spp., *Posidonia* spp. dominated (sometimes with sparse *Sargassum* sp.), *Sargassum* sp. and *Posidonia* spp., and *Zostera* sp (Table 6.14).

Some additional sub-groups have also been defined within these four main groups. Where the amount of *Posidonia* spp. present varied with sand, small amounts of *Sargassum* sp. were occasionally present. In addition, there were often small to medium sized patched of *Posidonia* spp. in the expanses of sand. These sub-groups have been identified in Table 6.14 below.

Figure 6.9 Marine Habitats by Type

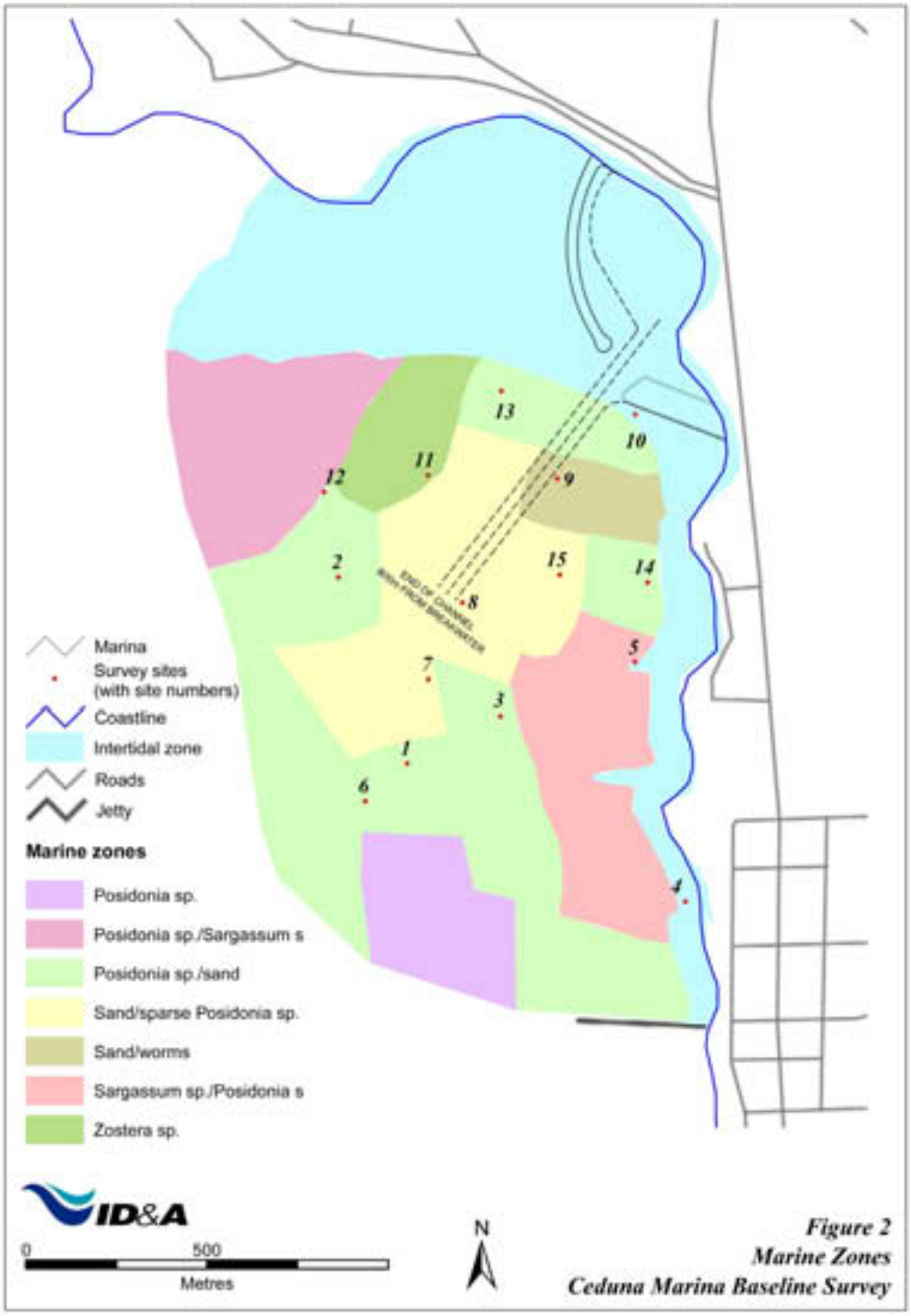


Table 6.14 Summary of Marine Survey Findings

Site	Depth (m)	Substrate	Site Description	Epiphyte abundance (+ low, +++ high)	Plants /Algae	Animals
1	3.9	Fine silt/sand	70% sand/ worm holes; seagrass patches	+	SARGASSUM *SP., SPARSE* POSIDONIA *SPP. PATCHES*	sponges; wormholes, gastropods, egg masses
2	3.6	Fine silt/sand	70% seagrass, 30% sand	+	*Posidonia* spp. patches	sponges, gastropods, *Pinna* sp., worm holes, several fish types (pipe, soldier, spider crab)
3	4.3	Sandy, less silt	Continuous seagrass	+	*Scabaria* sp., *Posidonia* spp. patches	shrimps, sponges, fish, *Pinna* sp.
4	2.5	Rocky bottom/silt/ sand	Seagrass/ brown macroalgae	+++	*Sargassum* sp., *Posidonia* spp. red algae (encrusting & foliaceous)	worm holes, mussells, Scleractinia
5	2.9	Rocky bottom/silt/sand	Brown macroalgae	+++	*Sargassum* sp., *Scabaria* sp., red algae (encrusting & foliaceous)	Scleractinia, mussells
6	4.1	Fine silt/shells	Continuous seagrass	+	Posidonia spp.	*Pinna*, gastropods, sponges
7	4.4	Silty sand	90% sand/worm holes, sparse patches of seagrass	+	*Posidonia* spp., turfing green algae, *Sargassum* sp.	*Pinna* sp., worm holes, brittle star, sponges, fish
8	3.3	Silty sand	Sand/many worm holes, seagrass	++	*Posidonia* spp./epiphytic algae, turfing green algae, red algae, *Sargassum* sp.	worm holes, ascidians, brittle star, *Pinna* sp.
9	4.4	Fine silt	Fine epiphytic algae throughout water column	+++	SARGASSUM SP.	worm holes
10	3.6	Sand	90% seagrass, sand patches	+++	*Posidonia* spp., red algae	barnacles, limpets, *Pinna* sp., red algal mass, worm holes, large hole (?sp)
11	2.1	Sand	Seagrass/ sandy patches	+++	Posidonia spp, Zostera sp.	ascidians, *Pinna* sp., sponges, worm holes, large hole (?sp)
12	1.8	Sand	90% seagrass, 10% brown macroalgae	+++	*Posidonia* spp., *Sargassum* sp., red foliaceous algae	barnacles, sponges, *Pinna* sp.
13	1.8	Sand/shell bottom	Continuous seagrass	+++	*Posidonia* spp., green turfing algae, encrusting red algae	large hole (?sp), worm holes, *Pinna* sp., egg masses, abalone, scallops, barnacles
14	3.1	Silty/shells/ sand	80% seagrass, 20% sand	+++	Posidonia sp, red encrusting algae	worm holes, *Pinna* sp., large hole (?sp), sponges, scallops, egg masses, gastropods, barnacles
15	3.1	Silt/sand	95% sand, small patches seagrass	+++	Posidonia spp.	worm holes, large hole (?sp), *Pinna* sp., sponges

Table 6.15 Marine Habitat Types in the Marina Study Area in Murat Bay

Habitat Type	Total Area (km^2)
1a) Posidonia spp.	0.155982
b) Posidonia spp./Sargassum sp.	0.252085
c) *Posidonia* spp./sand	0.799801
2a) Sand	0.38817
b) Sand/sparse *Posidonia* spp.	0.077015
3. *Sargassum* sp./Posidonia s	0.252072
4. *Zostera* sp.	0.104835
Total Area	2.03km^2

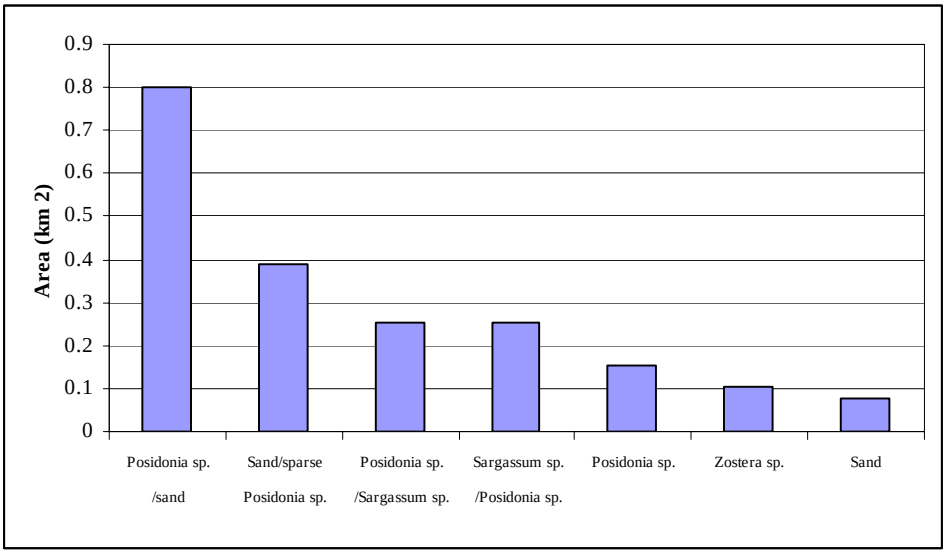


Figure 6.10 Graph of Marine Habitat Types in the Proposed Marina Site at Murat Bay

The most dominant habitat type was the seagrass *Posidonia* spp., commonly called tapeweed, which was interspersed with areas of clear sand. The abundance of *Posidonia* spp. varied throughout the area, tending to be very patchy. As the depth increased the seagrass tended to increase in density, with the greatest density occurring at the far south of the study site. A variety of other species also existed among the seagrass. Gastropods, sponges and egg masses, as well as epiphytic algae were commonly found attached to the leaves of the seagrass.

Plate 6.3 **Seagrass beds (*Posidonia* spp.)**

Sargassum sp., a brown macroalgae, is more common in the shallower inshore areas where the reefs tend to be and consequently there is a rocky substrate. It also occurs in very sparse patches among the seagrass beds.

Plate 6.4 ***Sargassum* sp. stands among seagrass (*Posidonia* spp.)**

Zostera sp., a fine seagrass (interspersed with *Heterozostera* sp.) was common on the shallow waters of the northern reef, to the west of the study site. It was however, overgrown with dense mats of epiphytes.

Plate 6.5 *Zostera* sp. interspersed with *Heterozostera* sp.

Epiphytic algae were very abundant in the area. It commonly covered the leaves of the seagrass in varying densities. It was particularly abundant in the in shore areas, where the algal abundance was so prolific in some areas that it covered the seafloor and seagrass almost entirely. In these areas the sediment also tended to be extremely silty, with fine silt enveloping the divers in clouds when touching the sea floor.

Fine silty sand was common across the area. There was a large area to the south of the proposed marina site that was almost continuous sand. There were also sometimes small patches of *Posidonia* spp, and or *Pinna* sp. present. The areas of sand had many "wormholes" in them. These were holes in the sand, where some flatworms were found (phylum Platyhelminth), but it is also possible that other taxa such as polychaetes could also be responsible for the holes. As samples of invertebrate fauna were not taken, it is uncertain exactly what taxa lay under the sand and therefore when these holes were identified they have been referred to under the general term of "wormholes".

Plate 6.6 Sandy areas with a high amount of fine silt and many "wormholes" in the sand

The razor-fish *Pinna* sp. commonly occurred across the whole study area. The only sites where it was not found in were quadrats at sites 1, 5, 9 and 15. It was most common at sites 8, 12, 7 and 3 (in order of dominance). This indicates the distribution of *Pinna* sp. is also very patchy. However, it did tend to be more common in the mid depths of approximately 3-4m and in the area around the reef at site 12.

Where razor-fish were present, other encrusting species attached themselves to the *Pinna* sp. shell. These species included barnacles, limpets, abalone, mussels, gastropods, scallops, sponges, encrusting and foliaceous red algae, and foliaceous green algae. The other large species that commonly occurred throughout the area were solitary ascidians from the Ascidiidae family. They were most common in the central section of the study area, at sites 8 and 3.

Plate 6.7 *Pinna* sp. with encrusting sponges and epiphytic algae

Plate 6.8 Ascidian and *Pinna* sp. with *Zostera* sp. andepiphytic algae surrounding

There were taxa species found in the area that were of particular interest, but do not hold a conservation significance. A sea cucumber (Class Holothuroidea) was found at site 12 and several stony corals (Order Scleractinia) were found in the shallow reef/*Sargassum* sp. area (sites 4 and 5).

6.11.4 Potential Impacts on the Subtidal Communities

The potential impacts include:

- The loss of marine habitat by the construction of the entrance channel. As indicated earlier, the channel would be excavated through *Zostera* sp. beds and some areas of sand with sparse *Posidonia* sp. These communities however are widespread throughout the bay.

- The potential for erosion of adjacent seagrass communities. It is intended however, to stabilise the channel edges with either rock or geotextile materials. Further geotechnical investigations (refer section 6.3) are still required to determine the nature of the material to be excavated. When this information is available, the risk of erosion and the most appropriate means of stabilisation can be determined.

- Damage to seagrass meadows in the shallows near the entrance to the marina basin, as a result of boats taking short cuts to the entrance. This should be prevented by the appropriate controls being put in place.

The potential impacts during construction are separately referred to in section 6.7.2. In consultation with the EPA, it is intended to develop quantitative baseline data of the benthic community and undertake long term monitoring of the subtidal communities in the vicinity of the channel.

6.11.5 Impacts During Channel Construction

(a) Construction Method

(i) Earthworks entrance channel

As indicated previously in Section 3.2, seaward of the breakwaters the entrance channel will be excavated to –4.0 m AHD. The channel depth will be about 1.2 m at the breakwater end and get progressively shallower as it extends out into deeper water.

Depending on the ground conditions excavations will either be by a barge-mounted excavator (or clamshell) or by a cutter suction dredge.

It is anticipated that the deeper, near-shore excavations will encounter limestone and possibly harder rock under the surface sands and may need to be excavated by an excavator, dragline or clamshell.

Off shore in the deeper waters where the depth of excavation will be less, it is anticipated that there will be less rock and that a cutter suction dredge may be an appropriate means of excavation.

In both circumstances the spoil generated will be transferred back to shore, dried to an appropriate moisture level and then incorporated into the general landfill.

Up to 10,000 m^3 of barged or trucked material will be allowed for. This material will be stockpiled on the surface of a previously filled area to facilitate drying before use as fill material.

In deeper waters (greater than –3.0 m AHD) the batters will be laid back at a slope of 1 in 3 for stability and to encourage the regrowth of seagrasses.

In shore (-3.0 m AHD and higher) the entrance channel batters will be laid back at 1 in 3 and protected against damage from wind and boat generated waves by rock rip rap.

(ii) Dredging process

A cutter suction dredge will be used to excavate the sections of the entrance channel that predominantly consist of sandy materials.

Depending on the nature of the excavated material it is anticipated that the volume of dredged material will be in the order of 20,000 to 30,000 cubic metres.

The dredged material will be pumped via a floating discharge line to a 45,000 cubic metre capacity, purpose-built holding basin located adjacent to the southern breakwaters.

The basin will be configured to reduce flow through velocities and encourage the suspended solids to settle before the water is allowed to return to the Bay.

The water in this basin will be tested and when turbidity levels meet agreed SA EPA requirements it will be allowed to return to Murat Bay. Regular monitoring of turbidity levels will be undertaken. Water not meeting the requirements will be diverted into the area enclosed by the breakwaters to allow further sedimentation and testing for compliance before being pumped out.

The proposed extent of dredging and location of the onshore holding and sedimentation basins are shown on Figure 10.5

(b) Potential Environmental Impacts

(i) Area directly affected by channel constructions

The channel alignment will cut through an inshore band of *Posidonia* spp on sand, which is approximately 180 metres wide. The channel width, including batters, is approximately 70 metres wide. An area of 1.25 ha will be impacted. This particular inshore band totals approximately 9 ha. However, this habitat is widespread in the Bay.

Further offshore the channel will be laid across an area that is largely bare sand, with sparse *Posidonia* spp. (refer Figure 6.9).

(ii) Effects on benthic fauna and flora in the excavation area

The proposed dredging operation will result in a depth increase of approximately 1.2 metres at the marina entrance, gradually decreasing further into the bay. While the nature of the deeper sediments near the entrance channel is unknown, for much of its length with only a shallow cut it is likely to be largely sandy material.

The excavation of the channel will initially result in a loss of the benthic fauna and flora (some of the sparse *Posidonia* spp).

There have been a number of major reviews on the environmental dredging. While undertaken some time ago, they still remain relevant. These include literature reviews by Min Con (Vic) 1974, May (1973), Jones and Candy (1981), and the

detailed review as part of the USA Corp of Engineers Dredge National Research Programme, (DMRP) reported by Hirsch et al (1978). These generally indicate that at sites of excavation biota may initially be decimated but recover with time.

The recovery period varies considerably depending upon the extent of disturbance, type of environment and the biological characteristics of the biota concerned. Recovery periods of weeks, (e.g. Slotta et al, 1973; Zajac and Whitlach, 1982; Dauer, 1984; Jones, 1986, months (Connor and Simon, 1979) and years have been reported.

Except in cases where there is a very large operation, say a deep excavation of several metres and over a large area (removing large quantities, say 1-2 million tonnes) excavation sites invariably recovered within one to two years, i.e. monitoring has indicated that the post dredging community is considered to be virtually the same as pre dredging. In summary, key factors in dredging are:

The environmental sensitivity of the area to be excavated and the adjacent areas.

This involves both a consideration of the conservation value of an area and the tolerance of different communities and species to the dredging activities. There is no offshore disposal area for dredged material.

The type of material to be dredged. This includes:

- Substrate type – whether sands or clays, etc. The excavation of clays is more likely to result in the production of a turbidity plume because of the suspension of colloidal material. Disturbed sands, including the fines, are more likely to rapidly settle out.

- The disturbance of contaminated sediments. Dredging of channels in port areas, or near major urban or industrial areas, frequently involves the disturbance of sediments containing contaminants, such as heavy metals, toxic organics, hydrocarbons, etc.

The method of operation

This involves the type of equipment, e.g. cutter suction, bucket or ‘grab’ dredge, dragline, etc. It also depends upon the method of access, duration of operation and season.

The more naturally variable the environment (e.g. an environment normally subjected to natural physical disturbance such as storm effects on open coasts) then the less effect dredging (and disposal) appear to have. It is variously suggested that the benthic communities of such areas are adapted to unstable sediment conditions and have natural lifecycles which allow them to withstand the stresses imposed by excavation and disposal. Lateral migration and larval recruitment play an important role in recolonisation. Disturbed sites are often initially recolonised by opportunistic species which occur at adjacent sites, but which are not dominant at these sites. During early recolonisation such opportunistic species may initially become quite abundant at the dredge site until a more stable community is established.

Recovery of the benthic community along most of the channel length, which is bare sand, should occur fairly rapidly. It is likely that with the inshore area of *Posidonia*, approximately 1.25 ha, it may take decades for this seagrass to re-establish, if at all. Other species, however, such as *Zostera* may establish instead.

Of greater concern would be the potential for lateral erosion of the adjacent inshore seagrass areas. This is not such an issue further offshore where it is largely bare

sand. It is intended to stabilise the channel, by placing a laid back side slope at (1:3). The batters will be protected by rock rip rap sourced from the same location as the breakwater armour rock.

For most of the channel length, it is likely that a cutter suction dredge will be used. This is the method that produces less sediment resuspension than other methods. While there will be some sediment deposition on adjacent areas, because it is likely to be sand that is removed for most of its length, this is likely to be localised. It also has to be seen in the context of the sediment disturbance and resuspension that occurs due to periodic storm events, particularly on the large bare sand areas over much of the bay offshore of the marina.

Overall, based on many studies undertaken elsewhere, the benthic communities along the length of the channel are likely to recover. It is proposed to determine this by monitoring. This will include developing a quantitative baseline data on the marine benthic communities along and immediately adjacent to the channel site prior to construction. Monitoring will include:

Examining the communities within the channel and adjacent area, 2 years after construction.

Monitoring of any turbidity plume during channel excavation. This would assist in defining any zone impacted by sediment deposition.

In addition, it is proposed to monitor for any erosion in the inshore seagrass area adjacent the channel:

- monthly after construction for a period of 2 years, and
- following large storm events.

(iii) Effects on water quality

During dredging operation, the major effect on water quality is that associated with suspended solids and turbidity. Heavy metals (such as Copper, Lead and Zinc), organics (such as pesticides), the plant nutrients nitrogen and phosphorus, hydrocarbons (oils) and dissolved oxygen are also of interest. These are usually an issue if contaminated sediments are being dredged. In this instance, it is unlikely that the area is contaminated. However, this still needs to be confirmed (Section 6.11.4 (c) below).

Dredging activity will inevitably produce an increase in the level of suspended particulate matter and turbidity.

In this instance, effects on turbidity can be due to:

- The dredging operation, creating the channel.
- The release of water from the onshore settlement ponds, back into the marine environment.
- The opening of the marina basin after construction, stirring up any unconsolidated sediments.

The effects of turbidity are likely to be short-lived. It is anticipated that the dredging of the channel will take a few weeks. Even during the operation, any turbidity increase will be intermittent, depending on the hours worked per day. To some

extent the effects can be reduced by avoiding rough weather or spring tides when there would be greater water movement.

It is unlikely that localised increased turbidity for a few weeks or months would significantly impact on seagrass areas within the Bay.

Suspended solids will also increase within the vicinity of the dredging operation. However, the disturbed sands will rapidly settle out. Smaller fractions (fines) will remain in suspension longer but will disperse rapidly with only a localised effect. While suspended solids can be abrasive or clog gill mechanisms, species such as fish or dolphins, etc., will normally avoid these conditions. As the operation is for a short duration, there would be no lasting effects. Nevertheless, turbidity and suspended solids will be monitored during the dredging operation.

A monitoring program will be defined as part of the Construction Management Plan, refer Section 10. The scope of the program will be confirmed with the EPA, but is likely to involve:

- Prior to the dredging operation

  At selected sites and tidal conditions along the length of the channel corridor, measurements will be taken of turbidity and samples collected for suspended solids/particle size analysis. The field measurements would use a combination of a secchi disc and a turbidity meter (nephelometer).

- During offshore dredging

  Measurements will be taken of turbidity and samples collected for suspended solids:
  - at a suitably located control site, away from the influence of the dredging;
  - at 2-3 locations in close proximity to the dredging operation (within 50-100 m), and
  - along the track of any observed turbidity plume.

  Records will also be kept of:
  - the days (dates) on which dredging occurred, and
  - the total hours and time of operation.

- Holding pond water release

  Measurements will be taken of the turbidity levels and suspended solids of water released to the marine environment, and at locations near the point of release (50, 100 m). Initially this should be undertaken daily to ensure that these parameters are at acceptable levels.

If monitoring indicates that predetermined acceptable levels (EPA, Environment Protection (Water Quality) Policy), of 10 NTU, turbidity), then the dredging operation should cease until conditions improve and/or the operation is modified.

Similarly, if turbidity levels exceed those of the policy levels for marine waters, in the receiving waters adjacent the point of discharge from the holding ponds, the discharge will also cease.

The effects of dredging activities on water quality have also been extensively studied in past reviews. Despite the range of possible adverse effects, Hirsch et al (1978), Burks and Engler (1978) and other reviewers have concluded that except in sensitive areas, such as coral reefs, the effects of suspended solids and turbidity were invariably minimal. They found that to a significant degree, this is usually the

result of the intermittent operation of excavation and the dispersion characteristics of any plume.

A review of studies being conducted on the New York Bight, Great Lakes, Texas Gulf and Chesapeake Bay as part of the Westernport Bay Environmental Study, Min Con (1974) indicated that in relatively unpolluted waters dredging caused only local and transient effects on marine communities with insignificant effects on planktonic and nektonic species. Studies showed that most adult organisms tolerate levels and durations far in excess of those recorded during actual dredging activities. These studies were done in the laboratory on a variety of marine, estuarine and freshwater species using bioassay techniques and verified in the field.

In this instance, it is intended that dredged material from the channel excavation will be pumped ashore to a holding basin, refer Figure 10.5 where it is dewatered. The holding basin will allow the settlement of suspended solids and water will only be discharged when turbidity/suspended solids are at low levels (10 NTU, to meet EPA (2003) Environment Protection (Water Quality) Policy requirements).

Within the onshore holding basins turbidity and suspended solid levels will reduce as the dredged material settles. No water will be released back to the marine environment, without levels being reduced to acceptable levels. The intent will be to conform with the Environment Protection (Water Quality) Policy EPA (2003). Like the dredging operation itself, the release of water will also only last for a few weeks, and could probably be released beyond the seagrass area into the sandy areas.

It can be expected that once the marina construction is completed and an opening made to allow the entry of seawater, there would initially be some resuspension of unconsolidated materials resulting in increased turbidity and suspended solids. While this would also be a short-lived effect, it will be minimised by controlling the rate at which the marina is initially filled and picking tides with low volume exchange (neap tide).

(c) Investigations Prior to Channel Excavation

Prior to dredging an environmental assessment will be undertaken for the purpose of:

- Sampling and testing the sediments to be dredged for the presence of contaminants greater than criteria to be established in consultation with an SA EPA approved Environmental Auditor.

  The criteria will be based on the Health Investigation Levels (HIL's), Ecological Investigation Levels (EIL's) for soil in Table 5-A of the NEPC Guideline on the Investigation Levels for Soil and Groundwater (NEPM 1999) and the Interim Sediment Quality Guidelines (ANZECC 2000).

- Selecting a location for the disposal of the dredged materials that minimises the impact on existing vegetation and groundwater.

- Establishment of criteria for the handling and ultimate use of the dredged soils.

The outcome of the above process is to obtain a licence to undertake the dredging and all associated activities.

6.11.6 Development of Marine Biological Communities in the Marina Waterways

It is important to appreciate that the marina waterways and the various rock walls and breakwaters will provide habitat for marine fauna and flora. There are many examples of

this occurring, and has been reported elsewhere in other constructed man made waterways, e.g. the post construction survey of the Lincoln Cove Marina AGC (1990) or the study of the ecology of marinas by Nixon et al (1973).

This is perhaps not surprising, as it would also be common knowledge that jetty pilings rapidly become encrusted by a diversity of species, boat harbours are typically popular fishing spots, and that artificial reefs, using car bodies, tyres etc., are developed because they are known to be of value. The possible introduction of marine pests, particularly from visiting boats, is a concern and is discussed in Section 6.11.7 below.

Other studies of waterways or marinas, including the initial investigations of water quality in West Lakes (EWS 1988) and water quality in coastal marinas by AEC (1988), also indicate the establishment of marine communities.

The Lincoln Cove Marina, constructed in 1988, is very similar in many respects to the proposed Ceduna Marina. Shortly after the marina was constructed, a survey was undertaken to examine the development of marine communities and was reported in AGC (1990). The following comments are taken from this source.

At the time of observation the main entrance channel still had little vegetation, although at the seaward end scattered patches of *Posidonia australis* remained and *Heterozostera tasmanica* were now colonising the disturbed sediments. Most of the channel bed was covered with a deep, soft layer of fine sediment and is marked by abundant worm mounds. Notable benthic animals in this area were sipunculid worms, the holothurian *Stichopus mollis* and an echiurian. The marina basin bottom was covered with a deep, soft layer of fine sediment, which was easily disturbed. Some of the basin was similar to the channel bed, with worm mounds and sabellid worm tubes.

Elsewhere, the bottom was covered by growths of macroalgae. Over much of the area a red algae (*Spyridia*, probably *S. breviarticulata*) formed a monospecific layer (10cm thick) resting on, but not attached to, the bottom. There were also many areas of bottom covered by attached mats of a short, filamentous form of this algae. The species of algae and their abundance would almost certainly vary seasonally. The growth observed was not regarded as excessive. The lack of stability of the sediment and flora associations of the marina bottom was attributed to the recency of construction. The land areas around the waterways at the time of observation were still being vegetated. Some small patches of the seagrass, *Halophila australis*, were well established in the southern part of the main basin.

The rock walls were examined during the survey. These were characterised, at shallow depths, by growths of the cosmopolitan initial colonising green algae *Enteromorpha flexuosa*; associated with *Cladophora sp.* along the southern side of the channel. Blue-green algae were also abundant on the northern wall, although they were absent on the southern wall. Fine red algae *(Pleonosporium sp.)* dominated the rock surface at depths greater than 2 metres, with other reds *(Nemalion helminthoides)* and brown algae *(Colpomenia peregrina* and *Lomentaria australis)* were also common. The tubular algae *N. helminthoides* was particularly common on the southern rock wall. The barnacle *Balanus amphitrites* was common in places, as was the butterfly shell *Electroma georginiana*. The oyster *Ostrea angasi* was very abundant on some of the pilings along many of the rock walls. These animals live attached to hard substrata from the sub-littoral fringe down to the bottom of the marine (4-5m). Significant numbers of oysters were being harvested for local consumption.

A number of fish species were observed in the marina waterways during the survey including Magpie Perch *(Coniistius vizonarius)*, Dusky Morwong *(Psilocranium nigricans)*, Common Bullseye *(Liopempheris multiradeata)*, Blenny *(Pictiblennius tasmanianus)* and Cobi *(Cobiidae sp.)*. These species are typically associated with rocky reefs and were probably present originally on the small reefs edging Porter Bay. These fish, then, are

indicative of the new marine community becoming established in the environment created by the marina. A number of species of recreational importance, including mullet and whiting, are also caught in the marina.

Overall, it was apparent that the marina was rapidly being colonised by marine flora and fauna and because of the array of habitats available, rock walls, sandy substrate pilings etc., would likely eventually be a relatively diverse community.

Nixon et al (1973) studied the ecology of boat marinas at Wickford Cove, Rhode Island. A comparison was made between the marina and the adjacent underdeveloped cove, which was an estuarine area with a large saltmarsh. This was the same environment that existed at the marina site prior to its development. The studies included marsh grass (seagrass) production, phytoplankton, fish diversity, fauna and flora growing on hard surfaces, sediments and water quality. It was found that in most respects the marina and underdeveloped cove appeared to be not only similar, but also comparable ecological systems.

6.11.7 Marine Pests

As described by the Department of the Environment and Heritage, “Introduced Marine Pests” (DEH, 2005), marine pests are species that are introduced to Australian waters and translocated by a variety of vectors, including ballast water, bio-fouling on boat hulls and inside internal seawater pipes, aquaculture operation, aquariums as well as marine debris and ocean currents.

There are currently about 250 introduced marine species in Australia, including both animals and plants. Better known species include the Black striped mussel (*Mytilopsis,* sp.) found in three marinas in Darwin Harbour, the Northern Pacific seastar (*Asterias amurensis*) introduced into Tasmanian waters and the European fan worm (*Sabella spollanzanii*) first discovered in Albany Harbour and also discovered in Port Philip Bay.

In South Australia, 22 introduced marine pests have been recorded including, European fan worm, toxic dinoflagellates and recently the plant *Caulerpa taxifolia* in West Lakes and the Port River.

The Australian Government has established a national approach to the problem, with a National Introduced Marine Pests Co-ordination Group (NIMPCG) set up in 2001. The focus is on the prevention of new pests into Australia, emergency responses with the discovery of new pests and the ongoing management and control of established pests.

It is recognised that the proposed marina presents a risk of marine pest introduction as a result of:

- Construction activities – marine pests could be transported by equipment used in the marina excavation or offshore channel excavation, if the equipment used has previously been in areas where pests are present.

- Vessels bringing in marine pests – visiting vessels or vessels based at the marina but which have been at other infected locations are major vectors.

Initially, the marina, following construction, will be colonised by species from adjacent areas, particularly the more opportunistic species. This is part of the natural colonisation process. This was observed at Lincoln Cove Marina, as described above. Introduction of marine pests during this early period may favour a more rapid spread of the organism within the marina waterways.

In addition to whatever measures can be taken to minimise risk, early detection of any introduction provides the best opportunity for eradication, before the pest spreads to surrounding waters, or is transported to other facilities.
It is proposed to undertake the following:

- for the first 5 years, an annual inspection will be undertaken of the marina waterways/structures by qualified personnel (probably PIRSA personnel);
- after 5 years, subject to advice and recommendation from PIRSA, it is likely that inspections will be undertaken every 2 years;
- all equipment brought to site will be cleaned before use;
- an awareness campaign will be developed for new residents of the marina, boat owners and the fishing/aquaculture industry, which may include distributing information in the form of pamphlets with photographs of species of concern, signage, etc;
- controls/advice on aquarium species; and
- keeping a register of boat movements. This will be a task for the marina manager.

Boat hull cleaning will not occur at the marina. Facilities are being provided at Thevenard for this purpose. This is not within the responsibility of the marina operators, but it would be appropriate that safeguards are incorporated into the hull cleaning operations.

WATER

6.12 Water Quality in Waterways

Measures are to be taken to protect water quality in the marina waterways and Murat Bay. In accordance with the ANZECC (2000) guidelines, the appropriate environmental values within the waterways would be:

- the protection and maintenance of marine biological communities, which would become established; and
- recreation, both passive and active, including general amenity.

The relevant water quality guidelines are included in the Table 6.16 below.

Table 6.16 ANZECC (2000) Guidelines for Key Water Quality Parameters

Parameter	Guidelines
Dissolved Oxygen	90 – 110% Saturation
pH	8.4
Turbidity	0.5 – 10 (NTU)
Phosphorus	
Total P	100 µg/L
FRP	10 µg/L
Nitrogen	
Total	1000 µg/L
NO_x	50 µg/L
Ammonia	50 µg/L
Heavy Metals	
Copper	0.13 µg/L
Lead	4.4 µg/L
Zinc	15 µg/L
Faecal Microorganisms	(Recreation)

E. coli	150 orgs/100 ML (primary
Enterococci	35 orgs/100 ML (primary)
E. coli	1000 orgs/100 ML (secondary)
Enterococci	230 orgs/100 ML (secondary)

The water quality in the waterway would be determined by:

- The water quality of the water in Murat Bay, which exchanges with that of the marina basin.
- The residence time of water in the marina basin, i.e. water turnover and flushing.
- The management of potential sources of contamination, including:
  - waste (sewage, sullage) from boats
  - waste (sewage) from developed areas (residential/commercial)
  - ballast waters from boats
  - the prevention of boat maintenance activities
  - the preparation of a spill (oil) contingency plan
- The management of stormwater runoff

These are discussed below.

6.13 Water Quality in Murat Bay

Although there is no comprehensive water quality monitoring programme for the Bay, it can be anticipated that the existing bay waters would be of a high standard, in that:

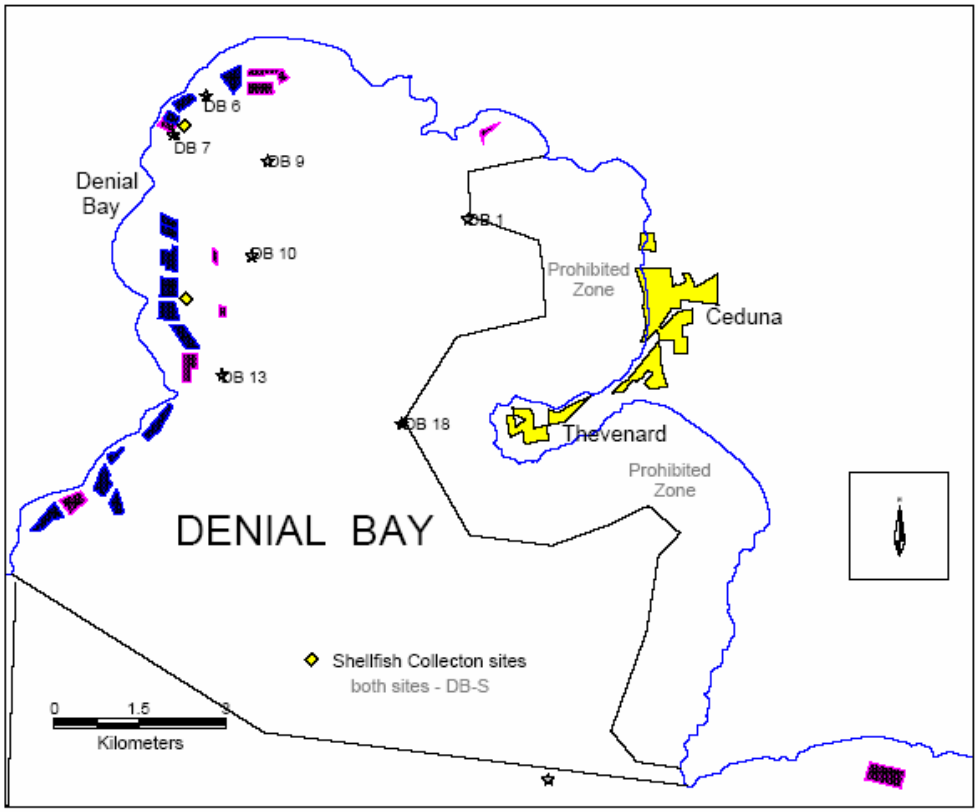
There is no effluent outfall from the existing Ceduna township.

The City of Ceduna is pursuing a stormwater management plan, with a view to minimising discharges. There are a number of small stormwater outlets. In view of the low rainfall, runoff for the area, the open waters of the bay facilitating rapid dispersion and dilution, the effects of these discharges are likely to be localised and transitory.

There are no major industrial activities which would have waste discharges.

The above points would suggest that the waters of Murat Bay should be of good quality. At the present time the only monitoring undertaken is that undertaken as part of the South Australian Shellfish Quality Assurance Program (SASQAP) from the locations indicated on Figure 6.11.

Figure 6.11 SASQP testing locations



The main focus of the SASQAP program is on microbiological quality in waters and shellfish and the presence of chemical contaminants and biotoxins in shellfish. Microbiological testing is undertaken at the SASQAP laboratory at Port Lincoln. It is accredited to ISO/IEC 17025 Certification and is audited by the National Association of Testing Authorities (NATA). Other tests are undertaken at other accredited agencies.

The results of water sample analysis for the period 1 January 1996 to 1 January 2003 for faecal coliforms are summarised in Table 6.17 below (SASQAP, 2003). Numbers are all very low, (<1), compared to the ANZECC Guidelines of 150 organisms/100 mL for contact recreation. Three locations, DBEC1-3, were all in close proximity to Ceduna and included the period during and immediately after the recent solar eclipse when there were large numbers of visitors to the area.

Table 6.17 **Summary of Faecal Coliform Results (orgs/100 mL) on water samples. 1 January 1996 – 1 January 2003**

Station	Mean	Min.	Max.	Std. Error	No. of Samples	90th Percentile	Geo Mean
DB 01	0.90	0.9	.9	0.16	3	.90	.90
DB 06	0.90	0.9	.9	0.16	3	.90	.90
DB 07	0.90	0.9	.9	0.16	3	.90	.90
DB 09	0.90	0.9	.9	0.16	2	.90	.90
DB 10	0.90	0.9		0.16	3	.92	.90
DB 13	0.90	0.9	.9	0.16	3	.90	.90
DB 18	0.90	0.9	.9	0.17	8	.90	.90
DBEC1	0.90	0.9	.9	0.64		.90	.90
DBEC2	0.90	0.9	.9	0.64		.90	.90
DBEC3	0.90	0.9	.9	0.64		.90	.90
SP 01	0.90	0.9	.9	0.17	9	.90	.90
SP 02	0.90	0.9	.9	.17	8	.90	.90

(For the period January 1996 – January 2003, all routine samplings of the presence of biotoxins in shellfish were negative)

As part of the Operational Management Plan outlined in Section 10, a regular monitoring program should be undertaken, integrated with monitoring of the Marina basin, that undertaken by SASQAP and any monitoring undertaken by Council adjacent Ceduna and Thevenard.

To provide some baseline data on water quality in the vicinity of the marina site, water quality monitoring is being undertaken, and monitoring of the waters of Murat Bay has already commenced (April 2005), with the intention of establishing baseline data on existing conditions prior to construction and operation. This initial program is outlined below:

- Sample site locations
  Initially sites have been selected. GPS coordinates will be recorded for subsequent repeat sampling. The sites are:

  - 50 metres offshore of the site of the breakwaters, aligned along the proposed entrance channel;
  - 250 metres offshore of the breakwaters along the proposed entrance channel.
  - 250 metres offshore of the service station, northern end of Ceduna urban area.
  - 250 metres offshore along the alignment of the main Ceduna jetty.

  These initial locations will be used to examine general water quality characteristics. Site location and/or their number may be varied before a long term monitoring plan is finalised.

- Parameters

  - nutrients
  - faecal bacteria
  - heavy metals
  - hydrocarbons

- Field measurements would be taken of:

  - dissolved oxygen / temperature
  - turbidity

- Frequency

Sampling frequency will be monthly, timed as far as practicable to coincide with the South Australian Shellfish Quality Program (SASQAP), see below.

6.14 Water Turnover and Flushing

The marina and waterways have been designed and are arranged such that tidal movements would be sufficient to 'flush' water within the system in a manner that does not require mechanical or other artificial intervention to achieve suitable water turnover.

As explained within the DSC Engineering Assessment (refer Volume 2, Working Paper 1) the proposal demonstrates a total waterway area of some 49 hectares linked to Murat Bay by a 50 metre wide channel. The average depth is designed to be 2.5 metres below low tide, i.e. –3.5 m AHD. Total waterway volume between tide levels 0.59 m AHD and –0.61 m AHD is 588,000 cubic metres. Over a 6-hour tide cycle this on average represents an inflow or outflow rate of 27.2 cubic metres per second through the channel.

Assuming an average water depth of 2.5 metres in the channel this flow takes place at a very low velocity of 0.21 metres / second. This analysis indicates that there is almost unrestricted exchange of water between Murat Bay and the waterways. It is therefore considered that exchange volumes can, for the purpose of assessing water quality in the waterways, be directly related to tidal variations.

Based on a statistical analysis of daily tidal variations at Thevenard, it is considered that 50% of total daily tidal variations represents the exchange depth of water that flows in and out each day. An average exchange of about 1.0 metre per day and an average waterway depth of 3.5 metres indicates an average exchange of about 3.5 days ignoring any lag effects.

Using the same logic as above a sea level rise of say 1.0 metre would increase the average exchange rate to about 4.5 days. These exchange rates are very similar to those that have been calculated for the waterways at Lincoln Cove Marina in Port Lincoln, a similar size waterfront and marina development. Experience elsewhere indicates that a hydraulic residence time of between 7-11 days is adequate to ensure good water quality.

6.15 Management of Marina Activities

Potential sources of contamination or water quality impairment would be prevented or minimised, as follows:

- The removal and treatment of all sewage waste from the development, with all effluent either reused or disposed of in the lagoons.
- For those vessels with ballast, in the commercial area a pump-out system for ballast/bilge water would be provided, with waste appropriately disposed of, as outlined in the EPA Code of Practice.
- No boat maintenance activities would be allowed in the marina, including repair work, hull cleaning or anti-fouling.
- Strict management and regulatory regimes are to be put in place for controlling boat speed and the movement of larger vessels at low tide, which would reduce sediment resuspension and turbidity effects.
- While fuelling facilities for diesel fuel and petroleum would normally be provided, the risk of contamination of the marina, and the marine environment is very small. In this regard the following are to be noted:

- Fuel storage areas would be bonded as part of normal design.
- Private storage of fuels is also discouraged.
- Light oil fractions are rapidly lost to the atmosphere.

Most concern with oil spills is where there are large volumes involved, particularly crude or bunker oils. In this instance, the most likely scenario is a small spill during fuelling. The volume involved would be small.

- An oil spill contingency plan would be prepared as part of the environmental management plan for the marina, which would:

  - Identify the equipment requirements (booms, sorbents);
  - Response procedures;
  - Equipment deployment, retrieval and disposal of recovered oils; and
  - Contacts and responsibilities.

There is no major watercourse entering the development area, nor any stormwater outlets from the Ceduna urban area. As indicated in the Engineering Assessment (DSC 2004), the adjacent rural catchment would only produce runoff during major events.

The development of the aquaculture industry i.e. tuna, oysters, abalone, finfish and mussels, on the Eyre Peninsula over the past ten years is a good example of the typical onshore impacts and requirements of the industry. The established onshore aquaculture areas in Pt Lincoln, Ceduna and Smoky Bay all clearly demonstrate the areas of land required and the types of activities that are generally undertaken with the onshore management of aquaculture leases. Activities such as net/basket repairs, net/basket cleaning, net/basket making and storage are all usually conducted onshore.

The Ceduna Keys therefore, is not a suitable or desirable location for this type of activity to be carried out, with opportunities for this to occur elsewhere such as Thevenard, Denial Bay or Smoky Bay.

Lincoln Cove marina is a good working example of the type of aquaculture activity that does take place in marina facilities. A large proportion of the industry has established office and commercial space in the marina. Along with this almost all of the companies in both the fishing and aquaculture industry have located their boats in the berthing facilities. Usually the boats would come into berth:

- for downtime between trips;
- to obtain supplies; and
- to unload packed frozen fresh product and equipment.

This is in turn, is all directly transported from the marina to other onshore facilities located in the industrial areas of Pt Lincoln.

The existing local aquaculture industry in Ceduna (Denial Bay) and Smoky Bay already has established onshore bases in both Denial Bay and Smoky Bay and would therefore not require such facilities.

Much of the interest in new aquaculture development has been in the offshore areas of the far west coast and not in Murat Bay itself. The industry prefers to establish onshore sites as close as practicable to their lease sites. It is therefore envisaged that aquaculture maintenance and repair activities including cage removal for cleaning etc would be undertaken either on the offshore lease sites or at the closest onshore site i.e. Thevenard Slipway, the industrial park, Denial Bay Aquaculture Zone or other designated onshore aquaculture zones along the coast etc

6.16 Stormwater Management

Of the total stormwater runoff, through the adoption of water-sensitive urban design features and the use of plumbed-in rainwater tanks, approximately 88% would either be clean (roofwater) or have been treated in swales, detention basins or soakage. Roofwater is generally clean, compared to runoff from typical urban areas. However, after longer dry periods there may be some accumulation of dust, bird faecal material, possibly some traces of metals (aluminium or zinc) from roof materials and organic debris (leaves, etc.).

It is appropriate that a first flush bypass be incorporated, with this water being discharged onto garden areas. The majority of stormwater runoff from the site would be from the sealed road surfaces, where traces of heavy metals, hydrocarbons and nutrients from organic litter would be the principal pollutants. Runoff from garden areas may contain some fertiliser material. Overall, however, only approximately 12% of the total volume would enter the basin direct, and this would have entered via GPTs. This is summarised as follows:

	By Area	By Volume
• Plumbed-in roofwater, with surplus clean roofwater discharged to waterways	22%	41%
• Soakage on allotments/sites	30%	21%
• Discharge to inland golf course	3%	2%
• Directed to detention basins	30%	26%
• To waterways via GPTs	14%	12%

Stormwater management is achieved by the incorporation of water-sensitive design features, including:

- Swales, where practicable, rather than kerbing is to be used as a form of pre-treatment for stormwater, using grass or gravel, to filter pollutants and enabling some infiltration along the flow path.

- Infiltration of stormwater, whether it be direct from swales, open channels, dryland infiltration basins, gravel filled soakage trenches or underground storage cells.

- Porous pavements, may be utilised and comprise bock paving which is formed with small gaps between pavers to enable soakage of stormwater to sand and gravel base layers below and ultimately through to the underlying ground.

- Kerb line turf strips, a minimum of 400 mm wide would assist to reduce sediment and pollutant load in stormwater from verges running into the kerb and gutter.

- Linking of drainage, from kerb inlet gullies to water street trees. This would involve placement of inlet pits adjacent street trees with water piped into a permeable layer from which the tree can draw water, and an agricultural drain to direct excess water back into the underground drainage system.

Overall, with regard to pollutant reduction, the engineering approach proposed is as follows:

- Excess roofwater, not used by the plumbed-in rainwater tanks, which is relatively clean, would discharge direct to the waterways.

- The majority of runoff discharging to the marina is generated and conveyed along internal road drainage.

- The Eyre Highway is separated from the development to a degree by the noise attenuation mound. The highway would be formed as a rural road and would have swales, with the drainage path essentially along the swales, finally through culverts to downstream systems, providing:

  - Grass filtration and some detention
  - The opportunity to isolate any spillages

With an improved swale system, compared to that at present, the current risk from the existing highway should be reduced.

- A large portion of the yard runoff would be contained by a plinth, which is proposed to extend across the property boundary to prevent runoff directly entering the waterways. Water would be able to pool temporarily and soak to the ground, benefiting gardens and plantings. Any water entering the waterways via the ground would be through sands providing filtration, removing sediments with any associated particulate pollutants.

- Other roadways and some road runoff would contribute to the roadway catchments. Approximately 30% of the total area (26% by volume) would enter one of three stormwater detention basins, shown on Figure 6.12. The basins in catchments 4 and 7 would be able to achieve an average annual residence time of 10 days. The basin in catchment 3 would have an average residence time of 5 days.

- The remainder of road runoff that cannot be diverted to basins (12% of the total by volume) would discharge directly to the marina basin via GPTs. These units are generally sized for capture of all flows up to 3 to 6 month ARI. As a general guide, units typically achieve the following:

  - >95% capture of gross pollutants greater than 2-3 mm
  - 85-90% of sediment greater than 0.1-0.25 mm size
  - a significant sediment load captured is the 0.1-0.6 mm range (based on testing)
  - >95% capture of free oils and greases

The measures taken to manage stormwater and other potential sources of contamination are adequate to protect water quality in the marina waterways, particularly with regard to:

- The low rainfall in the region, approximately 300 mm/annum, resulting in relatively small stormwater volume discharges.

- The volumes of the marina basin, approximately 590 ML and the short residence time of average 3-4 days, which would result in localised and transitory effects due to the very large dilution factor.

- The large proportion of the stormwater, approximately 88%, which is roofwater or treated in swales/soakage or diverted to detention basins, with the remainder (approximately 12%) passing through GPTs prior to direct discharge.

- Urban stormwater runoff contains an array of pollutants. AEC (1988) based on a national study, defined typical urban runoff, included suspended solids 150-160 mg/L, nitrogen 0.5-3.0 mg/L, phosphorus 0.1-1.5 mg/L, and the common heavy metals, lead 0.2 mg/L, zinc 0.2 mg/L, copper 0.04 mg/L, faecal bacteria 10000-100000 orgs/100 mL.

(This data have frequently been used to assist in defining potential stormwater quality for urban areas in the absence of data. However, most of these data were based on monitoring of larger

catchment areas, which contain some industrial and commercial areas, petrol stations, freeways, major arterial roads, etc. More recently a study by the Uni SA, Urban Water Resources Centre (Argue et al, 1999) has indicated that urban stormwater quality concentrations of most parameters for road runoff from residential urban areas are an order of magnitude less than that of arterial roads. As the runoff from the Eyre Highway is effectively isolated from the development, it is likely that the runoff quality from the residential areas would initially carry a smaller pollutant load, most of which would be removed by the proposed measures.

6.17 Exchange Waters Velocity

Channel velocities due to tidal flows have been assessed by the engineers to average about 0.21 metres per second. This is considered to be an acceptable performance standard and would not result in extensive disturbance to sediments or damage to the marine environment.

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Ceduna Keys

Figure 6.12 – Stormwater Drainage Layout

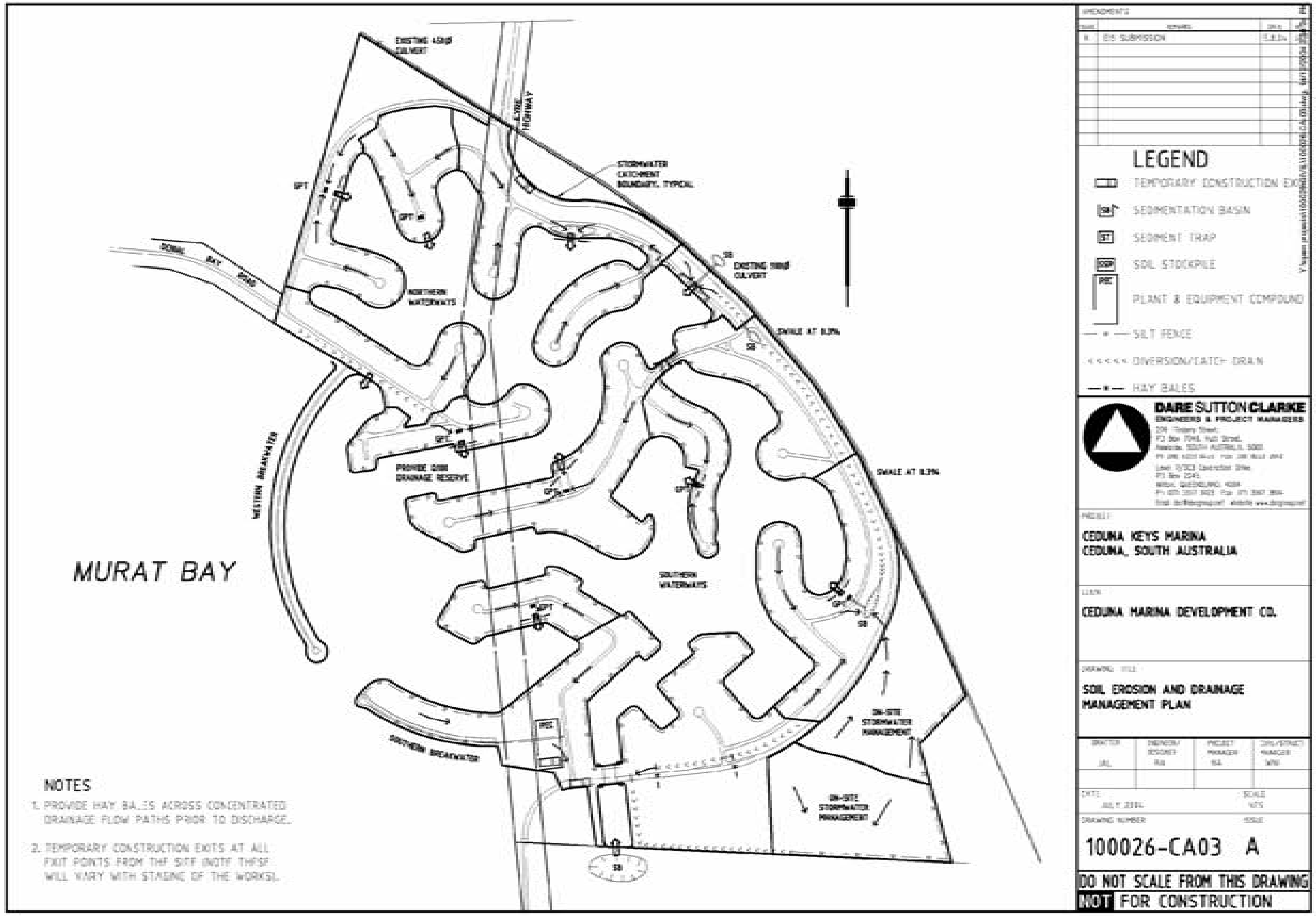
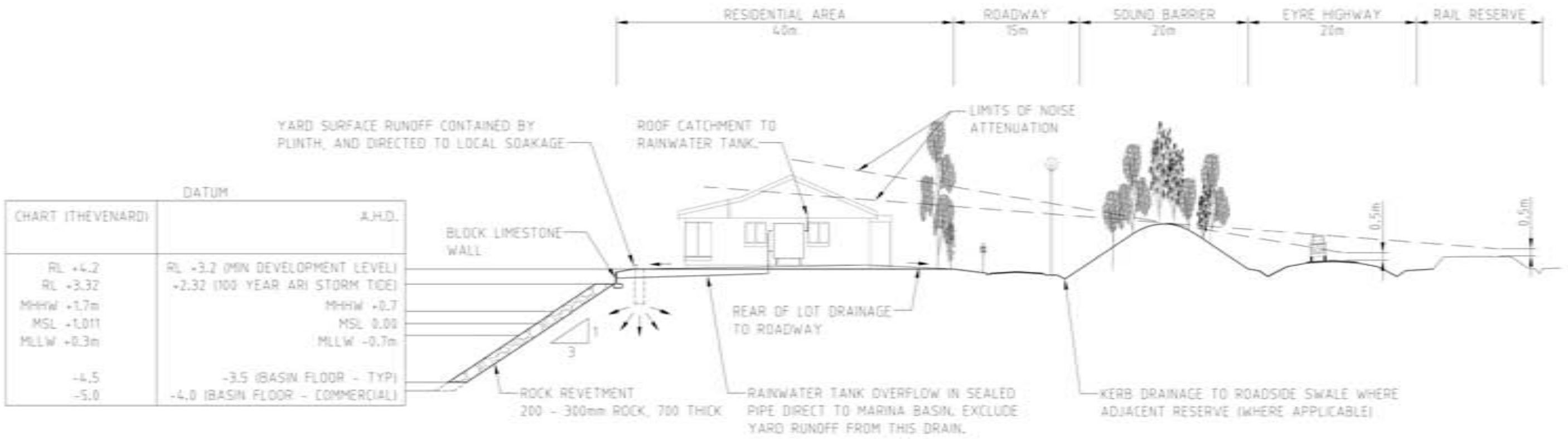


Figure 6.13 **Stormwater Drainage & Noise Attenuation**



DATUM	
CHART (THEVENARD)	A.H.D.
RL +4.2	RL +3.2 (MIN DEVELOPMENT LEVEL)
RL +3.32	+2.32 (100 YEAR ARI STORM TIDE)
MHHW +1.7m	MHHW +0.7
MSL +1.011	MSL 0.00
MLLW +0.3m	MLLW -0.7m
+4.5	-3.5 (BASIN FLOOR - TYP)
-5.0	-4.0 (BASIN FLOOR - COMMERCIAL)

SECTION A-A

HORIZONTAL 1:500 (0 5 10 15 20 25 30m)

VERTICAL 1:250 (0 5 10 15m)

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	01.12.04	JAL

AMENDMENTS

DO NOT SCALE FROM THIS DRAWING

NOT FOR CONSTRUCTION

PROJECT: CEDUNA KEYS
TYPICAL SECTION DRAINAGE

CLIENT: CEDUNA MARINA DEVELOPMENT CO

DRAWING TITLE: SECTION A-A

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	GROUP MANAGER
JAL	BA	WNC	BA

DATE: DEC. 2004 SCALE: AS SHOWN

DRAWING NUMBER: 100026-SK02 ISSUE: A

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CONNOR HOLMES

6.18 Water Quality Monitoring and Protection Measures

A water quality monitoring program is to be implemented. The overall program would be developed in consultation with the EPA and will include:

- The collection of water samples within the marina and at selected locations in Murat Bay adjacent to the Marina, with analysis for:

  - nutrients
  - faecal bacteria
  - heavy metals
  - hydrocarbons

- Field measurements would be taken of:

  - dissolved oxygen / temperature
  - turbidity

- Sediment samples would be collected in the marina basin and analysed for:

  - heavy metals
  - TBTs
  - hydrocarbons

- A biological monitoring program would be established in order to:

  - monitor the quality of algal growth (particularly of any nuisance algal mass)
  - the development of marine communities within the marina
  - detect the occurrence of any introduced pest species

The monitoring program will be implemented as part of the Operational Management Plan, refer Section 10.2. The effects of construction will also be separately monitored, refer Section 10.1. Monitoring of the waters of Murat Bay has already commenced (April 2005), with the intention of establishing baseline data on existing conditions prior to construction and operation. This initial program is outlined below:

- Sample site locations

  Initially sites have been selected. GPS coordinates will be recorded for subsequent repeat sampling. The sites are:

  - 50 metres offshore of the site of the breakwaters, aligned along the proposed entrance channel;
  - 250 metres offshore of the breakwaters along the proposed entrance channel.
  - 250 metres offshore of the service station, northern end of Ceduna urban area.
  - 250 metres offshore along the alignment of the main Ceduna jetty.

These initial locations will be used to examine general water quality characteristics. Site location and/or their number may be varied before a long term monitoring plan is finalised.

- Parameters

  These are as indicated above.

- Frequency

Sampling frequency will be monthly, timed as far as practicable to coincide with the South Australian Shellfish Quality Program (SASQAP), see below.

The SASQAP is being undertaken on a monthly basis to monitor water quality for the oyster industry. Currently testing is undertaken at a number of local sites including St Peters Island, Denial Bay and Murat Bay. This would provide additional baseline data for the maintenance of water quality in the commercial marina. A Management, Maintenance and Monitoring Agreement would be negotiated between the Applicant, Council and the EPA to ensure maintenance and repair activities are undertaken to ensure satisfactory water quality.

SASQAP was established in 1994 as a joint initiative between the shellfish industries and the Primary Industries and Resources SA (1994). SASQAP was developed; to provide consumer protection and ensure industry development with access to domestic and overseas markets; and all farmed shellfish meet relevant food safety standards. The SASQAP is designed to meet stringent national and international food safety guidelines and is accredited accordingly.

The program is administered from Pt Lincoln where it operates a NATA Accredited laboratory performing all microbiological testing. Phytoplankton enumeration on water samples is also undertaken at the laboratory but the other analytical services (biotoxin & chemical testing) are provided by other agencies on a fee for service basis. Murat Bay (Denial Bay) has been approved and classified as a clean water area that is free of impact from actual and potential sources of pollution and not subject to repeated and predictable biotoxin events. To obtain this approval detailed shoreline surveys of all real potential pollution sources were conducted in the Murat Bay area.

SASQAP is required to maintain an ongoing monitoring program for classified growing areas such as Murat Bay. This involves sampling of water and shellfish samples for microbioglocial, toxic phytoplankton, biotoxin as well as contamination. The program monitors and classifies all marine waters where farmed shellfish are grown in South Australia. It has been developed to ensure that shellfish does not come into contact with any deleterious substances such as bacteria, viruses, toxins, heavy metals and chemicals

Phytoplankton monitoring for toxic algae occurs on a fortnightly basis over the warmer months and at monthly intervals during other times. Elevated levels of toxic phytoplankton result in biotoxin testing of shellfish. Microbiological monitoring for approved growing areas including the waters of Murat Bay occurs a minimum of six times per year and often is scheduled following adverse environment conditions such as rainfall when impact is more likely to occur. Trained independent agents collect the samples under a standard procedure. The SASQAP monitoring program already takes samples very near to the proposed Ceduna marina site. There is potential for the Proponent to link into the SASQAP program and have a further number of samples taken adjacent to the site.

6.19 On site Water Collection

It is proposed that all development with Ceduna Keys provide rainwater tanks to collect all roof runoff. To maximise this resource it is proposed to plumb collection tanks into each residence for use particularly in toilet flushing, bathroom use, laundry and hot water systems, as well as for general outdoor and garden use.

The inclusion of rainwater tanks on each allotment is expected to minimise the demand on SA Water mains or potable water supply. 'Rainwater tanks, their selection, use and maintenance' indicates that in-house water use is typically 127 litres / person / day on Adelaide consumption figures. Water proofing Adelaide figures also suggest that 40% of residential use is for gardens and often outdoor uses. A three (3) person household is therefore likely to use 139 kL/yr in-house, and up to 92 kL/yr outdoors, though this may be reduced with use of water saving fixtures and attitudes. By comparison, a rainwater tank served by a roof area of 250 m^2 would supply up to 55 kL per year in Ceduna with 300 mm average rainfall.

The use of rainwater tanks could therefore reduce the demand on mains supply by the order of 25 to 30%, though this is expected to vary with level of occupancy, connected roof areas, and people's attitudes to water conservation.

The Land Management Agreement proposed as part of the development requires that all dwellings be provided with a rainwater tank plumbed to the residence and should be at least 15,000 litres in capacity. The LMA also requires swimming pools to be plumbed to rainwater tanks, and the use of covers so as to minimise loss through evaporation.

6.20 Water Sensitive Urban Design Measures

As indicated previously in 6.16 above, a range of water sensitive urban design measures are being adopted which would prevent pollution from stormwater and maximise its reuse.

Significant potential also exists for the secondary use of treated effluent for irrigation of landscaped areas within the development and the adjoining golf course, football oval, and Ceduna foreshore area, subject to a suitable Irrigation Management Plan that would incorporate a monitoring and testing program for the treated effluent. This would monitor not only public health criteria, but items such as conductivity, pH, and nutrient loadings, which present potential long term environmental effects. Groundwater would also be monitored on irrigated sites to ensure no significant influence from effluent irrigation.

A preliminary water balance has been determined as part of the Engineering Assessment undertaken by Dare Sutton Clarke that takes into account the existing STEDS flow from the Ceduna and Thevenard System, together with estimates of wastewater generation from the proposed Ceduna Keys development. Based on a final development scenario and 70% occupancy, the system could ultimately deliver up to 210 ML of treated water for irrigation and secondary use.

Storage basins would however require some reconfiguration to accommodate this additional volume, equivalent to deepening the existing lagoons from 1.0 to 2.0 metres deep or by raising the height of the perimeter embankments by 1 metre thus avoiding the need to dewater the basins. Significant potential also exists to greatly reduce evaporation loss as part of any reconfiguration.

Limited potential may exist for utilising aquifer storage and recovery albeit that the aquifer is unconfined and that water would become saline given native ground water.

GROUNDWATER AND CONDITION OF LAND

6.21 Groundwater and Condition of Land

Ground water levels encountered during the excavation of preliminary test pits have found groundwater at or just above mean sea level, approximately 0.0 metres AHD, though fluctuations are expected due to tidal and seasonal changes. Two groundwater monitoring bores established previously by the Council on the east side of the site have found ground water at approximately 0.4 metres AHD.

From testing undertaken groundwater inflow was noted at depths ranging between 0.55 metres and 1.9 metres below the existing surface level. From correlation with the survey plan, the groundwater level encountered in the test pits appears to be at about RL 0.0 m AHD. It should be noted that groundwater fluctuations are expected due to tidal and seasonal variations. The quality of ground water is also likely to be linked closely with the coastal environment, particularly given the sandy and highly permeable nature of the soils. Samples taken during preliminary geotechnical investigations, indicate very high salinity of between 58,000 and 190,000 parts per mg/L TDS.

Three groundwater samples were collected at monitoring sites GW1 (TP1), GW2 (TP3), GW3 (TP7) (refer Figure 1 Test Pit locations by Coffey Geosciences in June 2004) and analysed for heavy metals. The results are included in Table 6.18

The majority of the metals were at or below the ANZECC (2000) Guidelines for marine waters (protection of aquatic ecosystems). Copper was slightly elevated, with concentrations between 10-25 ug/L compared to the Guideline value of 3 ug/L for a 90% level of protection. This level of protection is considered appropriate for the marina.

Table 6.18 Heavy Metals in Groundwater (Coffey Geosciences) (all results ug/L)

Lab No./Sample Matrix	GW1 (TP1)	GW2 (TP3)	GW3 (TP7)	ANZECC (2000) Marine (90% level of Protection)
Antimony	40	<10	<10	ID
Arsenic	33	30	30	ID
Beryllium	<1	<1	<1	ID
Cadmium	<0.2	<0.2	<0.2	14
Chromium[1]	14	18	26	20
Cobalt	2	41	5	14
Copper	10	16	25	3
Lead	<1	<1	<1	6
Mercury	0.1	0.2	0.3	0.7
Molybdenum	32	490	95	ID
Nickel	7	22	120	200
Selenium	60	82	120	ID
Iron	<5	<5	<5	ID
Zinc	<1	<1	<1	23

[1] Guideline for CrVI
ID Insufficient data for criterion

The pH of the groundwater was measured as being neutral at 6.9 or 7.0.

To assess the potential impacts of the Council landfill to the east of the railway Council installed two groundwater monitoring wells on the east side of the site in October 2003. Samples were collected one week after installation and tested for the presence of Polyaromatic Hydrocarbons (PAH), Organochlorine (OC) and Organophosphate (OP) Pesticides, Total Petroleum Hydrocarbons and the heavy metals Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Selenium and Zinc

All test results for PAH, OCP and OPP were below the limits of reporting adopted by the test laboratory. The limit of reporting for benzo(a)pyrene is however greater than the criteria for aquatic ecosystems. Unfortunately, the samples were not filtered. Consequently, the analytical results for metals are not considered indicative of groundwater concentrations. Also the method of sampling was not in accordance with established protocols for obtaining representative groundwater samples. Some normal background levels of metals are to be expected, but are likely to be low, particularly in view of the very high salinities. With organics, unless the site is contaminated, negative results are to be expected. In this instance, even though the samples were not collected in accordance with established protocols, the results for the do suggest no contamination.

Additional sampling and testing needs to be undertaken to confirm minimal or no contamination. The following strategy will be implemented to provide information on which a groundwater monitoring and action plan can be formulated.

Additional groundwater wells will be installed at locations selected to provide the following information:

- Groundwater levels and gradients to determine flow direction in the vicinity of the rubbish dump;
- Groundwater quality up gradient of the rubbish dump;
- Groundwater quality directly under the rubbish dump, and
- Groundwater quality directly down gradient of the rubbish dump.

An environmental consultant with groundwater monitoring experience will undertake the installation of the monitoring wells and the collection of the water samples. The wells will be purged using either the bailer or micropurge method prior to the collection of samples.

Prior to bottling the samples to be analysed for dissolved metals will be filtered with a 0.45 micron filter to remove any suspended solids.

The information will be assessed to determine if the rubbish dump is impacting on groundwater quality.

A hydrogeological model will be assembled to provide an assessment of groundwater flows during dewatering of the proposed excavations.

The outcome of these tests will be used to determine the risk of contaminants reaching the excavation and their likely impact.

If necessary a vertical barrier of clay or similar will be installed along the route of the railway line to minimise the horizontal movement of groundwater from the vicinity of the rubbish dump towards the development site both during an after construction.

Previous testing of groundwater on the east of the site undertaken by Council to assess potential impacts of the dump site to the east of the railway, has found traces of arsenic, chromium, lead and diesel. Advice from the Department of Human Services Hazardous Substances Section was that any slight exceedence of the Guideline values for Recreational Water Quality and Aesthetics would not be a concern because of the large dilution with seawater if the groundwater flowed into the marina. It has been recommended that further testing verify the initial test results prior to developing and implementing the Environmental (Construction) Management Plan.

6.22 Effects on Land and Groundwater Quality

Groundwater levels are not likely to be affected significantly in the long term. During construction of the marina basin, groundwater would be lowered locally, and this would be incorporated into construction management plans to stabilise earthworks batters and minimise settlement of surrounding areas.

In consultation with the EPA, it is proposed to undertake periodical monitoring of the existing bores, to provide early detection of any potential problem due to contamination.

Because of very high salinity there is no risk of affecting any useable water resource.

WASTE AND EFFLUENT MANAGEMENT

6.23 Sewage Treatment and Rubbish Collection for Commercial and Recreational Boats

Wastewater collection facilities are intended to serve recreational and commercial vessels. Sewage discharge from boat holding tanks would be collected. Suitable options for the collection systems are being reviewed in terms of the nature and operation of pipe systems, expected

discharge flow rates, balancing storage volumes and wastewater quality. Such details would be developed and implemented as part of the detailed design phase of the development.

Commercial facilities within the marina would be required to develop specific management procedures to minimise the potential for pollution of waterways. This enables the preparation of a response specific to the activities associated with each business which have potential for spillage or generation of wastes. It is noted that commercial fisheries tend to operate with all outgoing seafood wastes contained in plastic wrapping or sealed vessels to enable disposal to a license landfill facility in the appropriate manner.

All areas with the potential for process wash down would be appropriately bunded and would ensure that site stormwater runoff would be excluded from the designated area. Any wash down area would be contained and pre-treated prior to discharge to either sewer or separate wastewater facility. The arrangements would be in accordance with current engineering and environmental best practice, and the EPA guidelines.

More specifically in relation to recreational vessels, hard rubbish would be managed in accordance with the provisions and requirements of the LMA such that in addition to strict prohibition of disposal of wastes overboard, adequate and appropriate provision would be made for the deposit, collection and disposal of wastes to the licensed landfill facility operated by Council. This may necessitate the preparation of management agreements with Council as the designated contractor for this responsibility.

6.24 Waste Management – Domestic and Tourist

Waste collection would be provided via a weekly 240 litre sulo bin utilising Council's robotic arm compactor collection system. Council's existing landfill facility would be upgraded and extended, subject to EPA licensing procedures, to accommodate the anticipated volumes of waste. It is understood that the existing facility operated by Council has capacity for this anticipated increase in demand.

Recycling of the following items would be catered for with off site collection depots accepting the following items:

- Ceduna Refuse Depot : all metal and whitegoods, green waste, automotive oil
- Ceduna Can Bottle Depot : container deposit items, glass, PET recyclable plastic products

Further recycling opportunities would be investigated with the assistance of Zero Waste SA.

6.25 Management of Black Water and Grey Water

The existing towns of Ceduna and Thevenard are served by the Ceduna septic tank effluent disposal scheme (STEDS) operated by Council. This scheme is at maximum operating capacity and uses open surface lagoons situated adjacent to Goode Road for treatment of effluent from the collection system. Effluent is then stored in an evaporation lagoon, and some treated effluent is drawn off during summer months for irrigation of the nearby gold course and sporting fields.

The proposed development is intended to be served by a sewer scheme that eliminates the need for septic tanks on each allotment. The new scheme would provide a series of gravity drains and the topography would dictate the need for several sewer pump stations. It is intended that the development be split into several catchments, with pumping discharge from one catchment discharging to gravity mains in the next. The final pump station would deliver sewage to the existing treatment area adjacent Goode Road.

The existing treatment site location is well located in relation to the development site being approximately 400 to 500 metres from the closest point of the development which is to be used

for sporting and recreation proposes. The distance to the nearest residential use is far greater and well above the minimum 350 metres required by DHS guidelines.

It is the Council's intention to provide a new activated sludge treatment plant adjacent to the existing lagoons, with sufficient capacity to treat the Ceduna Thevenard STEDS grey water and the Ceduna Keys development black water. The plant would discharge to the current lagoon area which would be retained and their capacity increased. The system is likely to require a winter balancing storage of up to 90 ML, which would be equivalent to deepening the existing effluent lagoons from 1.0 to 2.0 m deep.

The configuration of the storage basin would need to account for use as treated effluent storage, and would need to be designed to minimise infiltration (clay or HDPE liner), minimise potential for interaction with groundwater, balance evaporation losses, sustain water quality, and operate at suitable levels to function hydraulically, all of which are design constraints which can be incorporated in the area available to Council. This project presents a key opportunity for a significant upgrade of the town effluent treatment and reuse system so as to reduce pollution and maximise reuse of water resources in a controlled manner.

Council intends to use treated water to irrigate the golf course and sporting fields together with other locations such as the foreshore and other landscaped areas. The Ceduna Golf Club utilise the treated water according to the requirements of an Irrigation Management Plan (IMP) and has done so for many years with no known detrimental effects. The IMP incorporates a monitoring and testing program for the treated effluent, and for soil analysis from each of the receiving irrigations sites. In addition to health-based criteria, this is established to monitor pH and nutrient loadings.

The areas to be irrigated are permeable well-drained soils that are not prone to flooding. The golf course fairways are planted with kikuyu and couch grasses, with the roughs being mainly native understorey from the original Mallee woodland. These grasses have a high tolerance to salinity. Groundwater below these sites is saline and is not used for irrigation purposes. Nevertheless there should be a testing and groundwater monitoring program for any new areas that are to be irrigated.

A preliminary water balance has been determined by DSC Engineers in consultation with Council and SA Water based on the estimated STEDS inflow from the existing Ceduna Thevenard system, and estimates on wastewater generation from the proposed development. The estimates are outlined in greater detail within the DSC Engineering Assessment report provides as a source document, have considered the final development scenario of 380 residential allotments, 2.3 ha of townhouses and 8.3 ha of apartment buildings and other commercial facilities.

The system is likely to require a winter balancing storage facility for up to 90ML which would be equivalent to deepening the existing effluent lagoons from 1.0 to 2.0 metres deep. The system could ultimately deliver up to 210ML of treated water for irrigation at 30 mm per week summer use on 19 ha of golf course and sporting groups, and 5.5 ha of landscaped areas elsewhere within the development and the township. This represents a significant increase in wastewater use of the golf course and it would be expected that irrigation systems, particularly pipe work and balancing storage tanks and pumps would need to be reviewed and most likely upgraded in conjunction with this project.

LANDSCAPING

6.26 Landscape Planting and Revegetation

A landscaping plan would be prepared during the detailed design stage. This would include:

- extensive planting throughout the development, roadsides, highway corridor, and reserves, street planting, etc.

- revegetation and stabilisation of remaining dune system;
- restriction of access to dunes and beach areas either side of marina site and breakwaters with measures including fencing;
- erosion control measures both during construction and thereafter;
- provision of buffers to intact beach dune and tidal areas from construction work associates with marina;

Significant opportunity exists as part of the proposed development to undertake extensive landscape planting to complement the built form appearance and to act as buffers or visual screens between differing land uses. While a detailed landscape proposal has not yet been developed suitable area has been provided for such landscape plantings to achieve this desired outcome. In particular landscape plantings would occur on the acoustic mound within the road reserve associated with the realigned section of the Eyre Highway and adjacent to the existing railway line.

Additional plantings would also be undertaken adjacent to and within the golf course in order to better define this area and enhance its visual amenity. High quality landscape proposals would also be implemented associated with the community centre, tourism developments and key commercial sites including in and around the commercial marina. The LMA also sets out strict requirements in respect to landscaping associated with proposed residential development.

Notwithstanding the ability to reuse greywater and stormwater for irrigation it is appropriate to pursue species that are of low water usage and where possible species endemic to the region. This serves a range of outcomes including water efficiency, a contextual landscape character and provision of some habitat, particularly in areas such as the golf course.

WEEDS AND FERAL ANIMALS

6.27 Management of Weeds and Feral Animals

It is appreciated that without adequate controls and management, the proposed development could be a source of or exacerbate any existing problems of feral animals or weed species. This could occur for example as a result of:

- increased numbers of cats and dogs;
- gardens escapes of inappropriate species into surrounding vegetation areas;
- increased weed infestation due to large bare soil areas following construction not being adequately stabilised and vegetated.

Previously EMS 2004 had pointed out that the existing remnant habitats in the study area, being in close proximity to the Ceduna urban area, would likely be impacted by feral animals. These would include wandering domestic cats and dogs, and vermin, rabbits and foxes also occur.

The Biodiversity Plan for Eyre Peninsula (DEH, 2002), outlines the issues and control strategies for pest plants and animals, that are briefly discussed below.

DEH (2002) indicate that of the animals feral cats foxes and rabbits are the most significant. The risk of impact arising from these animals should be minimised by:

- The Land Management Agreement (LMA)
- Cat and Dog Management Act (refer Council)

DEH (2002) indicate that there are 290 weed species on the Eyre Peninsula. As indicated in Section 6.6.3 43 exotic species were recorded in the vegetation surveys, which is approximately 35% of the floral biodiversity.

The landscape plan and construction management plan would aim to minimise increases in these species or prevent additional species:

- stabilising and vegetating bare areas following immediate construction;
- providing vehicle wash facilities for construction vehicles arriving at the site from elsewhere in South Australia or leaving the site;
- weed eradication area (eg spraying of weed infested areas) prior to construction
- avoiding disturbing ground in adjacent areas which would otherwise provide an opportunity for weed establishment. Frequently weeds are found around along road sides as a result of soil disturbance;
- controls on the species that can be planted in gardens via the Land Management Agreement;
- the landscape plan for the whole of the development would include a weed management program as part of the establishment and maintenance period (probably two to three years); and
- an ongoing weed management program as part of the operational management plan (refer Section 10.).

GENERAL

6.28 Air Quality

The primary potential for air pollution is as a result of dust generated from construction activities on site. Dust presents not only potential amenity impacts, depending on prevailing wind conditions, but may also compromise water quality within the waterways and Murat Bay. The construction management procedures and protocols outlined in the Engineering Assessment prepared by Dare Sutton Clarke Engineers address this issue in detail. The approach to be adopted during construction is outlined in further detail within Section 10 of this report.

6.29 Noise

Over and above noise resulting from construction activities, it is reasonable to anticipate the generation of environmental noise from a range of activities and functions within the marina development once completed and operational. Potential noise sources include domestic activities associated with residential living, marina activities both commercial and recreational, use of the community centre, tourism accommodation and related commercial activities, vehicle traffic within the development and from the Eyre Highway; together with noise resulting from use of the Thevenard Kooniba railway line.

To varying degrees these potential noise sources would be audible above general background noise, with some risk of disturbance and loss of amenity if such sources are not appropriately managed or mitigated. The Proponent is committed to minimising and responding to such risk in an appropriate manner according to recognised standards including the EPA (Machine Noise) Policy, and the Noise (Industrial) Policy and Environmental Noise Guidelines. In particular, measures would be taken to minimise and avoid noise sources and have the potential for sleep

disturbance and where noise generators significantly threaten the living and working environment to be created by the proposed development.

More particularly, the following physical and management measures are to be implemented as part of the proposed development.

- Acoustic mounding has been proposed between the proposed residential development and Eyre Highway and the railway line. Reference to the lines of noise attenuation as drawn on Figure 6.13 indicates that the mound is of sufficient height to provide protection to single story housing. As such there is no requirement or proposal to provide additional fencing or any other similar measures. Similar sections will be drawn during the detailed design phase to check that this level of protection is maintained all the way along the Eyre Highway.

- separation of potentially incompatible land uses and activities with the use of roadways, public reserves and open space to be landscaped and fenced as necessary;

- containment of noise sources activities within buildings and enclosures of suitable design, siting and layout, construction type, and acoustic insulation;

- point source management in terms of the operation, insulation and maintenance of machinery and mechanical plant and equipment;

- insulation and other acoustic measures to ameliorate impacts experienced by sensitive noise receivers rather than the point of generation and / or transmission;

The management of environmental noise in an urban environment is not a new or recent phenomenon, nor unique to the proposed development. Noise is an inevitable by product of human activity and is experienced within the tolerances of society, that are reflected in environmental legislation and regulation. Such checks and balances assist in managing urban environments in an equitable and responsible manner recognising the various cost benefits associated with noise generating activities.

6.30 Energy Conservation

The Land Management Agreement addresses a range of energy conservation and efficiency measures through appropriate design considerations and the installation of solar hot water systems. Significant potential exists to implement best practice in energy efficiency as part of construction practices using appropriate materials and building systems. As the cost effectiveness of photovoltaic technology improves it is also reasonable to anticipate the domestic and commercial application of this method of electrical power generation, that in high output periods may be redirected into the regional grid.

Potential also exists for wind generation of electrical power as is evident on a number of nearby country living properties along Denial Bay Road. Geothermal systems may also be implemented to off set energy consumption and reduce demand on reticulated systems. Publications prepared by the Office of Energy and the Australian Greenhouse Office regarding energy efficient housing may also be provided to purchase prior to site planning and design considerations for individual sites.

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7

SOCIAL EFFECT ON COMMUNITIES

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

7. SOCIAL EFFECT ON COMMUNITIES

7.1 Construction Workforce

SA Centre for Economic Studies, has undertaken a comprehensive investigation into the economic impact of the proposed project during the construction phase. The following commentary is provided having regard to this extensive body of work that is included as a source document in relation to this EIS.

A large proportion of the construction workforce would be sourced from the local and regional community. The employment impact of the construction phase would be very strong in the first few years of development. Whilst employment would decline after the initial heavy construction phase, further opportunities for ongoing employment would continue to be maintained in related sectors particularly; residential building, landscaping, maintenance services, signage installation, wharf services, grounds people and irrigation works

It is expected that the construction phase would require an estimated 129 employees in the first years of development. It is expected that a proportion of these full time equivalents would be sourced from locally skilled people already living in Ceduna and therefore no accommodation would be required. However, there would inevitably be a need to import people and/ or companies with specialist services and skills particularly, when they cannot be sourced at the local level. Regions need to be able to provide a skilled labour pool, as the skills and knowledge of a workforce are critical inputs to new development, production and service delivery.

With the stated profile of required employees in the initial construction stage of the marina 5% professions, 5% managerial/ technical and 90% semi-skilled operators/labourers, it is possible that the workforce requirement can be met from indigenous and non-indigenous locals.

It is fair to assume that during various stages of the development there would be influxes of people to the town. Ceduna is the major regional centre of the Far West Coast offering an established range of accommodation, hospitality and business services in the town. ABS Statistics reveal that the four hotel/ motels in Ceduna provide 149 rooms and 430 bed spaces, and the six caravan parks around town have 74 cabins and over 500 sites between them. This gives a maximum possible capacity of around 1500 persons. However, because of Ceduna's location on the National Highway many people use the town as a stopover point, therefore on average hotel/motel room occupancy rates are at 45% with bed occupancy rates being lower at 24%.

Taking this into account, there is more than enough capacity to cater for the anticipated increase in workforce population in the town.

7.2 Aboriginal Employment

The detailed research undertaken by the South Australian Centre for Economic Studies outlines that significant additional employment opportunities would be generated in Ceduna over the coming years both in the construction stage and operational stages of the project. This would result in a range of jobs being created with the aims of the Proponent to employ as many local people as possible including a proportional share of Aboriginal people.

One of the main objectives of the marina development has been to maximise employment and education opportunities for local Aboriginal people and the wider community. Employment opportunities would inevitably increase particularly in the short to medium term through the construction phase and later through the operation and building of residential homes.

SA Centre for Economic Studies identified 100 indigenous persons with the necessary skills such as machine operators, back hoe operators, light truck and bob-cat operators and in occupations related to earthmoving, pipeline construction, building, roadworks and concreting who are

currently available to the marina construction project. In addition, the District Council of Ceduna has previously, and would be establishing more Indigenous employment gangs for this project.

Up to 12 Indigenous employees previously worked on the construction of the Ceduna-Koonibba pipeline. Since then many have been employed as building teams in the communities of Ceduna, Koonibba and Yalata. There are also currently 145 indigenous persons in training and employment programs with the CDEP at Tjutjunaku Worka Tjuta Inc. (TWT) in Ceduna. In recent years TWT have conducted training courses in machine operations, licensed truck, back-hoe and fork-lift operations. A Level 1 Certificate in Building and Construction and Multi-trades course have also been run by the local Spencer Institute of TAFE during this time

Construction work would be required in the development of infrastructure such as marina channel walls, earthworks, revetment walls marina wharves and roadworks. Within all this construction there would be a broad range of trade skills required.

7.3 Visual Amenity and Landscape Quality

The proposed development would have a visual effect on the locality.

The proposed development would alter the landscape and existing visual character along this section of the coast to Murat Bay by virtue of the built form improvements including the breakwaters and the various structures including dwellings that may be visible from the surrounding locality.

While this development would result in a change, the resulting appearance is anticipated to be compatible with its context having regard to its location adjacent the existing urban area of Ceduna. The proposed development would establish a new desired character and a 'sense of place' that would be of a sympathetic design in a manner that would not be visually obtrusive given its position within the Bay and relative to the township of Ceduna.

The proposed development would not be readily visible when viewed from the existing township of Ceduna other than for oblique views to the north from the foreshore area. The scale and form of structures anticipated are to be sympathetic to the topography of the wider locality and would not dominate vistas from either the existing township or Murat Bay.

So too, existing residents along the Denial Bay Road would not be significantly impacted upon in terms of interruptions to the views they presently experience over Murat Bay. The development may change the nature of views, but would not obscure their aspect towards the coast, with a substantial arch of vision remaining further to the west.

This outcome would be facilitated by the proposed LMA and policies to be included within the draft PAR to be prepared that would amend the existing Development Plan, which would enable the planning authority to guide development through appropriate siting, form, scale, design and visual appearance requirements. Dwellings are anticipated to be no higher than two storeys (3 storeys for medium density dwellings) and would be designed to be compatible with and further the achievement of a desired future character for the land. This desired future would be further articulated within the draft PAR to be prepared by Council.

It is anticipated that electrical power lines are to be undergrounded, and that other 'street furniture' such as light poles, directional and traffic signage, etc. would be specified as part of a 'design suite' to complement the built form appearance and achieve this desired future character. Landscape plantings would be an integral component of this enhancement program to not only screen structures from view and reduce their visual prominence, but to achieve an environment of high amenity for the enjoyment of users. Detailed landscaping proposals would be formulated according to these criteria as part of the implementation phase of the development in order to achieve the desired visual amenity and character outcomes.

The extent of this visual effect is proportional to the scale and extent of the various components that comprise the development, such as the breakwaters, earthworks undertaken to achieve the waterway, buildings on land (which are not specifically proposed by this application), roads and other major public infrastructure, landscaping and fencing. In general terms, as set out in the draft Guidelines under the LMA, no building is to exceed 15 metres in height.

The context in which these improvements are proposed has a generally open character rising up to the ridgeline to the north and northeast. The point that extends southwards into Murat Bay to the west is also a prominent topographical feature. The site is there most visible from these higher points. The main township of Ceduna is at a comparable relative level, with the site not being visually prominent when viewed from the existing urban area other than for points along the foreshore.

Accordingly, the proposed development would be visible primarily from positions in Murat Bay to the south west and from these high points that enjoy a view over the subject land. While the appearance of the proposed development would be different to that of the existing coastal character in this locality, the proposal would nonetheless be an attractive well planned and laid out arrangement of mutually reinforcing components.

While judgements as to whether the proposed development would result in an attractive appearance are subjective, the proposed development would not be so visually prominent so as to dominate the existing landscape given its relatively low scale and form. Moreover, structures would not project or skyline above the ridge line of the high ground to the north when viewed from Murat Bay. These undulating hills form a suitable back drop to the development when viewed from this aspect.

The Plan Amendment Report to be prepared by Council would address issues in terms of visual appearance and policies introduced within the Development Plan that would provide the appropriate assessment criteria to ensure that a suitable outcome may be achieved. These policies are to be introduced over and above controls placed on building forms within the design guidelines under the LMA.

7.4 Local Amenity

The proposed development is not anticipated to have a serious deleterious effect on local amenity either in terms of its visual appearance and character, its operation and use, nor in its management and maintenance.

The development site while adjacent is suitably separated from the existing township of Ceduna, with appropriate buffers provided to ameliorate potential negative off-site impacts. In addition to the development and management controls outlined above, Council would ensue as part of its ongoing role as planning authority to assess each component of the development as it is implemented with the clear objective of avoiding and / or minimising impact on local amenity.

Based on the investigations undertaken by Eco Management Services Pty Ltd, seagrass build up is not anticipated to be an issue in this area of Murat Bay given the extent and nature of seagrass communities, the likely effect on such, and the coastal dynamics in terms of water movement and tidal fluctuations.

Should a build up of seagrass be experienced, appropriate management and maintenance responses may be implemented as part of the Environmental Management Agreement. Experience in like situations has demonstrated that such an issue may be suitably managed and responded to without loss of amenity or environmental harm.

7.5 Residential Character

The proposed development is to be an integrated and coordinated residential environment having a 'master planned' character similar in many respects to that achieved at Lincoln Cove in terms of layout, siting, built form and appearance. Invariably, there would be diversity in building design reflecting the preferences and choices of individual property owners as the various stages of the waterway development are implemented. Such would occur however in a control manner managed by tools including the LMA and Council's Development Plan. The Proponent has an aspiration of achieving a desired future character that reflects and enhances the fundamental components or elements of the marina and waterway environment.

A range of residential accommodation types would be facilitated within the proposed development ranging from low density residential allotments to medium density dwelling for both permanent and temporary accommodation. The proposed development would respond to identified need in terms of the demand profile and preferences of market segments considered more fully as part of the business planning for this development. The preliminary call for expressions of interest in residential allotments has been substantial. The price point anticipated for residential allotments is considered affordable in context with like living environments within the district, the region more generally and throughout the State.

The design and siting of housing may occur in a manner that does not offend the principles or requirements of the Disabilities Discrimination Act in terms of access, and would be guided by sound crime prevention principles. Suitable opportunities would be provided for passive recreation within designated areas in addition to the waterway environment that would provide a unique and engaging experience for users of a wide range of craft and vessels. Appropriate security measures both passive and active may be implemented in order to manage behaviour in much the same manner as other urban environments. Council has implemented several crime prevention initiatives that would be extended into the area of the proposed development.

7.6 Integration with Ceduna Township

The proposed development while adjacent to the existing urban area of the township of Ceduna is sufficiently separated so as not to impact upon existing character and function of the township.

The two areas would however be integrated via the 'green belt' of open space and recreational and community activities comprising the public golf course, the sporting and recreational complex, and the Community Centre. These land uses would serve as an important focus for community activity for the populations of both the marina development and the existing township. Whereas initially the Community facility was to be located more centrally within the proposed development it was considered that a location between the existing and proposed urban areas would assist in integrating these communities. The Community Centre would act as a focus for social and cultural activities of the community of Ceduna as a whole, and that of the wider district.

The revised location of the Commercial Marina would also assist in integrating communities in terms of a focus for economic activity and business associated with the vital fishing and aquaculture industries. Direct and convenient access may be achieved via the proposed road network to this facility from the existing urban area of Ceduna. Employees engaged in these industries, whether living within the proposed development or the existing township, would converge on this area in their common pursuits of prosperity. The location of the marina facilities in relation to the nearby industrial areas would enable efficient and effective movement between the two using existing road networks without having to disturb residential areas.

The increase in population facilitated by the proposed development does have the potential to result in environmental impacts that would be suitably avoided, mitigated and / or managed via the measures outlined in this document and supporting investigations. In particular, the following issues have been addressed that may give rise to environmental risks:

- development within the physical capacity of the land
- development of land that is not in a pristine state
- development of land that is not identified as having unique habitats (marine or terrestrial)
- development of land that is not identified as being of high biodiversity conservation value in a regional context
- development that minimises environmental risks via appropriate water use, waste water collection and treatment, stormwater management
- a restriction on uses that may potentially give rise to risk such as that associated with the operation of the commercial marina

It is also anticipated that the works proposed as part of Council's Streetscape Program will assist in achieving a pedestrian link between the proposed development site and the existing town centre along the foreshore.

The foreshore area has been identified by Council as part of the work undertaken by Landscape Architect James Hayter as being a key opportunity to provide a focus for the community in terms of passive recreation in an attractive setting.

The proposed development has been configured in such a manner as to integrate into these proposed works such that a walking and cycling path may be achieved between the town centre and the marina and community facilities.

A detailed design for such works may be prepared as part of the construction design and implementation stage of the development in collaboration with Council and the local community.

7.7 Effects on Character and Lifestyle

Ceduna's greatest asset is its frontage onto the spectacular surrounding coastline and yet, to date the potential of this asset has not been fully promoted or realised. To a certain extent the town lacks a vibrant urban atmosphere particularly, when comparing it to many other coastal centres. Whilst the existing foreshore is well established, the infrastructure is dated and the space is limited.

With this in mind, the community has been focusing on developing the Ceduna Keys to essentially re-vitalise the character and amenity of the town, re-invigorate the social fabric and unique culture and heritage of Ceduna, improve the performance of the local economy, and create an environment which is conducive to investment and job creation.

The general liveability of a region, being an amalgam of social infrastructure, 'production infrastructure' and general environmental quality is increasingly recognized as an important influence on investment decisions[16].

The Ceduna Keys project has been developed in response to the community's interest in re-vitalising the town through an innovative waterfront development, which would encourage industry growth but also make a vast difference to the existing amenity of the township. The development would provide new services and facilities for the community. Essentially, it is looking to facilitate the development and re-claim public facilities within the precinct by combining open

[16] Opportunities for Local Government-Developing Competitive Regions Australian Local Government Association (ALGA), 1999.

spaces, walkways, public seating, innovative street scaping, visitor information centre, interpretive facilities, recreational facilities (i.e. golf course), conference and meeting centres.

Because of Ceduna's remoteness the town has limited facilities and services available to locals and visitors alike. What is available is dated, neither inviting, nor visually appealing, lacks identity and is desperately in need of change. Improvements to the physical infrastructure and general amenity of Ceduna would present a highly visible and attractive gateway to South Australia. This project would provide an exciting modern waterfront precinct incorporating state of the art public amenities such as walkways, streetscapes, public seating, toilet facilities and rest areas amongst recreational facilities and commercial activity, which would dramatically improve the quality of lifestyle

Ceduna has a rich culture and heritage, which is quite distinct from any other place in the State. Yet, to date very little has been done in the public spaces to promote this or create a sense of place, or even an identity for the community. Good quality community art and design features in public areas are almost non-existent. Without a doubt this is a contributing factor to the towns' struggle with ongoing social problems, lack of ownership and community pride particularly in relation to public facilities. Through this development Council is keen to re-kindle community pride and culture via the establishment of a uniquely designed development which integrates the strong Indigenous and coastal culture of Ceduna.

7.8 Traffic Generation During Construction

It is anticipated that the construction of the project would require mainly the transport of cut to fill within the site boundary. As this project site is well buffered from current residential areas, there may be opportunity to extend hours of operation to complete the construction at an earlier time.

Construction machinery including trucks would be inspected for correct sound emission and hours of operation outside of normal construction time would only be done in consultation with the Ceduna Council. It is anticipated that the sound generated by the construction of the project would be consistent with the existing heavy truck transport that already exists passing through the site.

Further details regarding the manner in which traffic movements are to be managed during construction are provided within Section 10 of this report.

7.9 Re-routing of Eyre Highway and Denial Bay Road

The traffic management and construction logistics associated with the rerouting of the Eyre Highway around the development site, and the intersection with Denial Bay Road would be pursued in greater detail as part of the implementation of the proposed development.

Based on negotiations between Council, Transport SA and the Proponent to date, subject to cost considerations and responsibilities, the proposed works may be affected in a suitable manner and that 'agreement in principle' has been reached. The detailed design of these sections of road and intersections would be undertaken in accordance with accepted road design and construction standards to the satisfaction of Transport SA.

Suitable provision exists for accommodation of the proposed realignment of roads within the development site so as to avoid the need for disturbance and / or acquisition of other nearby or adjoining land.

The arrangement of the Eyre Highway is also not anticipated to have a negative impact on existing businesses adjoining the subject land such as the BP Petrol Filling Station to the south. Vehicles would continue to be able to access this site in a safe and convenient manner for refuelling, in particular long haul road transport vehicles.

The arrangement of the proposed commercial marina in relation to this existing land use also presents a significant business opportunity in terms of servicing vehicles associated with this facility.

The rerouted Eyre Highway around the development site would have minimal effects on access to and from the township of Ceduna and the hamlet of Denial Bay. Communities within these settlements would be able to negotiate the proposed road system in an efficient and effective manner and would not be prejudiced in terms of significantly increased distance or frustrated by complex or confusing road systems.

The proposed arrangement of road would follow a logical hierarchy such that suitable access is provided to all users. Noise generated from vehicles using this road is not anticipated to present a serious amenity concern given the extent of noise attenuation that will be provided by the landscaped earth mound that is to be located all the way along the Eyre Highway. The noise attenuation lines drawn on Figure 6.13 shows that this acoustic mound provides adequate protection to the adjacent residential development from both the highway and the rail line.

Consistent with previous decision by the Council, it is not the intention to pursue a bypass of heavy vehicles around Ceduna in so far as the impacts that such would have in an economic and social sense. The potential loss of economic activity associated with such an arrangement is sought to be avoided by the Council. The preferred approach is to better manage traffic as it is making its way through the town, rather than keeping it out of the town. Accordingly, the proposed development does not seek to frustrate this desired arrangement.

In terms of access from the west, the proposed reconfiguration of the Denial Bay Road and the Eyre Highway is not anticipated to have a deleterious effect on traffic movements between Denial Bay and the town of Ceduna. Seasonal heavy vehicle traffic, such as during the grain harvest season would be able to conveniently negotiate the proposed road pattern with not apparent frustration or impact on proposed residences. Given the limited period of time within which grain haulage occurs and the limited number of properties to the west of the township, the potential level of disturbance to future residents is considered minimal

7.10 Relocation of Quarantine Inspection Station

Preliminary discussions with Primary Industries SA indicate no objection to the relocation of the existing Quarantine Inspection Station further along the Eyre Highway to the north subject to a suitable facility being provided.

7.11 Public and Private Service Providers

Ceduna is the focal point and business centre of the Far West Coast of Eyre Peninsula.

The town is the regional centre for a range of government agencies and services including; Family and Youth Services, health, aged care, recreational, education, Child Care, TAFE, Police, Justice, Centrelink, National Parks & Wildlife, SA Housing Trust, Indigenous Regional Co-ordination Centre Job Networks, retail, tourism and hospitality, professional and financial services. Many of the existing services such as the schools local health and recreational facilities were established when the town had a population of well over 5,000 people. These services therefore, have the capacity and capability to cater for a significant increase in population.

Some major upgrades have also been planned for a number of services in the town. The Ceduna Area School is currently being re-developed with new building infrastructure to be established over the coming years. The Government has highlighted and earmarked major upgrades and an expansion of the Ceduna Health Services including the hospital.

The town is also supported by a range of transport services including road, air and sea. The Ceduna airport is licensed by the Civil Aviation Safety Authority (CASA) and airlines servicing the

location operate turbo prop aircraft. The airport has the capability to support larger aircraft such as a Fokker F27 48 seater aircraft or a DASH 8 50 seater aircraft. It is the far west coast's only major regional airport, with a fully sealed runway and regular passenger transport services operating on a daily basis.

There are a number of boat launching facilities in Ceduna and Smoky Bay enabling both industry and recreational craft easy access to the ocean. The Port of Thevenard located 3 kilometres from Ceduna, is the major multi-commodity port of the far west coast of Eyre Peninsula and has the capability to handle handimax vessels.

The impact of the development over the long term would also create the demand for the expansion of existing and the attraction of new government and business services to the town. The injection of new capital is considered to be a key driver of economic expansion and job growth. The benefits of attracting this new development to the town would include enhanced long term economic growth through expanded business and government services, a boost in investment, enhanced critical mass (i.e. population growth), a diversification in employment opportunities, and injection of new ideas and skills into the community. Investment growth creates and maintains the investment environment, facilitates new local investment by existing firms and attracts external investment into the community.

7.12 Safe Haven for Recreational and Commercial Boating

The provision of safe mooring facilities for both commercial and recreational craft is a key outcome of the proposed development and would be of significant benefit to these two user groups. Safe and convenient access to vessels presents a social benefit in a community that has a strong affinity for the sea.

Although the safe haven created by the proposed development may increase the amount of recreational and commercial boating, there are existing controls over marine habitat, fisheries, and off shore islands to ensure the sustainable enjoyment of these natural resources. This issue is addressed further in Section 8.9 of this report.

7.13 Tourism and Recreational Activities and Infrastructure

The main issue with existing tourism and recreation activities and their infrastructure is that a population of 3,500 is insufficient critical mass to provide the throughput required for these facilities to be maintained at an affordable cost per user. The development of Ceduna Keys adds to the base number of users, which should be a catalyst for expansion. The potential spin off for tourism and recreation has been identified in the SA Centre for Economic Studies Report.

Discussions with the Ceduna Golf Club indicate that membership numbers are around 50 per annum paying less than $100 each. This results in an annual budget of less than $5,000 per annum, inadequate to maintain the infrastructure required. The solution has been to open the golf course only in winter. The Ceduna Golf Club welcome the opportunity to structure an arrangement to transfer the ownership, and more importantly, the cost of maintenance and management, to the developer with existing and future membership rights preserved.

7.14 Local Shellfish Aquaculture

Water flow in Murat Bay is characterised by a northward flow into the bay with maximum current speeds of up to 0.3m/s between Cape Thevenard and Matts Point. In the central part of the Bay the flow is directed towards the north with current speeds not exceeding 0.05-0.1m/s. From there, the flow continues further northward with reduced current speeds of 0.05 m/s or less.[17]

[17] Water Circulation patterns in South Australian coastal seas caused by tides and meteorological effects. John Noye & Julianne Stevens Department of Applied Mathematics, The University of Adelaide, South Australia March 1998

Detailed technical studies conducted in Murat Bay indicate that the flow of water through Murat Bay is clockwise, or from west to east and in surge conditions north to south. Hence, this evidence suggests that there would be minimal impact on the Shellfish Industry. Refer to Appendix F- Key Sites for off-shore Aquaculture Development in South Australia, Oceanique, 1998 & Appendix J- Hydrodynamic Modeling of Smoky Bay and Denial Bay, Belinda Ronai, 1996, Flinders University

As outlined in Section 6.11 to 6.15 there is minimal risk of the development impacting on the waters of Murat Bay. It is also to be noted the main circulation of water (refer Section 6.13) is clockwise making it even less likely that there could be any adverse effects on the industry.

7.15 Adjoining/Adjacent Land Uses

The proposed site is surrounded by farming and rural properties to the north and north west, to the east vacant rural land, and south sporting facilities and the outer township of Ceduna. The site is adjacent to the Penong rail line and National Highway One. Impact therefore, is expected to be minimal on the existing land uses around the proposed development.

To the north of the development is a rural zone, north west a rural living zone, south east a public utilities zone, south a recreational zone and west a coastal zone. None of these would have a detrimental effect on the development.

The rural & public utilities zone are separated from the development by the railway line and re-routed Eyre Highway and buffer zone. The recreation zone is the golf course, which would be significantly upgraded to complement the development. The public utilities zone would most likely house public utilities (e.g. storm water, effluent storage etc) which would be re-used on the golf course and landscaped areas of the development.

The rural living zone again is separated from the development by the Denial Bay Road and road reserve buffer. The desired uses in this policy area are: - detached dwellings, land based processing of aquaculture product and outbuildings to support land management and animal keeping (aquaculture).

The Coastal Zone identifies a range of desired uses such as conservation, coastal protection works, interpretive signage and facilities, tourism, visitor facilities etc. that certainly complements the development.

Those types of commercial operations close to the development (e.g. Highway One Motel/ Restaurant/ Fuel Filling station close to the development and the Oyster Bar which is currently on road reserve within the development site) also would complement the development.

The Oyster Bar which is under short-term site lease would have to be re-located or purchase a site within the development. This has been clearly stated to the owners of this commercial venture since the lease was issued.

In summary the surrounding land uses and the development are very complementary. This is one of the many reasons this site was originally selected as ideal for such a development.

7.16 Aboriginal Homeland Settlement

During the construction process the road access from Aboriginal homelands and the school bus to the Ceduna township would be maintained to ensure continuity of provision of these services.

Following construction the proposed road network would allow for safe and efficient connection to the township without requiring extensive detours around the development site. Some modification to the route would however be required.

The proposed development is sufficiently removed and designed to facilitate the continued use of the Aboriginal homeland settlement by the existing and future users of this property.

Given the distance between the two areas, the land form and presence of vegetation, one site would not be readily seen from the other. The proposed development is not anticipated to have a significant effect on the visual amenity of locality as it is experienced from the Aboriginal Homeland Settlement.

During construction, suitable arrangements would be made to assist this community and the residents of Denial Bay in terms of ensuring suitable access to the town centre with the least inconvenience possible.

Post construction, access will continue to be provided between the aboriginal Homeland Settlement and the main township of Ceduna through and around the proposed development site. The development is not a closed site with public road access throughout.

7.17 Land Tenure Arrangements and Access

The land tenure arrangement for the marina berths, launching facilities and other associated facilities would be managed through a plan of community division. Public access would be available to specific areas that would be transferred to Council.

7.18 Public Facilities

All public facilities would be developed in accordance with Australian Standards and the developer would negotiate with the Council for additional facilities that may be required. Facilities that would be available for public use would include:

- public open space reserves
- sporting and recreational facilities
- commercial and retail uses
- tourism and community centres

Public access would be unrestricted within residential areas, the community uses including the interpretive centre, other commercial uses and within the marina, other than for direct access to mooring points, which would be regulated for security purposes.

7.19 Infrastructure Upgrades

The proposed development would result in the extension and potential upgrade of a range of infrastructure services including water supply, electrical power supply and telecommunications via the increased scale at which such services may be provided. A critical mass in terms of population would enable greater economies and efficiencies in the delivery of these services to the community.

The marina development would provide infrastructure and facilities not presently available within the district in the form of safe and convenient mooring facilities for recreational and commercial vessels. The provision of such facilities would enable these activities to occur in a more efficient

manner and would assist in improving quality of life in terms of access and the economic activity that such facilities would assist in generating.

7.20 Access to Foreshore

Public access would continue to be made available to the foreshore area, which is not part of the development site. It is however proposed to restrict access to the breakwater in order to ensure public safety.

Other areas within the marina development would also be restricted access such as the sections within the commercial and recreational marinas. Access would however be provided to the waterways from various points within the development.

It is proposed to integrate pedestrian spaces and walkways within the marina development with existing pedestrian walkways along the foreshore connecting with the town centre of Ceduna and beyond to Thevenard.

It is understood that the foreshore to the development site is used to a limited extent by residents within the area for primarily recreational walking purposes. While the development would restrict this practice, suitable paths would be provided within the development to achieve a pleasant and safe walking environment for recreational purposes.

7.21 Noise from Marina Activities

The potential for noise generated from sources or activities within and outside of the development impacting on sensitive receivers such as residential land uses is addressed at Section 6.29 of this report.

The approach to be taken is to avoid, manage and/or mitigate the sources and effects of noise via the means outlined.

The Proponent of this development has an inherent commercial interest in ensuring that noise does not diminish the amenity and quality of life for future residents. Accordingly, every effort would be made to minimise the potential for noise nuisance.

7.22 Recreational Activities

The proposed development would provide for a range of recreational activities including those associated with boating and fishing, together with a range of other passive recreational pursuits such as walking and cycling as the development is to be integrated with the existing coastal reserve walking trail that extends through to Ceduna and then onto Thevenard.

Boating and fishing is a key recreational pursuit of the population of the west coast. The facilities proposed within the proposed development in particular the marina mooring facilities would enable a greater range of craft to be used including sailing craft that may be kept permanently in the water. Larger sailing vessels in particular would benefit by the proposed facilities.

7.23 Medium Density Housing

The location anticipated for medium density housing is more particularly indicated on the development concept and is largely adjacent to community and commercial facilities more centrally within the development.

The form of medium density residential dwelling anticipated is set out in some detail within the Land Management Agreement, with the overall height of such buildings being limited to 15 metres. This form of residential accommodation seeks to respond to an identified demand for a

more compact and efficient form of housing, that may better meet the needs of the community, in particular residents that may be absent for periods of time.

Medium density residential development is to be provided with a range of suitable facilities and amenities including private open space both at ground level and, where achievable, in a balcony arrangement subject to privacy issues being addressed.

Each dwelling is to be provided with suitable on site resident and visitor parking in accord with Development Plan policies.

Proposals for medium density residential development would be assessed against relevant provisions of the Development Plan with decision being made based on the merits of each proposal.

Specific polices are to be drafted for inclusion within the Development Plan to assist in this purpose.


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ECONOMIC ISSUES

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

8. ECONOMIC ISSUES

8.1 Tourism Activity and Investment

Tourism has developed into the third largest industry on Eyre Peninsula behind agriculture and fishing. Eyre Peninsula is the fourth most visited region in South Australia with annual visitor numbers exceeding 455,000 or 2.083 million nights, an average of 4.6 nights per visitor.

This represents an additional total expenditure in the Eyre Peninsula region of $290 million. The industry accounts for around 4% of total turnover in the Eyre Peninsula. Around 2000 jobs are supported by the tourism industry, representing 15% of total regional employment.

From a strategic perspective Ceduna is one of South Australia's most important tourism gateways. It is the entry and exit point to and from Western Australia with 240,000 visitors passing through the town each year. Of this number an estimated 64,000 persons per annum currently spend at least one night in Ceduna. This is just over 25% of the potential 240,000 visitors to Ceduna.

The changing market trends have led to a shift and diversification from traditional lower yield markets to the more specialised emerging markets. From Ceduna's perspective, the most critical emerging markets that it is well positioned to attract are the self-drive, soft adventure, coastal relaxer, aquaculture/fishing industry based tourism and eco-tourism segments.

Reinvigorating on the coast is based around resting, recuperating and a little indulging, at an accommodation venue surrounded by peaceful yet inspiring views. The venue must provide a sense of ambience and solitude, the accommodation must offer comfort (three star or above) and character, and the food must be interesting and rewarding. The accommodation may be self-contained, bed and breakfast, farm stay or resort, but must offer privacy.

Soft adventures in the natural environment involve an escape into the natural environment to 'rough it but not risk it'. The most popular form of this product is four wheel driving and camping, and examples include: four wheel driving and camping on the Googs Track in the central west, Coffin Bay National Park, the Gawler Ranges National Park and Lake Gairdner; sailing alongside the Lincoln National Park; four wheel driving and overnight stays in built accommodation at the Nuttbush Retreat near Port Augusta; sea kayaking near Port Lincoln; and quad biking at Port Neill and near Lincoln National Park and authorised caving and swimming in underground lakes across the Nullarbor.

The majority of soft adventures in the natural environment involve couples, family and friends using their own vehicle and equipment, and this experience is a mature product. Nonetheless, a small and growing number of individuals and couples are choosing soft adventures in the far south, far north and far northwest via one of several locally based nature tour operators. The nature product is relatively new and growing, and has potential for further growth.

A related and innovative aspect of fishing has been the establishment of various forms of aquaculture, and their part use as tourism attractions that feature guided tours. Examples of aquaculture attractions include the oyster farm at Ceduna and the tuna boat tours from Port Lincoln. These products appeal to a wide range of visitors because they offer 'a fishing experience without going fishing', and because they can directly or indirectly add eating fresh seafood at the end of the experience. The sea horse farm at Port Lincoln offers another opportunity to learn about the breeding of sea horses for the aquarium market. Additional opportunities include existing oyster processors, fin fish hatcheries, abalone and live lobster exporters. The highly acclaimed Eyre Peninsula Aquaculture & Seafood Trail established last year is based on this concept.

The encountering wildlife product is based around getting close to wildlife in its natural habitat, watching, learning and leaving no impact. Examples of the encountering wildlife product include:

diving with cuttlefish and watching dolphins near Whyalla; swimming with seals and dolphins at Baird Bay; watching sea lions at Point Labatt; watching whales on the Great Australian Bight, from the cliffs, Gawler Ranges Wilderness safaris and finding Fairy Penguins on charter boat tours to the islands.

The many unique natural assets including recognised national icons such as the Head of the Bight, the Nullarbor, its spectacular caves, the Great Australian Bight Marine Park, Goog's Track and Cactus Beach. Along the vast pristine coastline secluded beaches including Davenport Creek, Laura Bay, Fowlers Bay and the numerous offshore Nuyts Archipelago islands give visitors the opportunity to get away from it all. Ceduna and the region boasts one of Australia's richest fishing grounds. The town is one of the last frontiers where fish stocks have been looked after, and it is therefore not surprising to see visitors gravitating to the region specifically for fishing adventures.

These markets are characterised by higher average expenditure per day compared to the traditional markets. They also show the greatest potential for the region to grow its tourism base through reinvigorated and new product that reflects the key strengths of the Eyre Peninsula.

The Strategy also highlighted the core products that show substantial growth opportunities and have a strong potential to differentiate the region from other areas. These include:

- reinvigorating on the coast;
- aquaculture;
- local food and wine;
- soft adventures in the environment;
- Aboriginal culture.

The Head of the Bight is located nearly 300 kilometres to the west of Ceduna on the edge of the Nullarbor Plain in the Great Australian Bight. The Bunda Cliffs are recognised as one of the best viewing platforms in the world to watch the large numbers of Southern Right Whales gather between May & October each year. The location is unique in Australia and the backdrop is nothing short of spectacular. Whale watching has become the fastest growing tourism based industry sector in Australia with $12 million in direct revenue in 1996. According to Environment Australia, the activity's rapid growth is revealed in the fact that it was worth approximately $9 million in 1994. Ceduna is already being used as the main stop over base for tourists visiting the whales and this is continuing to develop especially with packaged bus tours and fly in fly out visitors.

Ceduna has developed a strong reputation for producing high quality, premium seafood products, in particular, oysters, King George Whiting, Blue Crabs and Snapper. The recent initiation of the Eyre Peninsula's tourism Aquaculture and Seafood trail has enabled visitors to gain a first hand experience of the industry.

The proposed development seeks to include a unique blend of tourism, conventions and recreational activity alongside residential development. The tourism aspect of the development would showcase the natural assets, the cultural heritage, Great Australian Bight and marine environment including the aquaculture industry of the region.

Since 1996 the community of Ceduna has strongly supported the development of an interpretive centre. Over the past few years the concept has evolved and the idea of the (Eyre Peninsula) regional tourism interpretive centre has been born. This would also be located in the main community precinct of the Ceduna Keys marina development. The theme of the centre would be based on all aspects of the coastal-marine environment and the indigenous culture of the region.

This would be done by taking the opportunity to integrate and showcase the theme through interpretive displays and programs highlighting; the Coastal marine environment of the region including the Great Australian Marine park, the Nullarbor, integrating the unique indigenous culture of the region, marine history, the fishing and aquaculture industries, linking the seafood with the food and wine experience i.e. Seafood & Aquaculture trail etc. As the regional tourism

centre one of its primary roles would be to also promote Eyre Peninsula's premier tourism products in the region.

Over the past five years the community has investigated a number of indigenous and non-indigenous interpretive and visitor centres in the Northern Territory, Queensland, South Australia and Canada. This research has shown that there would be opportunities for a range of cultural tourism ventures/ enterprises that can either be linked or located within the Ceduna Keys and in particular, the community precinct area.

The Ceduna Keys and in particular the Coastal Centre, would provide significant opportunities for indigenous involvement in investment and also employment. As with many other Interpretive Centres the indigenous community may choose to have equity in the Coastal Centre, train and then employ local indigenous people in the many functions of the facility including i.e. the retail, ticketing, management, conference organization, cultural entertainment, landscaping etc.

Aboriginal tourism gives Indigenous people the chance to tell their story in their way, to share cultural insights, traditional practices and contemporary concerns with non-Indigenous Australians and international visitors. Indigenous communities view tourism as a means of both educating others about Indigenous culture, and creating employment and training opportunities at a local level.

The National Aboriginal and Torres Strait Islander Tourism Industry Strategy 1997[18], recognises that the industry as a whole would benefit from increased product diversity. However, it is generally more feasible to develop Indigenous cultural tourism in a facility such as the Ceduna Keys so that an enterprise can:

- be linked to existing transport and accommodation infrastructure, or
- be linked to other destinations as part of a special interest package.
- cater to places where tourists already visit,
- be linked to an area of spectacular environmental quality,

This strategy also identified that cultural centres assist communities in recording and protecting their cultural resources, while interpreting their culture to tourists. Indigenous cultural tourism opportunities can often encourage young people to value their cultural heritage. For this and other reasons, involvement in cultural tourism may be pursued for reasons other than economic ones. Provided it is well managed in terms of social and environmental impacts, tourism can provide an incentive for increased cultural awareness and activity, and therefore produce a wide range of social benefits including personal pride and dignity.

Other indigenous tourism product would inevitably develop from the establishment of the Coastal Centre including activities such as cultural tours and arts and crafts.

Indigenous cultural industries, particularly arts and crafts, are very popular with tourists. Recent surveys indicate that international tourists regularly buy what they believe to be Indigenous arts and crafts (though it is unclear to what extent they select authentic products). Tourist purchases have been estimated as over 50% of sales (Altman, 1989). The value of these arts and crafts sales far exceeds the current value of Indigenous cultural tourism, and it represents the main form of contact that most tourists have with Indigenous cultures at present This represents a considerable economic strength that can be built on, to benefit both tourism and cultural industries. The local indigenous community in Ceduna has already expressed an interest in exploring opportunities for indigenous arts and crafts to be located in the Coastal Centre precinct.

Although tourists are coming to Ceduna their visits on average are only for relatively short periods of time i.e. 1.3 nights. The primary aims for developing tourism in Ceduna and the region are to:

- increase the length of visitor stays (i.e. visitor nights)

[18] The National Aboriginal and Torres Strait Islander Tourism Industry Strategy, 1997

- attract more visitors to the region particularly, with a focus on the interstate and international markets.

The community and commercial precinct in the Ceduna Keys would have a strong emphasis on tourism via the facilities and services being proposed. The core elements of this area would incorporate:

- 4-5 star hotel/motel accommodation facilities
- 4-5 star tourist apartment accommodation facilities
- conference and convention facilities
- open public spaces
- A regional tourism interpretive centre (gateway to the Eyre Peninsula and South Australia)
- commercial onshore facilities for the fishing and aquaculture industries
- marina facilities for the fishing, aquaculture and recreational boating fraternities.
- Country club incorporating the golf course and entertainment facilities

This area would become a focal point for tourism. The regional tourism interpretive centre (the Coastal Centre) would be located in the main community precinct of the marina development. The town is ideally positioned to promote what the region and State has to offer in terms of tourism whilst, at the same time offering visitors a unique interpretive experience.

The preliminary research investigated twenty other similar facilities including marinas and interpretive centres throughout Australia and in the USA. This research has confirmed that the establishment of interpretive and related facilities would inevitably lead to a range of jobs being created mainly, in the tourism and hospitality fields. Depending on the size of the business the interpretive centres directly employed between 30 –100 people.

An analysis of the types of jobs created included; tour guides, facility managers, administration/ ticketing, accounting, cultural entertainment, restaurant/cafe operators, retail sales, cleaners, rangers, gardeners and maintenance. Flow on effects were also experienced throughout the community but most directly in the hospitality, accommodation, fuel and retail sectors. Because tourism is a labour intensive industry, many additional job opportunities are created at the local level particularly for young people.

Although considered a niche market the convention market has continued to expand in South Australia in recent years. Interest has stemmed from the potential to link motel accommodation with convention facilities in a regional coastal environment. There has been interest in the opportunity to develop a complex with these specialised facilities for the small to medium sized conference market. This is a lucrative high yield market, with the average length of stays around 3.5 nights and average expenditure per night $166.

Developing regional tourism therefore, is a key factor in ensuring the future sustainability of regional communities through creating employment opportunities for local people. If the multiplier developed by SA Centre for Economic Studies is applied for each $1,000,000 of visitor expenditure in the community, 29.5 jobs are directly and indirectly created.

Tourism not only creates jobs directly but acts as a dynamic catalyst for employment in a myriad of other industries- financial services, retail stores, telecommunications, mechanical and fuel

services to name a few. Globally, travel & tourism generate 1 in 10.7 jobs directly or indirectly- many of them in small business and urban areas.[19]

The tourism industry provides significant economic benefits to regional communities with around 44 cents of every dollar spent going directly to the tourism/ hospitality related enterprises and the balance being spent in other local business within the town (SA Tourism Commission 1999)

8.2 Employment Opportunities

The underpinning key factor to rejuvenating economic/ regional development, improving regional competitiveness and encouraging investment is to have the supporting infrastructure in place to enhance and capitalise on opportunities.

Infrastructure is widely regarded as fundamental to regional development, and a major consideration in business investment decisions and, hence, in generating employment. The importance of infrastructure for Australia's future growth was made explicit in the Kelly report (1993), which linked national development and regional development. The report further argued that there should be equal access to basic infrastructure for all regions[20].

The Ceduna Keys project is strategically important to South Australia as the development is considered a vital link to develop growing industries such as; tourism, mining, aquaculture and commercial fishing in the town and region.

One of the main objectives of the marina development has been to maximise employment and education opportunities for local Aboriginal people and the wider community. The detailed research undertaken by the South Australian Centre for Economic Studies outlines in their report that it is expected significant additional employment opportunities would be generated in Ceduna over the coming years both in the construction stage and operational stages of the project.

This would result in a range of jobs being created and the aim of the developer is to employ as many local people as possible including a proportional share of Aboriginal people. It is also assumed that most of the employees would be based in Ceduna and that all the equipment and supplies would be sourced locally through retailers/wholesalers so that the retail margin stays in the Ceduna region.

The projected employment impact of the construction phase would be very strong in the first few years of development. SA Centre for Economic Studies has suggested that this first stage would require an estimated 129 employees in the first years of development**.** Whilst employment would decline after the initial heavy construction phase, further opportunities for ongoing employment would continue to be maintained in related sectors particularly; residential building, landscaping, maintenance services, signage installation, wharf services, grounds people and irrigation works.

The Lincoln Cove marina clearly demonstrates the form of employment that is created as a direct result of this type of development. Once the earthworks/construction phase of the Lincoln Cove project was completed a large proportion of these employees transferred into the building and construction industry. Over the past eighteen years the uptake and subsequent building of residential allotments in the marina has been very consistent with an average of 40 homes/ apartments being constructed per year. Since 1990/91 Pt Lincoln has experienced significant growth in the number of building approvals from 39 in 1999/91 increasing to 129 in 1999/2000 (ABS). With the stated profile of required employees in the initial construction stage of the Ceduna Keys: 5% professions, 5% managerial/ technical and 90% semi-skilled operators/labourers, it is possible that the workforce requirement can be met from indigenous and non-indigenous locals.

[19] The Economic Impact of Travel & Tourism Development in the APEC Region, 1998, WTTC & APEC Tourism Working Group)
[20] SA Regional Development Taskforce- Report, April 1999

It is difficult to project the rate of development and uptake of the residential allotments for the Ceduna Keys however, it is fair to say that the pre-sale of the residential blocks has to date been very strong and has exceeded Lincoln Cove when it was first established. Once the earthworks and essential service infrastructure is completed it is expected that construction and building on the residential allotments would commence almost immediately. The 350 residential allotments and 250 waterfront apartment sites in Ceduna Keys development would provide a significant ongoing boost to the local construction industry and related tradespeople.

Using Lincoln Cove as an example it is anticipated that the building of the residential homes and apartments would provide direct long-term employment opportunities for the local indigenous and wider community. These would include; builders, bricklayers, equipment companies, transport, steel fabrication, engineers, surveyors and trades (plumbers, electricians etc). It is envisaged that the existing local building companies would be looking to expand their businesses to keep up with the increased demand for housing. Every direct job created in this sector would have direct flow on effect into other local businesses in the community (1:4 flow-on jobs) in particular; concrete supplies, hardware supplies, transport, manufacturing, landscaping and retail services.

The proposed Ceduna Keys Marina and community precinct development represents a significant opportunity for Ceduna to be a major focus for economic development and social activity on Eyre Peninsula. As the proposal would be centred on the development of a commercial marina and wharf facilities, it would facilitate and support a burgeoning aquaculture industry, the existing fishing industry and a very important tourism industry at the gateway to and from the west coast of Australia

Ceduna offers an established range of accommodation opportunities in the town. ABS Statistics reveal that the four hotel/ motels in Ceduna provide 149 rooms and 430 bed spaces, and the six caravan parks around town have 74 cabins and over 500 sites between them. This gives a maximum possible capacity of around 1500 persons. However, because of Ceduna's location on the National Highway many people use the town as a stopover point, therefore on average hotel/motel room occupancy rates are at 45% with bed occupancy rates being lower at 24%. Taking this into account there is still more than enough capacity to cater for a short term increase in the workforce.

8.3 Attraction and Enhancement of Business

Not only would opportunities be created for new investment but, most importantly for the existing businesses in the town and immediate area. Additional activity brought about by the development of the Ceduna Keys would inevitably create a positive multiplier effect filtering directly back through existing businesses in Ceduna and the region. The construction of the project would create a direct impact in the town particularly relating to; the actual construction work in developing the marina, the ongoing demand for housing construction and therefore the need for builders and other trades on an ongoing basis. The attraction of the fishing industry would bring with it a demand for fuel, transport and other related supplies.

By far the most significant impacts would be experienced through the expenditure of additional visitors to Ceduna staying for longer periods of time. It is well documented that the tourist dollar is a new dollar injected into a local economy. This money is spent and re-spent by local businesses in the town thereby creating an economic multiplier effect throughout the community and local region. The larger the amount of visitor money spent in the community the longer it is retained and the greater the overall benefits.

Tourism is a labour intensive industry, which creates many additional job opportunities particularly for young people at the local level. Developing regional tourism therefore, is a key factor in ensuring the future sustainability of regional communities through creating employment opportunities for local people. The additional tourism expenditure in these communities would create an environment, which would encourage business growth and diversification into new products, facilities and services such as the marina and interpretive centre facilities.

8.4 Relationship to Ceduna Business Centre

It is important to acknowledge that the proposed development does not include nor provide the opportunity for the establishment of a business centre in terms of shopping and other commercial uses that may draw the focus away from the existing business area within the township of Ceduna.

Retail and commercial development within the proposed development would be restricted to the provision of a limited range of goods and services for the daily needs of residents, such as a neighbourhood shopping centre. The existing business or town centre zone within Ceduna would continue to be the primary focus for retail shopping and access community and business.

Business and commercial uses envisaged within the proposed development do not seek to replicate or duplicate the offering of retail goods and services to the community. The Council is conscious of maintaining the economic viability of and community focus on the existing business centre within Ceduna.

This issue is addressed in further detail in terms of the Development Plan policy framework to be established via the PAR process to be undertaken as outlined in Section 12.5 of this report.

8.5 Cost of Infrastructure to Government

The proposed development would require significant investment on infrastructure such as road construction, electricity supply, water supply, sewage treatment, and the like. While government agencies and utility providers seek to enable economic development by providing suitable access to such infrastructure services, development of the scale proposed is invariably faced with the necessity to make contribution towards and payment for the augmentation of existing infrastructure in order to accommodate the anticipated increase in demand. The proposed development is not dissimilar in this regard.

The economic feasibility of the project has taken into account the costs of augmentation and extension of key infrastructure services such as water and electrical power. Discussions have taken place with the providers of these utilities in order to ascertain the scope of works required and the quantum of charge that may be anticipated once more detailed engineering design has been undertaken.

A development of this scale has a capacity to absorb reasonable costs in terms of extension and augmentation of existing infrastructure that ultimately assist in achieving a sustainable delivery of service to the community as a whole. Without development of this nature the full costs of infrastructure upgrade would be borne by government with limited ability to pass such costs onto existing subscribers. New development provides an opportunity to review the capacity of existing networks and plan for future demand.

Discussions will continue to occur with the State Government in respect to assistance, as such investment would have a significant positive multiplier effects within the local and wider community economy.

8.6 Long Term Costs to Council

Upon the expiry of the Initial Maintenance Period, Council would be required to maintain in a good order and condition the revetments, waterway reserves, water quality to a standard acceptable for recreational use (excluding swimming), the entrance channel at a navigable depth; and navigational structures as will be addressed in the MMM Agreement. Other requirements would be no different than tasks Council is now obligated to maintain e.g. roads, footpaths, stormwater, effluent, landscaping etc.

Pursuant to the heads of agreement signed between the developer & Council, 15% of the rates raised each year would be committed to a reserve fund to assist in future maintenance costs. Upon completion of construction, estimated in 2006/07 year an additional $500,000 in rates is expected increasing each subsequent year till full development of the site.

At today's values the rates expected on the fully developed site would be an estimated $1.4m. Of this sum $210,000 would be committed to the reserve for future maintenance of the facilities within the development, which are a Council responsibility. Effluent would be cost neutral due to a separate charge being raised to manage such facilities operation, maintenance & future requirements. There are no constructed wetlands planned for the development.

It is envisaged at this time that various infrastructure facilities would have different maintenance periods for transfer to Council, rather than one common date after the completion of construction. Such will be addressed in detail within the MMM Agreement.

8.7 Relationship to Port of Thevenard

In recent years the fishery in the Great Australian Bight has proved to be one of the richest and largest untapped resources in Australia. Industry interest and activity in the region has therefore almost doubled during this time. Over the past four years a number of fishing boats including tuna, fishing trawlers, shark, pelagic and pilchard boats have been coming into the Port of Thevenard to unload product, re-fuel and obtain supplies on a regular basis.

The Great Australian Bight Trawl Fishery (GABTF) covers an estimated area of 812,000 km^2 extending from Kangaroo Island to Cape Leeuwin in Western Australia. This fishery shares the waters with other fisheries including the tuna fisheries and the small pelagic fishery. The fishery is managed through input controls including limited entry of vessels, limited cod-end mesh size and area restrictions for boats in excess of 40 metres in length.

Ten trawl fishery licences currently operate in the Great Australian Bight producing an annual catch of 2,488 tonnes valued at $6.846 million. The Great Australian Bight fishery is a multi species trawl fishery with over 80 species being caught. The most commonly taken fish are, orange roughy, deepwater flathead, bight redfish, gemfish, angel shark and leatherjacket, Lynch A.W & Garvey J.R (2003)[21]

During the past twelve months the unloading activity at the Port has increased dramatically with just over 10 fishing boats now using the facility as their main base for unloading and obtaining supplies. Of the 10 trawler boats currently using the Port of Thevenard most are characterised as being very old and a heavier type of boat. In addition to this, they are very large and are difficult to manoeuvre in confined spaces.

On average these boats come into Port around every 10 days to unload product, re-fuel, change crews over and collect supplies. The size and draft of these vessels would restrict them in having access to the commercial facilities in the marina. However in saying this there are a number of other boats that currently use the Port of Thevenard for re-fuelling and obtaining supplies. These tuna and pilchard vessels are newer, have a lighter draft and would be able to access the marina facilities. The development of the marina would open up opportunities for other fishers to be based in Ceduna on a more regular basis. Consultation with key industry groups has revealed that many companies would have boats located and operating out of the Ceduna Keys commercial facilities.

There are no current plans to develop a marina facility at Thevenard. However, the increased usage of the Thevenard wharf with the large ships and the fishing trawlers currently working in the Great Australian Bight is causing considerable ongoing congestion. This problem is not helping any of the current users and by all accounts will not improve in the future.

[21] Great Australian Bight Trawl Fishery Data Summary 1990-2002, Lynch A.W & Garvey J.R (2003)

It is expected that the Ceduna Keys would cater for a significant proportion of these fishing boats currently using the Thevenard wharf. However, some of the older, heavier trawlers would not be able to get into the marina because of their requirements for deeper drafts. There is however a need for an unloading facility of some type in Ceduna to cater for the trawler industry. At this stage the most likely scenario is that a simple structure may eventually be connected to the Thevenard wharf in some way. However, this is currently only an idea and a full feasibility study is yet to be undertaken.

That said, Council has recognised the need for on shore facilities to service the needs of the fishing and aquaculture industries, together with recreational vessels, in so far as the provision of industrial and commercial activities such as vessel maintenance and repair activities that may otherwise not be appropriate within the Ceduna Keys Development. Council is soon to commission the preparation of a needs analysis in this respect with a view to preparing a 'master plan' for the long term development of such facilities, to be implemented via the Plan Amendment Report Process to the extent that rezoning or change of Development Plan policy may be required.

8.8 Opportunities for Aquaculture and Fishing Industries

The commercial harvesting of a variety of species has occurred in the Great Australian Bight for many years. To ensure the long-term sustainability, both the inshore (State waters) and offshore (Commonwealth waters) commercial fisheries, are managed through stringent control methods including;

- licensing controls,
- catch limits,
- size restrictions,
- area restrictions,
- limited entry,
- and in some cases fishery management plans.

According to the Great Australian Bight 1000-West Coast Strategy, 2000, the major commercial fishing sectors represented along the West Coast comprise the Northern Zone Southern Rock Lobster fishery, the Western Zone Abalone Industry (including both Blacklip and Greenlip Abalone), the Western King Prawn Fishery and the Marine Scalefish fishery. These sectors are effectively managed by independently chaired Fisheries Management Committees (FMCs). FMCs are jointly charged with the Director of Fisheries under the *Fisheries Act* 1982 to manage the fisheries. The committees comprise representatives of industry, PIRSA Fisheries and Aquaculture, research agencies and in some cases, the recreational fishing sector and the community.

The commercial fishing sector is an important industry along the West Coast and Eyre Peninsula. In terms of produce value, approximately $20 million of Southern Rock Lobster, $22 million of Abalone, $22 million of Western King Prawns and $23 million of Marine Scalefish were harvested during 2000/01. The sardine (pilchard) industry is now South Australia's largest fishery by weight with a Total Allowable Catch (TACC) for 2001 of 9100 tonnes (Ward & McLeay 1999b, Ward et al. 2000; Knight et al. 2000). The fishery is managed by the State out to 200 nautical miles under the Offshore Constitutional Settlement agreement.

Over the years most of the fishing has been undertaken in the southern Spencer Gulf area (Ward et al. 1998; Ward and McLeay 1999a; Ward et al 2000). However, in recent years more activity has started to occur in the Great Australian Bight region. This is expected to increase with the establishment of the Ceduna Keys and appropriate onshore facilities in the town.

The South Australian sardine fishery is managed under a regime of input and output controls that involve entry limitations, gear restrictions, an annual total allowable catch (TACC) and individual

transferable quotas (ITQs). The fishery comprises 14 licences holders. Currently, nets cannot exceed 1000m in length or a depth of 200m and there are mesh size restrictions of 14 to 22mm[22].

The majority of the pilchards are sold to tuna farmers in Port Lincoln as feed. However, because the product is of such good quality the local industry has started to explore the potential for export and value adding for interstate and overseas markets and this has significantly increased the value of the fishery.

In recent years the trawl fishery in the Great Australian Bight has proved to be one of the richest and largest untapped resources in Australia. Anecdotal evidence suggests that there is significant potential for the pelagic fishery to expand into the harvesting of blue mackerel at a commercial level. However, any decisions as to whether this would occur or not lie with the appropriate Government Departments.

The Ceduna Keys marina facilities would enhance the existing fishing operations and attract additional vessels to the town via the provision of suitable facilities in a strategically important location in relation to existing and new fishing grounds in particular the pilchard grounds.

Currently the tuna fleet is travelling a considerable distance to catch their quota. The industry tows the live fish in nets back down to Pt Lincoln and this is a substantial cost to the industry each year. A high number of boats also steam back to Pt Lincoln to refuel and restock supplies, as the Port of Thevenard is often busy with the larger ships.

The proposal to construct a marina in Ceduna has been welcomed by members of the industry as it would provide a safe haven for boats, off loading facilities for product to be trucked frozen to Pt Lincoln and refuelling/ restocking facilities. A facility at Ceduna would save the tuna industry a considerable amount of valuable steaming time and money. The Thevenard Port Master Plan reported that the tuna industry was losing income from having to steam back to Pt Lincoln for unloading and refuelling. Each return trip costed $5,000, producing an unnecessary cost of $60,000 per season to the operator. A trawler fisher indicated an economic cost of $6-7,000 per week per vessel ($325,000 per annum) due to the lack of reliable facilities in Ceduna and region.

The attraction of the fishing industry to the town and region would provide the opportunity for business expansion through stocks/ supplies and fuel. “Data collected suggests that the direct economic activity in the local economy could be considerable in the order of $6.7m per annum if all activity could be direct to Ceduna, with the impact being wider taking into account a multiplier effect which follows from such expenditure. Presently there is a significant leakage of that economic activity from the local economy because of:

The absence of suitable facilities for direct unloading of larger craft in the local area
Restricted access for larger craft to existing inadequate facilities
Market performance to alternative facilities, although inadequate”

A number of people from the tuna industry have shown strong support for the initial concept proposal. The industry has indicated an interest in long term investment in the Ceduna Keys project.

The far west coast region of Eyre Peninsula is widely recognised as a prime region for aquaculture development mainly because of the clean unpolluted waters, low population base and vast stretches of coastline and offshore waters. There is considerable potential for these industries to expand and a range of alternative new sites are currently being identified by PIRSA. The offshore waters adjacent to Ceduna have been identified as having significant potential for future aquaculture development in species such as finfish, abalone, scallops and other molluscs.

According to the Far West Aquaculture Management Plan 1996, the Denial Bay/ St Peters and Smoky Bay zones would have 165ha respectively (a total of 330 hectares) when fully developed

[22] SARDI Aquatic Sciences Fishery Assessment Report, Sardine, October 2003.

and all of these areas have been fully allocated. At this stage the industry on the far west coast is far from reaching full production with all intertidal bays at varying levels of development, the most advanced being Ceduna (Denial Bay), where they are operating at approximately two thirds of their potential capacity. St Peters Island and Smoky Bay still have areas of water that are not yet developed i.e. the Waterwitch subtidal shellfish zone (80 hectares).

The diversification of the aquaculture industry has already started to occur in the area with the recent development of abalone aquaculture and scallops in the offshore waters near Ceduna. There has also been interest in developing finfish aquaculture in the region.

8.9 Recreational and Commercial Fish Stocks

According to traffic statistics recorded by the District Council of Ceduna, March-June 2004, an average of 210 recreational fishing boats use the main boat ramp in Ceduna on a weekly basis (or a total of 10,920 boat trips per year). During holiday periods the population of the town increases to 4,000 with an estimated further 120 recreational boats using the ramp over these times. In 1997, the Department of Transport from 96 observations recorded 2879 trips, 1792 (62 per cent) of these were recreational fishing trips. The boat ramp is ranked 33 for recreational fishing and 32nd overall ranking in terms of the assessment undertaken according to a range of criteria.

The Ceduna Keys project would inevitably attract new people to the town, resulting in population growth on a permanent basis. It is also expected that there would be a general increase in the recreational boating activity and in particular, recreational fishing in the area due to the development. It is highly probable that half of the properties in the marina would have a boat that would be used for recreational fishing purposes, and this would have an impact of some type on the current marine environment. It is therefore estimated that a further 150 recreational boats would be permanently located in Ceduna.

According to The National Recreation and Indigenous Fishing Survey, 2003, on average recreational fishers in South Australia fish for 6.10 days per annum. It is therefore fair to assume that the additional 150 boats located in the marina would account for a further 915 boat trips per year in Ceduna (an 8 per cent increase in overall usage).

Ceduna and the Eyre Peninsula have long been recognised as one of South Australia's best fishing locations, and recreational fishing has always been one of the most popular activities for the locals and visitors alike. The Eyre Peninsula Tourism Association Marketing and Business Plan 1997-1998, indicated that marine based visitor pursuits account for approximately three quarters of the region's tourism activity. One in four tourists identify fishing as the major factor influencing their decision to come to the region.

Past evidence has also shown that the town, its coastal surroundings and the fishery has long been able to support a significantly larger population of people. This occurred in the 1980's when Ceduna's population gradually increased to peak at 5,000 in 1986 (The Life on the Edge, J Faull, 1988). The people who worked at this time for the Ceduna Satellite Earth Station (OTC) and Telstra, were affluent, had disposable incomes and were able to regularly afford activities such as recreational fishing. Along with this, in 1987 there were 42 "A" Class commercial fishing licenses and 16 restricted licenses in comparison to around 20 licenses today.

It is also important to note that until 1982 fishing regulations were not very stringent and it could therefore be assumed that considerable pressure was placed on fish stocks in and around Ceduna prior to this time. However, even with this usage over the years the fishery has remained at a consistently sustainable level.

Today's fishing regulations do not allow for the exploitation of fish stocks throughout the State. Laws to control fishing activities are contained in the Fisheries Act 1982, which provides for the

conservation, enhancement and management of Australia's fisheries. The overall aim of the Act is to ensure the long-term health of Australia's fish stocks. To achieve this, regulations are applied rationally and fairly to fishing, to control the numbers taken. Australian fisheries management agencies in all States apply a range of measures to protect fish habitat and conserve fish stocks.

In South Australia, fisheries management is controlled by the Department of Primary Industries and Resources SA (PIRSA). Their primary role is to conserve fish stocks, manage sustainable harvesting, protect aquatic habitat and share the resource among users. Stock numbers are also monitored through ongoing research, which is managed by PIRSA and carried out by the SA Research and Development Institute (SARDI). Assessments of the impacts are made by PIRSA on a regular basis and management regulations are changed accordingly to ensure the long term sustainability of the State's fishery.

8.10 Financial Strategies for Infrastructure

The developer would seek to bond infrastructure development to ensure that the relevant infrastructure is in place for each stage of construction. The project has reached its current status with a combination of State Government, Local Government, initiating developer input and Ceduna Marina Development Company (CDMC) investment.

The CMDC is a company formed with a range of shareholders who have experience in these projects. It consists of equity capital and ability to raise the necessary construction funding in accordance with the market demand. In addition the development company has identified areas where the direct beneficiary of the construction relates to other community use groups and would pursue additional grants with and on behalf of these other groups to expedite the full construction program.

8.11 Land Tenure Arrangements

Tenure would revert from the Council to Developer upon settlement of the contract to purchase the majority of land described in the development application. Land tenure would transfer to purchasers of residential and commercial allotments upon issue of titles by the LTO. Public areas, such as reserves, breakwater and community facilities, would be retained by or transferred to Council upon deposit of plan at the Lands Title Office (LTO).

Crown land associated with the coast and seabed which is required for the proposed development would be transferred to the proponent (ie for commercial areas such as the marina) or Council (ie breakwaters and entrance channel). Road reserves would need to be created and/ or amended to be vested in Council.

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NATIVE TITLE & ABORIGINAL HERITAGE

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ENVIRONMENTAL IMPACT STATEMENT

9. NATIVE TITLE AND ABORIGINAL HERITAGE

9.1 Aboriginal Heritage

Prior to field work being commenced, consultation was undertaken with Mr Mitch Dunnett, the Aboriginal Liaison Officer with the District Council of Ceduna and a member of the Wirangu Aboriginal community. It was decided that the archaeological survey would be undertaken in the company of Mr Wayne Miller, a Warangu elder and Mr Dunnett. Consultation was also undertaken with representatives of the Ceduna Aboriginal Community Council Inc. as requested by the State Aboriginal Heritage Committee. Discussions were subsequently held with The Chairperson of the Council, Mr Oscar Richards and Mrs Sue Hazeldine.

From the preliminary work undertaken to date, it would appear that although not within the site of the proposed marina development, there is a 'fish trap' further to the west indicative of that found in locations along the coastline between Thevenard and the Halfway Camp near Ceduna. The fish trap is in the form of a natural limestone reef formation that would have been closed off by stones when in use. This fish trap site is a registered site with information held by the Department for Aboriginal Affairs and Reconciliation (DAARE). Apart from this 'fish trap' no other Aboriginal cultural material has been recorded within the study area.

From the archaeological surveys undertaken a range of Aboriginal cultural material was found in the form of midden and stone artefacts in two locations within the Study Area as identified and further elaborated on within the Environmental Assessment undertaken by Eco Management Services Pty Ltd. Both of these areas were located within the sand dunes to the coastline. Area A containing midden and stone artefacts is located to the west of the development site adjacent to the fish trap. Area B containing midden and a small number of artefacts including more recent evidence of camping, is located to the north of the BP Service Station in the Eyre Highway.

In addition to the two areas where midden and artefacts were evident, Mr Dunnett has indicated that a freshwater soak exists in the area where the service station has been extended adjacent to a natural channel which has now been filled in as part of road works associated with the Eyre Highway. The area to the east of the junction between the Eyre Highway and the Denial Bay Road was also pointed out as being the location of previously found burials.

Notwithstanding the research undertaken and preliminary findings presented to date, there is a need to undertake a more comprehensive archaeological and anthropological survey and clearance process by specialists chosen by the aboriginal communities.

The site clearance for Native title would cover both the freehold and Crown Land, which takes the entire site into account. The Heritage Survey will be undertaken by approved parties and is to be coordinated by the Aboriginal Legal Rights Movement ("ALRM") on behalf of the amalgamated claimant group for the Far West Coast. We expect this Heritage Survey to be completed and presented in June 2005.

A Native title mediation meeting will be conducted in late June early July 2005. At this meeting the Heritage Survey report will be released to the developers. Discussions will initially centre on any significant Heritage issues on the site. The Developers do not anticipate that there are any significant Heritage issues on the site based on the discussions with Council and a review of the previous Heritage studies on the site.

Once the Heritage issues, (if any) are satisfactorily resolved, a draft Indigenous Land Use Agreement ("ILUA") will be discussed and negotiated between parties.

9.2 Native Title

The Ceduna District Council commenced negotiations with the Aboriginal Community when it began studies for the possibility of the development and this has continued, in a variety of ways

due to the now 5 amalgamated claims that have been lodged over the land and seabed since the original negotiations took place.

There is currently an existing claim by 5 groups over Section 265 currently held as Crown Land. The claim was further amended in January 2005 to permit the amalgamation of the Far West Coast claim with the Mining claims.

The current existing claim has been referred to the National Native Title Tribunal by the Federal Court. The District Council of Ceduna and Ceduna Keys (being the Ceduna Marina Development Company Pty Ltd, who were the successful applicants from Tenders undertaken by the District Council of Ceduna to undertake the Ceduna Marina Project) are being represented by Rosemary Craddock and Carey Goodall as the legal representatives.

The Proponent and Council are currently undertaking meetings with the Statewide ILUA Negotiation Team. It has been agreed that the National Native Title Tribunal mediation be suspended and that the parties would continue mediation through the Statewide ILUA process. There would be public consultation with all relevant aboriginal communities, including the Ceduna community.

The land contained within Section 197 is currently vested in the ALT and is used as a homeland property for the Miller Family. There are various processes under that Act in order to obtain appropriate title to the land.

Negotiations are currently being undertaken with the Aboriginal Land Trust ("ALT") the owners of the land, and ALRM, who represent the Far West Coast Claimant Group, in respect to the portion of the land in Section 197.

Negotiations are being undertaken with the ALRM on behalf of the Far West Coast Claimant Group for portion of the land in Section 265, this land is currently Crown Land.

The Developers seek to procure the freehold of the portions of Sections 197 and 265 as shown to construct portion of Stage 11 and portion of the commercial marina area in the Ceduna Keys Project.

There is a further section of Section 197 that is shown as white, and this area would not be disturbed or changed in regard to the current title, nor ownership and would not be further developed.

When negotiations have been agreed with the ALT and the ALRM in respect to the land, the seabed and the Crown Land needs to be converted to freehold title, and such would require amendment through the two Houses of Parliament to be ratified.

Further consultation with the Aboriginal communities would be required and would take place with public meetings to complete the Native Title issues. All native title matters would be continued to be mediated in the early portion of 2005 by all parties and reports would continue until all issues are resolved with a view to developing an Indigenous Land Use Agreement.

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Figure 9.1 **Parcels subject to Native Title negotiations**

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ENVIRONMENTAL IMPACT STATEMENT

10. ENVIRONMENTAL MANAGEMENT – CONSTRUCTION & OPERATIONAL

10.1 Construction Environmental Management Plan (CEMP) Preparation and Implementation

A Construction Environmental Management Plan (CEMP) will be prepared by the proponent. It will involve the development of a specification by the Proponent, outlining all issues to be covered, the standards that need to be achieved and monitoring requirements that must be included in an Environmental Management Implementation Plan (EMIP).

The Construction EMP would address a wide range of issues, including stormwater and erosion management, dewatering, acid sulphate soils, noise, dust, safety (public and construction workers), traffic management, etc. It would be prepared in accordance with available guidelines, particularly the EPA Codes of Practice and would be submitted for approval of any licensed activities by Planning SA in consultation with the EPA, before the commencement of any construction activities.

With respect to environmental protection, the key objectives of the plan are:

- To minimise any turbidity, sedimentation of the waters of Murat Bay.
- To prevent the disturbance or leachate from any acid soils entering the Waterways or Murat Bay.
- To prevent or minimise the disturbance of any flora habitat outside the construction area.
- To minimise the effects of noise or dust on adjacent areas.
- To minimise any disruption to traffic movement during the diversion of the Eyre Highway and Denial Bay Road.
- To maintain high standards of public safety throughout the construction period.

The likely construction sequence is outlined in Section 10.2 and the matters to be addressed by the contractor(s) in the CEMP are outlined in Section 10.3 below.

All site works will be undertaken under AS 4000 (General Conditions of Contract).

The following parties will be involved:

Member	Role	Responsibility
Ceduna Marina Development Company (CMDC)	Proponent/Principal	Ensure that all construction and ongoing operational aspects of the development are undertaken and implemented in accordance with the EIS and conditions of development approval. Overall responsibilities for environmental performance (duty of care under Section 25 of the Environmental Protection Act 1993).
To be determined by tender or other means. Contractual conditions to be AS 4000.	Contractor	Responsibility for environmental performance (duty of care under Section 25 of the EP Act 1993). Compliance with all provisions of the EMP Preparation and implementation of environmental management implementation plan (EMIP) for the site.
Dare Sutton Clarke (DSC)	Lead Consultant, Construction Superintendent	Design and documentation of earthworks, waterways, breakwaters, entrance channel, edge treatments and all land division infrastructure. Monitoring and assessment of Contractor's performance against provisions of the EMP Ensure that the EMP addresses all the issues raised in the EIS and details the manner in which construction and associated monitoring of potential impacts will occur.
Coffey Geosciences	Geotechnical Consultant. Acid Sulphate soil specialist.	Investigate the entire site in detail to determine the physical properties of the soils and groundwater and the potential risk from acid sulphate soils. Develop mitigating strategies in collaboration with DSC.
To be determined	Hydrogeological Consultant	Investigate the existing groundwater regime and assess the potential for impact on the development from the existing Council landfill. Develop mitigating strategies in collaboration with the Principal, Council and DSC.
John Chappell Engineers	Marine and Coastal Engineering	Design of Breakwaters and Entrance Channel
DSC Andrew	Cadastral and Engineering Surveys	
Eco Management Services Pty Ltd	Environmental Science	Reviewing design documentation for compliance with the EMP and monitoring.

The development and implementation of the plan will involve the following:

- **Implementation of Environmental Management Measures**

Based on the specification prepared by the Proponent, all environmental management requirements during construction will be documented in an Environmental Management Implementation Plan (EMIP), to be produced by the Contractor prior to commencing site works. It will detail how the Contractor will implement and manage environmental aspects of the project. This plan will form part of an overall Quality Plan, which also addresses safety, operating procedures, inspection and test plans and checklists.

The Contractor's environmental management responsibilities for the proposed site works will include:

- preparation of an EMIP in accordance with the requirements of the EMP to show how the environmental requirements for the project will be met
- carrying out the work in accordance with the EMIP and the provisions of the EMP
- monitoring the environmental impact of the work
- assessing the effectiveness of the EMIP based on monitoring and auditing results
- updating and improving the plans as required.

- **Induction and Training**

Project specific training or certification requirements for all site personnel (Superintendent's Representatives, consultants, Contractor's personnel and subcontractors) will be the responsibility of the Contractor. Appropriate training records and certificates shall be maintained by the Contractor and provided to the Superintendent prior to commencing site works.

It will be the responsibility of the Contractor to ensure that all project personnel are aware of environmental management requirements and procedures.

- **Inspection and Monitoring**

A representative of the Superintendent will undertake inspections of the Contractor's activities. The Superintendent's Representative will have full time presence on site.

Monitoring for dust, dust contents, noise, surface water quality and groundwater quality will be carried out by the Superintendent.

- **Assessment and Reporting of Environmental Performance**

Reviews of environmental performances shall be undertaken by the Superintendent. Reviews will be undertaken as monitoring information becomes available. The Contractor will be instructed on the outcomes of reviews immediately. Summary review reports will be prepared monthly. The reports will be provided to the Contractor, the Principal and relevant government agencies.

Environmental incidents and emergencies will be reported immediately to the Principal (and if necessary the EPA) by the Contractor or the Superintendent.

- **Auditing**

The performance of the project against this EMP will be audited by a suitably qualified and experienced environmental auditor (independent of the parties listed above), three months after commencement of site works. Additional audits shall be undertaken thereafter at six monthly intervals.

Environmental audit findings will be submitted to the parties listed above. If necessary, the EMP will be amended and the amendments implemented.

- **Stakeholder consultation**

Project Steering Committee meetings will be held regularly with key stakeholders including representatives from the local community, Council, relevant government agencies (such as Planning SA and EPA) and the parties listed above as a forum to provide advice to CMDC on project management and delivery issues.

Affected adjoining owners to the sites will be notified 10 days prior to each stage of the works of the Contractor's intention to commence works adjacent to their site boundary. Affected owners will be issued with a program for the completion of these works.

A 24 hour hotline will be established to address issues that may arise during the construction process that require an after hours response. During normal working hours the Contractor's site supervisor will address community concerns raised. The site supervisor will also maintain a register of representatives from each relevant stakeholder group to be displayed at the site information centre.

It is recognised that the construction phase potentially can have major environmental impacts, unless measures are taken for their minimisation encompassed in a Construction EMP.

10.2 Construction Sequence

Dare Sutton Clarke Engineers, in consultation with the Proponent, has outlined the likely construction sequence. As indicated in the Figures 10.1 to 10.4 the most likely sequence of activities is as follows:

Stage A

- Commence Eyre Highway Diversion including water main, sewer main and arch culvert to the future land division.
- Construction of the western and southern breakwaters including the temporary bund.
- Installation of the dewatering pumps or settlement ponds.
- Excavation of the southern waterways east of the Eyre Highway.
- Filling of the adjacent low-lying land and building the noise mounds.
- Stockpiling of excess excavated material at a suitable offsite location with appropriate drainage management.

Stage B

- The installation of riprap and concrete edge beam to southern waterway batters.
- The installation of a culvert to connect to the future northern waterways.
- Construction of Sub Stages 1, 2 and 3 land division infrastructure works (roads and services).
- Install settlement ponds and dewater enclosed area west of the Eyre Highway.
- Excavate waterways west of the Eyre Highway and fill low-lying areas.

- Connect the diversion road to the Eyre Highway and redirect all traffic along the new diversion road.
- Re-route the overhead powerlines along the Eyre Highway.
- Commence construction of the entrance channel.

Stage C

- Completion of the southern waterway excavation and installation of the riprap and concrete edge beam.
- Construction of the Denial Bay Road Diversion including services to Stages 8 and 9 allotments.
- Excavation of the northern waterways, filling of low-lying areas and the removal of excess cut material to a suitably located stockpile site.
- Construction of Stages Sub Stage 4 and 5 land division infrastructure works (roads and services).
- Installation of riprap and concrete edge beam to northern waterway batters.

Stage D

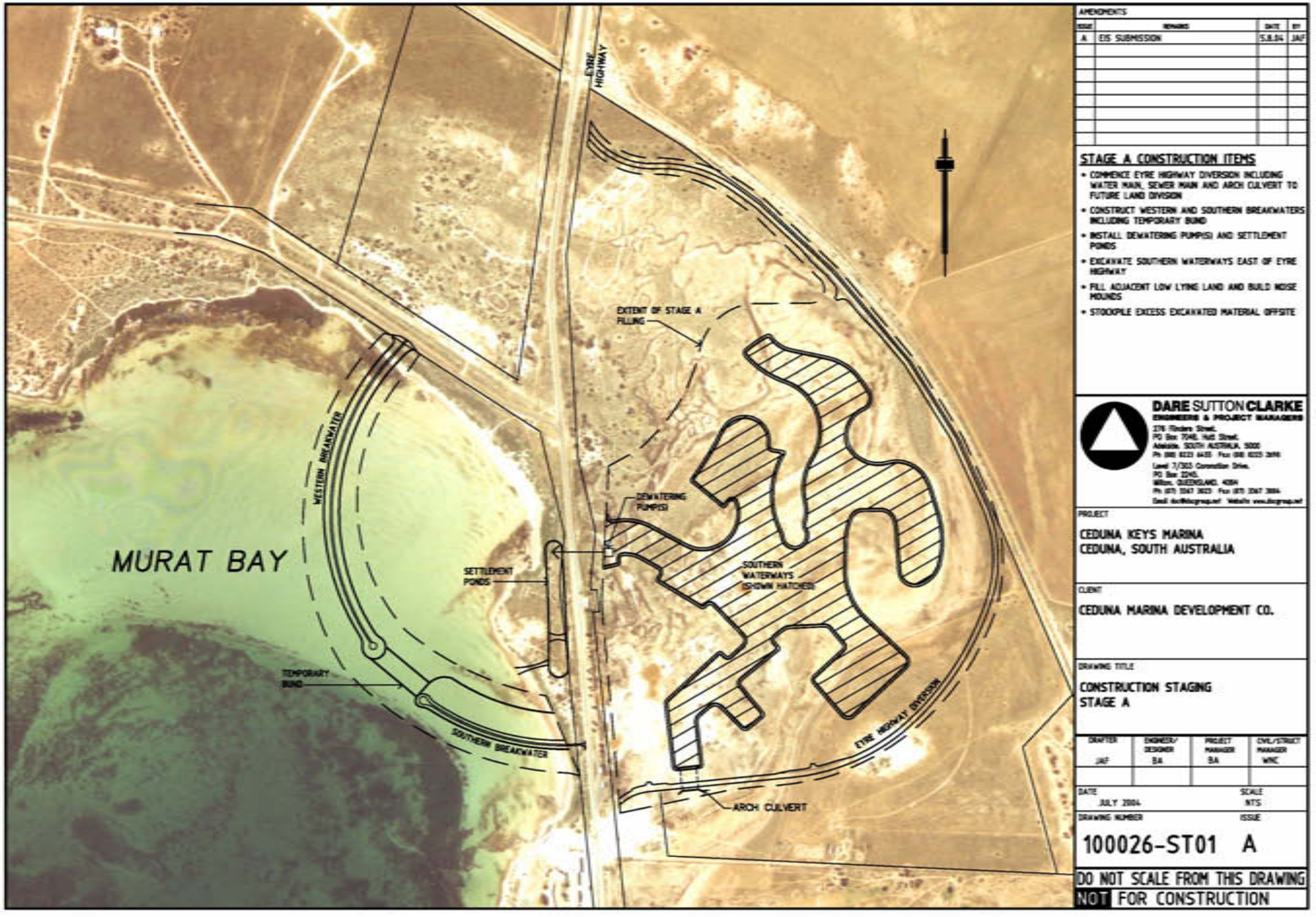
- Construction of Sub Stages 6 to 11 land division infrastructure works (roads and services).
- Cease dewatering, remove the settlement ponds.
- Remove the temporary bund between the western and southern breakwaters and flood the waterways with seawater.
- Complete the construction of the entrance channel and breakwater armour works.

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Ceduna Keys

Figure 10.1 Construction Sequence Stage A



AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE A CONSTRUCTION ITEMS

- COMMENCE EYRE HIGHWAY DIVERSION INCLUDING WATER MAIN, SEWER MAIN AND ARCH CULVERT TO FUTURE LAND DIVISION
- CONSTRUCT WESTERN AND SOUTHERN BREAKWATERS INCLUDING TEMPORARY BUND
- INSTALL DEWATERING PUMP(S) AND SETTLEMENT PONDS
- EXCAVATE SOUTHERN WATERWAYS EAST OF EYRE HIGHWAY
- FILL ADJACENT LOW LYING LAND AND BUILD NOISE MOUNDS
- STOCKPILE EXCESS EXCAVATED MATERIAL OFFSITE

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PROJECT
CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT
CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE
CONSTRUCTION STAGING
STAGE A

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WHC

DATE: JULY 2004
SCALE: NTS
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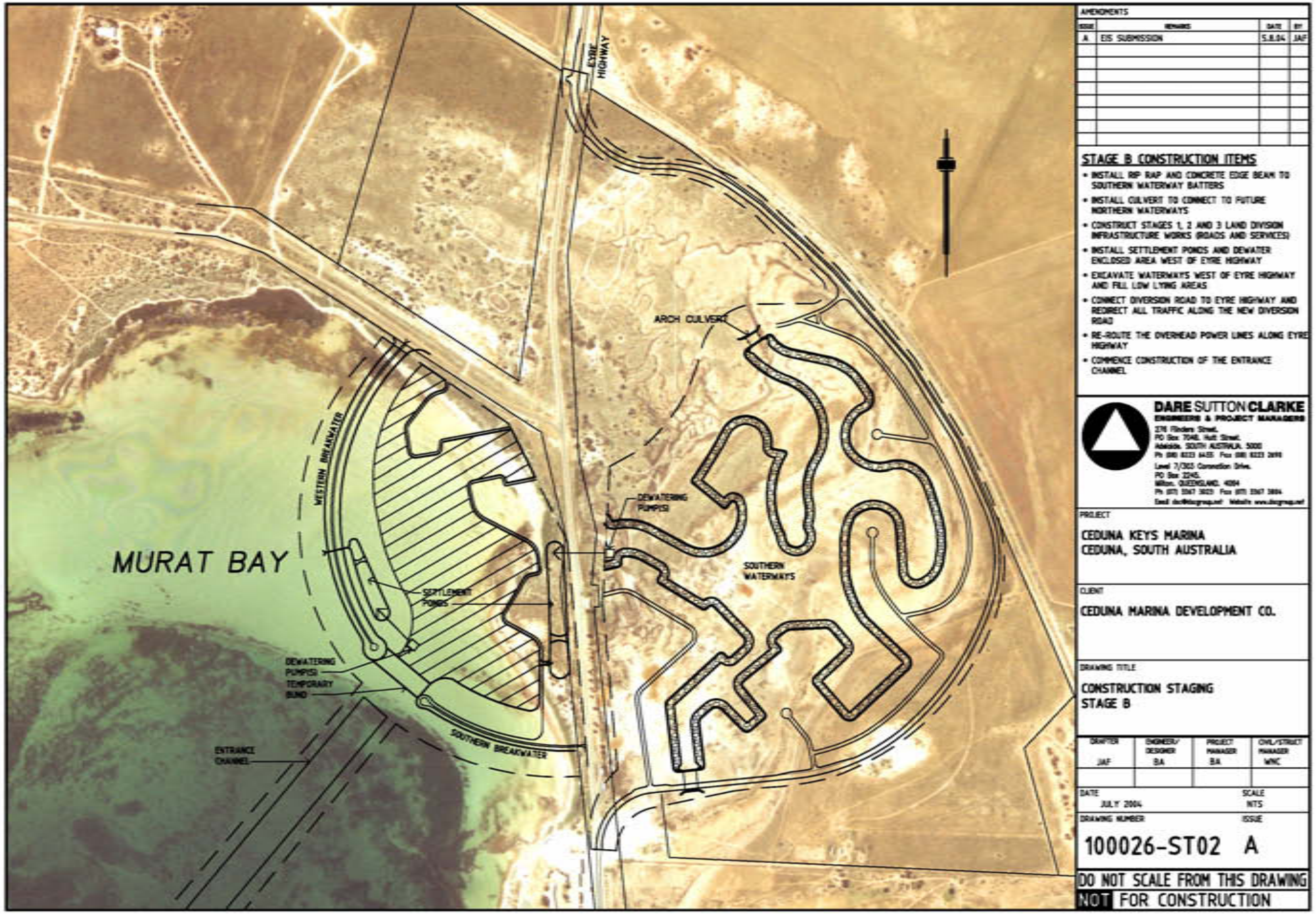
Figure 10.2 Construction Sequence Stage B



AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE B CONSTRUCTION ITEMS

- INSTALL RIP RAP AND CONCRETE EDGE BEAM TO SOUTHERN WATERWAY BATTERS
- INSTALL CULVERT TO CONNECT TO FUTURE NORTHERN WATERWAYS
- CONSTRUCT STAGES 1, 2 AND 3 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)
- INSTALL SETTLEMENT PONDS AND DEWATER ENCLOSED AREA WEST OF EYRE HIGHWAY
- EXCAVATE WATERWAYS WEST OF EYRE HIGHWAY AND FILL LOW LYING AREAS
- CONNECT DIVERSION ROAD TO EYRE HIGHWAY AND REDIRECT ALL TRAFFIC ALONG THE NEW DIVERSION ROAD
- RE-ROUTE THE OVERHEAD POWER LINES ALONG EYRE HIGHWAY
- COMMENCE CONSTRUCTION OF THE ENTRANCE CHANNEL

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DRAWING TITLE
CONSTRUCTION STAGING
STAGE B

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
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Figure 10.3 Construction Sequence Stage C

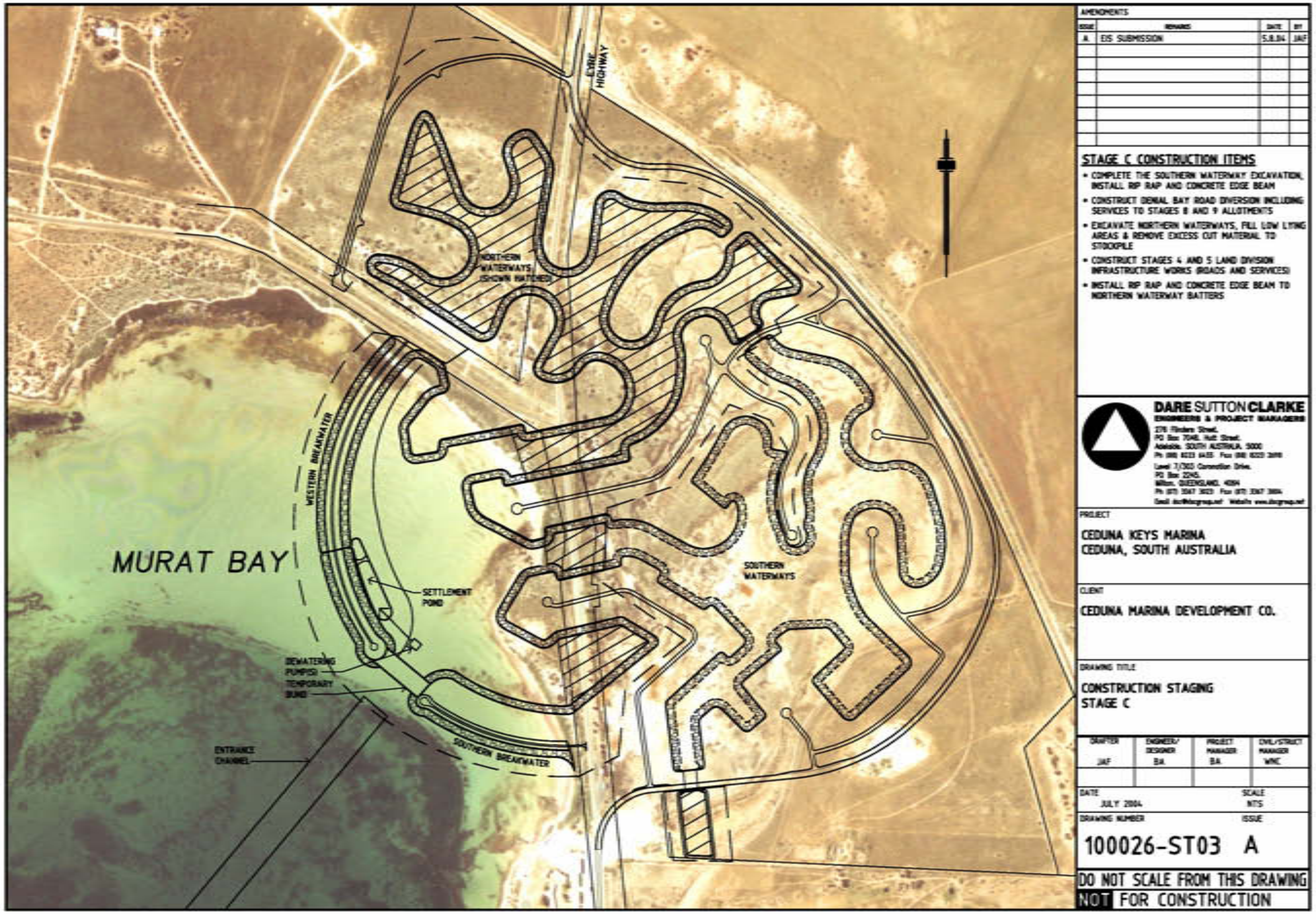
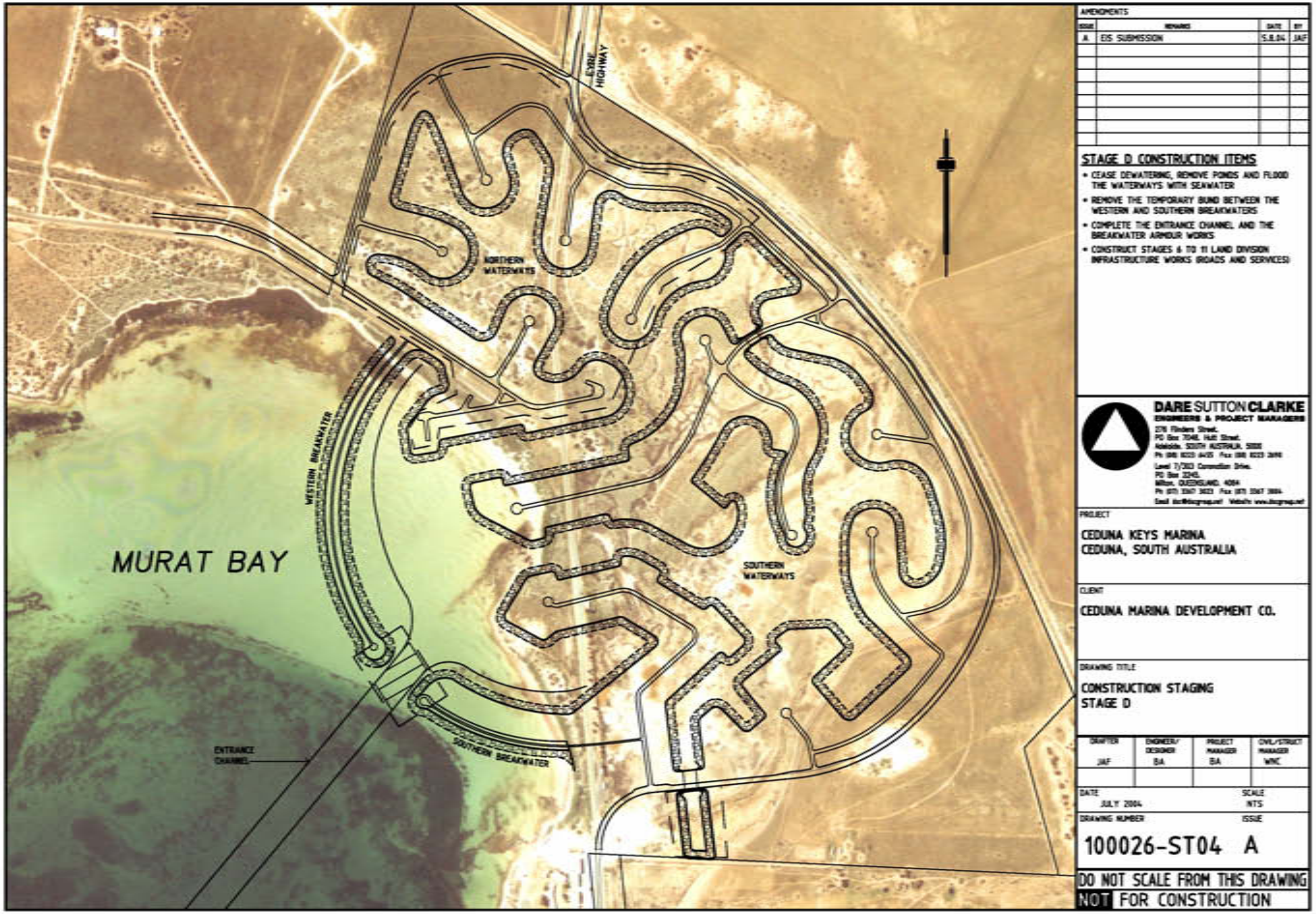


Figure 10.4 Construction Sequence Stage D



AMENDMENTS

ISSUE	REMARKS	DATE	BY
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STAGE D CONSTRUCTION ITEMS

- CEASE DEWATERING, REMOVE PONDS AND FLOOD THE WATERWAYS WITH SEAWATER
- REMOVE THE TEMPORARY BUND BETWEEN THE WESTERN AND SOUTHERN BREAKWATERS
- COMPLETE THE ENTRANCE CHANNEL AND THE BREAKWATER ARMOUR WORKS
- CONSTRUCT STAGES 6 TO 11 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)

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STAGE D

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
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10.3 Elements of the Environment (Construction) Management Plan

10.3.1 Coastal Acid Sulphate Soils (CASS) Management Plan

Reference to the South Australian Coastal Atlas on www.atlas.sa.gov.au indicates that there are two areas marked as Potential ASS (Mangrove) and Potential ASS (intertidal) that lie within the development site. These are located on the coastal side of the Eyre Highway adjacent to the headland that lies to the south of the proposed entrance channel.

No potential acid sulphate soils were encountered during the investigations undertaken by Coffey Geosciences. The investigations did however terminate above the expected waterway excavation depth due to the influx of groundwater.

Nevertheless it is recognised that acid sulphate soils can be very destructive to the environment therefore before any development takes place it is proposed that further detailed soil analysis plus surface water and groundwater monitoring be undertaken by a qualified ASS scientist. The analysis will be undertaken in accordance with South Australian Coast Protection Board publication Coastline No 33 January 2003 "A strategy for Implementing CPB Policies on Coastal Acid Sulphate Soils (CASS) in South Australia"

Based on the results of the investigations a long term CASS Management Plan that includes remedial actions at each stage of the development will also be prepared. The plan will include contingency measures in case unexpected complications arise.

The strategy will not only include deeper and detailed geotechnical investigations to more accurately determine the geotechnical and chemical properties of the soils to be excavated and reused within the site but also the collection of water samples for determination of acidity, soluble iron, aluminium and heavy metal concentrations. These investigations will include further assessment of the potential for generating acid sulphate soil conditions. Even if not discovered during investigations the environmental management plan will include techniques for identifying, isolating, handling and on site containment of potential acid sulphate soils in case these conditions are encountered during excavations. Particular attention will be paid to sampling and testing surface water and groundwater on a regular basis so that acidic discharges or soluble toxic metals greater than Marine criteria are not discharged into Murat Bay.

10.3.2 Soil Erosion and Drainage Management Plan

A most important element of the Construction EMP is a Soil Erosion and Drainage Management Plan. This soil erosion and drainage management plan will apply to both the construction and operational phases of the development. As outlined in the EPA Code of Practice, this is required to minimise offsite environmental impacts and also is to the benefit of the Proponent, reducing downtime from poor site conditions, loss of materials and site remediation costs.

To a great extent the most likely method of construction and the construction sequence of the residential allotments, provision of services, construction of the marina waterways etc. as indicated above, minimises the potential impacts on marine water quality because of the dry construction site. That is, the marina waterways would only be flooded by seawater, with the removal of the temporary bund when the majority of construction activities are finished and, to a significant extent, disturbed areas have been stabilised. Key elements that would be included in the plan area as follows:

The work is to be undertaken in the dry. Geotechnical investigations (see DSC 2004, Working Paper 1) indicate that groundwater is located at a depth equivalent to about mean sea level. Therefore, dewatering from a purpose-built low-lying location would be required. The water would be discharged into a custom-built detention pond, constructed from bunds.

The detention pond would be sized and configured to accommodate the dewatering and the pumps would also handle any stormwater entering the construction site.

Within the detention pond, due to settlement, turbidity/suspended solids would decrease prior to any outflow to the bay. The quality, particularly turbidity levels would meet the requirements of the EPA. Due to the presence of clays, some of the turbidity may be persistent. This would be monitored. If required, a suitable flocculant could be employed, e.g. alum, to ensure turbidity levels are within an acceptable range.

Interim general stormwater runoff and erosion controls such as earth bunds, swales and sedimentation basins would also be put in place for the period prior to the construction of roads and services.

The extent of disturbed areas at any one time would be minimised as follows:

Site Access:	Access to the site would be available only as directed. Access would be restricted to controlled egress points from surrounding roads.
Compound:	Confine all site accommodation, materials storage and construction equipment not in use and/or repairs to a designated site compound. Locate the compound to minimise nuisance to the surround area, to the approval of Council.
Proximity:	Confine machinery operations to a maximum of 10 m from all areas to be excavated.
Haul roads:	Prior to starting any operations on site, submit a marked up site plan showing the locations of temporary haul roads. Upon approval, peg the route of these roads and confine all future operations by plant and equipment to these areas.
Re-establishment:	Restore or stabilise disturbed, compacted or spoiled ground not required to be varied, as part of the works to the condition existing at the commencement of the work.
Damage to roads:	Repair any damage to roads or other structures caused by the actions of the Contractor in executing the works. Maintain the existing streets in the area in a clean state to the satisfaction of the local Council.

Soil erosion would be minimised by planning and carrying out the work to avoid erosion, contamination and sedimentation of the site, surrounding areas and drainage systems, and adopting such measures as may be necessary for erosion control, including the following, where applicable:

- Staging of operations (e.g. clearing, stripping).
- Temporary drains and catch drains.
- Diversion and dispersal of concentrated flows to points where the water can pass through the site without damage.

- Spreader banks or other structures to disperse concentrated runoff.
- Temporary silt fences and/or hay bales.
- Sedimentation ponds.
- After each rain the site would be inspected, with cleaning and repairing temporary erosion and sediment control works if required.
- Temporary erosion control measures would be removed when they are no longer required.

10.3.3 Entrance Channel

Overall, the environmental effects of the construction of the channel depends upon:

- The extent of construction.
- The method of construction.
- The duration of the construction period (and intermittent nature of operation – continuous, or a few hours/day).
- The nature of the materials being excavated.

Importantly, there would be no offshore disposal of excavated material.

Extent of Channel and Excavation Works

Seaward of the breakwaters the entrance channel will be excavated to -4.0 m AHD to provide a minimum water depth of 3.0 m below local datum (Indian Springs Low Water). The local Admiralty Charts indicate a water depth of about 1.8 m at the end of the breakwaters grading to a water depth of 2.8 m at a distance of about 800 m seawards from the breakwaters. The depth of channel excavation is expected therefore to range from a maximum of about 1.2 m at the breakwater opening grading to zero over a maximum distance of about 1000 m.

Depending on the ground conditions excavations will either be by a barge-mounted excavator (or clamshell) or by a cutter suction dredge.

It is anticipated that the deeper near shore excavations will encounter limestone and possibly harder rock under the surface sands and may need to be excavated by an excavator. Off shore in the deeper waters where the depth of excavation will be less it is anticipated that a cutter suction dredge may be an appropriate means of excavation.

The dredged material will be pumped via a floating discharge line to a 45,000 cubic metre capacity, purpose built holding basin located adjacent to the southern breakwaters. The basin will be configured to reduce flow through velocities and encourage the suspended solids to settle before the water is allowed to return to the bay. The location of the on-shore holding and sedimentation basins is shown on Figure 10.5.

Up to 10,000 m^3 of barged or trucked material will be allowed for. This material will be stockpiled on the surface of a previously filled area to facilitate drying before use as fill material.

In deeper waters (greater than 2 metres at low tide or -3.0 metres AHD) the batters will not be prone to damage from waves and can be laid back at a slope of 1 in 3 without further protection.

In shore (less than 2 metres at low tide or -3.0 metres AHD) where the batters may be prone to damage from wind and/or boat-generated waves they will be laid back at 1 in 3 and protected with rock rip rap, similar to that used on the breakwaters.

Investigations Prior to Channel Excavation

Prior to dredging an environmental assessment will be undertaken for the purpose of:

- Sampling and testing the soils to be dredged for the presence of contaminants greater than criteria to be established in consultation with an SA EPA approved Environmental Auditor.

  The criteria will be based on the Health Investigation Levels (HIL's) and Ecological Investigation Levels (EIL's) for soil in Table 5-A of the NEPC Guideline on the Investigation Levels for Soil and Groundwater (NEPM 1999)m, and the ANZECC (2000) Interim Sediment Quality Guidelines (ISQG).

- Selecting a location for the disposal of the dredged materials that minimises the impact on existing vegetation and groundwater.

- Assessing and establishing criteria to be complied with before water can be returned to Murat bay from the dredging process. This is likely to be 10 NTU as defined in the EPA Environment Protection (Water Quality) Policy.

- Establishment of criteria for the handling and ultimate use of the dredged soils.

The outcome of the above process is to obtain a license to undertake the dredging and all associated activities.

Monitoring

A monitoring program will be defined as part of the Construction Management Plan, refer Section 10. The scope of the program will be confirmed with the EPA, but is likely to involve:

- Prior to the dredging operation

At selected sites and tidal conditions along the length of the channel corridor, measurements will be taken of turbidity and samples collected for suspended solids/particle size analysis. The field measurements would use a combination of a secchi disc and a turbidity meter (nephelometer).

- During offshore dredging

Measurements will be taken of turbidity and samples collected for suspended solids:
- at a suitably located control site, away from the influence of the dredging;
- at 2-3 locations in close proximity to the dredging operation (within 50-100 m), and
- along the track of any observed turbidity plume.

Records will also be kept of:
- the days (dates) on which dredging occurred, and
- the total hours and time of operation.

- Holding pond water release

Measurements will be taken of the turbidity levels and suspended solids of water released to the marine environment, and at locations near the point of release (50, 100 m). Initially this should be undertaken daily to ensure that these parameters are at acceptable levels.

If monitoring indicates that predetermined acceptable levels of turbidity have been exceeded, then the dredging operation should cease until conditions improve and/or the operation is modified.

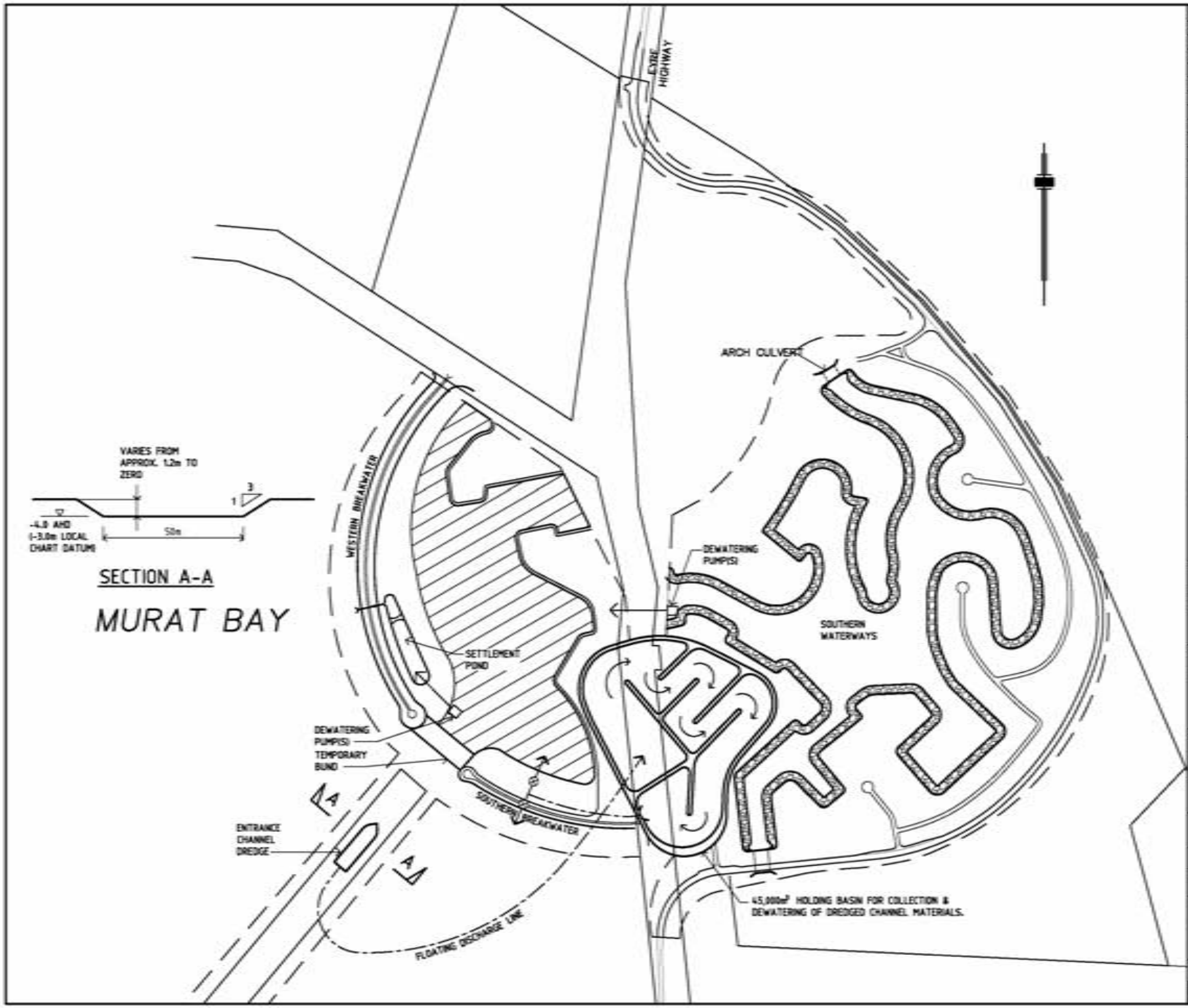
Similarly, if turbidity levels exceed those of the policy levels for marine waters, in the receiving waters adjacent the point of discharge from the holding ponds, the discharge will also cease.

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Ceduna Keys

FIGURE 10.5 EXTENT OF DREDGING AND LOCATION OF THE ON-SHORE HOLDING AND SEDIMENTATION BASINS



AMENDMENTS

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A	EIS SUBMISSION	5.8.04	JAF
B	HOLDING BASIN ADDED.	15.3.05	JAF

STAGE B CONSTRUCTION ITEMS

- INSTALL RIP RAP AND CONCRETE EDGE BEAM TO SOUTHERN WATERWAY BATTERS
- INSTALL CULVERT TO CONNECT TO FUTURE NORTHERN WATERWAYS
- CONSTRUCT STAGES 1, 2 AND 3 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)
- INSTALL SETTLEMENT PONDS AND DEWATER ENCLOSED AREA WEST OF EYRE HIGHWAY
- EXCAVATE WATERWAYS WEST OF EYRE HIGHWAY AND FILL LOW LYING AREAS
- CONNECT DIVERSION ROAD TO EYRE HIGHWAY AND REDIRECT ALL TRAFFIC ALONG THE NEW DIVERSION ROAD
- RE-ROUTE THE OVERHEAD POWER LINES ALONG EYRE HIGHWAY
- CONSTRUCT THE ENTRANCE CHANNEL HOLDING BASIN AND COMMENCE DREDGING.

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ENVIRONMENTAL IMPACT STATEMENT

10.3.4 Breakwater Construction

Construction of the breakwaters would be one of the early components of the works and can be concurrent with the relocation of the highway.

Core construction by end tipping would commence at the shoreline and proceed out along and to the required line and length. No disturbance to areas outside of the breakwater footprints other than at the entrance channel and at the shoreward links would be required or permitted during construction.

The core would be primarily constructed from crushed rock or paddock limestone to minimise turbidity. Sub armour would be placed immediately to protect the core followed later by the outer armour layer. For details of the proposed breakwater arrangement, refer to the cross section in Figure 3.3.

Both breakwaters would be joined initially to enable the landside of the site to be dewatered. If excessive leakage under or through the core occurs, a trench backfilled with clay would be constructed through the core to the depth required.

Rock that is suitable for breakwater construction would likely be sourced from existing quarries within about 40 km or so from the site.

As discussed in Section 6.11.2, culverts or pipes in the breakwater would facilitate drainage of the intertidal flats, minimising changes to the existing drainage pattern, which might otherwise impact fauna. In the short term, however, as the construction of the breakwater would take months, a temporary drainage line might be put in place to prevent short term effects.

10.3.5 Batter Construction

All edges within the waterways will be constructed to a slope of one vertical to two or three horizontal and protected from the action of wind and vessel generated waves by a geofabric filter cloth under a 600 to 700 mm thick layer of rock (riprap).

The source of rock will be similar to that used for the breakwater armour. The rip rap will extend below the lowest tide level to provide protection from propeller wash.

A small concrete or sandstone retaining wall would be provided at the top of the rip rap mainly for aesthetic purposes but can also function as a launching point for pontoon gangways.

10.3.6 Spoil Storage and Disposal

It would be required that the following materials be removed from the site, to a location agreed with the Superintendent and Council:

Surplus excavated materials;

Excavated material not reusable as filling;

All perishable material, rubbish and debris resulting from site clearing; and

Disposal of all material shall conform to EPA requirements. No material would be burned on site.

10.3.7 Weed Management

Bare soils would quickly become colonised by weeds. Disturbed areas such as vehicle parking, unvegetated areas, wheel tracks etc, provide opportunities for weeds.

To minimise this:

- weeds shall eradicated by spraying prior to construction;
- bare ground shall be stabilised as quickly as possible. This would be done as part of the Soil Erosion and Drainage Plan to minimise soil loss and sedimentation. It would also reduce weeds by using appropriate species, including temporary cover (sterile rye grass) until the landscape plan is implemented;
- off site parking is to be avoided by appropriate bunting to demarcate no go areas;
- washing of vehicles as proposed for the removal of dirt (to prevent soil on roads)

10.4 Protection of People, Property and Structures

The Construction EMP would address the following:

Until the Eyre Highway diversion is complete, the contractor would be required to restrict earthmoving activities to either side of the highway to minimise the movement of earthmoving equipment or trucks across the roadway.

Access with appropriate signage from the site on to Eyre Highway would be limited to one or two predesignated locations selected and designed by a traffic engineer.

As indicated earlier, management of the construction of roads and services, which would be undertaken in stages commencing from the south, would include the control of stormwater, erosion, dust, noise, access and safety. Access to the site from the Eyre Highway would be restricted to predesignated locations and closed off to the general public. With respect to the construction of the highway, the following measures would be included in the CEMP:

Construction of the proposed diversions for Eyre Highway and Denial Bay Road along their proposed new routes would be required before the waterway links to Murat Bay can be completed.

Clearing, filling, compacting and pavement construction activities would be carried out using normal road building techniques incorporating the control of dust and stormwater.

The existing communications, power, water and any other services that exist within the current road corridors would be either diverted along the new routes or laid below the new waterway invert.

Upon completion of the connections between the existing and new roads, traffic would be diverted and the old roads closed to prevent public access on to the site.

All pipes, poles, conduits, walls, fences, buildings, railway, and any other structures, utilities and property within the vicinity of work should be maintained in their places and protected from damage.

Dewatering would be monitored as necessary to ensure no excessive movement of the adjacent railway line or buildings, particularly due to dewatering of large areas.

Due notice should be given in writing to the owner of any property or utility that may be affected by construction operations prior to commencement of such work. There should be liaison with the relevant authorities to determine acceptable protection measures.

Should alterations to existing underground services be required by nature of the design, the necessary arrangements should be made with the appropriate authorities for the alterations having first provided 7 days notice. All existing services shall be protected from damage and interruption during construction and shall always be accessible.

There should be no excavation by machinery within 1 m of existing underground services without prior approval.

Warning devices are to be supplied, erected and maintained (lighting, road signs, etc.), for the duration of the work in accordance with AS 1742.3: Traffic Control Devices for Works on Roads.

Proper and adequate safeguarding of the works, including both fixed and unfixed material on the site, during both working and non-working hours is to be provided. All measures are to be taken, including the provision of warning lights, fencing and the employment of a watchman or watchmen and/or safety patrol services as may be necessary for this purpose.

All appropriate precautions should be taken to minimise noise, dust, mud, vibration and any other nuisance. Agreements should be obtained with appropriate authorities with respect to roads which may be used for importing materials and removing spoil. Wheels of vehicles should be cleaned as necessary to ensure against spoiling of local roads. All roads affected by construction activities should be cleaned to the satisfaction of the Superintendent.

Explosives should not be used without written permission of the Engineer. Where use of explosives is permitted, surveys of surrounding structures shall be made in the presence of the Engineer and a record made with photographs taken as may be necessary. Monitoring of the situation shall be carried out and all necessary making good provided.

Work should be organised and conducted so as to minimise inconvenience to residents near the site of the works by the control of noise, vibration, dust, mud and any other nuisance. Plant shall be fitted with effective silencing equipment.

In particular, the following conditions shall be observed:

Contractor

- Planning of site works to minimise the areas to be worked in at any one time.
- Planning of construction works to minimise noise generation.
- All works shall be carried out work in accordance with the current version of the Environment Protection (Industrial Noise) Policy.
- Working hours shall be from 7am to 5pm, Monday to Friday, and 7am to 1:30pm on Saturday, unless otherwise approved by the Superintendent and the EPA.
- Only machinery which has been fitted with appropriately maintained silencing equipment shall be used on site.
- Equipment shall be operated in a manner which minimises noise.
- Equipment shall be shut down or throttled when it is not in use.
- Equipment shall not be operated if repairs would eliminated or significantly reduce noise resulting from its operation.
- Site personnel shall be trained in operating equipment in a manner which minimises noise.
- Nearby residents and businesses shall be notified of potential Contractor increased noise levels and the likely duration of the works prior to commencement of work on site.
- If environmental noise criteria are exceeded the Superintendent shall instruct the Contractor to make immediate changes to site operations to ensure future compliance. If future monitoring demonstrates further non compliance, the Superintendent shall instruct the

Contractor to stop work; and site works shall only resume after the Contractor has implemented changes to work practices that will ensure future compliance.
- Maintenance of complaints register and immediate response to complaints.
- Supervision and monitoring (Superintendent).
- Review of Contractor's planning, site layout and program.
- Supervision of site works.
- Noise monitoring during construction works.

Monitoring:

- Monitoring will be undertaken using a hand held noise level meter, capable of measuring the 'LAeq,T' value of noise level. The noise level meter will be calibrated prior to each use.

- Continuous monitoring will be undertaken for approximately 1 hour at each monitoring location for each monitoring event with the 'LAeq,T' value recorded for each event. The monitoring location shall be selected on the basis of proximity of a residence to the construction activities.

All work shall be conducted so as to ensure the least possible obstruction to traffic. The convenience of the public and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

In particular, all necessary steps should be taken at all times to safeguard and ensure the safety of any person who may enter or trespass upon any part of the works.

Fencing or barriers should be provided to prevent or limit access to the works and in particular to prevent access of unauthorised motor vehicles to the works area.

10.5 Protection of Existing Dune Areas

Dune areas to the south west and north, which are immediately adjacent to the proposed development, will be protected by:

fencing, to designate them as "no go" areas;
preventing any surplus spoil being stored on or adjacent these areas; and
preventing any vehicles being parked on or immediately adjacent these areas.

10.6 Operational Environmental Management Plan

As outlined in the previous sections, to a significant degree, the design of the marina minimises potential environmental impacts, for example, by the provision made for ballast water, sewage and grey water disposal facilities for boats, the disposal and/or reuse by irrigation of sewage effluent and the incorporation of water sensitive urban design measures.

For the long-term operation of the facilities it is understood that an Operational Environmental Management Plan (OEMP) is required, in order to:

- ensure high standards of operation and maintenance of necessary infrastructure (stormwater, bunding, etc);

- ensure that environmental protection remains an ongoing primary management objective by marina operators;

- include actions within the plan such as an oil spill response plan, and ensure that equipment is on hand and that future operators are familiar with the response plan;

- ensure that standards of environmental management do not decline with the passage of time, by including periodic reporting at a frequency to be determined by the EPA (possibly every two years); and

- ensure that appropriate actions are taken to maintain infrastructure and any actions are taken as necessary if monitoring (e.g. water quality) indicates a problem is developing.

The main elements of an ongoing OEMP are outlined in the following sections.

10.6.1 Infrastructure Maintenance

General ongoing marina management for waste water and rubbish have already been outlined:

- Section 6.23 – Sewage Treatment and Rubbish Collection for Commercial and Recreational Boats

- Section 6.24 – Waste (rubbish) Management – domestic and tourist

- Section 6.25 – Management of Black and Grey Water

Other items documented in an ongoing OEMP would include:

- Inspection of GPTs after rainfall events and removal, as necessary, of accumulated materials.

- Annual inspection of the detention basins to determine the rate of accumulation of material, with removal as necessary to maintain adequate hydraulic capacity.

- Annual inspection of all bunds to ensure that they remain functional.

- Annual inspection of all other infrastructure, including pipework for pump out facilities for boats, to ensure early detection of any developing leaks.

- Annual inspection of all structures, stormwater system, etc.

10.6.2 Spill Contingency Plan (Oils and Sewage Leaks)

An oil spill contingency plan would be prepared which would define:

- Response strategies in the event of a spill.

- Containment procedures.

- Clean up procedures.

The plan would be developed in consultation with the EPA and Transport SA. Personnel would be trained in its use. The plan would also outline:

- Emergency contacts

- Reporting requirements

- Post-spill monitoring

Council is also an active participant in oil spill response training that is held regularly at the Thevenard Port. A wide range of clean-up systems and materials are maintained at

the facility, which can be called on in the unlikely event of a spill. The Ceduna SES unit has a marine response unit who also participate in the oil spill response training.

With regard to sewage leaks, it is important to note that Council would be ensuring that design and construction standards of all sewerage collection and pumping systems allow for:

- Sufficient storage times to allow for back-up operation procedures to be put in place to prevent any chance of overflows.
- Dual pump systems are installed at each site.
- Telephone dialler/pagers are installed to ensure operators are aware of any station faults.
- External power sockets are fitted to allow for the operation of the pump station utilising council's portable generating set during times of extended power disruption.

10.6.3 Floating Rubbish/Debris

The marina structures and waterways would require regular cleaning, to remove floating debris (seaweed debris) and any rubbish (bottles, containers, etc.). This would be identified as part of a regular schedule of activities.

10.6.4 Vessel Speed Control

Signage would be erected around the waterways, advising of boat speed limits. This is necessary to avoid sediment resuspension and damage to banks from boat wash.

Speed controls, generally limited to 5 knots, would be enforced by the Marina Manager, and according to Harbours and Navigation Act, 1993.

Further details in this respect are provided within Section 11 of this report and would be reinforced via the use of the Management, Maintenance and Monitoring Agreement.

10.6.5 Terrestrial Weed Control

As outlined earlier, weed management would be an important objective of:

- The Construction Environmental Management Plan (refer Section 10.3.7)
- The detailed landscaping plan prepared for the project. This would require a weed management plan for the establishment and maintenance period (probably to three years)
- The ongoing management of the project

It is intended that there also be controls on the species used by individuals in gardens, to ensure inappropriate species are not introduced. This would be achieved via the Land Management Agreement and education of the community.

10.6.6 Marine Pest Plants and Animals

It is recognised that the proposed marina presents a risk of marine pest introduction as a result of:

- Construction activities – marine pests could be transported by equipment used in the marina excavation or offshore channel excavation, if the equipment used has previously been in areas where pests are present.

- Vessels bringing in marine pests – visiting vessels or vessels based at the marina but which have been at other infected locations are major vectors.

Initially, the marina, following construction, will be colonised by species from adjacent areas, particularly the more opportunistic species. This is part of the natural colonisation process. This was observed at Lincoln Cove Marina, as described above. Introduction of marine pests during this early period may favour a more rapid spread of the organism within the marina waterways.

In addition to whatever measures can be taken to minimise risk, early detection of any introduction provides the best opportunity for eradication, before the pest spreads to surrounding waters, or is transported to other facilities.

It is proposed to undertake the following:

- for the first 5 years, an annual inspection will be undertaken of the marina waterways/structures by qualified personnel (probably PIRSA personnel);
- after 5 years, subject to advice and recommendation from PIRSA, it is likely that inspections will be undertaken every 2 years;
- all equipment brought to site will be cleaned before use;
- an awareness campaign will be developed for new residents of the marina, boat owners and the fishing/aquaculture industry, which may include distributing information in the form of pamphlets with photographs of species of concern, signage, etc;
- controls/advice on aquarium species; and
- keeping a register of boat movements. This will be a task for the marina manager.

Boat hull cleaning will not occur at the marina. Facilities are being provided at Thevenard for this purpose. This is not within the responsibility of the marina operators, but it would be appropriate that safeguards are incorporated into the hull cleaning operations.

10.6.7 Maintenance Dredging

As there appears to be little sand movement in this part of Murat Bay it is anticipated that maintenance dredging of the channel would be an infrequent requirement.

For future maintenance dredging the most suitable methods and disposal of excavation material would be discussed at the time with the Coastal Protection Board and the relevant Agencies.

At this stage the likely frequency is unknown. Further geotechnical work is still to be done to define the nature of substrate materials.

It is to be noted that there have been numerous studies of the environmental effects of maintenance dredging activities, including in South Australia, interstate and overseas. Invariably these indicate in similar situations the effects on bottom communities and water quality is localised and transitory. In this instance it is also very unlikely that this would disturb contaminated sediments.

10.6.8 Management and Reporting

The CEMP would clearly identify:

- Individuals and their responsibilities (including contact details).
- Emergency contacts.
- Training procedures for new personnel.
- Reporting schedule to the EPA (assume every 2 years at this stage) and reporting formats.
- Data from the water monitoring programme (probably monthly sampling) would be regularly reviewed. The EMP would outline procedures for providing these data to the EPA, and response procedures in the event that monitoring data indicates a potential problem.


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11. MANAGEMENT MAINTENANCE MONITORING

11.1 MMM Agreement

As identified earlier within this statement, there would be a need to prepare and enter into a Management Maintenance and Monitoring (MMM) Agreement between the Proponent and the District Council of Ceduna. This agreement is to be drafted and executed prior to the implementation of the development and would clearly identify the respective roles and responsibilities of parties in respect to the implementation and operation of the development,

This MMM Agreement would reinforce many of the requirements already set out in the Land Management Agreement together with the construction and operational requirements to be articulated within the Environmental Management Plan as discussed in the previous section. The MMM Agreement would also set out transfer of roles and responsibilities from the Proponent to the Council over the life of the development further to the Development Agreement.

As the MMM Agreement would need to have regard to various technical and performance measures that would be developed and agreed between parties to the agreement, there would be need to finalise this document once engineering designs and implementation plans have been completed. Additional work would be required following approval in order to draft and settle this document. Nonetheless, the key subjects and desired outcomes are identified below.

11.2 Waterway Depths & Maintenance

The agreement would set out that the channel is to be constructed so as to achieve a minimum navigable depth of – 4.5 metres AHD at the practical completion of the development. The construction and maintenance of the channel to this required depth would be the responsibility of the Proponent for a specified period.

Should this require additional works and maintenance than that associated with construction such would be at the expense of the Proponent, with Council being able to require such work within a nominated period. This would ensure that waterways continue to be safe and navigable by vessels visiting or moored within the marina.

Should the waterways fall below the required standard, and the Proponent not undertake the required works within the specified time period then Council may undertake the works with the expense recoverable from the Proponent. The exact mechanism for such recovery is yet to be determined.

The agreement will also address the ongoing responsibility of Council in respect to the repair and maintenance of revetment walls and breakwaters over time, acknowledging that individual property owners have the initial responsibility to maintain and repair revetment walls. Council would however be ultimately responsible for this task with powers to recover costs from individual property owners that fail to meet their responsibilities in this regard.

11.3 Water Quality & Marine Organisms

The Proponent would be required by the agreement to establish and implement a water quality regime so as to avoid harm to the marine environment. As described earlier within this report, this water quality program would not only be undertaken within the waterways but also external to the development within the wider Murat Bay area.

This water quality monitoring and testing program would also assist in the early detection of pest plant and marine organisms. Early detection would enable prompt response in accordance with the standard operating procedures to be set out within the MMM Agreement and thereby avoid environmental harm.

As with maintenance of the waterways, there would be a requirement for the Proponent to undertake such testing, and if in the event that such ceases to occur, then Council may assume the role and thereafter seek to recover expenses from the Proponent. Following a specified period of time the responsibility would transfer from the Proponent to Council.

11.4 Safe Navigation

The MMM Agreement would set out the requirement for the provision of appropriate navigational aids and other devices required to be installed within the area so as to enable vessels to safely navigate the waterway reserve. The Proponent would be required to provide Council with specifications and plans designating the location of such devices.

These devices are then to be installed according to the direction of Transport SA (Marine Operations Branch) and to the reasonable satisfaction of the Council, and would be at the Proponent's expense. The maintenance of these devices within a nominated period would also be the Proponent's responsibility.

Thereafter the Council would be responsible for the up keep and replacement of these devices as required in order to maintain safe navigation by vessels. This agreement would also clearly point out that Transport SA is not responsible for the costs associated with such devices or liable for any loss arising as a result of these devices.

11.5 Activities within Marina

As set out in the LMA, the Proponent would establish a Community Corporation under the provisions of the Community Titles Act 1996 in respect to marina berths and associated facilities, with By Laws prepared under this Plan of Community Division that would reinforce the operation and management requirements in respect to the use of these berths.

The construction, management and maintenance of these berths would be the responsibility of the Proponent for the initial period identified within the agreement and thereafter the Community Corporation, to which Council would be a party and have ongoing management and decision making powers according to the By Laws.

The construction of the marina berths and associated facilities are to be in accordance with Australian Standard 3962-1991 – guidelines for the Design of Marinas and other technical guides as specified. The Proponent would also ensure that appropriate quality control procedures are in place as part of the construction and commissioning of the development.

The Council would be required to appoint an officer of the council to be the Marina Manager of the facilities who would have responsibility for the care and control and management of the waterways and other facilities within the development particularly in respect to safe navigation and public safety and would enforce the Bylaws made by the Community Corporation.

The agreement would set out a requirement for the Proponent to contribute to the costs associated with the appointment of the Marina Manager to an agreed percentage split. The Proponent would also be required to develop a procedure and response action plan to manage spillages and pollutants which enter the waterways and the remediation of the waterways affected.

The Marina Manager would be responsible for reporting any spills or incidents that present an environmental risk to the appropriate authorities including Council and the Environment Protection Authority. The Marina Manager would also be responsible for the deployment of any immediate clean up measures and procedures including booms and other containment measures.

A range of other general and mores specific environmental reporting, monitoring, response and management responsibilities would be identified within the MMM Agreement, many of which

would be the immediate responsibility of the Marina Manager to implement, so to satisfy the General Environmental Duty of Care under the Environment Protection Act 1993.

11.6 Recreational Berths

The recreational marina berths and the waterways associated with the marina would be subject to conditions of use that would be reflected in the By Laws under the Plan of Community Division, the LMA and Council By Laws should they be required. In summary these requirements would be as follows:

- Only recreational vessels would be able to use the designed marina berths with all commercial vessels to be moored within the designed area for this purpose;
- Vessels are to be secured at all times when not in use;
- No major repairs to vessels are to occur in the Marina facility with any minor repairs to be undertaken with the consent of the Marina Manager;
- Sunken vessels are to be promptly removed;
- No refuse, pollutants or other materials are to be dumped or otherwise disposed of in the water of the marina facility;
- A register of ownership of vessels to be kept by the marina manager;
- The Marina Manager must ensure that any foreign vessels and its occupants and contents which enter the marina has been granted the necessary approvals by government authorities and agencies to be present in SA Coastal waters; and
- Noise levels are to be within guidelines acceptable to the Council.

11.7 Commercial Berths

The MMM would specify a minimum number of commercial berths that would be made available to fishing and aquaculture operations. In addition to the initial consideration for the purchase of tenure, the MMM Agreement would clearly establish that Council may levy a rate from these commercial berths. Such a rate would assist in the management and maintenance of this facility.

Full engineering and as constructed plans, including cross sections, are to be provided to Council for the commercial marina berths together with a quality plan and controls to ensure that they are constructed to appropriate standards and technical guides. The Agreement would also outline the requirement for final inspection at the time of practical completion.

As with the Recreational Berths, the Proponent would ensure that the occupiers of the commercial berths:

- Allow only commercial vessels to be moored at the berths;
- Not allow any other vessel to enter the area of the commercial berths;
- Ensure every vessel is properly secured at all times;
- Ensure no repairs to commercial vessels occurs, (except minor repairs);
- Ensure sunken vessels are promptly removed;
- Ensure noise levels are able to be within guidelines in the Corporation’s Bylaws and acceptable to the Council;

- Ensure no refuse, pollutants or other materials are dumped or otherwise disposed of, in the waters surrounding the commercial berths;
- Immediately take such action to remove such materials, which enter the waters or otherwise remediate the waters as directed by and to the reasonable satisfaction of the Manager, Council or relevant government agency.

Provision would be made to enable the Proponent or the Council to seek the occupiers of the commercial berths to remedy any default of breach of this Agreement and if not complied within a specified period of time would provide the power for Council to take action with the ability to recover costs.

The Agreement would also require the Project to develop and implement a procedure and policy to the satisfaction of all relevant authorities and the Council for the management of spillages and pollutants which enter the waterways and remediation of the waterways affected thereby, and fire.

The agreement would also seek to ensure safe navigation and use of the commercial berths in accordance with the provisions of the Harbours and Navigation Act, 1993.

In the event that any owner, occupier or user of a commercial berth pollutes or otherwise harms the environment of the area near of adjacent to the commercial berths, the agreement would require the Proponent to immediately make a report to Council and any other relevant authority.

If in the event that any owner, occupier or user of the commercial berths pollutes or otherwise harms the environment of the area or adjacent to the commercial berths, they must compensate any or all persons who have suffered damage as a result of the pollution or any other harm.

11.8 Waste Management

The Proponent must as part of the establishment of the Marina prepare and implement a Waste Management Plan for the marina in accordance with the current code of practice for commercial users of Transport SA and Marine facilities published by the Government of South Australia, and the Best Practice Guidelines for Waste Reception Facilities at Ports and Marina Boat Harbours in Australia and New Zealand published jointly by the Australia and New Zealand Environment and Conservation Council and the Australian Transport Council.

11.9 Refuelling

The Agreement would set out the requirement for the Proponent to construct the Boat Refuelling Facility in consultation with Council in relation to the types of facilities that are to be constructed within the Boat Refuelling Facility.

Detailed design plans and cross-sections of the facility proposed to be constructed would be provided, together with assurance that the construction of the Boat Refuelling Facility complies with the relevant Australian Standard and technical guides.

The Proponent would be required to ensure that the appropriate quality controls are in place in the construction of the Boat Refuelling Facility and must notify the Council of the progress of the works from time to time and the expected date of the completion of the Boat Refuelling Facility one month prior to the practical completion of the Boat Refuelling Facility. The Proponent would be required to remedy any defects (includes latent defects) that are, or become, evident in the construction of the Boat Refuelling Facility.

The Proponent must ensure safe navigation and use of the Boat Refuelling Facility in accordance with the provisions of the Harbours and Navigation Act, 1993.

11.10 Marine Toilet Pump Out Facility

A Marine Toilet Pump-Out/Treatment Facility would be available for use by the operation of any vessel.

The Proponent would be required to consult with the Council, the EPA and the South Australian Health Commission and meet the requirements of those organizations with respect to the connection of this facility to the existing effluent disposal system for the town of Ceduna.

The Proponent must provide to the Council detailed design plans and cross-section of the facility proposed to be constructed, and must ensure the construction of the Marine Toilet Pump-out/Treatment Facility complies with the relevant Australian Standard and technical guides. Appropriate quality controls are to be put in place under the agreement in the construction and operation of the Marine Toilet Pump-out/Treatment Facility.

The Council would assume responsibility for the Marine Toilet Pump Out Facility/Treatment following a specified period of time after the date of the practical completion of the Development provided that the Proponent has remedied any defects.

11.11 Practical Completion, Hand Over & Defects & Liability Period

In terms of the construction of the marina facility, the Proponent would have a responsibility to provide regular updates to the Council as to the progress of construction and at least one month prior to practical completion provide Council for a formal advice of such.

A Defects and Liability period of a specified time is to be negotiated during which any faults would be the responsibility of the Proponent for repair or replacement to the satisfaction of the Council.

The Proponent would be responsible during the nominated period and the Council thereafter for capital upgrade, maintenance, repair and cleansing of the edge treatments of the marina waterways and other infrastructure within the marina facility. A suitable income stream would be derived by a percentage of rates generated from this facility.

As part of the land division process, land will be assigned and transferred to Council for the purposes of roads, stormwater and reserves (including noise buffer mounds). Easements will also be identified and provided in favour of ETSA utilities and SA Water for the purposes of electrical supply, water supply and sewer.

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12. GOVERNMENT LEGISLATION AND POLICY

12.1 Commonwealth Environment Protection Act

The Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act) protects matters of national environmental significance and Commonwealth land. The benefits of the Act includes; stronger protection for the environment, more consistent national environmental standards, a more efficient and timely environmental assessment and approval process; and a reduction in intergovernmental duplication.

There are seven matters of national environmental significance that are triggers for Commonwealth assessment and approval. These are;

- World Heritage properties
- National Heritage places
- Wetlands which are lister as Ramsar Wetlands of international importance
- Nationally threatened species and communities which are listed under the EPBC Act
- Migratory species that are listed under the EPBC Act
- Commonwealth Marine Areas
- Nuclear Actions

The Act also provides that:

- A person must not take an action on Commonwealth land that has, would have or is likely to have a significant impact on the environment.
- A person must not take an action outside Commonwealth land that has, would have or is likely to have a significant impact on the environment on Commonwealth land;
- The Commonwealth (including a Commonwealth agency or corporation) must not take an action which has, would have or is likely to have a significant impact on the environment anywhere in the world

The Act provides that certain actions, which are likely to have a significant impact on a matter of national environmental significance are subject to a rigorous assessment and approval process. An action includes a project, development, undertaking or an activity or series of activities.

Actions that may need approval under the Act involve some physical interaction with the environment. A project or development proposing to take an action that may have a significant impact on a matter of national environmental significance or on Commonwealth land, needs to be referred to the Commonwealth Environment Minister before the action is taken.

In June 2002 the District Council of Ceduna submitted an application to Environment Australia for decision whether or not approval was needed under Chapter 4 of the EPBC Act 1999. The referral was considered under the EPBC Act and it was decided that the action would not be a controlled action. Approval has therefore not been needed under Part 9 of the Act before the action can proceed.

12.2 State Strategic Plan

The proposed development is considered to further the achievement of the following Objectives as articulated within the South Australia's State Strategic Plan which seeks to *create opportunity* and achieve 79 key targets set out under six areas or topics.

- growing prosperity
- improving wellbeing
- attaining sustainability
- fostering creativity
- building communities
- expanding opportunity.

The State Strategic Plan is an overarching document that is used by government to guide areas of endeavour including the application and administration of various strategies and statutory polices. The emphasis is on achieving economic growth without compromising environmental quality. The Plan reinforces the need for an integrated and cooperative approach to face the challenges and work on the solutions. The Plan's success depends upon the support and participation of all South Australians.

The State Strategic Plan identifies the following Objectives and key points. Key points of particular relevant to the proposed marina development are highlighted (my underlining) for consideration

Objective 1: Growing Prosperity

Our priority is sustained economic growth resulting in rising living standards, with all South Australians sharing in the benefits through more and better job opportunities and accessible, high quality services.

- Sustained economic and jobs growth
- Investment in education and skills
- Reduced social and economic inequality
- Enhanced quality of life
- Increased productivity
- Increased population
- Sharing in future prosperity
- Increased exports
- Focus on innovation and R&D
- Sound financial management
- Adequate strategic infrastructure
- Business climate that encourages investment
- Partnerships between government, business and community

Objective 2: Improving Wellbeing

Our priorities are to focus on further improving our quality of life and the wellbeing of the community and individual citizens. The focus would be on being healthier and fitter, having less crime and feeling safer. The emphasis would be placed on preventative measures including education programs.

- Meet new health challenges
- Close the gap in our living standards
- Have protective policies for children
- Address the challenge of an ageing population
- Meet community expectations of healthcare
- Maintain lifestyle quality

- Improve the safety of South Australians
- Be vigilant against terrorism

Objective 3: Attaining Sustainability

Our priority is to make South Australia world-renowned for being clean, green and sustainable. This would boost community wellbeing, safeguard future generations and contribute to our State's prosperity. The focus would be on protecting our biodiversity, securing sustainable water and energy supplies, and minimising waste.

- Foster a culture of sustainability
- Raise environmental profile globally
- Seek creative solutions to environmental issues
- Reinforce our 'clean and green' image for food and wine exports
- Meet the challenges of water management – especially the River Murray
- Stimulate growth of environmental business
- Show national leadership in environmental management

Objective 4: Fostering Creativity

Our priority is to reinforce South Australia as a place that thrives on creativity and innovation. This capacity to do things differently will be one of the keys to achieving all of our objectives. The focus will be on fostering a culture of creativity, on developing creative, innovative and enterprising people, on investing in science and research, and in innovation infrastructure, and on converting ideas into practise.

- Build on our creative heritage
- Foster a culture of creativity - vital for economic growth
- Encourage innovation, which will drive productivity growth and create new jobs
- Apply science and technology to boost innovation
- Encourage creativity and enterprise in our young people
- Support creativity with commercial reality

Objective 5: Building Communities

Our priority is to develop South Australia as a place in which people care for each other and contribute to their communities. This will enhance our peace, pride and prosperity and build "social capital". It will also attract new migrants, visitors and investors who bring skills, resources and ideas. The focus will be on improving trust, increasing involvement in voluntary activities, building strong community networks, and increasing participation in democratic processes.

- Community and citizenship inspired by our progressive past
- Foster and harness the benefits of social networks
- Enrich the community through volunteer groups and activities
- Strengthen regional communities in health, education and infrastructure
- Ensure equality of opportunity in access to services
- Attract people who wish to contribute to the State community

Objective 6: Expanding opportunity

Our priority is to ensure all South Australians are able to create and use opportunities that build on their talents. Restoring the State's leadership in education is fundamental, with a focus on establishing the foundations in early childhood and building the basic skills in primary school. Another priority is retaining our senior students at school so they can confidently make the transition to further education, work and community life.

- Education is the key to State growth

- Ensure parents remain confident in education system
- Retain our brightest and best students in South Australia
- Improve Aboriginal wellbeing
- Re-build confidence and self-esteem in disadvantaged people
- Support regions through effective partnerships
- Ensure an integrated approach across agencies
- Improve access to health care, education and affordable housing

12.3 Planning Strategy for Regional South Australia

The proposed development has been considered in context with the Planning Strategy for Regional South Australia, with those provisions relevant identified in Appendix D for which a commentary has been provided.

In summary the proposed development is anticipated to further many of the identified strategies for the State and the region more particularly, including a range of social and economic outcomes that may otherwise not be achieved.

12.4 Development Plan

The subject land is located partly in the Rural Living Zone, the Recreation Zone and the Coastal Zone of the Ceduna (DC) Development Plan.

The land is also within Policy Area 17 – Ceduna North as indicated on Maps Ced/33 and 34, and within Policy Area 21 – Tourist Use as indicated on Map Ced/34.

The provisions of the Ceduna (DC) Development Plan are considered relevant in the consideration of this proposal are provided an commented on in Appendix E.

12.5 Proposed Amendments to Development Plan

The District Council of Ceduna has commenced the preparation of a draft Plan Amendment Report in order to amend the Ceduna (DC) Development Plan in a manner that would provide a clear policy framework within which to assess subsequent components of the development as it is implemented.

It should be noted that the Major Development process would only apply to major earthworks, the excavation and formation of the land for the allotments, installation of marina structures, road works and land division. Approval for buildings related to residential and commercial and tourist components would be provided by the Council in accord with the relevant provisions of the Development Plan.

The following issues will be addressed in the draft Plan Amendment Report as outlined in the Statement of Intent that has been submitted to the Minister for Urban Development & Planning.

- On the basis of the 'Major Development' being authorised and effectively establishing a 'master plan' for the further development of this land, appropriate policies are required to be included in the Development Plan so as to guide future development including residential dwellings, commercial and service uses, a community centre, recreation and tourist accommodation, etc.

- The 'Major Development' process can approve the major components of the development including the breakwater, sheltered waterways, marina berths and related facilities, land for residential dwellings and the supporting road network, infrastructure services and major engineering structures including the realignment of the Eyre Highway.

- As this development would be implemented in a number of stages over a period of time that would be influenced to a large extent by commercial decision including take up rate of residential land opportunities, there is a need to ensure that these stages and the various components within are undertaken in a manner consistent with orderly and proper planning.

- Policies would be introduced to address a range of development issues including the appropriate use of land and management of potential conflicts, the scale and intensity of future development in particularly in relation to commercial, tourist accommodation, entertainment and recreational facilities, together with policies that address built form, site planning and appearance.

- The ultimate success of this marina development would be based on adherence to the 'master plan' in terms of the layout and arrangement of key uses and the achievement of a desired future character via building types and designs together with other urban design considerations such as set backs, fencing, landscaping, and streetscape improvements.

- Any approval granted under the 'Major Development' process would go only so far in order to achieve this desired result. Current Development Plan policies are either silent or provide very little guidance as to how such a form of urban development should be implemented. There is a need for a suite of policies contained within a discrete zone or policy area that relate to the development.

- Specifically with regard to built form, policies are required that provide guidance to the form and appearance of dwellings within the marina addressing such matters as height, character and style, set backs, privacy, shadow, open space and amenity, together with car parking and access. There is also a need to ensure that boat mooring points are appropriately designed and constructed.

- In respect to marina related development there is a need to introduce policies that would guide the design and assessment of buildings adjacent the marina berths in terms of use, built form and appearance, access for larger vehicles and the maintenance/servicing of vessels, together with policies that seek to manage the potential impacts arising from commercial uses towards residential.

- As provision has been made for tourist accommodation facilities and other related uses including limited retail opportunity, there is a need to clearly articulate the desired outcome in terms of the scale and intensity of such developments, including possibly floor area thresholds to ensure that retail activity within the marina development does not detrimentally impact on the commercial viability of existing business within the township.

- Policies are also required in order to ensure that the development integrates with adjoining uses including the golf course and that development maximizes the advantages that such offers while minimizing potential impacts and incompatibility. In particular policies that require landscape buffers and screening to features such as the railway line and the Eyre Highway are considered necessary.

- Policies are required within the Development Plan that provide a structure plan or concept plan that indicates the desired staging of development and the manner in which land division, with appropriate infrastructure services and roads, should be implemented. Minimum allotment sizes, width and depths are considered necessary in order to achieve an orderly and economic development outcome.

- Finally, and most importantly, environmental impact and ongoing management issues identified as a result of the EIS process may be addressed and responded to in the draft PAR when preparing an overall policy framework for the future development of this land that would not only address built form issues, but may also address the monitoring and

management of impacts on natural systems such as sand movement and the health of marine life in the marina site and Murat Bay.

- It is acknowledged that portion of the study area falls outside of the current municipal boundary of the District Council of Ceduna. It is intended to undertake a boundary realignment as provided for under Section 9 and 11 of the Local Government Act 1999. Council will work with the Boundary Adjustment Facilitation Panel in order to achieve this boundary alignment.

The following investigations will be undertaken in the preparation of the draft Plan Amendment Report.

- Review of Major Development

A review of the Major Development process and the approval granted for the development will be undertaken in order to determine the base or start point for the preparation of planning policy to guide the future development of this project. This will include reviewing any conditions appended to the approval together with regard being given to the approved plans and supporting documentation.

- Review of EIS and Assessment Report – Environmental Considerations

A key consideration of the Major Development process is the preparation and response to the Environmental Impact Statement and the preparation by the Government of an Assessment Report in terms of findings and conclusions, including any ongoing monitoring or management requirements so as to ensure the ongoing health of the natural environment and the continued efficient function of the development, i.e. sand movement and weed growth.

The findings of the EIS and Assessment Report would be worked into the PAR document and transposed into appropriate policy for inclusion within the Development Plan that provide guidance and key requirements in terms of the manner in which the overall development should be implemented. Specific provisions may be drafted that would require adherence to this document and implementation of requirements.

- Review of Development Plan

A comprehensive review of the Development Plan would be undertaken in terms of the implications of existing policy in relation to the proposed development. This process would be undertaken concurrent with the General PAR being undertaken by Council over the coming months. An inventory of provisions would be provided with any apparent inconsistencies or conflict identified and discussed with a view to undertaking an amendment if necessary. As the development site extends into land (or water) that is subject to the Land Not Within A Council (Coastal Waters) Development Plan, the relevant provisions of this document would need to be reviewed and amended as appropriate in order to provide a clearer path for the marina development.

- Review of Related Policy

Together with those policies contained within the Land Not Within A Council (Coastal Waters) Development Plan, the adjoining Development Plans for Streaky Bay and Land Not Within A Council Area (Eyre) Development Plan would be reviewed in detail to ensure consistency and identify any apparent conflicts that may frustrate the achievement of the marina development. Regard is also to be given to current initiatives of Planning SA in respect to Planning Bulletins, Design Guides and any impending policy contained within Ministerial PARs.

- Land and Housing Supply/Demand

While the business case for the marina development has been clearly outlined within the Business Plan commissioned by Council, this PAR would provide an opportunity for a more comprehensive land supply and demand analysis to be undertake in order to more particularly guide the formulation of planning policy that would guide the staged realise and development of residential land having regard to current and predicted market conditions.

- Retail & Commercial Capacity

Some concern has been raised by the proprietors of business within the existing business district of Ceduna in respect to the nature and scale of commercial, in particular retail uses, anticipated within the marina development.

In response to this issue Council has resolved to ensure that appropriate thresholds are put in place so as to ensure that any new retail or commercial development to occur within the marina development would not have a deleterious affect on existing business within the township. The emphasis should be on providing convenience goods and services to residents and visitors to the marina development.

An analysis of existing retail floor area and the demand for goods and services would be undertaken for the Ceduna township and the surrounding region, including the demand likely to be generated by increased tourism activity

- Industry Needs Analysis

As the proposed marina development is to service commercial vessels involved in both the fishing and the aquaculture industry, it is appropriate to consider the opportunities and constraints that the marina development presents in terms of providing shore based facilities immediately adjacent these marina berths but also in terms of access to industrial land nearby. The benefits and costs associated with these opportunities and constraints would be more particularly explored and articulated together with appropriate policy being prepared for inclusion within the Development Plan that would ensure amenity and desired future character issues are appropriately addressed.

- Transport & Movement

As part of the planning for the 'Major Development' application issues associated with access from the Eyre Highway were identified together with a need to ensure that heavy vehicle movement is not compromised. Further discussions with Transport SA would need to be provided to ensure that appropriate policy is put in place to ensure that road works are undertaken according to the requirements of Transport SA and in a manner consistent with the desired future character and function of the development.

The PAR provides an opportunity for a structure plan or concept plan to be prepared that would enable the road network and hierarchy to be confirmed and represented within the Development Plan in order to guide the various stages of the development over the coming years.

Critical is the need to minimize direct access to the Eyre Highway and still achieve a degree of permeability through the development. Together with vehicle movement pedestrian and cycle movements may be represented on a concept or movement plan that may coincide with key areas of open space and recreation.

- Urban Form & Character

The PAR provides an opportunity to represent the overall master plan for the marina development within the Development Plan in the form of a Concept or Structure Plan. This would ensure that the desired urban form and character is achieved through the various stages of the development. Such a plan would enable the Council as the relevant planning authority for subsequent stages, to ensure that approaches for significant changes may be assessed by the Development

Assessment Commission in an objective and structured manner according to the original concept and development objectives.

- Residential Design & Land Division

While the Major Development process does seek to address specific issues of residential design and land division, the PAR is a further opportunity by which to introduce appropriate policies within the Development Plan to guide future residential development in a manner that would assist in the achievement of desired future character.

In particular the maximum height of buildings should be addressed, site coverage, set backs, design and appearance, amenity in terms of privacy and shadowing, can be addressed via the Development Plan. So too, the ability for further division of land should be addressed within the Development Plan so as to provide Council with a clear basis upon which to assess such applications in the future.

- Physical Infrastructure

The provisions and arrangement of physical infrastructure including water, electrical power, and sewer can be addressed within the PAR so that appropriate policy is introduced within the Development Plan to ensure that such infrastructure can and is provided to subsequent stages of the development according to the capacity and availability of these services. Further research and investigations would be undertaken in conjunction with service providers including SA Water and ETSA Utilities.

- Open Space & Recreational Needs

As the proposed marina development adjoins the existing golf course such presents a significant opportunity to provide access top open space and address the recreational needs of future residents and visitors to the development. Further consideration would be given as part of the PAR process to ensure that these opportunities can be realized as part of the ultimate development of this site.

- Community Facilities

Further investigations would be undertaken in respect to the needs of the community in respect to the types of activities and services that should be accommodated within the proposed community centre that is a key deliverable as part of this marina development. Investigations would also be undertaken to ensure that a range of compatible and complementary uses and activities are considered for inclusion to achieve desired economies of scale.

- Natural & Cultural Heritage

While these issues would have been addressed to a comprehensive extent as part of the Major Development process, it is considered appropriate to articulate the findings of this research within the PAR document and introduce policies that provide due recognition of the natural and cultural heritage issues, in particular aboriginal heritage and former use of the land in this locality together with the need to ensure that protocols are followed when undertaking subsequent stages of the development.

- Tourism & Demand for Facilities

Further investigations would be undertaken in conjunction with Tourism SA and the Eyre Regional Development Board to further quantity and respond to the economic opportunities that tourism would generate as a result of the new marina development.

In particular, further work would need to be done in respect to the type and style of accommodation that should be provided together with the nature of facilities and activities that tourists seek from such a destination. Appropriate polices may then be drafted to respond to these opportunities.

- Landscape & Vegetation

While landscape and vegetation issues would have been addressed as part of the Major Development process, the Development Plan may be amended in order to introduce policies that require specific landscape and vegetation outcomes in so far as the land relates to the railway, the Eyre Highway and within local streets and collector roads. In effect a landscape theme may be developed for inclusion within the Development Plan to further achieve a desired future character.

- Stormwater Collection & Reuse

Appropriate research needs to be undertaken to further establish the extent to which stormwater may be collected and reused as part of the proposed development for human consumption, i.e. roof water together with secondary use from water collected at ground level for the irrigation of landscaping and potentially washing and flushing of toilets. Further work would need to be undertaken with SA Water, the SA Health Commission and Planning SA in this respect so as to achieve a viable and sustainable solution, which may then in turn be transposed into planning policy for inclusion within the Development Plan.

12.6 Environment Protection Act

Section 25 of the Environment Protection Act 1993 outlines a general environmental duty of care in so far as:

A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm

Schedule 1 of the Environment Protection Act identifies that the establishment of a marina is a prescribed activity of environmental significance for which a licence under Section 36 is required.

Part 5 of the Act provides for a range of Environment Protection Policies within which may contain mandatory provisions that must be observed by activities such as the Environment Protection (Water Quality) Policy 2003. Having regard to the guidelines under this policy the following matters are to be addressed by a marina proposal:

- No waste shall be discharged into a marina from the land or from vessels.
- Major stormwater and other land based discharges shall not discharge into the marina.
- A marina should have an oil spill contingency plan to minimise the impact and provide for the adequate clean up of any oil/hydrocarbon fuel spillage
- Boat maintenance, repair works, hull cleaning, painting and anti fouling may not occur within the marina
- Bilge and ballast waters may not be discharged into the marina

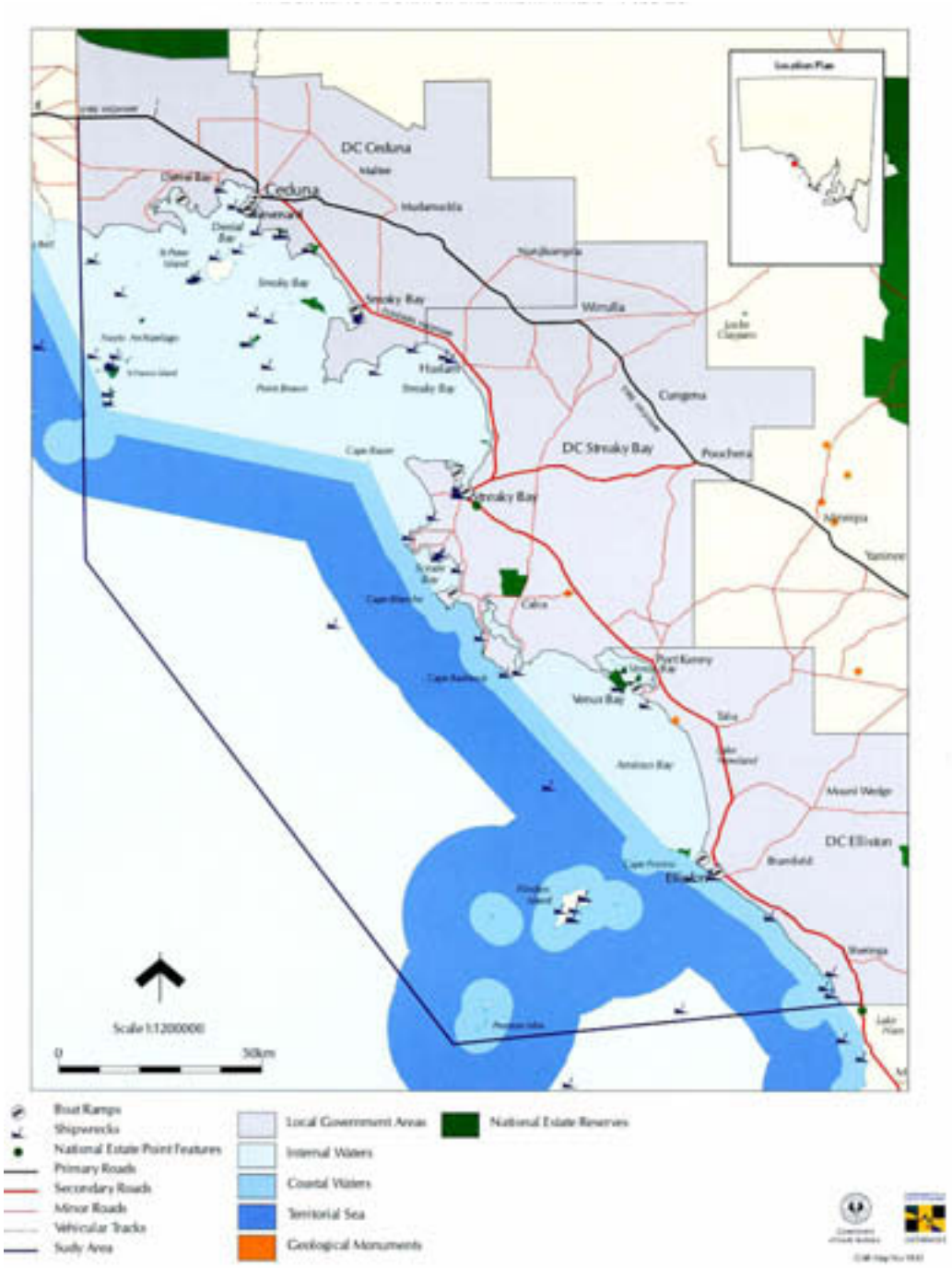
12.7 Heritage Act 1993 & Historic Shipwrecks Act 1981

The development site contains no identified heritage places of local or State significance.

No shipwrecks or other relics protected by the Heritage Act are located within the study area as indicated on Figure 12.1.

Should any unidentified objects be identified during construction that may have heritage significance appropriate contact would be made with the responsible Government department

Figure 12.1 Location of Historic Shipwrecks



12.8 Other Relevant Legislation

In addition to the above statutes, there may be further requirements in respect to the following legislation as part of the construction and operation of the proposed marina development.

Table 12.1 Other Relevant Legislation

Legislation	***Element***
Community titles Act, 1996	Plan of Community Division, Tenure arrangements
The Aboriginal Heritage Act, 1988	Under s 23 of the *Aboriginal Heritage Act 1988* ("the act"), a person must not without the authority of the Minister for Aboriginal Affairs and Reconciliation, ("the Minister") damage and disturb or interfere with any Aboriginal site or damage any Aboriginal object. Regardless of whether development approval has been granted (or is required), any activity that will damage, disturb, or interfere with an Aboriginal site or object must be first authorised by the Minister under s 23 of the Act. While a search of the Register of Aboriginal Sites and Objects maintained by the Minister has identified a registered fish trap site, authorisation must be obtained from the Minister for any activity which will disturb this or any other site. Authorisation to damage or disturb or interfere with any registered site can be applied for under s 23 of the Act. If a reported site is likely to be damaged or disturbed, an application requiring determination under s 12 of the Act is required in the first instance. The proponent may subsequently, if required, seek authorisation of the Minister to damage, disturb or interfere with a site under s 23 of the Act. The Register does not purport to be a comprehensive record of all Aboriginal sites and objects in South Australia and sites and objects may well exist on the land in question, even though the Register does not identify them. All Aboriginal sites and objects are protected under the Act regardless of whether they are listed in the Register. It is appropriate therefore to emphasize that it is an offence under the Act of damage, disturb or interfere with any Aboriginal site or damage any Aboriginal object (registered or not) without the authority of the Minister. Further the Act requires that any sites, objects or remains discovered on the land are to be reported to the Minister and that penalties apply for failure to comply with the Act.
Construction Industry Training Funds Act 1993	Payments in respect to the value of building work to be undertaken within the development towards the fund
Crown Lands Act 1929	Freeholding and leasholding of Crown Land
Dog & Cat Management Act 1995	The management of dogs and cats within the development
Geographical Names Act 1991	In respect of the names of places
Harbors and Navigation Act 1993	In respect to the safe navigation of the waterways and

	use of Murat Bay
Highways Act 1993	In respect to the realignment of the Eyre highway
Liquor Licensing Act 1997	In respect to possible future applications for liquor license within facilities to be constructed within the marina development.
Local Government Act 1999	In respect to the governance and management of the study area by the Council.
Native Vegetation Act 1991	In respect to native vegetation to the extent not excluded or exempted by the Development Act.
Natural Resources Management Act	Pest Plants, ground water, soil and erosion, etc
Petroleum Products Regulation Act 1995	In respect to the sale and refuelling of vessels within the marina.
Public & environmental Health Act 1987	In respect to the health and safety of the public within the study area
Real Property Act 1886	In respect to the creation, sale and purchase of property
Roads Opening & Closing Act 1991	In respect to the opening and closure of roads.
Road Traffic Act, 1961	In respect to the use and management of roads within the development
Sewerage Act, 1929	In respect to the provision and connection to sewer
South Australian Health Commission Act 1976	In respect to the treatment of sewerage
Stamp Duties Act 1923	In respect to payments as a result of various purchases and transfers of money and property
Zero Wastes SA Act 2004	In respect to waste management and resource recovery

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LIST

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REFERENCE LIST

Directions for Regional South Australia – A Framework for Action

Guide For Applicants – Marina and/or Boating Facilities, Planning SA, July 2004

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CONNOR HOLMES

APPENDIX A

CROSS REFERENCING TABLE – EIS TO GUIDELINES

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Cross Reference Table – EIS Guidelines

Issue		*Response*
5.1	**THE PROPOSAL**	
5.1.1	Describe the need for the proposed development, including the reasons for its proposed location and staging.	Section 2.0 Section 5.0
5.1.2	Assess the "do nothing" option.	Section 5.4
5.2	**ENVIRONMENTAL ISSUES**	
	Coastal	
5.2.1	Outline the visual effects on the coast of the development in this locality generally.	Section 7.3
5.2.2	Describe the effect of land reclamation and construction of the breakwaters and entrance channel on seagrass and sand movement on the coast.	Section 6.3 Section 6.11.2 Section 6.7.2 Section 6.11.3 Section 10.0
5.2.3	Outline management and rehabilitation measures for impacts on the coast.	Section 10.0
5.2.4	Describe the effect of the development on terrestrial and marine native flora and fauna.	Section 6.5 to 6.11
5.2.5	Identify measures to minimise vegetation clearance, including incorporating remnant stands in the layout design, and to compensate for the loss of native vegetation and habitat.	Section 10.0 Section 6.26
5.2.6	Detail the measures to protect dunes, tidal flats and beach during and after construction, including buffers.	Section 6.26 Section 10
5.2.7	Describe the general impact of increased recreational and commercial boating.	Section 8.8, 8.9
	Water	
5.2.8	Outline measures to protect and maintain suitable water quality in waterways, particularly the management of run-off and the control of pollutant and microorganism sources.	Section 6.12 – 6.20
5.2.9	Detail how sufficient water turn-over rates and flushing would be achieved for the marina basin and waterways.	Section 6.14
5.2.10	Describe the impact that water discharged from the development would have on the health of fish and other marine species.	Section 6.15

5.2.11	Outline measures to protect and monitor water quality in the marine environment from commercial fishing/aquaculture activities, including maintenance and repair.	Section 6.12 – 6.20
5.2.12	Describe the approach to water sustainability, including ways in which mains water supply use can be minimised or supplemented and opportunities for reducing and recycling water, particularly stormwater.	Section 6.19 Section 6.20 Section 6.25
5.2.13	Describe water sensitive urban design measures and uses of wastewater that could be adopted.	Section 6.20 Section 6.25
5.2.14	Outline measures to protect and maintain suitable water quality in the constructed wetlands.	
	Groundwater and Land Contamination	
5.2.15	Describe the known existing groundwater and land related environmental conditions, including possible contamination sources.	Section 4.3 Section 4.4 Section 6.21
5.2.16	Describe the short and long term effects of constructing channels and basins on land and/or groundwater quality and movement.	Section 6.22
5.2.17	Describe stormwater and wastewater management and the potential impact on land and/or groundwater.	Section 6.21, 6.22, 6.25
5.2.18	Detail the measures to be taken to manage and monitor groundwater resources.	Section 6.22
	Management	
5.2.19	Describe the sewage disposal and rubbish collection systems for commercial and recreational boats and the potential for incorporating recycling and resource recovery.	Section 6.23
5.2.20	Outline waste management strategies for households and tourist facilities and the potential for incorporating recycling and resource recovery.	Section 6.24 Section 6.25
5.2.21	Detail arrangements for managing solid waste, black water and grey water.	Section 6.24 Section 6.25
5.2.22	Describe the use of amenity/landscape plantings and broad scale revegetation, including the opportunities for the use of locally endemic species.	Section 6.26
5.2.23	Describe how the spread of pest plants and animals within and around the development would be managed	Section 6.27
5.2.24	Describe the risk of causing or exacerbating any environmental problems in the locality, and describe mitigation measures and their expected effectiveness.	Section 6.27 Section 10.0 Section 11.0
5.2.25	Outline the effects of boating traffic and additional people on the surrounding environment and how impacts would be managed, particularly for environmentally sensitive offshore islands.	Section 6.7.2

5.2.26	Describe the design and management requirements for the constructed wetlands to maintain suitable water quality and healthy ecosystems and to control pests and vectors of human disease (especially mosquitoes).	
5.2.27	Identify the implications for maintenance dredging, including disposal options and impacts on the environment and community.	Section 11.8
	General	
5.2.28	Detail the scope of investigations required to include in an environmental management plan.	Section 10.0 Section 11.0
5.2.29	Describe how all potential sources of air pollution (especially dust) would be controlled and monitored, including measures for the reduction or elimination of dust.	Section 6.28 Section 10.4
5.2.30	Provide information on the expected levels of environmental noise associated with the operation of the facility, identifying all potential noise sources, and describe the extent to which these noise emissions could be reduced and contained to minimise the effects upon the wider locality.	Section 6.29 Section 7.21
5.2.31	Describe the benefits of the proposal to the local environment.	Section 7.0
5.2.32	Detail measures for rehabilitating the coastal estuary into a waterbody that would function for both recreational/commercial uses and as a natural ecosystem, particularly the establishment of a suitable hydrological regime.	Section 6.14 Section 6.15 Section 6.12 Section 6.11.5
5.2.33	Detail measures to ensure that residential, recreational and commercial activities would be conducted in an environmentally sustainable manner, particularly to protect water quality	Section 6.12 – 6.16 Section 11.0
5.2.34	Identify opportunities for energy conservation.	Section 6.30
5.3	**EFFECTS ON COMMUNITIES**	
5.3.1	Outline the size and source of the construction workforce and identify how accommodation requirements would be met.	Section 7.1
5.3.2	Detail opportunities for Aboriginal employment.	Section 7.2
5.3.3	Describe the effect on visual amenity and landscape quality, especially the effects of the built form of structures (including the breakwater, earthworks and power lines) and impact on the coastal environment, particularly as viewed from the Ceduna township.	Section 7.3
5.3.4	Identify impacts on local amenity, including the potential build up of seagrass on adjoining beaches.	Section 7.4
5.3.5	Outline the expected character of the residential development, including the likely demographics of the marina community, provision of affordable housing, accessibility (especially for people with disabilities), opportunities for passive recreation and crime prevention initiatives.	Section 7.5
5.3.6	Describe how the proposal would be integrated with the Ceduna township.	Section 7.6

5.3.7	Identify the effects on the existing character and lifestyle of Ceduna, including existing cultural and heritage values of the area.	Section 7.7
5.3.8	Outline the traffic generation and truck movements to and from the site and their hours of operation during the construction period, particularly the impact on the Eyre Highway.	Section 7.8
5.3.9	Outline the impact of rerouting the Eyre Highway and Denial Bay Road, particularly the effect on adjoining landowners and existing businesses and the relocation of the Quarantine inspection station.	Section 7.9
5.3.10	Describe the implications for the full range of public and private service providers including health, aged care, education, transport and recreation to support the development in the short, medium and longer term.	Section 7.11
5.3.11	Detail the consequences of establishing a safe haven for the recreational and commercial boating fraternities.	Section 7.12
5.3.12	Outline the impact on existing tourism and recreation activities and infrastructure, including integration with the existing golf course.	Section 7.13
5.3.13	Describe the impact on local and regional land uses, such as shellfish aquaculture.	Section 7.14
5.3.14	Describe the potential impact of adjoining land uses on the development.	Section 7.15
5.3.15	Describe the impact on the nearby Aboriginal homeland settlement, particularly access to the Ceduna township and school bus routes.	Section 7.16
5.3.16	Describe the land tenure arrangements for the marina and the opportunities for commercial, private recreational or public access to berths, launching facilities or other associated facilities.	Section 7.17
5.3.17	Outline the location and availability of public facilities including telephones, toilets, showers and the lighting of public areas.	Section 7.18
5.3.18	Describe the benefit and amenity improvements due to infrastructure changes.	Section 7.19
5.3.19	Describe how access to the public foreshore would be maintained, enhanced and managed.	Section 7.20
5.3.20	Detail attenuation measures to minimise the noise emission impacts of potentially incompatible uses within the development.	Section 7.21
5.3.21	Identify the impact of the rerouted Eyre Highway and railway line on the amenity of residents and visitors of the development, particularly noise.	Section 7.8 Section 7.9
5.3.22	Identify opportunities for recreational activities, particularly walking, cycling and water sports.	Section7.22
5.3.23	Describe the nature of the medium density housing in regard to urban form and amenity, including provision for car parking.	Section 7.23
5.4	**ECONOMIC ISSUES**	
5.4.1	Outline the opportunity for tourism and investment in the area arising from the proposal.	Section 8.1

5.4.2	Identify employment and investment opportunities, including the "multiplier effect".	Section 8.2
5.4.3	Identify the economic effect the construction and on-going workforce would have locally and regionally.	Section 7.1, 7.2, 8.2
5.4.4	Outline the potential for the proposal to attract and enhance the business operations of other allied industries and commercial ventures.	Section 7.12, 8.3, 8.8
5.4.5	Outline the potential for the proposal to impact upon the business centre of Ceduna and other local businesses through competition and possible duplication of services.	Section 8.4
5.4.6	Describe any potential costs or savings to the Government of infrastructure expansion with regard to transport networks, electricity supply, water supply, sewerage, dredging or coastal management.	Section 8.5
5.4.7	Describe the sustainability of long-term management of the development, including potential costs and benefits to council and rate payers of long-term management and maintenance of the marina facilities, waterways, entrance channel, breakwaters, residential development and constructed wetlands	Section 8.6
5.4.8	Describe the impact on existing activities and infrastructure at the Port of Thevenard.	Section 8.7
5.4.9	Describe the opportunities for the aquaculture and fishing industries and their support services.	Section 8.8
5.4.10	Identify the impact of increased fishing pressure and aquaculture on recreational and commercial fish stocks, including implications for fisheries compliance.	Section 8.9
5.4.11	Outline the financial strategies to be employed to ensure the relevant infrastructure is in place for each stage in the project.	Section 8.10
5.4.12	Describe the land tenure arrangements during and after construction of each stage.	Section 8.11
5.5	**NATIVE TITLE AND ABORIGINAL HERITAGE**	
5.5.1	Identify the effect on any Aboriginal sites of archaeological, anthropological or other significance under the *Aboriginal Heritage Act 1988*, including any sites listed in the Register of the National Estate and the SA Register of aboriginal Sites and Objects, or identified after consultation with Aboriginal councils or groups.	Section 9.1
5.5.2	Identify any native title issues in respect of the requirements of the *Native Title Act1993 (Cth.)* and the *Native Title (South Australia) Act 1994*.	Section 9.2
5.5.3	Describe the impact on any Native Title Claimants and the consequent impact on the potential ongoing enjoyment of native title rights, if any, by native title holders.	Section 9.2
5.6	**RISK/HAZARD MANAGEMENT**	
5.6.1	Describe strategies for ensuring public safety during construction.	Section 10.4

5.6.2	Detail procedures to be adopted to confirm whether acid sulphate soils are present and management measures that would be required during construction and operation.	Section 10.3.5
5.6.3	Detail procedures to be adopted to confirm whether the land is contaminated and management measures that would be required during construction and operation.	Section 4.4
5.6.4	Describe procedures and strategies to prevent, manage and mitigate pollution spills or sewage leaks.	Section 11.3
5.6.5	Describe how the introduction of pest or nuisance marine organisms would be dealt with.	Section 11.7
5.6.6	Describe procedures and strategies to manage and monitor invasive weed species to protect coastal vegetation.	Section 11.6
5.6.7	Detail measures and strategies for the management of hazardous, flammable or explosive materials in the commercial areas or on boats, including risk contours.	Section 6.15
5.6.8	Detail the dry-dock management for careening (access to hull) and interception of pollutants such as hull scrapings, paints and anti-foulants.	
5.6.9	Detail the relevant requirements of the sea level rise policies in the Development Plan and how compliance would be achieved for this development.	Section 6.2
5.6.10	Detail the design of the breakwaters and their accessibility and safety, including design requirements for coastal hazards, such as tidal and wave action.	Section 3.2
5.6.11	Detail flood mitigation strategies including prevention of flooding and operation of waterways.	Section 3.2
5.6.12	Describe strategies to ensure public safety on and around waterways, breakwaters and the entrance channel and the permitted recreational use of water bodies, including boating navigation.	Section 7.18
5.6.13	Identify the seismic risk to infrastructure and reclaimed land, especially the potential for liquefaction.	Section 6.3
5.6.14	Identify any risk to the operation of the Ceduna Airport, especially from bird strike.	Section 6.7.3
5.7	**CONSTRUCTION AND OPERATIONAL EFFECTS**	
5.7.1	Provide a site construction plan and outline strategies to minimise effects on the local environment, particularly the ecological impact on mangrove, seagrass and reef communities.	Section 10.0
5.7.2	Describe the proposed methodology for dredging and earthworks drainage, dredging frequency, disposal of excavated material and impacts on water quality and the environment, including maintenance activities.	Section 10.0 Section 10.3.1
5.7.3	Identify the source and origin of any construction materials, including fill for the breakwaters, revetments and land forming.	Section 10.0 Section 10.3.3, 10.3.4

5.7.4	Describe the transport and storage of any construction materials to minimise effects on the local amenity.	Section 10.3.1
5.7.5	Identify measures for the control of stormwater run-off, groundwater discharges, dust, mud, vibration, noise, odour (including from rotting seagrass and organic soils) and other emissions during construction.	Section 10.3.1 Section 10.3.2 Section 10.3.3
5.7.6	Describe the implementation of environmentally acceptable work practices and monitoring programs, particularly through management plans.	Section10.0 Section 11.0
5.7.7	Describe the impact on road networks (including freight corridors) during construction and operation of the development.	Section 7.9
5.7.8	Describe the design and operational measures to prevent stormwater and other runoff from the residential, commercial, community centre and other built areas from entering waterways and the marine environment.	Section 6.16
5.7.9	Identify measures to protect any sites of non-indigenous heritage and historic shipwrecks within the declared area during construction, in accordance with the *Heritage Act 1993* and the *Historic Shipwrecks Act 1981*.	Section 12.7
5.7.10	Outline the impact of dredging and channel maintenance on boat access.	Section 11.8
5.7.11	Describe the compatibility of land uses, particularly measures to avoid conflict between commercial fishing/aquaculture and residents/tourists.	Section 3.3, 6.15, 7.2.11 12.5
5.7.12	Outline management controls for housing and commercial construction activities to minimise social and environmental impacts.	Section 12.5 and 2.3
5.7.13	Describe the management agreements between the District Council of Ceduna and the Proponent during and after construction.	Section 2.3
5.7.14	Detail long-term management agreements for operation of the development, including the ownership of land and infrastructure.	Section 2.3
5.7.15	Identify the need for any additional by-laws and encumbrances to control and manage operational activities of the marina community.	Section 2.3
5.7.16	Detail the proposed monitoring of impacts during and after construction.	Section 10.6 Section 6.18
5.8	**EFFECTS ON INFRASTRUCTURE REQUIREMENTS**	
5.8.1	Outline the requirements for an adequate supply and the likely location of distribution networks for gas, electricity, water, sewerage, stormwater management, communications systems and local roads.	Section 3.9 Section 6.16
5.8.2	Describe the impact the development would have on the existing Ceduna township effluent treatment system, including the need for infrastructure upgrading, or alternative systems to which the development will connect.	Section 6.2.3, 6.2.5
5.8.3	Describe the connection to water supply for the development proposal and include information on the quantity of potable water required and the impact on local and regional users.	Section 3.9, 6.19, 6.20

5.8.4	Outline the changes to be made to the Eyre Highway and Denial Bay Road and associated traffic management requirements, including the need for a heavy vehicle bypass around the development.	Section 3.10, 7.9, 7.10
5.8.5	Outline the potential for adopting water sensitive urban design measures for managing stormwater.	Section 6.16, 6.20
5.8.6	Outline the feasibility of using constructed wetlands and the golf course for managing stormwater run-off.	
5.8.7	Describe the feasibility of using the golf course for the disposal of treated effluent, such as wastewater.	Section 6.25
5.8.8	Describe the facilities to be provided for waste disposal from recreational and commercial vessels, especially black water, grey water and solid waste (including seafood waste and offal).	Section 6.23, 6.25
5.8.9	Detail emergency services arrangements.	Section 11.3
5.8.10	Outline opportunities to incorporate best practice measures of infrastructure design.	Section 6.16, 6.25, 6.30

5.9 PLANNING AND ENVIRONMENTAL LEGISLATION AND POLICIES

5.9.1	Describe the proposal's consistency with the relevant Development Plans and the Planning Strategy for Regional South Australia.	Section 12.3, 12.4
5.9.2	Describe the required changes that would need to be made to the zoning of the site.	Section 12.5
5.9.3	Describe the consistency of the development with State and Commonwealth legislation and initiatives relating to conservation or protection of the biological environment and heritage items.	Section 12.1
5.9.4	Detail any commercial fishing or aquaculture policies and any recreational boating and facilities policies relevant to the proposal.	Section 8.9
5.9.5	Detail any other relevant plans or studies that relate to the area.	
5.9.6	Identify legislative requirements and the range of approvals needed to complete the proposed development.	Section 12.0

APPENDIX B

DRAFT LAND MANAGEMENT AGREEMENT

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Ceduna Keys

Form B2

Insert type of document here: APPLICATION TO NOTE – DEVELOPMENT ACT 1993
LAND MANAGEMENT AGREEMENT

TO: **THE REGISTRAR GENERAL**

DISTRICT COUNCIL OF CEDUNA of 44 O'Loughlin Terrace, Ceduna SA 5690 **HEREBY APPLIES** pursuant to the provisions of Section 57(5) of the Development Act, 1993 for the noting of the attached Deed dated the day of 20 and made between **DISTRICT COUNCIL OF CEDUNA** aforesaid as the Council of the one part and **CEDUNA MARINA DEVELOPMENT COMPANY PTY LTD** of PO Box 6114 Halifax Street Adelaide SA 5000 as the Owner of the other part as a Land Management Agreement pursuant to Section 57(2) of the said Act. The said Deed binds the whole of the land comprised in Certificates of Title Register Book VOLUME FOLIO and operates to control the future conservation, preservation, management and development of the said land.

DATED the day of 2005

THE COMMON SEAL of **DISTRICT COUNCIL OF CEDUNA** was hereunto affixed in the presence of:)
)
)

..... Mayor

..... Chief Executive Officer

NB: This form may be used only when no paned form is suitable. A penalty of up to $2000 or 6 months imprisonment applies for improper witnessing.

CONNOR HOLMES

Ceduna Keys

LANDS TITLES REGISTRATION OFFICE
SOUTH AUSTRALIA

FORM APPROVED BY THE REGISTRAR GENERAL

BELOW THIS LINE FOR AGENT USE ONLY

CERTIFIED CORRECT FOR THE PURPOSES OF THE REAL PROPERTY ACT 1886

Solicitor/Registered Conveyance/Applicant

AGENT CODE

Lodged by:

Correction to: **NORMAN WATERHOUSE** **NWAM**

TITLES, CROWN LEASES, DECLARATIONS ETC. LODGED WITH INSTRUMENT (TO BE FILLED IN BY PERSON LODGING)

1. .....
2. .....
3. .....
4. .....
5. .....

Assessor

PLEASE ISSUE NEW CERTIFICATES OF TITLE AS FOLLOWS

1. .....
2. .....
3. .....

Series No.	Prefix

BELOW THIS LINE FOR OFFICE USE ONLY

Date	Time

FEES

R.G.O.	POSTAGE	NEW C.T.

CORRECTION	PASSED

REGISTERED

REGISTRAR-GENERAL

© CORPORATE FORMS PTY LTD (May 2000) Lic No 1

DELIVERY INSTRUCTIONS (Agent to complete)
PLEASE DELIVER THE FOLLOWING ITEM(S) TO THE UNDERMENTIONED AGENT(S)

ITEM(S)	AGENT CODE

Land Management Agreement 10 6 04.doc

CONNOR HOLMES

Ceduna Keys

DATED **2005**

BETWEEN:

DISTRICT COUNCIL OF CEDUNA

of the one part

AND

CEDUNA MARINA DEVELOPMENT COMPANY PTY LTD

of the other part

LAND MANAGEMENT AGREEMENT BY DEED

NORMAN WATERHOUSE
Lawyers
Level 15
45 Pirie Street
ADELAIDE SA 5000

Telephone: 8210 1200

Ceduna Keys

THIS DEED is made the day of 2005

BETWEEN: **DISTRICT COUNCIL OF CEDUNA** of 44 O'Loughlin Terrace, Ceduna SA 5690 (hereinafter with its successors and assigns called "the Council") of the one part

AND: **CEDUNA MARINA DEVELOPMENT COMPANY ABN 89 107 044 057** of PO Box 6114 Halifax Street Adelaide SA 5000 (hereinafter with its executors administrators successors and assigns as the case may be called "the Owner") of the other part

RECITALS:

A. Ceduna Marina Development Company (hereinafter called "CMDC") is the proprietor of an estate in fee simple in the whole of the land comprised in Certificates of Title Register Book Volume 5830 Folio 638 and Volume 5906 Folio 567 (hereinafter called "the Land"). The Land was formerly owned by the Council.

B. CMDC sought development authorisation from the Development Assessment Commission to divide the Land for the purposes of a residential and marina development known as "Ceduna Keys".

C. Ceduna Keys involved the division of the Land into waterfront allotments and non-waterfront allotments, tourist infrastructure, community title lots and the construction of commercial, recreational and residential marina berths. A development concept plan for "Ceduna Keys" is annexed hereto and marked Annexure "B".

D. CMDC and the Council have entered into a separate Agreement for the maintenance of public land and infrastructure for Ceduna Keys.

E. The Council and the Owner wish to ensure that the Land is developed in a manner that ensures a consistent and high standard of design to preserve the amenity of the Land.

F. Pursuant to the provisions of Section 57(2) of the Development Act 1993 (hereinafter called "the Act") the Owner has agreed with the Council to enter into this Deed relating to the management, preservation, conservation and development of the Land subject to the terms and conditions hereinafter mentioned.

NOW THIS DEED WITNESSES as follows:

1. **INTERPRETATION**

   1.1 The parties acknowledge that the matters recited above are true and accurate and agree that they shall form part of the terms of this Deed.

   1.2 In the interpretation of this Deed unless the context shall otherwise require or admit:

1.2.1 Words and phrases used in this Deed which are defined in the Development Act 1993 or in the Regulations made under the Act shall have the meanings ascribed to them by the Act or the Regulations as the case may be;

1.2.2 References to any statute or subordinate legislation shall include all statutes and subordinate legislation amending consolidating or replacing the statute or subordinate legislation referred to;

1.2.3 The term "the Owner" where the Owner is a company includes its successors, assigns and transferees and where the Owner is a person, includes his heirs, executors, administrators and transferees and where the Owner consists of more than one person or company the term includes each and every one or more of such persons or companies jointly and each of them severally and their respective successors, assigns, heirs, executors, administrators and transferees of the companies or persons being registered or entitled to be registered as the proprietor of an estate in fee simple to the Land or to each and every one of all separate allotments into which the Land may be divided after the date of this Deed subject however to such encumbrances, liens and interests as are registered and notified by memoranda endorsed on the Certificate of Title thereof;

1.2.4 The term "person" shall include a corporate body;

1.2.5 The term "the Land" shall include any part or parts of the Land;

1.2.6 Any term which is defined in the statement of the names and descriptions of the parties or in the Recitals shall have the meaning there defined;

1.2.7 Words importing the singular number or plural number shall be deemed to include the plural number and the singular number respectively;

1.2.8 Words importing any gender shall include every gender;

1.2.9 Where two or more persons are bound hereunder to observe or perform any obligation or agreement whether express or implied then they shall be bound jointly and each of them severally.

1.3 Clause headings are provided for reference purposes only and shall not be resorted to in the interpretation of this Deed.

1.4 The requirements of this Deed are at all times to be construed as additional to the requirements of the Act and any other legislation affecting the Land.

2. **OWNER'S OBLIGATIONS**

2.1 The Owner shall not cause, suffer or permit any act or activity on the Land in contravention of the provisions of the Design Guidelines and Use Obligations attached hereto and marked Annexure "A" (hereinafter called "the Design Guidelines and Use Obligations").

2.2 The Owner shall ensure that all development on the Land, including outbuildings and fences shall be undertaken in accordance with the Design Guidelines and Use Obligations.

3. **RESTRICTION ON LEASING AND OTHER DEALINGS**

The Owner shall not grant any right of any nature (such as a lease or licence) which may give any person the right to possession or control of the Land unless such grant:

3.1 is expressed in writing; and

3.2 contains as an essential term an obligation on the person not to cause, suffer or permit any breach of this Deed.

4. **COUNCIL'S POWERS OF ENTRY, ETC**

4.1 The Council and any employee or agent of the Council authorised by the Council may at any reasonable time enter the Land for the purpose of:

4.1.1 inspecting the Land and any building or structure thereupon;

4.1.2 exercising any other powers of the Council under this Deed or pursuant to law.

4.2 If the Owner is in breach of any provision of this Deed, the Council may, by notice in writing served on the Owner, specify the nature of the breach and require the Owner to remedy the breach within such time as may be nominated by the Council in the notice (being not less than twenty eight (28) days from the date of service of the notice) and if the Owner fails so to remedy the breach, the Council or its servants or agents may carry out the requirements of the notice and in doing so may enter and perform any necessary works upon the Land and recover any costs thereby incurred from the Owner.

4.3 If in a notice referred to in Clause 4.2 the Council requires the removal of the building or structure from the Land the Council and its servants or agents are hereby authorised and empowered by the Owner to enter and remove the building or structure from the Land and to dispose of it in any manner determined by the Council provided that if the building or structure shall have any monetary value then the Council shall use its best endeavours to realise that monetary value and shall after the disposal account to the Owner and pay to him the realised value less all expenses incurred.

4.4 The Council may delegate any of its powers under this Deed to any person.

5. **VARIATION AND WAIVER**

5.1 This Deed may not be varied except by a Supplementary Deed signed by the Council and the Owner.

5.2 The Council may waive compliance by the Owner with the whole or any part of the obligations on the Owner's part herein contained provided that no such waiver shall be effective unless expressed in writing and signed by the Council.

6. **NOTICES**

Notice shall for the purposes of this Deed be properly served on the Owner if it is:

6.1 posted to the Owner's last address known to the Council; or

6.2 affixed in a prominent position on the Land.

7. **COSTS**

Each party will bear their own costs and expenses (including without limitation legal costs and expenses) of and incidental to the negotiation preparation stamping and registration of this Deed.

8. **REGISTRATION OF THIS DEED**

Each party shall do and execute all such acts documents and things as shall be necessary to ensure that as soon as is possible after the execution of this Deed by all necessary parties this Deed is registered and a memorial thereof entered on the Certificate of Title for the Land pursuant to the provisions of Section 57(5) of the Act in priority to any other registrable interest in the Land save and except for the estate and interest of the Owner therein.

9. **GOVERNING LAW**

The law governing the interpretation and implementation of the provisions of this Deed shall be the law of South Australia.

10. **GENERAL PROVISIONS**

10.1 If any provision of this Deed shall be found by a court of competent jurisdiction to be invalid or unenforceable in law THEN and in such case the parties hereby request and direct such court to sever such provision from this Deed.

10.2 This Deed contains the whole agreement between the parties in respect of the matters referred to herein.

EXECUTED as a deed

THE COMMON SEAL of)
DISTRICT COUNCIL OF CEDUNA was)
hereunto affixed in the presence of:)

.....
Mayor

.....
Chief Executive Officer

The **COMMON SEAL** of **CEDUNA**)
MARINA DEVELOPMENT COMPANY)
PTY LTD was affixed in the presence of:-)
)

... ...
Director

... ...
Director/Secretary

The Owner **HEREBY CERTIFIES** pursuant to Section 57(4) of the Development Act 1993 that no other person has a legal interest in the Land.

.....
For and on behalf of Ceduna Marina Development Company Pty Ltd

Ceduna Keys

ANNEXURE "A"

DESIGN GUIDELINES AND USE OBLIGATIONS

CEDUNA KEYS

DESIGN GUIDELINES AND USE OBLIGATIONS

These design guidelines and use obligations have been formed with the intention of setting a theme for the built environment that is compatible with a waterway development and the surrounding natural features of the Ceduna Keys area.

Encouragement will be given to innovative designs that vary from the traditional approach to provide aesthetic variety and suit the climate of Ceduna.

Consideration must be given to adjacent built forms with respect to architectural style, building positioning, and light and sight optimisation. Shade indoor – outdoor living aspects and lifestyle designing.

When assessing, the Company will favourably consider building plans on their architectural merit.

1. **SPECIAL MEANING WORDS**

1.1 "Allotment" means both Dry Land Allotments and Waterfront Allotments.

1.2 "Building" means any building or out building and any structure whether free standing or affixed to any other building erected outside any building or out building and without in any way limiting this definition includes any portion of a building, balconies and/or eaves, garage, carport , shed, driveway, verandah, pergola, fence, wall, sink, tank, antenna, air-conditioner, sun blind, heater, clothes line, BBQ, letter box or boat mooring.

1.3 "Ceduna Keys" means the Development Site.

1.4 "Ceduna Keys Residential Marina Berths" means that part of Waterfront Land that is able to be used as a marina berth..

1.5 "Company" means Ceduna Marina Development Company Pty Ltd ACN 107 044 057 and any successor, administrator or assignee.

1.6 "Dry Land Allotment" means an allotment where no portion of which adjoins the Waterway Reserve.

1.7 "Jetty" means a jetty including walkways, boardwalks, piles and pontoons or any other structure constructed as part of the jetty.

1.8 "Revetment Capping" means the vertical wall forming part of the Revetments.

1.9 "Marina Manager" means the Marina Manager appointed to manage Ceduna Keys commercial and recreational marinas and public infrastructure by or for and on behalf of the Council

1.10 "Recreational Vessel" has the same meaning as is given to it in the Harbours and Navigation Act 1993 but (with the exception only of charter game fishing

vessels) excludes any vessel which has during the preceding twelve (12) months had issued to it a Certificate of Survey pursuant to Division 2 Part 9 the Harbours and Navigation Act 1993.

1.11 "Revetment Line" means the external face of the retaining vertical wall supporting the earthen rampart adjacent to the Waterway Reserve and Ceduna Keys.

1.12 "Revetments" means the retaining vertical wall supporting the earthen rampart adjacent to the Waterways, including the sloping embankment immediately adjacent to the vertical retaining wall and all other edge treatments to the marina basin within Ceduna Keys.

1.13 "Road Boundary" means the boundary of the Waterfront Land to a public street or road.

1.14 "Street Number" means the number allocated by Council under Section 220 of the Local Government Act 1999.

1.15 "Waterfront Allotment" means an allotment a portion of which adjoins a body of water forming part of the Ceduna Keys marina basin.

1.16 "Waterfront Land" means that portion of a Waterfront Allotment that is covered with water, with such water component forming part of the certificate of title for that Waterfront Allotment.

1.17 "Waterway Reserve" means the portion of the Ceduna Keys marina basin that is a public waterway (as delineated in the concept plan for Ceduna Keys annexed in Annexure B of this Deed) and does not form part of Waterfront Land.

1.18 "Waterways" means the Waterway Reserve and the water portion of Waterfront Land .

2. LAND TO WHICH THESE GUIDELINES APPLY

2.1 Waterfront Allotments

Subject to any express exclusion all provisions contained in these Design Guidelines and Use Obligations apply to the Waterfront Allotments.

2.2 Dry Land Allotments

Subject to any express exclusions the provisions contained in these Design Guidelines and Use Obligations apply to the Dry Land Allotments excluding Clauses 9 and 21.4.

2.3 Ceduna Keys Residential Marina Berths

All provisions contained in these Design Guidelines and Use Obligations apply to Ceduna Keys Residential Marina Berths excluding Clauses 3, 6, 9 and 21.1.

3. APPLICATIONS FOR APPROVAL

3.1 That all Development Applications lodged for approval in respect of any Building to be constructed or erected on the Allotment shall include the following details together with the information to which Council is entitled to be provided with pursuant to the Development Act, 1993:

3.1.1 all dimensions of the Building including floor areas and levels, and

3.1.2 the intended positioning of the Building in relation to the boundaries of the Allotment on which it is intended to be constructed, and

3.1.3 the location of all windows and doors forming part of the Building, and

3.1.4 the elevations and other details of the external appearance of the Building in sufficient detail so as to clearly indicate its architectural style, and

3.1.5 the position and dimensions of all car parking, fences and driveways to be constructed or erected upon the Allotment, and

3.1.6 a schedule of the materials which the Building or apparatus is to be constructed of, and

3.1.7 a schedule of all colours of external surfaces of the Building, and

3.1.8 the proposed use to which the Building will be put, and

3.1.9 the proposed dates for commencement and completion of the Building, and

3.1.10 such other information as Council may from time to time request, and

3.1.11 the location, type and colour of Rainwater tanks together with details of the means of directing the overflow to the street watertable.

3.2 Any Owner wishing to lodge a Development Application shall comply with the following procedures:

3.2.1 Subject to Clauses 3.2.2 and 3.2.3 any application by Owners for development authorisation in respect of any Building to be constructed or erected on the Allotment including all accompanying plans, specifications and documents shall be forwarded to the Company, or any person duly appointed by the Company for the purposes of this Clause 3.2, prior to being lodged with the Council.

3.2.2 The Company, or any person duly appointed by the Company for the purposes of this Clause 3.2 shall within sixty (60) days of receipt of all of the information which the Owner is obliged to provide to the Company under clause 3.1 of these Design Guidelines and Use Obligations make any comments which the Company considers appropriate on the contents of the application.

3.2.3 The Company, or any person duly appointed by the Company for the purposes of this Clause 3.2, shall make a determination on the merits of such application having regard to the terms of these Guidelines. A copy of the determination shall be provided to the Council.

4. COMMENCEMENT ON SITE

4.1 The Owner may not erect a garage, shed, carport or verandah on the Allotment before a dwelling is constructed.

4.2 "Garden sheds", subject to Clause 4.1 above, may be erected if less than $10m^2$ in area with maximum height of 2.1 metres to be colourbond finish to match dwelling or fence.

4.3 During the construction of any Development on the Allotment the Owner must:

4.3.1 from the time immediately before the laying of the concrete slab or foundations for construction on the Allotment, erect a fence on the perimeter of the Allotment to prevent rubbish and debris escaping. The fence must be constructed of 50 millimetre galvanised chicken mesh wire with star droppers at 3 metre centres, or similar construction and be of a minimum of 1200 millimetres in height;

4.3.2 on completion of the construction, remove and dispose of that fence;

4.3.3 contain all rubbish and debris in covered bins that are emptied regularly;

4.3.4 prevent any water or fluids draining from the Allotment and building site into the water on a Waterfront Allotment or the Waterways;

4.3.5 not allow any dogs to roam over the Allotment during the construction period;

4.3.6 minimise soil erosion.

4.4 No building, outbuildings, garage, carport, shed, fencing, swimming pool, or excavation shall be commenced unless working drawings showing the design, materials for external elements of structure, walls, roofing, or other such combinations of materials have been submitted to the Company for approval before submitting to the Council for assessment of the Plan for its decision.

5. BUILDING PROVISIONS DURING CONSTRUCTION

In the interests of safety, guarding water quality and the marine environment, builders and building owners will be required to meet criteria set down to minimise rubbish and debris leading to water pollution.

5.1 The following controls on all building sites will apply:

5.1.1 All waste without exception is to be collected and containerised in bins with lids prior to disposal off site. All waste to be removed weekly.

Any plastic or similar found loose will incur an administration fine of $500 per offence.

5.1.2 A waste storage bin with lids for solids is to be kept on site for the duration of building works.

5.1.3 All site amenities for workmen including toilets are to be connected to the site sewer system where there is a connection to the Allotment.

5.1.4 On no account are any water or fluids to drain from the building site directly into the water body.

5.1.5 During the course of any building works no dogs shall be allowed to roam freely over the site.

5.1.6 Loud music to be controlled during construction.

5.2 All building work will be subject to examination and scrutiny by the relevant authorities and the Company during the construction period to ensure that all construction and environmental standards are maintained in strict accordance with these conditions.

5.3 The Owner must procure that all workers, sub-contractors and the like on the Allotment are to adhere to these conditions and the conditions posted on each site during the construction period.

6. DESIGN

6.1 Building Envelopes

No structure shall be built outside the building envelope prescribed for the particular Allotment lights, landscaping, fencing and Jetty are the only permitted forms of construction outside the setback area.

6.2 Set Backs

6.2.1 Subject to Clause 6.2.2 hereof the Owner shall not construct any Building on any Allotment within six (6) metres of a Road Boundary. Dual road frontages will be assessed on merit.

6.2.2 Any Allotment with more than one road frontage shall have 6 metre setback from 1 road.

6.2.3 Subject to Clause 6.2.4 hereof the Owner shall not construct any Building, including eaves, closer than 1.2 metres to any side boundary of any Allotment.

6.2.4 Clause 6.2.3 shall not prevent an Owner from constructing a parapet wall being part of a Building on a side boundary of an Allotment provided that the external face of the parapet wall is situated immediately on the side boundary so that it forms part of the boundary between that Allotment and the adjoining Allotment.

6.2.5 The Owner shall not construct any Building (excluding an access ramp to a jetty) or store anything upon any dry land portion of a Waterfront Allotment within six (6) metres of the Revetment Line.

6.3 **Height Levels**

The Owner shall not erect any Building on an Allotment having a floor level of less than 3.2 metres above the Australian Height Datum (excluding swimming pools and/or jetties) as determined by a field survey by Council.

6.4 **Dwelling**

The design of the dwelling, its suitability for the use on the Allotment, orientation, and floor levels will be assessed by the Company and the Council and are to be shown on the drawings.

6.5 **Foundation**

Raw concrete, steel, or other stumping used in foundation work or supports shall be concealed from view.

6.6 **Verandahs/Carports**

The design, appearance, external colours, and materials of all verandahs, carports and outbuildings shall be integrated with the design of the main dwelling and placed behind the building line and should be of size and design and positioning to be useful shade for indoor-outdoor living.

6.7 **Air-conditioners**

6.7.1 Reverse cycle or evaporative air-conditioners with chilled water is recommended and must be integrated with the main dwelling (colour and design) and screened as much as possible from public view.

6.7.2 Split systems will only be approved after EPA sound reading has been taken into account for the exterior section of the system.

6.7.3 Air-conditioners to be positioned to minimize sound effect on neighbouring properties.

6.8 **Solar Power**

Solar power is recommended. Solar hot water services are suggested as the climate is ideal for it to work efficiently. The solar heating panelling must be integrated with the main dwelling (design) and screened as much as possible from public view.

6.9 **Satellite Dishes and other Similar Structures**

The Owner must not erect any aerial, satellite dish, windmill or other structure so that any part of it is ***"over 10 metres above the average height of the Allotment."***

7. MATERIALS

All materials, in the opinion of the Company and/or the Council, must be compatible and complimentary to the aims described in this annexure. Only new, good quality building materials shall be used for construction.

Taking into account the coastal conditions, the use of timber, glass and non-ferrous metals are encouraged. Ceiling fans is suggested for the living areas and bedrooms. Ceiling heights of minimum 2.7metres is suggested as this safely allows for ceiling fans.

7.1 External Walls

External walls should be brick, brick veneer, stone, concrete or approved texture-coated material. The use of timber, natural or simulated, will be endorsed by the Company provided that the dwellings are professionally designed and aesthetically pleasing. Rendered walls are recommended. External wall colour samples are to be submitted with building plans to the Company for approval.

7.2 Roofing

Roof materials must not be reflective and should compliment the style of the main dwelling. Roofs of colourbond clay or concrete tiles are recommended. Other products may be considered where the building is of architectural significance. Gutters and downpipes should be plastic, colourbond or painted to match the dwelling and take into account coastal conditions.

Roof colour samples are to be submitted with building plans to the Company for approval.

7.3 Insulation

Insulation is the material that is used to reduce the rate of heat transfer through external surfaces in the home.

Correctly installed insulation allows the home to stay considerably warmer in winter and cooler in summer. It saves money on heating and cooling bills and assists the environment by reducing the amount of energy required to heat and cool the home and therefore less greenhouse gas will be emitted.

Refer to Office of Energy for further information.

The 'Hot Box' Syndrome – happens when insulation is installed without adequate window shading. Heat can build up inside the house until inside temperatures are higher than outside temperatures. In this case, the insulation will help keep the heat inside, creating an 'oven effect'. Always provide adequate shading for these windows first.

Fire Protection – Make sure the insulation has been properly treated or is a non-combustible product. Some insulation materials may be combustible and a fire hazard.

The insulation should be installed allowing batts to expand to their natural thickness, cut neatly to fit snugly between ceiling joists, and kept clear of recessed light fittings. Blow in insulation should be sprayed with a solution that prevents disturbance from breezes within the ceiling spaces.

Foil under the roof provides waterproofing and also helps to reduce radiant heat transfer into the home. This can mean a reduction in the temperatures inside the home during summer. It is important to also use insulation to prevent heat loss during winter or convective heat entry in summer.

7.4 **Windows and Doors**

A range of materials are permitted for framing and detailing, including aluminium and timber. Consideration is to be given to colours and weatherproofing aspects. Window areas should take into consideration sun orientation and take advantage of water views without overlooking neighbours where visual privacy is impaired and shading of west windows is essential. Windows should be tinted. They should have screens on the inside as this assists screens staying clean from salt and dust. Windows should be set to make use of cross-ventilation and have large openings for indoor –outdoor living eg cantilever, bi-fold, sliding or similar doors.

Each house should have as many windows as possible facing the Waterways. These can be glass doors or a variety of doors and windows.

Window and door material samples are to be submitted with building plans to the Company for approval.

8. **COLOUR**

All colours shall not be other than those that compliment the aesthetics of the overall theme of Ceduna Keys.

9. **JETTIES**

9.1 The design and style of Jetties will be compatible with and similar to the design used in the Australian Standards (AS 3962 – 2001) and approved by the Marina Manager.

9.2 The ramp or walkways to the Jetty will not be attached or constrained to the free board of revetment wall.

9.3 Only new materials will be used for construction.

9.4 Designs that vary from the above will need to be supported by adequate evidence from professional engineers or architects to their aesthetic and structural suitability to this marine environment.

9.5 The Owners shall not build or construct any Jetty on any portion of a Waterfront Allotment without first obtaining the approval of the Council.

9.6 In making application for approval for the construction of a Jetty the Owners shall supply to the Council the following information, namely:

9.6.1 all dimensions of the Jetty including length, width and height, and

9.6.2 the intended position of the Jetty on the Waterfront Allotment, and

9.6.3 a schedule of the materials from which it is intended that the Jetty be constructed.

9.6.4 or any other information the Council may require under the Development Act.

9.7 The Owners shall not build a Jetty on any Waterfront Allotment except with the following materials:

9.7.1 all materials shall be new and no second-hand materials may be used.

9.7.2 shall comply with the Design Guidelines and Principles. (as per schedule)

9.7.3 Recreational marinas (Australian Standards AS 3962 – 2001 guidelines for design of marinas) will apply.

9.8 The Owner shall not construct a Jetty or pontoon so as to allow any portion of the same or moored craft to extrude from a Waterfront Allotment into the Waterway Reserve. No moored vessel is allowed to be outside of the title area.

9.9 The Owner shall ensure that all Jetties constructed are maintained in good order and condition and not allowed to become unsightly.

9.10 The Owner shall not allow any spot light or bright light on any Jetty between the hours of 8:00 pm to 7:00 am and during daylight saving, 9:00pm to 7:00am.

9.11 The Owner shall not construct any Jetty without first obtaining the consent of Council pursuant to Clause 3.1 of this Deed.

9.12 **Types of Vessels That May be Moored**

The Owner shall not allow to be moored on any Waterways any vessel that is not a Recreational Vessel.

9.13 **Moorings Generally**

9.13.1 The Owner shall not moor any vessel on the Waterway Land unless it is secured to a Jetty or pontoon.

9.13.2 The Owner shall not construct any moorings for vessels on any part of the Waterway Land other than a Jetty or pontoon.

9.13.3 The Owner shall not allow any vessel secured to a Jetty on any Waterway Land to extrude from the Waterway Boundary into the Waterway Reserve.

10. FENCING

The range of materials for the construction of fences at boundaries and elsewhere on the sites where exposed to view from the access roads and waterways is as follows:

Extent: Front facing, front courtyards and return boundaries.
Type: Face brick natural and painted stone, rendered masonry, timber
Height: 2.0 metres maximum

Extent: Side boundaries to the 6 metre set back line (road and waterway)
Type: As above
Height: 2.0 metres maximum

Extent: Side boundaries outside the building envelope at the waterfront.
Type: As above
Height: 1.2 metres maximum

Extent: Boundary facing waterway
Type: No fencing required. Optional fencing pre-coloured steel pool fencing (or similar).
Height: 1.2 metre maximum

Extent: Project boundary
Type: Limestone or rendered brick with powder coated cyclone in-fill or other approved in-fill.
Height: 2.0 metres maximum

Fence material and colour samples are to be submitted with building plans to the Company for approval.

11. LIGHTING

External garden lights, verandah lights, revetment lights and pontoon lights are to be low wattage to avoid glare on neighbouring blocks. They are to be located and directed and shielded and of such limited intensity that no unreasonable nuisance or loss of amenity is caused to any person beyond the site.

12. RAINWATER TANKS

Rainwater tanks must be installed, and be plumbed to the residence and should be at least 15,000 litres in capacity. Rainwater tanks shall be of fibreglass or similar construction or otherwise painted to integrate with the other improvements on the said land and screened from public view. Rainwater tanks are not to be visible from the waterways.

13. LANDSCAPING

13.1 All garden areas within public view shall be landscaped. Landscaping should be suitable for climate and available water supplies. Planting and all garden practices need to take into account waterfront living and ensure water quality. This includes planting, fertilizers, leaf matter, mulches and run-off of any paved areas. Council can provide a list of plants that will provide a green lush appearance but with low water needs.

13.2 All landscaping to be completed within 180 days of the first occupation of the Allotment.

14. SWIMMING POOLS

14.1 Rainwater is ideal for swimming pools, however it needs to be filtered to ensure the removal of bacteria. Covering the pool is encouraged to reduce evaporation. Sea water can be used with the correct filtering.

14.2 All swimming pools must be approved by the Council.

15. OUTDOOR LIVING AREAS

15.1 Proposed or future structures associated with indoor-outdoor living areas, (eg pergolas, verandahs or similar structures) should be anticipated in the overall design concept of the main residential building to maintain a homogenous development. Consideration should be given to the climate that lends itself to outdoor living.

15.2 Sample of materials and colours that will be used to be submitted with building plans to the Company and the Council for approval.

16. MEDIUM & HIGH DENSITY BUILDINGS

16.1 Apartments & Townhouses

16.1.1 Two storey is recommended.

16.1.2 Any building over 2 storey will require installation of elevators.

16.1.3 Roof top gardens and outdoor living areas are allowed in some designs (no overlooking into neighbours windows).

16.1.4 Noise controls apply for roof top areas.

16.1.5 Maximum height of any building is 15 metres.

16.1.6 Large balconies should be allowed for with roof or ceiling overhang, eg similar to a verandah.

16.1.7 Western facing windows should have allowances for sun shades in the late afternoons. Window treatments should be considered.

16.1.8 Insulation and noise attenuation between apartments and houses is essential.

Samples of all materials and colours of exterior finishes to be submitted with building plans to the Company for approval.

17. **REFUSE COLLECTION**

Refuse disposal containers must be screened from view of any public street or waterway. All bins to have lids.

18. **VEHICLE ACCOMODATION**

A minimum of 2 car parking spaces per dwelling and apartments and units shall be provided at the discretion of Council, at least one of which shall be under cover of a garage or carport.

19. **AMENITY OF STREET FRONTAGE**

19.1 In the design of the buildings and or fences to an allotment the following provisions shall be incorporated in the street frontage:

19.1.1 A personal access gate.

19.1.2 A letter box.

19.1.3 The Street number must be clearly defined on the house and letterbox, and be visible from the street.

19.1.4 Council will designate a street number to each allotment.

20. **SIGNS**

No signs may be erected on the allotment except a sign which advertises a display home, or vacant or improved land for sale, or any sign legally required under the Building Work Contractors Act.

21. **ACTIVITIES ON ALLOTMENTS**

21.1 **Incinerators**

The Owner shall not erect any incinerator upon the Land nor burn any waste or refuse upon the Land.

21.2 **Disturbances and Disorderly Behaviour**

The Owner shall not create any noise or unnecessary disturbance within Ceduna Keys so as to annoy other residents of Ceduna Keys who are entitled to consideration and in particular shall not:

21.2.1 use outboard motors or pump motors without approved and effective mufflers, or

21.2.2 create unnecessary noise including loud talking and playing of musical instruments from 11:00pm to 7:00 am, or from any device to impair or to impede on the amenity or neighbours.

21.2.3 operate engines unnecessarily within Ceduna Keys whilst stationary, or

21.2.4 use floodlights except when under way or manoeuvring vessels (which floodlights shall be turned off as soon as practicable after berthing) or for short periods of time during night time hours, or

21.2.5 allow rigging or spars to cause a nuisance or impair the amenity of Ceduna Keys.

21.3 **Generators**

The Owner shall not allow generators or compressors to be run on the Land nor engines to be allowed to idle on vessels from 8:00 pm to 7:00 am.

21.4 **Living on Board**

21.4.1 The Owner shall not allow any Person to reside on a vessel moored at a Jetty on any Waterfront Allotment without the consent of the Marina Manager.

21.4.2 Any floating structure deemed to be suitable for permanent living must be in the designated area only and approved by Council.

21.5 **Dumping of Refuse**

21.5.1 The Owner shall not:

21.5.1.1 deposit dead animals, fish, shellfish, bait or any other putrefying matter so that the same may escape into or pollute the Waterways, or

21.5.1.2 pump into the water on a Waterfront Allotment or the Waterways any oil, spirits or inflammable liquid or toxic substance, bilge water, fish-tank water, swimming pool water or detergent, or

21.5.1.3 discharge or deposit or allow into the water on any Waterfront Allotment or the Waterways any coal tar or refuse or residuary product of coal petroleum asphalt bitumen or other carbonaceous material or substance, or

21.5.1.4 whilst carrying out cleaning or maintenance operations permit bilge water, water, detergents, preservatives, contaminated water or deck waste to enter into the water on a Waterfront Allotment or the Waterways, or

21.5.1.5 operate a toilet on any vessel that has direct overboard discharge whilst moored on the Land, or

21.5.1.6 allow any blood spillage onto the water of any Waterfront Allotment or Waterway, or

21.5.1.7 take fuel on or discharge fuel from vessels moored on Waterway Land, or

21.5.1.8 moor a vessel on Waterways where the vessel is treated with anti-fouling paints which release more than five (5) micrograms of tributylin per square centimetre per day.

21.5.2 The Owner shall immediately report all spills of fuel, fish waste, detergent, rubbish and other offensive materials to the Marina Manager who may remove or cause the same to be removed and the cost of such removal shall be reimbursed by the responsible Owners to the Council.

21.5.3 All rubbish bins need to have lids.

21.6 **Boat Maintenance**

21.6.1 The Owner shall not effect any major repairs to a vessel moored within the Waterways or situated on a Waterfront Allotment or in Ceduna Keys.

21.6.2 The Owner shall in effecting any minor repairs to vessels moored within the Waterways or on a Waterfront Allotment or in Ceduna Keys ensure that all work is done within the confines of the vessel itself and is not carried out except from 7:00 am to 8:00 pm with no maintenance work occurring on Sundays and Public Holidays.

21.6.3 Nothing contained in Clause 21.6.2 hereof shall authorise or permit the Owner to:

21.6.3.1 carry out any spray painting on the Land or on a vessel in the Waterways, or

21.6.3.2 chip paint and rust on steel or aluminium vessels or use noisy equipment, or

21.6.3.3 use angle grinders, sand blasters or other electrical power tools and/or welding equipment on vessels situated on the Land or in the Waterway except for minor maintenance work with approval of the Marina Manager.

21.7 **Maintenance of the Revetments**

The Owner of the Waterfront Allotment shall at all times maintain the Revetments in good order and comply with any directions or orders issued by the Council to such Owner which require repair to the Revetments.

21.8 **Emergency Access**

The Owner shall permit the Council and its employees, agents, consultants and contractors to have free and unrestricted access to any portion of a Waterfront Allotment for any emergency purpose.

Ceduna Keys

APPENDIX C

CORRESPONDENCE FROM ENVIRONMENT AUSTRALIA

CONNOR HOLMES

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Ceduna Keys

#11272

Environment Australia
Department of the Environment and Heritage

FAXED
19 JUL 2002

6/0802

22 JUL 2002

Mr Anthony Irvine
Chief Executive Officer
District Council of Ceduna
PO Box 175
CEDUNA SA 5690

Dear Mr Irvine

District Council of Ceduna/Tourism, Recreation and Conservation Management Ceduna/SA/Ceduna Coastal Centre and Ceduna Keys Marina Development (EPBC Ref 2002/684)

The above action was referred by the District Council of Ceduna, and received on 6 June 2002, for decision whether or not approval is needed under Chapter 4 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The referral documentation nominated the District Council of Ceduna as the person proposing to undertake the action.

The referral has now been considered under the EPBC Act and I have decided that the action is not a controlled action. Approval is therefore not needed under Part 9 of the Act before the action can proceed.

A copy of the document recording my decision is attached for your information.

Yours sincerely

Gerard Early

Gerard Early
First Assistant Secretary
Approvals and Legislation Division

18 July 2002

GPO Box 787 Canberra ACT 2601 Telephone 02 6274 1111 Facsimile 02 6274 1666
Internet: www.ea.gov.au

Ceduna Keys

COMMONWEALTH OF AUSTRALIA

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

DECISION THAT ACTION IS NOT A CONTROLLED ACTION

Pursuant to section 75 of the *Environment Protection and Biodiversity Conservation Act 1999*, I, GERARD PATRICK EARLY, First Assistant Secretary, Approvals and Legislation Division, Environment Australia, decide that the proposed action, set out in the Schedule, is not a controlled action.

SCHEDULE

The proposed action by the District Council of Ceduna to construct and operate the Ceduna Coastal Centre and Ceduna Keys Marina and associated works, including a cultural/interpretive centre, wildlife/marine displays, eco-displays, aquaculture displays, a recreational lake area, marina facilities for up to 75 vessels, up to 200 waterfront allotments with private mooring facilities, a boat ramp, a fisherman's wharf, serviced apartments, and retail facilities, and as described in the referral received under the Act on 6 June 2002 (EPBC Reference No 2002/684).

Dated this 18th day of July 2002

Gerard Early

FIRST ASSISTANT SECRETARY
APPROVALS AND LEGISLATION DIVISION
ENVIRONMENT AUSTRALIA

APPENDIX D

RELEVANT PROVISIONS OF PLANNING STRATEGY

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Economic

Key Industry Sectors

1 Expand export growth by identifying new export opportunities, increasing horticultural production and food processing capability and fostering new supply chains.

a. Assist food exporters to achieve better penetration of global markets.
b. Encourage new investment in agricultural businesses.
c. Promote development of quality regional brands, linked to locality, which identify strongly with the State's 'clean, green' image.
d. Encourage clusters and networks of industry groups for greater cooperation and increased efficiency.
e. Encourage a range of housing types and tenures to meet the needs of people employed or seeking employment in regional areas.
f. Encourage the establishment of new fish processing and distribution facilities that assist efforts to maximise product distribution.

The proposed development would assist in facilitating the continued growth of the aquaculture industry with the provision of, and opportunity for, land based facilities including mooring and related wharf facilities.

2 Align land use planning with regional economic development priorities for key industry sectors.

a. Provide for the location and land needs of key industry sectors by changing Development Plans to include performance-based policies based upon land capability assessment.
b. Introduce greater flexibility into rural zones to encourage the processing of local agricultural products, tourist accommodation and facilities and other forms of value adding through the use of performance-based policies.

The proposed development is considered to be aligned with regional economic development priorities as will be set out further below when dealing with strategies for the Eyre Peninsula.

Aquaculture and Fishing

9 Encourage ecologically sustainable growth of the aquaculture industry while managing the resources on which the industry depends.

a. Encourage marine-based aquaculture in line with aquaculture management plans.
b. Identify sites for specific marine-based aquaculture and establish environmental capability for each area.
c. Ensure energy and other infrastructure is provided in a manner that meets the needs of the industry.
d. Promote the establishment and growth of land-based aquaculture industries where there is adequate water.
e. Manage effluent disposal from land-based aquaculture.

10 Encourage the development of land-based facilities and support services in support of the marine fishing and aquaculture industries.

a. Improve access between fish farms in open waters and related service area structures on land.

The proposed development would further facilitate the continued growth of the aquaculture industry, in terms of providing land based facilities.

Tourism

11 Encourage sustainable tourism development.

a. Ensure differentiation of areas based on their inherent strengths and attributes.
b. Undertake planning for tourism based on natural and cultural attributes, community values and market opportunities.
c. Establish a system to monitor the health of tourist destinations, which will enable appropriate management and policy responses.

12 Align land use planning with specialty tourism development priorities.

a. Facilitate small to medium tourism accommodation that is part of the natural and cultural experience of an area (eg bed and breakfasts, farm stays, backpacker lodges, guesthouses).
b. Facilitate the development of innovative and environmentally sensitive nature retreats in appropriate natural areas.
c. Facilitate the sustainable development of the State's coastal and marine tourism potential including the development of marinas in appropriate locations.
d. Provide for flexibility in land use policy to enable the establishment of complementary uses that form part of a tourism experience.
e. Encourage the restoration and commercial use of appropriate heritage assets for tourism.

13 Improve the appeal of destinations by encouraging the development of attractions.

a. Promote synergy between primary industries, tourism and local industries, particularly in areas where primary industries can benefit from a partnership with specialised tourism products.
b. Encourage festivals and events based on the natural or cultural attributes of an area.

14 Develop appropriate infrastructure and facilities for visitors.

a. Upgrade and maintain tourist roads and aerodromes that provide access to key locations.
b. Develop a variety of trails that link natural, landscape and cultural and recreational experiences.

15 Ensure the interpretation of features of interest and understanding of tourist attractions.

a. Integrate principal tourist attractions (such as scenic lookouts) into a network of touring and walking routes.
b. Encourage the development of appropriately located interpretative signs.
c. Upgrade visitor interpretive facilities in visitor arrival and departure sites.

The tourist components of the proposed development are to be based on the strength and attributes of the district in terms of coastal access, sailing and enjoyment of the marine environment including off-shore islands. Marinas are specifically anticipated within these strategies as a sought after holiday experience, so too the link between the aquaculture industry and tourism is considered to potentially generate mutually reinforcing outcomes. Ceduna also offers a range of existing events including festivals that enhance the experience of travellers. Another key component is the incorporation of interpretative and visitors centres, as proposed by the development.

Education and Training

23 Continue to develop linkages between schools, TAFE Institutes and private training providers, universities and industry in response to the needs of enterprises and the community.

a. Support the provision of high capacity, affordable and readily accessible broad-band telecommunications infrastructure for education and training.
b. Foster the sharing of some locations and the building of partnerships between sectors of education.

24 Improve the identification and provision of training to meet the skill needs of regions in terms of their enterprises, communities and individuals.

a. Continue programs aimed at targeting the training needs of small business.
b. Increase adult community education programs.
c. Increase opportunities for training and employment of Aboriginal people in the building industry.

25 Provide education and training which results in direct employment outcomes in industry and the local community.

a. Build regional skills bases by increasing the number of young people completing apprenticeships and traineeships.
b. Develop education and training programs that are informed by regional communities and tailored to meet their needs.
c. Increase access to post secondary and higher education.

The proposed development would further many of these strategies in relation to education and training, particularly that linked with the aquaculture industry. A key opportunity exists to promote Ceduna as a centre for the study and application of best practice in aquaculture, in particular intertidal shell fish such as oysters and scallops. A development of the nature proposed would provide the necessary capital base to build upon in order to establish such educational and training facilities.

The development also presents a significant opportunity in terms of increasing training and employment opportunities for local Aboriginal people in a wide range of areas as previously outlined in this report above when dealing with economic impacts. To this extent, the proposed development is considered consistent with the Planning Strategy.

Environment & Resources

Ecologically Sustainable Development

1 Promote ecologically sustainable development principles and apply them in all aspects of development and revitalisation.

a. Plan for and coordinate the sustainable management of renewable natural resources and the efficient use of non-renewable resources.
b. Establish and maintain an environmental information base and report regularly on the state of the environment.
c. Minimise greenhouse emissions through reducing energy demand and maximise energy efficiency.

Biodiversity

3 Conserve biodiversity and integrate with land use planning.

a. Ensure that land use planning is informed by relevant ecological data.
b. Protect and enhance reserves and areas of conservation significance through land use policies that recognise their conservation value and avoid inappropriate development adjoining these areas.
c. Reduce negative impacts on biodiversity through land use policies that discourage the further fragmentation of areas of native vegetation.
d. Support biodiversity conservation and management on public and private lands through incentives and new partnerships.
e. Encourage the use of local native species in all revegetation and landscaping programs.
f. Connect isolated habitats and vegetation within key biodiversity areas.

Coastal, Marine and Estuarine Resources

6 Protect and manage coastal, marine and estuarine resources.

a. Identify and protect ecologically sensitive and vulnerable coastal and marine habitats including native vegetation, estuaries, seagrasses, mangroves, tidal salt marshes, rocky reefs and important fish breeding grounds.
b. Establish a representative system of marine parks and mulit-use marine protected areas to protect and enhance biodiversity.
c. Minimise point and diffuse source pollutants from entering the marine and coastal environments through innovative stormwater management and re-use programs.
d. Ensure discharge of water from land and marine-based activities do not cause pollution or pose a threat to biological systems.
e. Encourage farming communities to develop environmentally sensitive and cost-effective means of erosion control.
*f. Reduce the amount of pollutants reaching t*he marine environment by constructing wetlands within catchments to reduce the load.
g. Protect dune vegetation, sea grasses, mangroves, samphire communities and algae in coastal, marine and estuarine areas.
h. Regulate the disposal of ship ballast water, sludge and hull fouling.

i. Manage ports and marinas to prevent the dumping and discharge of waste.

7 Base land use planning and location decisions relating to development on coasts, rivers, streams and lakes on performance-based policies.

a. Consolidate coastal and river urban settlements, associated industries, rural living areas, tourist complexes, holiday houses and marinas in environmentally acceptable areas.
b. Site compact holiday house developments and tourist developments on coasts, rivers, streams and lakes in-line with environmental, performance-based policies including potential sea level rise.
c. Increase public access to natural waterfronts where appropriate and provide reasonable public access in new waterfront development.
d. Acquire land for public ownership and maintain access for all users.
e. Redesign, redevelop or relocate coastal and river living areas that do not satisfy environmental, health or public access standards.
f. Restrict development in areas where there is potential for damage to the coast or exposure to hazards such as flooding, sea level rise or coastal erosion.

The proposed development aspires to incorporate the practical applications of ecologically sustainable development insofar as a 'triple bottom line' outcome is sought insofar as such relates to environmental, economic and social outcomes are concerned. The proposed development would achieve such a balance, acknowledging that certain trade offs will invariably be required in order to achieve a balanced outcome and one that is sustainable on all fronts including economically.

The proposed development is not anticipated to have a significant effect on the bio-diversity of the subject land and the surrounding locality in terms of species of plants and animals. The negative impacts of the proposed development such as dredging can be suitably managed so as to control the extent of damaged caused and implement remedial measures to stabilise and protect surrounding areas for harm. The balance of the coast along Murat Bay is not anticipated to be significantly or detrimentally affected by the proposed development.

Native Title

8 Foster productive negotiations with native title claimants with a view to developing indigenous land use agreements.

Heritage

9 Conserve places of Aboriginal and non-Aboriginal heritage value.

a. Establish mechanisms for effective consultation with Aboriginal people to ensure development recognises the importance of Aboriginal culture.
b. Identify, conserve and promote places of heritage value, including shipwrecks.
c. Designate areas of townscape significance in towns and settlements where control over development needs particular regard to heritage and visual character.
d. Encourage the private sector through incentives to recognise the economic value of heritage conservation (for example in tourism projects).

As outlined above the appropriate steps are being taken to address Native Title and heritage issues relating to the values of Aboriginal people.

Hazards

16 Minimise the impact of natural hazards.

a. Identify and protect areas susceptible to significant hazards such as fire, flood, coastal erosion and seawater flooding.

The proposed development takes into account tidal and sea level issues as part of the preliminary engineering design.

18 Avoid or minimise disturbance of acid sulfate soils.

a. Identify areas containing acid sulfate soils.
b. Determine the level of risk of acid formation from various land uses to enable the introduction of appropriate land use policies.

c. *Establish management practices to mitigate the impacts of any acid produced through* disturbance of acid sulfate soils.
d. *Introduce remedial measures to reduce the volume and frequency of acid water outflows.*

The extent to which disturbance of acid sulphate soils may occur has been addressed previously in this report.

People Towns & Housing

Housing

1 Ensure diverse and affordable housing to suit community needs and preferences.

a. *Ensure that the supply of land and infrastructure meet seasonal as well as average annual demands for all types of housing.*
b. *Encourage greater housing diversity and ensure housing affordability for people on low incomes and older people.*
c. *Support a stable housing industry based on the private sector.*
d. *Ensure a comprehensive range of affordable housing alternatives.*
e. *Reduce the concentration of older public rental housing through redevelopment and integrate public and private housing in new and existing communities.*
f. *Record surplus and under-used Government serviced land and release for development.*
g. *Continue with South Australian Housing Trust redevelopment program in the regional areas and explore possibilities for further redevelopment activities.*
h. *Explore opportunities for joint ventures and partnerships with both private and community housing organisations in providing affordable housing.*
i. *Improve the quality and standard of government employee housing in regional areas.*
j. *Develop financial schemes to encourage and assist in home ownership.*

The proposed development would provide for a diverse range of housing choice, albeit not necessarily geared to the affordable housing sector.

3 Provide for adequate accommodation for the aged in regional townships by providing a comprehensive range of aged housing alternatives at affordable prices.

a. *Provide acceptable sites for small-group aged housing projects integrated within the community and with ready access to transport and other community and human services.*
b. *Involve local councils, the community and human service providers in planning for aged housing to ensure necessary support services are available and accessible.*
c. *Facilitate joint developments between providers of housing, local councils and community groups to provide aged housing.*
d. *Develop specific public and community housing packages for aging and frail residents.*
e. *Link housing options with appropriate care and support services to ensure successful tenancies.*

4 Develop higher residential densities close to services.

a. *Select locations where relatively high standards of service and transport exist and where the potential for redevelopment is high.*
b. *Prepare a development strategy for each of the selected locations to maximise the use of public land and increase the density of housing and stage development as private land becomes available.*

The proposed marina housing development would appeal to a number of retirees or aged persons, as has been the experience at Lincoln Cove. Opportunity also exists for coordinated development on larger sites whereby the density may be increased so as to achieve smaller housing units so as to better cater for the needs of occupiers.

Town Growth and Business Centres

10 When investigating the potential growth of towns and cities consider the effect of regional growth issues.

a. *Assess the overall demographic impact on regions when considering the provision of public facilities in major towns.*
b. *Ensure towns and settlements have adequate areas for growth.*
c. *Distribute land uses in towns and settlements in a way that avoids conflict between incompatible development.*

d. *Ensure physical and social infrastructure is provided to growing towns and cities according to a coordinated and planned program.*
e. *Assess household and property statistics, public housing stock quality and location to plan and better meet the changing housing and geographic needs and patterns of settlement in regional areas.*

11 Establish environmentally responsible practices in urban development through joint ventures and other development activities.

a. *Introduce practices that promote ecological sustainability in new construction, infill and the refit of housing.*
b. *Promote land use policies that support energy and water conservation principles in the siting and design of new construction.*
c. *Reduce energy demand with good site design and by promoting building materials, which are energy efficient and low in embodied energy.*

The proposed development would result in growth of the township of Ceduna. The extent to which this might impact on the surrounding region would need to be considered carefully, but from the preliminary market analysis undertaken demand for this type of housing product is strong and an increased take up rate in Ceduna would not necessarily result in a drop of sales within other localities.

New dwellings to be constructed as part of this development would by mindful of new and efficient construction techniques and materials, including building systems such as air-conditioning and water use, etc. the careful siting and orientation of dwellings would also assist in the regard.

13 Integrate the planning and management of urban infrastructure in an efficient manner, to conveniently locate facilities and to create an attractive, safe, inclusive and enjoyable place to live.

a. *Encourage economic and efficient use and development of physical infrastructure and its provision to adequately meet existing and future needs of the community.*
b. *Ensure new housing and other urban development is continuous with and forms compact extensions of existing built-up areas.*
c. *Release areas for urban growth to maintain location choice and economic provision of services.*
d. *Eliminate physical and social barriers to full participation in community activities and services.*

14 Concentrate shops, offices, services, civic and community activities in towns and business centres.

a. *Locate retailing in designated centres.*
b. *Reduce conflicts between road traffic, customer parking and pedestrian movement.*
c. *Encourage housing within or adjacent to town and business centres, particularly to accommodate people without access to private transport.*

The proposed development seeks to facilitate the efficient coordination of physical infrastructure both to the subject land and within. As stated previously, the proposed development provides a critical mass for the on going provision of these services to continue to be economically viable.

While some minor retail trade would be anticipated within the development, the extent to which such might impact on existing retail and commercial development localities within the town centre has been carefully considered. Council has done so and has resolved to support the proposed development proceeding on the basis that certain thresholds and limits in terms of the nature and scale of retail activities that will be imposed via Development Plan policy.

15 Ensure services and facilities are fairly distributed and change with the population dynamics of different parts of South Australia.

a. *Monitor population and socio-demographic trends and prepare local area projections to guide government, community and industry in the provision of housing and services.*

b. Match service provision to needs in major development areas, in areas where the structure of the population is undergoing change, and in areas of disadvantage.
c. Improve the planning and delivery of services for specific and vulnerable population groups.
d. Implement community development measures that provide a framework for integrated service delivery in accordance with local conditions and circumstances.

16 Provide access to high quality, responsive and timely services.
a. Foster effective partnerships between public, private and community sectors in responding to identified community needs and in developing services.
b. Encourage integrated service development focused on health promotion, early intervention and prevention.
c. Build on the capacity and strengths of existing communities, families and individuals in planning and developing services.
d. Provide support and advice to individuals and families to enable them to take greater responsibility for their own health and wellbeing.

17 Plan services and facilities to accommodate changing use over time and enhance accessibility through careful design and siting.
a. Establish guidelines for facilities to accommodate co-located services.
b. Encourage the shared use of recreation, sporting and other community facilities.

The proposed development would likewise assist in providing the economic base upon which to provide improved and maintain existing access to goods and services, including schools, hospitals and other community and social services.

Support for Individuals and Families
18 Facilitate the economic, social and cultural wellbeing of Aboriginal people.
a. Promote self-determination and self-management for Aboriginal people in achieving improved health, welfare and housing outcomes.
b. Encourage cooperation in the development of opportunities for economic independence of Aboriginal people.
c. Improve service delivery to Aboriginal communities through better coordination, planning, funding and service delivery.
d. Assist in the development of improvement of the health, wellbeing and education of Aboriginal people by:
• working in collaboration with key Aboriginal agencies and organisations
• providing culturally and physically accessible human services, including housing
• supporting relevant programs led by local Aboriginal communities
• promoting greater continuity of programs.
e. Improve the responsiveness of mainstream services to meet the needs of indigenous communities.
f. Incorporate traditional Aboriginal land management and ownership into planning for tourism and agricultural development.

The proposed development presents an opportunity to generate economic activity that will assist local Aboriginal communities in terms of employment and training, together with an active involvement in the community interpretative centre proposed.

Water Resources

EFFICIENT USE OF WATER

Industry and Town Water Use
2 Plan for the sustainable, economic and efficient use of water resources a. Ensure the most efficient and economic use of imported water supplies based on the principles of avoidance, reduction, reuse, recycle and appropriate disposal.
b. Conserve water through on-site detention and retention and the re-use of water resources including urban stormwater and treated sewage effluent.
c. Establish incentives for efficient water use, based on water use efficiency targets.
d. Introduce water pricing strategies that reflect the true cost of water and encourage efficient water use.
e. Promote the use of aquifer storage and recovery schemes that do not adversely affect water dependent ecosystems.

f. *Improve understanding and provide a clear message regarding the impacts of excessive water use.*
g. *Locate and group industries to optimally use existing infrastructure and available water resources, such as process-recovered water, waste and stormwater re-use.*

The proposed development would be provided with mains water supply sourced from the existing trunk main to the township of Ceduna. SA Water is presently investigating the various technical options in terms of supply, in terms of extensions required and augmentation of the existing systems including source point desalinisation.

Infrastructure

INDUSTRY SUPPORT

1 Enhance the economic competitiveness of the State by supporting the provision of suitable infrastructure at reasonable cost.

a. *Where practical, locate industry to take advantage of emerging infrastructure such as telecommunications, wind farms and gas generation from waste.*
b. *Ensure industry is sited to maximise the use of current infrastructure and energy efficiency.*
c. *Ensure the public and private sector infrastructure providers have the strategic information to make accurate plans for the best location of new or augmented services.*
d. *Improve access to cost effective, reliable telecommunications infrastructure.*
e. *Improve the security and quality of water supply to the State.*

ENERGY

2 Enhance access to competitive energy supplies for all customers across the State.

a. *Work with business, industry and governments to resolve specific bottlenecks in the energy supply network.*
b. *Improve the security of the supply of gas to South Australia through the establishment of an enhanced national gas network to provide alternative sources of gas supply.*
c. *Support industry growth through enhanced access to competitive energy supplies for all customers.*
d. *Promote commercial opportunities for the development of renewable energy.*
e. *Support the expansion of the electricity network where it supports economic development or the connection of sustainable energy projects.*
f. *Promote the use of renewable energy sources by planning for wind farms, landfill gas extraction and other forms of renewable energy supply.*

WATER

3 Plan for water infrastructure.

a. *Reduce reliance on River Murray water for urban and domestic use.*
b. *Identify opportunities to use alternative water sources, including stormwater of suitable quality.*
c. *Reduce infrastructure unit costs by adopting innovative, multi-purpose designs for flood and stormwater management.*
d. *Investigate new technology capable of supplementing natural water supplies such as desalination.*

4 Ensure water supply, sewage and stormwater drainage services of appropriate standards and costs are available to meet community needs.

a. *Base the expansion of towns on potential water availability and quality.*
b. *Encourage private investment in alternative water supply and harvesting.*

The proposed development would assist industry through the improvement of infrastructure services to the land and locality. The proposed development would provide a larger economic base over which to fund the extension and augmentation of existing services such as electrical power and water. The cost associated with the provision of suitable water supply, sewage and stormwater systems would be accommodated within the cost of the development.

MOVING PEOPLE, GOODS AND SERVICES

Road

19 Enable the safe and efficient movement of people and goods.

a. Ensure safe access to, and use of, the road system by the various modes of travel (including non-motorised and unprotected road users, riders, cyclists, pedestrians).

b. Minimises the incidence for accidents by:

- *implementing the overtaking lane strategy*
- *undertaking regular road safety audits and develop a response program to* implement safety improvements.

The proposed development would provide for safe and efficient access to the land from Denial Bay Road via the Eyre Highway and the convenient movement of traffic within the site, together with pedestrian and cycle paths are appropriate.

Air

26 Develop an integrated, efficient and competitive air transport that supports South Australian businesses and regional communities.

a. Facilitate market support for the maintenance of existing air services and seek additional air services of benefit to the regions.

b. Facilitate and participate in industry-Government working groups that improve the efficiency of the air freight logistics chain.

c. Influence the process of Commonwealth regulatory change to take account of the State's special interests in improving its intrastate, interstate and international air access equity.

d. Work with operators of Adelaide International Airport to facilitate the improvement of air access to and within the State through market research, route evaluation and liaison with airlines, airport operators and other relevant Government and industry stakeholders.

e. Ensure that regional airports and airstrips throughout the State are operated, maintained and developed in accordance with social and economic needs.

f. Ensure land use policies allow and enhance the efficient operation of airports while minimising their impacts on surrounding communities.

The proposed development would provide an expanded base upon which the Ceduna airport would operate in terms of stabilised demand for existing services and increased demand that could or might support an improved level of service to the town and region.

Eyre Peninsula Planning and Development Area

The following strategies apply more specifically to the Eyre Peninsula Planning and Development area.

3 Manage the marine environment to protect important fish nurseries from loss of biodiversity including seagrass, algae and invasion by exotic species from ballast water.

a. Encourage 'best practice' environmental performance for long term sustainability.

4 Investigate the significant potential for aquaculture development near the shore and in bays, as well as the potential for land-based aquaculture developments.

a. Provide support for aquaculture development including education and training, industry research and development, processing facilities and marketing.

b. Develop marine aquaculture facilities in accordance with approved Management Plans.

c. Ensure Development Plans respond to the growing aquaculture industry by introducing performance-based policies to guide sustainable development in appropriate locations.

c. Promote opportunities for land-based aquaculture in appropriate zones where infrastructure such as power and water area attainable and where there is sufficient transport capacity.

d. Allow for land-based infrastructure and support services for the marine fishing industry.

There is need to ensure that the proposed development does not threaten the role that Murat Bay plays in terms of a habitat and breeding ground for fish stock.

7 Promote expansion of the tourist industry based on the natural and cultural assets of the area.

a. Encourage the development tourist accommodation in the form of nature retreats in the area.

b. Encourage small-scale marina developments in appropriate areas that enhance the area's character, to facilitate coastal recreational opportunities.
c. Develop small to medium-scale tourist accommodation in and around existing coastal settlements.
d. Develop tourism links with the fishing industry and aquaculture (oyster, abalone, tuna).

8 Upgrade visitor facilities and infrastructure at key tourist locations and improve visitor access to tourist attractions.
a. Develop and upgrade secondary roads, signage and interpretive facilities.
b. Manage visitor impacts in environmentally sensitive areas.
c. Identify the area's parks and reserves suitable for visitor access and develop associated facilities.
d. Upgrade recreational boating facilities.

The proposed development would further the tourism industry as outlined above. It is important to note that this strategy specifically acknowledges the potential for marina development in appropriate areas to maximise access and recreational opportunities associated with the coast. Together with interpretative centres, the proposed development would have a generally positive effect on the tourism industry.

Environment and Resources Strategies

13 Protect and enhance biodiversity and essential ecological processes.
a. Protect and manage important conservation areas, parks and reserves and key biodiversity areas.
b. Retain, re-establish and manage areas of native vegetation and threatened plant communities, including those that provide links and buffers between existing habitats.
c. Identify new areas of conservation significance and ensure their protection.
d. Control the spread of weeds, introduced animals, fire and other risks to biodiversity.
e. Promote revegetation programs using local native species to link and enhance existing remnant areas
f. Ensure land use policy recognises and protects areas of natural biodiversity and conservation significance.

The environmental investigations undertaken in the preparation of this report indicate that the proposed development is not anticipated to have a serious impact on biodiversity and ecological processes in the Murat Bay locality.

14 Maximise sustainable use of regional water supplies by managing demand and providing opportunities to supply future needs.
a. Protect and supplement recharge and retrieval of groundwater aquifers.
b. Promote efficient water use and reuse.
c. Apply techniques to desalinate seawater and brackish water.
d. Treat and recycle municipal and industrial wastewaters eg: reuse of effluent at Billy Lights Point.
e. Implement a total water cycle management approach to regional water supplies.
f. Ensure the most efficient and economic use of imported water supplies based on the principles of avoidance, reduction, reuse, recycle and appropriate disposal.
g. Maintain and improve the ability for environmental flows to be discharged through natural discharges to the sea.
h. Protect water-dependent ecosystems by ensuring necessary water flows.

The proposed development seeks to maximise regional water supplies by investigating alternate and new technologies in order to supplement and enhance existing supply including desalinisation. Best practice in on-site collection, storage and reuse will also be employed as part of the overall development of this land.

16 Manage coastal and marine environments in a sustainable way to meet multiple objectives.
a. Ensure dune and beach protection through restriction of inappropriate activities and implementation of revegetation programs.

b. Site and design development to avoid coastal erosion, seawater flooding and damage to the coast and the adjacent marine environment.
c. Ensure all development retains public access to the coast.
d. Minimise urban runoff discharge to the marine environment and reduce contamination of groundwater by septic tank discharges.
e. Develop, establish and clearly define marine protected areas in key biodiversity locations.
f. Identify core high protection areas for marine biodiversity conservation, as part of the representative system of marine protected areas.
g. Identify threatened marine species and develop recovery plans.

The proposed development is a good example of how the marine environment can be managed in order to meet multiple objectives in relation to environmental and recreational considerations.

17 Encourage the further development of Port Lincoln as a main regional service centre for the lower and western parts of the area.

Port Lincoln would continue to play the role as the major service centre for the region as a result of this development.

18 Encourage a variety of housing types appropriate to the location, size and character of townships.
a. Increase housing choice and diversity to meet the needs of current and future residents.
b. Develop a coordinated regional approach to the provision of affordable and appropriate workforce housing to accommodate emerging employment opportunities.
c. Review appropriateness of current housing stock available for low cost rental (including public housing) to meet the changing housing needs of low income and disadvantaged groups, including Aboriginal communities.
d. Complete the Lincoln Gardens redevelopment and explore the potential for other urban regeneration projects.
e. Coordinate provision of high quality rental accommodation to meet the needs of professional and managerial staff.
f. Base residential zoning and policy on demographic data, growth in industry sectors and local infrastructure capacity.
g. Encourage infill within town boundaries and selectively increase residential densities in appropriate areas.
h. Promote greater flexibility in housing and land division design that has regard to local characteristics and recognises Aboriginal homelands developments.

The proposed development would assist in achieving housing choice on the west coast.

19 Improve access to and the quantity and quality of health and community services, such as regional hospitals, aged care facilities, mental health services and Aboriginal health
a. Attract and retain key professionals in areas of health and community services, having regard to housing, education and career opportunities.
b. Identify and address gaps in medical specialist services.
c. Continue to assess human service needs to identify facilities as part of an integrated community planning process.
d. Attract capital to build facilities.
e. Investigate options to expand the range of public passenger transport services available to the area.
f. Develop alternative approaches to providing support services to frail older people to enable them to remain in their communities.

The proposed development would generate increased population and economic capacity in order to ensure the ongoing provision of services such as the hospital and other community facilities within Ceduna.

20 Provide opportunities for young people in education, employment and recreation.
a. Increase and promote available employment opportunities to attract people to return to the area after education.

b. Work with young people to increase the range of recreation and leisure opportunities available.

The proposed development would increase opportunities for young people in education, employment and recreation.

Infrastructure Strategies

21 Develop transport infrastructure practices, connections and capabilities to meet existing and future needs of exporters, producers, miners, residents and visitors.

a. Improve access between the Eyre Peninsula, Port Adelaide and Adelaide International Airport.
b. Ensure inter-modal connections are efficient, effective and reliable.
c. Investigate the potential to expand the heavy vehicle network for vehicles travelling to and from intermodal terminals.
a. Investigate the ability of airport facilities at Port Lincoln, Ceduna and Head of Bight to meet export and tourism objectives.
b. Liaise with industry groups to ensure that road, rail and port infrastructure meet changing requirements of grain handling and container based shipping.
c. Investigate ability of existing port infrastructure to accommodate operations that cater for specialised shipping needs.
d. Maintain and facilitate the upgrade of port facilities at Port Lincoln and Thevenard.
e. Explore opportunities to expand or better use the rail network.
f. Agree on a preferred solution for heavy vehicle movements within Port Lincoln.

The proposed development would assist in terms of an economic base upon which to undertake further improvements in air services to Ceduna and the region.

The proposal provides an opportunity to pursue innovative means of energy supply including solar and wind power in order to supplement conventional electrical power sources.

23 Promote innovative means of energy supply and capacity to areas that are remote from the distribution network.

a. Investigate alternative energy sources including wind and solar power and encourage their development.
b. Ensure land use policies guide the development of alternative energy infrastructure by providing for its specific requirements and managing the visual and environmental effects on a locality.

24 Ensure adequate supply of water of sufficient quantity and quality for industry development and human use.

a. Promote the conservation of water resources through land use policies that support water reuse and water recycling.
b. Investigate ways to effectively link desalination projects designed to increase local access to water to achieve a regional benefit.
c. Investigate the need to upgrade the existing water supply and wastewater systems.
d. Upgrade Streaky Bay water supply.

The proposed development can be provided with adequate water supply subject to extension and augmentation requirements by SA Water. Water efficiency and reuse strategies will be developed as part of the overall development.

In conclusion, the proposed development is considered to be generally in accord with the stated strategies as contained within the Planning Strategy for Regional South Australia.

APPENDIX E

RELEVANT PROVISIONS OF DEVELOPMENT PLAN

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Council Wide

Objectives: 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, 37, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 51, 53, 54.

Principles of Development Control: 1, 2, 3, 4, 5, 8, 9, 10, 11, 15, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 40, 41, 42, 43, 44, 46, 47, 49, 50, 51, 52, 54, 55, 56, 58, 59, 61, 62, 63, 64, 65, 71, 74, 75, 76, 80, 81, 82, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 104, 105, 106, 108, 109, 118, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 154, 155, 156, 157, 158, 159, 160, 161, 195, 196, 197, 198, 199, 200, 202, 206

Coastal Zone

Objectives: 1, 2, 3, 4, 5

Principles of Development Control:1, 2, 3, 4, 5, 6, 7, 20, 21

Recreation Zone

Objectives: 1,

Principles of Development Control: 1, 3, 4, 6,

Rural Living Zone

Objectives:1, 2

Principles of Development Control: 1, 3, 6, 7, 8, 9, 10, 11

The following statements are made in respect to the extent to which the proposed development is consistent with these provisions of the Ceduna (DC) Development Plan. To assist key provisions have been grouped under the following headings for ease of understanding.

Economic Development

Objective 1: *A diverse economic base for the district.*

The proposed development would result in a generally positive economic effect on the township of Ceduna and the district. The nature of the development with its various component activities and developments would assist in diversifying the economic base for the district in terms of facilitating growth and increased activity within the aquaculture industry, the residential sector, and the tourism industry primarily. The development would also have many flow on or multiplier effects that would assist in establishing a sustainable economic base for the township and the district based on the level of capital investment envisaged.

Form of Development

Objective 2: *Orderly development of the district, with the economic extension of services and facilities.*

Objective 3: *Ceduna-Thevenard Regional Settlement reinforced as the main urban centre of the district, while the coastal townships of Denial Bay and Smoky Bay are local centres.*

Objective 4: *Proper distribution and segregation of living, working and recreational activities by the allocation of suitable areas of land for those purposes.*

Objective 5: *Proper location of public and community facilities by the reservation of suitable land in advance of need.*

Objective 7: *Development to be safe from natural or man-made hazards and to be compatible with land capability.*

In terms of these Objectives that relate to form of development, the proposal would facilitate the economic extension of infrastructure services in an orderly and economic manner, as outlined earlier. The development would generate the necessary economic capacity to facilitate and finance the extension of these services without placing disproportionate impost on Government for assistance and/or subsidy.

The location of the development adjacent the township of Ceduna is also consistent with reinforcing the Ceduna-Thevenard area as the main urban centre. Smoky Bay and Denial Bay will continue to remain smaller coastal townships. A development of the scale proposed is considered most appropriate within or, for that matter, adjacent to the Ceduna township.

A logical pattern of development will be achieved as a result of the proposed development in terms of the arrangement of land uses with appropriate design and operational considerations given in respect to the separation of potentially conflicting or competing land uses. The development would also have access to an appropriate level of public and community services both within the development and adjoining township of Ceduna.

1 *Development should be in accordance with the Structure Plans for the whole of the council area and for the regional settlement of Ceduna/Thevenard shown on Maps Ced/1 (Overlay 1) and Enlargement A and B respectively, and Fig/1.*

2 *Development should be orderly and economic. Division of land for urban or town purposes should be in the nature of infilling or in the form of compact extensions to existing developed areas so as to achieve economy in the provision of public services.*

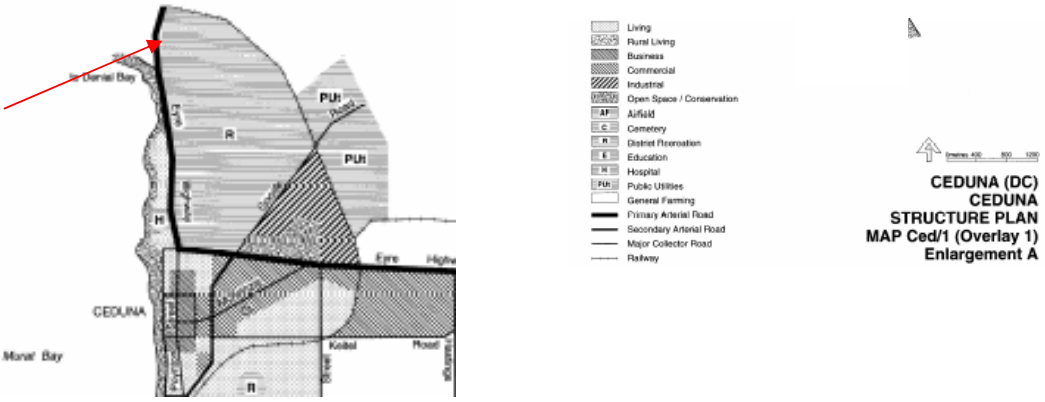
3 *Extensions of built-up areas should not be in the form of ribbon development along the main roads.*

4 *Urban development should be confined to township and settlement boundaries designated on Maps Ced/19 to 33 and create a safe, convenient and pleasant environment in which to live.*

5 *Development should not reduce the environmental quality of its locality.*

The following excerpt is provided from the Structure Plan.

Ceduna Keys



As can be seen from this Structure Plan, the land west of the Eyre Highway is designated as being appropriate for residential development. However, land west of the Eyre Highway is not specifically identified as being appropriate for urban development.

While the proposed development does not represent infill development within the existing township boundary, it is nonetheless considered to be an appropriate extension of the township to the north, albeit with a degree of separation achieved in the form of a recreation/open space area.

This will assist in the economic and efficient extension of services to the proposed development. That said, the proposed development is not necessarily considered to be 'ribbon' development and will be undertaken in a coordinated manner according to an approved master plan. The result will be a safe convenient and pleasant place in which to live.

The extent to which the development would have an effect on the environmental quality of the land will be discussed further below.

8 *Development which will be used by the public should have, as appropriate, pedestrian-related elements such as, ramps, external seating, litter bins, shelter and other elements providing for the comfort, convenience and enjoyment of the public.*

9 *Development should maximise the security and safety of users with good visibility into public space, adequate lighting and access points for surveillance.*

The plans for the proposal, which are effectively a Master Plan for the overall development of the land, clearly indicate a road network that would provide for appropriate pedestrian access, including to waterfront areas such as the marina berths and wharf area. A balance has been achieved in terms of safety and security for users and the amenity of spaces including casual surveillance considerations. This finer level of design will be progressed further at the detailed design stage of the development following approval of the Master Plan.

Appearance of Land and Buildings

Objective 8: *Appearance of land, buildings and objects to preserve the amenity of localities.*

Objective 9: *Landscaped residential streets, open spaces and residential areas.*

10 *Development should be of a high standard of design with regard to external appearance, building materials, colours, siting and landscaping so as to preserve and enhance the character and amenity of the locality.*

CONNOR HOLMES

11 *Development liable to detract from the appearance of the land should not be undertaken in areas of landscape significance.*

15 *Landscaping should be used as appropriate to the character of the locality to screen development.*

The proposed development is considered to be of a high standard and would have an external appearance befitting its setting. The exact design of buildings and structures would be pursued at the next stage following approval of the Master Plan.

The subject land, while essentially a nature setting, is not considered to be a locality of landscape significance. An appropriate landscape theme will be developed as the project progresses in order to complement the appearance of built form and blend in with the surrounding natural environment as far as is possible. The Master Plan acknowledges the desirability to retain some section of existing vegetation to form a visual landscape screen from adjoining land.

Movement of People & Goods

Objective 10: *A network of primary arterial and secondary arterial roads to serve local and district traffic.*

Objective 12: *Free flow of traffic on roads by minimising interference from adjoining development.*

142 *Development and associated points of access and egress should not create conditions that cause interference with the free flow of traffic on adjoining roads. In particular, direct access points to the Eyre Highway should be avoided.*

143 *Development should include an appropriate provision on the site to enable the parking, loading, unloading, turning and fuelling of vehicles and pedestrian or cycle movement in a safe and convenient manner. Shared parking areas or sites located elsewhere other than on site should only be provided where such an arrangement is to the benefit of the community.*

The proposed development would result in a logical hierarchy of roads such that different types of traffic could move independently of each other and without conflict.

Access to the development would be from Denial Bay Road, which serves as a major collector road off the Eyre Highway, which is a major arterial road. A network of collector roads and minor streets will then be provided within the development allowing for access to component uses including residential.

The free flow of traffic on the Eyre Highway would not be compromised or frustrated by the proposed development. No direct access is to be provided to the Eyre Highway. In addition, there is to be appropriate parking provided within the development site for vehicles so as not to result in parking on higher traffic routes.

Coastal Development

Objective 18: *Manage development in coastal areas to sustain or enhance the natural coastal environment and maintain the quality of coastal waters.*

Objective 19: *Protect the coast from development that will adversely affect the marine and on-shore coastal environment whether by pollution, erosion, damage or depletion of physical or biological resources, interference with natural coastal processes, or any other means.*

Objective 23: *Development which maintains or enhances public access to coastal areas in keeping with objectives for protection of the environment, heritage and amenity by provision of:*

(a) planned, appropriate easy to use public access to and along beaches;

(b) coastal reserves and lookouts;

(c) convenient and safe public boating facilities at selected locations;

(d) convenient vehicular access to points near beaches and selected points of interest; and

(e) adequate car parking.

Objective 24: *Development only undertaken on land which is not subject to, or can be appropriately protected from, coastal hazards such as:*

(a) inundation by storm tides or combined storm tides and stormwater;

(b) coastal erosion; or

(c) sand drift.

Objective 25: *Development located and designed to allow for changes in sea level due to natural subsidence and probable climate change during the first 100 years of the development. This change to be based on the historic and currently observed rate of sea level rise for South Australia with an allowance for the nationally agreed most-likely predicted additional rise due to global climate change.*

Objective 26: *Development which will not require, now or in the future, public expenditure on protection of the development or the environment.*

Objective 27: *The protection of the physical and economic resources of the coast from inappropriate development.*

Objective 28: *Development of coastal urban settlements, coastal rural living areas, tourist complexes, aquaculture, and marinas only in environmentally acceptable areas.*

Objective 29: *Urban development including housing, holiday houses, tourist accommodation, and rural living, as well as land division for all such purposes, only in the zones specifically created for such development.*

Objective 30: *Development of coastal urban settlements, coastal rural living, tourist accommodation, marinas and ports in an orderly and economic manner which provides for a range of sites while ensuring the number of locations and the size of the zones do not exceed that which is indicated as being required by a realistic assessment of future demand.*

The proposed development would seek to minimise impacts on natural systems and processes within the marine and coastal environment. However, invariably a development of the nature proposed would result in some disturbance. This disturbance would be minimised and the potential for serious impact minimised by adopting appropriate construction and operation techniques and procedures. Past examples including the marina development at Lincoln Cove, demonstrate such an outcome can be achieved.

The subject land and its surrounding locality, while attractive and typical of the coastline of Murat Bay, is not considered to be a site of environmental significance or particularly important in terms of marine life or vegetation. The extent to which the disturbance anticipated might have an impact beyond natural systems and processes outside the locality would be assessed more particularly as a result of the environmental reporting to be undertaken as part of the Major Developments process.

The final design of the marina development, in particular the physical form of the infrastructure such as the breakwater and seawalls, will be designed in such a manner so as to take account of tidal variations, together with sea level changes anticipated as a result of global climate change over the next 100 years. Finished floor levels would be set suitably high enough so as to minimise the potential for inundation in the event of a major storm event.

It is clear that Objective 28 does specifically anticipate marina developments in environmental acceptable areas. The subject land is considered to be such an environmentally acceptable area in terms of it not being an area of significance, with adequate opportunity available to accommodate the development in an attractive setting that complements the existing township. The uses proposed would provide a high level of amenity and are generally consistent with that envisages within Objectives 29 and 30.

The various Principles of Development Control that flow out of these Objectives address a range of issues including:

- Environmental protection
- Preservation of scenic, heritage and other values
- Maintenance of public access
- Hard risk minimisation
- Protection of physical and economic resources
- Settlement, tourist facilities and marina and other development in appropriate zones
- No premature development

In terms of environmental protection, the proposed development is not anticipated to have a serious and extensive impact on natural systems and processes. As outlined above, the extent to which impact will occur will be determined by the required level of environmental reporting to be undertaken by the applicant. These investigations will further identify, quantify, address and make recommendations in respect to water movement, wave action, ecology of the locality (including the sea bed and terrestrial environment), the dune system issues or erosion and stabilisation and rising sea levels.

The manner in which wastes and stormwater runoff is to be addressed will be determined as part of further engineering design. The approach taken will be to ensure that the potential for environmental harm is minimised via appropriate infrastructure, systems and processes. The extent to which development might impact on the quality or hydrology of ground water has been addressed above. Consideration has also be given to the extent to which the development might impact on terrestrial and marine biological communities including birds.

There will be an extensive alteration in the natural state of the land as a result of the proposed development. To this extent, the change would be dramatic, but following construction and the various replanting programmes that would be undertaken the proposed development would seek to blend with its surrounding physical environment. The retention of landscaped buffers to adjoining areas would assist in this regard. The scale and proportion of buildings would be mindful of the extent to which they would be visible at distance, and would generally not exceed 8 metres in height. Residential development should be generally limited to two storeys in height. However, some opportunity could be provided for tourist accommodation to achieve three of more floors subject to an appropriate design being proposed.

The proposed development seeks to maintain and improve access to the marine environment for the enjoyment of residents. The marina is to be a public facility and

subject to accepted security protocols in respect to accessing vessels. However, the public would be able to view and use facilities within the marina. Pedestrian and cycle paths would be provided throughout the development so as to facilitate the efficient and effective movement of people.

A degree of commercial development is anticipated as part of the proposal including that related to and serving the aquaculture industry and the fishing industry. Commercial development will occur on land that is not subject to flooding and inundation by tidal waters and be located in a convenient manner that minimises the potential for disruption to the balance of the development. Appropriate protection measures will be implemented to ensure that the marine environment is not compromised by these activities.

The extent to which the proposed development could have an effect on existing aquaculture operations has been carefully considered as part of the environmental investigations undertaken. From the work that has been undertaken, it would seem that the proposed development would have a generally positive effect in terms of providing access to mooring facilities and access to warehousing, storage and maintenance facilities.

In the absence of a specific zone that would direct the siting of a marina development, the Council has sought to identify an appropriate location that has the physical and environmental capacity to support such a facility that is also economically viable and commercially acceptable. Access to the airport and existing road networks is an important consideration together with the ability to provide infrastructure services in an orderly and economic manner.

Conservation

***Objective 34**: Conservation, preservation, or enhancement, of scenically-attractive areas, in particular land adjoining scenic routes.*

***Objective 35:** Preservation and replanting of roadside vegetation.*

***Objective 37:** Conservation and preservation of buildings or sites of Aboriginal heritage, architectural, historical or scientific interest.*

***Objective 40:** Retention of native vegetation for amenity purposes, for livestock shade and shelter and for the movement of native wildlife.*

***Objective 41:** Protection of water resources from pollution and the depletion of their catchment areas.*

***Objective 43:** The district's water resources protected from excessive usage and development encouraged to use water-saving devices recycling methods, and install rainwater storage tanks.*

***Objective 44:** The conservation of energy.*

Whilst an attractive setting, the subject land and the surrounding locality is not considered to be of significance other than as the backdrop that it provides to the township of Ceduna. Nor is the subject land and locality particularly significant in terms of existing vegetation. The proposed development could proceed without resulting in significant harm to areas of environmental and scenic significance. Roadside vegetation could be retained and supplemented as part of the revegetation and landscape programme to be undertaken as part of the development.

Acknowledging the previous users of this land is an important consideration and will be pursued in more detail with officers of the Department of State Aboriginal Affairs to ensure that any sites of significance are identified and responded to in an appropriate

manner. Based on the investigations and inquiries undertaken, the subject land has not been previously identified as being of Aboriginal heritage significance.

In terms of water and energy conservation, 'best practice' in these fields of service provision will be pursued in order to ensure that these resources are accessed and used in a responsible and efficient manner. The capacity of existing electrical power and water supply systems will be further quantified and responded to as part of the development implementation.

Open Space

Objective 45: *The development of existing and extensive public areas for passive and active recreation.*

Objective 46: *The limited provision of open spaces in residential areas only where access to parks and resources is remote or unavailable or there is a need to preserve natural features such as remnant vegetation.*

84 *Public open space created through land division should:*

(a) form linear connections to existing open space and community focal points or buffers between traffic and residential, where appropriate;

(b) incorporate and protect landscape features;

(c) be integrated with other community facilities where practicable.

85 *Communal open space and any required facilities should be designed according to projected user needs taking into account:*

(a) the overall housing density;

(b) the quality and extent of alternative public or private open space;

(c) the relationship to adjoining open space areas;

(d) the need to distinguish communal open space clearly from public or private open space;

(e) future maintenance requirements;

(f) the need to maintain the privacy of nearby dwellings; and

(g) the need for landscaping to enhance a sense of enclosure of communal open spaces, while allowing informal surveillance and meeting security needs.

The proposed development would result in the enhancement and possible extension for the existing Ceduna Golf Course, which is a key public recreation facility. In addition to this space, there is not considered to be a significant need for extensive areas of public open space, both in terms of the likely level of demand for such spaces and the emphasis the development has on the marine environment and recreation activities associated with the sea. Furthermore, the provision of large areas of green open space in the form of parks is not considered to be efficient and effective use of land and water in this environment.

Residential Development

Objective 48: *A range of attractive living environments and housing types.*

Objective 49: *Residential areas should contain a safe, convenient and legible network to all-weather paths for pedestrians and cyclist providing direct links to open space, shopping centre and community facilities. Such paths should follow local*

streets or open space reserves as far as practicable and should provide a township-wide network linking all areas.

Retail & Business Development

The proposed development would result in an attractive living environment providing choice in terms of waterfront or land based development opportunities, including adjacent the golf course. The exact type of housing will be a response to market demand; but care will be taken via encumbrances and similar mechanisms to ensure a suitable level of quality and standards in terms of design and construction is maintained.

The extensive list of Principles of Development Control that relate to residential design and siting will be attended to as part of the implementation stages of the proposed development, including issues such as collection and reuse of roof water on site, set backs, private open space, allotment sizes and widths, density and streetscape considerations. Local streets and the waterways between the residential development will provide adequate opportunity for movement within the development. Links will also be provided back to the main township of Ceduna along the recently constructed coastal walk.

Tourist Facilities

Objective 54: *Tourist facilities and rest areas located appropriately.*

The proposed development would provide for a range of facilities that would support the tourism industry, including accommodation, recreation, interpretation and cultural education and experiences.

Coastal Zone

Objective 1: *Preservation of the coast in a state which does not impede natural processes.*

Objective 2: *Enhancement of the ecological, geological and archaeological integrity and natural features of the zone.*

Objective 3: *Protection of the natural scenic attributes and landscape appearance of the zone.*

Objective 4: *Protection of the quality of marine waters.*

Objective 5: *Development of interpretative and educational facilities in suitable locations and only where such activities will not compromise the achievement of the above objectives.*

The proposed development would not seriously impede natural processes within Murat Bay and beyond, nor would the proposed development have a significant effect on the ecological, geological and archaeological integrity and natural features of the coast line, as set out above. So too, the extent to which the proposed development would impact on the scenic attributes of the land has been dealt with above.

It is important to note that the zone does anticipate the development of an interpretive centre and education facilities, as is proposed as part of the development. The subject land and a relationship with the marina development in near proximity to the Ceduna township are considered to be appropriate for such a development.

While a number of component uses identified within Principle of Development Control 21 for the Coastal Zone such as dwelling, hotel, industry, office, shop, and store are identified as being non-complying, the proposed development is considered an

appropriate mixed use development that should be considered on its merits. The Major Development process allows for such consideration.

Acknowledging that the Major Developments process may allow the development to proceed, it is considered necessary to undertake a Plan Amendment Report in order to change the zoning contained within the Development and provide a policy framework that would better guide the orderly and economic development of the subject land. A Statement of Intent for such a PAR has been prepared and submitted to the Minister for Urban Development and Planning shortly.

Recreation Zone

Objective 1: *A zone which makes provision for a range of recreation experiences to meet the needs of the population of the district and visitors to the region.*

(d) Policy Area 21 - Tourist Use

This policy area involves Section 230, Hundred of Bonython which is identified for recreation activities and tourist accommodation uses which could involve a golf driving range, caravan park, cabin accommodation, motel, roadhouse/petrol filling station. A system of artificial lakes and passive recreation areas may be appropriate.

To support development of the area housing will also be considered.

The proposed development is considered to be generally consistent with the Objective for this Zone in terms of providing for a range of recreational activities and pursuits including marine-based activities such as sailing and boating. This would provide an important focus for both residents and visitors to the area.

Policy Area 21 goes on to identify that portion of the subject land that might be used to support a 'mixed use' tourist and recreation style development similar to that now proposed. To this extent, the Development Plan does anticipate further development to the north of the township including residential and tourist accommodation around a system of waterways or lakes.

As with the Coastal Zone, a number of component uses for the proposed development are identified as being non-complying. For the reasons previously outlined, this should not prejudice the assessment and consideration of the proposal as a Major Development.

Rural Living Zone

Objective 1: *A zone for detached dwellings on large residential allotments with small-scale rural activities of a minor nature*

Objective 2: *Development compatible with adjoining land use zones.*

(c) Policy Area 17 - Ceduna North

The Policy Area is suitable for residential development on large allotments which are capable of supporting hobby rural activities such as animal keeping.

Development proposals need to give close attention to land management to ensure land is not degraded or untidy, with tree planting around the perimeters of properties and buildings strongly encouraged.

(i) Desired uses in the Policy Area:

Animal keeping
Detached Dwelling

The Rural Living Zone does anticipate forms of residential and other development, albeit on larger allotments and in a manner compatible with surrounding land use zones. The proposed development would represent a significant shift away from the stated intent for this Zone within the key Objectives, but for the reasons outlined above such is considered appropriate in the circumstance, including the intention on the part of Council to undertake a PAR to rezone this land in order to better facilitate the proposed development.

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

CEDUNA KEYS

ENGINEERING ASSESSMENT

Attachment to the
ENVIRONMENTAL IMPACT STATEMENT

For Ceduna Marina Development Company

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1. BACKGROUND

This report has been prepared in association with the Development Application lodged by the District Council of Ceduna for the Ceduna Keys Marina Development on land located to the north of the township on Denial Bay Road and the Eyre Highway, together with a portion of Murat Bay, Ceduna.

This report is intended to provide additional information, in order to address queries raised by Planning SA in a discussion paper regarding the development application and it's status as a major development, and also the guidelines for the preparation of an Environmental Impact Statement, provided by the Major Developments Panel. This report should be read in conjunction with details contained in earlier submission documents including:

- Development Application for a Major Development, Ceduna 'Keys' Marina Development and Coastal Community Centre, Connor Holmes Consulting, August 2003
- Development Application for a Major Development, Ceduna 'Keys' Marina Development and Coastal Community Centre, Appendices, Connor Holmes Consulting, August 2003
- Ceduna Keys and Coastal Centre Development, Preliminary Environmental Assessment, Eco Management Services, 2001.

2. COASTAL MANAGEMENT

This section assesses the projected impact of storm tides and sea level rises on the proposed development and the measures needed to mitigate and /or accommodate them.

2.1 STORM TIDES AND RISE IN MEAN SEA LEVEL (GREENHOUSE EFFECT)

For an open waterway system compliance with the Coastal Protection Board (CPB) policy has been assessed as follows.

Protection Criteria	**Tidal Waterways**	
	Piled buildings over waterways	**Areas capable of future protection**
100 year storm tide (Thevenard)	2.32m AHD	2.32m AHD
Wave set up	0.20m	0.20m
Freeboard	0.25m	0.25m
Sea Level Rise		
- 50 Year	N/A	0.35m
- 100 Year	1.00m	N/A
Minimum building floor level	3.77m AHD	3.12m AHD

Due to the fact that there will be a surplus of material excavated from the waterways a minimum general fill level of 3.20m AHD has been adopted in order to comply with the above requirement.

The 100-year storm tide of 2.32 m above mean sea level was based on advice provided by The National Tidal Centre (Bureau of Meteorology). Their advice was based on the results of a study undertaken in 1989 for Thevenard.

2.2 EFFECTS OF TIDAL LEVELS ON FLUSHING TIMES

The total waterway area is some 49 hectares linked to Murat Bay by a 50m wide channel. The average depth is designed to be 2.5m below low tide, i.e. -3.5m AHD. Reference to the Australian National Tide Tables (Table 1) gives the following values of tidal levels for Thevenard.

	HAT	MHHW	MLHW	MSL	MHLW	MLLW	LAT
Local Datum	2.2	1.6	Usually diurnal	1.0	Usually diurnal	0.4	0.0
AHD	1.19	0.59		0.0		-0.61	-1.01

As Thevenard is situated within Murat Bay it is considered that these tide levels are applicable to the development site.
Total waterway volume between tide levels 0.59m AHD (MHHW) and -0.61m AHD (MLLW) is 588,000 cu.m.
Over a 6 hr tide cycle this on average represents an inflow or outflow rate of 27.2cu.m. per sec through the channel. Assuming an average water depth of 2.5m in the channel this flow takes place at a very low velocity of 0.21 m/sec.
Although this is a somewhat crude analysis the outcome does indicate that there is almost unrestricted exchange of water between Murat Bay and the waterways.
It is therefore considered that exchange volumes can, for the purpose of assessing water quality in the waterways, be directly related to tidal variations.

A statistical analysis of the daily tidal variations at Thevenard for the period from May 04 to May 05 indicates the following:

	Total Daily Tidal Variation (m)	**Waterway exchange rate (days)**
0.10 percentile value	1.05	6.6
0.25 percentile value	1.43	4.9
0.50 percentile value	2.03	3.5
0.75 percentile value	2.51	2.8
Average	1.99	3.5
Median	2.03	3.5
Min	0.46	
Max	3.39	

It is considered that 50% of the above total daily tidal variations represents the exchange depth of water that flows in and out each day.

An average exchange of about 1.0m per day and an average waterway depth of 3.5m indicates an average water exchange rate of about 3.5 days ignoring any lag effects.

Based on the above statistical analysis the total tidal variation is less than 1.43m for less than 25% of the year and less than 1.05m for less than 10% of the year. Reference to a graph of the total daily tidal variations shows that the maximum sequence of variations less than 10% (1.05m) is 3 days and occurs for a total of 8 times per year. The maximum sequence of total tidal variations less than 25% (1.43m) is 7 days (3 times per year); usually the sequence is about 3 to 5 days. These statistics tend to support the use of the maximum water exchange rates presented in the table above.

Using the same logic as above a sea level rise of say 1.0m would increase the average exchange rate to about 4.5 days.

These exchange rates are very similar to those that have been calculated for the waterways at Lincoln Cove in Port Lincoln; a similar size waterfront and marina development.

2.3 CHANNEL VELOCITIES

Channel velocities due to tidal flows have been assessed to average about 0.21m/sec. This is not significant and therefore considered to be acceptable.

Sea level rises will not significantly impact on channel velocities as the depth of water in the channel increases accordingly.

2.4 IMPACT OF STORMWATER INFLOWS ON WATERWAY LEVELS

As the 50m wide channel imposes almost negligible restriction to outflows from the waterways into Murat Bay there will be very little impact on waterway levels during major flood events assuming that the flows do enter the waterways.
The development area including the waterways is some 125 hectares, and the waterways some 49 hectares. Assuming that 100mm of rain fell and there was no losses (very conservative assumption for the point of comparison), and no flow at all into Murat Bay, the waterway level rises by 250mm.

Any major stormwater flows that enter the waterways are therefore expected to discharge into Murat Bay without any detrimental flooding impacts.

2.5 SAND MOVEMENT

Reference to the local navigation charts indicates that Murat Bay should be well protected by the reef and island at the entrance of the bay from any coastal processes that take place seaward of Thevenard.

Local information and observations have not indicated that significant coastal processes such as sand movement are taking place in the vicinity of the proposed entrance to the development.

2.6 BREAKWATERS

The development is expected to be impacted by wind-generated waves from the west and southwest directions. The expected wave heights (Zw) based on a fetch distance of 9 km and a range of wind speeds are indicated on the following table:

References: Section 7-10 Wind Tides and Waves in Reservoirs 'Water resources Engineering' Linsley and Franzini 1964
Wind Roses prepared by the Bureau of Meteorology 1999 (Based on data collected from 1961 to 1990)

Fetch 9km from both the west and south westerly directions

Wind Roses indicate that velocities exceed 30 km/hr form the west and south west.

Zw Average height of the highest one third of waves from formula 7-3 in Linsley and Franzini

Duration Represents the minimum duration of wind to develop the indicated wave height.

Velocity	km/hr	30	40	50	60	70	80	90	100
Velocity	knots	16.2	21.6	27.0	32.4	37.8	43.2	48.6	54.1
Zw	m	0.52	0.70	0.89	1.08	1.27	1.46	1.66	1.85
Duration	mins	91	81	75	66	64	60	58	55

The above wave heights have been compared to those derived using the US Army Engineers forecasting curves for shallow water waves, constant depth 20 feet and were found to have very close agreement.

Given that the breakwaters are quite accessible for undertaking repairs, should damage from extreme events occur, a design wave height of say 1.8m would seem to be appropriate for use in the design of armour rock (size and/or mass) for this locality.

To minimise overtopping of the breakwaters it is considered that the crest height can be based on the following criteria derived from Fig 7.13 of Linsley and Franzini "Water-Resources Engineering":

Fetch 9km (5.6 miles)											
Wind Velocity	Vw	km/hr	30	40	50	55.5	60	70	80	90	100
		knots	16.2	21.6	27.0	30.0	32.4	37.8	43.2	48.6	54.1
		mph	18.6	24.8	31.1	34.5	37.3	43.5	49.7	55.9	62.1
Significant Wave height	Zw	ft	1.70	2.30	2.92	3.26	3.54	4.17	4.80	5.44	6.08
(Equation 7-3)		m	0.52	0.70	0.89	0.99	1.08	1.27	1.46	1.66	1.85
Wave period	tw	sec	2.70	3.06	3.38	3.54	3.66	3.92	4.16	4.38	4.58
Wavelength		ft	37.2	48.0	58.4	64.0	68.6	78.6	88.4	98.0	107.5
Ratio of wave height to wavelength (Fig 7.13)			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
Run up		m	0.41	0.56	0.71	0.79	0.86	1.02	1.17	1.33	1.48
Wind generated tide increase	Zs	m	0.02	0.04	0.06	0.07	0.08	0.12	0.15	0.19	0.24
Wave height + Run up + tide increase		m	0.95	1.30	1.66	1.86	2.03	2.40	2.78	3.17	3.57
Breakwater height above tide level of 1.19 AHD to prevent overtopping		(HAT)	2.14	2.49	2.85	3.05	3.22	3.59	3.97	4.36	4.76
of 2.32 AHD to prevent overtopping		(100yr)	3.27	3.62	3.98	4.18	4.35	4.72	5.10	5.49	5.89

Run up has been based on a relatively permeable rubble mound with batters of 1 vertical to 2 horizontal.

The wind generated tide increase is for that developed locally within Murat Bay.

The heights tabulated above are applicable to the ends of the breakwaters where the water depths are greatest. The height requirements will reduce at the onshore end of the breakwaters where the depths and hence wave heights will be reduced.

The final assessment and adoption of appropriate crest heights will depend on the degree/risk of overtopping during extreme events and the consequences of any overtopping.

2.7 EDGE TREATMENT

Edge treatments for all waterways will be local rock (riprap) placed on a geotextile fabric designed to protect the banks from erosion due to wind and boat generated waves.

3. GEOTECHNICAL ASSESSMENTS AND MANAGEMENT

3.1 PRELIMINARY SITE INVESTIGATIONS

Coffey Geosciences have carried out a preliminary geotechnical investigation on the site. This investigation was on the basis of eight test pits excavated with a backhoe on the 3rd June 2004. The locations of these test pits have been recorded by GPS and verified. Coffey's report describes the ground and subsurface conditions, together with key geotechnical issues for the development, and is attached as appendix B.

3.2 ACID SULPHATE SOILS

The South Australian Coast Protection Board, Coastline No33 dated January 2003, presents a strategy for implementing CPB policies on coastal acid sulphate soils in South Australia. Mapping of coastal acid sulphate soils has also been produced by the Department of Environment and Heritage Coast and Marine Branch in conjunction with the CSIRO. This mapping indicates potential acid sulphate soils (ASS) associated with mangrove and intertidal zones along the shoreline of Murat Bay. No mapping details are presented inland. Inland regions of this site are lower than the 5m AHD, as outlined in the Coastline document, which are noted to require investigation, and as such have been considered within the context of the preliminary geotechnical investigations.

The test pit observations suggest that there is relatively low risk of ASS, based on the observed soil profile. Some further assessments will continue, particularly in the low-lying areas at the southern end of the site. It is also noted that the CSIRO have undertaken testing of a location in this southern end of the site, as part of the earlier mapping work. Their test indicated that there is sulphur present in the top 300mm of the soil profile at the test location. These upper soils from the low lying area may therefore need to be managed with potential for ASS.

The calcareous nature of the majority of the soils on site will assist in neutralising acids should they form. In addition to minimising the oxidation of potential acid sulphate soils, mixing with calcareous soils would be undertaken to manage these effects.

Extents of potential ASS would be determined more definitively from further geotechnical assessments, particularly any to be excavated from below groundwater level and used as site fill, and incorporated into construction management plans.

3.3 GROUNDWATER

Groundwater conditions on the site are controlled by its close proximity to the coast. Groundwater levels encountered during the excavation of preliminary test pits have found groundwater at or just above mean sea level, approximately 0.0m AHD, though fluctuations are expected due to tidal and seasonal changes. Two groundwater monitoring bores established previously by Council on the east side of the site have found groundwater at approximately 0.4m AHD.

The quality of groundwater is also likely to be linked closely with the coastal environment, particularly given the sandy and highly permeable nature of the soils. Samples have been taken during preliminary geotechnical investigations, which indicate very high salinity (TDS) of between 58,000 and 190,000.

Department of Primary Industries and Resources SA (PIRSA) well information, indicates only one bore within the Ceduna township, one off Denial Bay Road, and clusters in Thevenard and some 6km north-east of town. The salinity (TDS) is typically 4,000 to 10,000 mg/l, and up to 56,000mg/l off Denial Bay Road. PIRSA data is presented in appendix C. There does not appear to be any use of groundwater resources in the vicinity of the site which could be affected by the marina construction works.

Previous testing of groundwater on the east side of the site, organised by Council to assess potential impacts of the dump site to the east of the railway, has found traces of arsenic, chromium, lead and diesel. Advice from the Department of Human Services, Hazardous

Substances Section, was that any slight exceedance of the Guideline values for Recreational Water Quality and Aesthetics would not be a concern because of the large dilution with seawater if the groundwater flowed into the marina. It has been recommended that further testing verify the initial test results, and this has been done as part of the preliminary investigations. Groundwater samples from three widely spaced test pits found similar levels of arsenic, but significantly lower levels of chromium, copper, lead and zinc to the earlier test.

Groundwater levels are not likely to be affected significantly in the long term. During construction of the marina basin, groundwater levels would be lowered locally, and this will be incorporated into construction management plans to stabilise earthworks batters and minimise settlement of surrounding areas.

3.4 SEISMIC RISK

Coffey's report indicates the presence of loose sandy soils, which are considered to be potentially vulnerable to liquefaction during an earthquake. It has been recommended that standard penetration testing of the natural subsurface materials be undertaken in future to further assess the level of risk to infrastructure and buildings.

Earthquake hazard mapping of Australia, as presented in AS1170.4, indicates that Ceduna is located in the lowest risk area, with an acceleration coefficient of less than 0.03. This value is noted to have a 10% chance of exceedence in 50 years. Even with a high site factor to allow for soft soils, the required earthquake design categories to AS1170.4 are likely to be low.

4. ENVIRONMENTAL SITE HISTORY

4.1 SITE DETAILS

The site comprises land based allotments held in freehold by the District Council of Ceduna, together with an area within Murat Bay that is Crown Land under the care and control of Transport SA. The proposed development would occupy land, including waterways, having a total area of approximately 230 hectares.

The subject land can more specifically be described as follows:

Address:	Murat Bay, Ceduna, South Australia.
Property Description:	Allotment 20 in Deposited Plan 55492 Area named Ceduna in the Hundred of Bonython. Allotment 22 in Deposited Plan 53902 Area named Ceduna in the Hundred of Bonython.
Title References:	CT Vol 5830 Fol 638 & CT Vol 5835 Fol 121
Local Government Authority:	The District Council of Ceduna.
Zoning:	Recreation (Rec) Map: Ced/20, Rural Living (RuL) Map: Ced/10 & Ced /20 Coastal (Cst) Map: Ced/10 & Ced /20
Current Land Use:	Predominantly vacant land, which includes section of the Eyre Highway, Quarantine Station and Oyster bar shop.
Current Ownership:	The District Council of Ceduna, PO Box 175, Ceduna SA 5690.
Proposed Land Use:	Marina, residential and commercial development.

4.2 SITE INFORMATION

The site largely comprises low-lying samphire flats. The northern and southern ends of the site rise slightly above the flats, with little remnant vegetation.

Regional geology of the area suggests predominantly calcareous sandy soils of the Bridgewater Formation. This typically comprises sands with varying degrees of calcareous cementation and calcrete.

The site is bounded on the northern and eastern sides by the Penong Thevenard railway line, which runs along an embankment across the low lying flats. An aboriginal housing site lies to the south-east, between the development site and railway. The town golf course lies immediately to the south of the development boundary.

The Eyre Highway and Denial Bay Road currently extend through the site. The Primary Industries and Resources of SA quarantine station, information bay and Oyster Bar are located adjacent the highway, between Denial Bay Road and the township of Ceduna.

The area to the west of the highway, across to the shoreline, comprises both tidal flats and sand dunes. This area contains saltbush, but also dune shrubs and small areas of coastal woodland.

In addition to the facilities along the Eyre Highway, inspection of the site shows several distinct areas of activity, which are located on the site plan in Appendix C:

- An old slaughterhouse and associated holding yard
- Motor cross/BMX track
- Two areas which appear to have been quarried
- Horse paddock and old stable area.

The old slaughterhouse comprises a small shed, approximately 4m x 3m, with outlying verandas. The shed itself is of concrete (cemented sands and shellgrit) with timber frame and galvanised iron roofing and a concrete floor. There are no odours or remaining visual signs of slaughterhouse operations at the shed, only more recent squatting and camping. The surface soil is sand and shellgrit, with some small rocks, charcoal, broken glass and metal fragments. Some 50m south of the shed is the old holding yard, which is little more than a oval shaped fence structure. There are also two areas to the east of the slaughterhouse, in which dumping has occurred, primarily of building waste, galvanised iron, concrete, pipe work, old machinery, steel drums, etc.

The motor cross track appears to have been formed recently, and comprises little more than shaped earth.

Two areas appear to have been quarried; which appear as depressions in the landform, and both have a whitish rocky surface. It is likely that limestone would have been quarried from these areas in the past. One area lies to the west of the highway, opposite the quarantine station, and the other is within the high ground to the southern end of the site.

The southern end of the site shows remnant fencing and feed troughs, together with other waste including old fridges, 44-gallon drums, a burnt out transportable hut and half of an old service station fuel tank. This higher land contains some grass cover, and the area also shows signs of more recent camping.

Preliminary geotechnical investigations have shown that the northern end of the site is very sandy, extending down beyond 3m. The southern end of the site shows a clay surface, overlying calcrete and sands at depth. Groundwater was encountered at depths of less than 0.5m in the low areas, and generally at 0.0m to Australian Height Datum.

A search of records held by Primary Industries and Resources SA (PIRSA) on groundwater information for registered wells within and the surrounds of the site was also conducted, in order to assess the potential for groundwater contamination in the area. There are no records of groundwater bores established by PIRSA within the site. The nearest bores to the site are located approximately 2.8 km to the west and 2.5 km south of the site labelled as bores 6533 23 and 6533 51 respectively. Bore 23 was established and tested in 1946 and bore 51 in 1958 and records indicate groundwater to be of poor quality at these locations at this time, having TDS levels of 56,106 mg/L and 4,455 mg/L respectively.

In April 2004 The District Council of Ceduna undertook preliminary groundwater investigations at the site. Two groundwater bores were installed halfway along the eastern side of the site adjacent the railway track. Both wells were sampled and a composite sample of the two wells was tested for Metals, TPH's, PAH's, OCP's and OPP's. The results indicated traces of Arsenic, Chromium, Copper, Lead, Zinc and Diesel (TPH fractions C15-C28) detected in the sample.

4.3 SITE HISTORY

4.3.1 Land Titles Office Records

The site is identified as Allotment 20 in Deposited Plan 55492 and Allotment 22 in Deposited Plan 53902 in the area named Ceduna in the Hundred of Bonython. The current registered owners of the site are The District Council of Ceduna. A copy of the current Certificates of Title are contained in Appendix C.

A review of past and current records of ownership was undertaken at the Land Titles Office (LTO). The information gathered from this search is summarised in Table 4.3.1 below.

The LTO records indicate that the site east of Eyre Highway identified as Lot 20 (forming the larger two thirds of the subject land area) has been in ownership by Ernest Charles Saunders between 1924 and 1964 who was a Land Agent. The land has then passed through various parties, likely adjacent landholders, until current ownership. The land use appears to have been very limited in this parcel of land other then for some limited grazing, quarrying of limestone and keeping of horse stables in the southern part of the land.

The LTO records indicate that the site west of Eyre Highway identified as Lot 22 (forming the smaller third of the subject land area) was initially granted to William Stagg in 1899 who was a labourer. The land was then transferred in 1930 to James Grady of Tarcowie who was a farmer. Between 1949 and 1964 the land was then owned by Walter Henry Sedgley, who was a butcher and grazier. It is expected that during this time a slaughter house, still remnant on site today, would have been used at the site as described later. Subsequently the land has then been owned by various farmers till current ownership.

Table 4.3.1
Lot 20 DP 55492

Date	CT Reference	Ownership	Comments/Assumed Land Use
2000	5830/638 5657/1295 737/376	The District Council of Ceduna	Current (Esso Encumbrance discharged)
1974-2000	5657/128 4007/701	Maxwell Robert Christie of Semaphore Park	Branch Manager (Esso Encumbrance)
1974-2000	4007/702	Vytautas Vincentas Patupas of Streaky Bay	Road House Proprietor
1971-1974	3744/145	Vytautas Vincentas Patupas of Streaky Bay	Road House Proprietor
1971-1974	3744/144	Maxwell Robert Christie of Semaphore Park	Branch Manager (Esso Encumbrance)
1970	3684/191	Maxwell Robert Christie of Semaphore Park	Road House Proprietor (Esso Encumbrance)
1970	"	Walter Karl Obersen of Ceduna	Service Station Proprietor
1970	"	Allience Acceptance Co Limited	-
1964-1970	"	Vytautas Vincentas Patupas of Streaky Bay	Road House Proprietor
1924-1964	1351/12	Ernest Charles Saunders	Land Agent

Lot 22 DP53902

Date	CT Reference	Ownership	Comments/Assumed Land Use
2000	5835/1215 782/655	The District Council of Ceduna	Current (Esso Encumbrance discharged)
1999-2000	5491/351	Dean Brenton Pilmore Annette Rhonda Karam	-
1980-1999	4157/438	Gilbert Wilfred Anderson	Farmer
1970-1980	4139/23 3683/102	Gilbert Wilfred Anderson	Farmer (Leased from Laurence Leopold Hoffrichter)
1964-1970	2214/182	Laurence Leopold Hoffrichter	Farmer
1949-1964	"	Walter Henry Sedgley	Butcher & Grazier
1930-1949	644/108	James Grady of Tarcowie	Farmer
1899-1930	"	William Stagg	Labourer

4.3.2 Aerial Photographs

Aerial photographs dated 1958, 1968, 1980, 1988, 1998 and 2000 were viewed in Mapland. The photographs were inspected in order to indicate changes in land use over time, in both the subject site and adjacent land. Copies of the 1958 and 1980 photos are included in Appendix C.

A summary description of information obtained from the historical aerial photographs is provided below:

Photo 1958
The land is traversed by Eyre Highway which appears to be unsealed at this time and Denial Bay Road is also visible. Southern quarter of the site east of Eyre Highway appears to be clear of any sizeable trees and a quarry with access from the south is evident about the centre of this area. Remainder of the subject land east of Eyre Highway appears to be marshy with a network of tidal tributaries spreading across the land area. Land to the west of Eyre Highway is part vegetated north of Denial Bay Road and cleared for the remainder of the land northwards. A large area of shallow sandy sea bed is evident across Murat Bay. Areas surrounding the subject land appear to be predominantly cleared and to be agricultural with some remnant vegetation retained to the north of the site.

Photo 1968
This photograph shows the appearance of the railway corridor hugging the eastern boundary of the subject land. Eyre Highway now appears to have been sealed. Area of the subject land to the west of Eyre Highway appears to be cleared further.

Photo 1980
The border quarantine station along Eyre Highway is now evident. A rectangular area is evident along the southern boundary of the site adjacent the existing horse stables area. Sheds have been constructed at the western end of this area with an oval like feature resembling a holding pen for horses. Land immediately north of Denial Bay Road appears to have been cleared. The information bay has been formed between the township and the quarantine station. Effluent ponds have been constructed to the southeast of the site.

Photo 1988
There is a ring road track around the quarry at the southern half the site. The quarry to the west of Eyre Highway has increased in size.

Photo 1998 & 2000
No apparent changes in land features are visible.

4.3.3 Other Historical Information

It is noted from locals that the slaughterhouse was used up until the 1950's. The operations were based on the purchase of sheep, together with the occasional pig or cattle, from local farmers, which were placed temporarily in the holding yard, then slaughtered and drained within the shed.

From inspection of historical aerial photography the existing railway corridor along the eastern boundary of the site was constructed between 1958 and 1968. This is the Penong to Thevenard railway, now used primarily for transport between the gypsum mines at Penong and the port at Thevenard.

It was identified that limestone was quarried from the site in some locations. From inspection of historical aerial photography, quarrying at these locations is evident to have occurred before the earliest available aerial photo taken in 1958.

In the area of the old horse stables there appeared to have been informal agreements that enabled several other locals other than the owner, to run horses in this area. Council have advised that since their purchase of the land in 1999, one lease was granted to continue this use. The area has not been in use for the past 2 years.

The Department of Primary Industries and Resources SA (PIRSA) quarantine station began its operation at its current location in 1971. The stations operation involves inspection of all fruit and vegetables being transported between the West Australian and South Australian border to control the migration of insects, particularly fruit fly. All confiscated fruit and vegetables are temporarily stored at the station in wheelie bins, which are then taken off site to the dump. Some chemicals are stored at the station, which include insecticides, pesticides, petrol, and diesel, which are housed in a dedicated chemical store shed in the back corner of the quarantine site. The station operators have confirmed that all insecticides and pesticides are used off site only at the Ceduna dump site when disposing of the collected fruit and vegetable matter. The diesel fuel which is stored has been for the operation of an incinerator, which has not been operated for the past 15 years. Some petrol reserves are also kept for the powering of a generator for electricity back up purposes.

The "Big Oyster Oyster Bar" was established adjacent the Eyre Highway in 2000, located between the township and the Quarantine station. This is a transportable building with access and parking from the highway. From discussions with the owners, the business operates as a shop/restaurant. The everyday running of this business has no requirement for use of chemicals or disposal of any materials on site.

4.3.4 Section 7

An Environment Protection Authority (EPA) Section 7 clearance was performed on the site for the current title references CT Vol 5830 Fol 638 & CT Vol 5835 Fol 121. The search has indicated that there are no:

- Encumbrances affecting the land;
- Environmental assessments held by the EPA affecting the land;
- Waste depot licenses affecting the land;
- Production of certain wastes licenses affecting the land;
- Records of waste deposited on the land.

4.4 ENVIRONMENTAL ISSUES

The site history has identified that the land comprising the site consists of both marine and terrestrial environments and has predominantly remained undeveloped.

Development of portions of the land has included the construction of Eyre Highway – a section of National Highway 1, which traverses the land and Denial Bay Road, which forms one of the

boundaries to the north. Part of the land has also been used for farming activities including a slaughterhouse and horse stables.

More recently a Quarantine station was established along the Eyre Highway and an Oyster bar shop.

Potential sources of contamination include:

- Temporary storage of insecticides at quarantine station;
- Diesel fuel storage to power incinerator at quarantine station;
- General dumping of rubbish, particularly old farming equipment and in the vicinity of the old fuel tank.

Potential contaminants associated with the above sources of contamination include:

- Organochlorine pesticides;
- Total Petroleum Hydrocarbons (TPH)
- Heavy metals.

4.5 CONCLUSIONS AND RECOMMENDATIONS

No significant land uses have been identified for the subject land. On the basis of the environmental site history investigations undertaken, it is concluded that the site appears to be suitable for the proposed marina and community centre development.

It is recommended however that further soil contamination investigations be undertaken locally at the rear of the Quarantine station to validate for any possible spills of insecticides stored at this location as well as any potential diesel fuel spills from the use of diesel fuel to power the site incinerator. Similarly, localised investigations should occur in the vicinity of dumped materials to the west of the slaughterhouse and near the site southern boundary, particularly for potential of heavy metals and petroleum hydrocarbons. This work should be undertaken in accordance with the National Environmental Protection Measure (NEPM) (NEPC 1999) and SA EPA guidelines on site assessment (SA EPA 1995 and 1997).

5. STORMWATER MANAGEMENT

5.1 OBJECTIVES

The new development is intended to deal with stormwater as near as practical to the source. This water is to be utilised as a resource where practical, both to minimise the size (and cost) of stormwater drainage systems and to minimise the pressure on the scarce water supply resources on the Eyre Peninsula.

The stormwater drainage concept will manage the conveyance of runoff to minimise nuisance ponding, and to mitigate flood risk to property in up to a 100 year average recurrence interval (ARI) storm event.

The other main objective is to minimise the potential impact of stormwater on water quality both within the marina basin and further out to sea.

5.2 REGIONAL DRAINAGE

The development site is largely low-lying samphire flats, shown on topographic mapping as land subject to inundation. From the advice of locals, this area is subject to tidal inundation, though the extent has been somewhat restricted since the construction of the Eyre Highway in its current location.

There are three potential drainage paths in the vicinity of the site conveying drainage from upstream catchments. Upstream drainage is effectively controlled, given that the railway line which borders the site, is on a raised embankment around most of the proposed development, which intercepts overland flows and directs them through culverts in a defined flowpath. The railway only goes through two small cuttings, one adjacent the aboriginal housing site and the other adjacent Eyre Highway, both of which would drain back to low lying areas to the north-east.

A galvanised steel culvert, approximately 1800mm diameter, conveys water beneath the railway line near the southern boundary of the aboriginal housing site, and is expected to drain back toward the golf course. A 900mm diameter concrete culvert projects beneath the railway between stages 3 and 6 of the development, and provision is to be made for this drainage path.

The northern end of the site is somewhat more sheltered by a ridge line approximately 1km up from Denial Bay Road. A 225mm diameter steel drain culvert adjacent the highway, and a 450mm diameter corrugated steel culvert further west, are the only drainage points beneath the railway from this area.

The upstream catchments are all rural land, and as such are unlikely to produce any runoff in regular storm events. It is only in major storm events, that the catchment is likely to generate any significant runoff.

The District Council of Ceduna commissioned a ‘Ceduna Stormwater Study’ which was undertaken by Tonkin Consulting in 2002. This study outlined the town drainage systems, with a focus on the management of stormwater pollutants and the catchment yield for stormwater reuse. The study identified catchments B and R with potential for stormwater reuse, and both of these catchments drain to inland low points located in the south-east and north-east corners of the golf course. The railway embankment and natural high point in the south-east corner of the proposed development site, effectively block any potential overflow path into the development. Both areas hold water during the winter months, and eventually soak away and/or evaporate.

5.3 WATER SENSITIVE URBAN DESIGN MEASURES

The following section 'Rainwater and stormwater reuse' is focused on measures proposed within allotments, and the development as a whole considered on a larger scale for larger reuse applications. The items outlined here identify local measures which may be considered along the subdivision roadways. The following list outlines options outlined in research literature together with a brief outline of the feasibility of each option.

The use of **vegetated swales** rather than kerbing has been used elsewhere as a form of pre-treatment, with grass cover filtering pollutants, and enabling some infiltration along the flow path. At Ceduna Keys, the road reserve widths are now fixed by allotment boundaries, and there is limited space available within the development for this approach. It is intended to use swales along the Eyre Highway, and these could be vegetated, provided there are suitable soils and/or salt tolerant species available. The low rainfall climate of Ceduna will also need to be considered in sustaining such vegetation. Vegetated swales also require water depths to be kept relatively shallow for them to act as a filter, and the ability to achieve this around the Eyre Highway will be limited by grading constraints.

Infiltration of stormwater, whether it be direct **from swales, open channels, dryland infiltration basins, gravel filled soakage trenches or underground storage cells** such as Atlantis, could be encouraged. The preferred location for soakage systems is in non-trafficable areas, which is limited on this site to the reserve strips and buffer adjacent the Eyre Highway. On-site soakage of runoff within individual allotments is also proposed (refer 'concept design').

Porous pavements can comprise block paving which is formed with small gaps between pavers to enable soakage of stormwater to sand and gravel base layers below, and ultimately through to the underlying ground. Such pavements are only suited to areas with light traffic loading, and as such are encouraged for carparking areas within the commercial premises, rather than roadways. These systems are also prone to clogging failure when the sediment load is moderate or high, which would be a significant risk prior to development of sites and establishing new vegetation.

Kerbline turf strips, a minimum of 400mm wide would assist to reduce the sediment and pollutant load in stormwater from verges running into the kerb and gutter. This is to be considered further in conjunction with landscaping details.

Linking of **drainage from kerb inlet gullies to water street trees** has been undertaken on a small scale elsewhere. This would involve placement of inlet pits adjacent street trees, with water piped into a permeable layer from which the tree can draw water, and an agricultural drain to direct excess water back into the underground drainage system. The feasibility of this option is dependent upon landscaping plans, suitable tree species in this coastal environment, and associated costs, which would need to be considered at a design phase of the project.

Gross Pollutant Traps, whether they be inline (within individual inlet pits) or end of line facilities prior to discharge to basins or waterways, would be used where required to protect downstream areas, and facilitate trash removal by Council. In addition, silt and oil traps may also be considered in series with a GPT in specific locations where the condition of a receiving waterway and its ecosystems are sensitive to potential stormwater pollutants.

Constructed wetlands require large areas of land, and an appropriate cycle of wetting and drying to sustain the necessary macrophytes and other aquatic life. There are no large available spaces for a wetland within the development. Stormwater flows would also be unreliable, and assuming most rainwater (from the smaller but more frequent rainfall events) is held on allotments, the value in developing wetlands externally for a relatively small amount of runoff would be prohibitive. The nature of the site would also require several holding basins and a large pumping scheme to even get all runoff to a common location. The provision of constructed wetlands to this proposed development is therefore not considered to be feasible.

5.4 RAINWATER AND STORMWATER REUSE

It is strongly recommended that all new development within Ceduna Keys provide rainwater tanks to collect all roof runoff. To maximise the use of this resource, it could ideally be plumbed into each residence, for use particularly in toilet flushing, bathroom uses, laundry and hot water system, as well as providing for outdoor use. Plumbing into residences could provide a continual use, extending through the winter months when little water tends to be used outdoors. In the low rainfall climate of Ceduna, this also uses the resource when available, to minimise draw on mains water supplies. National Environmental Health Forum Monographs 'Guidance on the use of rainwater tanks', 1998, and DEHAA 'Rainwater Tanks …….their selection, use and maintenance', 1999, both outline the selection of tanks for various roof areas, water demands and levels of security of supply, together with maintenance issues.

Other commercial products are also coming onto the market for the storage and reuse of rainwater. Several of these products, together with research and trial data are outlined in the joint Australian Water Association and CSIRO research paper 'Innovation in on-site domestic water management systems in Australia: a review of rainwater, greywater, stormwater and wastewater utilisation techniques', April 2004.

Opportunities for collection and reuse of rainwater on the proposed commercial and medium density housing sites could be investigated once more definitive concepts are established for each of these sites.

Stormwater runoff from road reserves is likely to require more pretreatment than roof rainwater collected on sites if intended for reuse. This runoff would also be directed to a number of collection basins around the site, the locations of which would be dictated by the topography together with the grading of reclaimed land. The basins enable sediments to settle out. Each of these basins is likely to be relatively small, given the need to split catchments, and the limited open space available in the low lying areas, so effectively limits the capture of significant storm events. Small basins only provide limited balancing storage for pump out to more suitable storage facilities. Soakage and evaporation losses would be expected from each storage area, and in some instances where soils are particularly sandy, there would be significant losses. To reuse this water would realistically require pump out from each collection basin, with rising mains around the extremity of the site to a dedicated storage basin offsite. The feasibility of stormwater reuse from such a concept is likely to be poor, and would need to be investigated further if still considered desirable.

The Council study of town stormwater identified two catchments, B and R, with reasonable opportunities for stormwater reuse. In both of these catchments, large storage dams are required, and the golf course and football oval were noted as possible sites for reuse. While such schemes could be developed, it was noted that when compared with the cost of using mains water at $1/kL, the benefit-cost ratios highlight that such schemes are not economic. The study concluded that town effluent reuse was likely to provide larger volumes, a more reliable supply, and a more economic option.

The feasibility of utilising aquifer storage and recovery (ASR) was also outlined in the town study. It was noted that the aquifer is unconfined, and issues would be expected with recovery given the high salinity of the native groundwater. The rate and duration of recharge may also be limited, but would require further geotechnical investigation if this concept is to be considered any further.

5.5 CONCEPT DESIGN

It is proposed that all new allotments have rainwater tanks to collect all roof runoff. This is intended to minimise the discharge of stormwater from developed areas. Control over allotment scale management of rainwater will be through land management agreements.

Overflow pipes from the rainwater tanks are intended to be connected directly to the marina waterways in most situations, without any interception of surface water within the allotments, so as to maintain a high quality of water discharge. For inland allotments, and particularly where

road runoff can be collected for reuse, tank overflows may be directed back to the adjacent street kerb.

It is expected that allotments would be graded with a portion grading back to roadways, and the remainder draining toward the waterways. No runoff shall flow directly into waterways, but be contained by a surface plinth and drainage system with some minor ponding and eventual discharge via soakage systems. Gross pollutants such as leaf litter and sediments should be filtered out to minimise blockage of the soakage systems. Overflow to waterways would only be in large storm events.

It is intended that all commercial and medium density housing sites also incorporate means for onsite retention of stormwater, and reuse where possible. This may include rainwater tanks, porous pavements and/or onsite soakage systems. Opportunities for collection and reuse of rainwater on the proposed commercial and medium density housing sites could be investigated once more definitive concepts are established for each of these sites.

Roadway drainage is proposed to drain back toward the mainland where possible, in order to direct this runoff to swale systems and/or basins. This concept requires road levels out on the individual peninsulas to be raised in order to grade back. This conflicts with the objective to maintain surface levels as near possible to the required minimum development levels, for aesthetic reasons as well as optimising access from landowners to the waterways. To strike a form of compromise, it is proposed that roads be graded back toward the mainland with a maximum ground level in the order of 4.0m AHD. Grades of roads and of underground drainage systems will need to be kept at a minimum. Where this is not feasible, roadway drainage will need to discharge into the marina basin. In these locations, pollutant traps will be placed to improve the water quality prior to discharge. It should also be noted that the flat grades around the majority of the site will keep flow velocities low, and thereby also minimise scour.

Stormwater collection basins, where feasible, will provide a means for dissipation of roadway drainage through soakage, and may incorporate a nominal ponding volume below any pipe outlet, so as to enable some sedimentation prior to discharge. Other gross pollutant traps, and/or silt traps could be incorporated if required. Basins in some locations, particularly the south-west area of the site, adjacent the golf course, may also be utilised for storage of stormwater for reuse where feasible.

Conventional table drains, surface swales and depressions are proposed adjacent the Eyre Highway. These provide low cost drainage, as well as encouraging infiltration, and with vegetation would encourage filtration of runoff also. These open drains adjacent the highway would also inadvertently provide a detention buffer for accidental spills from vehicles. The greatest risk for chemical spillage would be along the Eyre Highway, particularly at junctions.

The above concept effectively reduces the quantity of stormwater runoff to the marina. The table below outlines the land uses with discharge to the marina without some form of storage area to intercept the small, regular rainfall events. This indicates approximately 20% of the site will have direct discharge to the basin, and this would all pass through pollutant traps. Given the high level of tidal flushing of the marina, any effects are likely to be localised and transitory.

Land Use	% of Site	% Direct Discharge	Totals
Allotment roofs	12.5	0	0
Allotment (ground)	25	20 say	5
Commercial sites	32.6	20 say	7
Roads	20.3	40	8
Green areas	9.6	0	0
Total	100		20

Some drainage path would still be required to allow major storm overland flows to escape to the marina, once the roadway and underground drainage system flow capacity is exceeded. This will be a combination of gutter flows, swale drains and culverts sized for up to 100 year ARI

flows. Easements may be required where overflow paths to the marina are landlocked by presold allotments.

All development will also be above the 100 year ARI storm tide level of 2.32m AHD. Tide levels above the highest astronomical tide of 1.19 may reduce discharges from some pipe drainage systems, depending on the outfall level, however this risk of these events coinciding are lower.

The existing culverts providing drainage from the rural areas across the railway line will be extended through this development. Serving rural land, these culverts are assumed to be for dealing with major storm events, given that regular rainfall events will be dissipated through infiltration, with very little surface runoff. Small bunds or basins could be provided adjacent the culvert inlets to facilitate sedimentation of low flows if required, and to prevent backflow in extreme high tides.

6. WASTEWATER MANAGEMENT

6.1 SEWERAGE SYSTEMS

The existing towns of Ceduna and Thevenard are served by the Ceduna septic tank effluent disposal scheme (STEDS). This scheme is at maximum operating capacity and uses open surface lagoons situated adjacent to Goode Road for the treatment of effluent from the collection system. Effluent is then stored in an evaporation lagoon, and some treated effluent is drawn off during summer for irrigation of the nearby golf course and sporting fields.

The proposed Ceduna Keys development is intended to be served by a new sewer scheme. This eliminates the need for septic tanks on each allotment. The new system would provide a series of gravity drains, and the topography will dictate the need for several sewer pump stations. It is intended that the development be split into several catchments, with pumping discharge from one catchment discharging to gravity mains in the next. The final pump station will deliver sewage to the existing treatment area adjacent Goode Road.

While the new sewerage system is likely to be Council infrastructure, the design of this system will be to SA Water standards. Pump stations will be to Council's standard technical specification, so as to ensure consistency of maintenance and parts with the remainder of their systems.

6.2 SEWAGE TREATMENT

The existing treatment site location is still appropriate relative to the siting of this development. The treatment area is approximately 400 to 500 metres from the closest corner of the development, in a section proposed as a sporting area. The distance to the nearest residential area is therefore even greater, and well above the minimum 350m required in DHS guidelines.

It is Council's intention to provide a new activated sludge treatment plant adjacent to the existing lagoons, with sufficient capacity to treat the Ceduna Thevenard STEDS grey water and the Ceduna Keys development black water. The plant would discharge to the current lagoon area which will be retained, and deepened if necessary, to provide temporary storage of treated effluent.

The project represents an opportunity for the upgrade of the town effluent treatment and reuse, together with the development in an integrated sewer scheme, to reduce pollution and maximise reuse of water resources in a controlled method.

6.3 EFFLUENT REUSE FEASIBILITY

Council intends to maintain secondary use of the treated wastewater, continuing to be utilised to irrigate the golf course and the Ceduna Sporting Club oval as well as replacing the potable water irrigation of the Ceduna foreshore and other landscaping areas within Ceduna. The Ceduna Golf Course fairways and sporting club oval already receive treated effluent water, under an Irrigation Management Plan (IMP), and has done so for many years with no known detrimental effects.

The IMP incorporates a monitoring and testing program for the treated effluent, and for soil analysis from each of the receiving irrigation sites. In addition to health based criteria, this is established to monitor items such as conductivity, pH, and nutrient loadings, which are potential long-term environmental effects.

As described in the IMP, the sites comprise a sandy soil profile with a pH of 9, which indicate a permeable, well-drained soil. It is noted the irrigation areas are not prone to flooding. The golf course fairways are noted to be kikuyu and couch grasses, and roughs are essentially native understorey from the original Mallee woodland. These grasses have a moderate to high tolerance for salinity.

Groundwater below these sites is saline, and not known to be utilised as a resource. Nevertheless, testing and monitoring of groundwater quality should be incorporated into the established monitoring program to ensure there is no significant influence from effluent irrigation.

A preliminary water balance has been determined, based on the estimated STEDS inflow from the existing Ceduna Thevenard system, and estimates on wastewater generation from the proposed Ceduna Keys development. These estimates have considered a final development scenario only, with 382 residential allotments together with 2.3ha of townhouses, 8.3ha of 3 storey apartment buildings and other commercial facilities. Commercial apartments were assumed to be 70% occupied. The system is likely to require a winter balancing storage of up to 90ML, which would be equivalent to deepening the existing effluent lagoons from 1.0 to 2.0m deep. The system could ultimately deliver up to 210ML of treated wastewater for irrigation, which could provide for 30mm use per week during summer down to zero in winter, covering the golf course fairways (approx 19ha), together with the sports club, and an additional 5.5ha of reserves within the town. Various options for reconfiguring storage basins should be reviewed, as there would be potential to greatly reduce evaporation losses, and therefore increase the available supply to irrigation. More accurate water balances can be prepared as further details of the development, treatment area, storage basins and golf course irrigation are determined and assessed.

The above represents a large increase in wastewater use for irrigation of the golf course and oval. It would be expected that irrigation systems, particularly inground pipework, balancing storage tanks and feed pumps on the golf course would need to be reviewed, and most likely upgraded to suit the new usage rates. It is proposed to upgrade the golf course in conjunction with this project, so provides a good opportunity to incorporate this.

6.4 MONITORING AND CONTINGENCY PLANS

It is proposed, and Council will be ensuring that design and construction standards of all sewerage collection and pumping systems allow for:

- Sufficient storage times to allow for back-up operation procedures to be put in place to minimise risk of overflows. STEDS design criteria suggest storage provision for at least 20% of the average daily flow. As a guide only, a pump station serving 60 lots, with 8m3 storage would hold peak flows for 2 hours, or 6 hours of average dry weather daily flow.
- Dual pump systems are installed at each site.
- Telephone dialler/pagers are installed to ensure operators are aware of any station faults
- External power sockets are fitted to allow for the operation of the pump station utilising Council's portable generating set during times of extended power disruption.

Council has in place an emergency response and contingency plan for the Ceduna STED Scheme. This plan remains appropriate to prevent, manage and mitigate pollution spills from the proposed development sewerage in various possible incidents.

Should any overflows reach stormwater drainage systems, then the potential to limit outflow is area dependent. Around the outside of the development, drainage systems will incorporate basins where possible, which would serve to capture sewage overflow before it is able to discharge to waterways. On island or long peninsulas, it may be necessary to place sandbags across the drainage system, to minimise the impact of potential spills and associated cleanup.

It should be understood that minor sewage leaks from underground pipework would be difficult to detect. If there is reason to suspect any leakage, due to either saline groundwater infiltration into the effluent lines, or any signs of higher nutrient loadings in water, then investigations could proceed to determine the source and rectify any leak.

Council is also an active participant in oil spill response training that is held regularly at the Thevenard Port. A wide range of clean-up systems and materials are maintained at the facility which can be called on in the unlikely event of a spill. The Ceduna SES unit has a marine response unit who also participate in the oil spill response training.

6.5 MARINA FACILITIES

Wastewater collection facilities are intended to serve recreational and commercial vessels. Sewage discharge from boat holding tanks will be collected. Suitable options for the collection systems are being reviewed in terms of the nature and operation of pipe systems, expected discharge flowrates, balancing storage volumes, and wastewater quality.

A separate facility would be provided for the collection of ballast. When required, pump out from holding tanks to mobile tankers could be undertaken.

No slipways or boat ramps are provided for commercial or public use. No dry dock boat maintenance facilities are therefore provided at Ceduna Keys. Boat maintenance and hull cleaning while in water is prohibited, except under extraordinary circumstances as outlined in the EPA guideline on stormwater management for marinas, boat sheds and slipways. Public boat ramps already exist further south, and a slipway at Thevenard.

One refuelling area is intended to service both commercial and recreational boats. Fuel storage tanks are likely to be underground, with supply lines and bowsers to the wharf. Bunding and drip trays would be provided in areas such as around the bowsers where there is potential for leakage. Emergency cleanup facilities should also be readily available, as outlined previously under contingency plans.

Commercial facilities around the marina will need to develop their own site management procedures to minimise the potential for pollution of marina waterways. This enables the plan to specifically identify activities relevant to each business which have potential for spillage and/or pollution of waterways. It is noted that commercial fisheries now tend to operate with all outgoing seafood wastes contained in plastic wrapping or sealed vessels.

All areas with the potential for process or chemical spillage would be appropriately bunded, and would ensure that general site stormwater runoff is excluded from the designated area. Any area washdown is to be contained and pretreated prior to discharge to either sewer or separate wastewater facility. The arrangements would be in accordance with current best practice and the EPA guidelines on stormwater management.

7. ROADS AND TRAFFIC MANAGEMENT

The proposed realignment of the Eyre Highway and Denial Bay Road has been identified, and liaison with Council and Transport SA has shown no major objections. Liaison will continue to establish and confirm requirements for the design and construction of these major roads. The standards of Transport SA would be adopted.

The development will have a limited number of controlled access points from the Eyre Highway. This will minimise impacts on traffic flow and improve road safety. Junction treatments, including those with Denial Bay Road and realignment near to the railway crossing will be developed in consultation with both Council and Transport SA.

Construction access to the site will also be limited, and controlled with appropriate signage and facilities to minimise disruption to through traffic, and to maximise safety. This will be incorporated into a construction management plan.

8. INFRASTRUCTURE AND SERVICES

8.1 WATER SUPPLY

SA Water mains currently extend through the site parallel to the Eyre Highway. Near the Denial Bay Road junction, there is a changeover to Water West under the control of Council, and takeoff to the Ceduna – Koonibba water supply project. Council are continuing liaison with SA Water regarding the relocation of this point, and supply to the proposed development.

The inclusion of rainwater tanks on each allotment is expected to minimise the demand on SA Water potable water supply. 'Rainwater Tanks… their selection, use and maintenance' indicates that in-house water use is typically 127L/p/d based on Adelaide consumption figures. Waterproofing Adelaide figures also suggest that 40% of residential use is for gardens and other outdoor uses. A 3 person household is therefore likely to use 139kL/yr inhouse, and up to 92kL/yr outdoors, though this may be reduced with the use of water saving fixtures and attitudes. By comparison, a rainwater tank served by a roof area of 250m2 would supply up to 55kL per year in Ceduna with 300mm average annual rainfall. The use of rainwater tanks could therefore reduce the demand on mains supply by the order of 25 to 30%, though this is expected to vary with the level of occupancy, connected roof areas, and peoples attitudes to water conservation.

8.2 POWER AND TELECOMMUNICATIONS

Overhead power lines extend between stobie poles along the Eyre Highway road reserve, across parallel to Denial Bay Road, parallel to the railway at the northern end of the site, and parallel to the southern site boundary. A series of stobie poles are located just to the north of the aboriginal community housing site to the south-east of the site. It is noted that supply from the ETSA substation is situated adjacent Goode Road, approximately 600m from the site.

Liaison with ETSA Utilities has enabled some forward planning and a speculative quotation for the provision of power supply to the proposed development. Further liaison will clarify requirements for the relocation of overhead lines to suit the proposed development layout.

Telstra main cable (optic fibre) routes currently extend through the site, nominally along the eastern side of the Eyre Highway road reserve. Major cables also extend along the northern side of Denial Bay Road. Council has initiated liaison with Telstra on the relocation of these services, in addition to the future servicing of the development.

Telstra local (minor) cable also currently extends along the Eyre Highway, from the southern end of the site, up to the approximate location of the Quarantine Station. This local cabling would become redundant when the Quarantine Station and Oyster Bar relocate.

An additional optic fibre communications line, an asset of IP1 (Australia), extends around the site parallel to the railway, which is advised by Council to have been installed within the site, but within 3m of the boundary. This line will need to be accurately located, and is to be retained within the proposed road reserves of the development.

8.3 GAS SUPPLY

There is currently no reticulated gas supply within Ceduna. Origin Energy have expressed interest in the project, and liaison is continuing with them on the feasibility of a new system for the development and possibly supply back into the town.

8.4 RETICULATION INFRASTRUCTURE

Services infrastructure within the proposed development would be designed and constructed in accordance with the requirements of each service authority. Electrical and communications reticulation infrastructure would be installed underground in a shared trench, in accordance with standard common service trench (CST) arrangements. The layout and design of all infrastructure would incorporate best practice, based on current approach to systems, an understanding of land development issues and current design standards and guidelines.

8.5 SOLID WASTE MANAGEMENT

Waste collection will be provided via a weekly 240 litre sulo bin utilising Councils robotic arm compactor.

Recycling of the following items is catered for with off site collection depots accepting the following items:

- Ceduna Refuse Depot: all metal and whitegoods, green waste, automotive oil.
- Ceduna Can Bottle Depot: container deposit items, glass, PET recyclable plastic products.

Further recycling opportunities are being investigated with the assistance of Zero Waste SA.

9. CONSTRUCTION MANAGEMENT

9.1 CONSTRUCTION ITEMS

For a pictorial representation of the main construction activities and their sequence refer to sketches 1 to 4 attached in Appendix E. The following list although not exhaustive contains the main construction activities and summarises how the associated management issues will be addressed:

DIVERSION OF EYRE HIGHWAY AND DENIAL BAY ROAD
Construction of the proposed diversions for Eyre Highway and Denial Bay Road along their proposed new routes will be required before the waterway links to Murat Bay can be completed. Clearing, filling, compacting and pavement construction activities will be carried out using normal road building techniques incorporating the control of dust and stormwater.
The existing communications, power, water and any other services that exist within the current road corridors will be either diverted along the new routes or laid below the new waterway invert.
Upon completion of the connections between the existing and new roads, traffic will be diverted and the old roads closed to prevent public access on to the site.

EARTHWORKS - LANDSIDE
Cutting and filling will be required to create the waterways and the landforms to the extent and condition required for development purposes.

Based on the geotechnical investigations undertaken at this time it is anticipated that conventional earthmoving techniques using dozers, tracked excavators, trucks and/or scrapers will be appropriate for this work.

The geotechnical investigations undertaken also indicate that the materials excavated from the waterway areas will be suitable as fill in the residential and other development areas.

The investigations also revealed that the groundwater is located at a depth equivalent to about mean sea level.

The work will need to be undertaken in the dry therefore dewatering of the excavation by pumping from a purpose built, low lying location will be necessary. The water will be discharged into a custom-built detention pond constructed from earth bunds.

The pond will be configured to enable general turbidity levels to drop below that required for discharge into a marine environment. The pumps will also handle any stormwater that enters the construction site.

Where portions of the site require remediation for environmental reasons these areas will be isolated and treated before release for general earthmoving activities.

The contractor will be required to prepare and implement a construction management plan incorporating among other things measures for the control of dust, stormwater, noise, safety (public and construction workers) and dewatering discharges.

Until the Eyre Highway diversion is complete the contractor will be required to restrict earthmoving activities to either side of the highway to minimise the movement of earthmoving equipment or trucks across the roadway.

Access with appropriate signage from the site on to Eyre Highway will be limited to one or two predesignated locations selected and designed by a traffic engineer.

EARTHWORKS - ENTRANCE CHANNEL
Seaward of the breakwaters the entrance channel will be excavated to -3.5m AHD either by a barge mounted excavator with spoil barged to shore or by dredge with spoil pumped to appropriately sized onshore holding basins. The former method is preferred and is more suitable for rock or hard ground conditions. Investigation of the offshore ground conditions, particularly the extent of silts, clays and rock is required to clarify this approach. Protection of the batters should not be required as they are always submerged in these deeper waters. Turbidity of the local water would be monitored.

BREAKWATERS
Construction of the breakwaters will be one of the early components of the works and can be concurrent with the relocation of the highway.

Core construction by end tipping will commence at the shoreline and proceed out along and to the required line and length. No disturbance to areas outside of the breakwater footprints other than at the entrance channel and at the shoreward links will be required or permitted during construction.

The core will be primarily constructed from crushed rock or paddock limestone to minimise turbidity. Sub armour will be placed immediately to protect the core followed later by the outer armour layer.

Both breakwaters will be joined initially to enable the landside of the site to be dewatered. If excessive leakage under or through the core occurs, a trench backfilled with clay would be constructed through the core to the depth required.

Rock that is suitable for breakwater construction will likely be sourced from existing quarries within about 40km or so from the site.

BATTERS
All edges within the waterways will be constructed to a slope of one vertical to two or three horizontal and protected from the action of wind and vessel generated waves by a geofabric filter cloth under a 600 to 700 mm thick layer of rock (riprap). The source of rock will be similar to that used for the breakwater armour. The riprap will extend below the lowest tide level to provide protection from propeller wash.

A small concrete or sandstone retaining wall will be provided at the top of the riprap mainly for aesthetic purposes but can also function as a launching point for pontoon gangways.

EARLY INFRASTRUCTURE WORK
Installation of infrastructure within the waterways or below tide levels will, where possible, be undertaken prior to breaching of the breakwaters.

Interim stormwater runoff and erosion controls such as earth bunds, swales and sedimentation basins will also be put in place for the period prior to the installation of roads and services.

INFRASTRUCTURE
Management of the constructions of roads and services, which will be undertaken in stages commencing from the south, will include the control of stormwater, erosion, dust, noise, access and safety. Access to the site from the Eyre Highway will be restricted to predesignated locations and closed off to the general public.

9.2 SITE MANAGEMENT

The following requirements will be included in the specification for the construction of the works.

9.2.1 Construction Proposals

Requirement: Submit for review the methods and equipment proposed for the earthworks, including the following:

- Excavation methods, stages, clearances, batters and temporary supports.
- Dewatering and groundwater control and disposal of surface water.
- Soil erosion and drainage management plan.
- Control of all unsuitable fill materials, waste and contamination.
- Dust control.
- Stockpiles and borrow pits.
- Sources of imported filling.
- Placing and compaction methods and stages.

9.2.2 Extent of Disturbed Areas

Site Access: Access to the site will be available only as directed. Access will be restricted to controlled egress points to surrounding roads.

Compound: Confine all site accommodation, materials storage, and construction equipment not in use and/or repairs to a designated site compound. Locate the compound to minimise nuisance to the surrounding area, to the approval of Council.

Proximity: Confine machinery operations to a maximum of 10 m from all areas to be excavated.

Haul Roads: Prior to starting any operations on site, submit a marked up site plan showing the locations of temporary haul roads. Upon approval, peg the route of these roads and confine all future operations by plant and equipment to these areas.

Re-establishment: Restore disturbed compacted or spoiled ground not required to be varied as part of the works to the condition existing at the commencement of the work.

Damage to roads: Repair any damage to roads or other structures caused by the actions of the Contractor in executing the works. Maintain the existing streets in the area in a clean state to the satisfaction of the local Council.

9.2.3 Potential Acid Sulphate Soils

Identification: Have extents of potential acid sulphate soils identified by the Engineer, including surface soils in low lying areas and mangroves. Stake these areas on site.

Location: Where possible, place potential acid sulphate soils in low areas where they may be submerged.

Timing: During construction, keep these soils in-situ in tidal zones, and minimise the length of time for which they are drained and exposed to air.

Treatment: Mix with calcareous materials, and place as directed by the Engineer, dependant on the suitability of the soil for use as engineered fill.

9.2.4 Existing Trees

General: The locations of trees which are to be removed during the works period will be shown on the Drawings. Identify the locations of trees to be retained and erect temporary protective fences and tie battens and markers to the trunks to ensure that they are not damaged above or below ground. Additional trees or areas of trees to be retained and protected may be identified at any time during the works period.

Protection of Trees: Protect any groups of trees which are within the proximity of the works and which may be damaged by the works with temporary fencing located outside the drip line (ie crown of the tree). Protect any single trees which are within the proximity of the works and which may be damaged by the works with appropriate measures.

Do not drive vehicles, store materials, carry out earthworks or any other activity including refuelling of plant, under the crown of trees which are to be retained. Seek guidance if it is not practical to comply with the conditions above.

Roots: When any excavation is required in the vicinity of trees to be retained, hand excavation shall first be made to locate any roots. Roots which are then seen to be affected by the line of the proposed work shall be cleanly severed clear of the work before machine excavation commences, and the cut sealed with an approved tree wound sealant. The roots to be severed shall be sawn cleanly; an axe shall not be used.

9.2.5 Erosion Control

Requirement: Plan and carry out the work to avoid erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.

Necessary measures: Adopt such measures as may be necessary for erosion control, including the following where applicable:

- Staging of operations (eg clearing, stripping).
- Temporary drains and catch drains.
- Diversion and dispersal of concentrated flows to points where the water can pass through the site without damage.
- Spreader banks or other structures to disperse concentrated run-off.
- Temporary silt fences and/or hay bales.
- Sedimentation ponds.

Maintenance: After each rain inspect, clean and repair temporary erosion and sediment control works if required.

Removal: Remove temporary erosion control measures when they are no longer required.

9.2.6 Protection of People, Property and Structures

General: Maintain in their places and protect from damage all pipes, poles, conduits, walls, fences, buildings, railway, and any other structures, utilities and property within the vicinity of work.

Dewatering: Monitor as necessary to ensure no excessive movement of the adjacent railway line or buildings, particularly due to dewatering of large areas.

Notice: Give due notice in writing to the owner of any property or utility that may be affected by construction operations prior to commencement of such work. Liaise with the relevant authorities to determine acceptable protection measures.

Existing services: Should alterations to existing underground services be required by nature of the design, make the necessary arrangements with the appropriate authorities for the

alterations having first provided 7 days notice. All existing services shall be protected from damage and interruption during construction and shall always be accessible.

Approval: Do not excavate by machine within 1m of existing underground services without prior approval.

Warning devices: Supply, erect and maintain for the duration of the work all warning devices, lighting, road signs and the like, in accordance with AS 1742.3: Traffic Control Devices for Works on Roads.

Site security: Provide proper and adequate safeguarding of the works, including both fixed and unfixed material on the site, during both working and non-working hours. Take all measures including the provision of warning lights, fencing and the employment of a watchman or watchmen and/or safety patrol services as may be necessary for this purpose.

In particular, take all steps necessary at all times to safeguard and ensure the safety of any person who may enter or trespass upon any part of the works.

Provide fencing or barriers to prevent or limit access to the works and in particular to prevent access of unauthorised motor vehicles to the works area.

9.2.7 Dewatering

Methods: Provide and maintain the means and equipment required to sustain water at levels to suit chosen methods of excavation, and to dispose of water entering the excavation and other parts of the work.

Disposal: Ensure that water deviated due to construction work is prevented from entering or adversely impacting on adjoining property by way of suitably constructed swales or other means of redirecting flows. All water within the marina excavations is to be controlled internally, and contained in sedimentation basins to ensure suitable water quality prior to discharge to Murat Bay. All disposal of water shall conform to an approved soil erosion and drainage management plan. Pumped discharge from settling ponds would be monitored to conform to EPA requirements.

Surface drainage: Provide and maintain slopes, bunds and drains as required to ensure satisfactory drainage and to prevent stormwater from entering excavations. Protect freshly laid work from water damage.

9.2.8 Spoil

Off site disposal: Remove the following materials from the site, to a location agreed with the Superintendent and Council:

- Surplus excavated materials
- Excavated material not reusable as filling
- All perishable material, rubbish and debris resulting from site clearing

Burning: Do not burn any material on the site.

General: Disposal of all material shall conform to EPA requirements.

9.3 OPERATIONS

Take appropriate precautions to minimise noise, dust, mud, vibration and any other nuisance. Obtain agreement with appropriate authorities with respect to roads which may be used for importing materials and removing spoil. Clean the wheels of vehicles as necessary to ensure against spoiling of local roads. Clean all roads affected by construction activities to the satisfaction of the Superintendent.

Do not use explosives without written permission of the Engineer. Where use of explosives is permitted surveys of surrounding structures shall be made in the presence of the Engineer and a record made with photographs taken as may be necessary. Monitoring of the situation shall be carried out and all necessary making good provided.

The location of the Contractor's compound and stockpiles of material shall be subject to approval.

Organise and conduct work so as to minimise inconvenience to residents near the site of the works by the control of noise, vibration, dust, mud and any other nuisance. Plant shall be fitted with effective silencing equipment.

In particular, the following conditions shall be observed:

- Noisy machinery operating between the hours of 7.00 pm to 7.00 am or at any time on a Sunday shall be deemed to be an inconvenience to residents near the site of the works.
- If it is necessary to operate pumps or other noisy machinery close to a residence near the site of the works between the hours of 7.00 pm to 7.00 am or at any time on a Sunday, such machinery shall be electrically powered or otherwise effectively silenced.

Work on site on Sundays shall not be scheduled or proposed on a regular or a casual basis except in an emergency such as flood, accident or power failure. In the event of a crisis in which life or property may be at risk immediate action may be taken and reported as soon as practicable.

All work shall be conducted so as to ensure the least possible obstruction to traffic. The convenience of the public and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

APPENDIX A

DEVELOPMENT LAYOUT PLAN
&
LOCALITY PLAN


Cedunа Keys
www.cedunakeys.com.au

APPENDIX B

PRELIMINARY GEOTECHNICAL INVESTIGATIONS

DARE SUTTON CLARKE

CEDUNA KEYS WATERFRONT AND MARINA DEVELOPMENTS

CEDUNA

PRELIMINARY GEOTECHNICAL INVESTIGATION

A3998/2-AC

5 August 2004

A3998/2-AC GR:yb
5 August 2004

Dare Sutton Clarke
276 Flinders Street
ADELAIDE SA 5000

Attention: Mr Norman Clarke

Dear Sir

RE: CEDUNA KEYS WATERFRONT AND MARINA DEVELOPMENTS
CEDUNA
PRELIMINARY GEOTECHNICAL INVESTIGATION

Please find enclosed our report on the preliminary geotechnical investigation undertaken for the above project.

Your attention is drawn to the enclosed sheet titled "*Important Information About Your Coffey Report*" which outlines the limitations of this report.

Should you require any further information or clarification regarding our report please contact Greg Ralls or the undersigned.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

ROGER GROUNDS

Distribution: 3 copies Dare Sutton Clarke
1 copy Coffey Geosciences Pty Ltd Library
Original held by Coffey Geosciences Pty Ltd

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APPENDICES

1. INTRODUCTION

This report describes the results of a preliminary geotechnical investigation carried out by Coffey Geosciences Pty Ltd (Coffey) at the proposed site of the Ceduna Keys Waterfront and Marina Developments, Ceduna.

The investigation was commissioned by Mr Brett Aesche of Dare Sutton Clarke (DSC) in a facsimile dated 14 May 2004 (Project Number: 100026, Reference Number: 003). The scope of the investigation was broadly consistent with a proposal prepared by Coffey dated 14 April 2004 (Reference: ADP2257).

It is understood that the aim of the preliminary geotechnical investigation is to identify key geotechnical issues relevant to the design and construction of the project.

This report describes the investigation undertaken and summarises the subsurface conditions encountered. Recommendations relating to key geotechnical issues are presented in Section 4.

2. OUTLINE OF THE INVESTIGATION

2.1 Field Work

The field investigation was carried out on 3 June 2004 and comprised the excavation of eight test pits (referred to as TP1 to TP8) across the area of the proposed development. The test pits were excavated to either a maximum depth of about 3 m, backhoe refusal or pit wall collapse.

The test pits were excavated with a JCB 4CX backhoe fitted with a 600 mm wide toothed bucket. The test pits were located to provide a broad coverage of the proposed development area and were located within areas of proposed canals to minimise disturbance to the ground in areas of proposed residential development.

The test pit locations were generally measured by car odometer and by pacing relative to Denial Bay Road and the Eyre Highway and are shown approximately on Figure 1.

Samples of groundwater were collected at three locations (from test pits TP1, TP3 and TP7) for laboratory testing to provide a preliminary assessment of groundwater quality.

The field investigation was undertaken in the presence of a Geotechnical Engineer from Coffey who was responsible for locating the test pits, logging the soil profile encountered and carrying out groundwater sampling.

The soil profile encountered in the test pits is described on the engineering logs contained in Appendix A. The logs are preceded by an explanation sheet which outlines the terms and symbols used in their preparation.

2.2 Laboratory Testing

The groundwater samples were submitted to the NATA registered laboratory of MGT Environmental Consulting Pty Ltd for the assessment of heavy metals, pH and Total Dissolved Solids. The results of the laboratory testing are presented in Appendix B.

3. SITE CONDITIONS

3.1 General

The site is located near the intersection of Denial Bay Road and the Eyre Highway near Ceduna, South Australia. The site is bounded to the north and east by an existing railway and is generally bounded to the west by the Murat Bay coastline.

At the time of the investigation, the proposed development area generally comprised uneven, low lying ground which was largely covered by salt bush.

Access for the rubber tyred backhoe was possible over most of the site, however, was not possible over the south-western corner of the site at the time of the investigation.

During a site walk-over, a prominent rocky headland was observed along the coastline opposite the existing fruit checking station on the Eyre Highway. The headland comprised variably weathered sandstone with no obvious bedding or joint sets. The sandstone was overlain by a profile of calcareous sandy soils and calcrete.

3.2 Regional Geology

According to the Geological Survey of South Australia (1:250,000 Streaky Bay map sheet) the site would be expected to be predominantly underlain by calcareous sandy soils of the Bridgewater Formation. The Bridgewater Formation was deposited in shallow subtidal beach and coastal dune environments in the Pleistocene period.

Calcareous soils have properties that require special consideration, namely:

- they are water soluble under low pH conditions that can occur naturally;
- the particles are weaker than typical siliceous soil particles, and can be crushed at comparatively low stress;
- the carbonate materials act as a cementing agent.

The Bridgewater Formation typically comprises poorly graded, fine or medium or coarse grained sand with little or no fines content. The continuity and degree of calcareous cementation can be extremely variable with strengths ranging from uncemented sand to strong rock (calcarenite / sandstone). The strongly cemented zones often have a high voids ratio (porous structure). It is possible that sinkholes, cavities, solution pipes and other karstic features, could be present in the Bridgewater Formation.

Calcrete may also be encountered within the soil profile. The calcrete can occur as either poorly graded silty gravel, rubbly layers of cobble to boulder sized fragments or a massive continuous sheet. The calcrete strength is highly variable, ranging from low to extremely high rock strength.

The lower lying southern portion of the site would be expected to comprise supratidal and extratidal flats (rarely inundated prior to construction of the Eyre Highway) which would be expected to be underlain by carbonate and gypsum mud, clay, silt and sand.

3.3 Subsurface Conditions

The soil profile encountered in the test pits comprised a mixture of quartz and calcareous sands, containing abundant bivalve mollusc shells in places. Other materials encountered included shell grit and sandy gravel, comprised of fine to coarse grained gravel-sized marine shells.

A layer of dark grey, low plasticity sandy clay was encountered in test pit TP6. The sandy clay layer was about 100 mm thick and the sandy clay was of soft to firm consistency.

No peaty or highly organic soils considered likely to generate acid sulphate soil conditions were encountered during the course of the investigation.

Groundwater was encountered in six of the test pits over the depth range investigated. Groundwater was not encountered in test pits TP4 and TP8. Groundwater inflow was noted at depths ranging between about 0.55 m and 1.9 m below the existing ground surface level. From correlation with the survey plan provided, the

groundwater level encountered in the test pits appears to be about RL 0 mAHD. It should be noted that groundwater fluctuations are expected due to tidal and seasonal variations.

Four of the test pits (test pits TP2, TP3, TP4 and TP5) were terminated due to collapse of the sides of the pit in loose sandy soils. Backhoe refusal was encountered at three locations, namely, in test pits TP1, TP6 and TP8 on suspected medium to high strength calcrete.

4. GEOTECHNICAL ASSESSMENT

4.1 General

It is understood that the proposed development comprises the construction of canals, residential allotments and road pavements across the site. The proposed nominal base level of the canals is understood to be RL -3.5 mAHD, although as low as RL –4.5 mAHD in places.

The existing ground surface levels at the site range between about RL 0.2 mAHD and RL 8.8 mAHD. At the test pit locations (and across the majority of the site where the canals are proposed) the maximum surface elevation was about 2.5 mAHD.

4.2 Key Geotechnical Issues

The key geotechnical issues affecting site development are:

- the presence of variable, non-engineered fill to a depth of 0.7 m at the location of test pit TP1. The fill is judged to be unsuitable in its present condition as a founding layer for footings or pavements;
- the presence of loose sandy soils. The soils are considered to be potentially vulnerable to liquefaction during an earthquake and will require relatively flat batters to maintain stability, especially close to (or below) the water level;
- the presence of shallow groundwater. Excavations extending below about 0.5 mAHD would need to be dewatered.

4.3 Bulk Earthworks

4.3.1 Excavatability

The materials encountered in the test pits were generally able to be excavated with the JCB 4CX backhoe used in the field investigation, however, backhoe refusal was observed at test pit locations TP1, TP6 and TP8. Backhoe refusal occurred at two locations on strongly cemented calcrete (test pits TP6 and TP8). The material on which refusal occurred at the remaining location (test pit TP1) was not observed as refusal occurred below the groundwater table.

The soil profile encountered in the test pits up to a depth of about 3 m is expected to be generally excavatable using conventional earthmoving equipment such as large backhoes and hydraulic excavators. Where strongly cemented calcrete is encountered, which should be expected within 0 to 3 m depth in places, an hydraulic rock breaker or ripping by bulldozer may be required.

4.3.2 Trafficability

Trafficability across the lower lying areas of the site is expected to be poor. Groundwater levels across the site may be related to tidal variations and at high tide the groundwater is likely to rise to a level sufficient to

restrict access to parts of the site. It is expected that a working (construction) platform of granular material would need to be placed to allow site access for construction equipment. The thickness of the construction platform would depend on the construction equipment used and high tide levels.

4.3.3 Dewatering

At the time of the investigation, groundwater was encountered in all of the test pits except TP4 and TP8. Groundwater was encountered at depths ranging between about 0.55 m and 1.9 m and is inferred from the survey plan provided to be at about RL 0 mAHD.

The rate of groundwater inflow into excavations through predominantly sandy soils would be expected to be relatively high. The in situ permeability of the sandy soils would be expected to be of the order of about 1×10^{-3} m/s, which indicates highly permeable ground conditions.

The use of perimeter trenches and sumps located within the excavation are considered a viable dewatering option for the canals although the stability of the sides of the excavation would need to be carefully considered. Constant seepage of groundwater through the sides of the excavation may result in slumping and sloughing of the batters. Given the expected highly permeable ground conditions, high flow rates into the excavations would be expected and the excavations would need to be continuously dewatered. The use of conventional well pointing systems may also be effective within predominantly sandy soils, however, the presence of calcrete in places may make it difficult to install the wells. The use of well point dewatering would improve the stability of the sides of the excavation, as the exposed batters would not be subject to seepage forces and constant erosion.

4.4 Slope Stability

For slopes not subject to seepage forces (ie. dry slopes or permanently submerged slopes) it is recommended that cut batter slopes of 3H:1V (or flatter) be provided to achieve adequate stability and allow construction equipment to operate, for cut slopes up to 5 m high. Flatter slopes may be required where seepage forces act on a slope. Fill embankments may be constructed at the same batter slope provided the fill is compacted in accordance with the recommendations given in Section 4.5.

All batter slopes within the tidal zone and above the permanent water level must be adequately protected against erosion by wind and water. The effects of propellar wash on submerged slopes must also be considered. Above the water level erosion protection could be achieved by topsoiling and establishing a suitable vegetation cover. Within the tidal zone and below scour protection should be provided by the placement of rip rap, as described in Section 4.7.

4.5 Site Preparation And Compaction Requirements

Based upon the materials encountered in the test pits the following site preparation and filling sequence is recommended in areas to be raised with engineered fill:

- Excavation of the uppermost root-bearing topsoil materials and any non-engineered fill;
- Proof rolling of the exposed materials with a vibrating smooth drum roller of at least 10 tonnes static weight. In low lying areas, proof rolling the exposed natural subgrade may not be practical due to poor trafficability and shallow groundwater. In these areas, a working platform of coarse, reasonably graded rock may be required. A thickness of working platform of about 0.4 m is suggested, although a trial area on site is recommended to optimise the thickness for the machinery and site conditions prevailing at the time. Proof rolling of the surface working platform should then be performed. Any soft, wet, weak or organic materials encountered during proof rolling should be removed and

replaced with compacted select fill, and;

- Filling to the required design levels. The fill should be placed in layers not exceeding 250 mm loose thickness, moisture conditioned to within +/- 3% of the optimum moisture content and compacted to achieve a minimum dry density ratio of either 95% Standard (bulk allotment fill) or 98% Standard (road subgrade).

Inspection of the site preparation and compaction works, by a suitably experienced Geotechnical Engineer is recommended.

4.6 Re-Use Of Site Won Materials

Based upon the thicknesses of the various materials encountered in the test pits, it is expected that the bulk of the site won material will comprise calcareous sandy soils. This material is considered suitable for re-use as bulk allotment fill provided it is properly engineered.

The other materials encountered in the test pits included shell grit and sandy gravel, comprised of predominantly fine to coarse grained gravel-sized bivalve mollusc shells. These materials would generally be unsuitable for re-use as bulk allotment fill.

The upper 100 mm to 300 mm of root-bearing material is also considered unsuitable for reuse in engineered fill. It should be stripped and stockpiled for use in landscaping.

4.7 Rip Rap And Scour Protection

Scour and erosion of unprotected natural soils from around the edge of the proposed canals is expected. It is therefore important that protection such as rip rap be provided around the edge of the canals.

The size of the rip rap stones must be determined as part of the design of the marina, based on the expected wave heights (from storm and boating activities) and slope stability considerations. The rip rap should be laid on a geotextile fabric, to prevent the underlying sand washing out through the rip rap. Alternatively, progressively coarser layers of filter gravel could be placed between the sand and rip rap.

It is recommended that the condition of the rip rap protection be monitored and that any movement of rip rap materials or deterioration of rip rap cover be corrected immediately.

Alternative scour protection measures such as proprietary grout mattresses and other products may also be considered. Coffey would be pleased to review alternative measures if required.

5. ADDITIONAL SERVICES AND FURTHER INVESTIGATIONS

It is recommended that an experienced Geotechnical Engineer review plans and specifications which affect or are affected by geotechnical issues to help assure proper interpretation of the geotechnical findings and recommendations. We are pleased to offer our services for the review.

It is recommended that additional investigations be carried out at the location of the entrance channel to the canals to identify the presence of any rock, which would require blasting. It is anticipated that the investigation would comprise drilling several boreholes from a jack-up barge along the alignment of the proposed channel. Further investigations at selected locations within the proposed canals are also recommended using a hydraulic excavator fitted with a rock bucket and possibly using a rock breaker, both to determine the ease of excavatability and to determine the properties of the materials beneath the calcrete encountered at some locations during the preliminary investigation.

A program of drilling and in situ Standard Penetration Testing at locations which are accessible to a drilling rig should also be considered in order to allow an assessment of the liquefaction potential of the natural subsurface materials.

We would be pleased to offer our services for these activities.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

Coffey Geosciences Pty Ltd ACN 056 335 516	Geotechnical I **Resources** I Environmental I **Technical** I Project Management		
Drawn	GR	DARE SUTTON CLARKE CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENT PRELIMINARY GEOTECHNICAL INVESTIGATION FIELD INVESTIGATION PLAN	**FIGURE 1**
Approved			
Date	07/06/2004		
Scale	As Shown		Job no: **A3998/2**

F:\GeoTechnical\A3998.2\[A3998.2 Figure 1.xls]A4 Portrait Figure

Information

Important Information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope of service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time; fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of the subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

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Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design toward construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

** For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, National Headquarters, Canberra, 1987.*

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APPENDIX A

Soil Description

Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil.

Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (USC) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 – 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 – 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 – 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 – 200	The surface of the soil can be marked but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 – 35
Medium Dense	35 – 65
Dense	65 – 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component	Coarse grained soils: 5 – 12% Fine grained soils: 15 – 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample	Weakly cemented	Easily broken up by hand in air or water
Lenses	Discontinuous layers of lenticular shape	Moderately cemented	Effort is required to break up the soil by hand in air or water
Pockets	Irregular inclusions of different material		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil	Deposited by wind.
Alluvial soil	Deposited by streams and rivers.
Colluvial soil	Deposited on slopes (transported downslope by gravity).
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.
Lacustrine soil	Deposited by lakes.
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.

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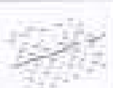
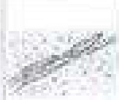
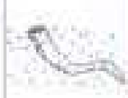
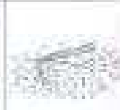
SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)							USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing			SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing			SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			SM	SILTY SAND
				Plastic fines (for identification procedures see CL below)			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm				IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm				
				DRY STRENGTH	DILATANCY	TOUGHNESS		
		SILTS & CLAYS Liquid limit less than 50		None to Low	Quick to slow	None	ML	SILT
				Medium to High	None	Medium	CL	CLAY
				Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50		Low to medium	Slow to very slow	Low to medium	MH	SILT
				High	None	High	CH	CLAY
				Medium to high	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS				Readily identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT

• Low plasticity – Liquid Limit W_L less than 35%. • Medium plasticity – W_L between 35% and 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2m in length.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar, curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter.	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

Coffey Geosciences Pty Ltd ACN 056 335 516

Engineering log - Excavation

Excavation No. ***TP1***

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE***

Date started: ***3.6.2004***

Principal: ***-***

Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS***

Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1***

Checked by:

equipment type and model: JCB 4CX BACKHOE | Pit Orientation: | Easting: m | R.L. Surface:

excavation dimensions: 3.4m long 1.1m wide | Northing: m | datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.5			**FILL: SAND:** fine to medium grained, dark grey, trace of non-plastic fines, contains rootlets.	M D			FILL
									FILL: SAND: fine to medium grained, pale grey quartz, with some shelly fragments, trace of medium to coarse grained calcrete gravel.				
									FILL: SAND: fine to medium grained, grey quartz, with some shelly fragments.				
						1.0		GP	**SHELL GRIT:** fine to coarse grained, gravel-sized shell fragments, pale brown, with some fine to coarse grained sand, trace of coarse grained subrounded gravel.		L / MD		NATURAL, sides of pit collapsing
						1.5		SP	**SAND:** fine to medium grained, pale brown, calcareous, with some shelly fragments.	M			
			I			2.0		GP	**SHELL GRIT:** fine to coarse grained, gravel-sized, brown and grey, with some fine to coarse grained sand, with some cemented cobbles, medium to high strength.	W			steady groundwater inflow
			L	GW1		2.5							water level measured after 5 minutes
						3.0			Refusal on rock at 2.8m Test pit TP1 terminated at 2.8m				
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Engineering log - Excavation

Excavation No. ***TP2***

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE*** Date started: ***3.6.2004***

Principal: ***-*** Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS*** Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: JCB 4CX BACKHOE Pit Orientation: Easting: m R.L. Surface:

excavation dimensions: 3.5m long 1.6m wide Northing: m datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.5		SP	**SAND:** fine to medium grained, brown, trace of non-plastic fines.	M	L / MD		NATURAL, sides of pit collapsing
						1.0		SP	**SAND:** fine to medium grained, pale grey with orange brown patches, calcareous, with some medium grained gravel-sized bivalve mollusc shell halves.				
			▶			1.5			becomes grey	W			rapid groundwater inflow
			▼			2.0			with some pockets of predominantly bivalve mollusc shells, coarse gravel to small cobble-sized				water level measured after 10 minutes
						2.5			Test pit TP2 terminated at 2.4m				
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Excavation No. ***TP3***

Engineering log - Excavation

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE*** Date started: ***3.6.2004***

Principal: ***-*** Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS*** Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: JCB 4CX BACKHOE Pit Orientation: Easting: m R.L. Surface:

excavation dimensions: 3.6m long 1.9m wide Northing: m datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.0		SP	**SAND:** fine to medium grained, brown, trace of non-plastic fines, rootlets throughout.	M	L / MD		NATURAL, sides of pit collapsing.
								SP	**SAND:** fine to medium grained, pale grey brown.				
						0.5			with numerous bivalve mollusc shell halves				
						1.0							
			▼			1.5			becomes grey, no bivalves, calcareous	W			rapid water inflow
			▼	GW2		2.0							water level measured after 5 minutes
									Test pit TP3 terminated at 2.1m				
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Engineering log - Excavation

Excavation No. ***TP4***

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE***

Date started: ***3.6.2004***

Principal: ***-***

Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS***

Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1***

Checked by:

equipment type and model: JCB 4CX BACKHOE | Pit Orientation: | Easting: m | R.L. Surface:

excavation dimensions: 5m long 2.3m wide | Northing: m | datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N	None observed			0.5		SP	**SAND:** fine to medium grained, grey, with some non-plastic fines, rootlets throughout.	D	L / MD		NATURAL, sides of pit collapsing.
								SP	**SAND:** fine to medium grained, pale brown, calcareous, with some bivalve mollusc shell halves.				
						1.0		SP	**SAND:** fine to medium grained, pale grey.	M			
						1.5							
						2.0			becomes grey, trace of bivalve mollusc shell halves.	W			
						2.5			Test pit TP4 terminated at 2.5m				
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering log - Excavation

Excavation No. ***TP5***

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE***

Date started: ***3.6.2004***

Principal: ***-***

Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS***

Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1***

Checked by:

equipment type and model: JCB 4CX BACKHOE | Pit Orientation: | Easting: m | R.L. Surface:

excavation dimensions: 3.5m long 1.6m wide | Northing: m | datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N				0.5		SP	**SAND:** fine to medium grained, brown, contains some rootlets.	M	L / MD		NATURAL, sides of pit collapsing
						1.0		SP	**SAND:** fine to medium grained, pale grey. becomes orange brown.	W			some calcrete cobbles at 1.3m depth
			▶			1.5		GP	**SHELL GRIT:** fine to coarse gravel-sized mollusc and oyster shells, grey and orange brown, with some fine to coarse grained sand.				steady groundwater inflow
						2.0							
						2.5			Test pit TP5 terminated at 2.3m				
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Engineering log - Excavation

Excavation No. ***TP6***

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE*** Date started: ***3.6.2004***

Principal: ***-*** Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS*** Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: JCB 4CX BACKHOE Pit Orientation: Easting: m R.L. Surface:

excavation dimensions: 3.1m long 1.3m wide Northing: m datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N	▶			0.5		SP	**SAND:** fine to medium grained, brown.	M	L / MD		NATURAL
								SP / SC	**SAND: CLAYEY SAND:** fine to medium grained, pale grey, low plasticity fines.	>Wp	S / F	×	
								CL	**SANDY CLAY:** low plasticity, dark grey, sand fine to medium grained.	M	L / MD		
								SC	**CLAYEY SAND:** fine to medium grained, brown, low plasticity fines.				
						1.0		SP	**SAND:** fine to coarse grained, orange brown and grey, with some low plasticity fines.				
									Refusal on medium to high strength calcrete at 0.6m				
						1.5			Test pit TP6 terminated at 0.6m				
						2.0							
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Excavation No. ***TP7***

Engineering log - Excavation

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE*** Date started: ***3.6.2004***

Principal: ***-*** Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS*** Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: JCB 4CX BACKHOE Pit Orientation: Easting: m R.L. Surface:

excavation dimensions: 3.4m long 1m wide Northing: m datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N						SC	**CLAYEY SAND:** fine to medium grained, brown, low plasticity fines.	M	L / MD		NATURAL
								SP	**SAND:** fine to medium grained, grey.				
						0.5		SP	**GRAVELLY SAND:** fine to medium grained, pale grey, gravel comprises fine to coarse grained bivalve mollusc shells.				
									CALCRETE: pale grey, low to medium strength.				
						1.0		GP	**SANDY GRAVEL:** fine to coarse grained bivalve mollusc shells, pale grey, sand fine to medium grained, moderately to strongly cemented in places, with porous structure.	W			excavates in places as cobble-sized cemented material
				GW3		1.5							
						2.0							water level about 10 minutes after digging, water inflow occurred during digging
						2.5							
						3.0			Test pit TP7 terminated at 3m				
						3.5							
						4.0							

Sketch

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

support
S shoring N nil

penetration
1 2 3 4 no resistance ranging to refusal

water
water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Geosciences Pty Ltd ACN 056 335 516

Excavation No. ***TP8***

Engineering log - Excavation

Sheet 1 of 1

Office Job No.: ***A3998/2***

Client: ***DARE SUTTON CLARKE*** Date started: ***3.6.2004***

Principal: ***-*** Date completed: ***3.6.2004***

Project: ***CEDUNA KEYS WATERFRONT & MARINA DEVELOPMENTS*** Logged by: ***GR:det***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: JCB 4CX BACKHOE Pit Orientation: Easting: m R.L. Surface:

excavation dimensions: 3.4m long 1.2m wide Northing: m datum: NOT MEASURED

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
BH		N	None observed					SM	**SILTY SAND:** fine to medium grained, brown, non-plastic fines, contains rootlets.	M	L / MD		NATURAL
								SP	**SAND:** fine to medium grained, brown, with some fine to medium grained calcrete gravel.	D			
						0.5			Refusal on high to very high strength calcrete at 0.35m				
						1.0			Test pit TP8 terminated at 0.35m				
						1.5							
						2.0							
						2.5							
						3.0							
						3.5							
						4.0							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

APPENDIX B

mgt Environmental Consulting Pty. Ltd.
A.B.N. 50 005 085 521

3 Kingston Town Close, Oakleigh, Victoria, 3166, Australia
Postal Address: P.O. Box 276, Oakleigh, Victoria, 3166, Australia
Telephone: + 61 3 9564 7055
Fax + 61 3 9564 7190
Email: mgt@mgtenv.com.au

FACSIMILE TRANSMISSION DETAILS.
FAX : (03) 9564 7190.

TO :	COFFEY	FROM :	Andrew Thexton
ATT :	Greg Ralls	DATE :	14/7/04
FAX No. :	08 8234 0932	PAGE :	1 OF

PRELIMINARY RESULTS

Greg

1R23 det.

results ex A3998/2

Andrew

Andrew Thexton
Client Manager
MGT Environmental Consulting Pty Ltd.
3 Kingston Town Close, Oakleigh
Victoria, Australia.

Telephone:- (+61 3) 9564 7055
Fax:- + 61 3 9564 7190
email:- athexton@mgtenv.com.au

If all pages not received, please contact the above on (03) 9564 7055.

Coffey Geosciences
14B Henley Beach Rd
Mile End
South Australia 5031

Site : A3998/2

HEAVY METALS USEPA 6010B (ICP), 7470/1 (CVAA)

Sample	GW1	Dup GW1	GW2	GW3	Spike % Recov	Meth.Bl.(mg/l)
Lab. No. / Sample matrix	JN3189#Water	JN3189D#Water	JN3190#Nater	JN3191#Water	JN3189S#Water	
Antimony	0.04	0.04	<0.01	<0.01	99%	<0.01
Arsenic	0.033	0.034	0.030	0.030	87%	<0.001
Beryllium	<0.001	<0.001	<0.001	<0.001	81%	<0.001
Cadmium	<0.0002	0.0002	<0.0002	<0.0002	85%	<0.0002
Chromium	0.014	0.014	0.018	0.026	96%	<0.001
Cobalt	0.002	0.002	0.041	0.005	83%	<0.001
Copper	0.010	0.011	0.016	0.025	81%	<0.001
Lead	<0.001	<0.001	<0.001	<0.001	87%	<0.001
Mercury	0.0001	0.0001	0.0002	0.0003		<0.0001
Molybdenum	0.032	0.032	0.49	0.095	98%	<0.005
Nickel	0.007	0.007	0.022	0.012	84%	<0.001
Selenium	0.060	0.058	0.082	0.12	80%	<0.005
Tin	<0.005	<0.005	<0.005	<0.005	88%	<0.005
Zinc	<0.001	<0.001	<0.001	<0.001	85%	<0.001

Extraction with H2O2, HNO3 & HCl. Results in ppm (soils mg/kg dry, waters mg/l).

Date received 22/06/04

Coffey Geosciences
14B Henley Beach Rd
Mile End
South Australia 5031

Site : A3998/2

MISCELLANEOUS ANALYSES. METHODS US EPA SW846 OR APHA STANDARD METHODS 19TH ED. 1995.

Sample	GW1	GW2	GW3			
Lab. No. / Sample matrix	JN3189#Water	JN3190#Water	JN3191#Water			
pH(units)	6.9	7.0	7.0			
Total Dissolved Solids	58000	130000	190000			

Results in ppm (soils mg/kg dry, waters mg/l.) except where specified otherwise.

Date received 22/06/04

APPENDIX C

SUPPORTING INFORMATION TO THE ENVIRONMENTAL SITE HISTORY

- **Site plan**
- **Certificate of Titles**
- **Land use zoning**
- **Historical aerial photographs 1958 & 1980**
- **PIRSA bores, groundwater summary**
- **EPA section 7 clearances**

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

NOTE
ALL LOCATIONS AND DIMENSIONS OF SITE FEATURES ARE APPROXIMATE ONLY.

EYRE HIGHWAY

PENONG - THEVENARD RAILWAY

N

DENIAL BAY ROAD

SLAUGHTER HOUSE & HOLDING PENS

DUMPED BUILDING WASTE

BMX / MOTORCROSS TRACK

MURAT BAY

QUARANTINE STATION

SAMPHIRE FLATS

GROUNDWATER MONITORING BORES

OLD QUARRY AREA

HIGH TIDE WATER LEVEL

ROADSIDE INFORMATION BAY

OYSTER BAR

OLD LIMESTONE QUARRY

ABORIGINAL COMMUNITY HOUSING SITE

FILLED AREA LARGE VEHICLE PARKING

FORMER STABLE / HORSE PADDOCKS

EYRE HIGHWAY

BP ROADHOUSE

SCATTERED ITEMS

SCALE
0 50 100 150 200 250
METRES

AMENDMENTS

ISSUE	REMARKS	DATE	BY

DARE SUTTON CLARKE
ENGINEERS & PROJECT MANAGERS
276 Flinders Street.
PO Box 7048. Hutt Street.
Adelaide. SOUTH AUSTRALIA. 5000
Ph (08) 8223 6455 Fax (08) 8223 2698
Level 7/303 Coronation Drive.
PO Box 2245.
Milton. QUEENSLAND. 4064
Ph (07) 3367 3823 Fax (07) 3367 3804
Email dsc@dscgroup.net Website www.dscgroup.net

PROJECT
CEDUNA KEYS

CLIENT
CEDUNA MARINA DEVELOPMENT COMPANY

DRAWING TITLE
EXISTING SITE PLAN

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	PROJECT DIRECTOR
JH	BA	BA	WNC

DATE: JUNE 2004
SCALE: AS SHOWN

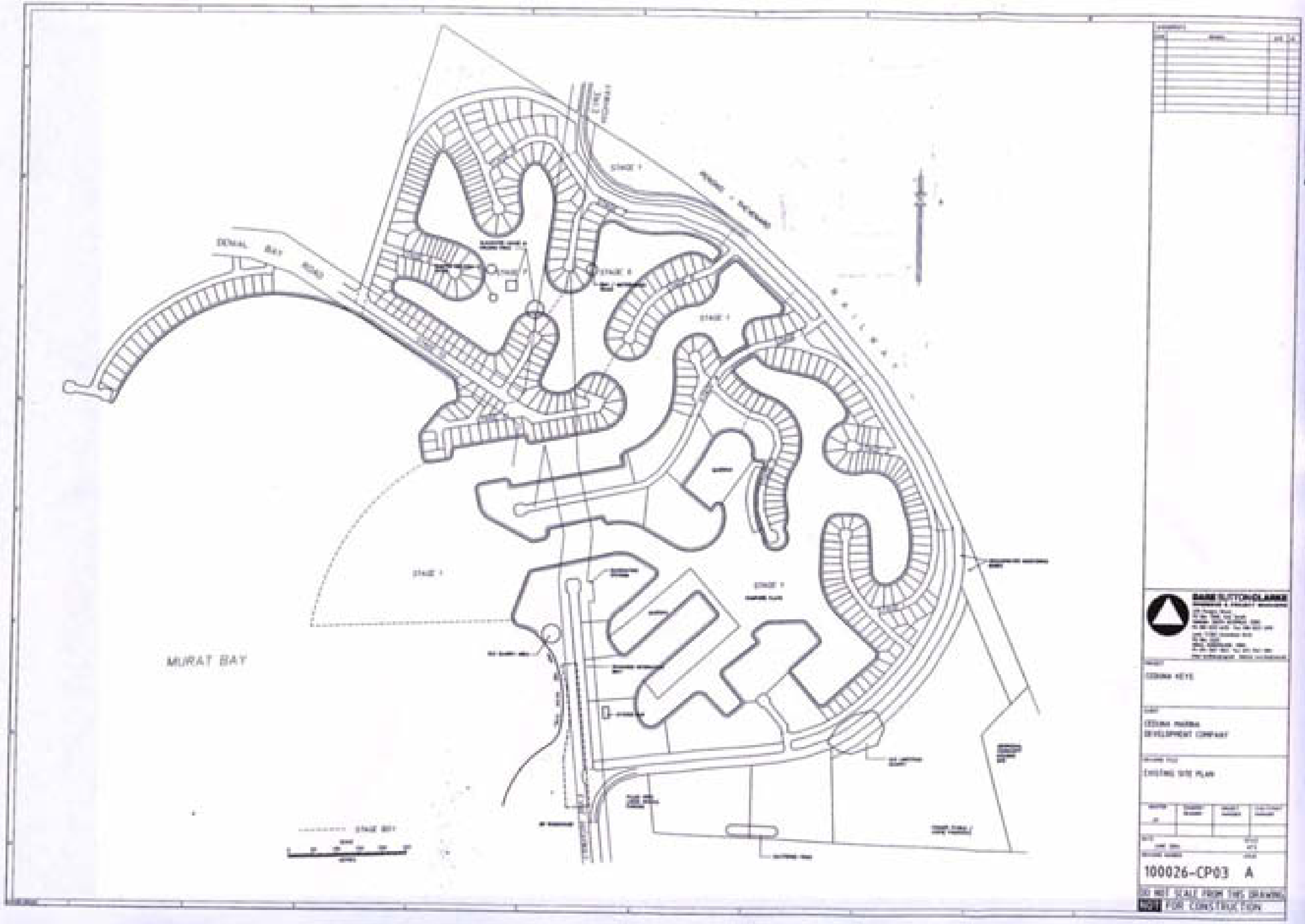
DRAWING NUMBER: 100026-CP03
ISSUE: A

DO NOT SCALE FROM THIS DRAWING
NOT FOR CONSTRUCTION

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers


DENIAL BAY ROAD
MURAT BAY
STAGE 1
CEDUNA KEYS
CEDUNA MARINA
DEVELOPMENT COMPANY
EXISTING SITE PLAN
100026-CP03 A
DO NOT SCALE FROM THIS DRAWING
NOT FOR CONSTRUCTION

CERTIFICATE OF TITLE

REAL PROPERTY ACT, 1886

VOLUME 5830 FOLIO 638

Edition 1
Date Of Issue 19/12/2000
Authority RTU 8933987

South Australia

I certify that the registered proprietor is the proprietor of an estate in fee simple (or such other estate or interest as is set forth) in the land within described subject to such encumbrances, liens or other interests set forth in the schedule of endorsements.

REGISTRAR-GENERAL

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 20 DEPOSITED PLAN 55492
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

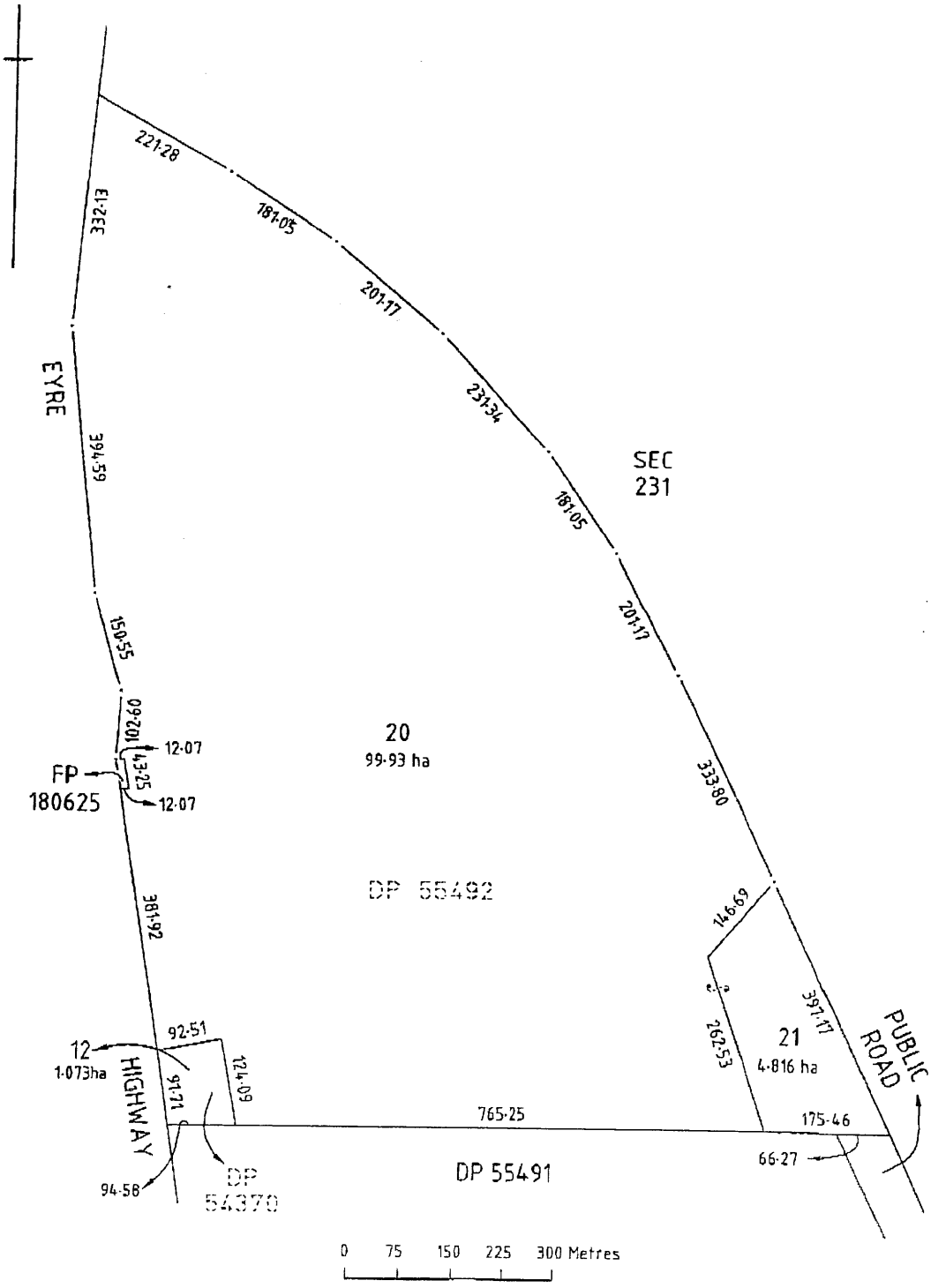
NIL

SCHEDULE OF ENDORSEMENTS

NIL

End of Text.

VOLUME 5830 FOLIO 638



095-004.02

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5835 FOLIO 121 *

COST : $14.50 (GST exempt)	PARENT TITLE : CT 5782/655
REGION : FAX 0886253435	AUTHORITY : DM 8945238
AGENT : LGU8P BOX NO : 000	DATE OF ISSUE : 24/01/2001
SEARCHED ON : 14/08/2003 AT : 09:48:42	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 22 DEPOSITED PLAN 53902
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

SUBJECT TO EASEMENTS OVER THE LAND MARKED B.A.E.D.F AND C (T 4249305 T 4249306 T 4463473 T 4463474 T 4489132 AND T 4489133 RESPECTIVELY)

SCHEDULE OF ENDORSEMENTS

NIL

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

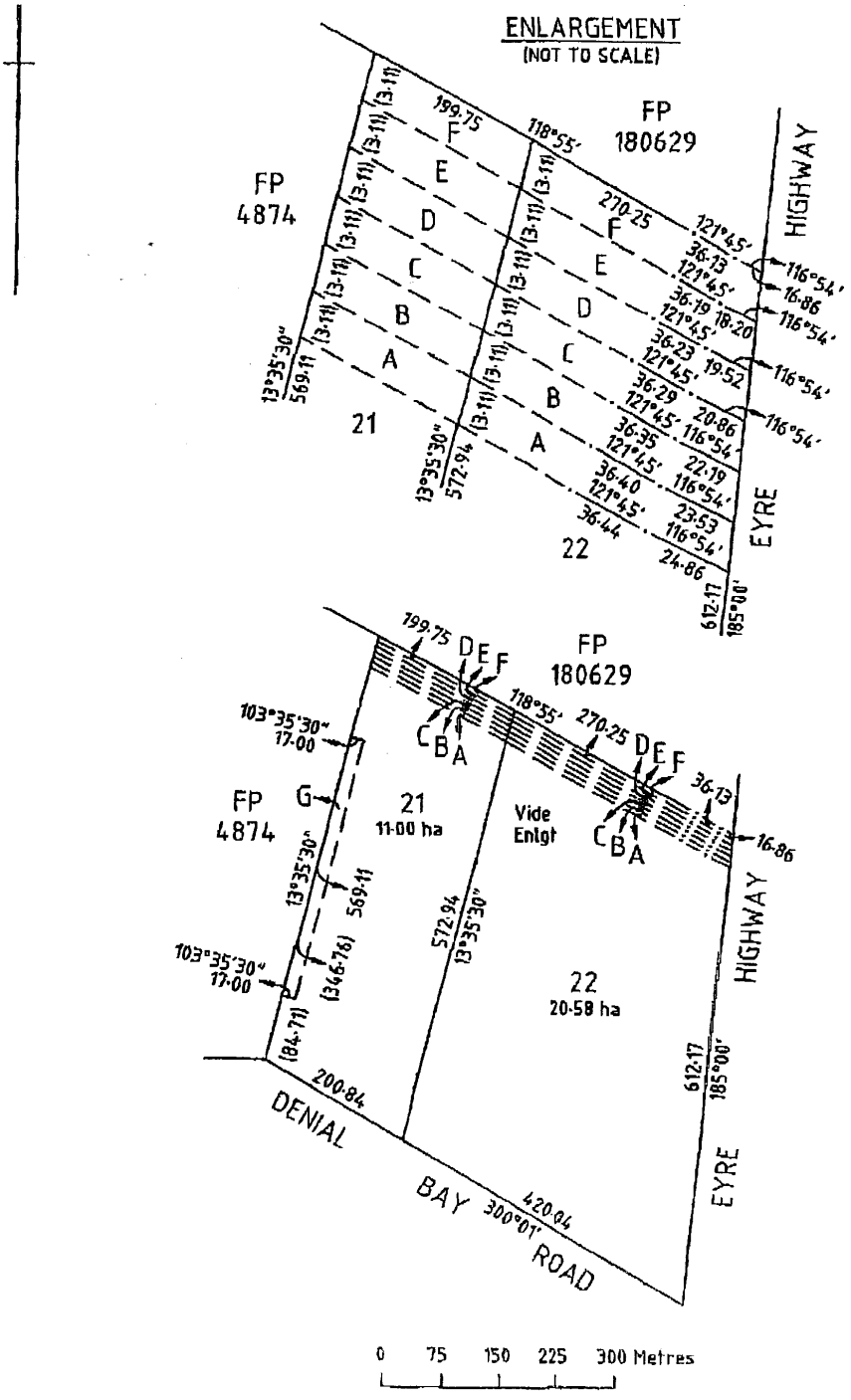
NIL

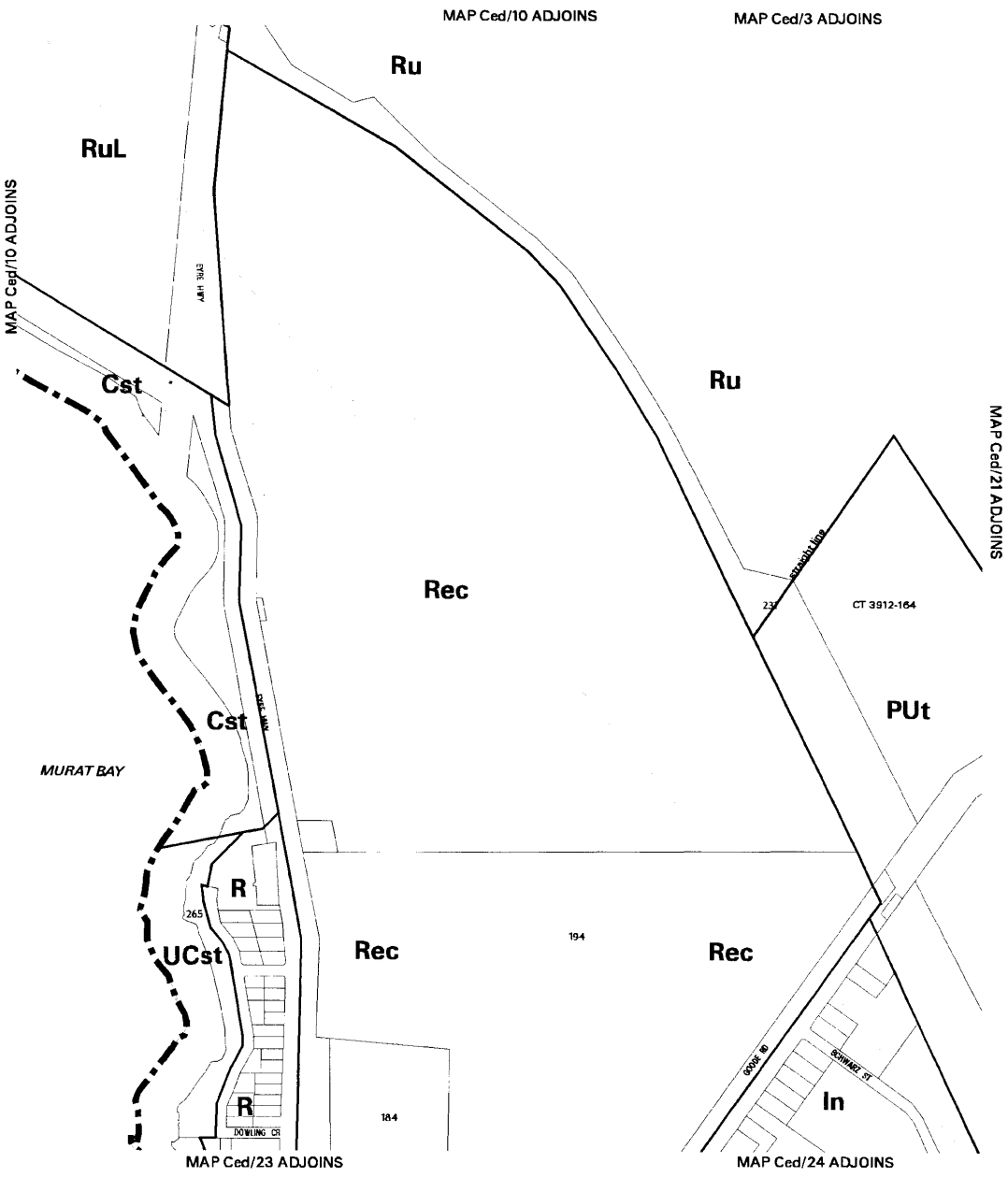
END OF TEXT.

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5835 FOLIO 121

SEARCH DATE : 14/08/2003 TIME: 09:48:42





CEDUNA
Note : For Policy Areas See MAP Ced/34.

Cst	Coastal
In	Industry
PUt	Public Utilities
R	Residential
Rec	Recreation
Ru	Rural Zone
RuL	Rural Living
UCst	Urban Coastal

Zone Boundary

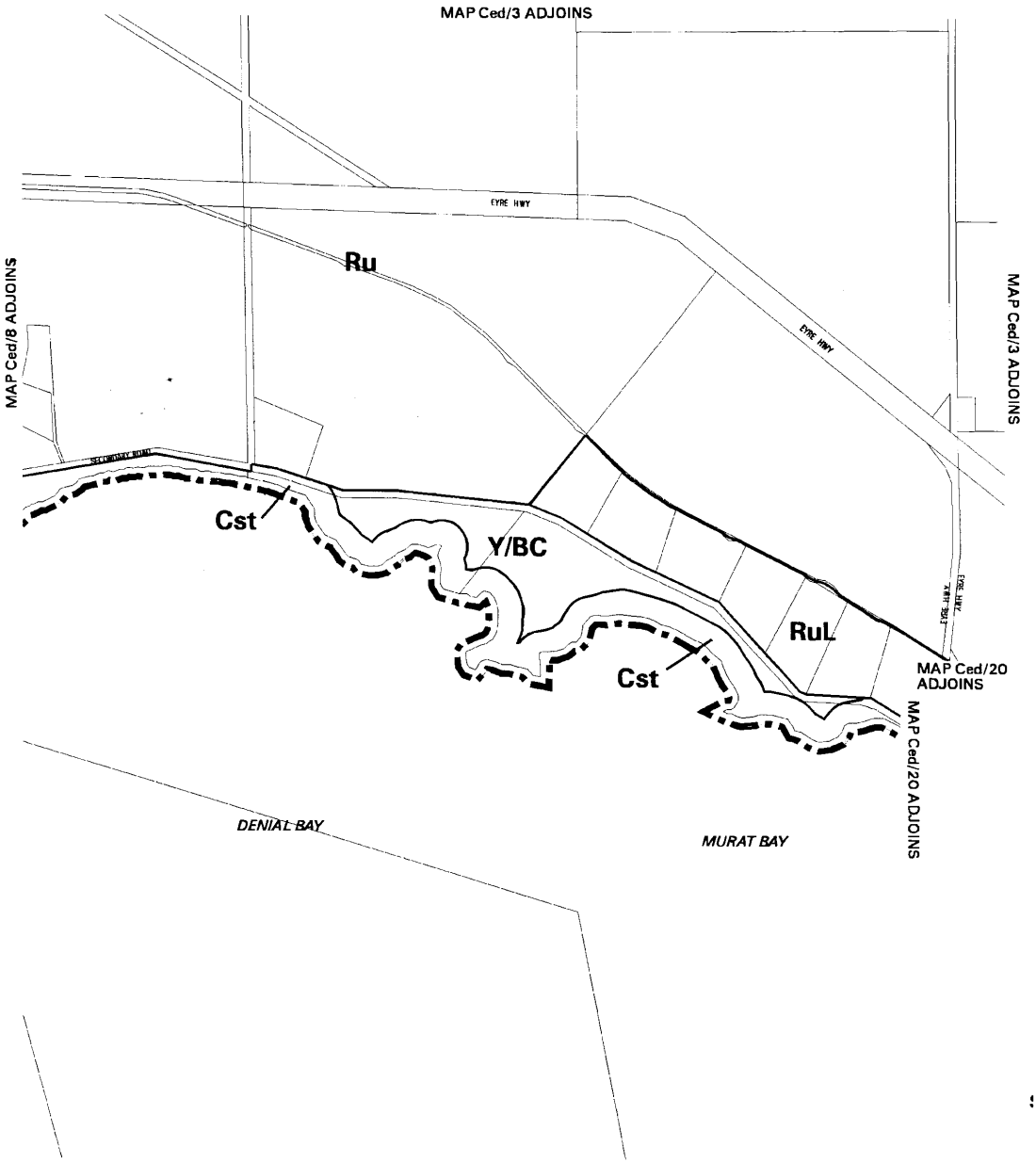
Development Plan Boundary

Scale 1:10000

0 500metres

CEDUNA (DC) ZONES MAP Ced/20

Consolidated - 21 August 2003



Note : For Policy Areas See MAP Ced/33.

Cst	Coastal
Ru	Rural Zone
RuL	Rural Living
Y/BC	Yarilena/Betts Corner

Scale 1:45000

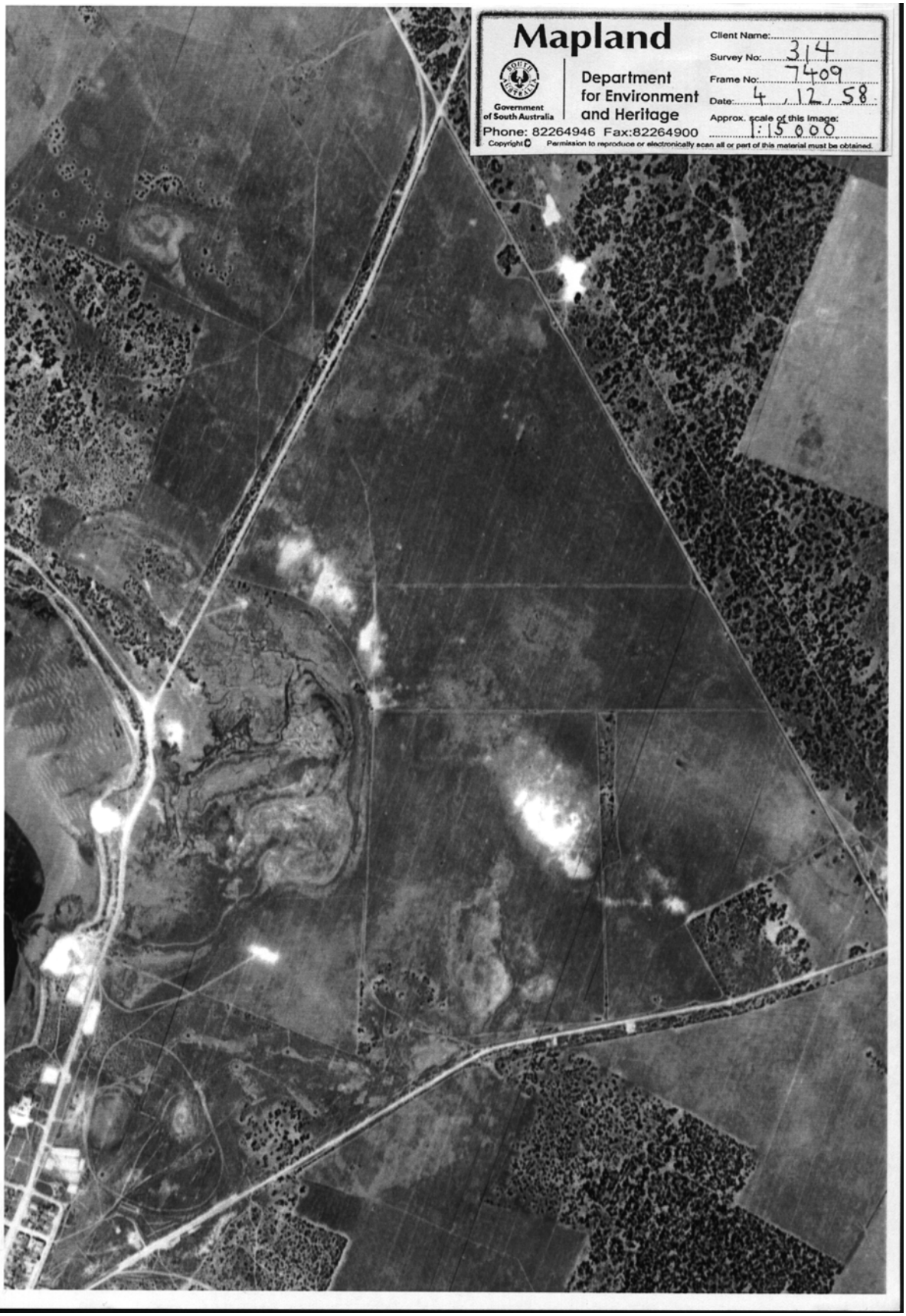
0 2km

Zone Boundary

Development Plan Boundary

CEDUNA (DC)
ZONES
MAP Ced/10

Consolidated - 21 August 2003


Mapland
Government of South Australia
Department for Environment and Heritage
Phone: 82264946 Fax:82264900
Client Name:
Survey No: 314
Frame No: 7409
Date: 4 , 12 , 58
Approx. scale of this image: 1:15 000
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Mapland

Government of South Australia

Department for Environment and Heritage

Phone: 82264946 Fax:82264900

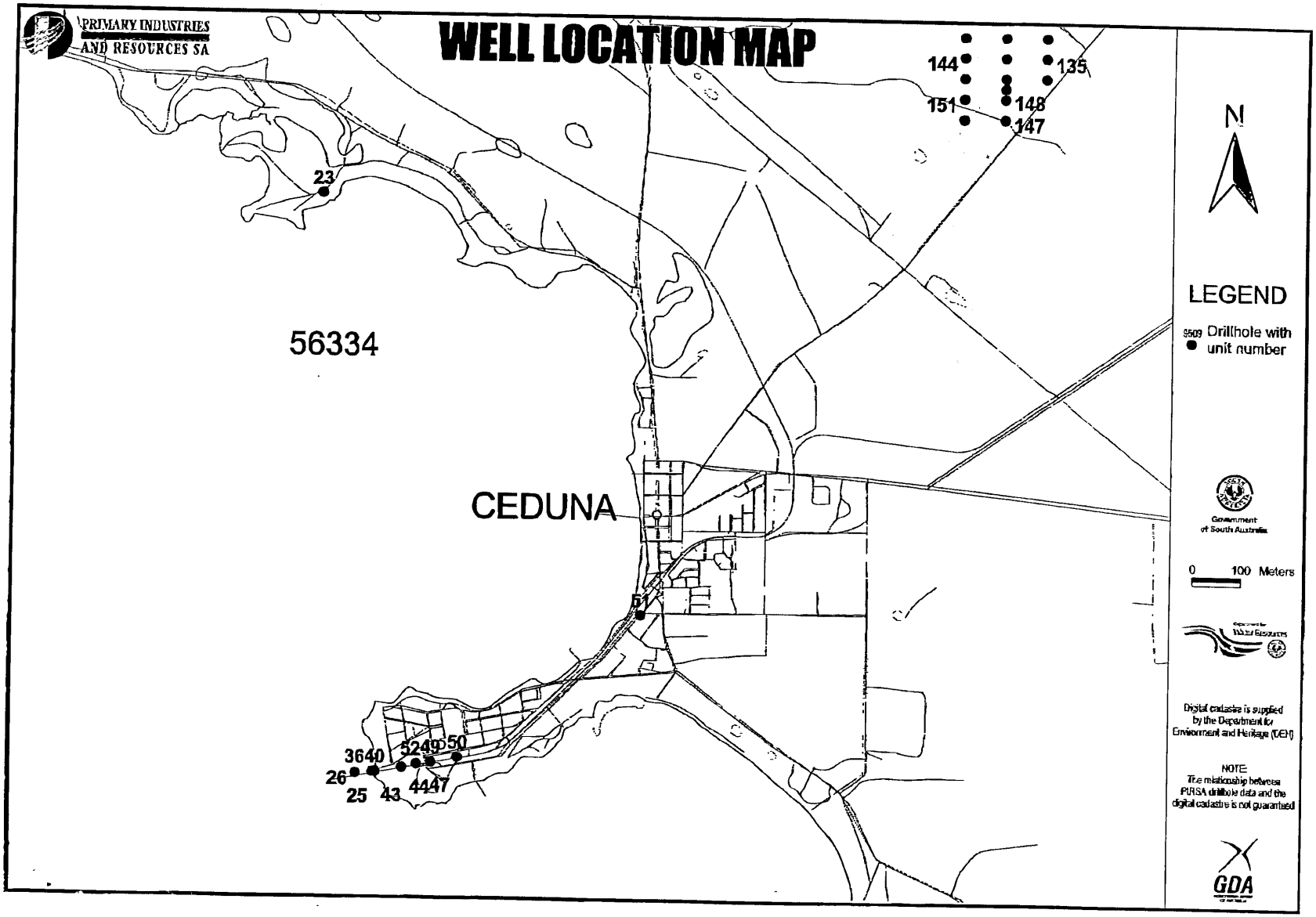
Client Name:

Survey No: 2562

Frame No: 38

Date: 29 / 4 / 80

Approx. scale of this image: 1:10 000


PRIMARY INDUSTRIES AND RESOURCES SA
WELL LOCATION MAP
144
135
151
148
147
23
56334
CEDUNA
51
36
40
52
49
50
26
25
43
44
47
N
LEGEND
$509 Drillhole with unit number
Government of South Australia
0 100 Meters
Digital cadastre is supplied by the Department for Environment and Heritage (DEH)
NOTE
The relationship between PIRSA drillhole data and the digital cadastre is not guaranteed
GDA

The Department of Water, Land and Biodiversity Conservation

Summary of Latest Water Information for Drillholes

PRIMARY INDUSTRIES AND RESOURCES SA

Unit No	Classification	Max Drilled Depth (m)	Orig Drill Date	Current Depth (m)	Current Depth Date	Cased To (m)	Standing Water Level (m)	Standing Water Level Date	Well Yield (Gal/hr)	Well Yield Date	Salinity EC	Salinity TDS (mg/L)	Salinity Date	pH	Location Hundred	Location Parcel	Permit No	Logs Chem Anal	Logs Drillers	Logs Geol	Logs Geophys	Status	Status Date
6533 32	Mineral	60.96	11/58	60.96	11/58		5.79	11/58			7885	4455	11/58		Cudla Mudla	S 48		●				Unknown	11/58
6533 35	Mineral	60.96	07/58	60.96	07/58		10.67	07/58			11185	6397	07/58		Cudla Mudla	S 53		●				Unknown	07/58
6533 36	Mineral	60.96	07/58	60.96	07/58		7.62	07/58			7885	4455	07/58		Cudla Mudla	S 53		●				Unknown	07/58
6533 37	Mineral	60.96	07/58	60.96	07/58						7885	4455	07/58		Cudla Mudla	S 53						Unknown	07/58
6533 38	Mineral	60.96	08/58	60.96	08/58		7.01	08/58			7885	4455	08/58		Cudla Mudla	S 53		●				Unknown	08/58
6533 39	Mineral	60.96	08/58	60.96	08/58		5.96	08/58			7885	4455	08/58		Cudla Mudla	S 53		●				Unknown	08/58
6533 40	Mineral	60.96	10/58	60.96	10/58		5.64	10/58			7885	4455	10/58		Cudla Mudla	S 53		●				Unknown	10/58
6533 41	Mineral	60.96	11/58	60.96	11/58		5.79	11/58			7885	4455	11/58		Cudla Mudla	S 53		●				Unknown	11/58
6533 42	Mineral	68.58	12/58	68.58	12/58		21.34	12/58			15202	8825	12/58		Cudla Mudla	S 53						Unknown	12/58
6533 43	Water Well	17.07	07/58	17.07	07/58	11.68	4.27	07/58	499	07/58	14514	8410	07/58		Cudla Mudla	S 54		●		●			
6533 45	Mineral	54.86	02/58	54.86	02/58		4.27	02/58			16175	9425	01/58		Cudla Mudla	S 54						Unknown	02/58
6533 46	Mineral	349.91	06/58		08/58						16175	9425	08/58		Cudla Mudla	S 54						Unknown	08/58
6533 51	Mineral	60.96	09/58	60.96	09/58		5.18	09/58			7885	4455	09/58		Cudla Mudla			●				Unknown	09/58
6533 52	Mineral	60.96	10/58	60.96	10/58		39.62	10/58			7885	4455	10/58		Cudla Mudla			●				Unknown	10/58
6533 54	Mineral	60.96	12/58	60.96	12/58		7.01	12/58			4882	2727	12/58		Cudla Mudla	S 54		●				Unknown	12/58
6533 55	Mineral	60.96	02/59	60.96	02/59		9.14	02/59							Cudla Mudla	S 54						Unknown	02/59

The Department of Water, Land and Biodiversity Conservation

Summary of Latest Water Information for Drillholes

PRIMARY INDUSTRIES AND RESOURCES SA

Unit No	Classification	Max Drilled Depth (m)	Orig Drill Date	Current Depth (m)	Current Depth Date	Cased To (m)	Standing Water Level (m)	Standing Water Level Date	Well Yield (Gal/hi)	Well Yield Date	Salinity EC	Salinity TDS (mg/L)	Salinity Date	pH	Location Hundred	Location Parcel	Permit No	Chem Anal	Logs Drillers	Logs Geol	Logs Geophys	Status	Status Date
5633 23	Water Well	1.83		1.83	11/46						80151	56106	11/46		Bonython	S 197		•				Unknown	11/46

ATTN:- RADOVAN.

82232690.

Date 09/06/2004 01:39 PM
Printed By Daniels E
Phone 08 8463 3000 Fax 08 8463 6518

EPA
South Australia

Environment Protection Authority

GPO Box 2607
Adelaide
SA 5001

77 Grenfell Street
Adelaide SA

www.epa.sa.gov.au

Telephone
(08) 8204 2000

1800 623 445
(country areas)

Facsimile
(08) 8204 2020

Dare Sutton Clarke
P.O.Box 7048
ADELAIDE SA 5000

Contact: Lorraine Armstrong
Telephone (08) 8204 2179
Contact: Rosslyn Farquharson
Telephone (08) 8204 1112
Fax (08) 8204 2338

07 June, 2004

Dear Sir/Madam,

Section 7 - Land and Business (Sale and Conveyancing) Act 1994

I refer to your enquiry concerning the parcel of land comprised in

Title Reference **CT Volume 5830 Folio 638**

Address Allotment 20, Eyre Highway, CEDUNA SA 5690

I advise as follows:

PARTICULARS OF MORTGAGES, CHARGES & PRESCRIBED ENCUMBRANCES AFFECTING THE LAND

53.	Environment performance agreement under section 59 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
54.	Environment protection order issued under section 93 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
55.	Clean-up order issued under section 99 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
56.	Clean-up authorisation issued under section 100 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO

EPA
South Australia

PARTICULARS RELATING TO ENVIRONMENT PROTECTION
Section 7 - Land and Business (Sale and Conveyancing) Act 1994
The answers to the following questions are shown:

Environment Protection Authority

GPO Box 2607
Adelaide
SA 5001

77 Grenfell Street
Adelaide SA

www.epa.sa.gov.au

Telephone
(08) 8204 2000

1800 623 445
(country areas)

Facsimile
(08) 8204 2020

Environmental assessments

2. (3) Does the Environment Protection Authority hold a copy of a report on any environmental assessment of the land or a part of the land carried out at any time -
   (*a*) by or on behalf of the owner or occupier of the land -
      (i) pursuant to an authorisation, agreement or order under section 52(1)(*b*), 59, 93, 99, or 100 of the *Environment Protection Act 1993*;
      or
      (ii) for the purposes of a notification given under section 83 of that Act;
      or
   (*b*) by the Environment Protection Authority (whether alone or jointly with another authority);
      or
   (*c*) by a Contaminated Site Auditor recognised by the Environment Protection Authority for the purposes of carrying out such an assessment? NO

Waste depots

3. (1) Was a licence to operate a waste depot on the land ever issued under the repealed *South Australian Waste Management Commission Act 1979*, a record of which is on the Public Register? NO

   (2) Was a licence to operate a waste depot on the land ever issued under the repealed *Waste Management Act 1987*, a record of which is on the Public Register? NO

   (3) Is an environmental authorisation currently in force under the *Environment Protection Act 1993* in the form of a licence to operate a waste depot on the land, a record of which is on the Public Register? NO

   (4) Was an environmental authorisation ever issued under the *Environment Protection Act 1993* in the form of a licence to operate a waste depot on the land, being a licence that is no longer in force and a record of which is on the Public Register? NO

Production of certain waste

4. (1) Was a licence under the repealed *South Australian Waste Management Commission Act 1979* ever issued for the production of waste of a prescribed kind (within the meaning of that Act) on the land, a record of which is on the Public Register? NO

   (2) Was a licence under the repealed *Waste Management Act 1987* ever issued for the production of prescribed waste (within the meaning of that Act) on the land, a record of which is on the Public Register? NO

Part of the Environment and Conservation portfolio

Government of South Australia

4. (3)	Is an environmental authorisation currently in force under the *Environment Protection Act 1993* in the form of a licence to carry out an activity that produces listed waste (within the meaning of that Act) on the land, a record of which is on the Public Register?	NO
(4)	Was an environmental authorisation ever issued under the *Environment Protection Act 1993* in the form of a licence to carry out an activity that produces listed waste (within the meaning of that Act) on the land, being a licence that is no longer in force and a record of which is on the Public Register?	NO

Waste on land

5.	Did the former Waste Management Commission under the repealed *Waste Management Act 1987* have any record of waste (within the meaning of that Act) being deposited on the land between 1 January 1983 and 30 April 1995, details of which are on the Public Register?	NO

All care and diligence has been taken to access the above information from available records. Historical records provided to the EPA concerning matters arising prior to 1 May 1995 are limited and may not be accurate or complete and therefore the EPA cannot confirm the accuracy of the historical information provided.

Delegate for
ENVIRONMENT PROTECTION AUTHORITY

EPA
South Australia

Environment Protection Authority

GPO Box 2607
Adelaide
SA 5001

77 Grenfell Street
Adelaide SA

www.epa.sa.gov.au

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1800 623 445
(country areas)

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Contact: Lorraine Armstrong
Telephone (08) 8204 2179
Contact: Rosslyn Farquharson
Telephone (08) 8204 1112
Fax (08) 8204 2338

07 June, 2004

Dear Sir/Madam,

Section 7 - Land and Business (Sale and Conveyancing) Act 1994

I refer to your enquiry concerning the parcel of land comprised in

Title Reference **CT Volume 5906 Folio 567**

Address Allotment 22, Denial Bay road, CEDUNDA SA 5690

I advise as follows:

PARTICULARS OF MORTGAGES, CHARGES & PRESCRIBED ENCUMBRANCES AFFECTING THE LAND

53.	Environment performance agreement under section 59 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
54.	Environment protection order issued under section 93 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
55.	Clean-up order issued under section 99 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO
56.	Clean-up authorisation issued under section 100 of the *Environment Protection Act 1993* that is registered in relation to the land.	NO

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Government of South Australia

EPA
South Australia

PARTICULARS RELATING TO ENVIRONMENT PROTECTION

Section 7 - Land and Business (Sale and Conveyancing) Act 1994
The answers to the following questions are shown:

Environment Protection Authority

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www.epa.sa.gov.au

Telephone
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1800 623 445
(country areas)

Facsimile
(08) 8204 2020

Environmental assessments

2. (3) Does the Environment Protection Authority hold a copy of a report on any environmental assessment of the land or a part of the land carried out at any time -
   (*a*) by or on behalf of the owner or occupier of the land -
      (i) pursuant to an authorisation, agreement or order under section 52(1)(*b*), 59, 93, 99, or 100 of the *Environment Protection Act 1993*;
      or
      (ii) for the purposes of a notification given under section 83 of that Act;
      or
   (*b*) by the Environment Protection Authority (whether alone or jointly with another authority);
      or
   (*c*) by a Contaminated Site Auditor recognised by the Environment Protection Authority for the purposes of carrying out such an assessment? NO

Waste depots

3. (1) Was a licence to operate a waste depot on the land ever issued under the repealed *South Australian Waste Management Commission Act 1979,* a record of which is on the Public Register? NO

   (2) Was a licence to operate a waste depot on the land ever issued under the repealed *Waste Management Act 1987*, a record of which is on the Public Register? NO

   (3) Is an environmental authorisation currently in force under the *Environment Protection Act 1993* in the form of a licence to operate a waste depot on the land, a record of which is on the Public Register? NO

   (4) Was an environmental authorisation ever issued under the *Environment Protection Act 1993* in the form of a licence to operate a waste depot on the land, being a licence that is no longer in force and a record of which is on the Public Register? NO

Production of certain waste

4. (1) Was a licence under the repealed *South Australian Waste Management Commission Act 1979* ever issued for the production of waste of a prescribed kind (within the meaning of that Act) on the land, a record of which is on the Public Register? NO

   (2) Was a licence under the repealed *Waste Management Act 1987* ever issued for the production of prescribed waste (within the meaning of that Act) on the land, a record of which is on the Public Register? NO

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Government of South Australia

4. (3)	Is an environmental authorisation currently in force under the *Environment Protection Act 1993* in the form of a licence to carry out an activity that produces listed waste (within the meaning of that Act) on the land, a record of which is on the Public Register?	NO	
(4)	Was an environmental authorisation ever issued under the *Environment Protection Act 1993* in the form of a licence to carry out an activity that produces listed waste (within the meaning of that Act) on the land, being a licence that is no longer in force and a record of which is on the Public Register?	NO	

Waste on land

5.	Did the former Waste Management Commission under the repealed *Waste Management Act 1987* have any record of waste (within the meaning of that Act) being deposited on the land between 1 January 1983 and 30 April 1995, details of which are on the Public Register?	NO

All care and diligence has been taken to access the above information from available records. Historical records provided to the EPA concerning matters arising prior to 1 May 1995 are limited and may not be accurate or complete and therefore the EPA cannot confirm the accuracy of the historical information provided.

Delegate for
ENVIRONMENT PROTECTION AUTHORITY

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South Australia

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(country areas)

Facsimile
(08) 8204 2020

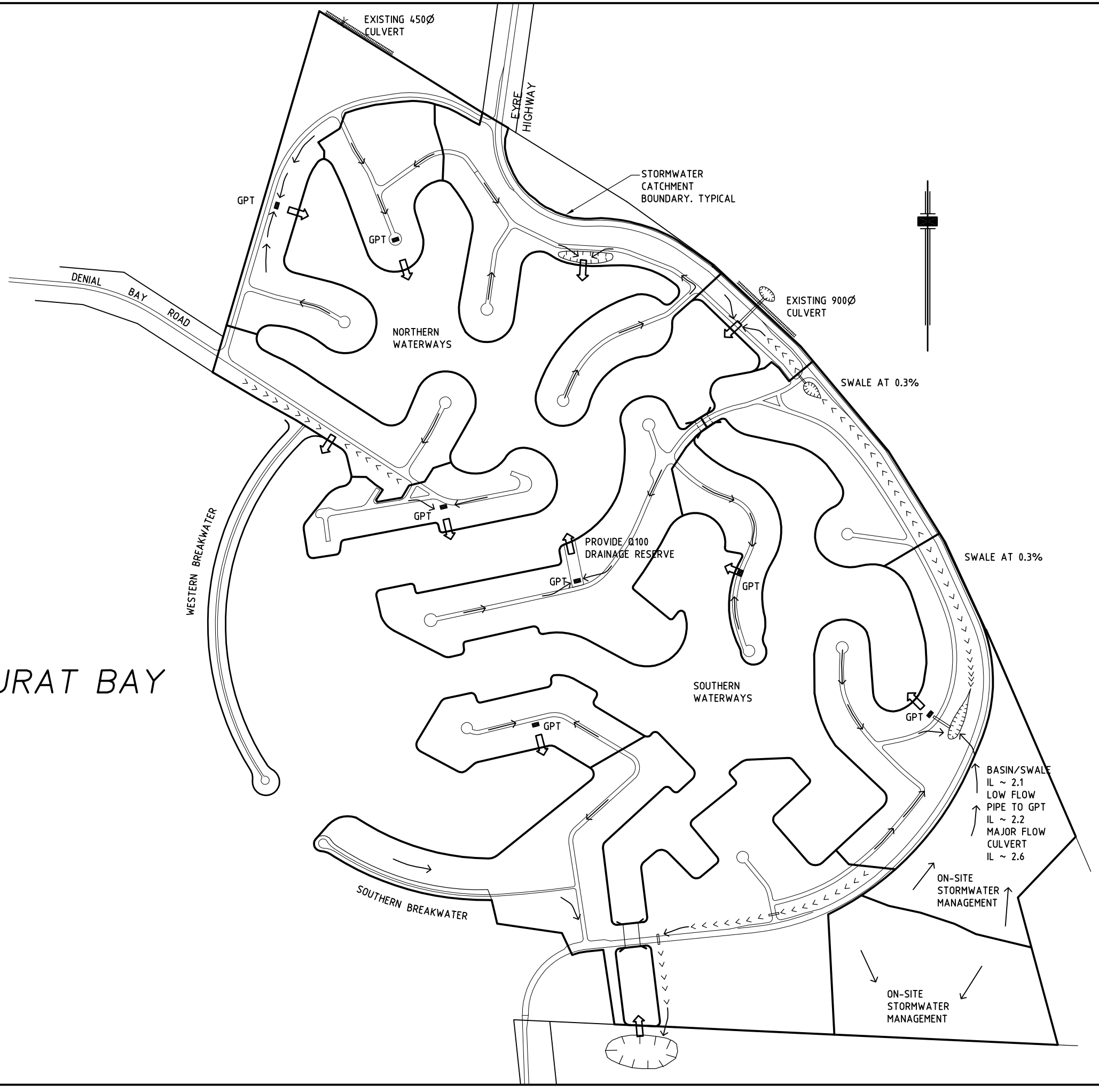
APPENDIX D

STORMWATER CATCHMENT PLAN (CONCEPT)

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers



MURAT BAY

AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

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Milton. QUEENSLAND. 4064
Ph (07) 3367 3023 Fax (07) 3367 3804
Email dsc@dscgroup.net Website www.dscgroup.net

PROJECT
CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT
CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE
STORMWATER CATCHMENT PLAN CONCEPT

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WNC

DATE JULY 2004
SCALE NTS

DRAWING NUMBER 100026-CA01
ISSUE A

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Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

APPENDIX E

CONSTRUCTION SEQUENCING

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE A CONSTRUCTION ITEMS

- COMMENCE EYRE HIGHWAY DIVERSION INCLUDING WATER MAIN, SEWER MAIN AND ARCH CULVERT TO FUTURE LAND DIVISION
- CONSTRUCT WESTERN AND SOUTHERN BREAKWATERS INCLUDING TEMPORARY BUND
- INSTALL DEWATERING PUMP(S) AND SETTLEMENT PONDS
- EXCAVATE SOUTHERN WATERWAYS EAST OF EYRE HIGHWAY
- FILL ADJACENT LOW LYING LAND AND BUILD NOISE MOUNDS
- STOCKPILE EXCESS EXCAVATED MATERIAL OFFSITE

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PROJECT

CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT

CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE

CONSTRUCTION STAGING
STAGE A

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WNC

DATE JULY 2004

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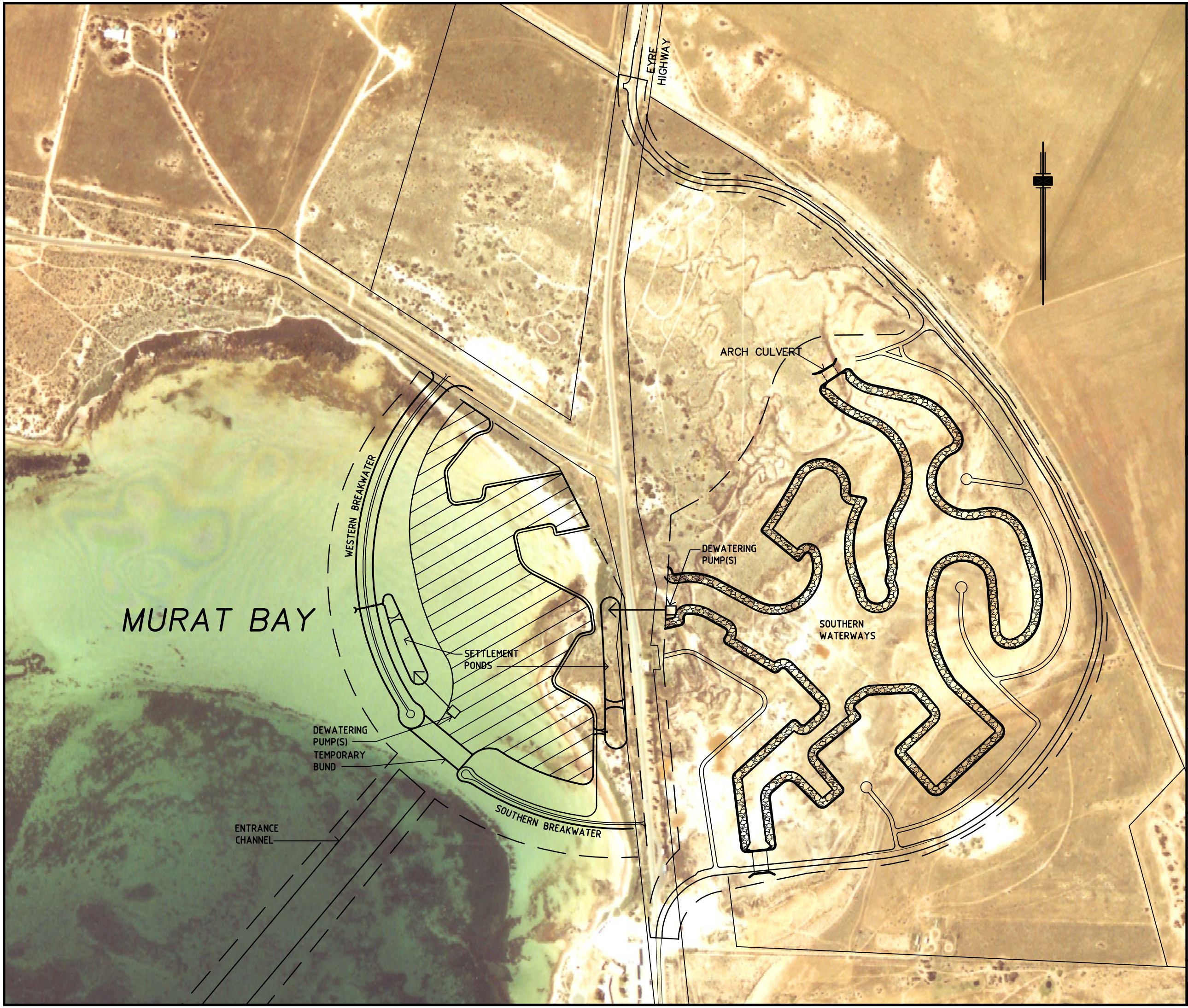

AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE B CONSTRUCTION ITEMS

- INSTALL RIP RAP AND CONCRETE EDGE BEAM TO SOUTHERN WATERWAY BATTERS
- INSTALL CULVERT TO CONNECT TO FUTURE NORTHERN WATERWAYS
- CONSTRUCT STAGES 1, 2 AND 3 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)
- INSTALL SETTLEMENT PONDS AND DEWATER ENCLOSED AREA WEST OF EYRE HIGHWAY
- EXCAVATE WATERWAYS WEST OF EYRE HIGHWAY AND FILL LOW LYING AREAS
- CONNECT DIVERSION ROAD TO EYRE HIGHWAY AND REDIRECT ALL TRAFFIC ALONG THE NEW DIVERSION ROAD
- RE-ROUTE THE OVERHEAD POWER LINES ALONG EYRE HIGHWAY
- COMMENCE CONSTRUCTION OF THE ENTRANCE CHANNEL

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PROJECT

CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT

CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE

CONSTRUCTION STAGING
STAGE B

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WNC

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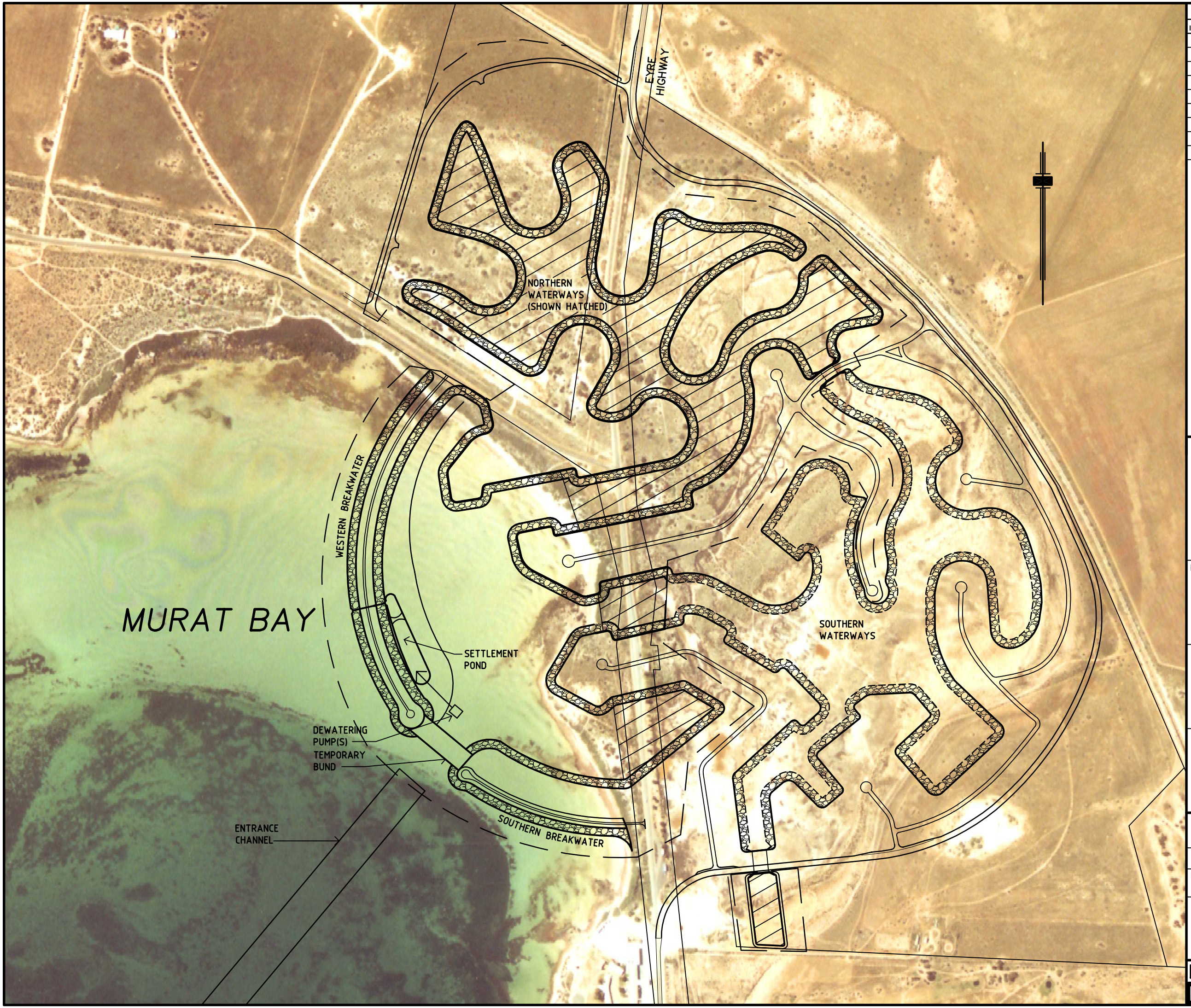

AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE C CONSTRUCTION ITEMS

- COMPLETE THE SOUTHERN WATERWAY EXCAVATION, INSTALL RIP RAP AND CONCRETE EDGE BEAM
- CONSTRUCT DENIAL BAY ROAD DIVERSION INCLUDING SERVICES TO STAGES 8 AND 9 ALLOTMENTS
- EXCAVATE NORTHERN WATERWAYS, FILL LOW LYING AREAS & REMOVE EXCESS CUT MATERIAL TO STOCKPILE
- CONSTRUCT STAGES 4 AND 5 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)
- INSTALL RIP RAP AND CONCRETE EDGE BEAM TO NORTHERN WATERWAY BATTERS

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PROJECT

CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT

CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE

CONSTRUCTION STAGING
STAGE C

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WNC

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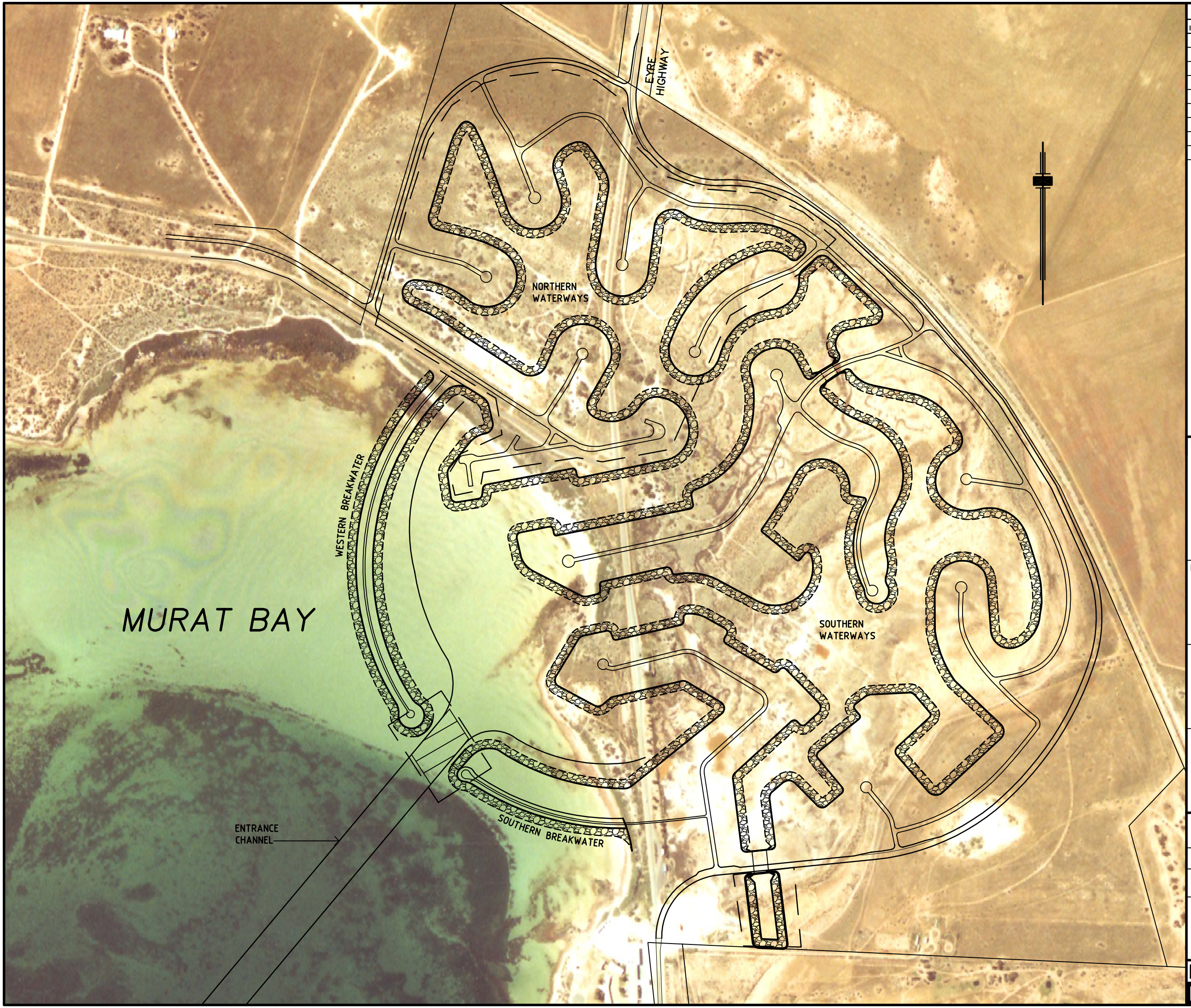

AMENDMENTS

ISSUE	REMARKS	DATE	BY
A	EIS SUBMISSION	5.8.04	JAF

STAGE D CONSTRUCTION ITEMS

- CEASE DEWATERING, REMOVE PONDS AND FLOOD THE WATERWAYS WITH SEAWATER
- REMOVE THE TEMPORARY BUND BETWEEN THE WESTERN AND SOUTHERN BREAKWATERS
- COMPLETE THE ENTRANCE CHANNEL AND THE BREAKWATER ARMOUR WORKS
- CONSTRUCT STAGES 6 TO 11 LAND DIVISION INFRASTRUCTURE WORKS (ROADS AND SERVICES)

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PROJECT

CEDUNA KEYS MARINA
CEDUNA, SOUTH AUSTRALIA

CLIENT

CEDUNA MARINA DEVELOPMENT CO.

DRAWING TITLE

CONSTRUCTION STAGING
STAGE D

DRAFTER	ENGINEER/ DESIGNER	PROJECT MANAGER	CIVIL/STRUCT MANAGER
JAF	BA	BA	WNC

DATE: JULY 2004
SCALE: NTS

DRAWING NUMBER: 100026-ST04
ISSUE: A

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CEDUNA KEYS

Addendum to
Environmental Impact Statement

ENVIRONMENTAL ASSESSMENT

Eco Management Services Pty Ltd
2004

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

CEDUNA KEYS

ADDENDUM TO ENVIRONMENTAL IMPACT STATEMENT

ENVIRONMENTAL ASSESSMENT

prepared by

Eco Management Services Pty Ltd

in association with

ID&A Pty Ltd
Vivienne Wood

Job Ref: 381/04
August 2004

PO BOX 379 BLACKWOOD SA 5051

TEL: 8270 3066 FAX: 8270 3706 EMAIL: pfmems@senet.com.au

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SUMMARY

The Ceduna Keys Marina is a residential/marina/tourist project, located immediately north of Ceduna on the Eyre Peninsula.

This Environmental Assessment is an Addendum to the Ceduna Keys Environmental Impact Assessment. It was originally prepared for the District Council of Ceduna. It summarises the findings of the site survey and general investigations undertaken to examine marine and terrestrial biological environmental issues, Aboriginal Heritage and water quality issues in the marina and recreational lake. These site investigations were undertaken in 2000.

The results of the investigation are summarised below in relation to the study objectives.

Objective

To describe the subtidal and intertidal marine communities that would be directly affected by the proposed development, i.e. within the site and those in the immediate vicinity, in order to define the habitat type, delineate them and place them in regional perspective.

The marina breakwaters will extend approximately 320 m out from the beach into Murat Bay, and the total area directly affected is approximately 0.25 Km^2. A survey of the subtidal and intertidal communities has been undertaken, as indicated above, and the area surveyed extended approximately 2.5 Km out from the beach. The area that would be directly affected by the marina is predominantly sandy beach and rocky intertidal community. The extensive sandy beach is exposed at low tide. A small area (approximately 0.15 Km^2) is subtidal. The results of the survey are summarised below.

Subtidal Communities

Offshore of the marina in the deeper waters there are four main habitat types, *Zostera* sp. Beds (seagrass), *Posidonia* sp. Beds (seagrass), *Posidonia* sp./*Sargassum* sp. Beds (seagrass/algal community) and large mostly bare sandy areas. These habitats are widespread in the Bay and in the region. Previous regional studies have not identified any significant biological features in the study area. This was confirmed in the current survey. Some taxa species of interest, but which do not have a conservation status, were found in the survey, but were well removed from the marina site and outside the likely area that would be affected by the construction of the marina.

The construction of the marina will result in the loss of some of the existing marine habitat. However, as found elsewhere, it is expected that a relatively diverse marine community will establish in the marina basin and recreational lake.

The proposed development is very similar to the existing Lincoln Cove Marina, Port Lincoln. Surveys undertaken of the marine community after construction indicated that the effects were localised, and immediately adjacent to the breakwater and channel. It is anticipated that this will also be the case at Ceduna.

During the survey, an abundance of epiphyte algae was observed in the subtidal and intertidal areas. This was suggestive of nutrient enrichment. However, there is no effluent discharge to the bay, although at a number of points stormwater runoff enters the bay. It is

understood however, that Council is examining ways to capture and reuse some of this runoff, or treating it in retention basins. The growth may also have been transitory, caused by storm-induced resuspension of nutrient rich sediments into the water column. The presence of large quantities of plant debris could be an important design and management issue for the marina.

Intertidal

The intertidal zone is characterised by rocky headlands with large sandy beach in between. In the Bay there are small areas of mangroves, with approximately 120 larger trees and 500 smaller seedlings. Associated with the mangroves and rocky headlands are patches of samphire. In the shallows, there are also patches of the seagrasses, *Posidonia* sp., *Zostera* sp. and *Heterozostera*.

A diverse assemblage of fauna and flora were observed in these habitats, all of which are common along the coast.

Fossilised wood occurred on one rocky outcrop, to the south and outside of the area of the development.

The construction of the marina will result in the loss of some of these habitat areas, including approximately 20-30% of the mangroves. However, in view of their small area on the site, and the extent to which they occur regionally, this is not seen as a major issue. The marina structure will have breakwaters and rock walls. As observed to be occurring at Lincoln Cove, it is anticipated that these will also develop a diverse fauna and flora.

Objective

To describe the terrestrial fauna and flora habitat on the proposed site, their condition, and by placing them in regional perspective define their ecological or conservation significance.

A botanical survey has been undertaken of the proposed development site and adjacent areas. Vegetation associations/habitats have been defined and species present recorded. Their value as faunal habitat on fauna surveys undertaken or sightings in the area, and/or region has also been reviewed.

Patches of remnant, original vegetation remain around Murat and Denial Bays. However, little of the remnant vegetation remains at the development site. What remains consists of coastal vegetation (salt bush/bluebush shrublands, coastal dune shrubland, samphire flats) and small areas of coastal woodland (mallee woodland, tall shrubland on terrestrial dunes). Most of the native vegetation present is recent, due to re-colonisation after considerable past disturbances. It is still in a state of transition and new species are recolonising as evident by the fact that only juvenile plants are present for most of the species.

The proposed development will involve the removal of part of the small areas of mallee woodland, the tall shrubland on the terrestrial dunes. These associations are widespread in the region.

The samphire flats and low saltbush/bluebush (*Atriplex/Mareana spp.*) will also be removed by development and altered by the reintroduction of tidal flows.

Overall, the development will not impact on any significant areas, or any areas on which any fauna species are dependent for survival in this region.

Importantly, the dune shrubland immediately north of the Ceduna township and, as indicated above, the area where fossilised wood occurs, will not be effected.

Three species of flora were found which have a conservation status (rare or uncommon) for the Eyre Peninsula region. They are not vulnerable or endangered. Few individuals were found and none were mature. One, the Western coastal wattle, is not found in the Ceduna Environment Association and is considered introduced. The other two, the Cotton bush and Trailing hemichroa would easily be propagated and used in landscaping. They are likely colonisers from adjacent scrub, and their removal is not seen as a significant issue.

Objective

To undertake an archaeological survey of the site, documenting known sites of Aboriginal significance in the area in consultation with Aboriginal communities.

A pedestrian survey of the site has been undertaken, accompanied by representatives of the Aboriginal community. Available records for the area have also been reviewed. No sites were located within the development area. Known sites were located outside the development area and need not be affected. Cultural material in the form of two middens were located, but outside the area of development.

Objective

To review water quality issues for the marina basin and inland recreational lake.

Water quality in the Ceduna Keys marina needs to be good in order to:

- facilitate the development and maintenance of a diverse and healthy marine aquatic fauna and flora;
- be suitable for contact recreation; and
- have an attractive appearance, and be relatively free of nuisance algal growths.

Ensuring the above essentially involves:

- The provision of adequate water circulation and regular exchange with marine waters. The residence time will be between 3-5 days. This is more than adequate.

- By design and management, controlling (eliminating) potential sources of contamination.

  The major potential source of contamination is effluent from the development and boats. This will be taken to a new wastewater treatment plant and reclaimed water irrigated. Other potential sources have been identified and appropriate management strategies will be put in place, including fuelling and fuel storage. Of the total stormwater runoff, only 20% will be diverted without treatment, except through GPTC, to the marina. Because of this relatively small volume, the size of the marina

waterways, and short residence time in the system, its effect will be localised and transitory, and should not effect the overall utility of the lake or the aquatic community.

The indications are that the waters of Murat Bay are of good quality, although as referred to earlier, there was an abundance of epiphyte algae during the survey. There is minimal risk of any impact by the development on the water quality of Murat Bay.

CEDUNA KEYS DEVELOPMENT

1.0 INTRODUCTION

The proposed Ceduna Keys and the Ceduna Coastal Centre is a residential/marina/tourist project, located north and immediately adjacent to Ceduna on the Eyre Peninsula.

The project is an initiative of the District Council of Ceduna and is being directed by the Council, the Aboriginal community, the Ceduna Business & Tourist Association and a major resort project developer.

This preliminary environmental assessment of the proposed Ceduna Keys and the Ceduna Coastal Centre has been prepared for the District Council of Ceduna, in consultation with the Project Manager, D Kelsey. It summarises the findings to date of the site survey and general investigations undertaken to examine the marine and terrestrial biological environmental issues and Aboriginal Heritage. In addition issues in relation to waterway tidal exchange are discussed.

2.0 LOCATION

The project site is located north of Ceduna, on Murat Bay, and is shown on Figure 1. Figure 1 also shows the physical layout of the proposed development, which is described in detail in the Ceduna Keys Development Application.

Ceduna, located approximately 800Km to the north west of Adelaide, is the largest regional centre on what is known as the west coast, that is, the western side of Eyre Peninsula, South Australia.

3.0 SCOPE AND OBJECTIVES OF THE PRELIMINARY ENVIRONMENTAL INVESTIGATIONS

In accordance with the study requirements, this preliminary study addresses:

(a) Describing the subtidal and intertidal marine communities that would be directly affected by the proposed development, i.e. within the site, and those in the immediate vicinity.

The object is to delineate and define the various habitats, their condition and place them in regional perspective. This study does not examine all individual plants and animals to species level, but gives an overview of the general community types that are currently present and defines their boundaries. This study therefore establishes a baseline with which future studies can be compared and so assess any impact the marina may have on the environment.

Figure 1


Ceduna Keys
www.cedunakeys.com.au
Murat Bay
Ceduna
DSC ANDREW
SURVEYORS

(b) Describing the terrestrial fauna and flora habitat on the proposed development site.

Similarly to the marine environment, the objective is to define the habitats on site, their condition and, by placing them in regional perspective, define their ecological or conservation significance.

(c) Undertaking an archaeological survey of the site, documenting known sites of Aboriginal significance in the area in consultation with Aboriginal communities.

(d) Review water quality issues for the inland waterways.

The object is to examine the water quality status of the marina waterways, and the proposed stormwater, wastewater and infrastructure management measures required to protect water quality. In addition, the need to manage ballast water is also identified.

(e) Identify the potential effects of construction.

Without adequate safeguards, the construction of the marina and breakwaters could have significant impacts on the adjacent marine environment. The effects of construction are, to a considerable degree, dependent on the method of construction. As this is still to be determined, this issue can only be discussed in general terms at this stage.

As the design is further developed, particularly with the extent and location of breakwaters, the potential effects on sand movement will be separately addressed.

4.0 MARINE ENVIRONMENT

4.1 The Marine System

The particular area examined is the marine environment of Murat Bay, directly north of the Ceduna township. The proposed site of the marina extends out 320 m from the beach, but the study site was extended out to 2.5km to accommodate a buffer zone for any potential impacts.

The proposed marina and breakwater will potentially cover approximately 0.25 km^2 of marine and coastal environment. The area is predominately sandy beach and rocky intertidal community.

The region along the southern coast of Australia is known as the Flindersian Province, which extends from south-west Western Australia to southern New South Wales and is characterised by warm to cool temperate waters (Edyvane, 1999).

Murat Bay is a shallow bay, with depths in the region of the proposed marina being particularly shallow, the deepest area reaching three metres at high tide. The study area is typified by large tidal fluctuations, which diurnally cover and expose the intertidal communities. Fluctuations reach up to two metres and this tidal change exposes most of the proposed marina site at low tide.

Few previous studies of the marine system in this area have been undertaken. An assessment of the marine environment in South Australia was carried out by Edyvane (1999). This study classified the Murat Bay area as being within the "Streaky" biounit. Features typical of this biounit area sheltered bays with rocky headlands interspersed by sandy beaches. Samphire and mangrove habitats line the shore and limestone reefs are common.

There have been no areas identified as having significant biological value in the study area, or in close proximity to the proposed marina. The closest region considered to have significant environmental value is Tourville Bay (Davenport Creek), which has been identified as a wetland of national importance (Edyvane 1999).

The township of Ceduna is directly south of the study site and consequently there are many associated human uses of the area. The beach is used by many people for recreation such as walking and bathing in warmer weather. Fishing is also popular in this area and boats commonly come close in shore to fish. Evidence of people having harvested oysters from the intertidal area is also present. Pacific Oysters, a non-native species are farmed in Murat Bay, at the town of Denial Bay, 10km west of Ceduna.

Rubbish and waste are left by people and items on the shore from fishers and people using the coast are common. As the study site is close to the township, any ocean discharges such as stormwater could also influence the biota at the study site. No effluent outfalls currently discharge into the area (Ceduna Council, pers. comm.).

4.2 Field Survey Methodology

The field survey consisted of two main components

- diving to delineate and describe the various subtidal marine communities, and
- map the extent and type of intertidal communities by walking along the zone at low tide

4.2.1 Subtidal Survey

The aim of this procedure was to examine all habitat sites in the region, gaining representative records that accurately reflect all habitat types. The goal was also to map the extent of these habitat types within the study area. Survey sites were initially determined from an aerial photo, then reviewed and varied as necessary upon finding additional information on site when viewing the area and also with the assistance of local knowledge.

When a site was found, the coordinates were entered into a Trimble Pro-XRS GPS. This GPS enabled the survey party to locate themselves to within 1.5 metres accuracy ensuring that the dive site and the survey sample site on the GIS was as close a match as possible.

A total of 15 dives took place over three days, from 6th to the 8th April. Weather was predominately fine, ranging from 17 to 22^{o}C. Seas were calm to slight (10-15 knots), and wind direction was predominately from the south-east. The survey had been immediately preceded by stormy weather. Consequently visibility was poor due to a combination of the disturbance of the silty substrate and a high abundance of dislodged epiphytic algae in the water. Friday, April 7, was a particularly fine calm day which allowed a scan to be made of

the whole area at low tide from the boat, by passing back and forth along the length of the coast in the study site several times. This provided the opportunity to gain additional information with which to assess the location of habitat types.

The divers recorded the following information about each site:

- weather conditions and underwater visibility;
- comments on overall condition/appearance of the area;
- sediment type;
- depth;
- taxa present to phyla, or class level only (fauna and flora);
- their dominance, using a scale: 1 (rare) to 5 (continuous);

In addition to this, a pictorial record was also taken, which consisted of still camera images. At each site a 50x50cm quadrat was laid down at three areas around the point where the anchor was sited. Two photos were taken of each quadrat. The first photo had information on the site and quadrat number (eg 1.2, site 1 quadrat 2), the second photo was taken without this information, so the whole quadrat could be viewed. In addition, at each site photos were taken at the four compass points from the point where the anchor was, to gain an overall view of the area.

Plate 1 Diver carrying out the marine survey

4.2.2 Intertidal Zone Survey

The entire intertidal zone along the length of the study area was surveyed. The total length surveyed was 3.8 km. This region was examined by walking along the intertidal zone at low tide to map the extent and type of communities present. The intertidal survey was carried out on the 5th of April when diving was prohibited by rough weather and additional information was also collected on the 9th of April after the diving survey was complete. Conditions on the 5th of April were 17^{o}C and overcast, with gusty winds.

Information mapped included the substrate types, plant and animals communities and their dominant phyla. Structures built by people were also noted. Information was recorded in the field on A3 aerial photos produced by the GIS and later digitised.

4.3 Description of Marine Communities

4.3.1 Subtidal Communities

Table 1 contains a summary of the findings in the marine survey. For full details of the findings in the survey see Appendix 1. The information gained in the marine survey has also been transposed onto a map of the area in Figure 2. Habitats were defined and their areas summarised in Figure 3.

There were four main habitat types in the study area; sandy bottom (sometimes with small patches of *Posidonia* spp., *Posidonia* spp. dominated (sometimes with sparse *Sargassum* sp.), *Sargassum* sp. and *Posidonia* spp., and *Zostera* sp (Table 2). Some additional sub-groups have also been defined within these four main groups. Where the amount of *Posidonia* spp. present varied with sand, small amounts of *Sargassum* sp. were occasionally present. In addition, there were often small to medium sized patched of *Posidonia* spp. in the expanses of sand. These sub-groups have been identified as, a, b etc in Table 2 below.

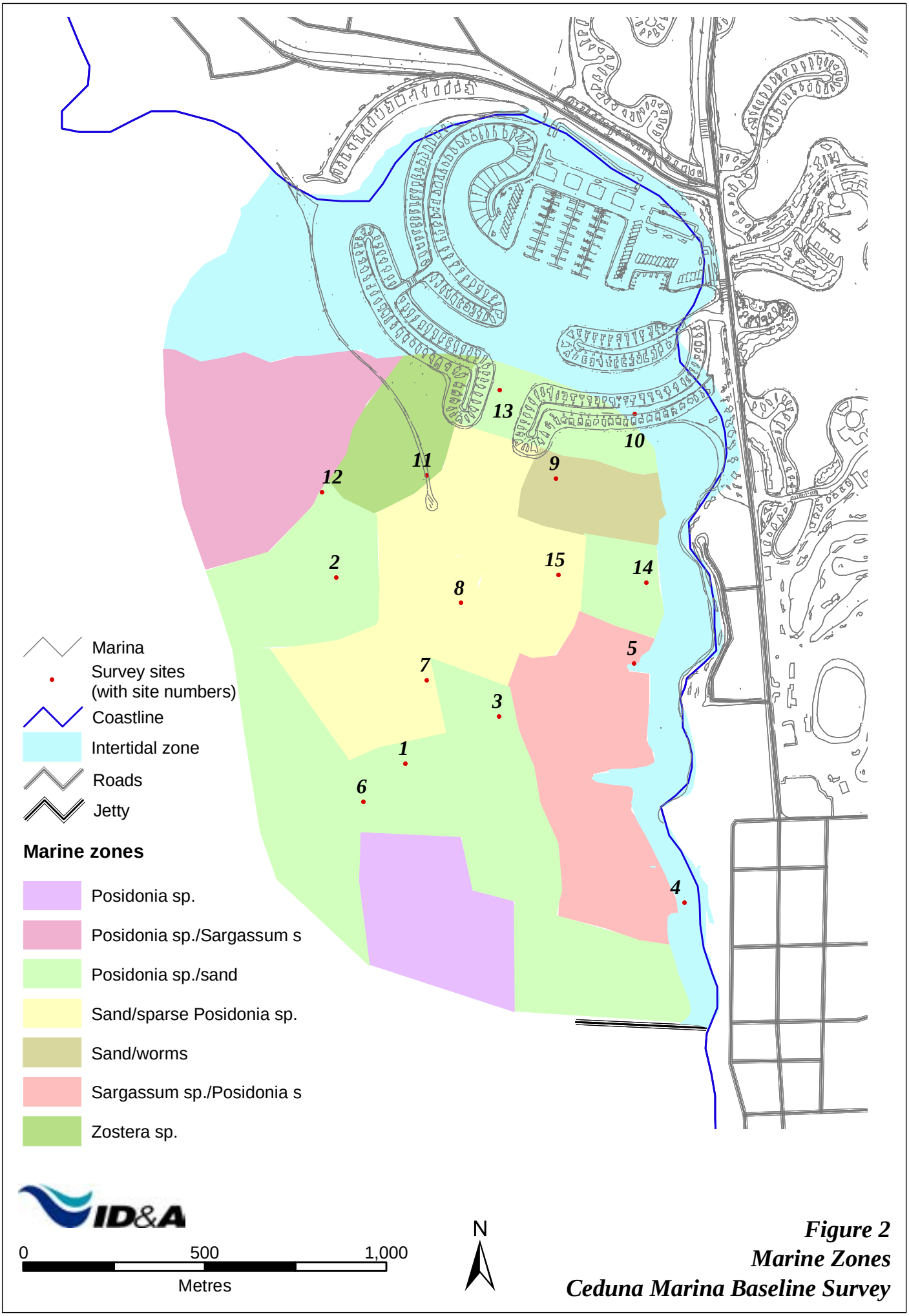


Figure 2
Marine Zones
Ceduna Marina Baseline Survey

Table 1 Summary of Marine Survey Findings

Site	Depth (m)	Substrate	Site Description	**Epiphyte abundance** (+ low, +++ high)	Plants /Algae	Animals
1	3.9	Fine silt/sand	70% sand/ worm holes; seagrass patches	+	***Sargassum* sp., sparse *Posidonia* spp. patches**	sponges; wormholes, gastropods, egg masses
2	3.6	Fine silt/sand	70% seagrass, 30% sand	+	*Posidonia* spp. patches	sponges, gastropods, *Pinna* sp., worm holes, several fish types (pipe, soldier, spider crab)
3	4.3	Sandy, less silt	Continuous seagrass	+	*Scabaria* sp., *Posidonia* spp. patches	shrimps, sponges, fish, *Pinna* sp.
4	2.5	Rocky bottom/silt/ sand	Seagrass/ brown macroalgae	+++	*Sargassum* sp., *Posidonia* spp. red algae (encrusting & foliaceous)	worm holes, mussells, Scleractinia
5	2.9	Rocky bottom/silt/sand	Brown macroalgae	+++	*Sargassum* sp., *Scabaria* sp., red algae (encrusting & foliaceous)	Scleractinia, mussells
6	4.1	Fine silt/shells	Continuous seagrass	+	Posidonia spp.	*Pinna*, gastropods, sponges
7	4.4	Silty sand	90% sand/worm holes, sparse patches of seagrass	+	*Posidonia* spp., turfing green algae, *Sargassum* sp.	*Pinna* sp., worm holes, brittle star, sponges, fish
8	3.3	Silty sand	Sand/many worm holes, seagrass	++	*Posidonia* spp./epiphytic algae, turfing green algae, red algae, *Sargassum* sp.	worm holes, ascidians, brittle star, *Pinna* sp.
9	4.4	Fine silt	Fine epiphytic algae throughout water column	+++	***Sargassum sp.***	worm holes

Table 1 Summary of Marine Findings contd

10	3.6	Sand	90% seagrass, sand patches	+++	*Posidonia* spp., red algae	barnacles, limpets, *Pinna* sp., red algal mass, worm holes, large hole (?sp)
11	2.1	Sand	Seagrass/ sandy patches	+++	Posidonia spp, Zostera sp.	ascidians, *Pinna* sp., sponges, worm holes, large hole (?sp)
12	1.8	Sand	90% seagrass, 10% brown macroalg*ae*	+++	*Posidonia* spp., *Sargassum* sp., red foliaceous algae	barnacles, sponges, *Pinna* sp.
13	1.8	Sand/shell bottom	Continuous seagrass	+++	*Posidonia* spp., green turfing algae, encrusting red algae	large hole (?sp), worm holes, *Pinna* sp., egg masses, abalone, scallops, barnacles
14	3.1	Silty/shells/ sand	80% seagrass, 20% sand	+++	Posidonia sp, red encrusting algae	worm holes, *Pinna* sp., large hole (?sp), sponges, scallops, egg masses, gastropods, barnacles
15	3.1	Silt/sand	95% sand, small patches seagrass	+++	Posidonia spp.	worm holes, large hole (?sp), *Pinna* sp., sponges

Table 2 Marine Habitat Types in Proposed Marina Site at Murat Bay

Habitat Type	Total Area (km^2)
1a) Posidonia spp.	0.155982
b) Posidonia spp./Sargassum sp.	0.252085
c) *Posidonia* spp./sand	0.799801
2a) Sand	0.38817
b) Sand/sparse *Posidonia* spp.	0.077015
3. *Sargassum* sp./Posidonia s	0.252072
4. *Zostera* sp.	0.104835
Total Area	2.03km^2

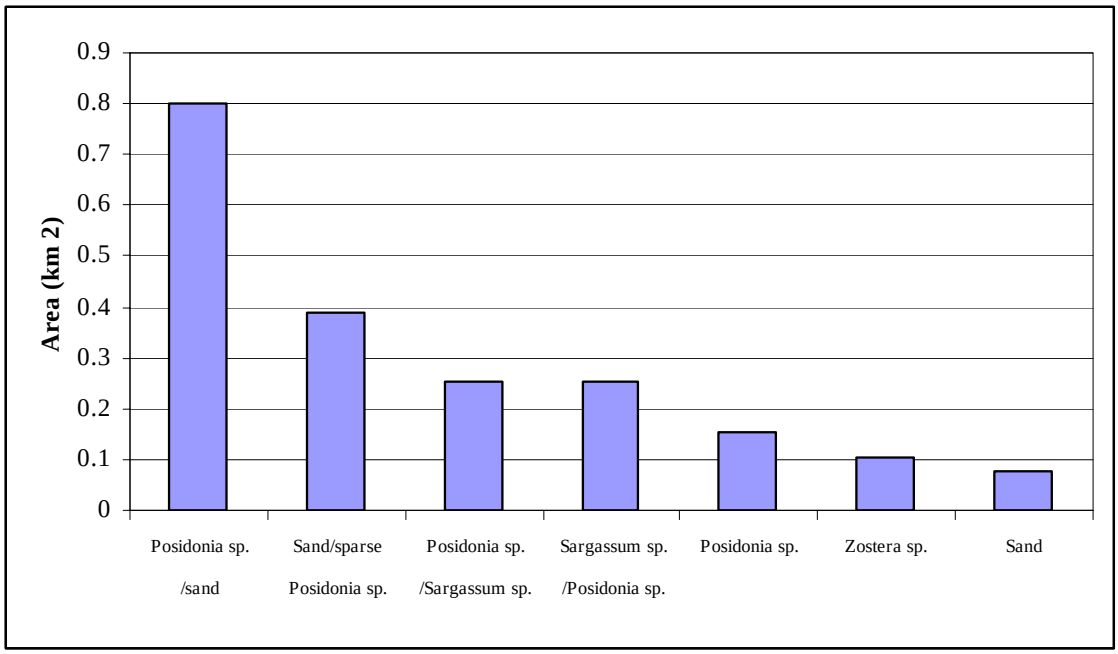


Figure 3 Graph of Marine Habitat Types in the Proposed Marina Site at Murat Bay

The most dominant habitat type was the seagrass *Posidonia* spp., commonly called tapeweed, which was interspersed with areas of clear sand. The abundance of *Posidonia* spp. varied throughout the area, tending to be very patchy. As the depth increased the seagrass tended to increase in density, with the greatest density occurring at the far south of the study site. A variety of other species also existed among the seagrass. Gastropods, sponges and egg masses, as well as epiphytic algae were commonly found attached to the leaves of the seagrass.

Plate 2 Seagrass beds (*Posidonia* spp.)

Sargassum sp., a brown macroalgae, is more common in the shallower inshore areas where the reefs tend to be and consequently there is a rocky substrate. It also occurs in very sparse patches among the seagrass beds.

Plate 3 *Sargassum* sp. stands among seagrass (*Posidonia* spp.)

Zostera sp., a fine seagrass (interspersed with *Heterozostera* sp.) was common on the shallow waters of the northern reef, to the west of the study site. It was however, overgrown with dense mats of epiphytes.

Plate 4 *Zostera* sp. interspersed with *Heterozostera* sp.

Epiphytic algae were very abundant in the area (refer Table 1). It commonly covered the leaves of the seagrass in varying densities. It was particularly abundant in the in shore areas, where the algal abundance was so prolific in some areas that it covered the seafloor and seagrass almost entirely. In these areas the sediment also tended to be extremely silty, with fine silt enveloping the divers in clouds when touching the sea floor.

Fine silty sand was common across the area. There was a large area to the south of the proposed marina site that was almost continuous sand. There were also sometimes small patches of *Posidonia* spp, and or *Pinna* sp. present. The areas of sand had many "worm" holes in them. These were holes in the sand, where some flatworms were found (phylum Platyhelminth), but it is also possible that other taxa such as polychaetes could also be responsible for the holes. As samples of invertebrate fauna were not taken, it is uncertain exactly what taxa lay under the sand and therefore when these holes were identified they have been referred to under the general term of "worm" holes.

Plate 5 Sandy areas with a high amount of fine silt and many "worm" holes in the sand

The razor-fish *Pinna* sp. commonly occurred across the whole study area. The only sites where it was not found in were quadrats at sites 1, 5, 9 and 15. It was most common at sites 8, 12, 7 and 3 (in order of dominance). This indicates the distribution of *Pinna* sp. is also very patchy. However, it did tend to be more common in the mid depths of approximately 3-4m and in the area around the reef at site 12.

Where razor-fish were present, other encrusting species attached themselves to the *Pinna* sp. shell. These species included barnacles, limpets, abalone, mussels, gastropods, scallops, sponges, encrusting and foliaceous red algae, and foliaceous green algae.

The other large species that commonly occurred throughout the area were solitary ascidians from the Ascidiidae family. They were most common in the central section of the study area, at sites 8 and 3.

Plate 6 ***Pinna*** **sp. with encrusting sponges and epiphytic algae**

Plate 7 **Ascidian and** ***Pinna*** **sp. with** ***Zostera*** **sp. and epiphytic algae surrounding**

There were taxa species found in the area that were of particular interest, but do not hold a conservation significance. A sea cucumber (Class Holothuroidea) was found at site 12 and several stony corals (Order Scleractinia) were found in the shallow reef/*Sargassum* sp. area (sites 4 and 5). See Table 4 for a review of these and other taxa found.

4.3.2 Intertidal Zone Communities

Table 3 contains a summary of the general habitat types found in the intertidal survey. Table 4 lists the dominant taxa.

Table 3 Inter-tidal Habitat Types in Proposed Marina Site at Murat Bay

HABITAT TYPE	AREA (m^2)	AREA (km^2)
1a) Cliff	3919	0.004
b) Rocky outcrop	3455	0.004
c) Exposed rock	1898	0.008
2a) Beach	33361	0.03
b) Beach cast seagrass	21524	0.02
c) Rock/beach cast seagrass	10261	0.01
d) Rock/beach seagrass/ samphire	8694	0.008
3a) Mangroves/samphire	28218	0.03
b) Samphire	27815	0.03
4a) Submersed sand	458561	0.5
b) Submersed sand/rocky	93614	0.095
c) Submersed sand/*Pinna* sp.	21892	0.025
5a) Reef	180961	0.2
b) Semi-submersed rocky area	16524	0.02
5a) *Zostera* sp.	20531	0.02
b) Submersed sand/*Zostera* sp.	44457	0.04
6a) *Posidonia* spp.	4188	0.004
b) Posidonia spp./Pinna sp.	10588	0.01
TOTAL		1.03

There were six main habitat types identified in the intertidal zone. These were: cliff, beach, mangroves/samphire, submersed sand, reef *Zostera* sp. and *Posidonia* spp. The most dominant habitat was submersed sand, followed by areas of reef (Figure 4).

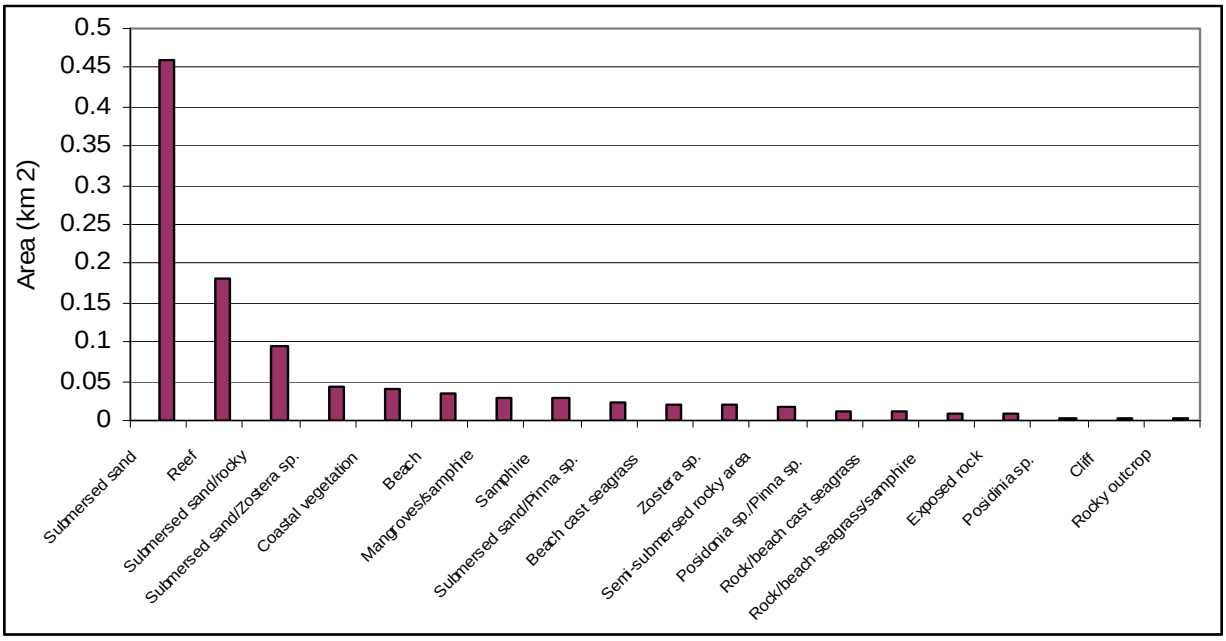


Figure 4 Intertidal Habitat Types and their Area in the Proposed Marina Site at Murat Bay

Table 4: Intertidal Communities - Dominant Taxa

Id	Habitat type	Other habitat features	Taxa -1	Taxa -2	Taxa -3	Taxa -4	Taxa -5
1	Beach						
2	Cliff						
3	Beach cast seagrass						
4	Submersed sand	rocky, anoxic sediment	polychaetes				
5	Reef		Hormosira sp.	blue-green algae			
6	Beach cast seagrass						
7	Beach						
8	Cement Wall						
9	Shelter						
10	Swimming platform						
11	Road to beach						
12	Road to beach						
13	Cliff						
14	Beach						
15	Reef		Hormosira sp.				
16	Submersed sand	rocky, glass on beach					
17	Reef		oysters	limpets		barnacles	
18	Reef		Hormosira sp.				
19	Semi-submersed rocky area		Hormosira sp.	Sargassum sp.		Pinna sp.	
20	Submersed sand	rocky, anoxic sediment	polychaetes				
21	Submersed sand	rocky, anoxic sediment	polychaetes				
22	Reef		Hormosira sp.				
23	Beach cast seagrass						
24	Beach						
25	Cliff						
26	Reef		Hormosira sp.				
27	Reef		Hormosira sp.	mussels	Austrocochlea sp.	blue-green algae	
28	Submersed sand	rocky					
29	Submersed sand	rocky					
30	Samphire						
31	Semi-submersed rocky area		Hormosira sp.	mussels			

Id	Habitat type	Other habitat features	Taxa -1	Taxa -2	Taxa -3	Taxa -4	Taxa -5
32	Semi-submersed rocky area		Hormosira sp.				
33	Exposed rock						
34	Reef						
35	Semi-submersed rocky area						
36	Samphire						
37	Submersed sand	rocky					
38	Reef		Hormosira sp.	epiphytic algae	blue-green algae	mussels	Austrocochlea sp.
39	Reef						
40	Submersed sand		polychaetes				
41	Beach						
42	Coastal vegetation						
43	Cliff						
44	Beach cast seagrass						
45	Samphire						
46	Exposed rock						
47	Reef		Hormosira sp.	Pinna sp.	mussels	algae	
48	Coastal vegetation						
49	Beach cast seagrass						
50	Beach						
51	Submersed sand	rocky					
52	Submersed sand		Pinna sp.				
53	Reef		Hormosira sp.				
54	Cliff						
55	Exposed rock						
56	Mangroves		samphire				
57	Mangroves		samphire				
58	Submersed sand	rocky	Hormosira sp.	Austrocochlea sp.	filamentous green algae on rock	mussels	
59	Submersed sand		polychaetes	small gastropods			
60	Beach cast seagrass						
61	Coastal vegetation						
62	Beach						
63	Fossilised wood						

Id	Habitat type	Other habitat features	Taxa -1	Taxa -2	Taxa -3	Taxa -4	Taxa -5
64	Reef		Hormosira sp.	gastropods	filamentous green algae on rock	mussels	
65	Samphire						
66	Beach cast seagrass						
67	Posidonia spp.		Pinna sp.				
68	Mangroves		samphire				
69	Rock	Beach cast seagrass, pools of water		Rocks with some samphire			
70	Coastal vegetation						
71	Submersed sand		Zostera sp.	bivalves		small gastropods	
72	Rocky outcrop						
73	Beach						
74	Posidonia		sparse Posidonia spp.				
75	Submersed sand		sparse Posidonia spp.	Pinna sp.		worms	
76	Mangroves		samphire	50 mature trees		200 seedlings	
77	Beach cast seagrass						
78	Mangroves		samphire	Dense- 50 mature			
79	Samphire						
80	Submersed sand		Sparse brown algae	slime		dead	
81	Mangroves		samphire	10 mature			
82	Mangroves		samphire	5 mature			
83	Samphire						
84	Mangroves		samphire				
85	Submersed sand	rocky	mussels				
86	Submersed sand		Zostera sp.				
87	Submersed sand		Pinna sp.				
88	Beach cast seagrass						
89	Coastal vegetation						
90	Rocky outcrop						
91	Rock	Beach cast seagrass		samphire			
92	Rock		gastropods	blue-green algae			
93	Submersed sand		Zostera sp.				

Id	Habitat type	Other habitat features	Taxa -1	Taxa -2	Taxa -3	Taxa -4	Taxa -5
94	Reef		Hormosira sp.	filamentous green algae on rock	chitons	barnacles	mussels
95	Submersed sand		polychaetes				
96	Reef		Sargassum sp.	Hormosira sp.	gastropods	epiphytic lagae	
97	Reef		Hormosira sp.	limpets			
98	Zostera		Zostera sp.	slime		dead seagrass	
99	Coastal vegetation						

The bay where the survey was undertaken was characterised by a number of rocky headlands, with sandy beaches between. There were five small rocky headlands lying along the eastern beach and one large headland on the northern side. These headlands were almost totally exposed at low tide, revealing a diversity of species attached to the rocky limestone surfaces. Typically the rocks were covered with the brown algae, *Hormosira* sp., and or molluscs and crustaceans. The species encrusting the rock surface tended to be dependent upon the water level. A typical profile of one of these rocky areas is shown on Figure 5. Figures 6a to 6e map these habitat types in the intertidal zone.

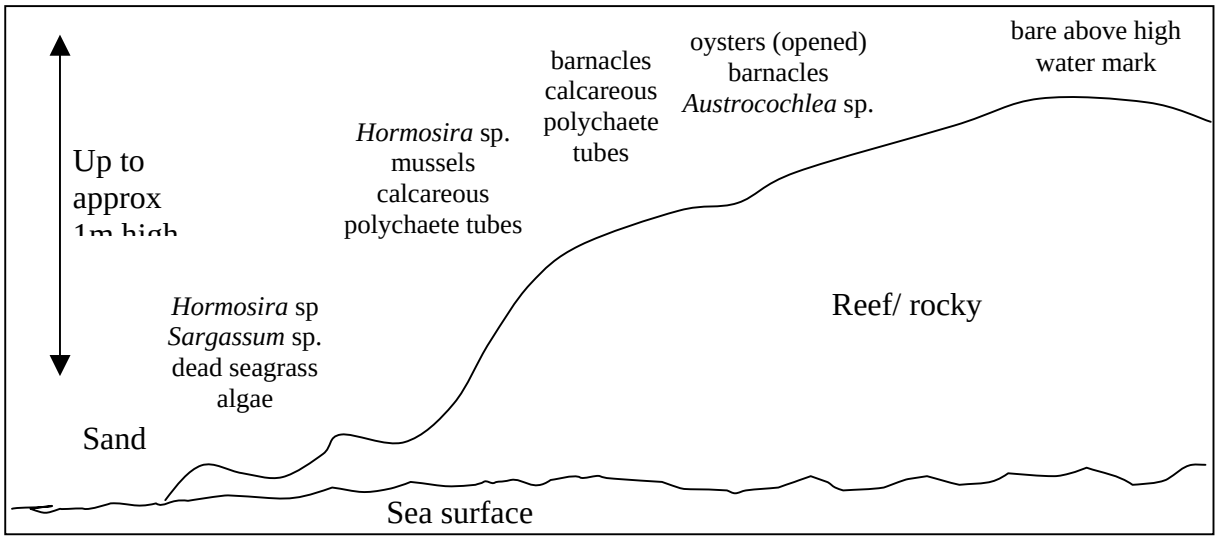


Figure 5 Profile of an example of major taxa found in the rocky intertidal zone

Taxa found on the rocky surfaces included; gastropods which were predominately *Austrocochlea* sp., blue-green algae, chitons, filamentous green algae on rock, mussels, oysters, bivalves, epiphytic algae, limpets and barnacles. Crabs lay underneath the rocks and small fish swam in the rock pools between.

Plate 8 Rocky limestone exposed reef with encrusting flora and fauna

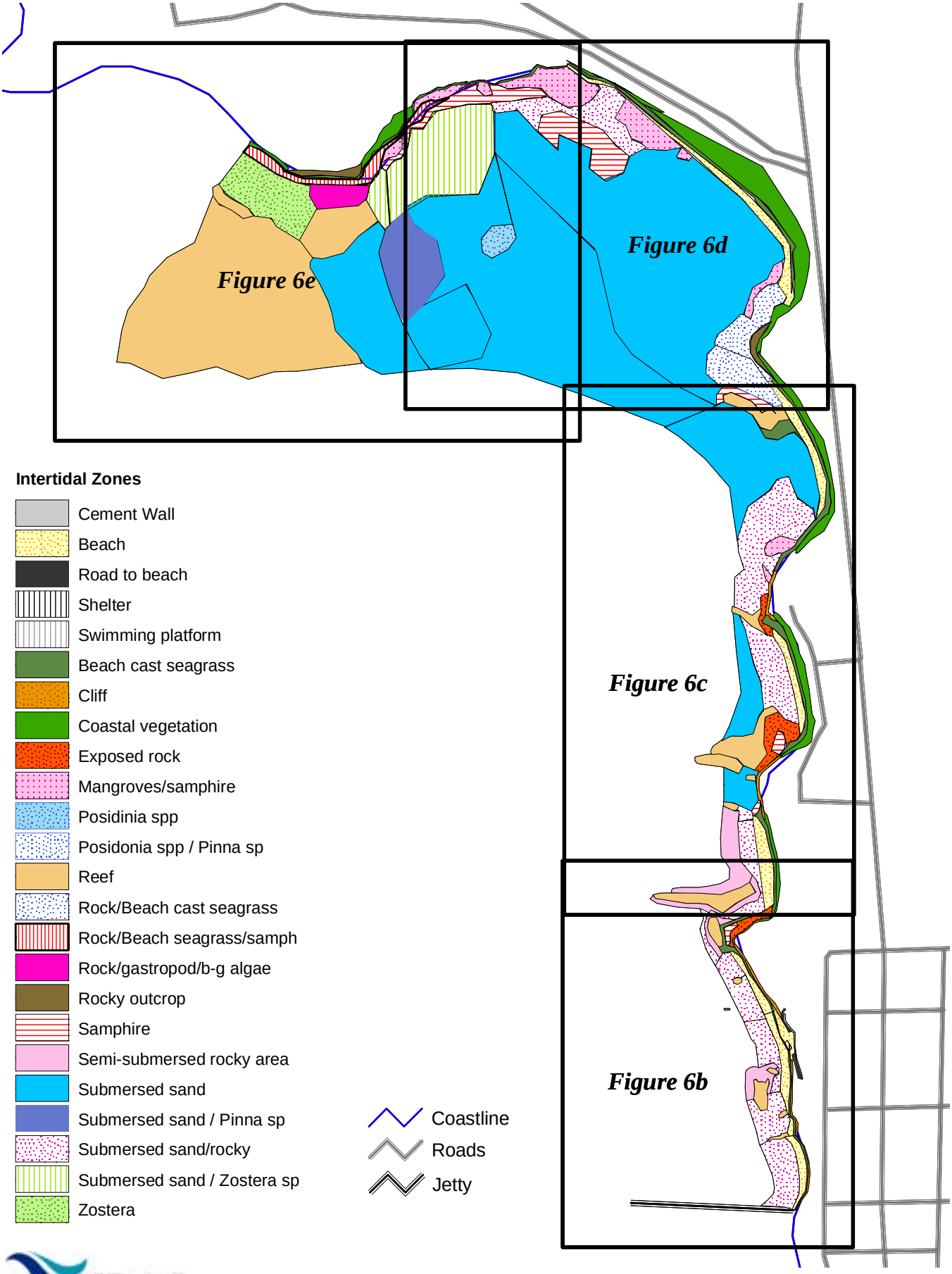


Figure 6a
Intertidal survey areas
Ceduna Marina Baseline Survey

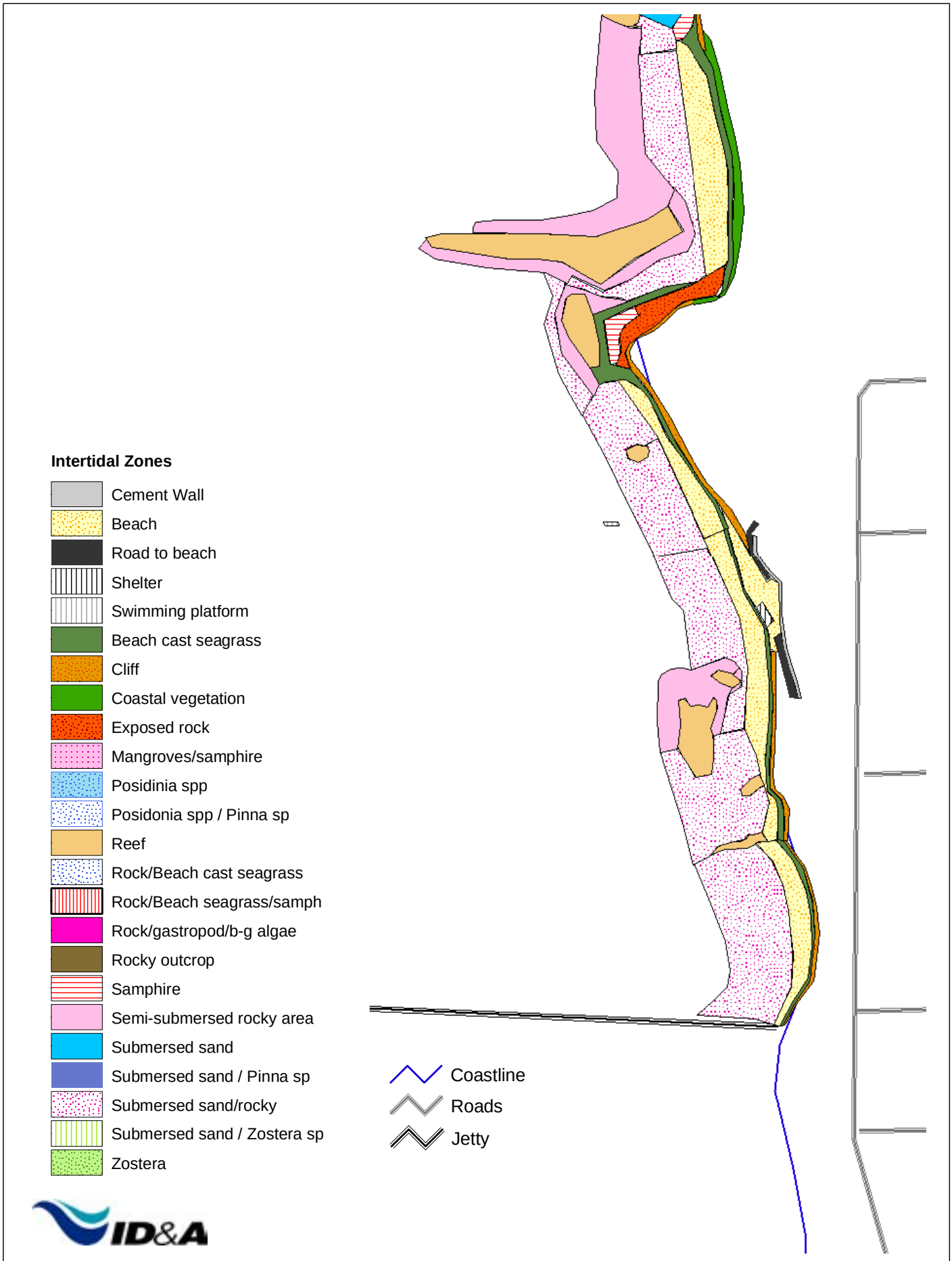
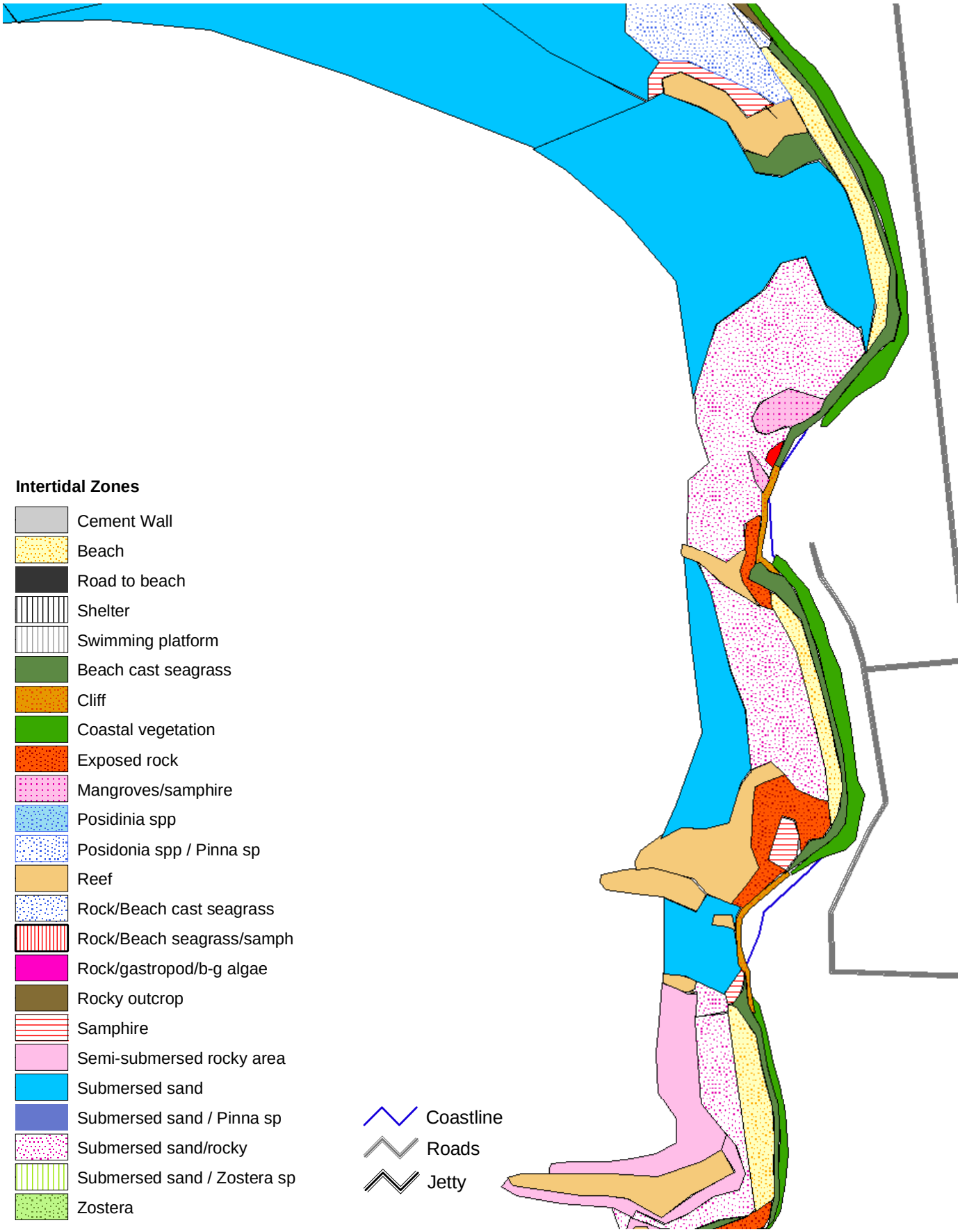


Figure 6b
Intertidal survey
Ceduna Marina Baseline Survey



ID&A

0 25 50 100 150

Metres

N

Figure 6c
Intertidal survey
Ceduna Marina Baseline Survey

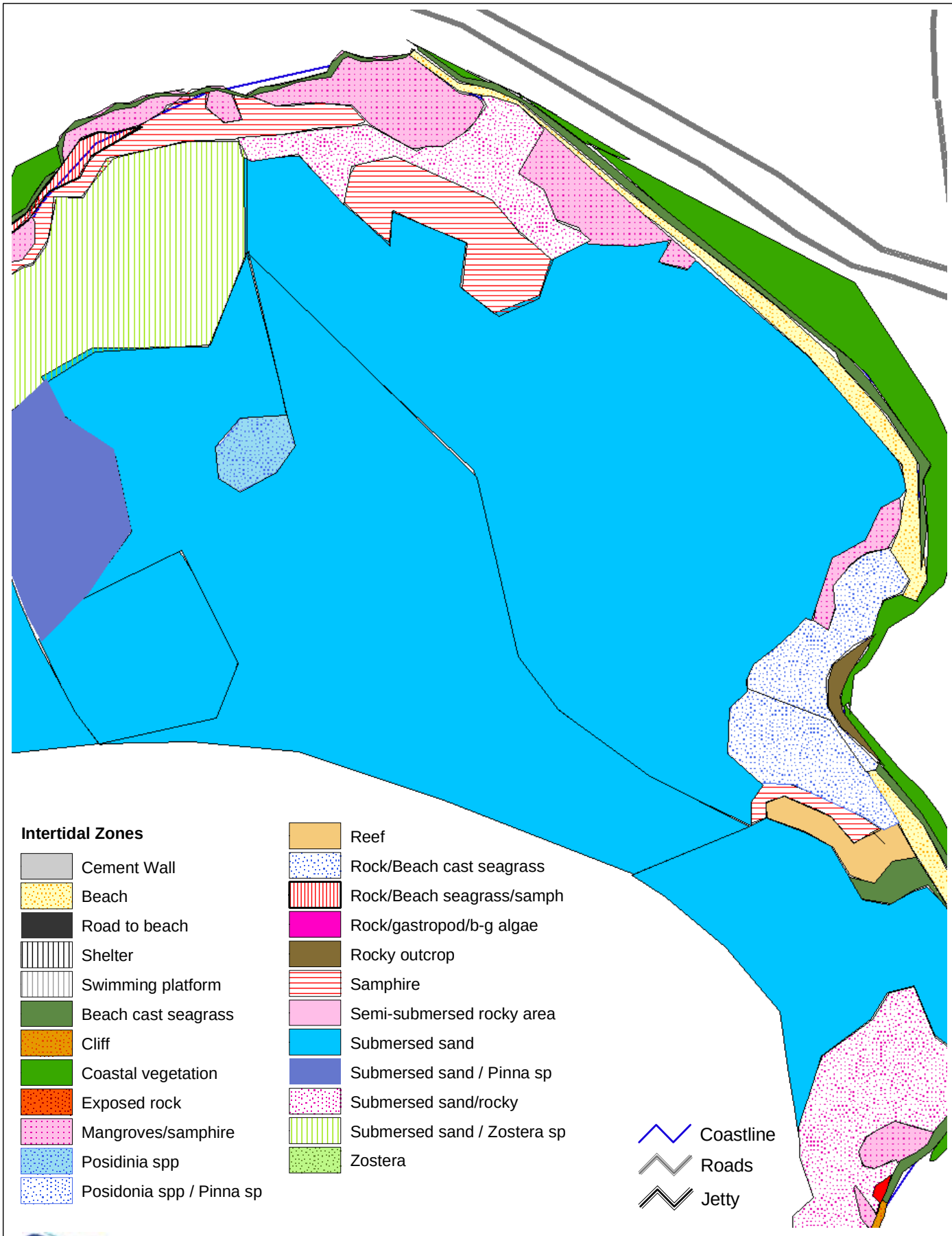
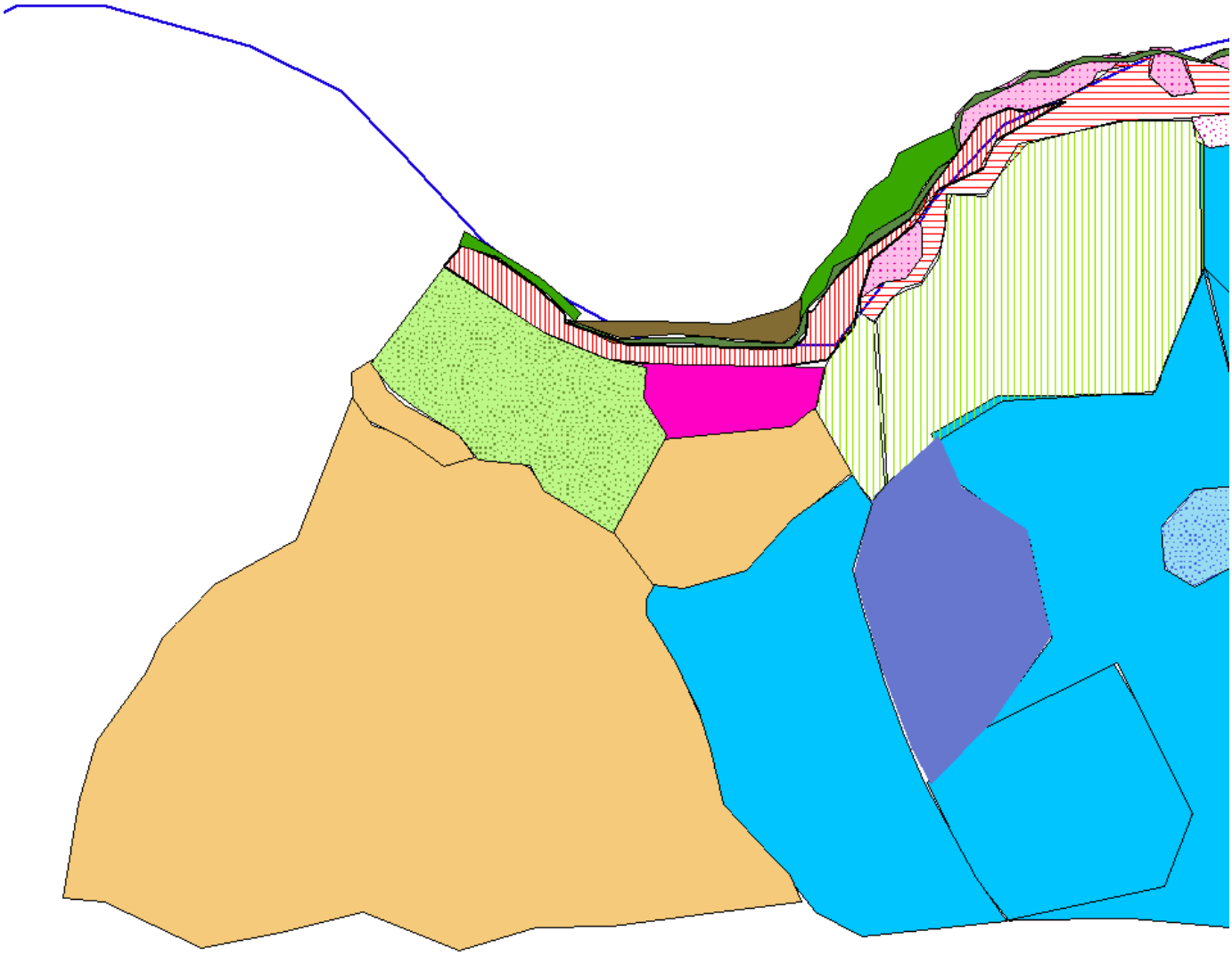


Figure 6d
Intertidal survey
Ceduna Marina Baseline Survey



Intertidal Zones

- Cement Wall
- Beach
- Road to beach
- Shelter
- Swimming platform
- Beach cast seagrass
- Cliff
- Coastal vegetation
- Exposed rock
- Mangroves/samphire
- Posidinia spp
- Posidonia spp / Pinna sp
- Reef
- Rock/Beach cast seagrass
- Rock/Beach seagrass/samph
- Rock/gastropod/b-g algae
- Rocky outcrop
- Samphire
- Semi-submersed rocky area
- Submersed sand
- Submersed sand / Pinna sp
- Submersed sand/rocky
- Submersed sand / Zostera sp
- Zostera

- Coastline
- Roads
- Jetty

ID&A

0 25 50 100 150 200

Metres

N

Figure 6e
Intertidal survey
Ceduna Marina Baseline Survey

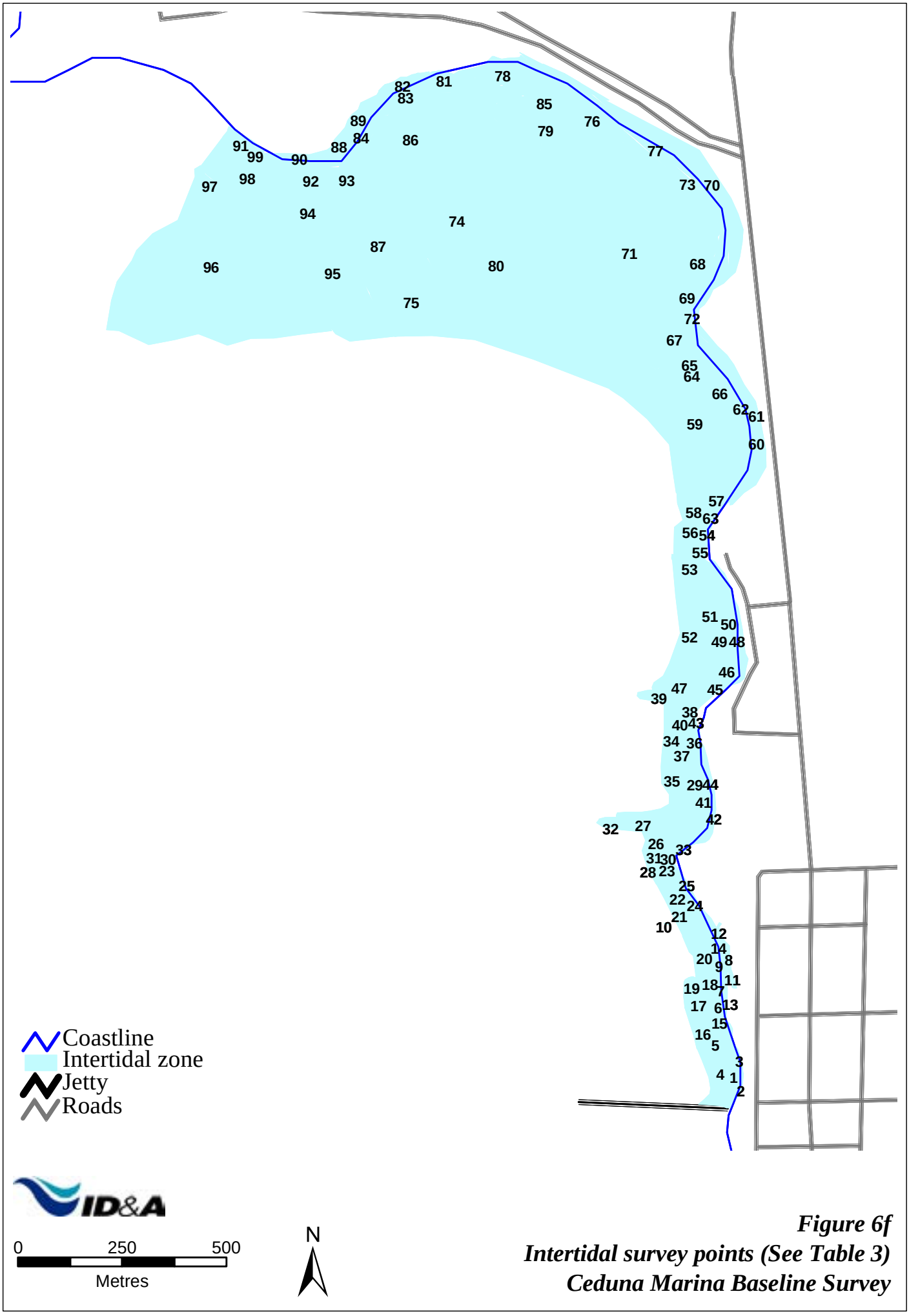


Figure 6f
Intertidal survey points (See Table 3)
Ceduna Marina Baseline Survey

Plate 9 An example of the gastropods and green and blue-green algae covering the rocks

Below the white sandy surface of the submersed sand (i.e. sand that was inundated daily by the sea) there were often dark grey anoxic sediments. In some areas this sandy area was also covered by patches of seagrass or brown algae (predominately *Sargassum* sp.). On the east beach *Sargassum* sp. was more common and on the larger reef on the north beach *Sargassum* sp., was intermixed with *Posidonia* spp., and in the shallower areas *Zostera* sp. and *Heterozostera* sp.. The razor-fish, *Pinna* sp. was also commonly found amongst the seagrass and macroalgae.

Plate 10 Sandy areas with surrounding macroalgae and seagrass, and razorfish (*Pinna* sp.)

Epiphytic algae were covering much of the seagrass and macroalgae. The area around the large northern reef was particularly covered with a thick blanket of brown epiphytic algae. Higher up the shore, on the rocky surfaces, blue-green algae were often found in patches

amongst the crustaceans and molluscs. Dead seagrass was a common sight in this northern reef area and it also covered much of the intertidal zone.

The areas of sand that lay in between the reefs often had small rocky patches, and *Hormosira* sp. and mussels usually covered these rocks. Where the sand was bare "worm" holes were common and small gastropods moved across the sand. The sediments under the white sand that were inundated by water each day were often grey and anoxic. A large sandy area, fully exposed at low tide lay in the large bay where the proposed marina is to be sited. This sandy area was almost completely devoid of any material on its surface, apart from a small patch of *Posidonia* spp. in the central area. To the western side of the bay *Pinna* sp. and *Zostera* sp. are found.

Plate 11 Large sandy areas where the proposed marina is to be sited

There were often patches of samphire surrounding the rocky areas. The samphire communities were mainly *Sclerostegia* sp. and *Sarcocornia quinqueflora*, with some *Suaeda australis*. The samphire occurred higher on the shore, above the high water mark. Samphire also surrounded the mangrove areas. There were several patches of mangroves in the area, the largest being in the centre of the main bay of the study site. The mangrove is the grey mangrove, *Avicennia marina*, the only mangrove species in South Australia. There were approximately 100 larger mangroves and 500 smaller seedlings in this area. Further south along the eastern beach there were 18 larger trees and a further patch of 5 mangroves approximately a further 500m south.

Plate 12 Mangroves with surrounding samphire community

An unusual species of note that was found in the survey was the shovel-nosed lobster, *Ibacus alticrenatus*. Its is a moderately common species reported to be more commonly found in the deeper waters of coastal bays (Edgar, 1997), but in this instance was found on the outer edge of the intertidal area at low tide.

Another feature of note in the intertidal zone are some areas of fossilised wood. These consist of an area of approximately $10m^2$ of rock at one of the rocky outcrops of the limestone headlands (at number 54, Figure 6e).

Plate 13 Fossilised wood found in the rocky intertidal zone

5.0 TERRESTRIAL ENVIRONMENT

5.1 Flora, Regional Perspective

Ceduna and its immediate hinterland, includes the development site is part of a coastal belt of native vegetation extending around the perimeter of both Murat and Denial Bays. Immediately inland of Ceduna are a number of blocks of various sizes of remnant native vegetation consisting primarily of older remnant Eucalyptus woodland. Many of these blocks are interconnected by broad roadside corridors especially along the Eyre highway.

Both the coastal belt and the remnant terrestrial blocks of vegetation would together offer refuge and appropriate habitat for a large suite of local-native flora and fauna species.

The regional terrestrial vegetation for the Eyre Peninsula has been described by Specht (1972) and Laut et al. (1977). This region is described by Laut et al (1977) as the Ceduna Environmental Association, as follows:

"An undulating calcarenite plain with overlying dunes, and low cliffs, lagoons and mangrove flats along the coast. Most of the plain has been cleared to an open parkland or grassland used for rotational cereal cultivation and livestock grazing, with small remnants of mallee woodland or open scrub. The dunes retain a native heath cover. The woodlands, open scrub and heath are used for extensive livestock grazing."

Specht (1972) described the original terrestrial plant cover over the area corresponding to the Ceduna Environmental Association in general terms as *E. socialis – E. gracilis* mallee.

Buckley and Fotheringham (1987) and Oppermann (1999) also described the coastal vegetation for the Eyre Peninsula. However, the nearest, surveyed locations to the Murat and Denial Bays area, were at Whittelbee Point and Laura Bay.

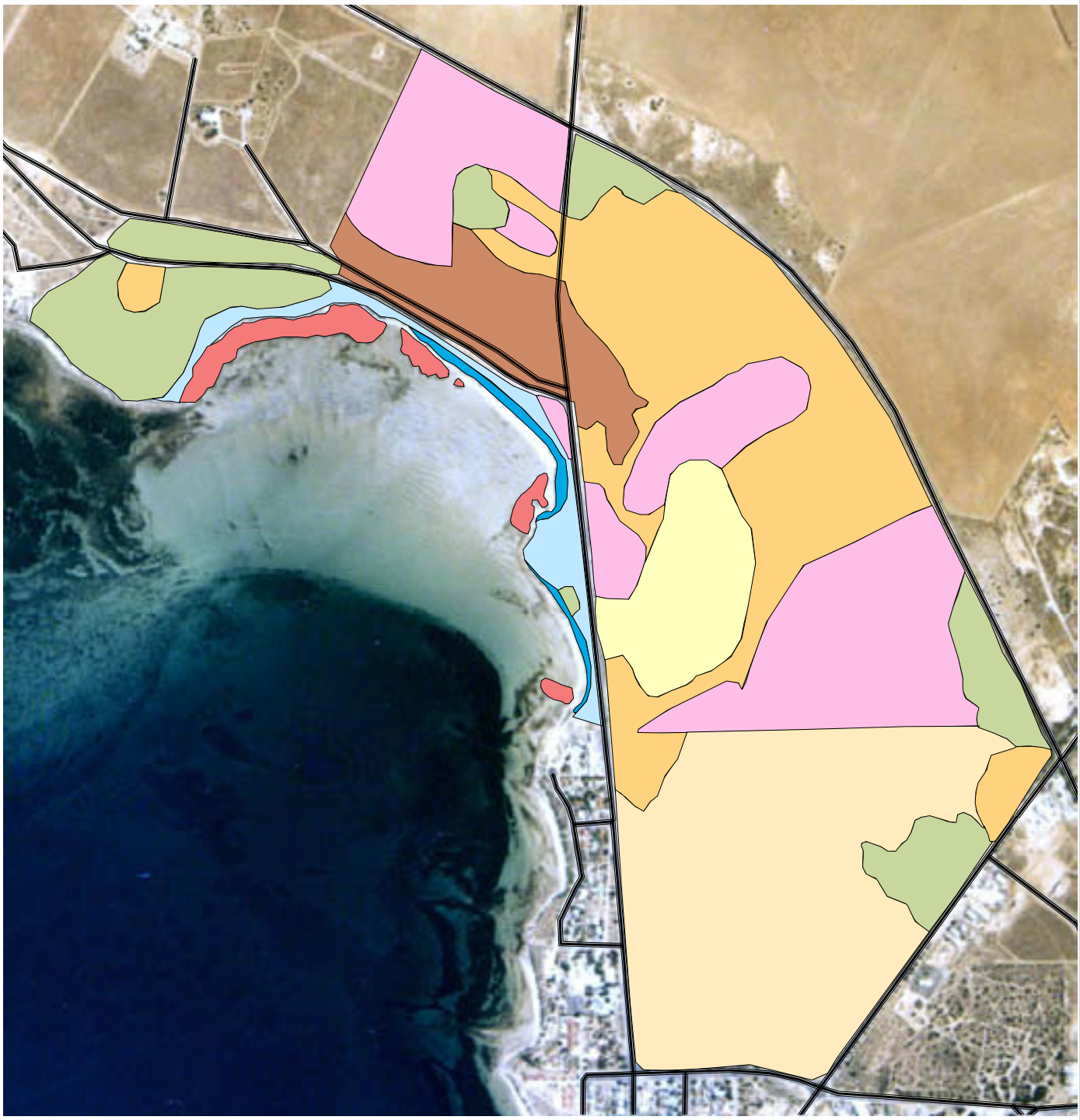
The west coast is a semi-arid region typified by a Mediterranean climate, featuring cool wet winters and warm dry summers. Rainfall is low, with the annual average rainfall at Ceduna being 290 mm/year. The average maximum summer temperature is 28^{o} C and the minimum 18^{o} C.

5.2 Flora at the Development Site

5.2.1 Vegetation Types

The development site contains a number of local landforms, each with its associated vegetation communities. Behind the sandy beaches or mangrove flats there are small coastal dune fields. These then grade to either tidal flats artificially landlocked, or raised terrestrial dunes and plain. The latter have vegetation consistent with mallee woodland or at least its understorey.

Essentially, the study area possesses two broad vegetation types, one consisting of coastal vegetation and the other of mallee woodland. A number of floristic communities were identified within these broad categories. These are mapped in Figure 7 and the species present for each community are recorded in Table 5.



Roads

- Mallee woodland
- Salt scald
- Low saltbush / bluebush shrublands (Atriplex / Maireana spp.
- Closed coastal dune shrubland
- Golf Course
- Intertidal mangrove flats
- Open coastal dune shrubland
- Samphire flats on less saline soils
- Tall shrubland on terrestrial dunes

ID&A

0 500 1,000

Metres

N

Figure 7
Terrestrial Vegetation
Ceduna Marina Baseline Survey

Table 5 Species Recorded For Each Floristic Community

CEDUNA PLANT LIST-Species	Common Name	Status	Intertidal Mangrove Flats	Closed Nitre Bush Shrubland	Open Coastal Dune Shrubland	Intermittently Flooded Saltflats	Samphire Flats	Low Saltbush / Bluebush Shrubland	Tall Shrubland on Terrestrial Dunes	Mallee Woodland	Golf Course
Acacia Cyclops	Western coastal wattle	I#							X		
Acacia ligulata	Umbrella bush								X	X	
Acacia notabilis	Notable wattle				X				X		
Allocasuarina verticillata	Drooping sheoak									X	
Atriplex cinerea	Coast saltbush				X						
Atriplex paludosa ssp. cordata	Marsh saltbush			X	X		X	X	X	X	X
Atriplex semibaccata	Berry saltbush										
Atriplex suberecta	Lagoon saltbush										X
Avicennia marina var. resinifera	Grey mangrove		X								
Beyeria lechenaultii	Pale turpentine bush									X	
Carpobrotus rossii	Native pigface				X		X	X	X	X	
Cassytha sp.	Dodder-laurel				X						
Chloris truncate	Windmill grass										
Cratystylis conocephala	Bluebush daisy				X					X	X
Dianella revolute	Black-anther flax-lily								X	X	X
Disphyma crassifolium ssp. Clavellatum	Round-leaf pigface				X		X	X	X	X	X
Dodonaea stenozyga	Desert hop-bush									X	
Dodonaea viscose	Sticky hop-bush										X
Enchylaena tomentosa var. tomentose	Ruby saltbush							X	X	X	

CEDUNA PLANT LIST- Species	Common Name	Status	Intertidal Mangrove Flats	Closed Nitre Bush Shrubland	Open Coastal Dune Shrubland	Intermittently Flooded Saltflats	Samphire Flats	Low Saltbush / Bluebush Shrubland	Tall Shrubland on Terrestrial Dunes	Mallee Woodland	Golf Course
Eremophila deserti	Turkey-bush			X				X	X	X	X
Eremophila glabra ssp. glabra	Tar bush								X	X	X
Eremophila weldii	Purple emubush									X	X
Eucalyptus 'anceps'	Sessile-fruit white mallee									X	
Eucalyptus calcareana	Nundroo mallee									X	
Eucalyptus gracilis	Yorrell									X	
Exocarpos aphyllus	Leafless cherry									X	X
Frankenia pauciflora	Southern sea-heath				X		X	X	X		X
Geijera linearifolia	Sheep bush				X			X	X	X	X
Hakea rugosa	Dwarf hakea									X	
Hemichroa pentandra	Trailing hemichroa	R			X			X		X	X
Lawrencia squamate	Thorny lawrencia						X		X	X	X
Lomandra effuse	Scented mat-rush									X	X
Lycium australe	Australian boxthorn							X		X	X
Maireana aphylla	Cotton-bush	U						X		X	X
Maireana brevifolia	Short-leaf bluebush				X		X	X			X
Maireana oppositifolia	Salt bluebush				X		X	X			
Melaleuca lanceolata ssp. Lanceolata	Dryland tea-tree								X	X	
Muehlenbeckia gunnii	Coastal climbing lignum				X				X	X	
Myoporum brevipes	Warty boobialla				X				X		
Myoporum insulare	Common boobialla									X	X
Myoporum platycarpum	False sandalwood									X	
Nitraria billardierei	Nitre-bush			X	X		X	X	X	X	X
Olearia axillaris	Coast daisy-bush				X				X	X	

CEDUNA PLANT LIST- Species	Common Name	Status	Intertidal Mangrove Flats	Closed Nitre Bush Shrubland	Open Coastal Dune Shrubland	Intermittently Flooded Saltflats	Samphire Flats	Low Saltbush / Bluebush Shrubland	Tall Shrubland on Terrestrial Dunes	Mallee Woodland	Golf Course
Olearia exiguifolia	Lobed-leaf daisy-bush									X	
Pittosporum phylliraeoides var. macrocarpa	Native apricot				X					X	X
Rhagodia candolleana ssp. Candolleana	Seaberry saltbush								X	X	X
Rhagodia crassifolia	Fleshy saltbush									X	X
Salsola kali	Buckbush						X		X	X	X
Santalum sp.	Quandong									X	
Sarcocornia blackiana	Thick-head samphire					X					
Sarcocornia quinqueflora	Beaded samphire		X								
Scaevola spinescens	Spiny fanflower				X						
Sclerolaena obliquicuspis	Oblique-spined bindyi				X			X		X	X
Sclerolaena sp.	Bindyi							X		X	X
Sclerolaena uniflora	Small-spine bindyi						X	X	X	X	X
Sclerostegia sp.	Glasswort		X		X	X	X	X		X	X
Senecio lautus	Variable groundsel						X			X	
Senna artemisioides	Desert senna								X		
Stipa sp.	Spear-grass				X			X	X	X	X
Suaeda australis	Austral seablite		X								
Templetonia retusa	Cockies tongue				X						
Threlkeldia diffusa	Coast bonefruit				X		X	X	X	X	X
Vittadinia sp.	New Holland daisy							X			
Westringia rigida	Stiff westringia							X		X	
Zygophyllum sp1	Twinleaf								X	X	
Zygophyllum sp2	Twinleaf									X	

CEDUNA PLANT LIST- Species	Common Name	Status	Intertidal Mangrove Flats	Closed Nitre Bush Shrubland	Open Coastal Dune Shrubland	Intermittently Flooded Saltflats	Samphire Flats	Low Saltbush / Bluebush Shrubland	Tall Shrubland on Terrestrial Dunes	Mallee Woodland	Golf Course
*Asphodelus fistulosus	Onion weed	I						X	X		
*Avena barbata	Bearded oat	I						X			
*Cakile maritima ssp. maritima	Two-horned sea rocket	I			X						
*Chloris virgata	Feathertop Rhodes grass	I									
*Dittrichia graveolens	Stinkweed	I									
*Euphorbia terracina	False caper	I			X						
*Gazania rigens	Gazania	I			X						
*Limonium companyonis	Sea-lavender	I			X						
*Limonium lobatum	Winged sea-lavender	I									
*Lycium ferocissimum	African boxthorn	I						X	X	X	
*Marrubium vulgare	Horehound	I						X		X	
*Mesembryanthemum crystallinum	Common iceplant	I					X				
*Mesembryanthemum nodiflorum	Slender iceplant	I					X				
*Reichardia tingitana	False sowthistle	I			X						X

Note:
Plant Names according to Florlist Version 2.0d.
Status: I = introduced; U = uncommon; R = rare
Conservation Status ratings are according to Lang and Kraehenbuehl (Jan, 2000).
* indicates an introduced or weed species.
# As stated above, Whibbley & Symon (1992) consider that *Acacia cyclops* is not found naturally in the Ceduna Environmental Association. As such it is treated here as introduced.

Considerable overlap of species occur across these floristic communities with species dominance changing with location and soil type. The floristic communities identified are:

(a) Intertidal Mangrove Flats
(b) Closed Coastal Dune Shrubland
(c) Open Coastal Dune Shrubland
(d) Salt Scald
(e) Samphire Flats on Less Saline Soils
(f) Low Saltbush ± Bluebush Shrublands (*Atriplex* ± *Maireana spp.*)
(g) Tall Shrubland on Terrestrial Dunes
(h) Mallee Woodland
(i) The Golf Course
(j) Roadsides

These are briefly described below.

(a) Intertidal Mangrove Flats

As described earlier, small patches of relatively young Mangroves (*Avicenia marina var. resinifera*) occur around the coast. Their youth indicates recent colonisation. Beneath them are metre tall shrubs of Glasswort (*Sclerostegia* sp.) over a dense groundcover layer of Beaded samphire (*Sarcocornia quinqueflora*) and Austral seablight (*Sueda australis*).

(b) Closed Coastal Dune Shrubland

Inshore from the intertidal zone is a narrow sandy beach followed by a foredune, which extends the entire length of the development site. This dune is covered with a dense, 1 to 2 m tall thicket of Nitre bushes (*Nitraria billardierei*) interspersed with Coastal saltbush (*Atriplex cinerea*) and Sea rocket (*Cakile maritima*). These are pioneer species, which have rapidly recolonised the newly formed coastal sand dunes.

(c) Open Coastal Dune Shrubland

The more recently formed coastal hind dunes are covered in open shrubland that is predominantly 0.5 to 1m tall Nitre bushes (*Nitraria billardierei*) and Marsh saltbush (*Atriplex paludosa* ssp. *cordata*). Above these, on the older and taller hind dunes are sparsely scattered taller shrubs such as Cockie's tongue (*Templetonia retusa*), Sheep bush (*Geigera linearifolia*), Native apricot (*Pittosporum phylliraeoides* var. *microcarpa*) or Coast daisy-bush (*Olearia axillaris*). The bare ground beneath the above mentioned species is covered by a suite of smaller species including the Native pigface (*Carpobrotus rossii*) and Round-leaved pig-face (*Disphyma crassifolium* ssp. *clavellatum*).

(d) Salt Scald

Once a tidal flat, this low lying area is now landlocked. Bare, quite saline soil occurs between low (<30cm) samphire shrubs of only two species namely the Thick-headed samphire (*Sarcocornia blackiana*) and Glasswort (*Sclerostegia* sp.). These are pioneer species, which have colonised a newly formed environment after tidal flows ceased.

(e) Samphire Flats on Less Saline Soils

Low-lying areas occur in several places that support predominantly samphires (*Sclerostegia* sp.) with a mixed shrub understorey. Secondary species include Bluebushes (*Maireana brevifolia and M. oppositifolia*), Nitre bush (*Nitraria billardierei*), Southern sea-heath (*Frankenia pauciflora*) and Round-leaved pig-face (*Disphyma crassifolium* ssp. *clavellatum*). These are also of recent composition, presumably since grazing has ceased, as evident by the lack of thick woody tissue amongst older plants.

(f) Low Saltbush ± Bluebush Shrubland

Found on open, low, sandy, terrestrial slopes and dunes, the predominant species is Marsh saltbush (*Atriplex paludosa* ssp. *cordata*) with secondary species which may include the bluebushes (*Maireana brevifolia and M. oppositifolia*) and Nitre bush (*Nitraria billardierei*). Occasionally the Nitre bushes form taller, mounding shrubs. A suite of smaller species also occurs. These are also of recent composition, presumably since grazing has ceased with many plants still too immature to flower.

(g) Tall Shrubland on Terrestrial Dunes

Three to four metre tall shrubs of Notable wattle (*Acacia notabilis*) with or without Dryland tea tree (*Melaleuca lanceolata*) predominate over a mid storey of 1 to 2 metre tall shrubs. These include Sheep bush (*Geigera linearifolia*), Native apricot (*Pittosporum phylliraeoides* var. *microcarpa*), Coast daisy-bush (*Olearia axillaris*), Umbrella bush (*Acacia ligulata*), Western coastal wattle (*Acacia cyclops*) and Leafless cherry (*Exocarpos aphyllus*). Beneath these is a broad range of low shrubs and groundcovers, the majority identical to those in the Low Saltbush / Bluebush Shrubland. Few of the taller species appear to be older than 10 years.

(h) Mallee Woodland

Elevated locations of coastal dunes and terrestrial sites still contain patches of single species Eucalypts with their associated understorey. Besides the occasional older remnant tree, most appear to be younger than 20 to 30 years. The most common species is the Yorrell (*Eucalyptus gracilis*) with the Sessile-fruited white mallee (*E. 'anceps'*) occurring in the golf course and a patch of Nundroo mallee (*E. calcareana*) occurring along the coastal hind dunes. Understorey shrub species were predominantly 1 to 3m tall and included Dryland tea tree (*Melaleuca lanceolata*), Sheep bush (*Geigera linearifolia*), Native apricot (*Pittosporum phylliraeoides* var. *microcarpa*), Coast daisy-bush (*Olearia axillaris*), Bluebush daisy (*Cratystylis conocephala*) and Leafless cherry (*Exocarpos aphyllus*). Beneath these was a suite of low shrubs and groundcovers, many similar to those found in other formations.

(i) Golf Course

This area was most likely covered with Mallee woodland originally before being cleared as many of the understorey species of this association still survive. Two distinct patches of remnant Sessile-fruited white mallee (*E. 'anceps'*) remain with a patch of Samphire flat (*Sclerostegia* sp.) between them. Exotic eucalypts and other trees and shrubs have been planted around the fairways and along fencelines. These have not been identified. The fairways themselves are irrigated areas of Kikuyu (*Pennisetum clandestinum*) and Couch

(*Cynodon dactylon*). The roughs are essentially local native understorey vegetation, either left as low shrubby bands or have been mown.

(j) Roadsides

Few native species have survived the regular grading and soil disturbance in this zone. Native species found are Windmill grass (*Chloris truncata*) and New Holland daisy (*Vittadinia* sp.) which are both ready colonisers of disturbed sites. Dominant weed species include Feathertop Rhodes grass (**Chloris virgata*), Stinkweed (**Dittrichia graveolens*), Winged sea lavender (**Limonium lobatum*) and False sow-thistle (**Reichardia tingitana*).

5.2.2 Condition of Vegetation and Conservation Status

Buckley and Fotheringham (1987) record that patches of remnant, original vegetation remain around Murat and Denial Bays. Little of the remnant vegetation remains at the development site today, perhaps only a few straggling eucalypts and melaleucas, and these mostly contained within the two patches of mallee woodland in the golf course. Most of the native vegetation present is recent, due to re-colonisation after considerable past disturbances. It is still in a state of transition and new species are recolonising as evident by the fact that only juvenile plants are present for most of the species.

As already mentioned, considerable disturbance of the site has occurred in the past. The area to the north of the Denial Bay/Davenport Creek road has been largely disturbed through stockpiling of road materials, excavations and the dumping of refuse. A former abattoir building is also present and it is likely that operations at the site would have contributed to disturbance in the area. The area to the south of the road and to the west of the Eyre Highway remains relatively undisturbed although there is evidence of recent camping throughout. To the east of the Eyre Highway, the intertidal area is also largely undisturbed although off-road bike trails have been constructed in the far northern corner and there has been some disturbance through road and rail construction. A quarantine station is also in this area. The study area incorporates the existing Ceduna golf course in the south. Most had been cleared for farming and therefore kept relatively denuded, also resulting in minimal fauna habitat. Construction of the coastal roads has significantly altered the local geography by land-locking the tidal samphire flats. These changed conditions have resulted in a succession in species as former residents have perished and new coloniser species have replaced them.

Part of the area had been grazed in the past. The removal of grazing from all but a small section of the site has allowed native vegetation to re-colonise. This has been aided by the fact that few aggressive weed species are present to compete for newly available niches. Only where the soil remains disturbed, such as along graded roadsides or along vehicle tracks are perennial weeds present in any number. These weeds extend into the adjoining native vegetation for a number of metres before gradually thinning out. Even the annual weeds make little impact. Consequently the newly colonising native vegetation is growing vigorously and is generally quite healthy with little displacement by perennial weed species.

Evidence for this re colonisation comes from the fact that few plants of any species appear to be in a mature state. Most vegetation appears to be less than 10 years old and even the few, scattered, older trees appear to be less than 20 to 30 years; with the exception of the two remnant patches of mallee woodland within the golf course.

Some stresses to native vegetation still occur as a result of :

- trail bike traffic along rough tracks along the samphire flats and salt scald
- a rubbish dumping site opposite the BP station
- continual grazing by horses in one paddock
- repeated mowing of most of the golf course site

Three species found within the development site have a conservation status for the Eyre Peninsula Region according to Lang and Kraehenbuehl (2000). This simply means that they are present throughout the peninsula in low numbers. None were found in a mature state at the development site and most individuals present were small and with tender tissue. Few individuals were old enough to flower for the first time. Many are young enough to transplant to other sites.

It is highly likely that they have recently colonised the site from adjacent scrub. Therefore, clearing the development site will, at worst, remove these new colonisers. It will have no impact on parent plants that are found elsewhere.

The species are discussed below.

(a) The Cotton bush (*Maireana aphylla*) has a conservation status for the Eyre Peninsula of Uncommon. Only a few immature individuals exist throughout the development site, and mostly within the golf course roughs. Native plant nurseries readily propagate plants from the *Maireana* genus from seed.

(b) The Trailing hemichroa (*Hemichroa pentandra*) has a conservation status for the Eyre Peninsula of Rare. Only immature, non-flowering plants are present indicating that they are very recent colonisers to the site from elsewhere. The species is also found in nearby sites at Ceduna, so it is not uncommon for the area. The plant itself is an attractive, bright green groundcover, in its juvenile form, and could be well used within the landscaping plan of the future development. Judging by its morphology, it appears to be a species that would readily propagate from cuttings. These may need to be placed within a hothouse using the bottom heat technique. Propagation from seed is also a suitable method.

It is recommended that 50 to 100 individuals of each of the above species be propagated and planted either within the landscaping arrangement of the development, such as the golf course roughs, or in nearby sites around Ceduna to compensate for the loss of individuals currently present.

(c) According to Whibbley & Symon (1992) the Western coastal wattle (*Acacia cyclops*) is not found naturally in the Ceduna Environmental Association. As such it has been treated here as introduced, probably recently self sown from nearby civic plantings. It is, however acknowledged that *Acacia cyclops* is native to the western most section of the Eyre Peninsula where it has a conservation status of Uncommon.

5.3 Fauna

Detailed fauna surveys of the Ceduna area are generally not available. Single day surveys of fauna will produce few results, as fauna residence is often temporary or seasonal. Only ongoing year-round survey work will provide an adequate picture of fauna populations present and their usage of a site.

Nevertheless, habitat availability (i.e. habitat type and condition) is a sound indicator of potential fauna presence at a site. The presence of fauna is strongly related to the presence of appropriate habitat. Where habitat is lacking fauna will scarcely be found if at all. The overall picture of the development site is one of newly emerging vegetation communities developing after considerable disturbance due to clearing, grazing and road development with its attendant changes to local geography. This immense disturbance has meant that little habitat diversity existed until recently and most is still developing. As yet insufficient cover exists for most native fauna species to find shelter for breeding or from predators, both natural (e.g. hawks) and feral (e.g. cats and dogs). Proximity to the urban centre also gives the site another disadvantage in providing native fauna with competitive pressure from feral species such as rats and mice and predation by cats and dogs. Few local species were observed during the vegetation surveys and these in very low numbers.

As mentioned earlier, the development site rests between two broad vegetation categories, one consisting of coastal vegetation and the other a terrestrial, mallee woodland. Both the coastal belt and the nearby remnant terrestrial blocks and roadside corridors of vegetation together offer refuge and appropriate habitat for a large suite of local-native flora and fauna species. In general, the further from Ceduna and Thevenard the better the condition of the habitat and therefore the more likely that fauna will shelter there.

It can therefore be surmised that the general lack of appropriate habitat over much of the development site and the presence of suitable habitat nearby is likely to draw most species elsewhere with most of the development site becoming essentially a location for transient visitors. Loss of the development site to native fauna is therefore unlikely to make much impact on local fauna populations.

5.3.1 Birds

Species lists for terrestrial birds of Ceduna are not available. However, species present are most likely to be similar to those indicated on regional lists, as remnant blocks of terrestrial vegetation are relatively abundant both in the Ceduna hinterland and beyond to regional conservation parks. NPWS, (1991a) provide a bird list for the entire Far West Region while a bird list for the entire Eyre Peninsula and offshore islands is provided by Eckert et al. (1985). There is also a detailed bird list for the nearby coastal Conservation Park at Laura Bay (NPWS 1991b) and the nearby inland Yumbarra Conservation Park (Nature Conservation Society 1995).

There is information available for coastal birds. NPWS officers at Ceduna were able to supply the following unpublished bird lists from an unknown source (Anon. 1999a &b). These are presented in Tables 6 and 7. All of the species mentioned in these tables feed along the shoreline, with perhaps the exception of seagulls, so are unlikely to be affected by the development.

Table 6 A Survey Of Migratory Birds That Use Shallow Shorelines Around Ceduna.

Sharp-tailed sandpiper	Lesser Golden plover
Common sandpiper	Great knot
Curlew sandpiper	Red knot
Wood sandpiper	Sanderling
Treck sandpiper	Eastern curlew
Red-necked stint	Whimbrel
Green shank	Bar-tailed godwit
Ruddy turnstone	Grey tailed tattler
Grey plover	Mongolian plover

Table 7 Other Waders And Water Birds Which Utilise Shallow Inshore Waters And Tidal Flats Or Beaches Around Ceduna.

Hooded plover
Red capped dotterel
Red kneed dotterel
Pied oyster catcher
Sooty oyster catcher
Masked lapwing
Banded stilt
Black wing stilt
Black swan
White faced heron
Eastern reef heron
Chestnut teal
Grey teal
Musk duck
Caspian tern
Crested tern
Fairy tern
Pacific gull
Silver gull
Osprey
White breasted sea eagle

5.3.2 Mammals and Reptiles

As indicated above, being in close proximity to the Ceduna urban area, it is likely that there will be feral animals, wandering domestic cats and dogs and vermin. Several rabbits were seen but no burrows or warrens found. Fox scats were also not found. Lack of fresh surface water within the Ceduna hinterland will preclude the presence of amphibian species although they are found elsewhere within the Eyre Peninsula. Horses are currently agisted on part of the development site.

As mentioned previously, the coastal vegetation belt and the nearby regional remnant terrestrial blocks of vegetation together offer refuge and appropriate habitat for the full suite of local-native fauna species. Species present are likely to be similar to those for the entire Eyre Peninsula. These lists are available. They include lists for mammals (Watts & Ling 1985) and reptiles and amphibians (Schwaner et al 1985). The Nature Conservation Council (1995) also provides a detailed mammal and reptile list for the nearby inland Yumbarra Conservation Park.

Again, it can be surmised that the general lack of appropriate habitat over much of the development site and the ready access to urban predators means that little opportunity currently exists for these species.

6.0 ABORIGINAL HERITAGE

6.1 Introduction

This section presents the findings of an Aboriginal heritage study of the location for the proposed marina. The study was undertaken over two days: 13-14 April 2000, with the assistance in the field by Craig Westell.

6.2 Consultation

Consultation was undertaken in the first instance with Mitch Dunnett, the Aboriginal Liaison Officer with the Ceduna Council and a member of the Wirangu Aboriginal community. It was decided that the archaeological field survey would be undertaken followed by discussion of the results. In order therefore to further discuss the proposal and its implications, as well as the results of the survey, Mr Wayne Miller, a Wirangu elder was visited, accompanied by Mr Dunnett.

Consultation was also undertaken with representatives of the Ceduna Aboriginal Community Council Inc., as requested by the State Aboriginal Heritage Committee. The Chairperson of the Council, Mr Oscar Richards, and Mrs Sue Hazeldine were subsequently shown over the study area following the field survey and the project discussed.

The concerns of each of the above groups are included in the recommendations below and copies of the report were sent to both groups for comment.

6.3 Archaeological Background

At the time of writing, the Register of Aboriginal Sites and Objects, maintained by the Department of State Aboriginal Affairs (DOSAA), was not open for access. An enquiry was however made as to whether there are any registered or reported Aboriginal sites within the study area. The results of this enquiry are included below. The accompanying register of previously undertaken cultural heritage reports was also closed at the time of writing. As such, the following information was obtained from previously held information.

Of direct relevance to the present project is a study undertaken by Sarah Martin of Aboriginal fish traps on the Eyre Peninsula and West Coast (Martin 1988). The aims of the study were to "locate, record and determine method of operation of existing fish traps and to collect oral history and ethnohistorical information pertaining to their construction, history of use and method of operation" (Martin 1988:4). Hartley Clothier and Morris Miller were the two main interviewees for the west coast section of the study.

In relation to the Ceduna area, Martin states that Mr Clothier said that:

... there had been fish traps all the way along the foreshore from Thevenard to Halfway Camp in the Ceduna area. He pointed out the remains of these which are natural limestone reefs forming enclosures with minimal gaps that would have been blocked up by stones when in use (Martin 1988:46).

Martin also recorded some information about 'Halfway Camp':

The 'Tjinardu' law men used to sit on the high sand-hill near Halfway Camp and there was a fishtrap on the foreshore below. Hartley Clothier pointed out natural limestone reefs forming several enclosures in the intertidal zone.

This fishtrap, known as Halfway Camp Fishtrap, is included in the general study area, although outside the proposed area for the marina, and Figure 8 shows its location. The site is a reported site and information on it is held by DOSAA. Other registered fishtraps occur further west at Duck Ponds.

There has been one other study relevant to the present project. This was a survey carried out for Department of Transport for road widening of the Eyre Highway near the area where the Thevenard - Penong railway crosses (Walshe 1996). Despite a thorough field inspection, no Aboriginal cultural material was found.

In summary there is one known Aboriginal site in the present study area. This comprises a natural fish trap. No other Aboriginal cultural material has been previously recorded.

6.4 Study Methodology and Results

The field survey was undertaken on Thursday 13 April 2000. The entire study area was subjected to detailed pedestrian survey with the emphasis being placed on the dunal areas in the west and north, but also covering the intertidal and mangrove areas. Visibility was generally excellent and there were numerous exposures where it was possible to ascertain if subsurface cultural material was present.

FIGURE 8 Study area showing the location of Aboriginal cultural material recorded during the survey, the previously recorded fish trap and the freshwater soak.

Aboriginal cultural material in the form of midden and stone artefacts was found in two locations within the study area and these are shown on Figure 8. Both areas are located in sand dunes adjacent to the coastline. Following are descriptions of the cultural material found.

Area A

The cultural material in this location is immediately inland from the recorded fish trap discussed above. It comprises a midden of a variety of locally available shell species, along with other faunal material such as fish, large mammal and crab. Numerous stone artefacts manufactured from silcrete, flint, chert and quartz are also present. The midden and stone artefacts occur in varying densities across the area and are interspersed with more recent evidence of camping, e.g. broken glass, tin cans, old blankets, mattresses, shoes, etc. This accords with the use made of the area as described to Martin (see above) and bears testimony to the continuity of Aboriginal occupation in this region.

Area B

This area of midden is located in the dunes north of the BP Service Station. In addition to midden material there are a small number of stone artefacts and, again, evidence of more recent occupation. According to Mr Mitch Dunnett this area is used frequently by hitchhikers to camp whilst waiting for lifts. Mr Dunnett also pointed out the location of a freshwater soak that exists in the area where the service station has been extended. The soak is located adjacent to the original natural channel leading from the coast to the intertidal area now on the eastern side of the highway. This channel has since been filled in.

In addition to these two areas of cultural material, another area of dunes was pointed out by Mr Dunnett as being the location previously found burials. This area is on the eastern side of the Eyre Highway, immediately across from the junction of the Denial Bay Road. It was also pointed out that the swamp and wetlands area to the east of the Eyre Highway is of significance in terms of Aboriginal anthropology.

7.0 DISCUSSION OF THE EFFECTS OF THE DEVELOPMENT

7.1 Issues Addressed

As previously indicated, the main issues addressed in this Environmental Assessment are:

- The development of the Ceduna Keys Marina, and the loss of existing marine habitat of Murat Bay.
- The effects of construction on the marine environment
- The maintenance of good water quality in the marina and lake waterways.
- The effects on the terrestrial environment, i.e. remnant flora.
- Aboriginal Heritage issues.

These are briefly discussed in the following sections.

7.2 Effects on the Marine Environment

7.2.1 Marine Biological Communities

Loss of Existing Marine Habitat

There were no subtidal or intertidal marine habitats found in this survey that are of conservation status. This survey however was not an extensive assessment of all species present, therefore it cannot guarantee there are no species of conservation status in the area. The survey was rather an assessment of the community types in the area and their current condition.

Habitats that would be removed by the marina include approximately 20-30% of the mangrove/samphire area, which at the time of survey consisted of approximately 120 mature trees and 500 seedlings. This vegetation community is commonly found throughout the Southern Australia and is not threatened. The main area lost by the construction of the entrance groynes and marine opening is the sandy intertidal area of the main bay. The offshore entrance channel will be excavated through *Zostera sp* beds and areas of sand with sparse *Posidonia sp.*

Development of Marine Biological Communities in the Marina Waterways

It is important to appreciate that the marina basin, the lake and the various rock walls and breakwaters will provide habitat for marine fauna and flora. There are many examples of this occurring, and has been reported elsewhere in other constructed man made waterways, e.g. AGC (1990) Westlakes (EWS 1988) or marinas (Nixon et al 1973, William 1985, and AEC 1988). This is perhaps not surprising, as it would also be common knowledge that jetty pilings rapidly become encrusted by a diversity of species, boat harbours are typically popular fishing spots, and that artificial reefs, using car bodies, tyres etc., are developed because they are known to be of value.

The Lincoln Cove Marina, constructed in 1988, is very similar in many respects to the proposed Ceduna Marina. Shortly after the marina was constructed, a survey was undertaken to examine the development of marine communities and was reported in AGC (1990). The following comments are taken from this source.

At the time of observation the main entrance channel still had little vegetation, although at the seaward end scattered patches of *Posidonia australis* remained and *Heterozostera tasmanica* were now colonising the disturbed sediments. Most of the channel bed was covered with a deep, soft layer of fine sediment and is marked by abundant worm mounds. Notable benthic animals in this area were sipunculid worms, the holothurian *Stichopus mollis* and an echiurian.

The marina basin bottom was covered with a deep, soft layer of fine sediment, which is easily disturbed. Some of the basin was similar to the channel bed, with worm mounds and sabellid worm tubes. Elsewhere, the bottom was covered by growths of macroalgae. Over much of the area a red algae (*Spyridia*, probably *S. breviarticulata*) formed a monospecific layer (10cm thick) resting on, but not attached to, the bottom. There were also many areas of bottom covered by attached mats of a short, filamentous form of this algae.P The species of

algae and their abundance would almost certainly vary seasonally. The growth observed was not regarded as excessive.

The lack of stability of the sediment and flora associations of the marina bottom was attributed to the recency of construction. The land areas around the waterways at the time of observation were still being vegetated.

Some small patches of the seagrass, *Halophila australis*, were well established in the southern part of the main basin. Further growth in the basin may occur.

The rock walls were examined during the survey. These were characterised, at shallow depths, by growths of the cosmopolitan initial colonising green algae *Enteromorpha flexuosa*; associated with *Cladophora sp.* along the southern side of the channel. Blue-green algae were also abundant on the northern wall, although they were absent on the southern wall. Fine red algae *(Pleonosporium sp.)* dominated the rock surface at depths greater than 2 metres, with other reds *(Nemalion helminthoides)* and brown algae *(Colpomenia peregrina* and *Lomentaria australis)* were also common. The tubular algae *N. helminthoides* is particularly common the southern rock wall.

The barnacle *Balanus amphitrites* was common in places, as was the butterfly shell *Electroma georginiana*. The oyster *Ostrea angasi* was very abundant on some of the pilings along many of the rock walls. These animals live attached to hard substrata from the sub-littoral fringe down to the bottom of the marine (4-5m). Significant numbers of oysters were being harvested for local consumption.

A number of fish species were observed in the marina waterways during the survey including Magpie Perch *(Coniistius vizonarius)*, Dusky Morwong *(Psilocranium nigricans)*, Common Bullseye *(Liopempheris multiradeata)*, Blenny *(Pictiblennius tasmanianus)* and Cobi *(Cobiidae sp.)*.

These species are typically associated with rocky reefs and were probably present originally on the small reefs edging Porter Bay. These fish, then, are indicative of the new marine community becoming established in the environment created by the marina.

A number of species of recreational importance, including mullet and whiting, are also caught in the marina.

Overall, it was apparent that the marina was rapidly being colonised by marine flora and fauna and because of the array of habitats available, rock walls, sandy substrate pilings etc. would likely eventually be a relatively diverse community.

7.2.2 Effects During Construction

Construction activities can also potentially be very significant, depending upon the method of construction, season and duration of operation. If constructed in open water, the main dredging effect would be the resuspension of silts into the water column increasing turbidity and causing siltation of adjacent habitats.

It is understood from the proponent that the preferred method of marina construction will almost certainly be construction in the dry, i.e. breakwaters will be placed first as a

continuous barrier and the basin pumped out. Only after the basin has been excavated, will the marina be opened to tidal movement. This was the method employed for the Lincoln Cove Marina in Porter Bay.

A post construction survey was undertaken (AGC, 1990) to examine the condition of the marine communities immediately adjacent to the Lincoln Cove Marina and to compare them to a marine baseline survey undertaken in 1985 (Manning, 1985). The distribution of the main subtidal communities recorded during the pre-construction surveys is shown in Appendix 2. During the post construction survey emphasis was given to examining the area in close proximity to the marina and entrance channels in order to determine the degree of any disturbance. Particular attention was given to the seagrass beds because of their importance and reported extent. Beds of *Posidonia australis* are immediately adjacent to the development. In the post construction survey it was found that offshore of the development these communities were in the same condition as previously observed. The only observed change was in a localised area immediately, adjacent to the dredged entrance channel (see Appendix 2). As expected, as a consequence of the construction there was some disturbance. There were some bare areas, probably created during the construction, immediately adjacent to the channel edge, but which were being colonised by *Heterozostera sp.* The remaining *Posidonia* seagrass in this disturbed area had increased epiphytic growth but this was not excessive. Elsewhere however, the seagrass beds appeared to be in the same condition, even in the areas immediately adjacent to the new beaches created as part of the development.

Overall the impact on the marine biota in Porter Bay is apparently limited to the area of construction. Importantly, disturbed areas immediately adjacent to the site are being recolonised.

Inevitably, during construction there will be some disturbance of sediments, with some being released to the water column. However, the method of construction will greatly minimise this. There have been many studies of the effects of construction (dredging) activities on marine communities and it is consistently reported that the effects are localised and transitory, and that disturbed areas rapidly recover.

7.3 Water Quality and Compliance with the Marina Guidelines, and State Government Legislation

It is intended that the marina basin and inland lake have a good water quality status, in order to:

- Facilitate the development and maintenance of a diverse and healthy marine aquatic fauna and flora.
- Be suitable for contact recreation.
- Have an attractive appearance, and be relatively free of nuisance algal growths.

Ensuring good water quality in the system essentially involves:

- Providing adequate water circulation in the system and regular exchange with marine waters.
- By design and management, controlling potential sources of contamination.

These are briefly discussed below:

7.3.1 Water Circulation and Exchange with Marine Waters

Experience elsewhere indicates that a hydraulic residence time of between 7-11 days is adequate to ensure good water quality. It is found that it is only with systems that have extended residence times, or are extensive in length, up to 5 Km, and/or have major inputs from surrounding catchments, that water quality problems occur. As indicated above, the average residence time will be between 3-5 days, which will ensure good water quality in the marina. Also important, however, is the control of potential sources of contamination. This is separately addressed below:

7.3.2 Control of Potential Sources of Contamination

Measures are to be put in place for the most significant potential sources of contamination. In this regard the development will be consistent with relevant guidelines and State Government legislation. Relevant guidelines include the South Australian Coastal Marina Development Strategy for Recreation Boats, Rep. No. 1 Marina Guidelines (DEP 1990) and the more recent EPA Stormwater Management for Marinas, Boat Sheds and Shipways (EPA 2004).

As indicated in EPA (2004), the stormwater pollution is covered by the Environment Protection (Water Quality) Policy (2003) (under the EPA Act 1993) and various other Acts. Also as indicated the Water Quality Policy provides for the most specific protection for the waters.

Referring to the guidelines, and with regard to the EPA Water Quality Policy, the key points to note are:

(1) No waste shall be discharged into a marina either from the land or from vessels.

It is intended by the proponent that:

- Sewage effluent from the associated urban development and from boats.

  All waste will be taken to the new WWTP outlined in the Ceduna Keys Engineering Assessment (DSC, 2004) and treated effluent irrigated. Consequently this will pose no risk to the basin or adjacent marine environment. There is no discharge to the marine environment.

- Refueling.

  As indicated in the Engineering assessment (DSC, 2004), one refuelling area is intended to service both commercial and recreational boats. Fuel storage tanks are likely to be underground, with supply lines to bowsers at the wharf. Bunding and drip trays would be provided in areas such as around the bowsers, The underground tank will need to be periodically checked to detect any deterioration, in order to prevent fuel loss to the marina. This should be specified in the ongoing maintenance plan. Stormwater from service areas and

the commercial area will be diverted to a detention basin and will not discharge to the marina.

(2) Major stormwater and other land based discharges shall not discharge into the marina.

The development is not located on an estuary or on a major watercourse, which has a large inland catchment. Currently there is no major watercourse entering the development area, nor any major stormwater outlets into the marina from the Ceduna urban area. As indicated in Engineering Assessment (DSC, 2004), the adjacent rural catchment will only produce runoff during major events. There will be some stormwater runoff from the development. Because of the configuration of the development, this could not all be intercepted and ponded. Measures are being taken to minimise the quantity of stormwater entering the waterways, including measures such as swales etc. to also reduce the quantities of pollutants in the runoff. Significantly, rainwater tanks plumbed into the houses will utilise much of the roof runoff. Surplus clean roofwater will be diverted to the marina and not to the road drainage system. Overall, only 20% of the total stormwater will be diverted direct to the basin (not inc clean excess roof runoff), and this will have been through GPTs. Within the waterways, because of the relatively small volumes involved, the size of the marina basins and scale of tidal exchange, the effects are likely to be localised and transitory.

Some of the stormwater from the urban areas will be diverted to detention basins. Although indicated at this stage as detention basins, they will be landscaped and designed to maximise pollutant removal, having aquatic microphyte vegetation (reeds etc.).

(3) A marina should have an oil spill contingency plan to minimise the impact and provide for the adequate cleanup of any oil/hydrocarbon fuel spillage.

While fuelling facilities for diesel fuel and petroleum would normally be provided, the risk of contamination of the marina, and the marine environment is very small. In this regard the following are to be noted:

- Fuel storage areas would be bunded as part of normal design.
- Private storage of fuels is also discouraged.
- Light oil fractions are rapidly lost to the atmosphere. Most concern with oil spills is where there are large volumes involved, particularly crude or bunker oils. In this instance, the most likely scenario is a small spill during fuelling. The volume involved would be small.

However, an oil spill contingency plan will be prepared as part of the environmental management plan for the marina. Booms could be placed at the entrance to the marina or at the entrance to the commercial basin.

(4) Boat Maintenance, Repair Works, Hull Cleaning, Painting and Anti

These are identified in EPA (2004) and the EPA Code of Practice for Marina and Boating Management as significant potential sources of contamination including:

- Solvents
- Oils, grease, lubricants
- Anti substances, such as copper ans TBT (tributyltin)

Consequently these activities will not occur in the marina. Boat owners requiring such activities will need to take their vessel to another location. Such activities are also incompatible with the residential nature of the development.

(5) Bilge and Ballast Water

It is understood that boat owners using the marina will also be required to comply with the EPA Code of Practice and be discouraged from discharging bilge water.

A separate facility will be provided for the disposal of ballast water. When required, pump out from holding tanks to mobile tankers could be undertaken. This avoids the problem of the potential introduction of pest species into the marina from visiting larger vessels.

7.3.3 Monitoring

A long-term water quality monitoring programme of the waterways will be established as part of a marina management plan. This will be developed in consultation with the EPA, and will include:

- The collection of water samples within the marine and at selected locations in the Bay adjacent to the marina, with analysis for:
    - nutrients
    - faecal bacteria
    - heavy metals
    - hydrocarbons

- Field measurements will be taken of:
    - dissolved oxygen/temperature
    - turbidity (secchi disc)

- Sediment samples will be collected in the marina basin and analyse for:
    - heavy metals
    - TBTs
    - hydrocarbons

- A biological monitoring programme will be established in order to:
    - monitor the quality of algal growth (particularly of any nuisance algal mass)
    - the development of marine communities within the marine.
    - detect the occurrence of any introduced pest species.

This monitoring programme will be regularly reported to the EPA

Additional potential sources of contamination, the risk of which can be minimised by careful design and/or management are:

- General fertiliser use on the adjacent golf course, and newly landscaped areas.
- The exposure of acid sulphate soils in the excavation of the waterways. However, adverse effects can be prevented, if these are either removed or never exposed to air during the life of the system, i.e. kept inundated.

Overall, it is anticipated that the water in the basin and lake, will be generally that of the waters of Murat Bay, and should achieve the required use objectives.

7.4 Effects on the Terrestrial Environment

The proposed development will involve the removal of part of the small areas of mallee woodland, the tall shrubland on the terrestrial dunes. As indicated earlier in Section 5.0, this is newly regenerated vegetation after post disturbance, and these associations are widespread in the region.

The samphire flats and low saltbush/bluebush (*Atriplex/Mareana spp.*) will also be removed by development and altered by the reintroduction of tidal flows.

Overall, the development, as proposed in the initial concept plan, will not impact on any significant areas, or any areas on which any fauna species are dependent for survival in this region.

Importantly, the dune shrubland immediately north of the Ceduna township and the area where fossilised wood occurs, will not be effected.

7.5 Aboriginal Heritage

The cultural material present in both Area A and Area B, as well as the previously recorded fishtrap, are located outside of the area for the proposed development. No other sites were identified within the area of proposed development. There are, therefore, no reasons for the development not to commence.

The following recommendations are made in relation to the Aboriginal cultural material located outside of the project area during the survey of the proposed development. The recommendations also include those highlighted through the consultation process as being important to the relevant Aboriginal communities.

- Should it become necessary, in the future, for the material present in Areas A and B to be disturbed or destroyed, an application for permission to do so will be required from the Minister of Aboriginal Affairs, under Section 23 of the *Aboriginal Heritage Act 1988*.

- It is recommended that any new channel to be excavated in the reinstatement of the swamp and wetlands on the eastern side of the Eyre Highway be excavated in the vicinity of the original channel.

- It is recommended that the area in the vicinity of the freshwater soak be fenced off and revegetated.

- It is recommended that signs be erected which acknowledge the traditional Aboriginal owners of the region and the significance of the area to this group.

- It is recommended that consultation with the Aboriginal groups continue to ensure full acquaintance with the development proposal and all it entails.

- Should Aboriginal burials be unearthed during excavations associated with the development, work should stop immediately and contact made with Mitch Dunnett as well as the Department of State Aboriginal Affairs, for advice on how to proceed.

The proponent is aware that all Aboriginal sites, objects and remains in South Australia are protected by provisions of the Aboriginal Heritage Act, 1988, which makes it an offence to collect, damage or destroy Aboriginal sites, objects or remains without the written authorisation of the Minister for State Aboriginal Affairs.

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APPENDIX 1

Marine Survey Results

Ceduna marina baseline survey

Site	1

Date	6/04/2000	**Time**	7:47
Lat (E)	373731	**Long (N)**	6445466
Depth (m)	3.9	**Visibility**	5m
Weather	Fine, sunny, (17oC), 0-5 knots		
General description	Fine sand, alot of silt in water, Sargassum sp., sparse Posidonia sp. patches/algae, few sponges, worm holes		

Quadrat data

Quadrat	Taxa	Relative abundance
3	egg masses on Posidonia spp.	2
2	gastropods on Posidinia sp.	4
3	Posidonia spp.	4
2	Posidonia spp.	4
1	Posidonia spp.	4
3	worm holes	2
2	worm holes	2
1	worm holes	2

Site	2

Date	6/04/2000	**Time**	9:00
Lat (E)	373542	**Long (N)**	6445858
Depth (m)	3.6	**Visibility**	5m
Weather	Wind increasing		
General description	Silty, sponges, Pinna, Posidonia sp. dense/algae, worm holes, several fish types (pipe, soldier, spider crab)		

Quadrat data

Quadrat	Taxa	Relative abundance
2	fish (1)	1
3	gastropods on Posidonia spp.	2
1	gastropods on Posidonia spp.	2
2	Pinna sp. (1)	2
1	Pinna sp. (1)	1
3	Posidonia spp.	4
2	Posidonia spp.	3
1	Posidonia spp.	5
2	sponges	1
1	sponges (1)	2
1	sponges on Pinna sp.	2
3	worm holes (6)	3

Site	3

Date	6/04/2000	**Time**	10:45
Lat (E)	373991	**Long (N)**	6445476
Depth (m)	4.3	**Visibility**	
Weather	Wind increasing		
General description	Sandy/ shell grit, less silt, shrimps, sponges, fish, Pinna, Scabaria sp., Posidonia sp. patches/algae		

Quadrat data

Quadrat	Taxa	Relative abundance
1	algae	2
3	Ascidian (2)	2
2	gastropods on Posidonia spp.	1
1	gastropods on Posidonia spp.	2
3	Pinna sp.	2
2	Pinna sp.	3
3	Posidonia spp.	3
2	Posidonia spp.	4
1	Posidonia spp.	3
1	rock (limestone) with encrusting algae	2
2	sponge on Pinna sp.	1

Site	4

Date	6/04/2000	**Time**	11:30
Lat (E)	374498	**Long (N)**	6444965
Depth (m)	2.5	**Visibility**	good
Weather	Calm, sunny, NE winds- 0-5 knots		
General description	Rocky bottom/silt/sand, Sargassum sp., Posidonia sp./algae, Red algae		

Quadrat data

Quadrat	Taxa	Relative abundance
3	brown algae	3
2	brown algae	2
2	Mussell- lg	1
2	Pinna sp.	1
2	Posidonia spp.	2
1	Posidonia spp.	2
3	red encrusting algae	1
1	red encrusting algae	2
3	red foliaceous algae	2
3	Sargassum sp.	3
1	Sargassum sp.	2
3	Scabaria sp.	2
3	Scleractinia	2
1	worm holes	1

Site	5

Date	6/04/2000	**Time**	13:00
Lat (E)	374361	**Long (N)**	6445622
Depth (m)	2.9	**Visibility**	
Weather	Slight winds, 5-10 knots, slightly overcast		
General description	Rocky bottom/silt/sand, a lot of filamentous algae/slime, Sargassum sp./algae		

Quadrat data

Quadrat	Taxa	Relative abundance
3	Mussles- sm	2
3	red encrusting algae	1
2	red encrusting algae	2
3	red foliaceous algae	2
2	red foliaceous algae	3
1	red foliaceous algae	3
3	Sargassum sp.	2
2	Sargassum sp.	2
1	Sargassum sp.	2
2	Scabaria sp.	5
2	Scleractinia	2

Site	6

Date	7/04/2000	**Time**	8:30
Lat (E)	373620	**Long (N)**	6445243
Depth (m)	4.1	**Visibility**	10m
Weather	Fine, sunny, no wind, flat and clear waters		
General description	Fine sediment/silt/shell grit, brown algae. Posidonia sp./algae, Pinna		

Quadrat data

Quadrat	Taxa	Relative abundance
3	Pinna sp.	3
1	Pinna sp.	1
3	Posidonia spp.	2
2	Posidonia spp.	2
1	Posidonia spp.	3
2	small gastropods on Posidonia spp.	2
1	small gastropods on Posidonia spp.	2
1	sponge on Pinna sp.	1
3	sponges on Pinna sp.	2

Site	7

Date	7/04/2000	**Time**	9:40
Lat (E)	373793	**Long (N)**	6445575
Depth (m)	4.4	**Visibility**	7-8m
Weather	Sunny, fine, no wind		
General description	Silty sand, lots of worm holes, sparse patches of Posidonia sp./algae, Pinna		

Quadrat data

Quadrat	Taxa	Relative abundance
1	Ascidian	1
2	brittle star	1
3	Pinna sp.	1
1	Pinna sp.	4
3	Sargassum sp.	1
3	small fish	1
3	small sponge	2
1	sponges on Pinna sp. (2)	1
3	turfing green algae	1
1	worm holes (4)	4
3	worm holes (5)	4
2	worm holes (5)	4

Site	8

Date	7/04/2000	**Time**	10:45
Lat (E)	373892	**Long (N)**	6445788
Depth (m)	3.3	**Visibility**	5-6m
Weather	NE wind, 0-2 knots, fine, sunny		
General description	Silty, many worm holes, ascidians, sparse Posidonia sp./algae		

Quadrat data

Quadrat	Taxa	Relative abundance
3	Ascidian (2)	4
1	brittle star	1
3	green turfing	1
3	Pinna sp.	4
2	Posidonia spp./algae	2
3	red algae	1
3	Sargassum sp.	1
1	worm holes (7)	6
2	worm holes (9)	6

Site	9

Date	7/04/2000	**Time**	11:50
Lat (E)	374151	**Long (N)**	6446129
Depth (m)	4.4	**Visibility**	poor
Weather	Fine, sunny, strengthening westerly, 5 knots		
General description	Lots of fine silt, mucous like material throughout water column; many worms and sand, Sargassum sp., ++ algae		

Quadrat data

Quadrat	Taxa	Relative abundance
1	large hole (?sp)	1
2	Sargassum sp./algae	3
3	worm holes	4
2	worm holes	4
1	worm holes	6

Site	10

Date	7/04/2000	**Time**	12:45
Lat (E)	374362	**Long (N)**	6446309
Depth (m)	3.6	**Visibility**	poor
Weather	High wind gusts, waves 0.5m		
General description	Posidonia sp/algae. and sand patches; Pinna; slime/algae, red algae		

Quadrat data

Quadrat	Taxa	Relative abundance
3	barnacles on Pinna sp.	2
1	barnacles/limpets on Pinna sp.	3
2	large hole (?sp)	1
3	Pinna sp.	1
1	Pinna sp.	1
3	Posidonia spp./algae	4
1	Posidonia spp./algae	4
3	red algal mass	1
2	red algal mass	2
3	worm holes	3
2	worm holes	6
1	worm holes	4

Site	11

Date	8/04/2000	**Time**	7:45
Lat (E)	373784	**Long (N)**	6446140
Depth (m)	2.1	**Visibility**	
Weather	Fine, sunny, (17oC), flat, light breeze		
General description	Zostera, small patches of Posidonia sp., sandy patches, ascidians, ++ algae		

Quadrat data

Quadrat	Taxa	Relative abundance
3	dead sponge	1
3	large hole (?sp)	3
2	large hole (?sp)	3
1	large hole (?sp)	3
3	Pinna sp.	2
2	slime/algae	5
1	slime/algae	5
3	worm holes	1
2	worm holes	1
1	worm holes	2
3	Zostera sp.	2
2	Zostera sp.	5
1	Zostera sp.	5

Site	12

Date	8/04/2000	**Time**	8:50
Lat (E)	373506	**Long (N)**	6446093
Depth (m)	1.8	**Visibility**	6m
Weather	Fine, sunny, 5 knot winds from NNE		
General description	Posidonia sp./algae/ sand, Sargassum sp., many sponges		

Quadrat data

Quadrat	Taxa	Relative abundance
1	barnacles on Pinna sp.	2
3	brown algae on rock	2
1	brown algae/slime	5
1	Holothuroidea	1
2	Pinna sp.	2
1	Pinna sp.	5
3	Posidonia spp.	2
2	Posidonia spp.	4
1	Posidonia spp.	2
1	red algae	2
2	red foliaceous algae	1
3	rock (10x10cm)	1
3	Sargassum sp.	1
2	Sargassum sp.	2
1	Sargassum sp.	3

Site	13

Date	8/04/2000	**Time**	9:45
Lat (E)	373992	**Long (N)**	6446373
Depth (m)	1.8	**Visibility**	5m
Weather	Fine, sunny, increasing NNE wind, 5-10 knots		
General description	Sand/shell grit bottom, Posidonia sp./algae on leaves, worm holes, Pinna		

Quadrat data

Quadrat	Taxa	Relative abundance
2	abalone on Pinna sp.	1
3	barnacles on Pinna sp.	2
2	barnacles on Pinna sp.	2
1	egg masses on Posidonia spp.	1
3	encrusting red algae on Pinna sp.	2
2	green turfing algae on Pinna sp.	2
3	large hole (?sp)	1
2	large hole (?sp)	1
1	large hole (?sp)	1
3	Pinna sp.	1
2	Pinna sp.	2
1	Posidonia spp.	5
3	Posidonia spp./algae	4
2	scallop on Pinna sp.	2
1	worm holes	3

Site	14

Date	8/04/2000	**Time**	10:25
Lat (E)	374398	**Long (N)**	6445844
Depth (m)	3.1	**Visibility**	3m
Weather	Same as 13		
General description	Silty/shelly sand, worm holes, Posidonia sp./algae, Pinna		

Quadrat data

Quadrat	Taxa	Relative abundance
2	barnacles	1
3	brown algae/slime	1
2	egg mass	1
2	gastropods on Pinna sp.	1
2	large hole (?sp)	1
3	large hole (?sp)	1
2	Pinna sp. (2)	2
2	Posidonia spp./algae	2
1	Posidonia spp./algae	4
2	red encrusting algae	1
2	red foliaceous algae	1
2	scallops	2
2	sponge on Pinna sp.	2
3	worm holes	6
1	worm holes (3)	2
2	worm holes (4)	3

Site	15

Date	8/04/2000	**Time**	11:25
Lat (E)	374156	**Long (N)**	6445864
Depth (m)	4.3	**Visibility**	3m
Weather	same as 14, becoming calmer		
General description	Sand, worm holes, sparse Posidonia sp./algae, sparse Pinna with sponges		

Quadrat data

Quadrat	Taxa	Relative abundance
2	large hole (?sp)	2
1	large hole (?sp)	1
1	Posidonia spp./algae	2
3	worm holes (10)	6
2	worm holes (9)	5
1	worm holes (9)	5

APPENDIX 2

Lincoln Cove Marina
Biological Survey Information

Presence and Abundance of Organisms on Rock Walls Near Pedestrian Bridge in Porter Bay Marina – 15/8/88

Quadrat No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Depth of quadrat top below AHD (m)	**0**	**0.64**	**1.35**	**2.06**	**2.77**	**3.48**	**4.19**	**4.9**	**5.61**	**0.67**	**1.38**	**2.09**	**2.8**	**3.51**	**4.22**	**4.93**	**5.64**
Blue-green Alga	❋																
Enteromorpha flexuosa	❋	❋								✦	❋						
Balanus amphitrites	✦	❋															
Galeolaria caespitosa	✳	✳		✳						✳	✳	✦	✳	✳			
Nemalion helminthoides											❋	✳					
Pleonosporium sp.		✦	✦	❋	❋	❋	❋	❋	❋		✳	❋	✦	✦	✳	❋	❋
Lomentaria australis			✦	✳		✳	✳				✳	✳	✳	✳	✳		
Ostrea angasi			✳	✦	✦	✳	✳	✳				✳	✦	✳	✳	✳	✳
Colpomenia peregrina			✳		✳							✳		✳			✳
Finger sponge (cream)			✳									✳					
Small clear Ascidian			✳	✳	✳	✳							✳	✳	✳	✳	
Yellow Ascidian					✳			✳	✳							✳	✳
Cladophora sp.						✳		✳	✳	❋†							
White Ascidian						✳	✦	✳							✳		
Electroma Georgiana													✳	✳			
Small red Ascidian													✳				

Abundance	Very abundant	❋
	Moderately abundant	✦
	Present only	✳
	Growing on rocks and *Enteromorpha*	†

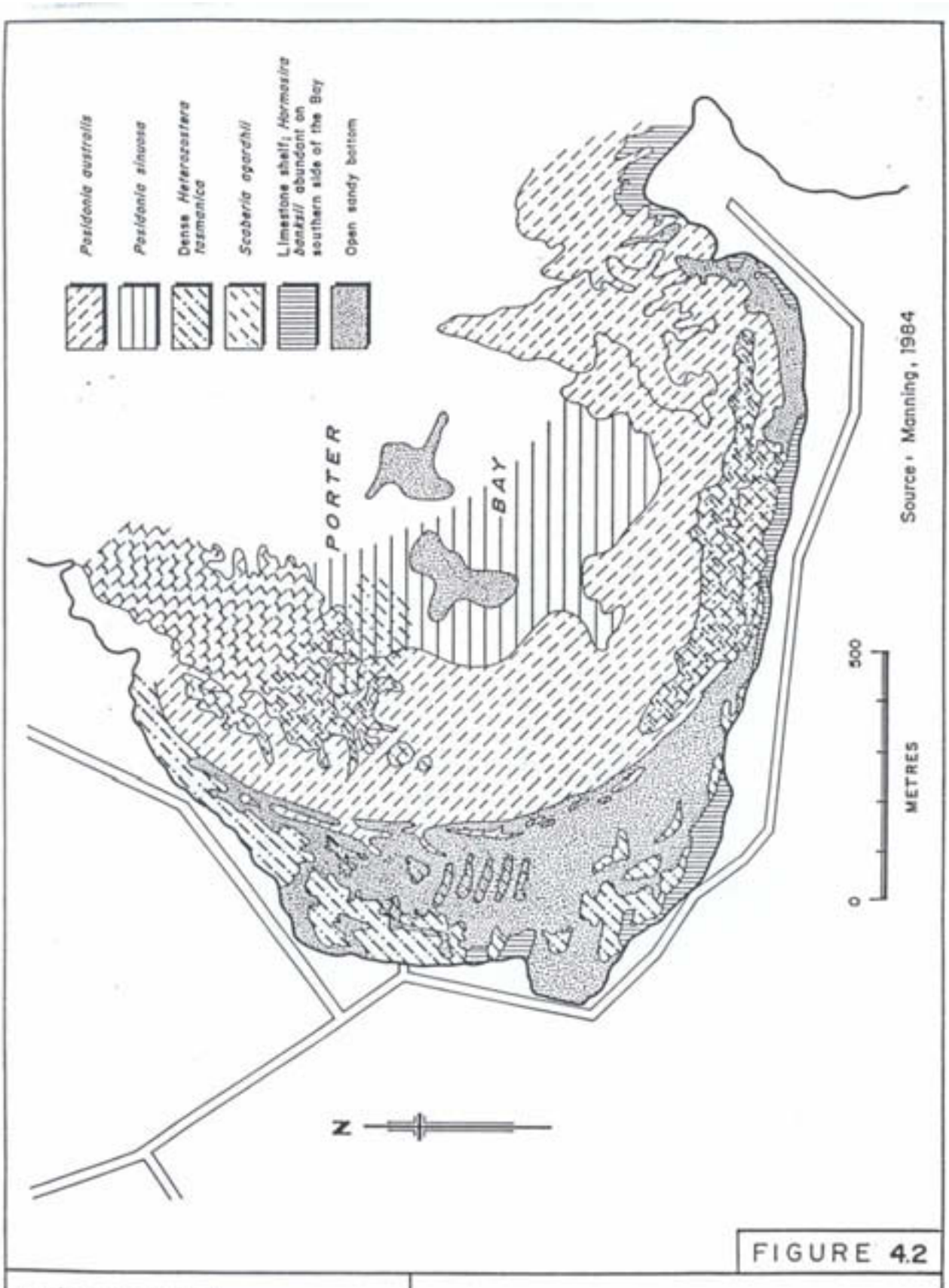


FIGURE 4.2

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

MARINE PLANT COMMUNITIES PORTER BAY - 1984

Drawn:	Approved:	Date: September 1988	Job N°: 5031	Dwg N°:

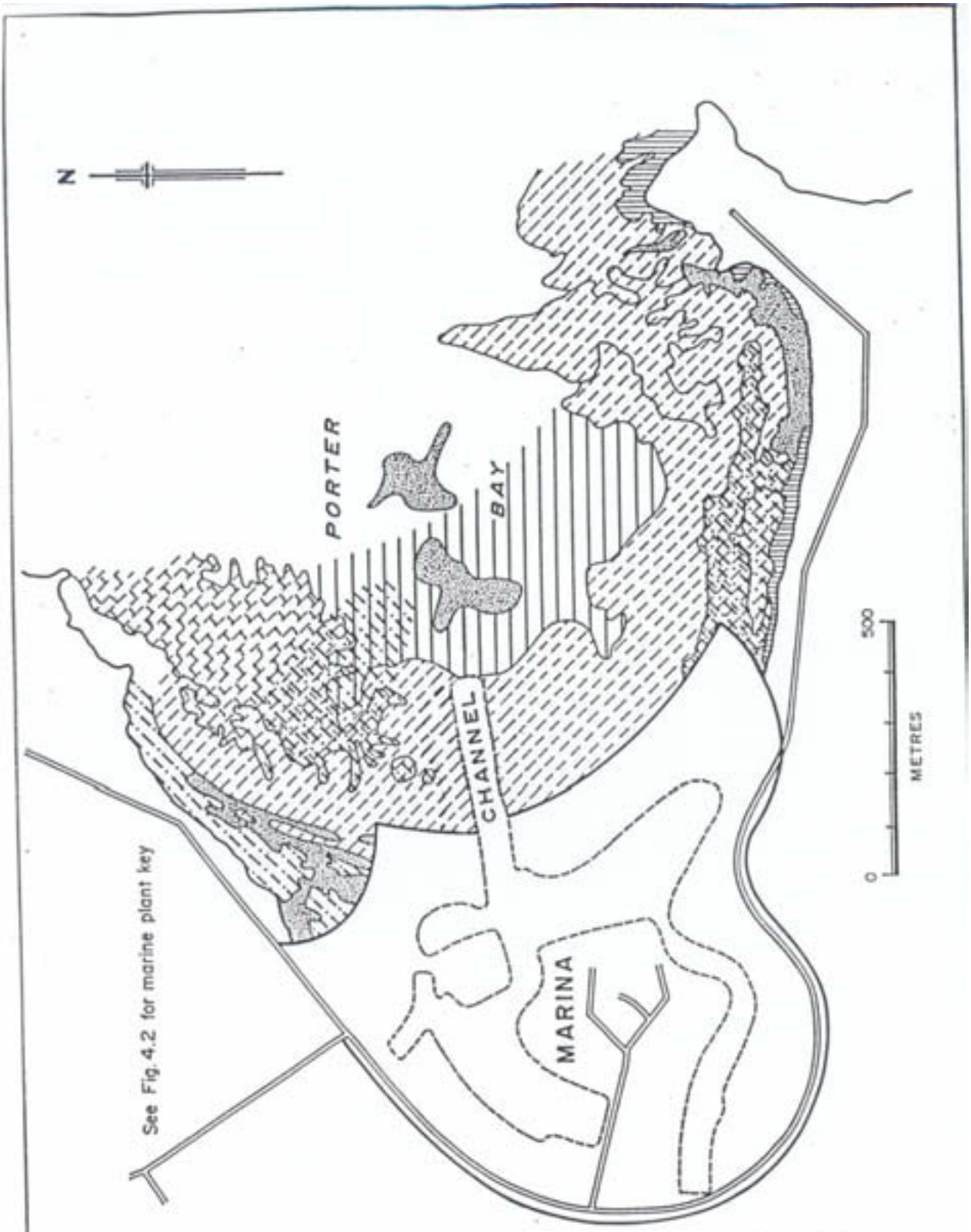


FIGURE 4.3

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

MARINE PLANT COMMUNITIES PORTER BAY - 1988

Drawn :	Approved :	Date : September 1988	Job N° 5031	Dwg N°

Biodiversity Survey

Ceduna Marina site

Peri Coleman and Faith Cook

01/02/04

LIMITATIONS STATEMENT

The sole purpose of this report and the associated services performed by Delta Environmental Consulting is to conduct an environmental assessment of the proposed Ceduna Keys site in accordance with the scope of services set out in the contract between Delta Environmental Consulting ('Delta') and Eco Management Services ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Delta derived the data in this report primarily from visual inspections, examination of records in the public domain and interviews with individuals with information about the site. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data, analysis and a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Delta has relied upon and presumed accurate certain information (or the absence thereof) relative to the site, provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, Delta has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by Delta in this report are not, and should not be considered, an opinion concerning environmental or operational liability. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions and information in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Delta and the Client. Delta accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Document history:
Draft released for comment: 30/12/2004
Final version printed (edits in avian section and typography): 01/02/2005

Table of Contents

Figures

Tables

1. Introduction

Delta Environmental Consulting was approached by Eco Management Services to conduct a range of biodiversity surveys on a site at Ceduna on the Eyre Peninsula. The site is proposed for use as a marina and residential development. The developers have already submitted a Draft Environmental Impact Statement, dated 11 August 2004 to Planning SA. Planning SA has forwarded comments about the Draft EIS to the proponents, who in turn have requested that Delta Environmental Consulting provide them with information that would enable them to respond to the comments.

The client specifically required the following tasks be undertaken to aid them in preparing a response to feed back on their draft Environmental Impact Statement:

1. Reassessing the current state of vegetation on the non-tidal (terrestrial) subject area, and describing the possible impacts of any development on this vegetation.
2. Discussing any known species that occur in the area that may trigger the EPBC Act or state legislation, and completing appropriate fauna assessments to fill in knowledge gaps to allow a detailed assessment.
3. Calculating the relative area of each terrestrial and intertidal vegetation community type that may be lost, including a description of the condition and/or health of the vegetation. The layout plan of the current proposed development would be laid over this vegetation map to support this information.
4. Assessing any risk that large birds attracted to the site may pose to the nearby airport, including an assessment of current bird usage of the site.
5. Establishing a good baseline level of data related to intertidal flora and fauna, using a repeatable methodology that will allow identification of impacts post-development. Plants and animals growing or living in the intertidal zone should be collected and identified to species level if possible. All methodologies should be documented so that the surveys could be replicated by other organizations if required.

Delta Environmental Consulting committed to undertake the following activities:

1. Assess the history of the site including past uses, clearance dates and past biodiversity.
2. Conduct a full vegetation survey using DEH standard methods and preparation of maps/overlays.
3. Calculate the potentially impacted areas, habitat types, percentages of total area and current vegetation health.
4. Conduct fauna observations, tracks & scats analysis for mammals & reptiles.
5. Conduct diurnal invertebrate sweeps & night-time light trapping of nocturnal insects.
6. Undertake point counts & observations for birds.
7. Assess which birds presently pose a risk to aircraft and whether changes as a result of the proposed development may increase strike risk.
8. Complete 20 quadrats & 20 sediment cores to quantify and identify algae and/or animals present in the intertidal zone (to species level where practicable).
9. Prepare a report summarising the results of surveys or assessments

2. Consultant

Delta Environmental Consulting is an independent South Australian consulting business. The company provides services in the areas of: biological survey work, environmental education programs, saltfield technology and saline wetland ecology, scientific illustration & desktop publishing, preparation of herbarium and museum specimens, taxonomy and classification, revegetation and rehabilitation, and computer application development.

The company is a member of Standards Australia, and its quality assurance management system has been third party certified to the international Q-base standard by NATA Certification Services International. A copy of the scope of certification is available on request.

Delta Environmental Consulting has a policy of continuous improvement in the areas of:

- providing a quality service to our clients
- providing ongoing training and educational opportunities for our consultants
- maintaining high standards in the areas of health, safety and environment both within Delta and while working with our clients

The consultants undertaking this project are detailed in *Appendix VIII - Details of Consultants*.

Water Industry Alliance

QUALITY CERTIFIED COMPANY

3. The site

3.1 Location and landform

The land being investigated is situated on a coastal floodplain on the northern outskirts of Ceduna, around the shores of Murat Bay. The land is owned largely by three organisations - the Crown, the Ceduna Regional Council and the Aboriginal Lands Trust. There are several other stakeholders, in the form of easement owners and lessees.

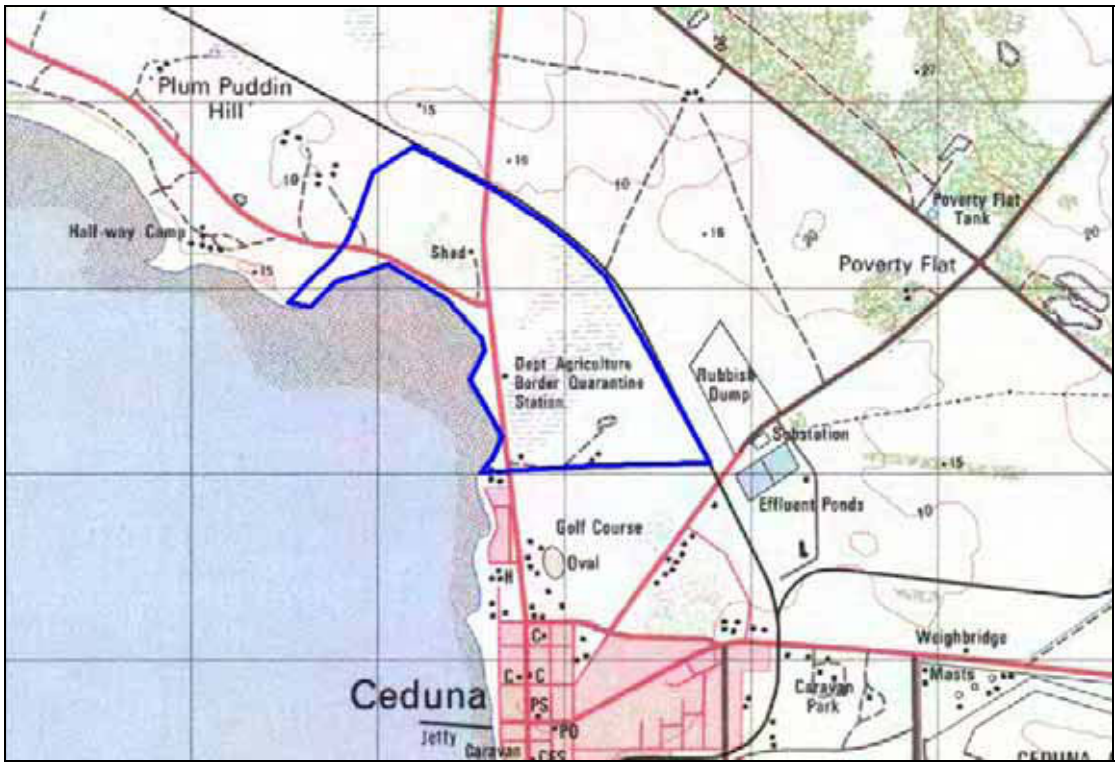


Figure 1 - Approximate boundaries of study site, outlined in blue

Historic aerial photographs of the area reveal that the land has been used for various purposes including sand mining, grazing and rubbish dumping. There has been no attempt to revegetate the site, with most trees currently present on the site pre-dating the 1950's aerial photograph. Existing published species lists for the surrounding areas were also obtained where available, as these aid in assessing the potential for species not in evidence at the time of the survey.

The photograph presented in Figure 2 is an aerial view of the land area being investigated in this survey, overlayed with the proposed development in fine black lines.

Figure 2 - Aerial photograph of the survey site (derived from provided concept plan)

The property occupies a centroid located at approximately Zone 53H 374745 E and 6446831 N (Aust Geodetic Datum 1984). The land comprises a large central stranded tidal saltmarsh surrounded by coastal dunes to the southwest and northwest and cleared farmlands on the landward boundaries of the central basin. The land shows limited signs of being filled, with the only fill sites being located near the fuel station and for rail and road reserves. The block was partially cleared prior to 1949, leaving small stands of trees and the current samphire shrub land.

The main highway was constructed prior to 1950, and the samphire swamp on the claypan was probably cut off from the tide at this time. It is likely that there may be areas of Acid Sulfate Soils within the stranded salt marsh. There will be areas of Potential Acid Sulfate Soils underlying the intertidal saltmarsh and mangrove areas. There may be areas of Potential Acid Sulfate Soils in the seagrass beds of the intertidal and subtidal areas.

The soils on the site are variable, with areas of saltmarsh clays, intertidal sediment, sodic clay and sands. The current saltpan is underlaid with a hard layer, similar to a duripan found in vernal pools, which may be a contributing factor to the continued existence of these samphires. In some locations, areas of this pan have been dug up, possibly in an attempt to drain the pan. In the pits remaining on the pan surface, numbers of sub-fossil shells are visible, including shells of the beaked mussel *Brachiodontes rostratus*, the queen scallop *Chlamys bifrons*, the anemone cone shell *Conus anemone*, and two species that may be

remnants from the last high stand of the sea - a circular cockle, possibly *Circe weedingi*, now only occurring in Gulf St Vincent and Spencer Gulf, and the mud ark or Sydney blood cockle *Anadara trapezia*, now extinct in South Australia.

Prior to clearance and road construction, this area would have resembled the nearby Davenport Creek salt marsh. Further details regarding the land use and vegetation history of the site are included in the site history section of this report.

The nearest weather station to the site (at the Ceduna Airport Meteorological Station) receives an average 300.1 mm of rain a year, with most rain occurring during in winter. Average annual maximum temperatures for the weather station are 23.3^{o}C and average summer maxima are around 28^{o}C.

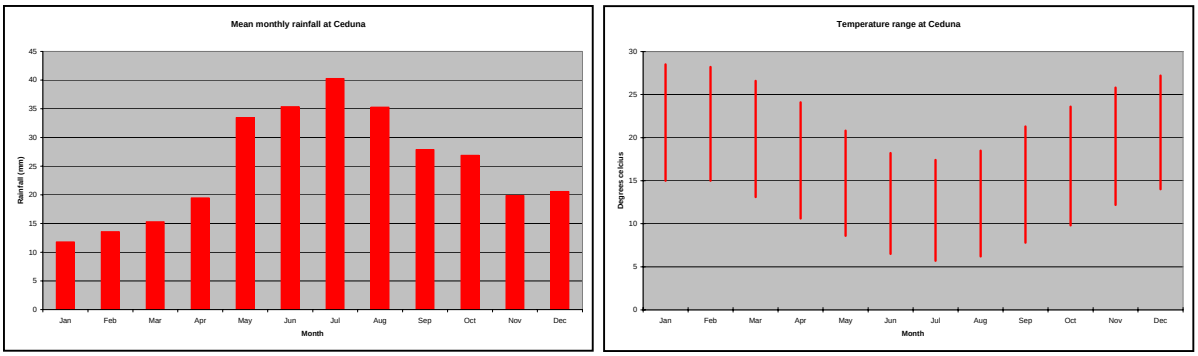


Figure 3 - Monthly rainfall and temperature averages for Ceduna

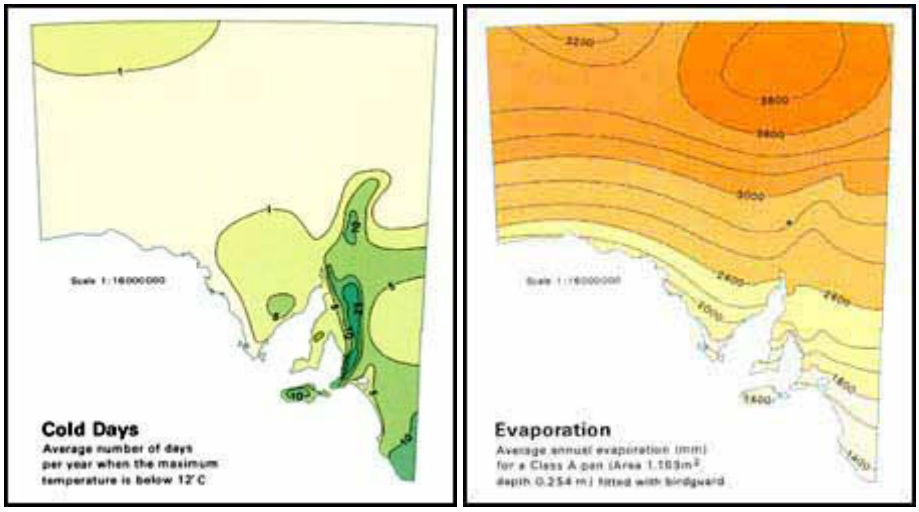


Figure 4 - Cold days and evaporation per year (BOM)

4. The terrestrial vegetation

4.1 Existing vegetation units

The site has several morphological terrestrial vegetation units that occur from the landward edge of the intertidal zone, through salt pans, dunes and cheniers. The more 'marine' of the intertidal vegetation units will be addressed in a separate section on intertidal marine vegetation, while this section only includes the more 'coastal' of the intertidal vegetation units. The unit definitions are based on McDonald *et al* (1990).

The plant associations in the surveyed morphological units are:

- **C1D:** Closed dwarf chenopod shrubland in the intertidal area, dominated by *Sarcocornia quinqueflora* and *Suaeda australis*.
- **C2M:** Mid-dense low chenopod shrubland dominated by *Halosarcia pruinosa, H. pergranulata*, and *H. halocnemoides* often with *Hemichroa diandra* as a sub-dominant.
- **C3S:** Open mid-high chenopod shrubland dominated by *Atriplex* spp., *Maireana* spp. and/or *Frankenia* spp. often with an understorey of *Hemichroa diandra*.
- **C4D:** Closed tall chenopod shrubland in the supratidal area, dominated by *Sclerostegia arbuscula.*
- **D3M:** Mid-dense tall sod grassland dominated by anthropogenic grasses.
- **F2S:** Open mid-high forbland dominated by Ward's weed interspersed with scattered chenopods (*Sclerolaena* spp.and *Salsola* kali).
- **G2S:** Open tussock grassland dominated by *Austrostipa* spp. and *Danthonia setacea*.
- **S3S:** Open mid-high shrubland on dunes and shelly ridges with *Geijera linearifolia, Olearia* spp., *Acacia* spp. and *Pittosporum phylliraeiodes*. Isolated tall shrubs may occur in patches.
- **S3V:** Sparse mid-high shrubland dominated by *Olearia* spp., *Geijera linearifolia, Maireana* and *Cratystylis conocephala*.
- **S41:** Isolated tall shrubs, usually *Melaleuca* spp. or *Acacia* spp.
- **S4D:** Closed coastal dune tall shrubland dominated by *Nitraria billardierei, Atriplex vesicaria* and *Cakile maritima*.
- **T4V:** Open low mangrove woodland in the intertidal area (*Avicennia marina*) with a poor understorey except where the woodland is prograding across the neighbouring low chenopod shrubbery.
- **Y4L:** Isolated clumps of tall mallee shrub or other tall shrubs, usually *Eucalyptus gracilis, Eucalyptus calcareana* or *Melaleuca* spp.

A supervised classification of the various plant associations shown in the 1995 aerial photography is provided in Figure 5, and an A3 sized version is attached to this document in *Appendix 1 – Vegetation associations*. Aerial photographs from 1995 were used in place of more recent data because of their clarity, and the season of the year these images were taken.

Figure 5 - Terrestrial vegetation associations

Habitat code	% of site	Area covered (Hectares)
C1D: Closed dwarf chenopod shrubland (intertidal)	1.3	2.4
C2M: Mid-dense low chenopod shrubland (extratidal)	19.1	34.5
C3S: Open mid-high chenopod shrubland (extratidal)	11.2	20.1
C4D: Closed tall chenopod shrubland (supratidal)	0.4	0.6
D3M: Mid-dense tall sod grassland	6.6	12.0
F2S: Open mid-high forbland	3.1	5.6
G2S: Open tussock grassland	11.2	20.3
S3S: Open mid-high shrubland (dunes, berms)	8.4	15.1
S3V: Sparse mid-high shrubland (dunes, ridges)	4.2	7.5
S41: Isolated tall shrubs	3.9	7.1
S4D: Closed coastal dune tall shrubland (primary dune)	2.5	4.4
T4V: Open low mangrove woodland (intertidal)	0.9	1.6
Y4L: Isolated clumps of tall mallee shrub or other tall shrubs	2.0	3.6
Bare soil	23.9	43.0
Rocky reef	1.5	2.7
Total	100.0	180.4

Table 1 - Percentage cover of each habitat type

Studies by Young (1988) broke the vegetation of the coastal strip along this stretch of the South Australian coast into three broader categories:

- Beach/dune vegetation – cover includes species such as *Olearia axillaris, Nitraria billardierei, Spinifex seriaceus* and other salt-tolerant species.
- Coastal heath vegetation – cover includes *Alyxia buxifolia, Melaleuca lanceolata, Beyeria lechenaultii*, on soils varying from calcareous sands to thin sands overlying calcarenite.
- Sub-coastal scrub – *Melaleuca lanceolata* (coastwards) and *Melaleuca pauperiflora* (inland) with occasional *Eucalyptus oleosa* (*E. gracilis, E. yalatensis, E. calcareana*) and an understorey of *Atriplex paludosa* (coastwards) or *Atriplex vesicaria* (inland).

The study site contains all three of Young's habitats, plus the area of stranded salt marsh.

4.1.1 Impact area

Table 1 detailed the existing percentages and areas of the site covered by each habitat type. The direct impact area of the proposed development, shown below, covers 81% of the site, with no area of the study site being more than 200m from the direct impact site. Those habitats occurring inside the outline are likely to be extirpated completely by residential development or the development of waterways. Those habitats occurring outside the outline may not be immediately impacted, but may be ultimately impacted by weed incursion (terrestrial habitats) or by hydrological/sedimentary process change (intertidal and supratidal habitats).

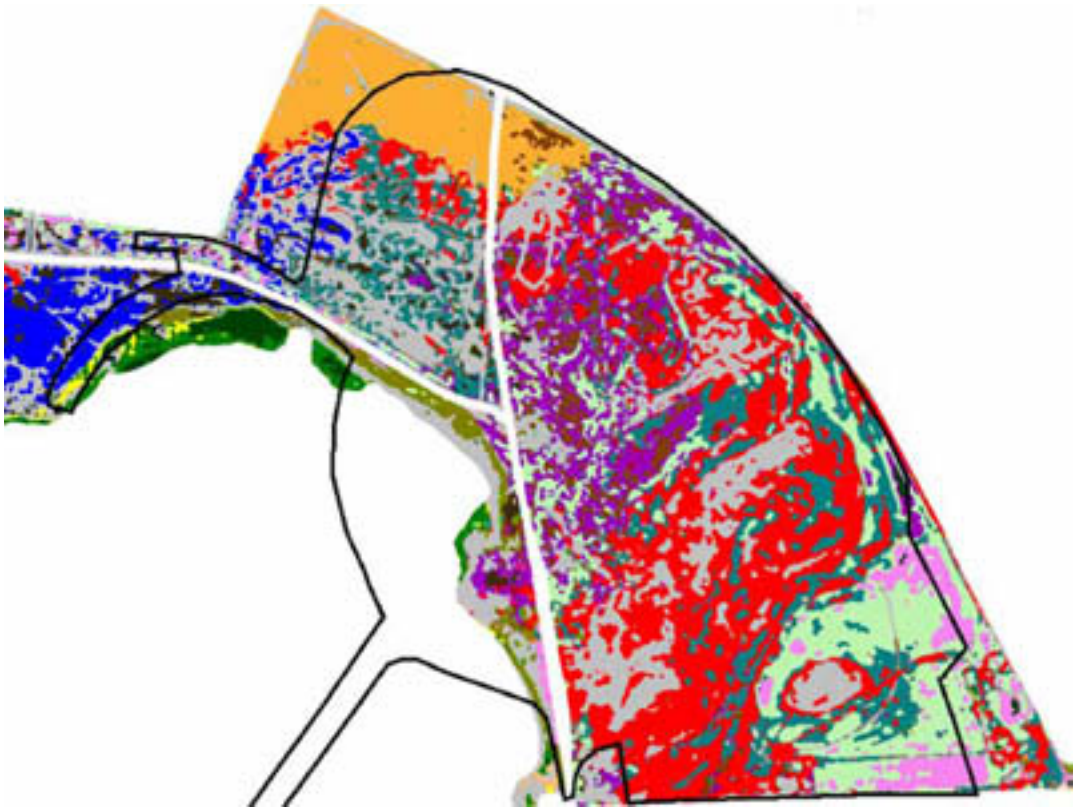


Figure 6 - Approximate impact zone

4.2 Plant species recorded during survey

The survey was conducted by gathering vouchers of each new plant species found on the site, as it was first encountered in a sampling quadrat. Sampling quadrats were reasonably large, being roughly circular, with radii of 30m from the GPS location for each quadrat. Sufficient sampling quadrats were used to ensure representation of all vegetation units occurring on the body of the site. Graphs of new species found at each site (total species and indigenous species) show the reduction in new species encountered at new sample locations as sampling progressed, with occasional increases as new vegetation units were encountered.

At each selected location a GPS was used to record the location (accurate to approximately 5m), the vegetation association was noted (see Table 2), and the quadrat was searched for plants not recorded previously. As a precaution where similar species are difficult to determine in the field, some vouchers were replicates.

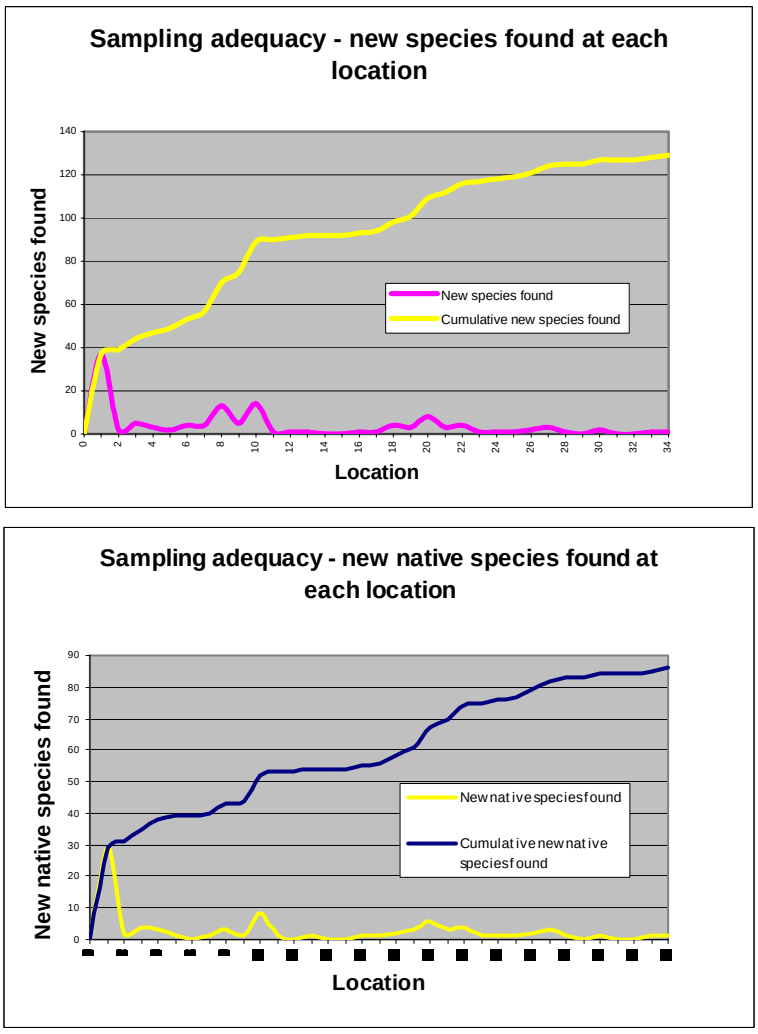


Figure 7 - Adequacy of sampling effort

Figure 8 - Locations sampled during the survey (aerial photography from Mapland, 2003)

At each sampling location a description of the habitat type was recorded, to allow ground-truthing and supervision of the geographic information system's image classification analysis.

One hundred and fifty-one (151) vouchers pairs were collected for later identification. All vouchers were dried, then one of each voucher pair was sent to the Herbarium as required under the collection license (*Appendix 2 – Collection permit*), and the other was retained, to be provided to the client for reference purposes. A list of all vouchers and the locations they were collected from is appended to this document in *Appendix 3 – Flora voucher specimens*.

There were eighty-six (86) indigenous species and forty-three (43) alien species, one hundred and twenty-nine (129) species in all, encountered and collected during the site visit.

Details of the locations sampled, illustrated earlier in Figure 8, are provided along with their co-ordinates and voucher specimen numbers in *Appendix 3*.

Location	Description
1	Limestone cliff/ridge with sand dune. Tall shrubs - *Pittosporum* & *Melaleuca*, low shrubs - *Geijera*, Bladder saltbush, herbaceous understorey
2	Dunes. Taller mallees in small groups, site dominated by bluebush daisy and *Geijera*.
3	Dense band of *Nitraria* backing a sandy beach with a seaward rim of mangroves.
4	Dominant species - Bladder saltbush, *Nitraria*, variable groundsel, *Frankenia*.
5	Sandy chenier on landward side of track, *Sclerostegia* shrubland on seaward side of track.
6	Chenier dominated by *Nitraria*, devolving to a *Sclerostegia* shrubland closer to the sea, then a band of *Sarcocornia*, then mangroves.
7	Weedy roadside vegetation dominated by *Limonium*.
8	Weedy chenier/dune dominated by *Nitraria* near the beach, *Limonium* and *Gazania* nearer the road.
9	Large dune. Mallees with an understorey of *Rhagodia* & *Halosarcia*.
10	Herb and tussock grassland dominated by Ward's weed, Linclon weed, spent *Stipa* and *Danthonia*.
11	Saltpan with cyanobacterial polygons impregnated with gypsum and salt. Dominated by *Halosarcia pergranulata* and *H. pruinosa*.
12	Sodic erodible ridge on surface of saltpan. Mosses dominate.
13	Small dune ridge on surface of saltpan. Dominated by *Frankenia sessilis*.
14	Small dune ridges on surface of saltpan. Dominated by *Frankenia, Maireana* and *Halosarcia*.
15	Patch of *Halosarcia halocnemoides* on the saltpan.
16	Dune ridge on the landward edge of the saltpan. Quadrat dominated by tussock grasses, *Sclerolaena* and *Lycium australe*
17	Dune ridge on the landward edge of the saltpan. Quadrat dominated by Bladder saltbush, *Myoporum, Scaevola* and tussock grasses.
18	Chenier/dune dominated by *Austrostipa*, Bladder saltbush, *Hemichroa, Silene* and *Exocarpos*.
19	Slope dominated by Bladder saltbush on its lower reaches, upper slope dominated by *Stipa*, Ward's weed, *Sclerolaena* & *Salsola*. Crest - *Danthonia*
20	Crest of sandpit and pit itself. Many *Westringia rigida* bushes and some *Kippistia* growing in patches, occasional *Acacia*, herbs.
21	Base of slope near the saltpan. Tussock grasses and single *Allocasuarina*, some balls of foliose lichen.
22	Dune slope. Tussock grassland to small herbland. Scattered shrubs of *Nitraria* and *Zygophyllum*. Scattered *Melaleuca*, mallees and *Pittosporum*.
23	Small shell ridge dominated by *Geijera, Pittosporum* and *Hemichroa*.
24	Dissected saltmarsh dominated by *Halosarcia, Hemichroa* and *Lawrencia*.
25	Shell ridge dominated by Bladder saltbush & *Frankenia*, with an understorey of *Carpobrotus* and occasional clumps of *Austrostipa elegantissima*.
26	Shell ridge dominated by *Hemichroa, Olearia* & *Senna,* with patches of *Melaleuca, Exocarpos* and *Acacia*
27	Sandy slope dominated by *Myoporum, Santalum* and *Acacia* with very large clumps of *Dianella revoluta*.
28	Sandy area with large *Melaleuca* and *Acacia* shrubs, young *Pittosporum* and clumps of *Rhagodia*.
29	Swale along a drainage line, dominated by *Hemichroa* and *Sclerostegia*.
30	Old dump area. Dominated by *Mesembryanthemum*
31	Slope. Single mallee in grassland.
32	Mallee scrub with Bladder saltbush and *Frankenia*
33	Dune with mallees, old *Melaleuca* trees & *Eremophila*
34	Dune with mallees, *Hakea* and *Santalum*.

Table 2 - Details of sampling quadrats

Family	*Species*	Common name	Exotic	Conservation status
Agavaceae	*Agave americana*	Century plant	*	
Aizoaceae	*Carpobrotus rossii*	Karkalla or Ross' noonflower		
Aizoaceae	*Disphyma crassifolium*	Round leaf pigface		
Aizoaceae	*Galenia secunda*	Blanket weed	*	
Aizoaceae	*Mesembryanthemum aitonis*	Angled iceplant	*	
Aizoaceae	*Mesembryanthemum nodosum*	Slender iceplant	*	
Aizoaceae	*Mesembryanthum crystallinum*	Common iceplant	*	
Aizoaceae	*Tetragonia implexicoma*	Bower spinach		
Amaranthaceae	*Hemichroa diandra*	Mallee hemichroa		
Amaranthaceae	*Ptilotus obovatus* var *obovatus*	Silver mulla mulla		
Avicenniaceae	*Avicennia marina*	Grey mangrove		
Boraginaceae	*Heliotropium europaeum*	Potato weed	*	
Caryophyllaceae	*Silene gallica*	French catchfly	*	
Caryophyllaceae	*Silene nocturna*	Mediterranean catchfly	*	
Caryophyllaceae	*Spergularia marina*	Salt sand-spurry	*	
Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak		
Chenopodiaceae	*Atriplex acutibractea*	A saltbush		
Chenopodiaceae	*Atriplex cinerea*	Coast saltbush		
Chenopodiaceae	*Atriplex paludosa* ssp. *cordata*	Marsh saltbush		
Chenopodiaceae	*Atriplex vesicaria*	Bladder saltbush		
Chenopodiaceae	*Atriplex vesicaria* var *variablis*	Bladder saltbush		
Chenopodiaceae	*Beta vulgaris*	Beet	*	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush		
Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
Chenopodiaceae	*Halosarcia pergranulata* var *pergranulata*	Black seed samphire		
Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
Chenopodiaceae	*Maireana appressa/radiata*	A cotton bush with no fruit		
Chenopodiaceae	*Maireana brevifolia*	Small-leaved bluebush		
Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
Chenopodiaceae	*Maireana erioclada/pentatropis*	A maireana with no fruit		
Chenopodiaceae	*Maireana oppositifolia*	Heathy bluebush		
Chenopodiaceae	*Maireana scleroptera*	A maireana		
Chenopodiaceae	*Maireana trichoptera*	A bluebush		
Chenopodiaceae	*Rhagodia candolleana*	Seaberry saltbush		
Chenopodiaceae	*Rhagodia crassifolia*	Fleshy saltbush		
Chenopodiaceae	*Salsola kali*	Buckbush rolypoly	*	
Chenopodiaceae	*Sarcoconia quinqueflora*	Bearded glasswort		
Chenopodiaceae	*Sclerolaena brevifolia* poss. hybrid with *S. obliquicuspis*	A copperburr or bindyii		
Chenopodiaceae	*Sclerolaena uniflora*	Bassia		

Family	*Species*	Common name	Exotic	Conservation status
Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
Chenopodiaceae	*Suaeda australis*	Austral sea-blite		
Chenopodiaceae	*Threlkeldia diffusa*	Coast bone fruit		
Compositae	*Angianthus tomentosus*	Hairy cup flower		
Compositae	*Arctotheca calendula*	Cape weed	*	
Compositae	*Centaurea melitensis*	Maltese cockspur	*	
Compositae	*Conyza bonariensis*	Flaxleaf fleabane	*	
Compositae	*Cratystylis conocephala*	Bluebush daisy		
Compositae	*Gazania linearis*	Gazania	*	
Compositae	*Hedypnois rhagadioloides*	Cretan weed	*	
Compositae	*Helianthus annuus*	Common sunflower	*	
Compositae	*Ixiolaena pluriseta*	A plover daisy		Rare in SA, Unknown for EP
Compositae	*Kippistia suaedifolia*	Kippistia		Rare in EP
Compositae	*Olearia axillaris*	Coast daisy bush		
Compositae	*Olearia exiguifolia*	Small-leaved daisy-bush		
Compositae	*Reichardia tingitana*	False sow thistle	*	
Compositae	*Senecio lautus*	Variable groundsel		
Compositae	*Sonchus oleraceus*	Common sow thistle	*	
Compositae	*Vittadinia cervicularis*	Fuzzweed		
Compositae	*Vittadinia cuneata*	Fuzzweed		
Compositae	*Vittadinia eremaea*	A vittadinia		
Crassulaceae	*Crassula sieberana* var *tetramera*	Austral stonecrop		
Cruciferae	*Brassica tournefortii*	Long fruited wild turnip	*	
Cruciferae	*Cakile maritima*	Sea rocket	*	
Cruciferae	*Carrichtera annua*	Ward's weed or duck-bill burr	*	
Cruciferae	*Diplotaxis tenuifolia*	Lincoln weed	*	
Epacridaceae	*Acrotriche patula*	Shiny ground berry		
Euphorbiaceae	*Euphorbia terracina*	Carnation weed, false caper	*	
Frankeniaceae	*Frankenia pauciflora*	Sea heath		
Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
Gentianaceae	*Centaurium tenuiflorum*	A centaury		
Goodeniaceae	*Scaevola spinescens*	Spiny fanflower		
Gramineae	*Austrostipa drummondii*	Cottony speargrass		
Gramineae	*Austrostipa elegantissima*	Feather speargrass		
Gramineae	*Austrostipa eremophila*	Desert spear-grass		
Gramineae	*Austrostipa flavescens*	A spear-grass		
Gramineae	*Avena barbata*	Bearded oat	*	
Gramineae	*Bromus catharticus*	Prairie grass	*	

Family	*Species*	Common name	Exotic	Conservation status
Gramineae	*Bromus rigidus*	Rigid brome	*	
Gramineae	*Critesion murinum*	Barley grass	*	
Gramineae	*Cynodon dactylon*	Couch grass		
Gramineae	*Danthonia setacea* var *setacea*	Bristly, or small flowered, or mulga wallaby grass		
Gramineae	*Festuca littoralis*	Coastal fescue		
Gramineae	*Lolium perenne*	Perennial ryegrass	*	
Gramineae	*Parafolis incurva*	Curly rye	*	
Gramineae	*Polypogon monspeliensis*	Annual beard-grass	*	
Gramineae	*Tribolium acutiflora*	Desmazeria	*	
Iridaceae	*Gynandriris setifolia*	Thread Iris	*	
Iridaceae	*Romulea minutiflora*	Guildford grass	*	
Labiatae	*Marrubium vulgare*	Horehound	*	
Labiatae	*Westringia rigida*	Stiff westringia		
Leguminosae	*Acacia anceps*	Port Lincoln wattle		
Leguminosae	*Acacia cyclops*	Western coastal wattle		
Leguminosae	*Acacia hakeoides*	Hakea wattle		
Leguminosae	*Medicago polymorpha*	Burr medic	*	
Leguminosae	*Senna artemesiodes*	Desert cassia		
Leguminosae	*Templetonia retusa*	Cockie's tongue		
Liliaceae	*Asphodelus fistulosus*	Onion weed	*	
Liliaceae	*Dianella brevicaulis*	Short fruited black anther flax-lily		
Liliaceae	*Dianella revoluta*	Black anther flax lily		
Liliaceae	*Lomandra collina*	Fibrous mat-rush		
Liliaceae	*Thysanotus baueri*	Mallee fringe lily		
Limoniaceae	*Limonium companyonis*	Sea lavender	*	
Limoniaceae	*Limonium sinuatum*	Notch leaved perennial sea lavender	*	
Loranthaceae	*Amyema melaleucae*	A mistletoe		
Malvaceae	*Lawrencia squamata*	Thorny lawrencia		
Myoporaceae	*Eremophila glabra*	Tar bush		
Myoporaceae	*Eremophila weldii*	Purple emubush		
Myoporaceae	*Myoporum brevipes*	Warty myoporum		
Myoporaceae	*Myoporum insulare*	Boobialla		
Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
Myrtaceae	*Eucalyptus gracilis*	White mallee		
Myrtaceae	*Eucalyptus stoatei*	Scarlet pear gum		
Myrtaceae	*Melaleuca lanceolata*	Moonah		
Myrtaceae	*Melaleuca pauperiflora*	Boree		
Pittosporaceae	*Pittosporum phylliraeoides*	Native apricot		

Family	*Species*	Common name	Exotic	Conservation status
Primulaceae	*Anagallis arvensis*	Blue flowered pimpernel	*	
Proteaceae	*Hakea rugosa*	Dwarf hakea		
Rutaceae	*Geijera linearifolia*	Sheepbush, oil bush or wilga		
Santalaceae	*Exocarpos aphyllus*	Leafless cherry		
Santalaceae	*Santalum acuminatum*	Quandong		
Sapindaceae	*Dodonaea stenozyga*	Desert hopbush		
Solanaceae	*Lycium australe*	Australian boxthorn		
Solanaceae	*Lycium ferocissimum*	African boxthorn	*	
Solanaceae	*Solanum hystrix*	Afghan thistle		
Umbelliferae	*Bupleurum semicompositum*	Bupleurum	*	
Umbelliferae	*Foeniculum vulgare*	Fennel	*	
Zygophyllaceae	*Nitraria billardierei*	Dillon berry or nitre bush		
Zygophyllaceae	*Zygophyllum aurantiacum*	Shrubby twinleaf		
Zygophyllaceae	*Zygophyllum billardierei*	Coast twinleaf		

Table 3 - Species list of plants occurring on the site

Statistics	
Total species	129
Species exotic to Australia	43
Australian indigenous species	86
Eyre Peninsula indigenous species	84
Exotics as percentage of biodiversity	35%
Species of conservation significance	2

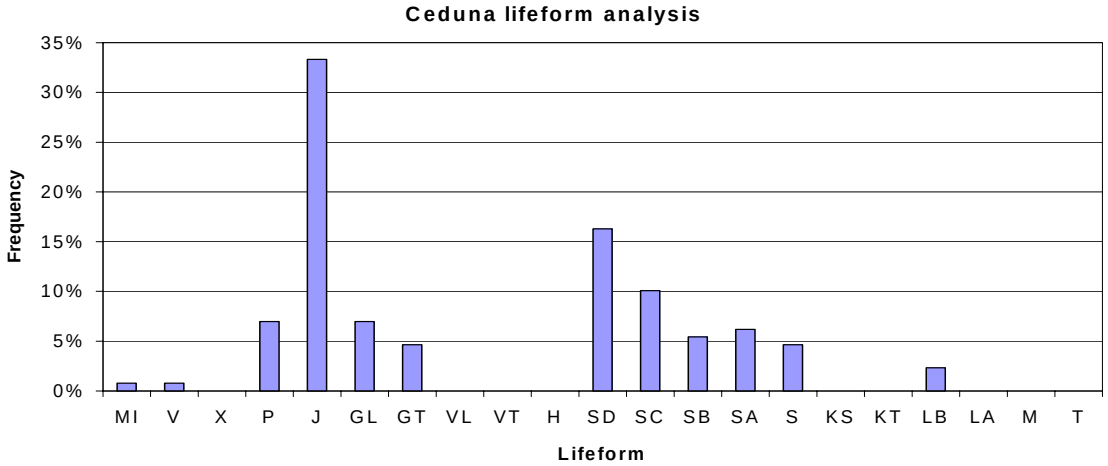
Table 4 - Biodiversity information

No single survey can capture all species found on a site, and this survey was conducted in late spring / early summer, so it may under-represent the winter and spring flowering annuals, orchids and some of the more ephemeral grasses. However the survey would adequately confirm the presence of perennials and the later flowering annuals. In order to address any shortcomings of this survey, a comparison was made between the species found in this survey and those found in surveys of nearby areas, or those conducted previously on the site.

The first quadrat of this survey was located on a cliff top area on the western extremity of the study site. It was a similar quadrat to those reported by Oppermann (1999) in *A Biological Survey of the South Australian Coastal Dune and Clifftop Vegetation*, making it useful site for comparative purposes. There were thirty-seven (37) distinct species found in this quadrat, of which eight (8) were exotic species. Oppermann records that the median number of species for clifftop locations in Eyre Peninsula West is twenty (20), with a maximum of forty (40) and a minimum of five (5). Similar statistics for the next region westward (Head of Bight) are lower, with the median number of species being thirteen (13), the maximum twenty-two (22) and the minimum three (3). From this comparison, it would appear that quadrat 1 represents the higher end of biodiversity for clifftop sites in the region.

Figure 9 - Silver mulla mulla on the site

Oppermann (1999) conducted lifeform analyses along the coastline, using amalgamated data for all sites in each region. Such analysis may be presented as frequency (percentage of species present) or abundance (area of cover) data and Oppermann presented both. The current survey only produced frequency data, so this is all that may be compared. All species located on the study site were classified according to their lifeform, and the frequency



graphed.

Note: MI: Mistletoes, V: Vines and twiners, X: Ferns, P: Mat plants, J: Herbaceous plants, GL: Grasses <0.5m, GT: Grasses >0.5m, VL: Sedges <0.5m, VT: Sedges >0.5m, H: Hummock grass, SD: Shrubs<0.5m, SC: Shrubs 0.5-1m, SB: Shrubs 1-1.5m, SA: Shrubs 1.5-2m, S: Shrubs >2m, KS: Low mallee <3m, KT: Mallee >3m, LB: Trees <5m, LA: Trees 5-10m, M: Trees 10-30m, T: Trees >30m

Figure 10 - Lifeform analysis of the Ceduna site

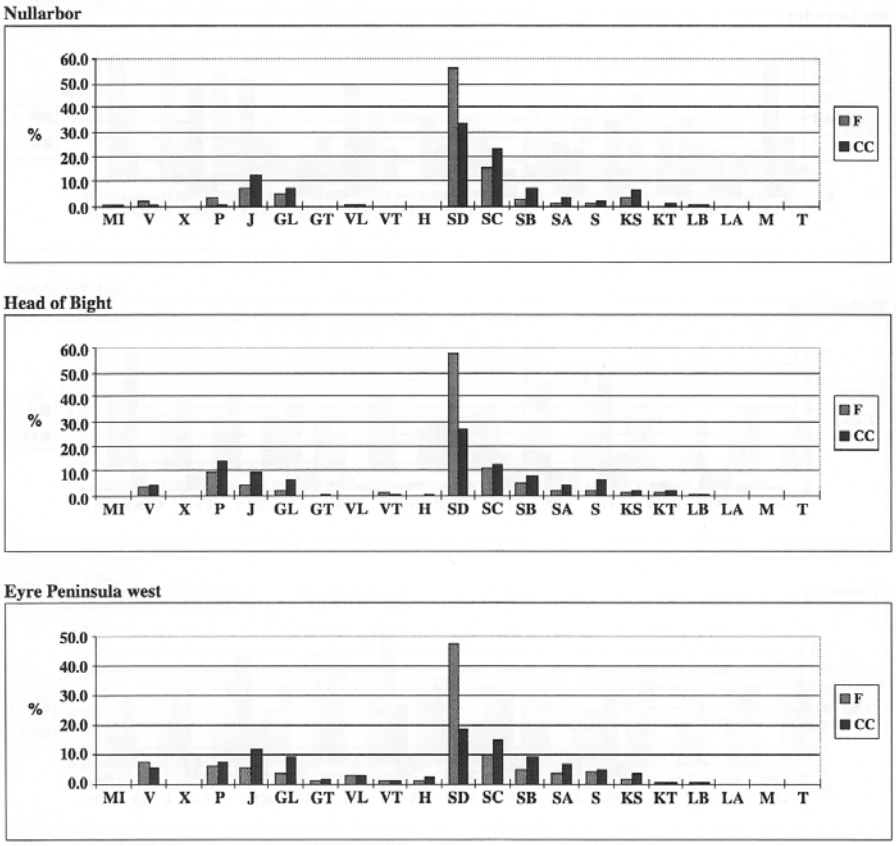


Figure 11 - Lifeform analyses, Eyre Peninsula West to Nullabor (Oppermann, 1999)

In all three of Oppermann's graphs, the dominant lifefoms are the low shrubs, followed by the taller shrubs, forbs, grasses and mat plants. The current survey site contains a much larger percentage of forbs than Oppermann's sites, however the overall lifeform classes and relative distributions are similar to her findings, with a complete lack of large trees, and a paucity of sedges, hummock grasses and ferns, and with the dwarf shrubbery providing the larger variety than the taller shrubbery. The difference may be explained by Oppermann mainly reporting perennial species, which would have resulted in an under representation in her graphs of annuals – these would have occurred largely in the forbs, mat plants and grasses classes.

The comparison above suggests that the site is relatively representative of the vegetation that is normally found in similar sites of the region, even though some of the site has been grazed extensively in the past.

Much of the published data for the coastal zone vegetation of the West Coast concentrates on dune and cliff top vegetation. Salt marsh vegetation is largely unstudied. Unpublished data is available on request from the Department for Environment and Heritage. Departmental staff (Fotheringham, pers.comm.) have recorded plants found in salt marsh areas at Laura Bay, Tourville Bay, Acraman Creek and Cape Missiessy. Thirteen individual site records are available for the four sites and the table below is a compilation of the species recorded across all the sites.

Species	Common name	Distribution
*Bupleurum semicompositum	Hare's Ear	<5%
*Hymenolobus procumbens	Oval Purse	sparsely present
*Parapholis incurve	Curly Ryegrass	<5%
Spergularia diandra	Lesser Sand-spurrey	sparsely present
Atriplex paludosa ssp. cordata	Marsh Saltbush	5-25%
Calandrinia eremaea	Dryland Purslane	sparsely present
Carpobrotus rossi	Native Pigface	<5%
Crassula sieberiana ssp. tetramera	Australian Stonecrop	<5%
Disphyma crassifolium	Round-leaf Pigface	<5%
Frankenia pauciflora var. fruticulosa	Southern Sea-heath	<5%
Frankenia sessilis	Small-leaf Sea-heath	sparsely present
Geijera linearifolia	Sheep Bush	sparsely present
Halosarcia flabelliformis	Bead Samphire	5-25%
Halosarcia halocnemoides	Grey Samphire	5-25%
Halosarcia indica ssp. leiostachya	Brown-head Samphire	25-50%
Hemichroa diandra	Mallee Hemichroa	<5%
Lawrencia squamata	Thorny Lawrencia	5-25%
Maireana oppositifolia	Salt Bluebush	5-25%
Nitraria billardierei	Nitre-bush	sparsely present
Poa fax	Scaly Poa	sparsely present
Rhagodia candolleana	Sea-berry Saltbush	sparsely present
Samolus repens	Creeping Brookweed	sparsely present
Sarcocornia blackiana	Thick-head Samphire	sparsely present
Sarcocornia quinqueflora	Beaded Samphire	5-25%
Sclerostegia arbuscula	Shrubby Samphire	>75%
Senecio glossanthus	Annual Groundsel	sparsely present
Senecio lautus	Variable Groundsel	<5%
Stipa drummondii	Cottony Spear-grass	sparsely present
Suaeda australis	Austral Seablite	5-25%
Threlkeldia diffusa	Coast Bonefruit	sparsely present
Triglochin sp.	Arrowgrass/Water-ribbons	<5%
Wilsonia humilis var. humilis	Silky Wilsonia	sparsely present
Zygophyllum billardierei	Coast Twinleaf	<5%

Table 5 - West Coast intertidal salt marsh species (DEH data, Fotheringham, 2004)

When compared to the salt marsh species found in the current survey, 64% of the species recorded on the Department's regional list were present on the Ceduna study site. Of the twelve species that were not recorded, the majority were specialist plants that would be expected only in specific habitats. For example, *Samolus repens*, *Sarcocornia blackiana* and some *Triglochin* species are found where there is an input of fresh or brackish waters, while *Halosarcia flabelliformis* has very specific soil and hydrological requirements that are not yet completely understood.

4.3 Conservation status of indigenous flora species

Conservation significance of plants occurring on the study site was determined at a regional level using Department for Environment and Heritage (2002), at a State level using the *National Parks and Wildlife Act 1972 of South Australia*, Schedules 7-9, and at a National level using Briggs and Leigh (1996). The latter document forms the basis for listing plants under the Federal *Environment Protection and Biodiversity Conservation Act 1999 of Australia*.

Two species present on the study site, *Ixiolaena pluriseta* and *Kippistia suaedifolia*, have conservation ratings.

Ixiolaena pluriseta (a plover daisy) has a rating of Rare for the State, and a status of Unknown for the Eyre Peninsula. According to Jessop and Toelken (1986) this species has only been collected from Smoky Bay to Fowler Bay, on the Nuyts Archipelago and one specimen from Nullabor Homestead. The plant is found principally on the calcareous sands of low coastal cliffs and the adjacent dunes. The specimens found in this survey were recorded in sampling quadrat 1, on sands overlying a low rocky clifftop.

Kippistia suaedifolia (fleshy miniura) has a rating of Rare for the Eyre Peninsula. It prefers to grow on sandhills, claypans, limestone and gypsum, and was recorded during this survey in quadrat 20, on the crest of the sandpit and within the pit itself.

Previous surveys (EMS, 2004) reported several other species with conservation significance or interest. *Maireana aphylla*, with conservation interest due to its status of Uncommon on the Eyre Peninsula, was not recorded during this survey, although seven other species of *Maireana* were found. The EMS survey noted that these plants were mainly located in the golf course roughs, and this more recent survey did not visit the golf course.

Figure 12 - Hemichroa diandra in a swale on Allotment 22

Trailing hemichroa (*Hemichroa pentandra*) with a rating of Rare for the Eyre Peninsula was not recorded in this survey, although its close relative *Hemichroa diandra* was a co-dominant in many of the quadrats surveyed. The EMS survey noted that the plants were not flowering during their survey. As the two species can be separated most reliably by examining the anthers of the flowers, it is possible that the earlier records were an estimate of the species, rather than a determination.

Under the *Native Vegetation Act 1991*, the District Council of Ceduna is not exempt from the operation of the Act. Therefore clearance of native vegetation requires a permit. While the Act does not apply to any planted specimens on the block, it does apply to natural regeneration that is older than five years, and also applies to plants that form a wetland habitat, as well as to species listed as rare, vulnerable or endangered in the Schedules of the *National Parks and Wildlife Act 1972*. The *National Parks and Wildlife Act 1972* would provide separate protection for *Ixiolaena pluriseta* should that species be found to occur on any land that is not freehold.

The *Environment Protection and Biodiversity Conservation Act 1999 of Australia* includes no South Australian ecological communities at present. Regionally, tussock grasslands are considered to be Threatened on the Eyre Peninsula (DEH, 2002).

Thirty-five percent (35%) of the species found on the site were weed species. This is a low infestation of weeds in comparison to metropolitan coastal sites, which typically average sixty-five percent (65%) exotics as a percentage of biodiversity. Many of the weeds were present in the dunal areas, while the salt marsh areas (dominated by samphires) tended to have a lower percentage of exotics. This is usual, and surveys of other salt marsh areas in the vicinity (see Table 5) suggest that in salt marsh areas the weed infestation is likely to be around twelve percent (12%) of the biodiversity.

Acacia cyclops (the western coastal wattle) tends to provoke debate on whether its status is indigenous or a regional weed. The Biodiversity Plan for Eyre Peninsula states that this species has “a strong western distribution becoming more dominant to the west.”

Another regional aberration was the presence of *Eucalyptus stoatei* (Scarlet pear gum) in the sand pit. This species of marlock has a very restricted distribution east and north-east of Ravensthorpe in Western Australia. The tree was quite possibly planted in its current location.

4.4 Vegetation history

Aerial photography of parts of the site is available from 1950 through to the present. This allows for some examination of the age of some of the mallees and larger shrubs on the site.

Figure 13 reveals that many of the shrubs along the western edge of the coastal strip north of the existing service station have been in existence for at least fifty years. The large dune itself has become steadily more vegetated over that time, but at least one large mallee is still in evidence today that predates the earliest photograph.

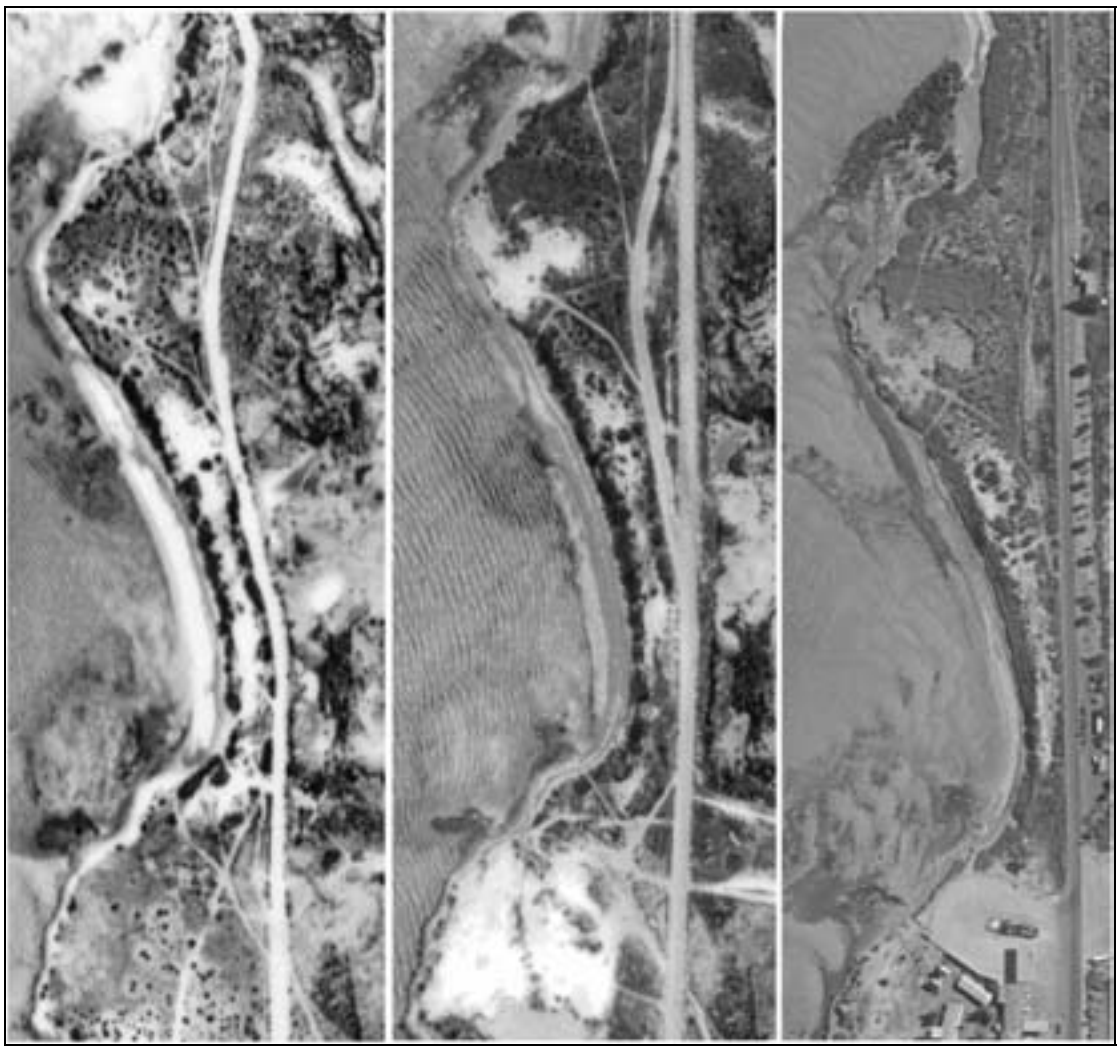


Figure 13 - Southern coastal strip, 1950, 1968 & 2004

Figure 14 - South-eastern hill, 1950, 1968 & 2004

The long sloping hill at the south-eastern corner of the study area was cleared prior to 1950, and has been mined for sand or gravel. Mining started between 1950 and 1968. The presence of native tussock grasses is not unusual in areas cleared for pastoral purposes, if improved pastures have not been seeded over the site, and this block has excellent quantities of

Danthonia setacea and several types of *Austrostipa* still existing between a heavy infestation of noxious and other weeds.

Figure 15 - Southern corner of the north-western block, 1968 & 2004

While much of the north-western block has been cleared, the southern part of the block contains many large shrubs and mallees that can be identified in the 1968 photograph. The coastal strip shows the gradual expansion of mangrove trees. The oldest mangroves are still in evidence in the earlier photographs, but the woodland is now both denser and more extensive than it was 36 years ago.

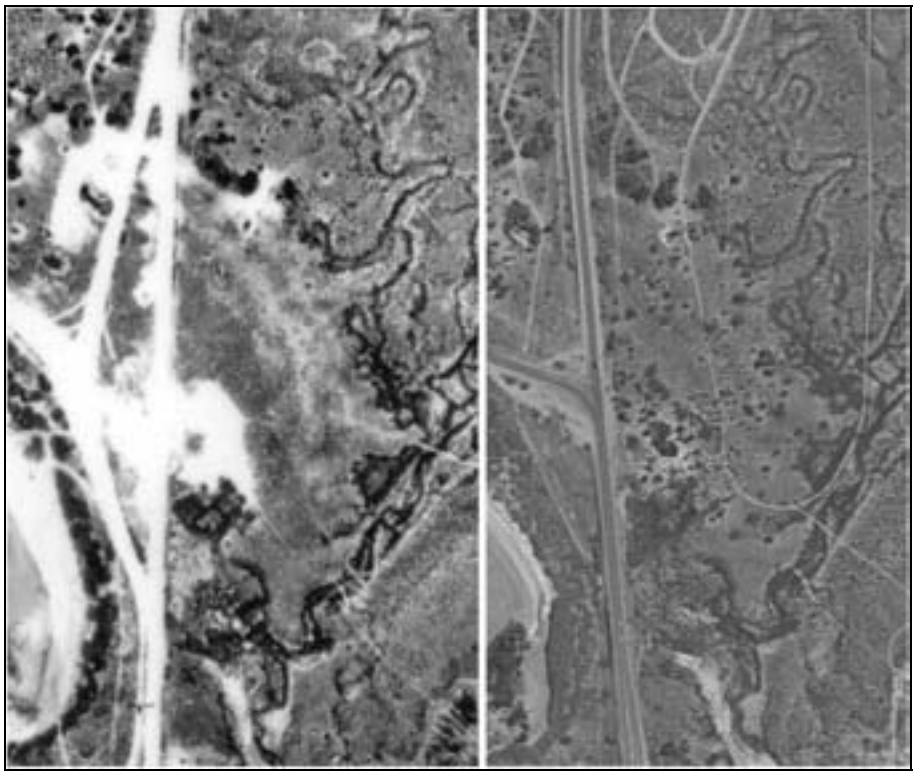


Figure 16 - Small dunes and dissected saltmarsh east of highway, 1968 & 2004

The small dune east of the highway has seen considerable growth of native vegetation in the denuded patch, however there are some older shrubs that are in evidence in both photographs – particularly towards the north of the dune and along its eastern boundary.

Dense *Sclerostegia arbuscula* mark the drainage channels through the salt marsh. Although these shrubs do not attain great stature, they are a long lived species, making it quite possible that the individual shrubs present today have survived the changed conditions since the highway cut off tidal flushing. Adult samphires in general do not tend to immediately die off in altered hydrological conditions (McComb *et al*, 1995), however the reproductive success of the plants is impacted.

In locations where the tide is prevented from flooding across a salt marsh the samphires may turn red (a result of increased salt content in the soil) and may produce little new spring growth each year, but they may survive in this parlous state for very long periods.

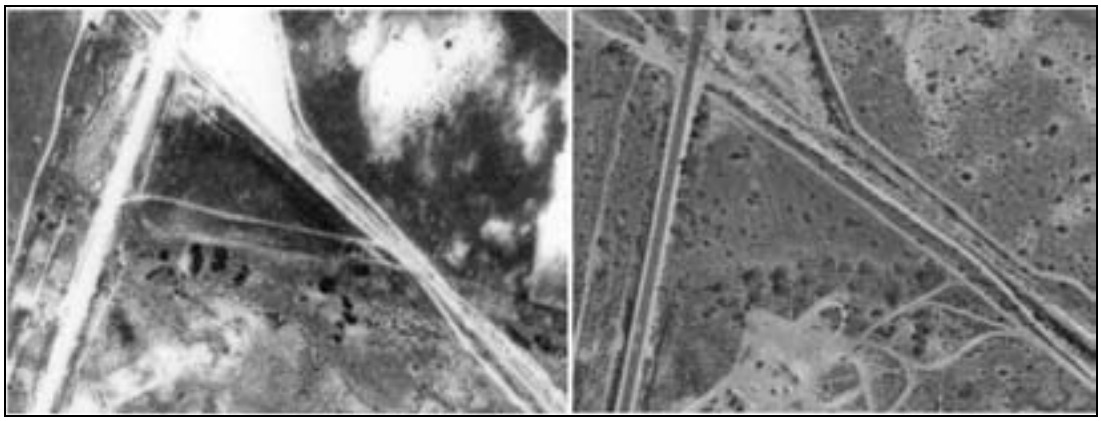


Figure 17 - Northern corner of the eastern block, 1968 & 2004

The trees currently growing along the road reserve on the north-western boundary of the north eastern block are only just in evidence in the 1968 photograph, however the band of tall shrubs and low mallees located along the southerly base of the slope were already mature. The effects of off-road vehicles and mining are clearly visible in the centre of the more recent photograph. This impact is limited in area, with the dunes along the eastern boundary of the block being in good condition. Many of the larger shrubs on these dunes are visible in the early photograph.

5. Terrestrial fauna observations

The following section details the fauna observations that occurred during this study. Additional information on fauna found in the vicinity has been compiled from other published sources.

In South Australia, most vertebrate fauna is deemed ‘protected’ under the provisions of the *National Parks and Wildlife Act 1972 of South Australia*. Under this Act,

> **“protected animal** means-
> *(a)* any mammal, bird or reptile indigenous to Australia; or

(b) any migratory mammal, bird or reptile that periodically or occasionally migrates to, and lives in, Australia; or
(c) any animal of a species referred to in schedule 7, 8 or 9; or
(d) any animal of a species declared by regulation to be a species of protected animals,

but does not include animals of the species referred to in schedule 10 or any animals declared by regulation to be unprotected."

The unprotected species (those listed in Schedule 10) are Zebra Finch *(Poephila guttata)*, Budgerygah *(Melopsittacus undulatus)*, Red Wattlebird *(Anthochaera carunculata)*, Grey-backed Silvereye *(Zosterops lateralis halmaturina)*, Galah *(Cacatua roseicapilla)*, Little Corella *(Cacatua sanguinea)*, Australian Raven *(Corvus coronoides)*, Little Crow *(Corvus bennetti)*, Australian Crow *(Corvus orru cecilae)*, Little Raven *(Corvus mellori)*, and Wild Dog (Dingo) *(Canis familiaris)*.

While most animals are protected, additional protection is provided to species considered to be vulnerable, endangered or rare under Schedules 7, 8 and 9 of the same Act. The *Environment Protection and Biodiversity Conservation Act 1999 of Australia* provides protection for those species of nationwide conservation significance.

5.1 Birds

During the site visits in late November 2004, opportunistic sightings of birds and a 20-minute point observation were recorded. The species are listed below, in Table 6. The days of the field trip were abnormally hot and windy, so the species observed were limited. Terrestrial birds were generally found hiding in vegetation, and water birds were usually out into the water as far as they could manage, or hidden in the mangroves until after sunset, where upon they came back onto the mudflat to feed during the cooler weather.

Species	Common name
Anthus novaeseelandiae	Richard's pipit
Calidris canutus	Red knot
Certhionyx niger	Black honey eater
Charadrius ruficapillus	Red capped dotterel
Chlidonias hybrida	Whiskered tern
Corvus spp.	Ravens
Cygnus atratus	Black swan
Falco cenchroides	Nankeen kestrel
Haematopus fuliginosus	Sooty oystercatcher
Haematopus longirostris	Pied oystercatcher
Larus novaehollandiae	Silver gull
Larus pacificus	Pacific gull
Limosa limosa	Bar-tailed godwit
Malurus spp.	Wrens (female)
Milvus migrans	Black kite
*Passer domesticus**	Sparrow
Pelecanus conspicillatus	Australian pelican
Phalacrocorax varius	Pied cormorant

Pomatostomus superciliosus	White browed babbler
Rhipidura leucophrys	Willie wagtail
Sterna bergii	Crested tern
Sterna caspia	Caspian tern
*Sturnus vulgaris**	Starling
Threskiornis molucca	Sacred ibis
Tringa nebularia	Greenshank
Tringa spp.	Sandpipers

Table 6 - Bird sightings in late November 2004 (Delta staff)

Red knots were seen working the northern reefs for food, while red capped dotterels (plovers) were common along the sandy beaches. Sandpipers and greenshanks foraged across the sand flats, following the tide out.

Figure 18 - Pelican and migratory waders

The unprotected birds one would expect to find on the site are ravens, crows and introduced species. All other birds occurring on the study area and adjacent blocks are protected under State and Federal legislation. The conservation significance of each species is given in the table below, which shows all species recorded by Birds Australia within one degree of the study site.

Members of Birds Australia have recorded 128 species of birds within the wider 1-degree map block surrounding the site. Ceduna is located in the northeastern corner of this block, which extends from Point Brown around the coast to Point Sinclair. This list is provided separately below.

Family	Common Name	*Species name*	Conservation Interest
Phasianidae	Stubble Quail	*Coturnix pectoralis*	
Anatidae	Blue-billed Duck	*Oxyura australis*	Rare (SA NP&WS), EPBC Act, rare EP
Anatidae	Musk Duck	*Biziura lobata*	Rare (SA NP&WS), EPBC Act
Anatidae	Black Swan	*Cygnus atratus*	EPBC Act
Anatidae	Grey Teal	*Anas gracilis*	EPBC Act
Anatidae	Chestnut Teal	*Anas castanea*	EPBC Act
Anatidae	Hardhead	*Anthya australis*	EPBC Act
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	
Podicipedidae	Hoary-headed Grebe	*Poliocephalus poliocephalus*	
Sulidae	Australasian Gannet	*Morus serrator*	
Anhingidae	Darter	*Anhinga melanogaster*	
Phalacrocoracidae	Little Pied Cormorant	*Phalacrocorax melanoleucos*	
Phalacrocoracidae	Black-faced Cormorant	*Phalacrocorax fuscescens*	
Phalacrocoracidae	Pied Cormorant	*Phalacrocorax varius*	
Phalacrocoracidae	Little Black Cormorant	*Phalacrocorax sulcirostris*	
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	
Phalacrocoracidae	Australian Pelican	*Pelecanus conspicillatus*	
Ardeidae	White-faced Heron	*Egretta novaehollandiae*	
Ardeidae	Little Egret	*Egretta garzetta*	Rare SA
Ardeidae	Eastern Reef Egret	*Egretta sacra*	Rare (SA NP&WS), EPBC Act, rare EP
Ardeidae	Great Egret	*Egretta alba*	EPBC Act
Plataleidae	Royal Spoonbill	*Platalea regia*	
Pandionidae	Osprey	*Pandion haliaetus*	Rare (SA NP&WS), EPBC Act, rare EP
Accipitridae	Black-shouldered Kite	*Elanus axillaris*	EPBC Act
Accipitridae	Black Kite	*Milvus migrans*	EPBC Act
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Accipitridae	Spotted Harrier	*Circus assimilis*	EPBC Act
Accipitridae	Swamp Harrier	*Circus approximans*	EPBC Act
Accipitridae	Wedge-tailed Eagle	*Aquila audax*	EPBC Act
Falconidae	Brown Falcon	*Falco berigora*	EPBC Act
Falconidae	Nankeen Kestrel	*Falco cenchroides*	EPBC Act
Turnicidae	Little Button-quail	*Turnix velox*	
Scolopacidae	Bar-tailed Godwit	*Limosa limosa*	EPBC Act
Scolopacidae	Whimbrel	*Numenius phaeopus*	EPBC Act
Scolopacidae	Eastern Curlew	*Numenius madagascariensis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	EPBC Act
Scolopacidae	Common Greenshank	*Tringa nebularia*	EPBC Act
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	EPBC Act
Scolopacidae	Grey-tailed Tattler	*Heteroscelis brevipes*	EPBC Act
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Scolopacidae	Great Knot	*Calidris tenuirostris*	EPBC Act
Scolopacidae	Red Knot	*Calidris canutus*	EPBC Act

Family	Common Name	*Species name*	Conservation Interest
Scolopacidae	Sanderling	*Calidris alba*	EPBC Act
Scolopacidae	Little Stint	*Calidris minuta*	EPBC Act
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	EPBC Act
Scolopacidae	Sharp-tailed Sandpiper	*Calidris acuminata*	EPBC Act
Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	EPBC Act
Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	
Haematopodidae	Sooty Oystercatcher	*Haematopus fuliginosus*	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	EPBC Act
Recurvirostridae	Banded Stilt	*Cladorhynchus leucocephalus*	EPBC Act
Charadriidae	Pacific Golden Plover	*Pluvialis dominica*	EPBC Act
Charadriidae	Grey Plover	*Pluvialis squatarola*	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Charadriidae	Red-capped Plover	*Charadrius ruficapillus*	EPBC Act
Charadriidae	Double-banded Plover	*Charadrius bicinctus*	EPBC Act
Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	EPBC Act
Charadriidae	Greater Sand Plover	*Charadrius leschenaultii*	EPBC Act
Charadriidae	Inland Dotterel	*Charadrius australis*	EPBC Act
Charadriidae	Hooded Plover	*Thinornis rubricollis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Charadriidae	Banded Lapwing	*Vanellus ticolor*	EPBC Act
Charadriidae	Masked Lapwing	*Vanellus miles*	EPBC Act
Laridae	Pacific Gull	*Larus pacificus*	
Laridae	Silver Gull	*Larus novaehollandiae*	
Laridae	Caspian Tern	*Sterna caspia*	
Laridae	Crested Tern	*Sterna bergii*	
Laridae	Fairy Tern	*Sterna nereis*	Vulnerable (SA NP&WS), ssp nereis vulnerable EP
Laridae	Whiskered Tern	*Chlidonias hybrida*	
Columbidae	Rock Dove	*Columba livia**	
Columbidae	Common Bronzewing	*Phaps chalocoptera*	
Columbidae	Brush Bronzewing	*Phaps elegans*	
Columbidae	Crested Pigeon	*Ocyphaps lophotes*	
Columbidae	Peaceful Dove	*Geopelia striata*	Rare EP
Cacatuidae	Galah	*Eolophus roseicapilla*	
Psittacidae	Australian Ringneck	*Barnardius zonarius race zonarius*	
Psittacidae	Mulga Parrot	*Psephotus varius*	
Psittacidae	Rock Parrot	*Neophema petrophila*	Rare (SA NP&WS), rare EP
Cuculidae	Pallid Cuckoo	*Cuculus pallidus*	
Cuculidae	Fan-tailed Cuckoo	*Cuculus flabelliformis*	
Cuculidae	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	
Tytonidae	Barn Owl	*Tyto alba*	
Apodidae	Fork-tailed Swift	*Apus pacificus*	EPBC Act
Maluridae	Variegated Fairy-wren	*Malurus lamberti*	
Pardalotidae	Striated Pardalote	*Pardalotus striatus*	
Pardalotidae	White-browed Scrubwren	*Sericornis frontalis*	

Family	Common Name	*Species name*	Conservation Interest
Pardalotidae	Weebill	*Smicrornis brevirostris race brevirostris*	
Pardalotidae	Inland Thornbill	*Acanthiza apicalis*	
Pardalotidae	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	
Pardalotidae	Southern Whiteface	*Aphelocephala leucopsis race maculatus*	
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*	
Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	
Meliphagidae	Yellow-throated Miner	*Manorina flavigula*	
Meliphagidae	Singing Honeyeater	*Lichenostomus virescens*	
Meliphagidae	Purple-gaped Honeyeater	*Lichenostomus cratitius*	
Meliphagidae	White-fronted Honeyeater	*Phylidonyris albifrons*	
Meliphagidae	Crimson Chat	*Epthianura tricolor*	
Meliphagidae	White-fronted Chat	*Epthianura albifrons*	
Petroicidae	Jacky Winter	*Microeca fascinans*	
Petroicidae	Red-capped Robin	*Petroica goodenovii*	
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	
Pachycephalidae	Gilbert's Whistler	*Pachycephala inornata*	Rare EP
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*	
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	
Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	
Dicruridae	Magpie-Lark	*Grallina cyanoleuca*	
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*	
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*	
Campephagidae	Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	
Campephagidae	White-winged Triller	*Lalage sueurii*	
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*	
Artamidae	Grey Butcherbird	*Cracticus torquatus*	
Artamidae	Australian Magpie	*Gymnorhina tibicen*	
Corvidae	Australian Raven	*Corvus coronoides*	
Corvidae	Little Raven	*Corvus mellori*	
Corvidae	Little Crow	*Corvus bennetti*	
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Vulnerable EP
Motacillidae	Richard's Pipit	*Anthus novaeseelandiae*	
Passeridae	House Sparrow	*Passer domesticus**	
Hirundinidae	White-backed Swallow	*Cheramoeca leucosternus*	
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	
Hirundinidae	Tree Martin	*Hirundo nigricans*	
Sylviidae	Little Grassbird	*Megalurus gramineus*	EPBC Act
Alaudidae	Rufous Songlark	*Cincloramphus mathewsi*	
Alaudidae	Brown Songlark	*Cincloramphus cruralis*	
Zosteropidae	Silvereye	*Zosterops lateralis*	
Muscicapidae	Common Blackbird	*Turdus merula**	
Sturnidae	Common Starling	*Sturnus vulgaris**	

Table 7 - Birds Australia records of birds within 1-degree block that includes study site

An expanded version of the Birds Australia species list, which includes the ecological preferences of each species is attached to this report in *Appendix 4*. Counts of waders, conducted in 1984 and 2000 by Birds Australia are provided in Table 8 below.

A point of interest is the Sooty Oystercatcher numbers. It was notable during the November 2004 site visit that while both Sooty Oystercatchers and Pied Oystercatchers were sighted foraging in the study area, only the Pied Oystercatcher was located further south, at Shelly Beach. This may be explained by the Sooty Oystercatcher's preference for reefs, which are present at both extremities of the study area. Watkins (1993) lists Murat Bay as a site of international importance for the conservation of this species.

Common Name	*Species name*	Murat Bay Wader Count (2000)	Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Bar-tailed Godwit	*Limosa limosa*	26		EPBC Act
Eastern Curlew	*Numenius madagascariensis*	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Common Greenshank	*Tringa nebularia*	46		EPBC Act
Common Sandpiper	*Actitis hypoleucos*	3		EPBC Act
Grey-tailed Tattler	*Heteroscelis brevipes*	6		EPBC Act
Ruddy Turnstone	*Arenaria interpres*	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red Knot	*Calidris canutus*	38		EPBC Act
Red-necked Stint	*Calidris ruficollis*	913		EPBC Act
Sharp-tailed Sandpiper	*Calidris acuminata*	271		EPBC Act
Curlew Sandpiper	*Calidris ferruginea*	144		EPBC Act
Pied Oystercatcher	*Haematopus longirostris*	29		
Sooty Oystercatcher	*Haematopus fuliginosus*	107	163	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Grey Plover	*Pluvialis squatarola*	81	123	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red-capped Plover	*Charadrius ruficapillus*	79		EPBC Act
Banded Lapwing	*Vanellus ticolor*	238		EPBC Act
Masked Lapwing	*Vanellus miles*	6		EPBC Act

Table 8 - Birds Australia wader counts in Murat Bay, 1984 & 2000

5.1.1 Possible impacts on bird life

Waders harvest food from the tidal flats. Each bird species has a particular preference – those with heavy beaks, such as Oystercatchers, can split open bivalve shells and would use the mussel top reefs as their major food source. Others, with more slender beaks, probe the sand flats for polychaete worms, sipunculids or small crustaceans. Those with longer beaks are able to obtain organisms that move deep within the sand, while the shorter beaked birds are restricted to those organisms that live close to the surface. These specific ecological preferences mean that the impacts of any development will vary, depending on the species involved.

The areas of possible impact could include:

- the construction of a boating channel and groynes may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, while other areas may drain less well (the newly formed 'pockets' where the groynes meet the beach) and therefore may become hypoxic. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos. This has implications on the availability of appropriate food sources for migratory waders,
- the increased usage of the sand flats as boats enter and leave the marina may disturb the more sensitive species of birds, and
- the *Sclerostegia arbuscula* chenopod shrubland present in the stranded dissected salt marsh currently provides habitat for many small birds such as Thornbills and Chats, and these birds do not utilise deep waterways as habitat.

5.2 Reptiles and amphibians

The sandy areas (dunes and ridges) of the site contained large numbers of small painted dragons (*Ctenophorus pictus*) that ran rapidly for shelter under thorny bushes as they were approached. In the early morning the sandy sections of the site showed tracks of small snakes and lizards. As well as the live lizards noted in the following table, a jaw of a sleepy lizard was found, several lizard holes were noted and a scat from a large lizard that contained plant materials, beetle elytra and white snails was recorded.

Common name	Family: *Species*
Painted dragons	Agamidae: *Ctenophorus pictus*
Sleepy lizards	Scincidae: *Tachydosaurus rugosus*
Small skinks	Scincidae

Table 9 – Lizards sighted

Figure 19 - Snake and lizard tracks

No amphibians were sighted or heard during the site visit. This is not surprising given the salty and dry nature of much of the site. It is possible that some amphibians may occur in

winter in the area near the BP service station where a soak apparently exists. The soak was not evident to the consultants who undertook this visit.

5.3 Mammals

During the site visit a fox (*Vulpes vulpe*s) was sighted and fox tracks and a hole were located. Several rabbits (*Oryctolagus cuniculus*) were seen, a scrape was located and their dung was widespread. The remains of a sheep (*Ovis aries*) and quantities of old sheep dung suggest that it may be some time since sheep were grazed on the site. Fresh horse tracks (*Equus caballus*) were also recorded.

Wallaby tracks were found on the rocky headland to the northwest of the site.

Conservation reserves in the district support populations of spinifex hopping mice (*Notomys mitchelli*) and echidnas (*Tachyglossus acculeatus*). It is possible that the dunal elements to the north and north west of the site may support these species. Other mammals that may possibly be found in the less disturbed portions of the site include the fat tailed dunnart (*Sminthopsis crassicaudata*), little long tailed dunnart (*Sminthopsis dolichura*), western pygmy possum (*Cercatetus concinnus*), western grey kangaroo (*Macropus fuliinosus*), and several species of bats. Strahan (1995) suggests that the area marks the western extremity of the eastern population of the southern forest bat, *Vespadelus regulus*.

5.4 Terrestrial invertebrates

During the vegetation survey, any invertebrates that were present were noted. Several sweeps were also made during the late morning, in a sunny period with a light to moderate wind. Additionally a night time light trap was used to determine the range of nocturnal insects present.

The weather during the site visit was hot, with a northerly wind blowing. In the day-time the small bush flies (*Musca vetustimma*) were in pestilential proportions, and at night they were replaced by the flying stages of termites in similar proportions. The other insect attracted to the light trap at night in large numbers was a small grey and white moth, probably *Protolechia* sp. Many small wasps were visible in the day time, and spiders were harvesting these in webs strung across the samphires and smaller shrubs.

Invertebrates are not protected under the *National Parks and Wildlife Act 1972 of South Australia*. However, some South Australian butterfly species are listed under the federal government's Action Plan for Butterflies (Sands and New, 2002), a document developed under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999 of Australia*. According to the *Biodiversity Plan for Eyre Peninsula* (DEH, 2002) the butterfly groups most likely to contain threatened members are the Skippers, Coppers and Blues. The latter two groups require the attendance of specific any species as well as habitat containing their food, making them particularly vulnerable to ecological disturbance.

The Dinosaur ant (*Nothomyrmecia macrops*) does not have protection under legislation but is only known from seventeen sites on the Eyre Peninsula. It inhabits patchy stands of mallee, including *Eucalyptus gracilis* (present on the site). While no dinosaur ants were observed, this

was expected as the ant is nocturnal. No honey trapping was conducted as the night time temperatures were too high. The ants only forage when the temperature drops to less than 15-18^{o}C (DEH, 2002).

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Insects			
Black longicorn beetles	Coleoptera: Cerambycidae	x	
Ladybirds	Coleoptera: Cocinellidae	x	
Brown scarab beetles (many)	Coleoptera: Scarabaeidae		x
Dragonflies (large grey blue)	Odonata: Libellulidae: poss. *Orthetrum* sp.	x	
Wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus plexippus*	x	
Lesser wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus chrysippus*	x	
Orange/brown butterfly	Lepidoptera: Nymphalidae	x	
Caper white butterfly	Lepidoptera: Pieridae: *Anaphaeis java*	x	
Skipper butterflies	Lepidoptera: Hesperiidae	x	
Blue butterflies on melaleucas	Lepidoptera: Lycaenidae	x	
Case moth	Lepidoptera: Psychidae:poss *Hylarcta* sp.	x	
Feather wing moths	Lepidoptera: Cosmopterigidae		x
Small grey/white moths (many)	Lepidoptera: Gelechiidae: prob *Protolechia* sp.		x
Termites (winged queens) (many)	Isoptera:		x
Green tree hopper	Hemiptera: Membracidae: *Sextius virescens*	x	
Brown & white bugs	Hemiptera: Lygaeidae		x
Stink bug	Hemiptera: Pentatomidae		x
Burrowing bug	Hemiptera: Cydnidae		x
Cotton cushion scale	Hemiptera: Margarodidae	x	
Native bee with blue stripes	Hymenoptera: poss Anthophoridae	x	
Meat ants	Hymenoptera: Formicidae: *Iridomyrmex* sp.	x	
Large inch ant black rear, red body and yellow jaws	Hymenoptera: Formicidae: *Myrmecia* sp.	x	
Flying ant	Hymenoptera: Formicidae		x
Large black/orange heavy built potter wasp	Hymenoptera: Vespidae	x	
Irridescent green small wasps	Hymenoptera	x	
Small yellow wasps	Hymenoptera	x	
Almost microscopic wasps	Hymenoptera: poss Diapriidae		x
Hoverflies	Diptera: Syrphidae	x	
Wait-a-while flies (bush flies, eye flies)	Diptera: Muscidae: *Musca vetustimma*	x	x
Big blue-bottle flies	Diptera: Calliphoridae	x	
Long-leg flies	Diptera: Dolchopodidae		x
Black biting flies	Diptera: Tabanidae	x	
Eucalyptus gall midges	Diptera: Cecidomyidae	x	
Antlions	Neuroptera: Myrmeliontidae	x	
Bush crickets	Orthoptera: Gryllidae	x	
Spiders			
Mexican hat spiders	Araneae: prob Stiphiidae	x	
Sac spider	Araneae: Miturgidae	x	
Garden orb, or wheel weaver spider	Araneae: Araneidae: *Eriophora transmarina*	x	
Green jumping spider	Araneae: Salticidae	x	
Flower spider	Araneae: Thomisidae	x	

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Other arthropods			
Small red mites	Acarina	x	
Scorpion hole	Scorpionida	x	
Gastropods			
White snails	Molluca: Helicidae: *Cernuella vestita**	x	
Small snails	Molluca: Helicidae: *Cochlicella acuta**	x	

Table 10 - Terrestrial invertebrates recorded on the site

Figure 20 - Spider webs catching the many small flying wasps

6. Intertidal flora and fauna

This study examined only the intertidal zone of the study area. Subtidal areas (those covered by water in the photograph below) were not observed.

6.1 Observations

The study site is a sheltered, calm water coast, and the majority of the bay is taken up by wide sand flats, with rocky platforms confined to the southern and northern extremities. A series of observations was recorded for the intertidal zone. The locations of these observations are shown in Figure 16, over the page.

The rocky portions of the site are dominated by *Hormosira banksii*, with small quantities of other brown macroalgae. The tubeworm *Galeolaria* is often present on these rocky sections, along with ribbed top shells, conniwinks and beaked mussels.

Musseltop reefs, formed by the growth of beaked mussels over limestone or coffee-rock, project out from the shore towards the sandy flats. These are sometimes edged with *Hormosira banksii* and *Enteromorpha intestinalis*.

The sand flats themselves vary. There are firm areas of bare sand, large zones of soft sand with beds of *Zostera* and *Ruppia*, and some firm sand areas supporting *Hormosira* beds. The tidal flat version of *Hormosira* has larger, spherical vesicles (Womersley, 1984) when compared to the same alga growing on the reefs. Few other plants are present. Evidence of sand snails and benthic worms is common. Some areas appear to contain slightly hypoxic sediments, evidenced by the grayish colouration of the underlying sands, but these areas also contain evidence of worm habitation, suggesting that these zones may be organically enriched. Where clean sand occurs in rear reef pools, *Pinna bicolor* can be found.

Figure 21 - Observation points in the intertidal zone

At each observation point the location was recorded using a GPS, and a note made of the species present and any geomorphological features.

Location	Easting	Northing	Mangrove	Samphire	Seagrass	Hormosira	Reef	Rock	Sand	Sulfidic	Worms	Mussels	Comments
1	373882	6446949			Y				Y				Dense *Zostera muelleri* and *Ruppia* bed heading SE from location
2	373838	6446918			Y				Y				Dense *Zostera* and *Ruppia* bed, firmer on higher part of sandbar
3	373724	6446837				Y	Y					Y	Muddy rock reef with mussels and *Hormosira*
4	373704	6446788			Y								Large *Ruppia* bed with some *Zostera*, short billed migratory shorebirds feeding
5	373646	6446773										Y	Musseltop reef
6	373612	6446789			Y	Y							*Hormosira* bed with small amounts of green and brown macroalgae, *Zostera* in gaps
7	373603	6446810			Y								Dense long *Zostera* bed stretching in to shore, pebble crabs
8	373644	6446822							Y				Razorfish in reasonably clear sand
9	374552	6446040	Y	Y									*Sarcocornia* with half a dozen mangroves
10	374552	6446059		Y									Small patch of *Sclerostegia arbuscula*, seaward of mangroves
11	374506	6446052				Y	Y						Seaward of samphires - *Austrocochlea, Ostrea, Hormosira, Galeolaria*
12	374512	6446071					Y	Y					Patch of black rocks within reef area
13	374523	6446126			Y				Y				Tiny blades of *Zostera/Ruppia* protruding through sand in patches about 50cm across
14	374511	6446138				Y	Y	Y				Y	*Hormosira* topped with cast seaweed and some exposed patches of musseltop reef
15	374588	6446134	Y	Y									Area of *Sarcocornia, Suaeda, Sclerostegia* with a dozen small scattered mangroves
16	374559	6446213				Y			Y				Wide sandy bay with *Hormosira* beds on locations 16 and 17
17	374580	6446227				Y			Y				Wide sandy bay with *Hormosira* beds on locations 16 and 17
18	374567	6446256								Y	Y		Area of sulfidic grey sand with wormholes, approximately 6m x 12 m across
19	374538	6446307					Y					Y	Musseltop reef with *Hormosira* on Locations 19 and 20
20	374511	6446325				Y	Y						Musseltop reef with Hormosira on Locations 19 and 20
21	374527	6446358					Y						Areas of bare coffee-rock reef
22	374481	6446421							Y	Y	Y		Beach, small protruding rocks run north to next point, sulfidic areas with worms, approx 50m long near channel
23	374468	6446439							Y	Y	Y		Second sulfidic patch, occurring on megaripples intersecting northerly reef
24	374423	6446517					Y					Y	Exposed coffee-rock with musseltop surround along waterline
25	374437	6446536					Y					Y	Low reef seaward all musseltop, lots of patches of coffee rock, many *Bembicium* & *Nerita*
26	374456	6446563		Y									*Sarcocornia*
27	374465	6446572	Y	Y									*Suaeda* inland to mangroves & *Sclerostegia,* which start at GPS location

Table 11 - Intertidal zone observations

Figure 22 - Pinna bicolor in a rear reef pool

Figure 23 - Pebble crab and brown algae in rear reef pool

6.2 Benthic surface quadrats

Figure 24 - Benthic quadrat and core locations

To obtain baseline information on the inhabitants of the sand flats a transect was laid across the intertidal zone. At twenty (20) locations a quadrat was placed, and a record was made of the numbers of worm holes, snail trails, vegetation or visible animals.

Figure 25 - Shorebirds and protruding polychaete worm tubes

As with the observations recorded in the previous section, the presence of slightly hypoxic sediments was linked to apparently larger numbers of worm holes. The largest numbers of worm holes were located in quadrats nearer the centre of the sampling transects, while snail trails were located towards the edges of the transect.

Quadrat	Easting	Northing	Worm holes/m2	Snail trails/m2	Mussels/m2	Zostera presence	Ruppia presence	Comments
1	374462	6446431	0	0	0			Just bird dabbles & a half buried anemone nearby
2	374434	6446455	32	0	0			Sand black under the surface
3	374409	6446482	84	0	0			*Cymatiella leseuri* (Leseur's sand whelk) in quadrat, lives on intertidal reef & eats compound ascidians
4	374385	6446507	0	28	40			*Brachiodontes rostratus* (Beaked mussel) and *Austrococchlea constricta* (Ribbed top shell) on small rocks protruding through sand
5	374356	6446535	0	0	0	Yes		Very shelly under the surface rippled sand, small patches of *Zostera mucronata* protruding above sand on larger bars
6	374316	6446569	44	0	0	Yes	Yes	About 6% coverage with *Zostera mucronata* with small amounts of *Ruppia tuberosa* between *Zostera* tufts
7	374291	6446594	4	0	0	Yes	Yes	*Zostera mucronata* with small amounts of *Ruppia tuberosa* between *Zostera* tufts
8	374263	6446620	116	0	0			Sand soft, slightly greyish under the surface
9	374233	6446650	176	0	0			
10	374209	6446674	224	0	0			
11	374181	6446702	56	0	0			
12	374150	6446729	108	0	0			
13	374122	6446755	88	0	0			Small rock nearby with large beaked mussels (*Brachiodontes rostratus*)
14	374099	6446789	96	0	0			
15	374069	6446814	84	80	0			Many snail tracks, estimated number as they intersect and overlap
16	374039	6446838	40	12	0			Birds following the tide, further out
17	374010	6446867	32	0	0	Yes		Small lengths of *Zostera mucronata* protruding from the sand
18	373991	6446891	32	0	0			
19	373962	6446911	8	8	0			
20	373944	6446931	8	80	0			Many of the snail trails were short circular tracks, with a few longer tracks

Table 12 - Intertidal quadrats

6.3 Benthic cores

A benthic core of 500 cm^3 was extracted from under each of the twenty (20) quadrats, and returned to base for sieving and processing.

The benthic cores confirmed the surface observations, returning greater numbers of organisms in those cores taken from the centre of the transect line. The majority of the organisms were polychaete worms and peanut worms (sipunculids), however the cores also contained numbers of gastropods, bivalves, crustaceans and ribbon worms.

			Polychaetes		Gastropods							Bivalves	Sipunculids		Crustacea			Nemertea	**Total**
Core	Easting	Northing	*Olganereis edmondsi*	*Nephtys australiensis*	*Mitrella lincolnensis*	*Austrocochlea constricta*	*Clanculus plebejus*	*Diloma* sp.	Cerithiopsidae	*Batillaria* sp.	*Salinator* sp.	*Solemya australis*	*Phascolosoma nodulíferum*	*Themiste* sp.	Gammaridea sp. unk (1)	Gammaridea sp. unk (2)	Callianassidae sp. unk	Nemertea sp. unk	
1	374462	6446431	2																**2**
2	374434	6446455	3																**3**
3	374409	6446482	2																**2**
4	374385	6446507		4	1														**5**
5	374356	6446535		1			1												**2**
6	374316	6446569	1	2		2	1	1					1						**8**
7	374291	6446594		4					1										**5**
8	374263	6446620		3		1													**4**
9	374233	6446650		5									2	3					**10**
10	374209	6446674								1			3		2				**6**
11	374181	6446702		1									4		1	1			**7**
12	374150	6446729		2									1	2			1		**6**
13	374122	6446755		1									2						**3**
14	374099	6446789		1									4						**5**
15	374069	6446814		1															**1**
16	374039	6446838										1	1						**2**
17	374010	6446867		2									1						**3**
18	373991	6446891	1	4															**5**
19	373962	6446911	1	2							3	1						1	**8**
20	373944	6446931									2		1						**3**

Table 13 - Intertidal benthic cores

6.4 Intertidal species – ecological notes

The north western extremity of the site contains several reefs that form fish traps. From the headland it was possible to observe fish in these areas as the tide went out. Mullet, whiting and black finned rays were sighted in the shallows.

Amalgamated lists of all recorded fauna and flora of the intertidal zone, as well as notes on their ecological preferences, is presented in the following two tables.

Group	Species	Common name	Ecological preferences (MacPherson & Gabriel (1962), Shepherd & Thomas (1989), Hale (1976))
Polychaete worms	*Australonereis ehlersi*	Bait worm	Estuarine conditions, hunts from shelter of tough but limp sandy tube
	Galeolaria caespitosa	Tubeworms	On hard substrates such as coffee-rock and limestone
	Nephtys australiensis	A polychaete	Prefers muddy sand, burrows actively using pharynx, associated with seagrass beds
	Olganereis edmondsi	A polychaete	Lives in intertidal sandy areas in a gelatinous sandy tube, only recorded in SA
Gastropods	*Austrocochlea constricta*	Ribbed top shell	Variety of habitats on low to medium energy coastlines
	Batillaria sp.	Mud whelk	Sand and mud flats, feeds by crawling just under the surface
	Bembicium melanostomum	Dark mouthed conniwink	Prefers sheltered bays and mangrove swamps
	Cerithiopsidae	Little creeper	Almost microscopic small shells, no ecological details
	Clanculus plebejus	A clanculus	Littoral reefs in calm waters
	Cymatiella leseuri	Leseur's sand whelk	Intertidal reefs, eats anemones and ascidians
	Diloma sp.	A periwinkle	Rocks and weeds in littoral pools
	Lepsiella flindersi	Flinder's lepsiella	Found in association with *Galeolaria*, mussels and barnacles, its food source, on littoral reefs
	Mitrella lincolnensis	Dove shell	Found on algae or crawling on the surface in the shallows
	Nerita atramentosa	Black nerite	Littoral and supralittoral reefs
	Salinator sp.	Air breather, sand snail	Samphire and mangrove flats as well as back dune swamps
Bivalves	*Brachiodontes rostratus*	Beaked mussel	On "mussel-top" reefs in upper and mid littoral zone, small bivalve *Kellia australis* **always** associated (not observed)
	Katelysia scalarina	Stepped venerid	Sandy shores, lower littoral
	Ostrea sp.	Oyster	On rocky reefs, mid littoral
	Pinna bicolor	Razorfish	In soft sand
	Solemya australis	Southern date shell	Burrows in mud or sand in sublittoral zone
Sipunculids	*Phascolosoma noduliferum*	A peanut worm	In sand or embedded in *Galeolaria* colonies
	Themiste sp.	A peanut worm	Gut contents: sand, shell particles and marine plant detritus
Crustaceans	Callianassidae sp. unk	Sand borer shrimp	Muddy sand flats
	Gammaridea sp. unk (1)	Sea louse	Intertidal sand, detrital feeders
	Gammaridea sp. unk (2)	Sea louse	Intertidal sand, detrital feeders
	Philyra laevis	Pebble crab	Amongst brown algae in shallow pools
Nemertean worms	Nemertea sp. unk	Ribbon worm	Burrows in soft sediments of intertidal zone
Bryozoans	Unknown sp	Lace coral	In shallow back-reef pools

Table 14 - Intertidal fauna list, with ecological preferences

Phyla	Order	Family	Species	Common name	Comments
Cyanophyta			*Rivularia* sp.	Blue green colonies	Attached to rocks
Phaeophyta	Fucales	Cystoseiraceae	*Cystoseira trinodis*		Common in estuaries and sheltered rear-reef pools
			Scaberia agardhi		Cast specimen from deeper water
		Sargasaceae	prob *Sargassum verruculosum*		In sheltered rear-reef pools
		Hormosiraceae	*Hormosira banksii* forma *banksii*	Neptune's necklace	On sheltered platforms or musseltop reefs in sandy/muddy tidal flats
	Ectocarpales	Ectocarpaceae	Unknown species		In sheltered rear-reef pools
Rhodophyta	Cryptonemiales	Corallinaceae	Unknown species of coralline algae		On other macroalgae
Chlorophyta	Ulvales	Ulvaceae	*Enteromorpha intestinalis*	Green guts	On reefs and platforms
Magnoliophyta	Potamogetonales	Zosteraceae	*Zostera mucronata*	Eel grass	Sandy/muddy intertidal flats
			Zostera muelleri	Eel grass	Sandy/muddy intertidal flats
		Potamogetonaceae	*Ruppia tuberosa*	Sea tassels	Sandy/muddy intertidal flats

Table 15 - Intertidal flora list, with ecological preferences

6.4.1 Possible impacts in the intertidal zone

Impacts to the intertidal zone may result from developments that alter the geomorphic and hydrological aspects of the bay:

- the construction of a boating channel may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, drier and better oxygenated. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos, so this type of habitat change could be reflected by a change in the species of invertebrates occupying the benthos.
- where groynes meet the beach the newly formed ‘pockets’ may drain less well, and may accumulate seaweed and seagrass wrack. This could result in the sediments becoming softer, organically enriched and more hypoxic. If accumulation is minor, the benthos may become dominated by species that can tolerate such conditions. If accumulation is major, the rotting organics could produce hydrogen sulfide gases. This has ecological effects, as H_2S can cause the death of benthic organisms, and aesthetic/health effects on air quality.

7. Site usage history

7.1 Aerial photography review

Earliest aerial photography (Survey 49, 1950) covers only the southern portion of the study site. The south eastern part of Allotment 20, including the long sloping hill at the south-eastern corner of the study area, was cleared prior to 1950, with small stands of trees and shrubs remaining and leaving the current samphire shrub land uncleared. The main highway was constructed prior to 1950, although not sealed, and the samphire swamp on the claypan was probably cut off from the tide at this time.

Wood (2004) specifies that a midden is located in the sandhills north of the BP service station, and a burial ground is reputed to be located on the small ridge in the stranded saltmarsh, north of the current border checking station. Both of these areas are visible in this early photograph and show signs of disturbance, with narrow tracks leading to and around them.

By 1968 (Survey 1115) some form of mining was occurring on the south eastern corner of the study site. The Town Camp location was well serviced by tracks and there were several large trees in evidence. Some disturbance, in the form of a rectangular track, appears to be occurring along the old drainage channel from the saltmarsh. This is reputedly where a natural soak occurs. A track, or possibly a fenceline, runs diagonally across the stranded saltmarsh, from the south eastern hill slope. The northern part of Allotment 20 has a small pit, possibly mining of materials for road base. The trees on the ridge at the northern extremity of the stranded saltmarsh appear to be in good condition.

A small building is present on the northern block (Allotment 22), which is only partially cleared (mainly in the north) and contains good stands of trees. Section 197 shows evidence of tracks, and may be grazed, but has not apparently been cleared.

The 1972 photograph (Survey 1399) shows the entire site. Dumping of fill appears to be occurring along the old drainage channel from the saltmarsh. There are buildings where the roadhouse currently is located, and a building at the current location of the border checking post.

By 1979 (Survey 2401) some form of mining appears to be occurring in the sourthern part of Allotment 22. The south eastern corner of Allotment 20, adjacent to the pit, shows evidence of some type of light cultivation, possibly the placing of improved pasture. Further development of the road house is visible and there appears to be an extension of the filled area in the southernmost corner of the stranded saltmarsh.

Survey 4532, flown in 1992 is in colour. Continued expansion of the southern filled area is visible.

The photographs show that the most northerly and south easterly portions of the study area were cleared in the past, however the remainder of the site has only been either lightly cleared or not cleared but simply grazed. The portions of the block that were cleared are visible in the present vegetation associations as predominantly D3M: mid-dense tall sod grassland, F2S: open mid-high forbland and G2S: open tussock grassland.

7.2 Land tenure review

The study area is shown on the original diagram book drawing (attached in *Appendix VII – Diagram book*) as parts of the larger Sections 13 and 35, along with several pieces of coastal reserve. The land is now denominated as Allotment 22 DP 53902, Allotment 20 DP 55492, Allotment 593 FP 180625, Parts of Section 197, Parts of Section 265 and a portion of seabed.

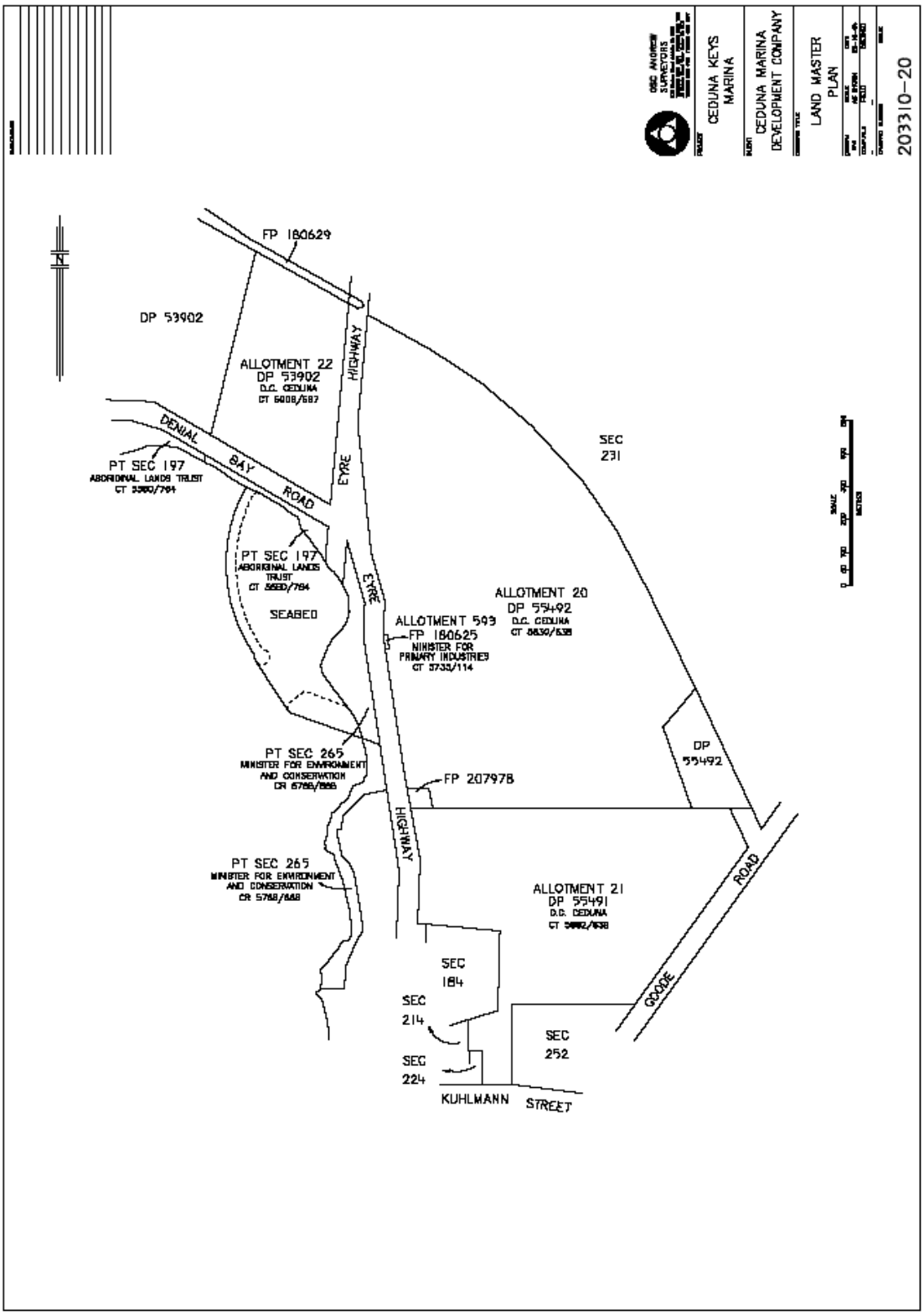


Figure 26 - Cadastral information on study area

7.2.1 Coastal reserve

The coastal reserve along the northern portion of the study site was deemed to be Section 197 in 1972 and granted as a land grant (LG 3969/65) to the Aboriginal Lands Trust. In 1980 it was leased to the Far West Aboriginal Progress Association for a term of 99 years. The lease was surrendered in 1991 and a new lease to the Yarilena Community Incorporated was issued, with an expiry date of 2016. In 1998 a new title (CT 5580/764) was issued.

The coastal reserve along the southern portion of the site was unallocated crown land until 2000 when a new Crown Record was created (CR 5768/868) and Section number 265 was allocated to the land. This land is under the care and control of the Minister for Environment and Conservation.

7.2.2 Section 35

Section 35, which included the land now forming Allotment 20 and the Town Camp, was held as an undated Miscellaneous lease by George Edward Fleetwood, farm labourer until 1903 when Act 830 of 1903 allowed for the creation of Perpetual Lease 11408. In 1928 the lease was transferred to Leo Bernhardt Hughes, farmer. In 1951 the land was transferred to Kenneth Allen Schiverz, also a farmer. Schirvarz partially surrendered the lease in 1963, and transferred portion of the lease to Eric Leslie Baumann in 1965.

In 1968 a new Crown Lease was issued, for all of Part 230, to Water Karl Obersen, service station owner. In 1969 the lease was transferred to Vytuatus Vincentas Patupas, road house proprietor, with the mortgage held by Water Karl Obersen.

In 1970 tile for the land was issued (CT 3684/191) with an encumbrance on it to ESSO Australia Pty Ltd, then was transferred to Water Karl Obersen and finally transferred to Maxwell Robert Christie, Branch Manager. In 1971 the title was apportioned between Vytuatus Vincentas Patupas and Maxwell Robert Christie.

In 1973 portions of the land were discharged from encumbrances, new titles were issued (CT's 4007/699, 4007/700, 4007/701 and 4007/702) and a portion was transferred to the Minister for Agriculture (CT 4007/698, replaced by CT 5735/114) for the border checking station.

In 1998, 4007/702 was reissued as CT 5657/128. In 2000 this title and the others forming Part 230 were amalgamated as CT 5830/129 (with the land now denominated as Allotment 20) and transferred to the District Council of Ceduna, with a caveat by Ceduna Marina Development Co Pty Ltd.

7.2.3 Section 13

Section 13 was a very large section, of which the current Allotment 22 is only a small part. In 1921 an agreement for sale was entered into, between the Commisioner of Crown Lands (George Laffer) and Walter Henry Sedgley and Harold Thomas Sedgley, farmers and graziers. In 1945 Harold Sedgley died. In 1952 Land Grant 2214/182 was issued to Walter Henry Sedgley, butcher and grazier. In 1957 the land was transferred to Ronald Alex Kies and in 1962 it was transferred to his widow, Viola Elsa Kies. Seven years later the land was sold

to Laurence Leopold and Erna Alvira Hoffrichter (farmers), with a caveat by the South Australian Railways Commissioner.
In 1970 the land was transferred to Gilbert Wilfred Anderson and Yvonne Cherie Anderson, who leased it back to the Hoffrichters as a 10 year lease. Yvonne Cherie Anderson transferred her moiety to Gilbert Wilfred Anderson in 1975. A portion of the land was transferred to South Australian Railways as CT 3683/100.

The land was divided in 1978, with portions being transferred to Richard Swinburne Jolly and Helen Fraser Fell (CTs 4139/17 and 4139/16), amongst others, while Gilbert Wilfred Anderson retained what was now Allotment 7 of Section 13, as CT 4139/23. Numerous railway easements were negotiated over the next few years, before the title was reissued as CT 4157/438 in 1980. In 2000 the title was computerised and reissued as CT 5491/351. The title was cancelled and transferred as a Crown Lease to the District Council of Ceduna. In 2003 a new title CT 5906/567 was issued to the District Council of Ceduna subject to 6 railway easements and a caveat by Ceduna Marina Development Co Pty Ltd.

A land tenure summary is attached to this report in *Appendix V – Land ownership summary*, and copies of the results of LTO searches are attached in *Appendix VI – Land tenure documents*.

8. Interaction with airport

The proposed development is located on a site that varies from between 2 and 4 kilometres from the Ceduna airport. Birds can pose a flight hazard near airports, and some sorts of developments may attract large numbers of birds. The twenty most dangerous birds, according to the Australian Transport Safety Bureau (2002) are the following:

Species	Number of strikes (1991-2001)	% resulting in damage to aircraft	% having effect on planned flight	Composite hazard ranking
Eagle	38	55.3	13.2	1
Ibis	39	41.0	17.9	2
Duck	52	26.9	19.2	3
Bat	72	25.0	13.9	4
Galah	154	17.5	14.9	5
Gull	136	15.4	3.7	6
Kite	90	14.4	4.4	7
Hawk	156	12.8	5.1	8
Pigeon	53	16.9	0	9
Owl	19	5.3	10.5	10
Lark	16	12.5	0	11
Starling	17	11.8	0	12
Magpie	117	5.1	5.9	13
Plover	143	6.9	2.8	14
Curlew	31	9.7	0	15
Peewee	18	0	5.6	16
Falcon	18	0	5.6	17
Swallow	66	4.6	0	18
Kestrel	92	1.1	0	19
Sparrow	38	0	0	20

N.B. Due to the nature of birdstrike reporting, general terms are often used to identify the species of bird struck. Therefore, a number of sub-species may be listed under the one common generic name.

Table 16 - Bird strike hazards (ASTB, 2002)

The main hazard appears to be confined to those larger birds that fly in open areas, or that flock. Developments that encourage the presence of ibis, ducks, galahs and gulls would appear to be the most likely to increase the risk of bird strike at an airport.

The existing site is an important wading bird site, and the proposed marina is not likely to increase the numbers of these birds. However, changed land use may attract other species in larger numbers.

Open areas of fresh and brackish (as opposed to saline) wetlands are likely to attract birds such as ducks, ibis and egrets. The evaporation rate at Ceduna is unlikely to permit the development of fresh to brackish wetlands in anywhere other than soaks or in infrastructure areas such as sewage treatment facilities. At Ceduna the town's sewage effluent ponds are located between the development and the airport, and increased numbers of houses and businesses will result in increased capacity requirements for the WWTP works. The expansion of the WWTP may result in a larger area of fresh water lagoons being available for ducks, ibis and egrets.

Galahs may be attracted to open parks and gardens if the grasses include weed species such as guildford grasses (*Romulea* spp.) and *Erodium* sp. (crane's and stork's bills). They also prefer areas where cover is kept less than 15 cm tall.

Open flat areas may provide roosting areas for gulls. Gulls are a particular problem as they are scavengers, and will move to new developments to scavenge from parks, bins, the outside of food processing plants and shopping centres. Gulls tend to be attracted to fishing vessels, and may be attracted to the marina if it is developed as a commercial fishing centre. Besides being attracted to the development itself, gulls may be attracted to the local support infrastructure. At Ceduna the rubbish tip is located between the proposed development and the airport, and increased numbers of houses and businesses will result in increased usage of the tip. Unless the expansion of the tip is managed carefully, larger exposures of waste may occur, and these may attract gulls.

9. Concluding summary

9.1 Current state of vegetation

Reassess the current state of vegetation on the non-tidal (terrestrial) subject area, and describe the possible impacts of any development on this vegetation.

The site has several morphological terrestrial vegetation units that occur from the landward edge of the intertidal zone, through salt pans, dunes and cheniers. These are represented in the map in *Appendix I – Vegetation associations*.

The plant associations in the surveyed morphological units are:

- **C1D:** Closed dwarf chenopod shrubland in the intertidal area, dominated by *Sarcocornia quinqueflora* and *Suaeda australis*. This habitat is in good condition and covers approximately 1.3 percent of the study area, or 2.4 hectares.

- **C2M:** Mid-dense low chenopod extratidal shrubland dominated by *Halosarcia pruinosa, H. pergranulata,* and *H. halocnemoides* often with *Hemichroa diandra* as a sub-dominant. This habitat is within the stranded saltmarsh and covers approximately 19.1 percent of the study area, or 34.5 hectares.
- **C3S:** Open mid-high chenopod shrubland dominated by *Atriplex* spp., *Maireana* spp. and/or *Frankenia* spp. often with an understorey of *Hemichroa diandra*. This habitat is within the stranded saltmarsh and covers approximately 11.2 percent of the study area, or 20.1 hectares.
- **C4D:** Closed tall chenopod shrubland in the supratidal area, dominated by *Sclerostegia arbuscula.* This habitat is in good condition and covers approximately 0.4 percent of the study area, or 0.6 hectares.
- **D3M:** Mid-dense tall sod grassland dominated by anthropogenic grasses. This habitat covers approximately 6.6 percent of the study area, or 12 hectares.
- **F2S:** Open mid-high forbland dominated by Ward's weed interspersed with scattered chenopods (*Sclerolaena* spp.and *Salsola* kali). This habitat is dominated by a weed that is indicative of overgrazing (Mitchell & Willcox, 1998) and covers approximately 3.1 percent of the study area, or 5.6 hectares.
- **G2S:** Open tussock grassland dominated by *Austrostipa* spp. and *Danthonia setacea*. This habitat covers approximately 11.2 percent of the study area, or 20.3 hectares.
- **S3S:** Open mid-high shrubland on dunes and shelly ridges with *Geijera linearifolia, Olearia* spp., *Acacia* spp. and *Pittosporum phylliraeiodes*. Isolated tall shrubs may occur in patches. The majority of this habitat is within the stranded saltmarsh and covers approximately 8.4 percent of the study area, or 15.1 hectares.
- **S3V:** Sparse mid-high shrubland dominated by *Olearia* spp., *Geijera linearifolia, Maireana* and *Cratystylis conocephala*. This habitat is in good condition and covers approximately 4.2 percent of the study area, or 7.5 hectares.
- **S41:** Isolated tall shrubs, usually *Melaleuca* spp. or *Acacia* spp. The majority of this habitat is within the stranded saltmarsh and covers approximately 3.9 percent of the study area, or 7.1 hectares.
- **S4D:** Closed coastal dune tall shrubland occurring along the primary dune, dominated by *Nitraria billardierei, Atriplex vesicaria* and *Cakile maritima*. While primary dune plants are dominated by early colonisers, this habitat is in good condition and covers approximately 2.5 percent of the study area, or 4.4 hectares.
- **T4V:** Open low mangrove woodland in the intertidal area (*Avicennia marina*) with a poor (typical for a mangal) understorey except where the woodland is prograding across the neighbouring low chenopod shrubbery. This habitat is in good condition and covers approximately 0.9 percent of the study area, or 1.6 hectares.
- **Y4L:** Isolated clumps of tall mallee shrub or other tall shrubs, usually *Eucalyptus gracilis, Eucalyptus calcareana* or *Melaleuca* spp. This habitat covers approximately 2 percent of the study area, or 3.6 hectares.

The vegetation association map also displays about 43 hectares of bare earth (either in the pan sections of the stranded saltmarsh or denuded areas of sand in the dunes and ridges), and some small patches of intertidal reef.

A review of historic aerial photography suggests that only the northern extremity and south eastern extremity of the site have been cleared. The remainder of the site has been grazed to varying extents.

Many of the shrubs along the western edge of the coastal strip north of the existing service station have been in existence for at least fifty years. The large dune itself has become steadily more vegetated over that time, but at least one large mallee is still in evidence today that predates the earliest photograph.

The long sloping hill at the south-eastern corner of the study area was cleared prior to 1950, and has been mined for sand or gravel. This block has excellent quantities of *Danthonia setacea* and several types of *Austrostipa* still existing between a heavy infestation of noxious and other weeds.

While much of the north-western block has been cleared, the southern portion of the northern block contains many large shrubs and mallees that can be identified in the 1968 photograph.

The coastal strip shows the gradual expansion of mangrove trees. The oldest mangroves are still in evidence in the earlier photographs, but the woodland is now both denser and more extensive than it was 36 years ago, as it is prograding across the intertidal saltmarsh.

The small dune east of the highway, just north of the border checking station has seen considerable growth of native vegetation in the denuded patch, however there are some older shrubs that are in evidence in early photographs – particularly towards the north of the dune and along its eastern boundary.

Dense *Sclerostegia arbuscula* mark the drainage channels through the stranded salt marsh. Although these shrubs do not attain great stature, they are a long lived species, making it quite possible that the individual shrubs present today have survived the changed conditions since the highway cut off tidal flushing.

The trees currently growing along the road reserve on the north-western boundary of the north eastern block are only just in evidence in the 1968 photograph, however the band of tall shrubs and low mallees located along the southerly base of the slope were already mature. The effects of off-road vehicles and mining are clearly visible in the centre of the more recent photograph. This impact is limited in area, with the dunes along the eastern boundary of the block being in good condition. Many of the larger shrubs on these dunes are visible in the early photograph.

9.2 Area of impact for vegetation

Calculate the relative area of each terrestrial and intertidal vegetation community type that may be lost, including a description of the condition and/or health of the vegetation. The layout plan of the current proposed development would be laid over this vegetation map to support this information.

The direct impact area of the proposed development, shown below, covers 81% of the site, with no area of the study site being more than 200m from the direct impact site. Those habitats occurring inside the outline are likely to be extirpated completely by residential development or the development of waterways. Those habitats occurring outside the outline may not be immediately impacted, but may be ultimately impacted by weed incursion (terrestrial habitats) or by hydrological/sedimentary process change (intertidal and supratidal habitats).

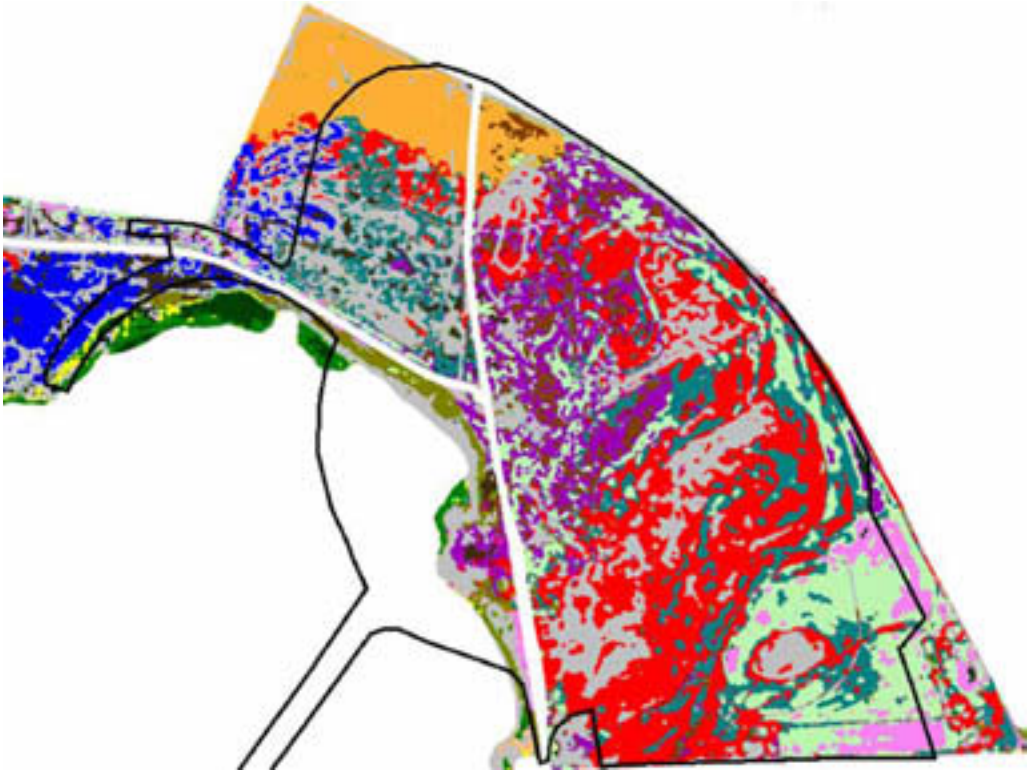


Figure 27 – Vegetation impact area

9.3 Flora that may trigger legislative response

Discuss any known flora species that occur in the area that may trigger the EPBC Act or state legislation.

Two species discovered to be present on the study site during this survey, *Ixiolaena pluriseta* and *Kippistia suaedifolia*, have conservation ratings.

Ixiolaena pluriseta (a plover daisy) has a rating of Rare for the State, and a status of Unknown for the Eyre Peninsula. According to Jessop and Toelken (1986) this species has only been collected from Smoky Bay to Fowler Bay, on the Nuyts Archipelago and one specimen from Nullabor Homestead. The plant is found principally on the calcareous sands of low coastal cliffs and the adjacent dunes. The specimens found in this survey were recorded in sampling quadrat 1, on sands overlying a low rocky clifftop.

Kippistia suaedifolia (fleshy miniura) has a rating of Rare for the Eyre Peninsula. It prefers to grow on sandhills, claypans, limestone and gypsum, and was recorded during this survey in quadrat 20, on the crest of the sandpit and within the pit itself.

Previous surveys (EMS, 2004) reported several other species with conservation significance or interest. *Maireana aphylla*, with conservation interest due to its status of Uncommon on the Eyre Peninsula, was not recorded during this survey, although seven other species of *Maireana* were found. The EMS survey noted that these plants were mainly located in the golf course roughs, and this more recent survey did not visit the golf course.

Trailing hemichroa (*Hemichroa pentandra*) with a rating of Rare for the Eyre Peninsula was not recorded in this survey, although its close relative *Hemichroa diandra* was a co-dominant in many of the quadrats surveyed. The EMS survey noted that the plants were not flowering during their survey. As the two species can be separated most reliably by examining the anthers of the flowers, it is possible that the earlier records were an estimate of the species, rather than a determination.

9.4 Fauna that may trigger legislative response

Discuss any known fauna species that occur in the area that may trigger the EPBC Act or state legislation, and complete appropriate fauna assessments to fill in knowledge gaps to allow a detailed assessment.

Murat Bay is recognised by Birds Australia as a significant wading bird site, and they have conducted wader counts there in 1984 and 2000. The results of those counts is presented in the table following, and includes 15 species of conservation significance ranging from regional to national interest. Additionally the table records that Murat Bay is considered a significant site (either nationally or internationally) for several species – the Ruddy turnstone, Sooty oystercatcher and Grey plover.

Common Name	*Species name*	Murat Bay Wader Count (2000)	Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Bar-tailed Godwit	*Limosa limosa*	26		EPBC Act
Eastern Curlew	*Numenius madagascariensis*	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Common Greenshank	*Tringa nebularia*	46		EPBC Act
Common Sandpiper	*Actitis hypoleucos*	3		EPBC Act
Grey-tailed Tattler	*Heteroscelis brevipes*	6		EPBC Act
Ruddy Turnstone	*Arenaria interpres*	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red Knot	*Calidris canutus*	38		EPBC Act
Red-necked Stint	*Calidris ruficollis*	913		EPBC Act
Sharp-tailed Sandpiper	*Calidris acuminata*	271		EPBC Act
Curlew Sandpiper	*Calidris ferruginea*	144		EPBC Act
Pied Oystercatcher	*Haematopus longirostris*	29		
Sooty Oystercatcher	*Haematopus fuliginosus*	107	163	Site of international importance according to

Grey Plover	*Pluvialis squatarola*	81	123	National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia. Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red-capped Plover	*Charadrius ruficapillus*	79		EPBC Act
Banded Lapwing	*Vanellus ticolor*	238		EPBC Act
Masked Lapwing	*Vanellus miles*	6		EPBC Act

Table 17 - Birds Australia wader counts, Murat Bay

Waders harvest food from the tidal flats. Each bird species has a particular preference – those with heavy beaks, such as Oystercatchers, can split open bivalve shells and would use the mussel top reefs as their major food source. Others, with more slender beaks, probe the sand flats for polychaete worms, sipunculids or small crustaceans. Those with longer beaks are able to obtain organisms that move deep within the sand, while the shorter beaked birds are restricted to those organisms that live close to the surface. These specific ecological preferences mean that the impacts of any development will vary, depending on the species involved.

While on site, Delta staff recorded two other non-wading species that are listed under the *EPBC Act* – the Black kite and the Nankeen kestrel.

Possible impacts on wading birds could include:

- the construction of a boating channel and groynes may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, while other areas may drain less well (the newly formed 'pockets' where the groynes meet the beach) and therefore may become hypoxic. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos. This has implications on the availability of appropriate food sources for migratory waders,
- the increased usage of the sand flats as boats enter and leave the marina may disturb the more sensitive species of birds, and
- the *Sclerostegia arbuscula* chenopod shrubland present in the stranded dissected salt marsh currently provides habitat for many small birds such as Thornbills and Chats, and these birds do not utilise deep waterways as habitat.

No other species of fauna that have legislated environmental significance were recorded on the site during the site visit.

9.5 Baseline intertidal flora and fauna data

Establish a good baseline level of data related to intertidal flora and fauna, using a repeatable methodology that will allow identification of impacts post-development. Plants and animals growing or living in the intertidal zone should be collected and identified to species level if possible. All methodologies should be documented so that the surveys could be replicated by other organizations if required.

A survey of intertidal flora and fauna was conducted on the site, incorporating observations, surface quadrats and benthic cores. The methodology and data from these surveys in included

in the body of this report, in *Section 6 – Intertidal flora and fauna*. Summary lists have also been prepared, showing the species of flora and fauna recorded, and their ecological preferences.

Impacts to the intertidal zone may result from developments that alter the geomorphic and hydrological aspects of the bay:

- the construction of a boating channel may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, drier and better oxygenated. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos, so this type of habitat change could be reflected by a change in the species of invertebrates occupying the benthos.
- where groynes meet the beach the newly formed 'pockets' may drain less well, and may accumulate seaweed and seagrass wrack. This could result in the sediments becoming softer, organically enriched and more hypoxic. If accumulation is minor, the benthos may become dominated by species that can tolerate such conditions. If accumulation is major, the rotting organics could produce hydrogen sulfide gases. This has ecological effects, as H_2S can cause the death of benthic organisms, and aesthetic/health effects on air quality.

9.6 Birds risk to airports

Assess any risk that large birds attracted to the site may pose to the nearby airport, including an assessment of current bird usage of the site.

Open flat areas may provide roosting areas for gulls. Gulls are a particular problem as they are scavengers, and will move to new developments to scavenge from parks, bins, the outside of food processing plants and shopping centres. Gulls tend to be attracted to fishing vessels, and may be attracted to the marina if it is developed as a commercial fishing centre. Besides being attracted to the development itself, gulls may be attracted to the local support infrastructure. At Ceduna the rubbish tip is located between the proposed development and the airport, and increased numbers of houses and businesses will result in increased usage of the tip. Unless the expansion of the tip is managed carefully, larger exposures of waste may occur, and these may attract gulls.

Expansion of the WWTP may result in a larger area of fresh water lagoons being available for ducks, ibis and egrets.

Galahs may be attracted to open parks and gardens if the grasses include weed species such as guildford grasses (*Romulea* spp.) and *Erodium* sp. (crane's and stork's bills). They also prefer areas where cover is kept less than 15 cm tall.

10. References

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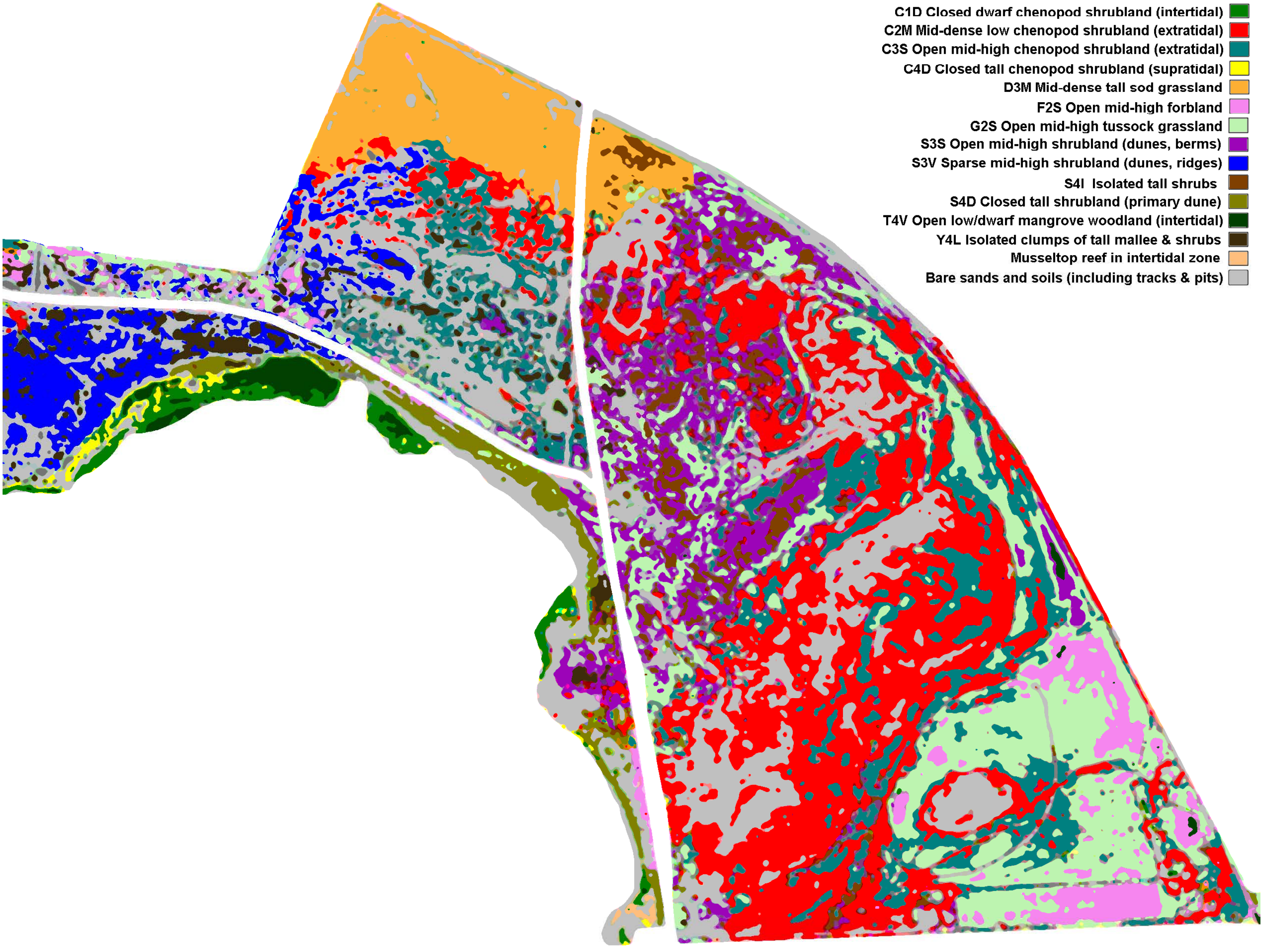
11. Appendices

Appendix I – Vegetation associations

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers


C1D Closed dwarf chenopod shrubland (intertidal)
C2M Mid-dense low chenopod shrubland (extratidal)
C3S Open mid-high chenopod shrubland (extratidal)
C4D Closed tall chenopod shrubland (supratidal)
D3M Mid-dense tall sod grassland
F2S Open mid-high forbland
G2S Open mid-high tussock grassland
S3S Open mid-high shrubland (dunes, berms)
S3V Sparse mid-high shrubland (dunes, ridges)
S4I Isolated tall shrubs
S4D Closed tall shrubland (primary dune)
T4V Open low/dwarf mangrove woodland (intertidal)
Y4L Isolated clumps of tall mallee & shrubs
Musseltop reef in intertidal zone
Bare sands and soils (including tracks & pits)

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix II – Collection permit

Department for Environment and Heritage
Science and Conservation Directorate
Research Permits Section
GPO Box 1047, Adelaide 5001 SA
1 Richmond Road, Keswick 5035 SA (Telephone 08 8124 4700 Fax 08 8124 4719)

YOU MUST CONTACT THE APPROPRIATE REGIONAL STAFF MEMBER BEFORE CONDUCTING FIELD WORK
PLEASE CARRY THIS PERMIT WHEN CONDUCTING RESEARCH

The SA Department for Environment and Heritage encourages scientific research both within the State's system of conservation reserves and on our protected native plants and animals. It is only through increased scientific understanding that we can develop a soundly based system of conservation management for the State.

In carrying out such research projects, you should be conscious that you are manipulating a part of Australia's natural heritage and this carries certain responsibilities. Some of the more obvious responsibilities are outlined under the standard conditions listed below. In addition the Department requires you to always conduct your research project in such a way as to have the smallest possible impact on the natural environment.

The Department for Environment and Heritage trust that this research project will be successful and looks forward to receiving a report of the results in due course.

Permit to Undertake Scientific Research

Title ***Ceduna Keys Marina flora survey***

This permit is valid from **21/10/2004** to **30/11/2004** unless cancelled or revoked.

PERMIT CONDITIONS

The permit is issued subject to the following conditions

1. The permit does not authorise the collection of specimens from private property without the written consent of the landowner granted not more than six months beforehand.
2. The Ranger-in-Charge of parks listed in the permit shall be notified beforehand of the exact dates on which research will be undertaken within approved reserves. Details of any vehicles to be used in field work should also be provided. If, for some reason, dates are changed, the Ranger-in-Charge must be advised accordingly. For research in remote areas, the Ranger-in-Charge must be notified at least 14 days in advance of visiting the area.
3. Upon arrival in a reserve attended by a resident Ranger, the permit shall be shown to the Ranger before research is undertaken.
4. Samples collected shall be limited in size and taken where they will cause the least disfigurement or disturbance.
5. The number of specimens of any one species which may be taken is limited to the number specified in the permit, or where the number is not stated to the minimum required for the approved scientific research.
6. You as the permit holder are responsible for the actions of other persons who may undertake this research or collect spe cimens on your behalf.
7. Specimens collected shall not be exported from this State without the consent of the Director, National Parks and Wildlife.
8. Specimens or the progeny and carcasses of animals taken under the permit may not be sold or transferred without the written consent of the Director, National Parks and Wildlife and all such specimens shall be disposed of in the manner specified in this permit at the termination of the permit or a time specified by the Director.
9. Upon completion of the research, all equipment shall be removed from the reserve, unless specific approval to the contrary has been obtained.
10. Within 14 days of the expiration of the permit, the Director, National Parks and Wildlife must be given a full report (marked 'Attention : Research Permit Section"), including all collection data, on the research carried out under the permit. Numbers and locations of all specimens collected must be supplied, together with a progress report if the project is not complete.
11. If an account of the research is published, or information circulated, a copy of the account or information shall be lodged with the Research Permit Section, within 28 days of its publication or circulation.
12. Any permits involving research on vertebrates will require the approval of an official South Australian Animal Experimentation Ethics Committee as a condition of this permit.
13. When planning and conducting your research, please be aware that your work may intrude on locations or involve species with cultural significance to local Aboriginal communities. As part of your project planning it would be a courtesy, and in some cases a requirement, to consult with local Aboriginal representatives to determine any potential impacts and the means of avoiding or limiting them.
14. This permit will cease to have effect upon a determination that native title exists in any of the lands or waters covered by this permit to the extent that such determination affects those lands or waters.

Permit Holder

Ms PSJ Coleman
Delta Environmental Consulting 12 Beach Rd
ST KILDA 5110 SA

PERMIT NO

Z24911 1

..... Signature of Permit Holder

..... John Hill, MP
MINISTER FOR ENVIRONMENT AND CONSERVATION

Additional Condtions:

GENERAL FLORA SURVEYS
Plant specimens are to be collected when validating a field identification, when a field identification cannot be reliably made, or if the specimen constitutes a new park species record, a significant range extension or an unusual form.

Advice on species likely to fall within these criteria, and recommended number of specimens is to be obtained from the appropriate specialist (eg from the Biodiversity Survey and Monitoring Section, Department for Environment and Heritage or the Plant Biodiversity Centre (State Herbarium). If such advice is not available then the specimen should be the minimum required to authenticate the record, ie one representative plant voucher specimen (representative is taken to mean a sample that includes foliage, flowers, fruits etc of sufficient quantity to meet State Herbarium standards).

In any case no more than ten percent of the visible local population (within an area of continuous habitat) is to be collected.

Collections of plant species classified as endangered, vulnerable or rare under the National Parks and Wildlife Act (SA) 1972, are to be kept to the minimum required to authenticate the record. Collection of additional material from these species must be anticipated prior to collection and specific approval sought.

MINIMUM DATASET
Researchers must collect at least a minimum set of data when carrying out biological studies under a Scientific Permit. The NPWSA Biodiversity Survey and Monitoring Group (BSM) has prepared guidelines, 'Scientific Permit Minimum Dataset', to ensure that the information collected is accurate, comprehensive and has relevance beyond the confines of the project for which it may have been originally intended.

Unless the recommended minimum dataset is collected, the information may be useless and is unlikely to be acceptable for addition into recognised, statewide, environmental databases (eg : DEH Environmental databases of SA (ESDA), South Australian Museum or Plant Biodiversity Centre). It is the responsibility of all researchers to maximise the use of the information they collect. This is especially important where studies involve the handling of and interaction with animals, and the collection of plant and animal specimens.

Specimen:

NSXCODE:

SPECIMEN: All plant species encountered: representative voucher specimens.

NUMBERSIZE: Minimum required.

LOCALITY: Ceduna Keys Marina area.

Notes:
Disposition:

Vouchers will be lodged with the State Herbarium and with the client.

Affiliates

Faith Cook, Renae Eden, Jennifer Larter, all of Delta Environmental Consulting, 12 Beach Road, St Kilda SA 5110.

Please contact these offices when using this Permit:

Far West 11 McKenzie St CEDUNA (08) 8625 3144

Appendix III – Flora voucher specimens

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Ceduna field data Permit: Z24911 1 Delta code: PSC_EMS_11/04

Datum: Aust Geod 84 GPS Zone: 53H GPS accuracy 4m

Location number	Voucher prefix	Voucher number	Date collected	Collector	Easting	Northing	Family	Species	Common name	Exotic	Conservation status
1	PSC_EMS_11/04	1	24/11/2004	COOF/COLP	373559	6446895	Pittosporaceae	*Pittosporum phylliraeoides*	Native apricot		
	PSC_EMS_11/04	2	24/11/2004	COOF/COLP	373559	6446895	Rutaceae	*Geijera linearifolia*	Sheepbush, oil bush or wilga		
	PSC_EMS_11/04	3	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Austrostipa flavescens*	A spear-grass		
	PSC_EMS_11/04	4	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Carpobrotus rossii*	Karkalla or Ross' noonflower		
	PSC_EMS_11/04	5	24/11/2004	COOF/COLP	373559	6446895	Myrtaceae	*Melaleuca lanceolata*	Moonah		
	PSC_EMS_11/04	6	24/11/2004	COOF/COLP	373559	6446895	Liliaceae	*Dianella brevicaulis*	Short fruited black anther flax- lily		
	PSC_EMS_11/04	7	24/11/2004	COOF/COLP	373559	6446895	Epacridaceae	*Acrotriche patula*	Shiny ground berry		
	PSC_EMS_11/04	8	24/11/2004	COOF/COLP	373559	6446895	Primulaceae	*Anagallis arvensis*	Blue flowered pimpernel	*	
	PSC_EMS_11/04	9	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex vesicaria*	Bladder saltbush		
	PSC_EMS_11/04	10	24/11/2004	COOF/COLP	373559	6446895	Labiatae	*Westringia rigida*	Stiff westringia		
	PSC_EMS_11/04	11	24/11/2004	COOF/COLP	373559	6446895	Iridaceae	*Gynandriris setifolia*	Thread Iris	*	
	PSC_EMS_11/04	12	24/11/2004	COOF/COLP	373559	6446895	Cruciferae	*Brassica tournefortii*	Long fruited wild turnip	*	
	PSC_EMS_11/04	13	24/11/2004	COOF/COLP	373559	6446895	Caryophyllaceae	*Silene nocturna*	Mediterranean catchfly	*	
	PSC_EMS_11/04	14	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Danthonia setacea* var *setacea*	Bristly, or small flowered, or mulga wallaby grass		
	PSC_EMS_11/04	15	24/11/2004	COOF/COLP	373559	6446895	Zygophyllaceae	*Nitraria billardierei*	Dillon berry or nitre bush		
	PSC_EMS_11/04	16	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush		
	PSC_EMS_11/04	17	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Reichardia tingitana*	False sow thistle	*	
	PSC_EMS_11/04	18	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Centaurea melitensis*	Maltese cockspur	*	
	PSC_EMS_11/04	19	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Threlkeldia diffusa*	Coast bone fruit		
	PSC_EMS_11/04	20	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Tribolium acutiflora*	Desmazeria	*	
	PSC_EMS_11/04	21	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Festuca littoralis*	Coastal fescue		
	PSC_EMS_11/04	22	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Olearia exiguifolia*	Small-leaved daisy-bush		
	PSC_EMS_11/04	23	24/11/2004	COOF/COLP	373559	6446895	Zygophyllaceae	*Zygophyllum billardierei*	Coast twinleaf		
	PSC_EMS_11/04	24	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Tetragonia implexicoma*	Bower spinach		
	PSC_EMS_11/04	25	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Ixiolaena pluriseta*	A plover daisy		Rare in SA, Unknown for EP
	PSC_EMS_11/04	26	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Cratystylis conocephala*	Bluebush daisy		
	PSC_EMS_11/04	27	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex vesicaria* var *variablis*	Bladder saltbush		
	PSC_EMS_11/04	28	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex cinerea*	Coast saltbush		
	PSC_EMS_11/04	29	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Sarcocornia quinqueflora*	Bearded glasswort		
	PSC_EMS_11/04	30	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Suaeda australis*	Austral sea-blite		
	PSC_EMS_11/04	31	24/11/2004	COOF/COLP	373559	6446895	Liliaceae	*Dianella revoluta*	Black anther flax lily		
	PSC_EMS_11/04	32	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
	PSC_EMS_11/04	33	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Mesembryanthum crystallinum*	Common iceplant	*	
	PSC_EMS_11/04	34	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Olearia axillaris*	Coast daisy bush		
	PSC_EMS_11/04	35	24/11/2004	COOF/COLP	373559	6446895	Santalaceae	*Exocarpos aphyllus*	Leafless cherry		
	PSC_EMS_11/04	36	24/11/2004	COOF/COLP	373559	6446895	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
	PSC_EMS_11/04	37	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Rhagodia candolleana*	Seaberry saltbush		
2	PSC_EMS_11/04	38	24/11/2004	COOF/COLP	373545	6446976	Compositae	*Angianthus tomentosus*	Hairy cup flower		
	PSC_EMS_11/04	39	24/11/2004	COOF/COLP	373545	6446976	Frankeniaceae	*Frankenia pauciflora*	Sea heath		
3	PSC_EMS_11/04	40	24/11/2004	COOF/COLP	373642	6446967	Amaranthaceae	*Hemichroa diandra*	Mallee hemichroa		
	PSC_EMS_11/04	41	24/11/2004	COOF/COLP	373642	6446967	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
	PSC_EMS_11/04	42	24/11/2004	COOF/COLP	373642	6446967	Avicenniaceae	*Avicennia marina*	Grey mangrove		
	PSC_EMS_11/04	43	24/11/2004	COOF/COLP	373642	6446967	Chenopodiaceae	*Sclerolaena uniflora*	Bassia		
	PSC_EMS_11/04	44	24/11/2004	COOF/COLP	373642	6446967	Compositae	*Senecio lautus*	Variable groundsel		
	PSC_EMS_11/04	45	24/11/2004	COOF/COLP	373642	6446967	Umbelliferae	*Bupleurum semicompositum*	Bupleurum	*	
4	PSC_EMS_11/04	46	24/11/2004	COOF/COLP	373685	6447023	Chenopodiaceae	*Atriplex vesicaria* (male specimen)	Bladder saltbush		
	PSC_EMS_11/04	47	24/11/2004	COOF/COLP	373685	6447023	Leguminosae	*Acacia anceps*	Port Lincoln wattle		
	PSC_EMS_11/04	48	24/11/2004	COOF/COLP	373685	6447023	Crassulaceae	*Crassula sieberana* var *tetramera*	Austral stonecrop		
	PSC_EMS_11/04	49	24/11/2004	COOF/COLP	373685	6447023	Aizoaceae	*Disphyma crassifolium*	Round leaf pigface		
5	PSC_EMS_11/04	50	24/11/2004	COOF/COLP	373966	6447103	Limoniaceae	*Limonium sinuatum*	Notch leaved perennial sea lavender	*	
	PSC_EMS_11/04	51	24/11/2004	COOF/COLP	373966	6447103	Chenopodiaceae	*Maireana oppositifolia*	Heathy bluebush		
6	PSC_EMS_11/04	52	24/11/2004	COOF/COLP	374218	6447023	Cruciferae	*Cakile maritima*	Sea rocket	*	
	PSC_EMS_11/04	53	24/11/2004	COOF/COLP	374218	6447023	Gramineae	*Avena barbata*	Bearded oat	*	
	PSC_EMS_11/04	54	24/11/2004	COOF/COLP	374218	6447023	Solanaceae	*Lycium ferocissimum*	African boxthorn	*	
	PSC_EMS_11/04	55	24/11/2004	COOF/COLP	374218	6447023	Chenopodiaceae	*Salsola kali*	Buckbush rolypoly	*	
7	PSC_EMS_11/04	56	24/11/2004	COOF/COLP	374479	6446876	Cruciferae	*Diplotaxis tenuifolia*	Lincoln weed	*	
	PSC_EMS_11/04	57	24/11/2004	COOF/COLP	374479	6446876	Chenopodiaceae	*Maireana brevifolia*	Small-leaved bluebush		
	PSC_EMS_11/04	58	24/11/2004	COOF/COLP	374479	6446876	Liliaceae	*Asphodelus fistulosus*	Onion weed	*	
	PSC_EMS_11/04	59	24/11/2004	COOF/COLP	374479	6446876	Cruciferae	*Carrichtera annua*	Ward's weed or duck-bill burr	*	
8	PSC_EMS_11/04	60	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Parafolis incurva*	Curly rye	*	
	PSC_EMS_11/04	61	24/11/2004	COOF/COLP	374642	6446093	Leguminosae	*Templetonia retusa*	Cockie's tongue		
	PSC_EMS_11/04	62	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Lolium perenne*	Perennial ryegrass	*	
	PSC_EMS_11/04	63	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Cynodon dactylon*	Couch grass		
	PSC_EMS_11/04	64	24/11/2004	COOF/COLP	374642	6446093	Compositae	*Gazania linearis*	Gazania	*	
	PSC_EMS_11/04	65	24/11/2004	COOF/COLP	374642	6446093	Myoporaceae	*Myoporum insulare*	Boobialla		
	PSC_EMS_11/04	66	24/11/2004	COOF/COLP	374642	6446093	Leguminosae	*Medicago polymorpha*	Burr medic	*	
	PSC_EMS_11/04	67	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Bromus catharticus*	Prairie grass	*	
	PSC_EMS_11/04	68	24/11/2004	COOF/COLP	374642	6446093	Umbelliferae	*Foeniculum vulgare*	Fennel	*	
	PSC_EMS_11/04	69	24/11/2004	COOF/COLP	374642	6446093	Compositae	*Helianthus annuus*	Common sunflower	*	
	PSC_EMS_11/04	70	24/11/2004	COOF/COLP	374642	6446093	Agavaceae	*Agave americana*	Century plant	*	
	PSC_EMS_11/04	71	24/11/2004	COOF/COLP	374642	6446093	Euphorbiaceae	*Euphorbia terracina*	Carnation weed, false caper	*	
	PSC_EMS_11/04	72	24/11/2004	COOF/COLP	374642	6446093	Aizoaceae	*Galenia secunda*	Blanket weed	*	
9	PSC_EMS_11/04	73	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Bromus rigidus*	Rigid brome	*	
	PSC_EMS_11/04	74	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	75	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	76	24/11/2004	COOF/COLP	374634	644389	Compositae	*Hedypnois rhagadioloides*	Cretan weed	*	
	PSC_EMS_11/04	77	24/11/2004	COOF/COLP	374634	644389	Compositae	*Arctotheca calendula*	Cape weed	*	
	PSC_EMS_11/04	78	24/11/2004	COOF/COLP	374634	644389	Limoniaceae	*Limonium companyonis*	Sea lavender	*	
10	PSC_EMS_11/04	79	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Polypogon monspeliensis*	Annual beard-grass	*	
	PSC_EMS_11/04	80	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Critesion murinum*	Barley grass	*	
	PSC_EMS_11/04	81	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
	PSC_EMS_11/04	82	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Sclerolaena brevifolia* poss. hybrid with *S. oi*	A copperburr or bindyii		
	PSC_EMS_11/04	83	24/11/2004	COOF/COLP	374634	644389	Labiatae	*Marrubium vulgare*	Horehound	*	
	PSC_EMS_11/04	84	24/11/2004	COOF/COLP	374634	644389	Compositae	*Vittadinia cervicularis*	Fuzzweed		
	PSC_EMS_11/04	85	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Maireana appressa/radiata*	A cotton bush with no fruit		
	PSC_EMS_11/04	86	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Austrostipa eremophila*	Desert spear-grass		
	PSC_EMS_11/04	87	24/11/2004	COOF/COLP	374634	644389	Compositae	*Sonchus oleraceus*	Common sow thistle	*	
	PSC_EMS_11/04	88	24/11/2004	COOF/COLP	374634	644389	Aizoaceae	*Mesembryanthemum nodosum*	Slender iceplant	*	
	PSC_EMS_11/04	89	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
	PSC_EMS_11/04	90	24/11/2004	COOF/COLP	374634	644389	Aizoaceae	*Galenia secunda*	Blanket weed	*	
	PSC_EMS_11/04	91	24/11/2004	COOF/COLP	374634	644389	Leguminosae	*Acacia cyclops*	Western coastal wattle		
	PSC_EMS_11/04	92	24/11/2004	COOF/COLP	374634	644389	Sapindaceae	*Dodonaea stenozyga*	Desert hopbush		
	PSC_EMS_11/04	93	24/11/2004	COOF/COLP	374634	644389	Boraginaceae	*Heliotropium europaeum*	Potato weed	*	
11	PSC_EMS_11/04	94	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pergranulata* var *pergranulata*	Black seed samphire		
	PSC_EMS_11/04	95	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	96	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
12	PSC_EMS_11/04	97	24/11/2004	COOF/COLP	374767	6446445	Caryophyllaceae	*Spergularia marina*	Salt sand-spurry	*	
13	PSC_EMS_11/04	98	24/11/2004	COOF/COLP	375003	6446651	Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
14	PSC_EMS_11/04	99	24/11/2004	COOF/COLP	375058	6446671	Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
15	PSC_EMS_11/04	100	24/11/2004	COOF/COLP	375154	6446626	Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
16	PSC_EMS_11/04	101	24/11/2004	COOF/COLP	375272	6446858	Chenopodiaceae	*Sclerolaena uniflora*	Bassia		

	PSC_EMS_11/04	102	24/11/2004	COOF/COLP	375272	6446858	Solanaceae	*Lycium australe*	Australian boxthorn		
17	PSC_EMS_11/04	103	24/11/2004	COOF/COLP	375266	6446935	Goodeniaceae	*Scaevola spinescens*	Spiny fanflower		
18	PSC_EMS_11/04	104	24/11/2004	COOF/COLP	374963	6446834	Myoporaceae	*Eremophila glabra*	Tar bush		
	PSC_EMS_11/04	105	24/11/2004	COOF/COLP	374963	6446834	Compositae	*Vittadinia cuneata*	Fuzzweed		
	PSC_EMS_11/04	106	24/11/2004	COOF/COLP	374963	6446834	Caryophyllaceae	*Silene gallica*	French catchfly	*	
	PSC_EMS_11/04	107	24/11/2004	COOF/COLP	374963	6446834	Iridaceae	*Romulea minutiflora*	Guildford grass	*	
19	PSC_EMS_11/04	108	25/11/2004	COOF/COLP	375228	644637O	Amaranthaceae	*Ptilotus obovatus* var *obovatus*	Silver mulla mulla		
	PSC_EMS_11/04	109	25/11/2004	COOF/COLP	375228	644637O	Chenopodiaceae	*Atriplex paludosa* ssp. *cordata*	Marsh saltbush		
	PSC_EMS_11/04	110	25/11/2004	COOF/COLP	375228	644637O	Chenopodiaceae	*Maireana scleroptera*	A maireana		
20	PSC_EMS_11/04	111	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Maireana trichoptera*	A bluebush		
	PSC_EMS_11/04	112	25/11/2004	COOF/COLP	375240	6446324	Compositae	*Kippistia suaedifolia*	Kippistia		Rare in EP
	PSC_EMS_11/04	113	25/11/2004	COOF/COLP	375240	6446324	Primulaceae	*Anagallis arvensis*	Scarlet pimpernel	*	
	PSC_EMS_11/04	114	25/11/2004	COOF/COLP	375240	6446324	Labiatae	*Westringia rigida*	Stiff westringia		
	PSC_EMS_11/04	115	25/11/2004	COOF/COLP	375240	6446324	Leguminosae	*Acacia cyclops*	Western coastal wattle		
	PSC_EMS_11/04	116	25/11/2004	COOF/COLP	375240	6446324	Compositae	*Conyza bonariensis*	Flaxleaf fleabane	*	
	PSC_EMS_11/04	117	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Beta vulgaris*	Beet	*	
	PSC_EMS_11/04	118	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Atriplex acutibractea*	A saltbush		
	PSC_EMS_11/04	119	25/11/2004	COOF/COLP	375240	6446324	Myrtaceae	*Eucalyptus stoatei*	Scarlet pear gum		
	PSC_EMS_11/04	120	25/11/2004	COOF/COLP	375240	6446324	Gentianaceae	*Centaurium tenuiflorum*	A centaury		
	PSC_EMS_11/04	121	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Maireana erioclada/pentatropis*	A maireana with no fruit		
21	PSC_EMS_11/04	122	25/11/2004	COOF/COLP	325401	64466592	Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak		
	PSC_EMS_11/04	123	25/11/2004	COOF/COLP	325401	64466592	Gramineae	*Austrostipa drummondii*	Cottony speargrass		
	PSC_EMS_11/04	124	25/11/2004	COOF/COLP	325401	64466592	Zygophyllaceae	*Zygophyllum aurantiacum*	Shrubby twinleaf		
22	PSC_EMS_11/04	125	25/11/2004	COOF/COLP	374602	6447509	Gramineae	*Austrostipa drummondii*	Cottony speargrass		
	PSC_EMS_11/04	126	25/11/2004	COOF/COLP	374602	6447509	Myoporaceae	*Eremophila weldii*	Purple emubush		
	PSC_EMS_11/04	127	25/11/2004	COOF/COLP	374602	6447509	Myrtaceae	*Melaleuca pauperiflora*	Boree		
	PSC_EMS_11/04	128	25/11/2004	COOF/COLP	374602	6447509	Myrtaceae	*Eucalyptus gracilis*	White mallee		
	PSC_EMS_11/04	129	25/11/2004	COOF/COLP	374602	6447509	Rutaceae	*Geijera linearifolia*	Sheepbush, oilbush or wilga		
	PSC_EMS_11/04	130	25/11/2004	COOF/COLP	374602	6447509	Compositae	*Vittadinia eremaea*	A vittadinia		
23	PSC_EMS_11/04	131	25/11/2004	COOF/COLP	374878	6447304	Liliaceae	*Thysanotus baueri*	Mallee fringe lily		
24	PSC_EMS_11/04	132	25/11/2004	COOF/COLP	374855	6447267	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby glasswort		
	PSC_EMS_11/04	133	25/11/2004	COOF/COLP	374855	6447267	Malvaceae	*Lawrencia squamata*	Thorny lawrencia		
25	PSC_EMS_11/04	134	25/11/2004	COOF/COLP	374786	6447134	Gramineae	*Austrostipa elegantissima*	Feather speargrass		
26	PSC_EMS_11/04	135	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
	PSC_EMS_11/04	136	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	137	25/11/2004	COOF/COLP	374683	6447082	Leguminosae	*Senna artemesiodes*	Desert cassia		
	PSC_EMS_11/04	138	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Rhagodia crassifolia*	Fleshy saltbush		
27	PSC_EMS_11/04	139	25/11/2004	COOF/COLP	374080	6447244	Leguminosae	*Acacia hakeoides*	Hakea wattle		
	PSC_EMS_11/04	140	25/11/2004	COOF/COLP	374080	6447244	Santalaceae	*Santalum acuminatum*	Quandong		
	PSC_EMS_11/04	141	25/11/2004	COOF/COLP	374080	6447244	Myoporaceae	*Myoporum brevipes*	Warty myoporum		
28	PSC_EMS_11/04	142	25/11/2004	COOF/COLP	374178	6447205	Liliaceae	*Lomandra collina*	Fibrous mat-rush		
	PSC_EMS_11/04	143	25/11/2004	COOF/COLP	374178	6447205	Myoporaceae	*Myoporum insulare*	Boobialla, native juniper		
29	PSC_EMS_11/04	144	25/11/2004	COOF/COLP	374266	6447177	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby glasswort		
30	PSC_EMS_11/04	145	25/11/2004	COOF/COLP	374358	6447092	Aizoaceae	*Mesembryanthemum aitonis*	Angled iceplant	*	
	PSC_EMS_11/04	146	25/11/2004	COOF/COLP	374358	6447092	Solanaceae	*Solanum hystrix*	Afghan thistle		
31	PSC_EMS_11/04	147	25/11/2004	COOF/COLP	374520	6447551	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
32	PSC_EMS_11/04	148	25/11/2004	COOF/COLP	374367	6447350	Myrtaceae	*Eucalyptus gracilis*	White mallee		
33	PSC_EMS_11/04	149	25/11/2004	COOF/COLP	373964	6447157	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
	PSC_EMS_11/04	150	25/11/2004	COOF/COLP	373964	6447157	Loranthaceae	*Amyema melaleucae*	A mistletoe		
34	PSC_EMS_11/04	151	25/11/2004	COOF/COLP	373657	6447082	Proteaceae	*Hakea rugosa*	Dwarf hakea		

Appendix IV – Birds Australia species list

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Birds Australia site list

Family	Common Name	Species name	Habitat (Simpson and Day)	Nest form / time / location (Gordon & Beruldsen) & (Simpson and Day)	Birds Aust Murat Bay Wader Count (2000)	Birds Australia Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Phasianidae	Stubble Quail	*Coturnix pectoralis*	Grasslands.	August to January. Shallow ground scrape.			Unprotected
Anatidae	Blue-billed Duck	*Oxyura australis*	Deep freshwater marshes. Large open lakes, tidal inlets and bays.	Neat bowl of reeds.			Rare (SA NP&WS) EPBC Act, rare EP
Anatidae	Musk Duck	*Biziura lobata*	Permanent swamps with dense vegetation. Large open lakes, tidal inlets and bays.	Loose bowl of reeds with hood.			Rare (SA NP&WS) EPBC Act
Anatidae	Black Swan	*Cygnus atratus*	Large expanses of open water. Pasture, crops and mudflats.	Febuary to April. Thick mattress, occasionally floating.			EPBC Act
Anatidae	Grey Teal	*Anas gracilis*	Any available water. More coastal during dry periods.	Late winter and spring. Variable nest structure and location.			EPBC Act
Anatidae	Chestnut Teal	*Anas castanea*	Disperses to freshwater, tidal mudflats and inlets.	July to October. Hollow on ground in brackish coastal swamps.			EPBC Act
Anatidae	Hardhead	*Anthya australis*	Deep, vegetated swamps, other large open waters.	Neat bowl of reeds.			EPBC Act
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	Generally freshwater.	October to December. Raft of floating vegetation.			Unprotected
Podicipedidae	Hoary-headed Grebe	*Poliocephalus poliocephalus*	Lakes, swamps; frequently on brackish water or on sea off estuaries.	Does not nest on salt water.			Unprotected
Sulidae	Australasian Gannet	*Morus serrator*	Oceans and bays.	Tasmainan and Victorian offshore islands.			Unprotected
Anhingidae	Darter	*Anhinga melanogaster*	Lakes, rivers, swamps. Rarely coastal.	Prefers inland waters.			Unprotected
Phalacrocoracidae	Little Pied Cormorant	*Phalacrocorax melanoleucos*	Most aquatic habitats.	Seldom breeds in marine saltwater habitats.			Unprotected
Phalacrocoracidae	Black-faced Cormorant	*Phalacrocorax fuscescens*	Off-shore rock stacks, islets; outer harbour beacons.	April to June. Nests are large platforms in colonies.			Unprotected
Phalacrocoracidae	Pied Cormorant	*Phalacrocorax varius*	Prefers large areas of water, coastal or inland lakes, rivers, mangrove lined esturaries.	Autumn. Nests in coastal and tidal stream mangroves.			Unprotected
Phalacrocoracidae	Little Black Cormorant	*Phalacrocorax sulcirostris*	Most aquatic habitats.	Spring and Autumn. Small stick structure in trees 1-20m tall, near water.			Unprotected
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	Most aquatic habitats.	Prefers secluded freshwater streams and lakes.			Unprotected
Phalacrocoracidae	Australian Pelican	*Pelecanus conspicillatus*	Open fresh and salt water.	Bare hollow scraped out in sand or earth. Generally in colonies.			Unprotected
Ardeidae	White-faced Heron	*Egretta novaehollandiae*	Pasture, farm dams, parkland, most wetlands including intertidal flats.	October to December. Platform in fork of tree 5-20m from the ground.			Unprotected
Ardeidae	Little Egret	*Egretta garzetta*	Shallows of wetlands, intertidal mud-flats.	Does not breed near study site.			Rare SA
Ardeidae	Eastern Reef Egret	*Egretta sacra*	Intertidal zone: Rocks, coral reefs, mangroves, mud-flats.	September to December. Platform on rocky ledge or trees on intertidal flat.			Rare (SA NP&WS) EPBC Act, rare EP
Ardeidae	Great Egret	*Egretta alba*	Floodwaters, rivers, shallows of wetlands, intertidal mudflats.	October to December. Platform in tree greater than 20m tall near water.			EPBC Act
Plataleidae	Royal Spoonbill	*Platalea regia*	Shallows of fresh and saltwater wetlands including intertidal flats.	August to November. Platform of sticks in tree.			Unprotected
Pandionidae	Osprey	*Pandion haliaetus*	Mangroves, rivers and estuaries. Inshore seas, coastal islands. Eats fish.	September to October. Generally a pile of seaweed in a tree fork.			Rare (SA NP&WS) EPBC Act, rare EP
Accipitridae	Black-shouldered Kite	*Elanus axillaris*	Open woodlands and tall grasslands. Hunts at dusk and dawn.	July to November. Nest placed in the crown of a Eucalypt tree.			EPBC Act
Accipitridae	Black Kite	*Milvus migrans*	Open plains, timbered water courses, rubbish dumps, abattoirs and cattle yards.	In trees over 10m tall.			EPBC Act
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Large rivers, fresh and saline lakes, reservoirs, coastal seas, islands.	On ledges of coastal cliffs.			Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Accipitridae	Spotted Harrier	*Circus assimilis*	Hunts over low open grassland, crops and windbreaks.	Flat structure of sticks in tree, within scrub.			EPBC Act
Accipitridae	Swamp Harrier	*Circus approximans*	Hunts low over tall grass, reeds, rushes and crops.	Does not breed near study site.			EPBC Act
Accipitridae	Wedge-tailed Eagle	*Aquila audax*	Most types except closed forest.	Nest in large tree with a wide view.			EPBC Act
Falconidae	Brown Falcon	*Falco berigora*	Most land surface types except closed forest.	Uses old nests of other species, particularly Corvus spp.			EPBC Act
Falconidae	Nankeen Kestrel	*Falco cenchroides*	Most land surface types except closed forest.	Small nest of sticks in tree, on cliffs or in haystacks.			EPBC Act
Turnicidae	Little Button-quail	*Turnix velox*	Dry to arid woodlands, grasslands.	October to January. Shallow ground scrape lined with grass.			Unprotected
Scolopacidae	Bar-tailed Godwit	*Limosa limosa*	Tidal flats, occasionally inland.	Migratory. Breeds in northern hemisphere summer.	26		EPBC Act
Scolopacidae	Whimbrel	*Numenius phaeopus*	Estuaries, mudflats, mangroves, sandspits, occasionally inland.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Eastern Curlew	*Numenius madagascariensis*	Estuaries, mudflats, mangroves, sandspits.	Migratory. Breeds in northern hemisphere summer.	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	Coastal, inland lakes, prefers freshwater.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Common Greenshank	*Tringa nebularia*	Coastal, inland lakes.	Migratory. Breeds in northern hemisphere summer.	46		EPBC Act
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	Banks, rocks near water.	Migratory. Breeds in northern hemisphere summer.	3		EPBC Act
Scolopacidae	Grey-tailed Tattler	*Heteroscelis brevipes*	Estuaries, rocky coasts, reefs.	Migratory. Breeds in northern hemisphere summer.	6		EPBC Act
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*	Rocky shores.	Migratory. Breeds in northern hemisphere summer. Juvenilles may overwinter on rocky coasts.	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Scolopacidae	Great Knot	*Calidris tenuirostris*	Tidal mudflats, rarely inland.	Migratory. Breeds in northern hemisphere summer. Some overwinter.			EPBC Act
Scolopacidae	Red Knot	*Calidris canutus*	Tidal mudflats, rarely inland.	Migratory. Breeds in northern hemisphere summer. Some overwinter.	38		EPBC Act
Scolopacidae	Sanderling	*Calidris alba*	Beaches, rarely inland.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Little Stint	*Calidris minuta*	Coastal, inland shorelines.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	Coastal, inland shorelines.	Migratory. Breeds in northern hemisphere summer.	913		EPBC Act
Scolopacidae	Sharp-tailed Sandpiper	*Calidris acuminata*	Inland waters, coastal.	Migratory. Breeds in northern hemisphere summer.	271		EPBC Act
Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	Coastal, inland mudflats.	Migratory. Breeds in northern hemisphere summer.	144		EPBC Act
Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	Coastal, prefers sandy beaches, estuaries.	October to December. Hollow scratched in loose sand, seaweed and driftwood.	29		Unprotected

Haematopodidae	Sooty Oystercatcher	*Haematopus fuliginosus*	Coastal, prefers rocky coastline; occasionally estuaries.	October to December. Hollow scratched in loose sand. Usually on offshore island.	107	163	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	Fresh and saltwater marshes. Flooded paddocks.	August to January.			EPBC Act
Recurvirostridae	Banded Stilt	*Cladorhynchus leucocephalus*	Fresh and saltwater marshes, marine mudflats, large ephemeral lakes.	Usually in Western Australian Inland lakes.			EPBC Act
Charadriidae	Pacific Golden Plover	*Pluvialis dominica*	Beaches, mudflats, may be inland.				EPBC Act
Charadriidae	Grey Plover	*Pluvialis squatarola*	Beaches, mudflats, may be inland.		81	123	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Charadriidae	Red-capped Plover	*Charadrius ruficapillus*	Sandy areas; coastal and inland.	September to December. Scrapes a small hollow in open sandy position.	79		EPBC Act
Charadriidae	Double-banded Plover	*Charadrius bicinctus*	Beaches, mudflats, grasslands, bare ground.				EPBC Act
Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	Shores, marshes, rarely inland.				EPBC Act
Charadriidae	Greater Sand Plover	*Charadrius leschenaultii*	Shores, marshes, rarely inland.				EPBC Act
Charadriidae	Inland Dotterel	*Charadrius australis*	Ploughed ground, open sparse plains and gibber.	August to November.			EPBC Act
Charadriidae	Hooded Plover	*Thinornis rubricollis*	Ocean beaches, sometimes coastal lakes. Inland saltlakes in WA.	September to January.			Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Charadriidae	Banded Lapwing	*Vanellus ticolor*	Open grasslands, bare plains and arable land.	July to December. Nest in open areas amoung short stubble or crops.	238		EPBC Act
Charadriidae	Masked Lapwing	*Vanellus miles*	Grasslands, mud-flats, urban parks.	June to December. Shallow hollow scraped in ground.	6		EPBC Act
Laridae	Pacific Gull	*Larus pacificus*	Coastal.	September to December. Hollow scratched into the sand above beach.			Unprotected
Laridae	Silver Gull	*Larus novaehollandiae*	Coastal, inland waters, urban areas.	August to December. Nests in colonies.			Unprotected
Laridae	Caspian Tern	*Sterna caspia*	Coastal; also inland watercourses.				Unprotected
Laridae	Crested Tern	*Sterna bergii*	Coastal.	Nests in colonies on off-shore islands.			Unprotected
Laridae	Fairy Tern	*Sterna nereis*	Coasts, occasionally inland watercourses.	Hollow among debris, close to water. Small colonies on islands or isolated locations.			Vulnerable (SA NP&WS) ssp nereis vulnerable EP
Laridae	Whiskered Tern	*Chlidonias hybrida*	Lakes and estuaries.	Usually nests in areas temporarily under flood waters.			Unprotected
Columbidae	Rock Dove	*Columba livia**	Rainforests and scrub. Occasionally isolated trees.	July to Febuary. Nest in hollows, dead wood and ground debris.			Unprotected
Columbidae	Common Bronzewing	*Phaps chalocoptera*	Dry forest, woodlands, mallee, heath and coastal scrub.	September to January. Small saucer of sticks in tall tree.			Unprotected
Columbidae	Brush Bronzewing	*Phaps elegans*	Woodlands, heathlands and some mallee areas.	Identical to Common Bronzewing.			Unprotected
Columbidae	Crested Pigeon	*Ocyphaps lophotes*	Lightly wooded grasslands near water.	Similar to Common Bronzewing.			Unprotected
Columbidae	Peaceful Dove	*Geopelia striata*	Lightly timbered country near water.	Spring to summer. Platform of twigs in tree or bush 6-8 m above the ground.			Rare EP
Cacatuidae	Galah	*Eolophus roseicapilla*	Woodlands, open shrublands, grasslands and parks.	In any suitable tree hollow.			Unprotected
Psittacidae	Australian Ringneck	*Barnardius zonarius* race *zonarius*	Mallee and Mulga.	August to December. In any suitable tree hollow.			Unprotected
Psittacidae	Mulga Parrot	*Psephotus varius*	Arid shrublands, mallee.	In deep tree hollows, generally in inland areas.			Unprotected
Psittacidae	Rock Parrot	*Neophema petrophila*	Coastal dunes, saltmarsh and rocky islands.	August to November. Bare earth beneath rocks or low vegetation, particularly pigface.			Rare (SA NP&WS), rare EP
Cuculidae	Pallid Cuckoo	*Cuculus pallidus*	Open areas with trees.	August to December. South of latitude 25-26 degrees.			Unprotected
Cuculidae	Fan-tailed Cuckoo	*Cuculus flabelliformis*	Forests and woodlands.	August to January.			Unprotected
Cuculidae	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	Open country.	August to January.			Unprotected
Tytonidae	Barn Owl	*Tyto alba*	Grasslands, farmlands, woodlands. May roost on ground in cave.	Food dependant breeding. Nests in tree hollows.			Unprotected
Apodidae	Fork-tailed Swift	*Apus pacificus*	Aerial, over a variety of habitats. N Asian migrant.	Migratory. Breeds in Northern Hemisphere Summer			EPBC Act
Maluridae	Variegated Fairy-wren	*Malurus lamberti*	Across inland Australia.	July to January. Nests in thick grass.			Unprotected
Pardalotidae	Striated Pardalote	*Pardalotus striatus*	Eucalypt forests, woodlands, in tree crowns.	July to December. Long tunnel drilled into the soil up to 1.5m long into creek banks.			Unprotected
Pardalotidae	White-browed Scrubwren	*Sericornis frontalis*	Dense undergrowth, including urban areas, saltmarshes and heaths.	June to December. Dome nest on ground or near ground in low vegetation.			Unprotected
Pardalotidae	Weebill	*Smicrornis brevirostris race brevirostris*	Dry forest, woodlands, mallee.	August to December. Small nest in tree or shrub of any height.			Unprotected
Pardalotidae	Inland Thornbill	*Acanthiza apicalis*	Dry scrub to coastal heaths.	July to December.			Unprotected
Pardalotidae	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	Dry woodlands, mallee and mulga.	August to December. In small hollow of tree. June to December.			Unprotected
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	Open woods, parklands.	June to December. Built 2-5m from the ground in dense folige.			Unprotected
Pardalotidae	Southern Whiteface	*Aphelocephala leucopsis* race *maculatus*	Open arid country, especially near dead trees.	June to November.			Unprotected
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*	Forests, woodlands and suburbs.	July to Febuary.			Unprotected
Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	Desert, coastal scrubs, mallee, woodland and orchards.	July to December. Built in dense foliage of tree or shrub.			Unprotected
Meliphagidae	Yellow-throated Miner	*Manorina flavigula*	Dry woodlands, especially mallee.	July to December. Frail nest built in foliage of sapling, shrub or vine.			Unprotected
Meliphagidae	Singing Honeyeater	*Lichenostomus virescens*	Arid and coastal shrublands, woodlands and suburbs.	July to January. Grass cup in bush or shrub.			Unprotected
Meliphagidae	Purple-gaped Honeyeater	*Lichenostomus cratitius*	Mallee, woodlands.	July to December . Built in dense shrub or bush.			Unprotected
Meliphagidae	White-fronted Honeyeater	*Phylidonyris albifrons*	Arid sburblands to woodlands.	July to December. Small nest built in bush or small tree.			Unprotected
Meliphagidae	Crimson Chat	*Epthianura tricolor*	Salty areas of inland plains, rocky hills, mallee heath.	July to November. A neat cup in saltbush, bluebush or samphire.			Unprotected
Meliphagidae	White-fronted Chat	*Epthianura albifrons*	Low vegetation in salty coastal and inland areas, crops.	June to January. Cup in centre of samphire and saltbush. Sometimes in rank grasses.			Unprotected
Petroicidae	Jacky Winter	*Microeca fascinans*	Drier country, farmland.	July to December. In fork of tree, 10m or more above ground.			Unprotected
Petroicidae	Red-capped Robin	*Petroica goodenovii*	Drier scrub, woodlands.	July to December. Small cup in fork of shrub or small tree.			Unprotected
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	Drier, more open forests with shrubby understory, mallee, mulga scrubs.	June to December. Enclosed nest in fork of tree. 3-15m above ground.			Unprotected
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	Scherophyll forests and woodlands.	July to December. Nest in vertical dead branches in tall trees.			Unprotected
Pachycephalidae	Gilbert's Whistler	*Pachycephala inornata*	Shrubby woodland, mallee.	September to December. Nest in vegetation less that 2m above ground.			Rare EP
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*	Rainforests, open forests, woodlands, mallee and coastal vegetation.	August to January. Nest in concealing vegetation.			Unprotected
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	Mostly open forest, woodland, mallee and scrub of arid interior.	August to Febuary. Nest in concealing vegetation.			Unprotected

Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	Forest, woodland, scrub, mallee, gardens.	July to Febuary. Nest in hollows, dead wood and ground debris.	Unprotected
Dicruridae	Magpie-Lark	*Grallina cyanoleuca*	Open areas, roadsides, often near water.	Spring to early summer. Any horizontal limb between 3-20m above ground.	Unprotected
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*	Forest and woodlands.		Unprotected
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*	Everywhere except from very wet forests.	July to December. Built on anything suitable, less than 5m above ground.	Unprotected
Campephagidae	Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	Open woodlands and forests.	August to January. Between 10-20m above ground.	Unprotected
Campephagidae	White-winged Triller	*Lalage sueurii*	Open country and woodlands.	September to Febuary. Small nest in fork. Also Magpie-Lark nests.	Unprotected
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*	Open forests and woodlands.	August to January. Fork of tree, between 5-10m above the ground.	Unprotected
Artamidae	Grey Butcherbird	*Cracticus torquatus*	Open forest, woodland, mallee, urban and farmland.	July to December. Fork of tree clear of foliage, up to 5m from the ground.	Unprotected
Artamidae	Australian Magpie	*Gymnorhina tibicen*	Open forest, farms and urban land.	June to December. Fork of tall tree. Between 5-15m.	Unprotected
Corvidae	Australian Raven	*Corvus coronoides*	Most types except closed forest.	July to September. Upright fork of tree/powerpole, over 10m above ground.	Unprotected
Corvidae	Little Raven	*Corvus mellori*	Most types except closed forest.	June to September. Smaller trees/powerpoles. Between 3-10m from the ground.	Unprotected
Corvidae	Little Crow	*Corvus bennetti*	Most types in arid and semi arid zones. Outback towns.	August to January. Fork of a tree, between 1-10m from the ground.	Unprotected
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Dry woodland and mallee.	August to December. Mud nest in tree between 3 and 10m from the ground.	Vulnerable EP
Motacillidae	Richard's Pipit	*Anthus novaeseelandiae*	Open country, grassland.	August to December. Grass nest in a depression.	Unprotected
Passeridae	House Sparrow	*Passer domesticus**	Human habitation, farmland, reedbeds.		Unprotected
Hirundinidae	White-backed Swallow	*Cheramoeca leucosternus*	Inland sandy country.	July to December. Tunnel in bank approx 1m long.	Unprotected
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	All kinds, especially near water.	July to January. Nest attatched to vertical support of many kinds.	Unprotected
Hirundinidae	Tree Martin	*Hirundo nigricans*	Open woodland.	July to December. Hollows 1-30m above the ground.	Unprotected
Sylviidae	Little Grassbird	*Megalurus gramineus*	Reeds, tussocks in swamps.	July to December. In herbage or lignum. Less than 1m from the ground.	EPBC Act
Alaudidae	Rufous Songlark	*Cincloramphus mathewsi*	Woodland, parklands, hedges, lightly timbered grassland.	August to December. Nest on ground, often in thick vegetation.	Unprotected
Alaudidae	Brown Songlark	*Cincloramphus cruralis*	Grassland and crops.	August to December. Nest on ground, under grass or cultivated crop.	Unprotected
Zosteropidae	Silvereye	*Zosterops lateralis*	All types, orchards, gardens.	August to December. In shrub or bush.	Unprotected
Muscicapidae	Common Blackbird	*Turdus merula**	Wide variety.	August to April.	Unprotected
Sturnidae	Common Starling	*Sturnus vulgaris**	Urban and country.	August to March. In tall trees.	Unprotected

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix V – Land ownership summary

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Year	Coastal reserve	Section number 35						Section 13							Coastal reserve
1880															
1881		Not dated. Misc. Lease 7043. George Edward Fleetwood Farm labourer													
1903		Act 830/03 for perpetual lease No. 11408													
1910		Crown Lease 568/96 George Edward Fleetwood Farm labourer													
1920								Agreement for Sale CT 644/108 Walter Henry Sedgley and Harold Thomas Sedgley Farmers and Graziers.							
1928		Transfer No. 1031976 to Leo Bernhardt Hughes													
1929		Agreement for sale and purchase 754/7. Leo Bernhardt Hughs Farmer													
1934		Crown Lease No.16197. CT 885/20 Leo Bernhardt Hughs Farmer													
1949								Transfer 1581093 Wallis Henry Sedgley to William Henry Sedgley, Butcher and grazier							
1951		Transfer No.1694122 Kennith Allen Schivarz Farmer													
1952								Land grant CT 2214/182 to Walter Henry Sedgley, Butcher and grazier							
1959								Transfer 2105283 to Ronald Alex Kies, farmer and grazier.							
1961															
1962								Transfer to Viola Elsa Kies widow							
1963		Partial surrender No.2460577 of Lease No. 16197													
1964								Transfer 2557087 to Laurence Leopold and Erna Alvira Hoffrichter Farmer.							
1965							Transfer of Lease No.16197 to Eric Leslie Baumann								
1968		Partial Surrender No. 2961368 of Lease No.16197. Crown Lease CT1351/12 appears to replace surrendered sections. Walter Karl Obersen service station owner **(Land now called Section 230)**						Caveat 2892526 by South Australian Railways commissioner							
1969		Transfer 3062567 to Vytuatas Vincentas Patupas Road House Proprietor. Mortgaged to Walter Karl Oberden													
1970		3684/191 encumbrance ESSO Australia.Ltd (PriceWaterhouse), Transfer 31226020 to Walter Karl Oberden, Service station proprietor. Transfer 3162126 to Maxwell Robert Christie.						Caveat withdrawn. Part replaced by CT 3683/102 Laurence Leopold and Erna Alvira Hoffrichter Farmer, Road Easement. Transfer 3113300 to Gillbert Wilfred Anderson and Yvonne Cherie Anderson Farmer. 10yr lease 3113303 to Hoffrichters to 5.5.1980							Portion of CT 2214/182 transfer 3070438 to South Australian Railways. new CT 3683/100
1971		Portion to CT 3744/144 Maxwell Robert Christie Branch Manager			Balance portion to CT 3744/145 Vytautas Vincentas Patupas Road House Proprietor			Transfer 3267782 portion to crown for road.							
1972	**Land Grant 3969/65** Aboriginal Lands Trust of 25 Bank Street, Adelaide. Given a **section number 197**. Lease 4549073 to Far West Aboriginal Progress Assoc.Inc. portion of land 99 year lease commencing 1.4.1980	New and balance CT 4007/701	New and Balance CT 4007/699	Portion of within land discharged form encumbrance. Transfer 3534069 to the minister of agriculture new CT for that portion 4007/698	Portion of within land discharged from emcumbrance. Transfer 3534069 portion to Minister for Agriculture new CT for that portion 4007/698	New and Balance CT 4007/700	New and Balance CT 4007/702. Vytautas Vincentas Patupas Road House Proprietor.							
1973															
1974				CT 4007/698											
1975								Transfer 3788933 from Yvonne Cherie Anderson to Gilbert Wilfred Anderson undivided moiety							
1978								Portion to CT 4139/17 transfer 4249305 to Richard Swinburne Jolly and Helen Fraser Fell. Easements set forth in transfer	Portion to CT 4139/18 transfer 4249306 to Richard Swinburne Jolly and Helen Fraser Fell. Easements set forth in Transfer	Portion to CT 4139/19	Portion to CT 4139/20	Portion to CT 4139/21	Portion to CT 4139/22	Balance to CT 4139/23 Gilbert Wilfred Anderson,farmer.	Portion to CT 4139/24	
1979								Easements for Railway: Transfer 4463473 of easement to Edward Mathew Gerovich 1.11.1979. Cancelled with regard to 4157/434, Transfer 4463474 of easement to Geoffrey Roy and Beverley Esther Mitchell 1.11.1979. Cancelled with regard to 5157/435, Transfer 4489132 of easement to Robert Bernhardt Anderson 24.12.1979. Cancelled with regard to 4157/436, Transfer 4489133 of easement to Graeme Neil and Pauline Joan McGuiness 24.12.1979. Canelled with regard to 4157/437							
1980													Gilbert Wilfred Anderson,farmer Balance to CT 4157/438		
1991	Lease No 7082685. Lease 4649073 surrended. Lease 4549073 to Yarilena Community Inc. Expiring 13.3.2016														
1998	**New CT 5580/764.**						CT 5657/129						New CT 5491/351		
1999															
2000				Minister of agriculture Replaced with CT 5735/114		Transfer 8761727 to District Council of Ceduna. Discharge of encumbrance. 5657/129 and others replaced by 5830/638 others may include 4007/701, 4007/699,							Transfer No. 8850523 Crown Lease CT 5835/121		CR 5768/868 Crown Record created with no parent title. New section number 265
2001															
2003													CT 5906/567 District Council of Ceduna Subject to 6 easments running paralell to the northern boarder, consuming approximately 50m. Caveat by Ceduna Marina.		
2004	Contains a range of Registrar-General notes, discussing filed plans and converted titles. Aboriginal Lands Trust of 1 Wright Road, Walkley Heights, SA 5098			5735/114 Minister for Primary Industries of Adelaide SA 5000		5830/638 District Council of Ceduna, PO Box 175 Ceduna, SA 5690. Caveat by Ceduna Marina Development Co. Pty Ltd.									CR 5768/868

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix VI – Land tenure documents

DSC ANDREW SURVEYORS

PROJECT
CEDUNA KEYS MARINA

CLIENT
CEDUNA MARINA DEVELOPMENT COMPANY

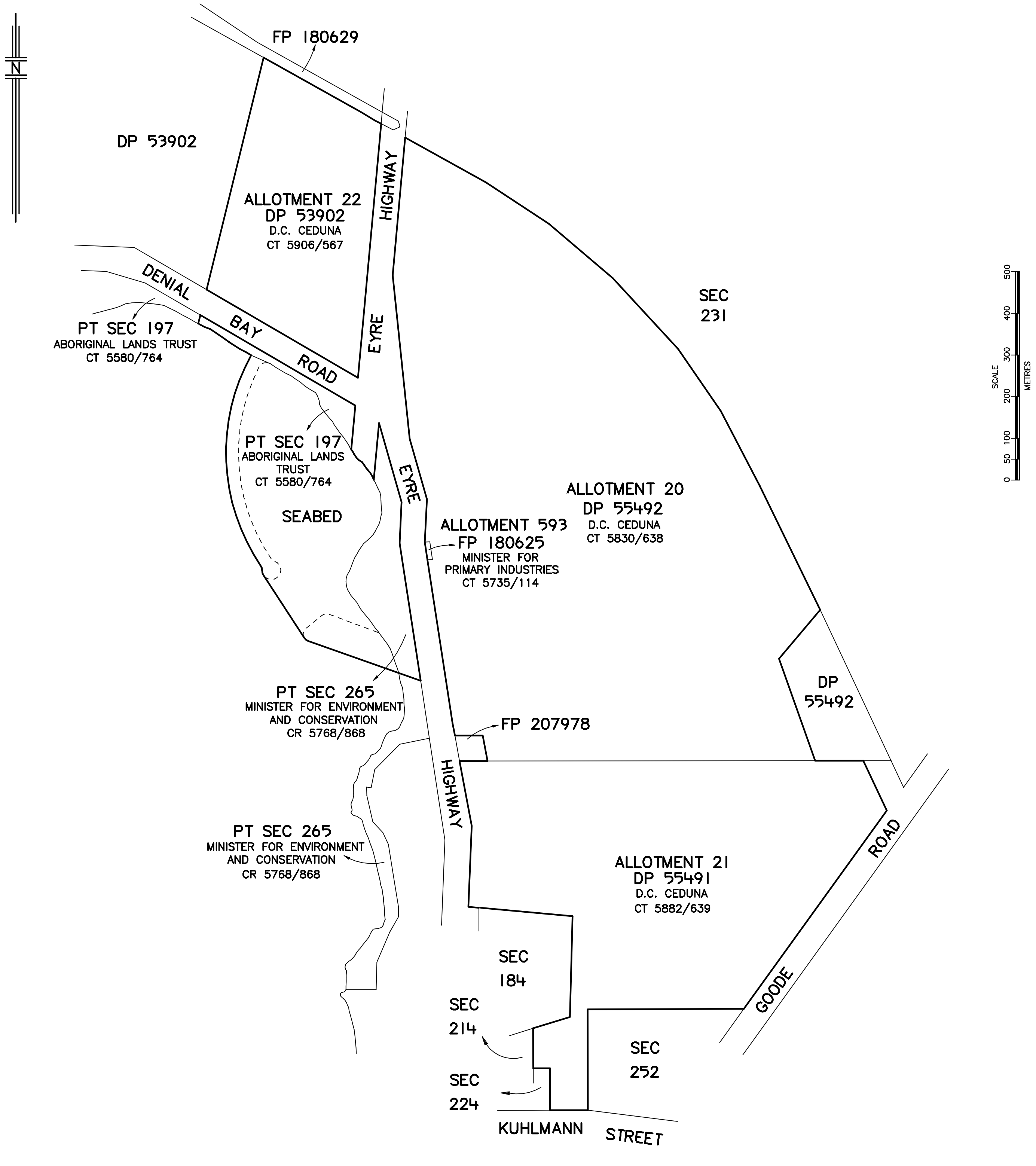
DRAWING TITLE
LAND MASTER PLAN

DRAWN	SCALE	DATE
RAS	AS SHOWN	20-10-04
COMP.FILE	FIELD	CHECKED
-	-	

DRAWING NUMBER
203310-20

ISSUE

AMENDMENTS



>HIS< Historical Search Enter Title Reference >CR>5768>868 <

HISTORICAL SEARCH OF CROWN RECORD

Title Searched	CR 5768/868	Previous Title	NONE
Title Status	CURRENT	Registration	NUMBER 1
Date of Issue	04/05/2000	Authority	RT 8862636

Produced	Completed	Document	Status	Details
NIL				

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5580>764 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5580/764	Previous Title	CT 3969/65
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	28/09/1998	Authority	CD 6987000

Produced	Completed	Document	Status	Details
05/04/91	11/07/91	7082685	REGD	LEASE YARILENA COMMUNITY INC.

No More Details > <

LIEUTENANT-GOVERNOR
SOUTH AUSTRALIA

South Australia.

Register Book,
Vol. 3969 *Folio* 65

Deputy *Registrar-General*

Land Grant

[IN DUPLICATE]

Certified correct, *Director of Lands*

Exd.

Diagram certified correct, *Surveyor-General*

HIS EXCELLENCY THE GOVERNOR doth hereby in the name of and on behalf of Her Majesty and by virtue of the provisions of the Aboriginal Lands Trust Act 1966-1968 and of a proclamation made pursuant to Section 16 of the said Act and dated the 7th day of December 1972 and all other enabling powers GRANT UNTO the ABORIGINAL LANDS TRUST of 25 Bank Street Adelaide 5000 hereinafter called the Grantee ALL that Section of land containing four hundred and thirty acres approximately situate in the Hundred of BONYTHON County of WAY and numbered 197 and delineated in the public maps deposited in the Department of Lands at ADELAIDE and in the plan in the margin hereof TO HOLD unto and to the use of the Grantee its Successors and Assigns for ever subject to the provisions of the Aboriginal Lands Trust Act 1966-1968

GIVEN under the hand of the Lieutenant Governor and the Public Seal of South Australia this tenth day of October one thousand nine hundred and seventy three

B

BY COMMAND,

THE MINISTER OF LANDS

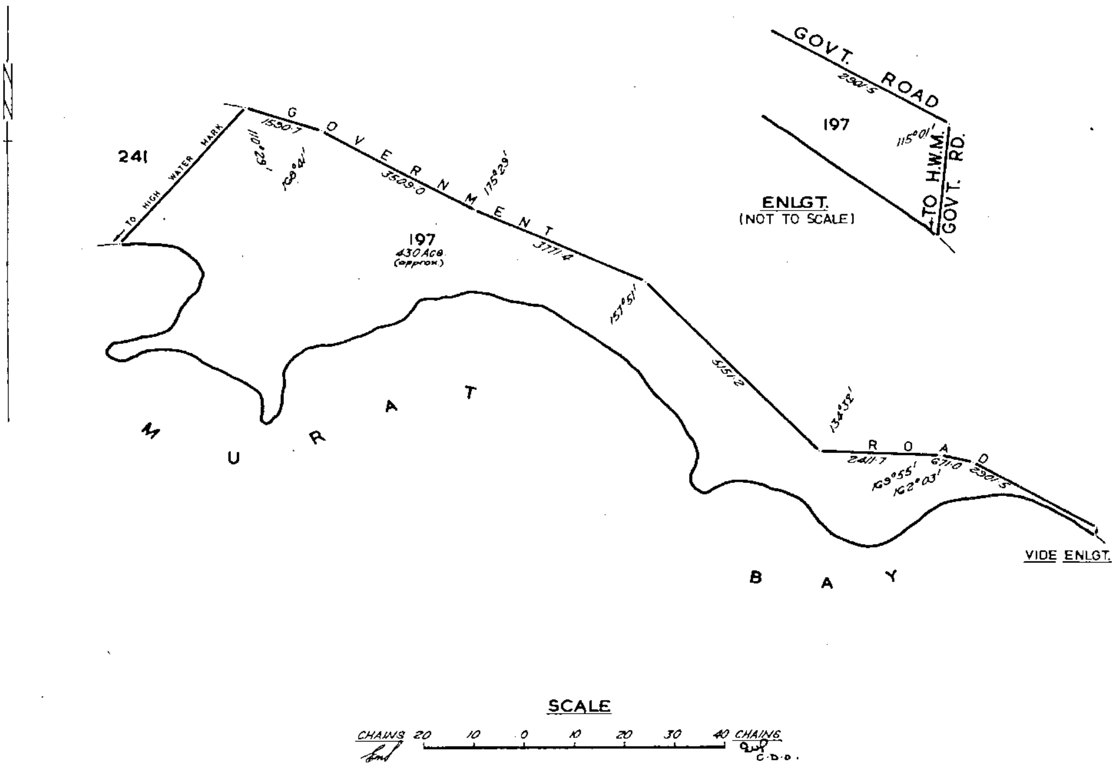
LEASE No. 4649073 to Far West Aboriginal Progress Association Incorporated
portion of
OF THE WITHIN LAND. TERM of 99 years commencing on 1.4.1980
PRODUCED 25.11.1980 AT 2.05 p.m.
(INCLUDING OTHER LAND)

OVER

SURRENDER OF LEASE No. 4649073
VIDE No. 7082684 PRODUCED 5·4·1991 AT 11:30

LEASE No. 7082685 TO
YARILENA COMMUNITY INC.
OF THE WITHIN LAND. TERM OF 25 YEARS
COMMENCING ON 14·3·1991
PRODUCED 5·4·1991 AT 11:30

CANCELLED
CONVERTED TO A COMPUTERISED TITLE


241
TO HIGH WATER MARK
GOVERNMENT
1530·7
110°29'
108°41'
3509·0
175°29'
3771·4
197
430 Acs
(approx)
157°51'
3151·2
134°32'
ROAD
2411·7
671·0
2301·5
169°55'
162°03'
MURAT
BAY
VIDE ENLGT.
GOVT. ROAD
2301·5
197
115°01'
TO H.W.M.
GOVT. RD.
ENLGT.
(NOT TO SCALE)
SCALE
CHAINS 20 10 0 10 20 30 40 CHAINS
C·D·O·

>HIS< Historical Search Enter Title Reference >CT>5906>567 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5906/567	Previous Title	CT 5835/121
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	13/11/2003	Authority	SC 9677926

Produced	Completed	Document	Status	Details
26/02/04	02/03/04	9792122	REGD	CAVEAT CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5835>121 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5835/121	Previous Title	CT 5782/655
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 1
Date of Issue	24/01/2001	Authority	DM 8945238

Produced	Completed	Document	Status	Details
09/09/03	14/11/03	9677926	REGD	SUBSTITUTE TITLE/CROWN LEASE

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5782>655 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5782/655	Previous Title	CT 5491/351
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 2
Date of Issue	15/06/2000	Authority	RTU 8803806

Produced	Completed	Document	Status	Details
17/08/00	30/01/01	8945238	REGD	DISCHARGE OF MORTGAGE 8733390
09/03/00	03/07/00	8850523	REGD	TRANSFER DISTRICT COUNCIL OF CEDUNA
16/08/99	25/08/99	8733390	REGD	MORTGAGE AUSTRALIA & NEW ZEALAND BANKING GROUP LT

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5491>351 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5491/351	Previous Title	CT 4157/438
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 3
Date of Issue	14/01/1998	Authority	CD 6987000

Produced	Completed	Document	Status	Details
19/05/00	19/06/00	8892617	REGD	AMENDMENT TO TEXT
14/12/99	20/06/00	8803806	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 53902
16/08/99	25/08/99	8733390	REGD	MORTGAGE AUSTRALIA & NEW ZEALAND BANKING GROUP LT
16/08/99	25/08/99	8733389	REGD	TRANSFER DEAN BRENTON PILMORE ANNETTE RHONDA KARAM

No More Details > <

ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,

Volume 4157 Folio 438

(Comprising 2 Sheets)

New Certificate for the balance of the Land in Vol.4139 Folio 23

GILBERT WILFRED ANDERSON of Ceduna 5690 Farmer is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in ALLOTMENT 7 of portions of Section 13 HUNDRED OF BONYTHON (L.T.R.O. FILED PLAN No.4874) and delineated on the plan hereon by bold black lines SUBJECT to the easements more particularly set forth in Transfers 4249305.4249306.4463473.4463474.4489132 and 4489133 in and over those portions marked A.B.C.D.E and F respectively hereon

In witness whereof I have signed my name and affixed my seal this 18th day of March 1980

Signed the 18th day of March)
1980, in the presence of Absastle)

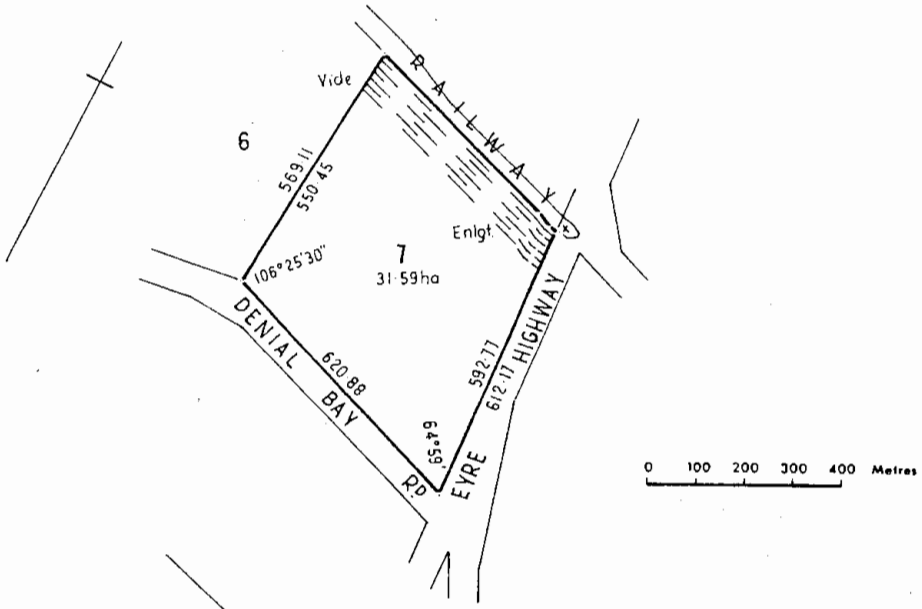
J.W.Hughes

Deputy Registrar-General

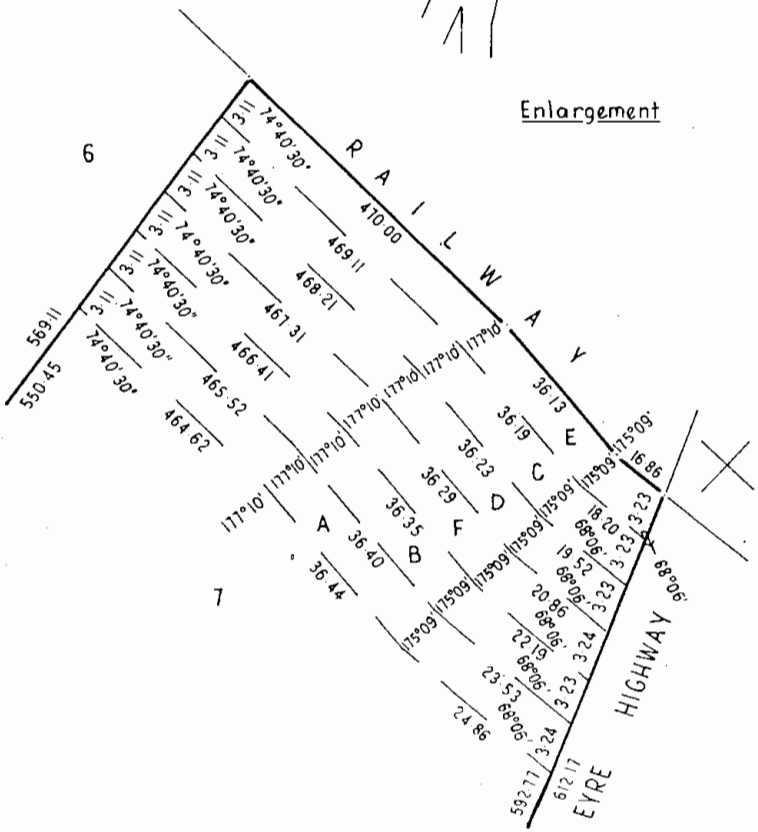
REGISTRAR-GENERAL SOUTH AUSTRALIA

CANCELLED
CONVERTED TO A COMPUTERISED TITLE
REGISTRAR-GENERAL SOUTH AUSTRALIA

SHEET 2



Enlargement



ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4139 Folio 23

New Certificate for portion of the Land in Vol.3683 Folio 102

GILBERT WILFRED ANDERSON of Ceduna 5690 Farmer is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in ALLOTMENT 7 of portions of Section 13 HUNDRED OF BONYTHON (L.T.R.O. FILED PLAN No.4874) and delineated on the plan hereon by bold black lines SUBJECT to the easements more particularly set forth in Transfers 4249305 and 4249306 in and over those portions marked B and A respectively hereon

In witness whereof I have signed my name and affixed my seal this 4th day of April 1979

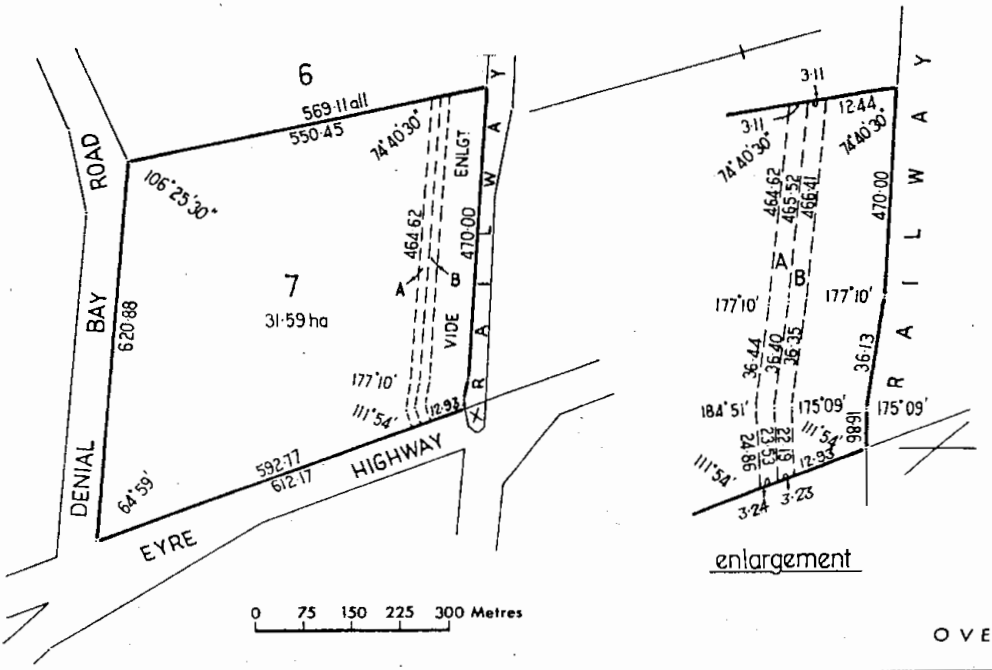
Signed the 4th day of April 1979, in the presence of R. Daniels

J.W. Hughes.

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

F.P. 4874
APPROVED



OVER

LEASE 3113304 to LAURENCE LEOPOLD HOFFRICHTER and ERNA ALVIRA HOFFRICHTER of portion of the within land Term of 10 years from 5.5.1970 Produced 24.6.1970 at 11.30 a.m. (Including other land)

MORTGAGE 4131476 to THE BANK OF ADELAIDE Produced 16.12.1977 at 11.50 a.m. (Including other land)

DH4349017- SE4463472(304)

DISCHARGE of Mortgage 4131476 vide 4349017 Produced 15.3.1979 at 12.20 p.m.

4463472.

SURRENDER of Lease 3113304 vide 4463472 Produced 1.11.1979 at 3.20 p.m.

TRANSFER 4463473 to EDWARD MATHEW GEROVICH of an Easement over PORTION of the within land Produced 1.11.1979 at 3.20 p.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 434

TRANSFER 4463474 to GEOFFREY ROY MITCHELL and BEVERLEY ESTHER MITCHELL of an Easement over PORTION of the within land Produced 1.11.1979 at 3.20 p.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 435

TRANSFER 4489132 to ROBERT BERNHARDT ANDERSON of an Easement over PORTION of the within land Produced 24.12.1979 at 11.30 a.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 436

TRANSFER 4489133 to GRAEME NEIL McGUINNESS and PAULINE JOAN McGUINNESS of an Easement over PORTION of the within land Produced 24.12.1979 at 11.30 a.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 437

CANCELLED

AND Balance CERTIFICATE OF TITLE

ISSUED VIDE VOL 4157 FOL 438

South Australia

CERTIFICATE OF TITLE

Register Book.

Vol. 3683 Folio 102

Balance Certificate of Title from Vol.3214 Folio 182

LAURENCE LEOPOLD HOFFMEISTER of Cadell 5580 Farmer and RINA ALVINA HOFFMEISTER his wife

are the proprietors of an estate in fee simple

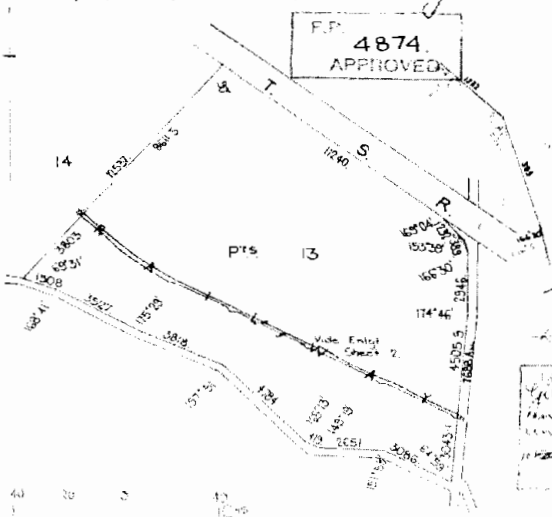
subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THOSE PIECES of land containing together one thousand seven hundred and forty six acres and three roods or thereabouts situated in the HUNDRED OF PONTYPOOL COUNTY OF ALE being PORTIONS OF SECTION 13 more particularly delineated and bounded as appears in the plan in the margin hereof and thereon colored green

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metalliferous minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section 13 delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 17th day of February 1970

Signed the 17th day of February 1970, in the presence of A. McHenry.



Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

to Viola Elsa Kier Produced 9.6.1969 at 11.05 a.m. (Including other land)

Asst. Genl.

Gilbert Wilfred Anderson of Cadell Farmer and Yvonne Grace Anderson his wife as joint tenants

Volume 3683 Folio 102 Page 1 of 4 (Printed at 13:23 on 30/Nov/2004)

DISCHARGE OF MORTGAGE No 2557088
... PRODUCED 24-6-1970 11·30am
DEP. REG. GEN.

TRANSFER No. ... from Laurence Leopold Hoffrichter and Erna Alvira Hoffrichter to the within named Gilbert Wilfred Anderson and Yvonne Cherie Anderson of one undivided moiety as tenants in common
... WITHIN LAND PRODUCED 24-6-1970 at 11·20am
DEP. REG. GEN.

MORTGAGE No. ... TO
Viola Elsa Kies
PRODUCED 24-6-1970 AT 11·30am INCLUDING OTHER LAND
DEP. REG. GEN.

MORTGAGE No. ...
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED 24-6-1970 AT 11·30am
DEP. REG. GEN.

LEASE No ... to Laurence Leopold Hoffrichter and Erna Alvira Hoffrichter
PORTION OF ... WITHIN LAND ... of 10 years from 5.5.1970
PRODUCED 24-6-1970 AT 11·30am
DEP. REG. GEN.

portion of
... 3113302 ... FROM MORTGAGE ... 3267780
7-12-1971 AT 11·20am
DEP. REG. GEN.

portion of
... 3113303 ... 3267781
... 7-12-1971 AT 11·20am
DEP. REG. GEN.

TRANSFER No 3267782
to ... THE SECOND of portion
OF THE WITHIN ... PRODUCED 7-12-1971 AT 11·20am
DEP. REG. GEN.

CANCELLED AS REGARDS ...
No. 3267782 ... SAID ...
ACQUIRED BY THE CROWN FOR ROAD ...
DEP. REG. GEN.

... 3113303 (...)

THE WITHIN LAND IS D...
No. 3113302
PRODUCED 6-11-1974 AT 2·30pm (Dup C.T. not prod)

from Yvonne Cherie Anderson to the within named Gilbert Wilfred Anderson of one undivided moiety in
THE WITHIN LAND PRODUCED ... AT ...

Discharge M3111564

... 3113302 ... BY
... PRODUCED 7-5-1974 AT 2·55pm

MORTGAGE No.
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED ... AT 2·55pm
INCLUDING OTHER LAND

... 3895281

MORTGAGE No. ...
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED 27.5.1976 at 2.20pm
... LAND

... 3844756

THE WITHIN LAND IS DISCHARGED FROM MORTGAGE
No. 3896281 and 3871869 VIDE 4131475
PRODUCED 16-12-1977 AT 11·50am

MORTGAGE No. ...
TO THE BANK OF ... PRODUCED 16-12-1977 AT 11·50am
...19 2185600

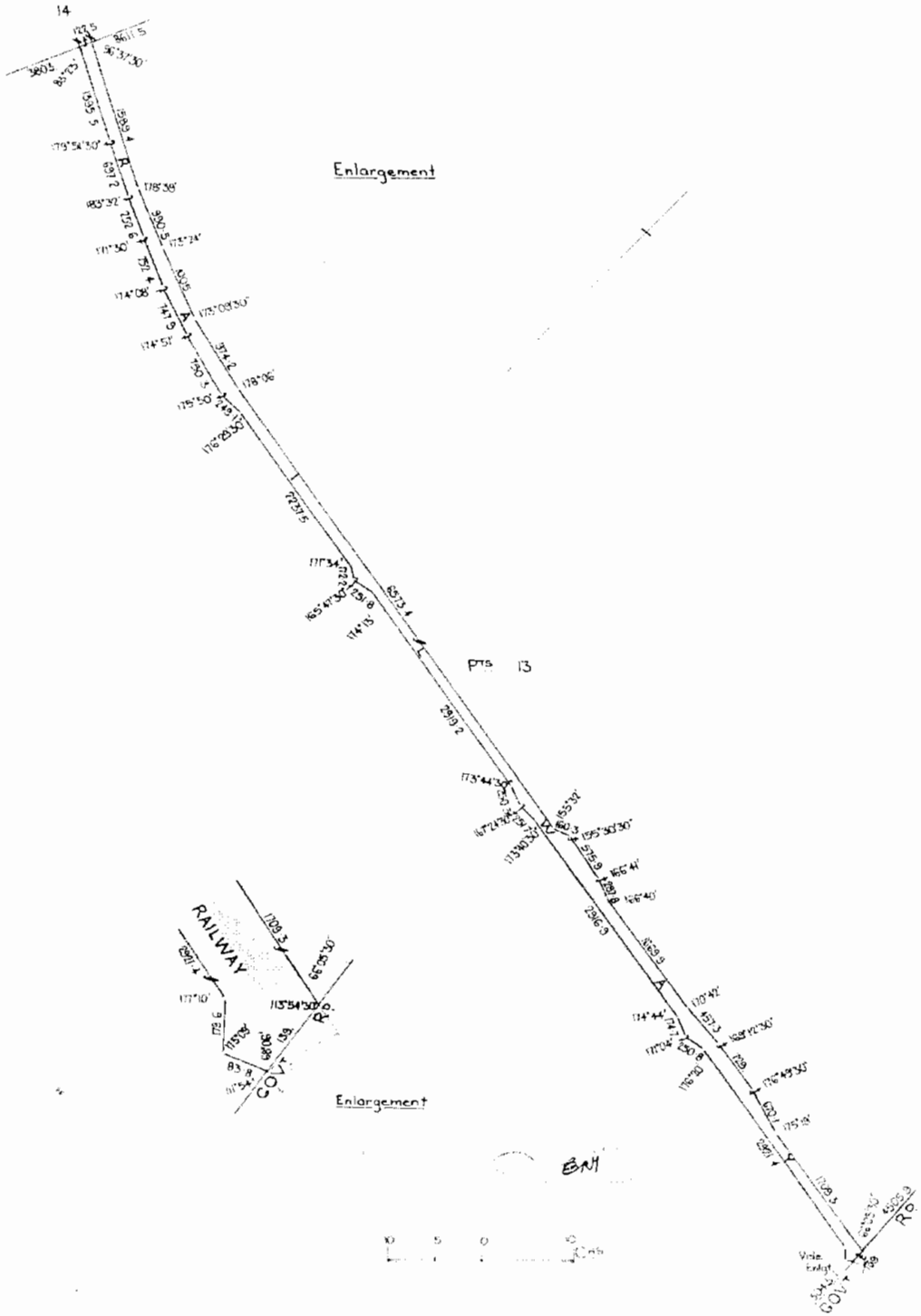
Portion of
Transfer and Reserving Easement 4249803
THE WITHIN LAND IS DISCHARGED FROM MORTGAGE
No. 4131476 4249804
PRODUCED 18-8-1978 ... 11·35am

TRANSFER No. ...
Richard Swinburne Jolly and Helen Fraser Fell of portion
OF THE WITHIN land (Lot 5 F.P. 4874) Together with and Reserving Easement
PRODUCED 18-8-1978 AT 11·35am
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED
VOL 4139 FOL 17

TRANSFER No. ...
Richard Swinburne Jolly and Helen Fraser Fell of portion
OF THE WITHIN land (Lot 6 F.P. 4874) Together with and Reserving Easement
PRODUCED 18-8-1978 AT 11·35am
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED
VOL 4139 FOL 18

...

5 New & Balance
4249306 4874
4139 s 19 to 24 inc.


14
Enlargement
Pts 13
RAILWAY
Enlargement
BM

Register Book.

Vol. 2214 Folio 182

Registrar General

South Australia.

Land Grant.

[IN DUPLICATE.]

(*In lieu of Surrendered* Agreement to Purchase No. 9588 Register Book Volume 644 Folio 103 ———)

His Excellency the Governor in consideration of four hundred and thirty nine pounds (£439: 0: 0) ———

heretofore paid to the Treasurer as appears by the receipt at foot by WALTER HENRY SEDDON of ———

Gentleman Butcher and Grazier ———

hereinafter called the Grantee doth hereby in the name and on behalf of HER MAJESTY GRANT unto the Grantee ALL that ——— Section of land containing one thousand seven hundred and seventy acres ——— or thereabouts situate in the

Hundred of BOOYTHON ——— County of WAY ———

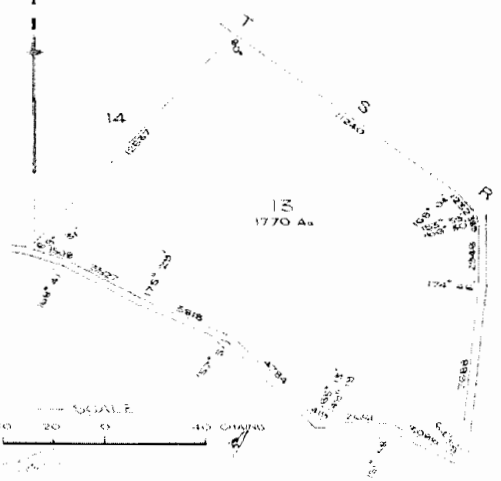
and numbered 13 ———

and delineated in the public maps deposited in the Land Office at ADELAIDE and in the plan in the margin hereof EXCEPT AND RESERVED UNTO HER MAJESTY Her Heirs and Successors all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land and all incidental powers as provided for in the Crown Lands Act 1929-1944 Provided that stone ordinarily used for building or road purposes shall be exempted from this reservation TO HOLD unto and to the use of the Grantee and the Heirs of the Grantee for ever.

GIVEN under the hand of the Governor and the Public Seal of South Australia this fifth ——— day of June ——— one thousand nine hundred and fifty two

BY COMMAND,

The Minister of Lands



Received four hundred and thirty nine pounds ———

£ 439:---0:---0

Public Treasurer

TRANSFER No. 1581093
Walter Henry Sedgley to
William Henry Sedgley of
Eduna Butcher and Grazier
OF AN ESTATE IN FEE SIMPLE IN THE WITHIN LAND
PRODUCED FOR REGISTRATION THE 15 DAY OF July 1949 AT 11 a.m.

TRANSFER No. 2105283 FROM
William Henry Sedgley to
Ronald Alex Kies of Eduna Farmer and Grazier
OF THE WITHIN LAND. PRODUCED 28/1/1959 AT 12.25 p.m.
DEP. REG. GEN.

MORTGAGE No. 2105284 FROM
Ronald Alex Kies to
William Henry Sedgley
PRODUCED 28/1/1959 AT 12.25 pm (Including other land)
DEP. REG. GEN.

APPLICATION No. THE WITHIN Land
IS TRANSMITTED TO Bagots Executor and Trustee Company Limited of 195 North Terrace Adelaide
AS THE EXECUTOR NAMED IN THE WILL DATED
OF Ronald Alex Kies WHO DIED
VIDE PROBATE DATED PRODUCED 19.9.1964 AT
L K D Anderson DEP. REG. GEN.

TRANSFER No.
to Viola Elsa Kies of Eduna Widow
OF THE WITHIN LAND. PRODUCED 19.9.1964 AT
L K D Anderson DEP. REG. GEN.

The estate of the within named Ronald Alex Kies deceased and his Executor Bagots Executor and Trustee Company Limited are released and discharged from all liability expressed or implied in the within mortgage No 2105284 Vide No 2382763
Produced 19.9.1964
L K D Anderson

DISCHARGE OF MORTGAGE No 2105284 BY ENDORSEMENT
PRODUCED 9 1964 AT 11.10am
L K D Anderson DEP. REG. GEN.

TRANSFER No. 2332088
to Laurence Leopold Hoffrichter of Eduna Farmer and Ilona Alvina Hoffrichter his wife
29 .64 11.25am

TRANSFER No.
to Viola Elsa Kies
PRODUCED 24.8.1964 11.25am (Including other land)

CAVEAT No 2897526 LODGED BY The South Australian Railways Commissioner
LODGED
(INCLUDING OTHER LAND)
DEP. REG. GEN.

Caveat 2897526 3070436 20.1.70 AT 11.35am

portion of THE WITHIN LAND IS DISCHARGED FROM MORTGAGE No 2557088 VIDE 3070437
PRODUCED 20.1.1970 AT 11.35am
DEP. REG. GEN.

TRANSFER No 3070438 to The South Australian Railways Commissioner of portion
OF THE WITHIN Land
PRODUCED 20.1.1970 AT 11.35am
DEP. REG. GEN.
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED
VOL 3683 FOL 100
DEP. REG. GEN.

CANCELLED
AND Balance CERTIFICATE OF TITLE
ISSUED VOL 3683 FOL 102
DEP. REG. GEN.

CANCELLED
CONVERTED TO A COMPUTERISED TITLE

South Australia.

Agreement for Sale and Purchase

No. 9588

(Made pursuant to the provisions of the "Crown Lands Acts, 1915 to 1919.")

Agreement made this Twenty eighth day of October One Thousand Nine Hundred and Twenty BETWEEN The Honorable George Richard Laffer of Adelaide Commissioner of Crown Lands of and for the State of South Australia herein contracting as a public officer for and on behalf of His Most Gracious Majesty King GEORGE THE FIFTH (hereinafter called "the Vendor") of the one part and Walter Henry Sedgley and Harold Thomas Sedgley both of Waranda Well Farmers and Graziers (hereinafter with his executors administrators and assigns called "the Purchaser") of the other part WHEREBY IT IS AGREED by and between the parties hereto as follows:—

1. The Vendor agrees to sell and the Purchaser agrees to purchase the land hereinafter mentioned and improvements thereon for the sum of eight hundred and seventy eight pounds (£878 0 0) being the price fixed by the Land Board and being ALL N.E. quarter section of land situated in the Hundred of Booyathon County of Way containing one thousand seven hundred and fifty four (1750) acres or thereabouts numbered 13

EXCEPT AND RESERVED all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land to the Vendor and all persons lawfully claiming under or authorised by him with full and free liberty of access ingress egress and regress with or without horses cattle carts drays carriages engines and all necessary implements and things into upon and from the said land for all reasonable purposes and to cut dig sink try search work remove and dispose of all or any of the said excepted and reserved things.

2. The Purchaser shall pay the purchase-money together with interest thereon in sixty half-yearly instalments of twenty three pounds ten shillings and ten pence (£23 10 10) payable in advance on the twenty eighth days of October and April in each year until the whole of the purchase-money together with interest shall be paid: PROVIDED that the Purchaser may complete the purchase of the said land at any time after six years from the date of this agreement on payment of the purchase-money in full and interest to the date of completion of the purchase and provided that the terms covenants conditions and provisions of this agreement have been fully complied with to the satisfaction of the Commissioner of Crown Lands and that improvements equal in value to Five Shillings per acre on the said land have been effected to the satisfaction of the Commissioner by the Purchaser.

3. The Purchaser will pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of [illegible] granted under the "Vermin Acts 1914 to 1919."

4. The Purchaser shall and will during the first five years from the date of this agreement substantially fence the boundaries of the said land with a fence or wall ordinarily capable of resisting the trespass of cattle and will until the completion of the purchase of the said land maintain and uphold such fence in good and substantial repair.

5. The Purchaser shall clear and render available for cultivation 750 acres of the said land.

6. The Purchaser shall and will during the first five years from the date of this agreement clear and render available for cultivation not less than 93½ acres of the said land and will during the second five years clear and render available for cultivation not less than 93½ acres of the said land and will during each succeeding five years clear and render available for cultivation not less than [illegible] acres of the said land until [illegible] acres of the said land have been cleared and rendered available for cultivation and will at all times during the currency of this agreement keep the land so cleared

Secretary for Lands

7. The Purchaser will not without the consent of the Vendor being first had and obtained transfer sub-let encumber or mortgage the said land.

8. The Purchaser will subject to the regulations in force for the time being under "The Mining Act 1893" or any other Act authorising the making of regulations permit every gold or mineral lessee or licensee holding a lease or licence under "The Mining Act 1893" or any other Act for the time being authorising the granting of gold or mineral leases or licences of or respecting any of the said land and all persons authorised by such lessee or licensee to have free and unrestricted access to and egress from the said land comprised in such gold or mineral lease or licence.

9. The Purchaser will insure and during this agreement keep insured in the full insurable value thereof in some Insurance Office in Adelaide to be approved by the Vendor all buildings and erections the property of the Vendor upon the said land or which may thereafter be thereupon against loss or damage by fire such insurance to be in the joint names of such Purchaser and the said Vendor and will forthwith lodge the policy of every such insurance in the office of the said Vendor and will forward to the said Vendor the receipts for the premiums payable in respect of every such policy within seven days after the same shall become due and that if the foregoing covenant shall not be duly observed then the said Vendor shall be at liberty to insure the said improvements in manner aforesaid and it is agreed that all sums of money received under any such insurance shall be and are in reinstating the premises in respect of which the same shall have been received.

10. The Purchaser will destroy all rabbits on the said land and bill up their burrows to the satisfaction of the said Vendor and will forthwith commence to destroy all other vermin on the said land such as are by or under the "Vermin Acts 1914 to 1919" or by or under any other Act for the time being in force in the said State declared to be vermin and will keep the said land free of all vermin to the satisfaction of the Vendor during this agreement and will destroy Bathurst burr and all other noxious weeds growing upon the said land and upon the half width of Government roads adjacent thereto.

11. The Purchaser will neither allow to remain if now existing nor erect nor suffer the erection of any brush fence upon the said land.

12. The Purchaser will and will use agree and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon at any time.

13. And it is hereby expressly agreed that the Vendor may at any time or from time to time hereafter resume possession of all or any part of the said land for roads railways or tramways or for sites for towns or park lands or for mining purposes or for any public purpose whatsoever after the expiration of three calendar months from the giving by the Commissioner of Crown Lands to the Purchaser of notice in writing of the intended resumption and that immediately upon the giving of such notice the right of the Purchaser to complete the purchase shall cease and determine and be void as to all or such of the said lands as shall be specified in such notice and that immediately after the expiration of the said three calendar months this agreement and the right of the Purchaser to possession shall cease and determine and be void as to all or such part of the said lands as shall be specified in such notice anything in this agreement to the contrary notwithstanding PROVIDED that upon any resumption the Purchaser shall except as hereinafter in the next following clause is provided be paid compensation for the loss the Purchaser shall sustain thereby and in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the said Commissioner or the Purchaser in the manner provided by the "Crown Lands Acts 1915 to 1919."

14. The Vendor reserves unto himself the right to construct drains whose course may through the said land and to acquire or resume possession of all or any portion of the said land for any such purpose without any payment to the Purchaser by way of compensation for the same so taken and the Purchaser will when called upon execute a surrender of this agreement as far as regards all land so taken.

15. It shall be lawful for the Vendor and all persons authorised by him at all times unrestrictedly to enter into and upon the said land for any purpose whatsoever before completion of the purchase thereof.

16. The Purchaser shall and will permit the Crown or the owner of any mining claim situated on the land or the holder of any mining lease of the whole or any portion of the said land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease.

17. And it is hereby agreed and declared that if any of the instalments hereby reserved shall be unpaid and in arrear for more than six months after the day whereon the same is hereby made payable the Purchaser having had at least three months' previous notice in writing demanding its payment or if the said Vendor shall be satisfied there has been a breach in the performance of any other of the covenants herein contained or that this agreement is liable to forfeiture the said Vendor may re-enter and take possession of the said land and it shall be lawful for the Vendor before or after re-entry to cancel and determine this agreement and the said Vendor may thereupon insert a notice in the *Government Gazette* declaring this agreement to be forfeited and such notice appearing in the *Government Gazette* shall in all Courts and elsewhere and under all circumstances be taken to be conclusive evidence that this agreement has been legally cancelled and forfeited: PROVIDED that the Vendor shall not (except in the case of an instalment being unpaid and in arrear as aforesaid or of a breach of clause 7 hereof) exercise the powers expressed in this clause in case of a breach of covenant before the expiration of the period of three months after notice has been given to the Purchaser of such breach and requiring the performance of the covenant: PROVIDED NEVERTHELESS that if notice has been given to the Purchaser of any breach of a covenant no notice of any future breach of the same covenant or of the continuance of the same breach thereof shall be necessary before the exercise of such powers: PROVIDED also that the Vendor instead of exercising such power of forfeiture or cancellation as aforesaid may impose on the Purchaser a penalty of such sum as may be fixed by the Land Board constituted under the "Crown Lands Acts 1915 to 1919" and such penalty shall be recoverable in the same manner as the instalments of purchase-money or/and interest under this agreement are recoverable when in arrear.

18. And it is hereby expressly declared that any notice to be served on [illegible] shall be deemed to have been duly served and given if the same be sent [illegible] addressed to the Purchaser at any address stated in any recent application [illegible] usual or last known place of abode in the said State or to the care of any [illegible] Purchaser's behalf in the particular matter in respect whereof such notice is given and [illegible] been served on the [illegible] and time shall run from the day of the posting thereof.

IN WITNESS whereof the hand and seal of the Commissioner and the hand of the Purchaser [illegible] the Seventh day of March 1927

Signed and sealed by the said Vendor in the presence of

[illegible]

H. H. Sedgley

Signed by the said Purchaser in the presence of

Percy G. Crafter

H. H. Sedgley

H. T. Sedgley

A440352

MORTGAGE No: FROM

Walter Henry Sedgley and Harold Thomas Sedgley

The Bank of Adelaide

PRODUCED FOR REGISTRATION THE 28 DAY OF July 1927 AT [illegible]

[illegible]

DEP. REG. GENL.

A.D. 1495480

DEATH. The within named Harold Thomas Sedgley died on the 15 day of August 1945 as appears by Certified Copy of Certificate of Death No. 1495480 Produced for registration this 27 day of March 1947 at 11 01 a.m.

[illegible]

of Dep Reg Gen.

SURRENDER OF THE within Lease 2588 WAS REGISTERED AND [illegible] SOLD FOR REGISTRATION THE 25 DAY OF September 1941 AT 2.20 p.m.

[illegible]

DEP. REG. GENL.

[illegible] DAY OF [illegible]

[illegible]

[illegible]

DISCHARGE OF THE within Mortgage No. 1295116 1450711 PRODUCED FOR REGISTRATION THE 24 DAY OF February 1926 AT 11.30 a.m.

[illegible]

Dep Registrar

[illegible] THE WITHIN MORTGAGE

[illegible] DAY OF [illegible] AT 12.15 p.m.

[illegible]

DEP. REG. GENL.

>HIS< Historical Search Enter Title Reference >CT>5830>638 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5830/638	Previous Title	CT 5657/129 & OTHERS
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	19/12/2000	Authority	RTU 8933987

Produced	Completed	Document	Status	Details
26/02/04	02/03/04	9792122	REGD	CAVEAT CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5657>129 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched CT 5657/129 Previous Title CT 4007/702
Title Status TOTALLY CANCELLED Latest Duplicate EDITION 2
Date of Issue 27/05/1999 Authority CD 6987000

Produced	Completed	Document	Status	Details
12/09/00	20/12/00	8959552	REGD	DISCHARGE OF ENCUMBRANCE 3118879
26/07/00	20/12/00	8933987	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 55492
22/02/00	20/12/00	8840914	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 54370
01/10/99	15/03/00	8761727	REGD	TRANSFER THE DISTRICT COUNCIL OF CEDUNA
14/07/70	14/07/70	3118879	REGD	ENCUMBRANCE ESSO AUSTRALIA LTD.

No More Details > <

ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4007 Folio 702

Comprising 2 sheets

New Certificate for the balance of the Land in Vol.3744 Folio 145

VYTAUTAS VINCENTAS PATUPAS of Streaky Bay Road Ceduna 5690 Road House Proprietor is the proprietor of on estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in PORTION OF SECTION 230 HUNDRED OF BONYTHON delineated by bold block lines on the plon hereon

In witness whereof I have hereunto signed my name and affixed my seal this 10th day of January 1974

Signed the 10th day of January 1974, in the presence of a. Wheatley.

B. L. Nairn

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

ENCUMBRANCE 3118879 to ESSO AUSTRALIA LIMITED
Produced 14.7.1970 at 10.40 a.m. (Single copy only)
(Including other land)

B. L. Nairn
Dep.Reg.Genl.

MORTGAGE 3217438 to THE BANK OF ADELAIDE
Produced 1.7.1971 at 11.35 a.m. (Including other land)

B. L. Nairn
Dep.Reg.Genl.

D4458724

The within land is discharged from Mortgage 3217438 vide 4458724 Produced 23.10.1979 at 11.15 a.m.

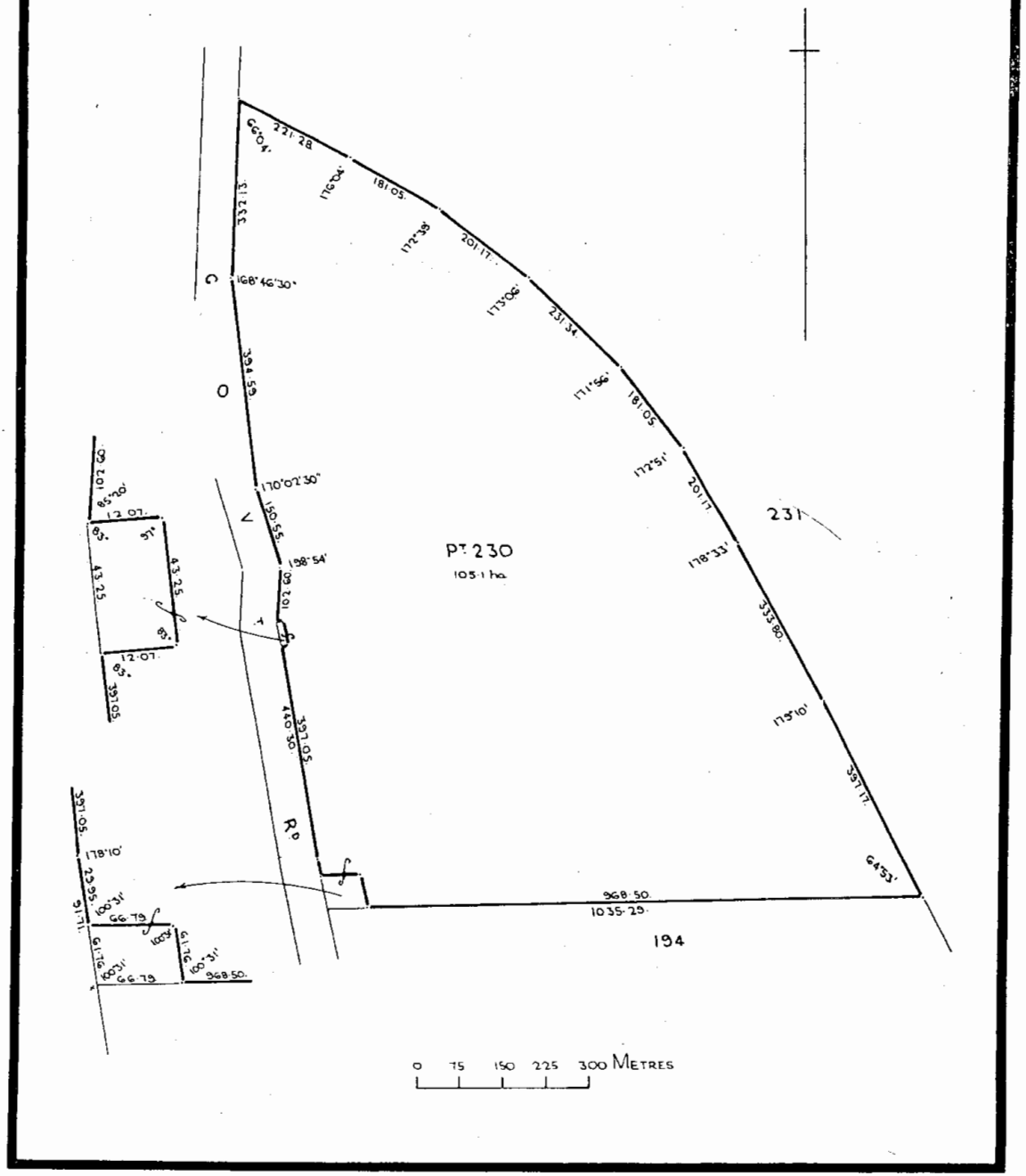
---------M5296877--

MORTGAGE 5296877 to WESTPAC BANKING CORPORATION
Produced 6.9.1984 at 10.10 a.m.

The within land is discharged from Mortgage 5296877 vide 8102543 Produced 23.4.1996 at 9:00

CANCELLED
CONVERTED TO A COMPUTERISED TITLE

ONE UNDIVIDED MOIETY



>HIS< Historical Search Enter Title Reference >CT>5735>114 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5735/114	Previous Title	CT 4007/698
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	17/02/2000	Authority	CD 6987000

Produced	Completed	Document	Status	Details
---	---	---	---	---

NIL

No More Details > <

ORIGINAL
CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4007 Folio 698

Pursuant to Transfer 3534069 Registered on Vol. 3744 Folios 144 and 145

THE MINISTER OF AGRICULTURE is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in PORTION OF SECTION 230 HUNDRED OF BONYTHON delineated by bold black lines on the plan hereon

In witness whereof I have hereunto signed my name and affixed my seal this 10th day of January 1974

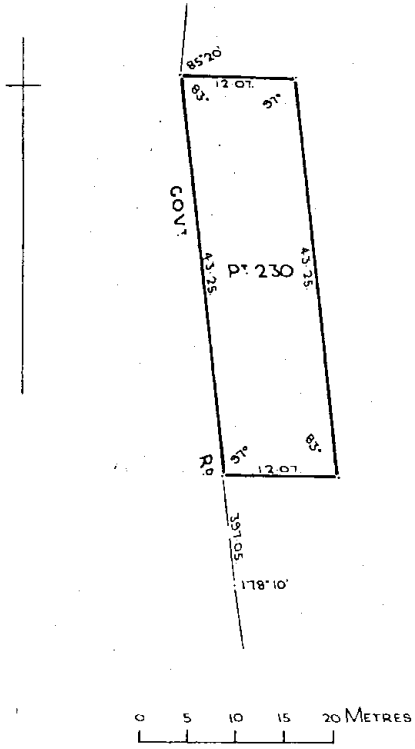
Signed the 10th day of January)
1974, in the presence of a. Wheatley.)

B. A. Nairn

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

CANCELLED
CONVERTED TO A COMPUTERISED TITLE
REGISTRAR-GENERAL SOUTH AUSTRALIA



South Australia

CERTIFICATE OF TITLE

Register Book,
Vol. **3744** *Folio* **144**

Pursuant to Memorandum of Transfer No.3162126 Registered on Vol.3684 Folio 191

MAXWELL ROBERT CHRISTIE of Ceduna 5690 Branch Manager

is the proprietor of an estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THAT SECTION of land containing two hundred and sixty one acres or thereabouts situated in the HUNDRED OF BONYTHON COUNTY OF WAY NO.250 and bounded as appears in the plan in the margin hereof

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metals ore minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section is delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 8th day of January 1971

Signed the 8th day of January 1971, in the presence of N Spears

[signature] Registrar-General

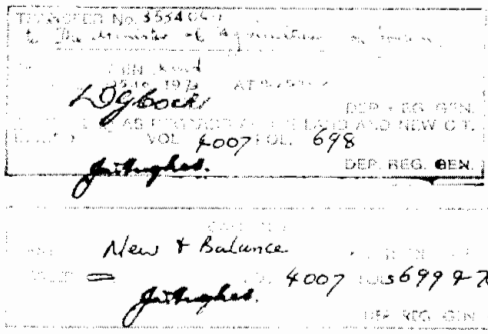
REGISTRAR-GENERAL SOUTH AUSTRALIA

... to Esso Standard Oil (Australia) Limited Produced 14.7.1970 at 10.40 a.m. (Single copy only) (including other land)

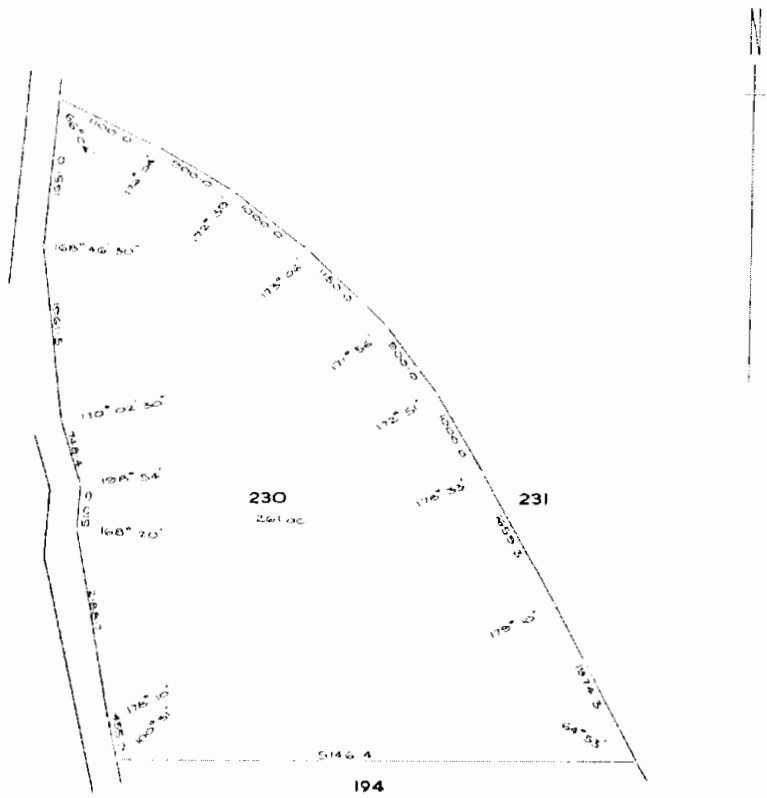
[signature] Reg.Genl.

P/A 1149469
5534 OCC
... to Esso Australia Ltd of c/- ... (Nominees) S.A.) Pty Ltd ... Adelaide 5000
[signature]

THE WITHIN LAND ... AT
[signature]
DEP. REG. GEN.


TRANSFER No. 555406
LOGbook
VOL 4007 FOL. 698
DEP. REG. GEN.
J.H.
New + Balance
4007 fols 699 + 701
J.H.
DEP. REG. GEN.

ONE UNDIVIDED MOIETY



South Australia

CERTIFICATE OF TITLE

Register Book,
Vol. 3744 *Folio* 145

Balance Certificate of Title from Vol.3654 Folio 191

VYTAUTAS VINCENTAS PATUPAS of Streaky Bay Road Ceduna 5690 Road House Proprietor

is the proprietor of an estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THAT SECTION of land containing two hundred and sixty one acres or thereabouts situated in the HUNDRED OF BONYTHON COUNTY OF WAY NO. 230 and bounded as appears in the plan in the margin hereof

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metals ore minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section is delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 8th day of January 1971

Signed the 8th day of January 19 71, in the presence of W Spears

Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

to Esso Standard Oil (Australia) Limited Produced 14.7.1970 at 10.40 a.m. (Single copy only) (Including other land)

Reg.Genl.

MORTGAGE No. 3217935

TO THE BANK OF ADELAIDE. PRODUCED 1-7 1971 AT 11.35

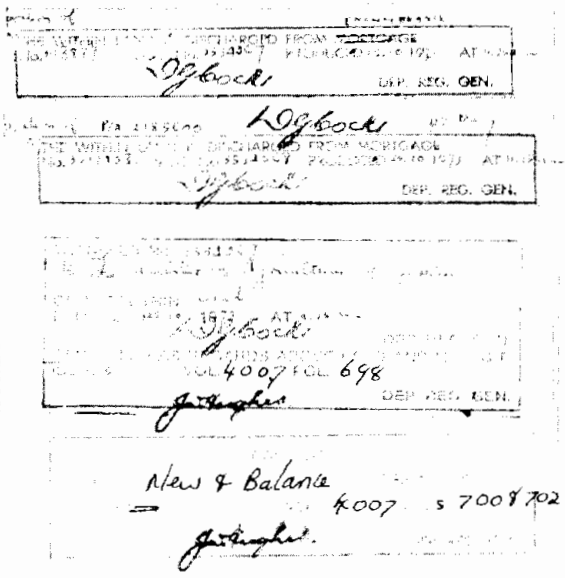
[signature] for DEP. REG. GEN.

D/A 3149443

CHANGE OF NAME 3594066

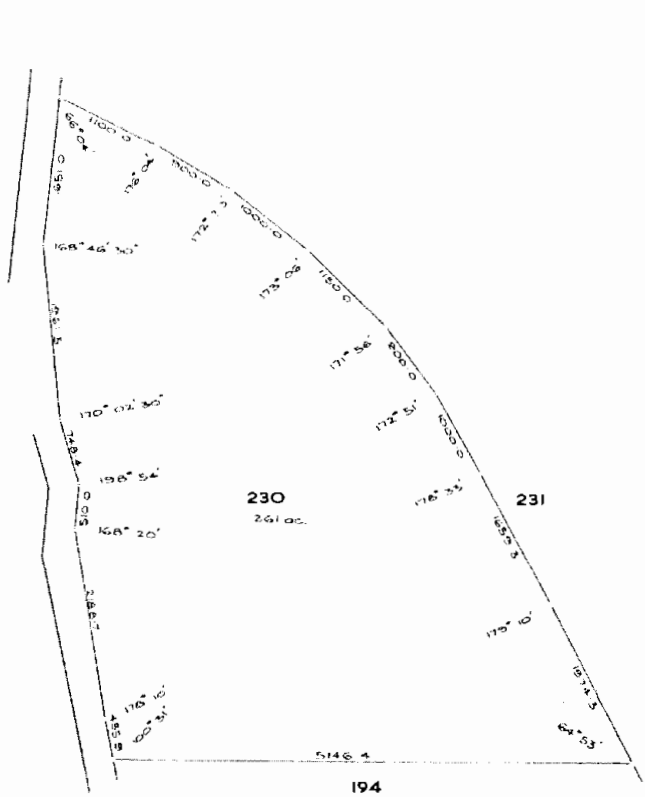
AT

[signature]



SHEET No. 2 ATTACHED

ONE UNDIVIDED MOIETY



South Australia

Register Book,

Vol. 3684 Folio 191

Registrar-General

Land Grant.

[IN DUPLICATE]

(*In lieu of Surrendered* [illegible])

His Excellency the Governor in consideration of [illegible]

[illegible]

heretofore paid to the Treasurer as appears by the receipt at foot by [illegible]

[illegible]

hereinafter called the Grantee doth hereby in the name and on behalf of HER MAJESTY GRANT unto the Grantee ALL [illegible] Section of land containing [illegible] or thereabouts situate in the Hundred of [illegible] County of [illegible] and numbered [illegible] and delineated in the public maps deposited in the Land Office at ADELAIDE and in the plan in the margin hereof EXCEPT AND RESERVED UNTO HER MAJESTY Her Heirs and Successors all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land and all incidental powers as provided for in the Crown Lands Act 1929-~~1960~~, Provided that stone ordinarily used for building or road purposes shall be exempted from this reservation TO HOLD unto and to the use of the Grantee and the Heirs of the Grantee for ever.

GIVEN under the hand of the Governor and the Public Seal of South Australia this [illegible] day of [illegible] one thousand nine hundred and [illegible]

BY COMMAND,

The Minister of Lands

~~Received~~

~~purchase-money as before expressed.~~

Under Treasurer [illegible] *Treasurer*

Certified correct, *Director of Lands*

Fwd. B D.L. 2279/37.

Diagram certified correct, *Surveyor-General*

TRANSFER No. 3062... to Vytautas Vincentas Patupas of Streaky Bay Road Ceduna 5690 Road House Proprietor

OF THE WITHIN LAND PRODUCED 16.12.1969 AT 2.55 pm

DEP. REG. GEN.

MORTGAGE No. 3062... to Walter Karl Obersen

PRODUCED 16.12.1969 AT 2.55 pm

DEP. REG. GEN.

TRANSFER No. 3091599 to Alliance Acceptance Co. Limited of 50 Grenfell Street Adelaide mortgage no. 3062569

OF THE WITHIN LAND PRODUCED 8/4/1970 AT 11.5 AM

DEP. REG. GEN.

ENCUMBRANCE No. 3118879

PRODUCED /1/1970 AT

(Single copy only) DEP. REG. GEN.

TRANSFER No. 3122602

OF THE WITHIN LAND, PRODUCED AT

DEP. REG. GEN.

DISCHARGE OF MORTGAGE No. 3062568

VIDE No. 3122603 PRODUCED 28/1/1970 AT 11

DEP. REG. GEN.

TRANSFER No. 3162126 to Roberts unotie of an undivided moiety in

THE WITHIN land

PRODUCED 17.12.1970 AT 11.28 am

CANCELLED AND NEW CERTIFICATE ISSUED

VOL. 3744 FOL. 144

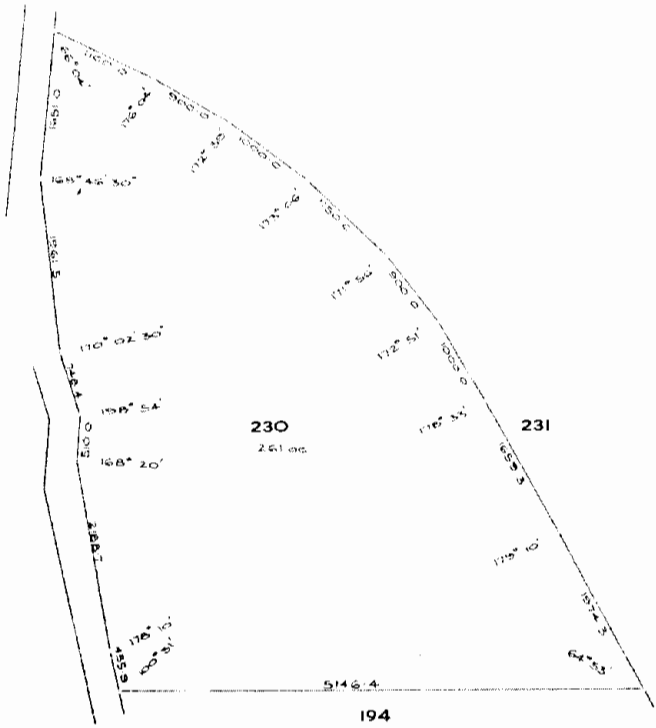
DEP. REG. GEN.

Balance

VOL. 3744 FOL. 145

DEP. REG. GEN.

SHEET No. 2



Chains 10 5 0 Scale 10 20 Chains

South Australia

Register Book,

Vol. 1351 Folio 12

K. London Deputy Registrar-General

Crown Lease

(PERPETUAL, No. 16197A)

In lieu of Surrendered Perpetual Lease 16197 *(part of) Reg. Vol.* 885 *Folio* 20

PERSONAL RESIDENCE

Her Majesty the Queen doth hereby lease to WALTER KARL OBERSEN of Ceduna 5690 Service Station Proprietor

herein designated by the term "Lessee" all that land containing approximately two hundred and sixty one (261) acres ~~or thereabouts~~ and being Section No. 230

in the Hundred of BONYTHON County of WAY as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held in perpetuity at the yearly rent of five dollars and sixty cents ($5-60) to be paid in advance on the second day of May commencing the twenty fifth day of November One Thousand Nine Hundred and ~~sixty eight~~ 1987 with such penalties as are provided for by the Crown Lands Act 1929 ~~1969~~, added thereto in case any of such rents is in arrear and subject to the reservations covenants and conditions shortly stated below and some of which are more fully set out in the Crown Lands Act 1929-1937

The Minister of Lands.

By command,

Director of Lands.

Certified correct,

RESERVATIONS

1. There are reserved to the Crown all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils with incidental powers of search and mining AND ALSO the right to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use where required without any payment to the Lessee by way of compensation

COVENANTS

2. The Lessee must—

I. Enclose the land with cattle-proof fence before the end of the first year of the lease and during the remainder of the term hereby granted maintain and uphold such fence in good and substantial repair

II. Keep in good repair all Crown improvements (if any) on the land

III. Pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of loans repayable under the Vermin Act 1931-1950 or any Act amending or extending that Act or substituted therefor

IV. ~~Clear so as to render available for cultivation or so as to improve the grazing capacity thereof acres of the land~~

V. ~~During the first two years clear so as to render available for cultivation or so as to improve the grazing capacity thereof not less than one-eighth of the area specified in that behalf in the lease and will during the second two years clear as aforesaid not less than one-eighth of the area so specified and will during each succeeding year clear as aforesaid not less than one-eighth of the area so specified until the whole of the area so specified has been cleared and will at all times keep available for cultivation or grazing as the case may be the land so cleared~~

VI. Insure and keep insured in the full insurable value thereof against loss and damage by fire storm and tempest all buildings erections and other improvements the property of the Crown upon the leased land in the joint names of The Minister of Lands (hereinafter called the Minister) and the Lessee in some Insurance Office in Adelaide to be approved of by the Minister and forthwith lodge the policy of every such insurance in the office of the Minister and forward to the Minister the receipts for the premiums payable in respect of such policy within seven days after the same shall become due. The Minister may insure on default by the Lessee and recover all amounts paid for such insurance in like manner as the rent is recoverable

EXD.

E ~~(c)~~ (b4)
P.R.
Act 1929-1937
~~D.L., 1810/36.~~
8901/50.
~~Subdivision forms R. of Pr.~~

COVENANTS—continued

VII. Personally reside on the land for nine months in each year

VIII. Permit the Minister and his authorized agents at all times to enter upon the land to search and mine for minerals on the land and remove therefrom any minerals or other things reserved and belonging to the Crown and also to permit the owner of any mining claim situated on the land and the holder of any mining lease of the whole or any portion of the land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease

IX. Set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon

X. ~~IX.~~ Set apart and keep reserved for the purpose of preventing soil erosion such areas of the land comprised in this lease being areas covered with natural scrub growth as the Minister or his servants shall notify to the Lessee and will not destroy or permit to be destroyed any natural scrub growth growing on the said areas; the said areas will be of the respective sizes and in the respective positions notified to the Lessee by the Minister or his servants provided that the total area of the said areas shall not exceed one-tenth of the area of the land comprised in this lease or such greater area as the Minister on the recommendation of the Land Board may determine The land to be set apart and kept reserved pursuant to this covenant shall be in addition to the land required to be set apart and reserved pursuant to covenant ix. hereof

XI. Forthwith commence to destroy and to keep the land and the adjoining half width of all public roads adjacent thereto free from vermin and noxious weeds to the satisfaction of the Minister during the lease and fill up all burrows on the land and the said half width of road

~~XI. Pay the balance of arrears of rent and interest thereon due under the former Lease to the~~ ~~day of 19 viz:~~ ~~together with interest thereon at the rate of~~ ~~per centum per annum in equal annual instalments of~~ ~~(being instalments of principal and interest) on the day of~~ ~~in each year the first of such instalments to be paid on the day of~~ ~~19 such instalments shall be payable and recoverable in the same manner as the rents to become due hereunder~~

~~Provided that in the event of any such instalment being in arrear the Lessee must pay interest thereon at the rate of Five Pounds per centum per annum from the date such instalment became due until the date of payment thereof~~

~~Provided also that the Lessee shall have the right to pay off the whole or any portion of the said arrears together with interest then due at any time~~

And the Lessee must not—

XII. Transfer sublet encumber or mortgage without the written consent of the Minister first had in each case

XIII. Erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS

3. The lease shall be liable to forfeiture in the following cases:—

I. If default be made in payment of any rent in arrear for six months after the same falls due the Lessee having had at least three months previous notice in writing demanding its payment or if

II. Default be made in the performance of any covenant or if

III. The land shall be transferred sublet or mortgaged without the written consent of the Minister first had in each case or if

IV. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use or if

V. The Lessee shall refuse to permit the Minister and his authorized agents and the owner of any mining claim and the holder of any mining lease to exercise the liberty hereinbefore mentioned or if

VI. The Lessee shall not set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land or if the Lessee shall destroy or permit or suffer to be destroyed any timber trees growing thereon or if

VII. The Lessee shall not set apart and thereafter keep reserved for the purpose of preventing soil erosion such areas of the land comprised in this lease being areas covered with natural scrub growth of the respective sizes and in the respective positions notified to the Lessee by the Minister or his servants or if the Lessee shall destroy or permit to be destroyed any natural scrub growth growing on the said areas or if

VIII. The Lessee shall erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS—continued

4. The land may be resumed by the Crown for mining or for any public work or purposes full compensation being made to the Lessee for his loss Provided that immediately upon the giving of a notice to the Lessee by publication in the *Government Gazette* of intended resumption of the whole or any portion of the said land the right of the Lessee to purchase the land comprised in this lease as provided in condition 5 hereof shall cease and determine and be void as to all or such parts of the said lands as shall be specified in such notice

5. The Lessee shall have the ~~right subject nevertheless to the provisions lastly hereinbefore contained~~ subject to the covenants conditions and provisions thereof at any time during the currency of this lease to purchase and obtain the fee simple of the land comprised in this lease on payment of the sum of two hundred and twenty five dollars and seventy nine cents ($225–79)

~~being at the rate of~~
~~per acre in addition to all arrears of rent (if any) and the balance for the time being of the arrears of rent (if any) under the former lease and interest thereon.~~

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the sixteenth day of January 19 69

Signed sealed and delivered by the above-named Lessee in the presence of

L. S.

L. S.

SURRENDER OF LEASE VIDE No. 3050960

16193A
6.11.69 AT 12.5 p.m.
SUB. REG. GEN.

Tom Duggan

South Australia.

Register Book,

Vol. 885 Folio 20

W. Playford Registrar-General.

76

Crown Lease.

(PERPETUAL, No. 16197).

In lieu of Surrendered Agreement to Purchase No. 11725 *Reg. Vol.* 754 *Folio* 7

PERSONAL RESIDENCE.

His Majesty the King doth hereby lease to LEO BERNHARDT HUGHES of Ceduna Farmer

herein designated by the term "Lessee" all that land containing one thousand one hundred and three (1103) acres or thereabouts and being Section No. 35

in the Hundred of BONYTHON County of WAY as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held in perpetuity at the yearly rent for the first ten years of the term hereof of nine pounds ten shillings and eight pence(£9:10:8) and thereafter of such amount as shall be fixed by the Land Board and approved by the Commissioner of Crown Lands hereinafter called the Commissioner pursuant to the Crown Lands Act 1929-1937 to be paid in advance on the second day of May commencing the second day of May One Thousand Nine Hundred and thirty four with such penalties as are provided for by the Crown Lands Act 1929-1937 added thereto in case any of such rents is in arrear and subject to the reservations covenants and conditions shortly stated below and which are more fully set out in the Crown Lands Act 1929-1937.

Commissioner of Crown Lands.

RESERVATIONS.

1. There are reserved to the Crown all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils with incidental powers of search and mining **AND ALSO** the right to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use where required without any payment to the Lessee by way of compensation

COVENANTS.

2. The Lessee must—

I. Enclose the land with cattle-proof fence before the end of the fifth year of the lease

II. Keep in good repair all Crown improvements (if any) on the land

III. Pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of loans repayable under the Vermin Act 1931-1936 or any Act amending or extending that Act or substituted therefor

IV. Clear so as to render available for cultivation or so as to improve the grazing capacity thereof Nil acres of the land

V. During the first two years clear so as to render available for cultivation or so as to improve the grazing capacity thereof not less than one-eighth of the area specified in that behalf in the lease and will during the second two years clear as aforesaid not less than one-eighth of the area so specified and will during each succeeding year clear as aforesaid not less than one-eighth of the area so specified until the whole of the area so specified has been cleared and will at all times keep available for cultivation or grazing as the case may be the land so cleared

VI. Insure and keep insured in the full insurable value thereof all buildings the property of the Crown upon the leased land in the joint names of the Commissioner and the Lessee in some Insurance Office in Adelaide to be approved by the Commissioner and forthwith lodge the policy of every such insurance in the office of the Commissioner and forward to the Commissioner the receipts for the premiums payable in respect of such policy within seven days after the same shall become due with a power for the Commissioner to insure on default by the Lessee and to recover the amount paid for such insurance in like manner as the rent is recoverable

Director of Lands.

Exd. (b4) 464

(Surrender.)

P.R. 1929-1937. 1937/34. A first ten years.

COVENANTS—continued.

VII. Personally reside on the land for nine months in each year

VIII. Permit the Crown or the owner of any mining claim situated on the land or the holder of any mining lease of the whole or any portion of the land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease

IX. Set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon

X. Forthwith commence to destroy and to keep the land and the adjoining half width of all public roads adjacent thereto free from vermin and noxious weeds to the satisfaction of the Commissioner during the lease and fill up all burrows on the land and the said half width of road

And the Lessee must not—

XI. Transfer sublet encumber or mortgage without the written consent of the Commissioner first had in each case

XII. Erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS.

3. The lease shall be liable to forfeiture in the following cases:—

I. If default be made in payment of any rent in arrear for six months after the same falls due the Lessee having had at least three months previous notice in writing demanding its payment or if

II. Default be made in the performance of any covenant or if

III. The land shall be transferred sublet or mortgaged without the written consent of the Commissioner first had in each case or if

IV. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use or if

V. The Lessee shall refuse to permit the Crown or the owner of any mining claim or the holder of any mining lease to exercise the liberty hereinbefore mentioned or if

VI. The Lessee shall not set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land or if the Lessee shall destroy or permit or suffer to be destroyed any timber trees growing thereon or if

VII. The Lessee shall erect brush fence or suffer or permit the same to be erected or to remain on the land

4. The land or any portion thereof may be resumed by the Crown for roads railways tramways or for sites for towns or for park lands or for mining purposes or for any public work or purpose upon the Commissioner giving three calendar months notice to the Lessee by publication in the *Government Gazette* of such intended resumption and that immediately from and after the expiration of three calendar months after such notice shall have been given as aforesaid this lease and the demise hereby made shall cease determine and be void as to all or such parts of the said lands as shall be mentioned and described in such notice anything in this lease to the contrary notwithstanding Provided that full compensation shall be made to the Lessee for his loss except where the land shall be resumed for the construction of drains and/or pipe tracks and/or the laying of pipes and/or for the conservation of water for the public use in which case no compensation shall be payable Provided that in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the Commissioner or the Lessee in the manner provided by section 289 of the Crown Lands Act 1929-1937 and provided that immediately upon the giving of a notice to the Lessee by publication in the *Government Gazette* of intended resumption of the whole or any portion of the said land the right of the Lessee to purchase the land comprised in this lease as provided in condition 5 hereof shall cease and determine and be void as to all or such parts of the said lands as shall be specified in such notice

5. The Lessee shall have the right at any time during the currency of this lease subject to the covenants conditions and provisions thereof to purchase the fee simple of the land comprised herein for the sum of four hundred and seventy six pounds twelve shillings and two pence (£476: 12: 2)

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the twenty first day of September 1938.

L. B. Hughes (L.S.)

Signed sealed and delivered by the above-named Lessee in the presence of

Martin

(L.S.)

R 1437044

CERTIFICATE NO. 1437044 of the Minister of LANDS THAT ON REVALUATION OF THE WITHIN LEASE NO. 16197 THE RENT HAS BEEN FIXED AT £ 11 : 18 : 1 PER ANNUM FROM THE 2 DAY OF May 1944 PRODUCED FOR REGISTRATION THE 8 DAY OF June 1945, AT 3 P.M.

W. Heeears DEP. REG. GENL.

T1694122

TRANSFER No. 1694122 FROM Leo Bernhard Hughes to Kenneth Allen Schwarz of Box 11 Ceduna Farmer OF THE WITHIN Lease No. 16197

PRODUCED FOR REGISTRATION THE 18 DAY OF [illegible] 1957 at 2.35 pm

Rogers DEP. REG. GENL.

(2460577)

2961368

PARTIAL SURRENDER No. 2961368 THE WITHIN LEASE No. 16197 IS SURRENDERED AS REGARDS 29 3/4 ACRES AND THE AREA by recalculation REDUCED TO 1072 ACRES ~~AND THE ANNUAL~~ AND THE ANNUAL RENT REDUCED ~~RENT REDUCED TO £~~ TO $23 FROM and the purchase money under conditions to be reduced to $928-50 20·11·1968 PRODUCED 22·11·1968 at 11 am.

L. Ogbock pro DEP. REG. GEN.

SURRENDER OF lease No. 16197 VIDE No. 2970694. PRODUCED 31 - 1969 AT 2.35 pm

L. Ogbock pro DEP. REG. GEN.

PARTIAL SURRENDER No. 2460577 THE WITHIN LEASE No. 16197 IS SURRENDERED AS REGARDS 29a 1r 33p ~~ACRES~~ AND THE AREA REDUCED TO 1100 ACRES AND THE amount required to purchase the fee simple under Condition 5 of the lease is ~~ANNUAL RENT IS~~ REDUCED TO £475 : 12 : 2 FROM 30/7/1963 PRODUCED 16/8/1963 AT 10.45 am

L. K. D. Anderson DEP. REG. GEN.

T [illegible] M [illegible]

TRANSFER No. 2628002 to Eric Leslie Baumann of Ceduna Share-Farmer OF THE WITHIN LAND PRODUCED 7-5-1965 AT 12.10 pm Lease No 16197

R. Wilson Cozzens DEP. REG. GEN.

MORTGAGE No. 2628003 to Kenneth Allen Schwarz

PRODUCED 7-5-1965 AT 12.10 pm

R. Wilson Cozzens DEP. REG. GEN.

D2628003 6/11/[illegible]

Australia.

Registrar-General.

Agreement for Sale and Purchase.

No. 11725

(Made pursuant to the provisions of the "Crown Lands Acts, 1915 to 1928.")

PERSONAL RESIDENCE.

(In lieu of Surrendered Perpetual Lease 11408 *Reg. Vol.* 568 *Folio* 96 *)*

ement made this first day of May One Thousand Nine Hundred and twenty nine BETWEEN The Commissioner of Crown Lands of and for the State of South Australia herein contracting as a public officer for and on behalf of His Most Gracious Majesty King GEORGE THE FIFTH (hereinafter called "the Vendor") of the one part and

LEO BERNHARDT HUGHES of Ceduna Farmer

(hereinafter with his executors administrators and assigns called "the Purchaser") of the other part WHEREBY IT IS AGREED by and between the parties hereto as follows:—

1. The Vendor agrees to sell and the Purchaser agrees to purchase the land and improvements thereon for the sum of five hundred and fifty two pounds (£552: 0: 0)

being the price fixed by the Land Board

and being ALL that Section of land situated in the Hundred of BONYTHON

County of EYRE containing one thousand one hundred and four (1104)

acres or thereabouts numbered 35 Near Ceduna

EXCEPT AND RESERVED all gold silver copper tin and other metals all ores and other substances containing metals minerals and all gems and precious stones coal and mineral oils upon in or under the said land to the Vendor and persons lawfully claiming under or authorised by him with full and free liberty of access ingress egress and regress with or without horses cattle carts drays carriages engines and all necessary implements and things into upon and from said land for all reasonable purposes and to cut dig sink try search work remove and dispose of all or any of the said excepted and reserved things.

2. The Purchaser shall pay the purchase-money together with interest thereon at the rate of three (3) pounds per centum per annum in sixty half-yearly instalments of thirteen pounds sixteen shillings and six pence (£13: 16: 6)

payable in advance on the first days of May November in each year until the whole of the purchase-money and interest shall be paid: PROVIDED the Purchaser may complete the purchase of the said land at any time after six years from the date when such land originally taken up on payment of the balance of the purchase-money and interest to the date of the completion of the purchase and provided that the terms covenants conditions and provisions of this agreement have been fully complied with to the satisfaction of the Commissioner of Crown Lands.

3. The Purchaser will pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of the said land granted under the "Vermin Acts 1914 to 1928."

4. The Purchaser shall and will during the first five years from the date of this agreement substantially fence the boundaries of the said land with a fence or wall ordinarily capable of resisting the trespass of cattle and will until the completion of the purchase of the said land maintain and uphold such fence in good and substantial repair.

5. The Purchaser will during this agreement keep and maintain in good and tenantable repair and condition all improvements on the said land.

6. The Purchaser will not without the consent of the Vendor being first had and obtained transfer sub-let encumber or charge the said land.

7. The Purchaser will subject to the regulations in force for the time being under "The Mining Acts 1893 to 1922" and authorising the making of regulations permit every gold or mineral lessee or licensee holding a lease or license under the Mining Acts 1893 to 1922" or any other Act for the time being authorising the granting of gold or mineral leases or licences of

8. The Purchaser will insure and during this agreement keep insured in the full insurable value thereof in some Insurance Office in Adelaide to be approved by the Vendor all buildings and erections the property of the Vendor upon the said land or which may thereafter be thereupon against loss or damage by fire such insurance to be in the joint names of such Purchaser and the said Vendor and will forthwith lodge the policy of every such insurance in the office of the said Vendor and will forward to the said Vendor the receipts for the premiums payable in respect of every such policy within seven days after the same shall become due and that if the foregoing covenant shall not be duly observed then the said Vendor shall be at liberty to insure the said improvements in manner aforesaid and it is agreed that all sums of money received under any such insurance shall be laid out in reinstating the premises in respect of which the same shall have been received.

9. The Purchaser will destroy all rabbits on the said land and fill up their burrows to the satisfaction of the said Vendor and will forthwith commence to destroy all other vermin on the said land such as are by or under the "Vermin Acts 1914 to 1923" and by or under any other Act for the time being in force in the said State declared to be vermin and will keep the said land free of all vermin to the satisfaction of the Vendor during this agreement and will destroy Bathurst bur and all other noxious weeds growing upon the said land and upon the half width of Government roads adjacent thereto.

10. The Purchaser will personally reside on the said land for nine months at least in every year during the currency of this agreement.

11. The Purchaser will neither allow to remain if now existing nor erect nor suffer the erection of any brush fence upon the said land.

12. It shall be lawful for the Vendor and all persons authorised by him at all times unrestrictedly to enter into and upon the said land for any purpose whatsoever before completion of the purchase thereof.

13. And it is hereby expressly agreed that the Vendor may at any time or from time to time hereafter resume possession of all or any part of the said land for roads railways or tramways or for sites for towns or park lands or for mining purposes or for any public purpose whatsoever after the expiration of three calendar months from the giving by the Commissioner of Crown Lands to the Purchaser of notice in writing of the intended resumption and that immediately upon the giving of such notice the right of the Purchaser to complete the purchase shall cease and determine and be void as to all or such of the said lands as shall be specified in such notice and that immediately after the expiration of the said three calendar months this agreement and the right of the Purchaser to possession shall cease and determine and be void as to all or such part of the said lands as shall be specified in such notice anything in this agreement to the contrary notwithstanding: PROVIDED that on any resumption the Purchaser shall except as hereinafter in the next following clause is provided be paid compensation for the loss the Purchaser shall sustain thereby and in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the said Commissioner or the Purchaser in the manner provided by the "Crown Lands Acts 1915 to 1928."

14. The Vendor reserves unto himself and all persons and bodies authorised by him full right and liberty without any payment to the Purchaser by way of compensation from time to time and at all times hereafter with or without beasts of draught or burden or any vehicles whatever to enter into and upon the said land for the purpose of laying pipes or a pipe track in along over or under the said land and to view the condition of and to cleanse relay repair and maintain the said pipes or pipe track and to allow water to be in and to flow through the said pipes or pipe track and to construct drains and pipe tracks and to lay pipes where required in along over or under the said land and to view the condition of and cleanse relay repair and maintain the said drains and pipe tracks and pipes and to allow water to be in and to flow through the said drains pipe tracks and pipes.

15. And it is hereby agreed and declared that if any of the instalments hereby reserved shall be unpaid and in arrear for more than six months after the day whereon the same is hereby made payable the Purchaser having had at least three months' previous notice in writing demanding its payment or if the said Vendor shall be satisfied there has been a breach in the performance of any other of the covenants herein contained or that this agreement is liable to forfeiture the said Vendor may re-enter and take possession of the said land and it shall be lawful for the Vendor before or after re-entry to cancel and determine this agreement and the said Vendor may thereupon insert a notice in the *Government Gazette* declaring this agreement to be forfeited and such notice appearing in the *Government Gazette* shall in all Courts and elsewhere and under all circumstances be taken to be conclusive evidence that this agreement has been legally cancelled and forfeited: PROVIDED that the Vendor shall not (except in the case of an instalment being unpaid and in arrear as aforesaid or of a breach of clause 6 hereof) exercise the powers expressed in this clause in case of a breach of covenant before the expiration of the period of three months after notice has been given to the Purchaser of such breach and requiring the performance of the covenant: PROVIDED NEVERTHELESS that if notice has been given to the Purchaser of any breach of a covenant no notice of any future breach of the same covenant or of the continuance of the same breach thereof shall be necessary before the exercise of such powers: PROVIDED also that the Vendor instead of exercising such power of forfeiture or cancellation as aforesaid may impose on the Purchaser a penalty of such sum as may be fixed by the Land Board constituted under the "Crown Lands Acts 1915 to 1928" and such penalty shall be recoverable in the same manner as the instalments of purchase-money or/and interest under this agreement are recoverable when in arrear.

16. And it is hereby expressly declared that any notice to be served or given to the Purchaser under this agreement shall be deemed to have been duly served and given if the same be sent through the post office enclosed in an envelope addressed to the Purchaser at any address stated in any recent application letter or document received from him or at his usual or last known place of abode in the said State or to the care of any Solicitor Attorney or Agent acting in the Purchaser's behalf in the particular matter in respect whereof such notice is given and such notice shall be deemed to have been served or given on and time shall run from the day of the posting thereof as aforesaid.

IN WITNESS whereof the hand and seal of the Commissioner and the hand of the Purchaser were hereunto set the Sixth day of September 1929

Signed and sealed by the said Vendor in the presence of

C Parry

Geo. F. Jenkins

L B Hughes

Signed by the said Purchaser in the presence of

L B Hughes

~~M1109505~~

MORTGAGE No. 1109505 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 3 DAY OF November 1930 AT 11.20 am (Including other land)
E[illegible]
DEP. REG GENL.

~~M1168512~~

MORTGAGE No. 1168512 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 17 DAY OF May 1934 AT 11.30 a.m.
(Including other land)
H Whitewood
DEP. REG GENL.

MORTGAGE No. 1203308 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 18. DAY OF December 1935 AT 11 a.m.
Including other land.
G Pinkerton & Sg DEP. REG GENL.

~~DM1109505 DISCHARGE OF THE within MORTGAGES~~

DISCHARGE OF THE within MORTGAGES
Nos. 1109505, 1168512 and 1203308
~~BY ENDORSEMENT THEREON~~
PRODUCED FOR REGISTRATION THE 17 DAY OF May 1937 AT 11.35 a.m.
G Pinkerton
DEP. REG. GENL.

~~E127955~~

SURRENDER OF THE within Agreement
No. 11725 BY MEMORANDUM No. 1270551
PRODUCED FOR REGISTRATION THE 11 DAY OF August 1938 AT 3 pm
A J Sidebottom
DEP. REG. GENL.

Day. H. Bosanquet

Register Book,

Vol. 568 *Folio* 96

M Giles Registrar-General.

South Australia.

Crown Lease.

(PERPETUAL, No. *11408* **.)**

PERSONAL RESIDENCE.

(In lieu of Surrendered Misc. Lease No. [illegible] *).*

His Majesty the King doth hereby lease to *George Edward Fleetwood & Albert Bay Dunn [illegible]* herein designated by the term "Lessee" all that land containing *one thousand one hundred and four (1104)* acres or thereabouts and being Section No *55 Near Cowana [illegible]* in the Hundred of *Brighton* County of *Hay* as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held **in perpetuity** at the yearly rent of *[illegible] and five shillings (£[illegible]:5:0)* to be paid in advance on the *first* day of *January* commencing the *first* day of *January* One Thousand Nine Hundred and *ten* and at a further rent of Five Pounds per centum per annum on any rent in arrear subject to the reservations covenants and conditions shortly stated below and which are more fully set out in "The Crown Lands Act 1903"

Certified correct, [signature] Surveyor-General

By command, [signature] Commissioner of Crown Lands.

RESERVATIONS.

1. There are reserved to the Crown all gold silver copper tin and other metals ores minerals and other substances containing metals and all gems and precious stones coal and mineral oil with incidental powers of search and mining **AND ALSO** the right to enter upon the land hereby leased to construct drains and pipe tracks and to lay pipes and to conserve water for public use where required

COVENANTS.

2. The Lessee must—

- I. Enclose the land with cattle-proof fence before the end of the fifth year of the lease and
- II. Keep in good repair all Crown improvements (if any) on the land
- III. Forthwith commence to destroy and to keep the land free from vermin to the satisfaction of the Commissioner during the lease
- IV. Insure and keep insured in the full insurable value thereof all buildings the property of the Crown upon the leased land in the joint names of the Commissioner and the Lessee in some Insurance Office to be approved by the Commissioner and forthwith lodge the policy of every such insurance in the office of the Commissioner and to forward to the Commissioner the receipts for the premiums payable in respect of such policy within seven days after the same shall become due with a power for the Commissioner to insure on default by the Lessee and to recover the amount paid for such insurance in like manner as the rent is recoverable
- V. Personally reside on the land for nine months in each year

And the Lessee must not—

- VI. Transfer sublet encumber or mortgage without the written consent of the Commissioner of Crown Lands first had in eachcase

Surrendered. P.R. (2)

CONDITIONS.

3. The lease shall be liable to forfeiture in the following cases and no others:—

i. If default be made in payment of any rent in arrear for six months after written notice requiring its payment or if

ii. Default be made in the performance of any covenant for three months after notice of its non-performance requiring its performance or if

iii. The land shall be transferred sublet or mortgaged without the written consent of the Commissioner of Crown Lands first had in such cases or if

iv. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and pipe tracks and to lay pipes and to conserve water for public use or if

v. The Lessee does not reside on the land for nine months in each year

4. The land may be resumed by the Crown for mining or for any public work or purpose full compensation being made to the Lessee for loss except where the land shall be resumed for the construction of drains or pipe tracks and the laying of pipes or for the conservation of water for the public use in which cases no compensation whatever shall be made to the Lessee

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the 26 day of July 1907

George Edward Fleetwood

Signed sealed and delivered by the above-named Lessee in the presence of

Wal. Warren.

Mortgage No 548701 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 5 day of May 1910 at 11 hour Vernon H Edwards Dep Reg Gen

Mortgage No 540612 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 8 day of August 1911 at 11 hour Vernon H Edwards Dep Reg Gen

Mortgage No 486549 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 25 day of April 913 at 11 50 am Vernon H Edwards Dep Reg Gen

DISCHARGE OF THE within MORTGAGE NO. 548701 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 12 DAY OF May 1910 AT 11 M
Robt Rowe
DEP. REG. GENL.

DISCHARGE OF THE within MORTGAGE NO. 540612 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 20 DAY OF May 1918 AT 3 10 M
Robt Rowe
DEP. REG. GENL.

DISCHARGE OF THE within MORTGAGE NO. 486549 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 18 DAY OF April 1923 AT 3 02 M
Robt Rowe
DEP. REG. GENL.

Transfer No 103196 from George Edward Fleetwood to Leo Bernhardt Hughes of Veduna Farmer of the within lease No 11408 Produced for registration the 22 day of March 1928 at 12.15 pm
Dep Reg Genl

SURRENDER OF THE within lease No 11408 BY MEMORANDUM No. 107356 PRODUCED FOR REGISTRATION THE 14 DAY OF June 1927 AT 3 pm

Computer Register Search

LANDS TITLES OFFICE, ADELAIDE

For a Certificate of Title issued pursuant to the Real Property Act, 1886, refer to certification overleaf.

REGISTER SEARCH OF CROWN RECORD * VOLUME 5768 FOLIO 868 *

COST : $15.10 (GST exempt)
REGION : GROUND FLOOR, L.T.O.
AGENT : GRFL BOX NO : 000
SEARCHED ON : 03/12/2004 AT : 11:09:01

NO PARENT TITLE
AUTHORITY : RT 8862636
DATE OF ISSUE : 04/05/2000
REGISTRATION : 1

OWNER

THE CROWN

CUSTODIAN

MINISTER FOR ENVIRONMENT AND CONSERVATION OF ADELAIDE SA 5000

DESCRIPTION OF LAND (UNALIENATED)

SECTION 265
HUNDRED OF BONYTHON
IN THE AREA NAMED CEDUNA

TOTAL AREA: 4.96 HECTARES APPROXIMATE

EASEMENTS

NIL

SCHEDULE OF INTERESTS

NIL

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

NIL

ADMINISTRATIVE INTERESTS AND CROWN NOTES

NIL

END OF TEXT. 2

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5580 FOLIO 764 *

COST	: $15.10 (GST exempt)	PARENT TITLE	: CT 3969/65
REGION	: GROUND FLOOR, L.T.O.	AUTHORITY	: CONVERTED TITLE
AGENT	: GRFL BOX NO : 000	DATE OF ISSUE	: 28/09/1998
SEARCHED ON	: 03/12/2004 AT : 11:08:34	EDITION	: 1

REGISTERED PROPRIETOR IN FEE SIMPLE

ABORIGINAL LANDS TRUST OF 1 WRIGHT ROAD WALKLEY HEIGHTS SA 5098

DESCRIPTION OF LAND

SECTION 197
HUNDRED OF BONYTHON
IN THE AREA NAMED CEDUNA

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

7082685 LEASE TO YARILENA COMMUNITY INC. COMMENCING ON 14.3.1991 AND EXPIRING ON 13.3.2016

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

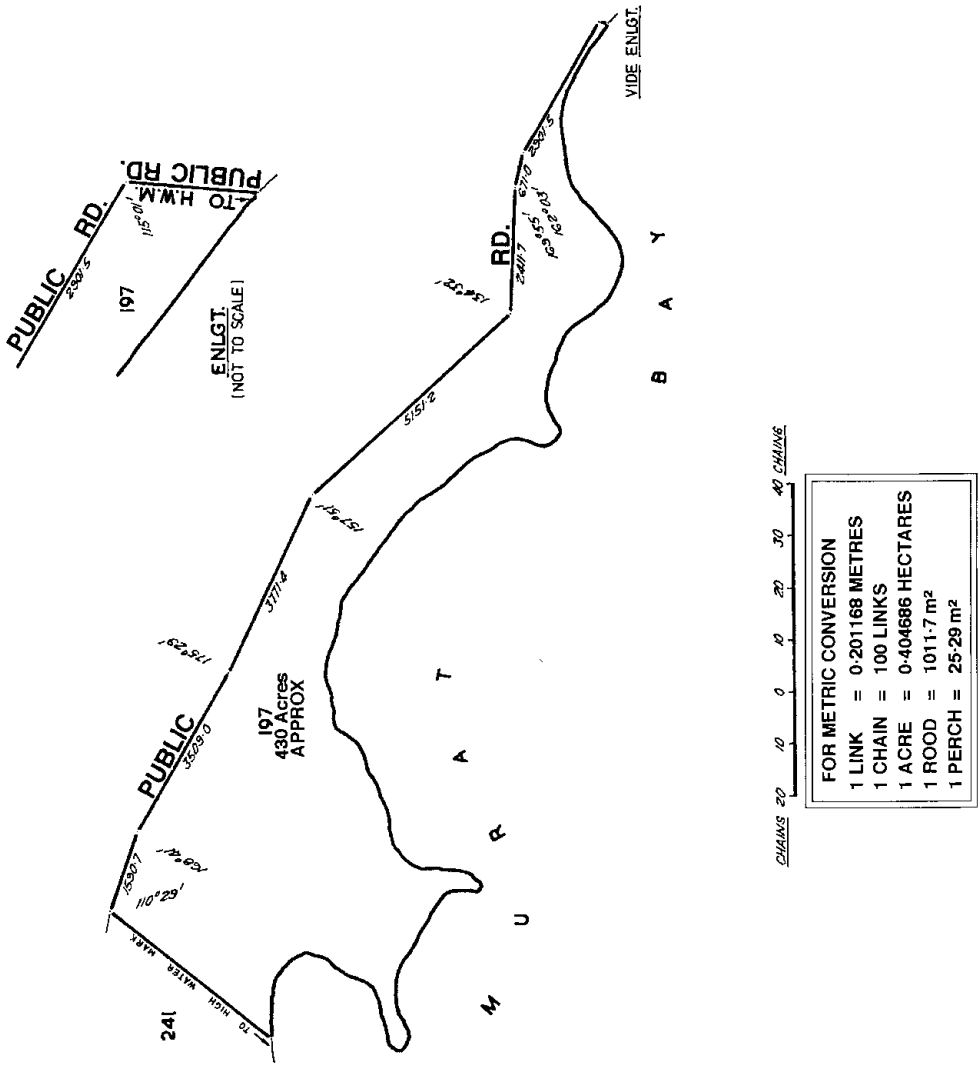
APPROVED FILED PLAN NO UNIQUE IDENTIFIER FX41295
CONVERTED TITLE-WITH NEXT DEALING LODGE CT 3969/65
COMPARE ADDRESS FOR SERVICE OF NOTICE WITH 7082685

END OF TEXT. 8

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5580 FOLIO 764

SEARCH DATE : 03/12/2004 TIME: 11:08:34



Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5735 FOLIO 114 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 4007/698
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : CONVERTED TITLE
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 17/02/2000
SEARCHED ON : 03/12/2004 AT : 11:08:35	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

MINISTER FOR PRIMARY INDUSTRIES OF ADELAIDE SA 5000

DESCRIPTION OF LAND

ALLOTMENT 593 FILED PLAN 180625
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

NIL

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

CONVERTED TITLE-WITH NEXT DEALING LODGE CT 4007/698

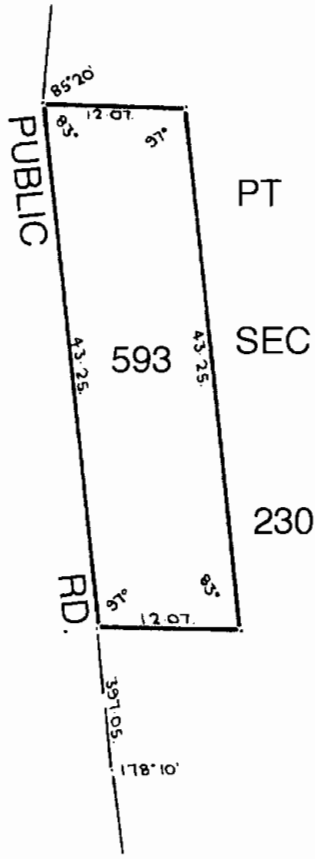
END OF TEXT.

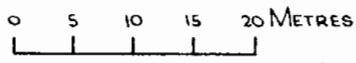
LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5735 FOLIO 114

SEARCH DATE : 03/12/2004 TIME: 11:08:35

THIS PLAN IS SCANNED FOR CERTIFICATE OF TITLE 4007/698





8761727

Series No.	Prefix
2	T

LANDS TITLES REGISTRATION OFFICE
SOUTH AUSTRALIA

MEMORANDUM OF TRANSFER

FORM APPROVED BY THE REGISTRAR-GENERAL

CERTIFIED CORRECT FOR THE PURPOSES OF THE REAL PROPERTY ACT 1886

Solicitor/Registered Conveyancer/~~Transferee~~

S. KAYANAGH

NOTES

1. Use this form for simple transfers. If insufficient space use Form T.2. Use Form T.3. for transferring a mortgage, encumbrance or lease.
2. State whether the whole or portion of the land comprised in the Certificate of Title and or Crown Lease. If portion only, specify.
3. Insert estate in fee simple or estate as Crown Lessee (as the case may be) and quantum being transferred.
4. If tenants in common in unequal shares, then specify shares. If a transferee is a minor state date of birth.
5. If the executing party is a natural person execution should read "SIGNED by the transferor/transferee in the presence of....." The witness must be a disinterested person. If the executing party is a body corporate execution must conform to any prescribed formalities relating to the affixing of the common seal.

No. 1 is Regd

BELOW THIS LINE FOR OFFICE USE ONLY

Date	- 1 OCT 1999	Time	13-18
FEES			
R.G.O.	POSTAGE	NEW C.T.	
12 50			

010CT1999 B10035967L.T.O. 1:250.00

EXAMINATION

CORRECTION	PASSED

BELOW THIS LINE FOR AGENT USE ONLY

AGENT CODE

Lodged by: BWJO

Correction to: BWJO

TITLES, CROWN LEASES, DECLARATIONS ETC. LODGED WITH INSTRUMENT (TO BE FILLED IN BY PERSON LODGING)

1. CT 4007/700
2. CT 4007/702
3.
4.
5.

Assessor

PLEASE ISSUE NEW CERTIFICATES OF TITLE AS FOLLOWS

1.
2.
3.
4.
5.

DELIVERY INSTRUCTIONS (Agent to complete)
PLEASE DELIVER THE FOLLOWING ITEM(S) TO THE UNDERMENTIONED AGENT(S)

ITEM CT/CL REF.	AGENT CODE
CT 4007/700	BWJO
CT 4007/702	BWJO
CT 4007/701	BWJO
CT 4007/699	BWJO

Form T.1
(See Note 1)

TRANSFER

NOW WHOLE OF THE LAND IN C.T. VOL 5737 FOL 376

LAND DESCRIPTION (See Note 2)	The whole of the land comprised in Certificates of Title Register Book VOLUME 5657 FOLIOS 128 & 129
ESTATE AND INTEREST (See Note 3)	Estate in Fee Simple
ENCUMBRANCES	Encumbrance No. 3118879 to Esso Australia Ltd.
TRANSFEROR Full Name and Address	**MAXWELL ROBERT CHRISTIE** of 3 Iluka Place Semaphore Park SA 5019 of 1 undivided 2nd part and **VYTAUTAS VINCENTAS PATUPAS** of Streaky Bay Road Ceduna SA 5690 of 1 undivided 2nd part
CONSIDERATION In words and figures	**THREE HUNDRED THOUSAND DOLLARS ($300,000.00)**
TRANSFEREE Full Name and Address and mode of holding (See Note 4)	**THE DISTRICT COUNCIL OF CEDUNA** of PO Box 175 Ceduna SA 5690

THE TRANSFEROR ACKNOWLEDGES RECEIPT OF THE ABOVE CONSIDERATION TRANSFERS TO THE TRANSFEREE THE ESTATE AND INTEREST HEREIN SPECIFIED IN THE LAND ABOVE DESCRIBED SUBJECT TO THE ABOVE ENCUMBRANCES

DATED 23rd September 1999

TRANSFEROR

EXECUTION AND ATTESTATION (See Note 5)

SIGNED by the TRANSFEROR

.....

.....

in the presence of:

Witness:.....

Full names of Witness:.....

Address:.....

.....

Daytime Phone No.....

TRANSFEREE-ACCEPTED

The Common Seal of The District Council of Ceduna was hereunto affixed in the presence of:

THE DISTRICT COUNCIL OF CEDUNA

.....
Mayor

.....
Chief Executive Officer

REGISTERED 14 MAR 2000

REGISTRAR-GENERAL

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5830 FOLIO 638 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 5657/129 & OTHERS
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : RTU 8933987
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 19/12/2000
SEARCHED ON : 03/12/2004 AT : 11:08:36	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 20 DEPOSITED PLAN 55492
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

9792122 CAVEAT BY CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

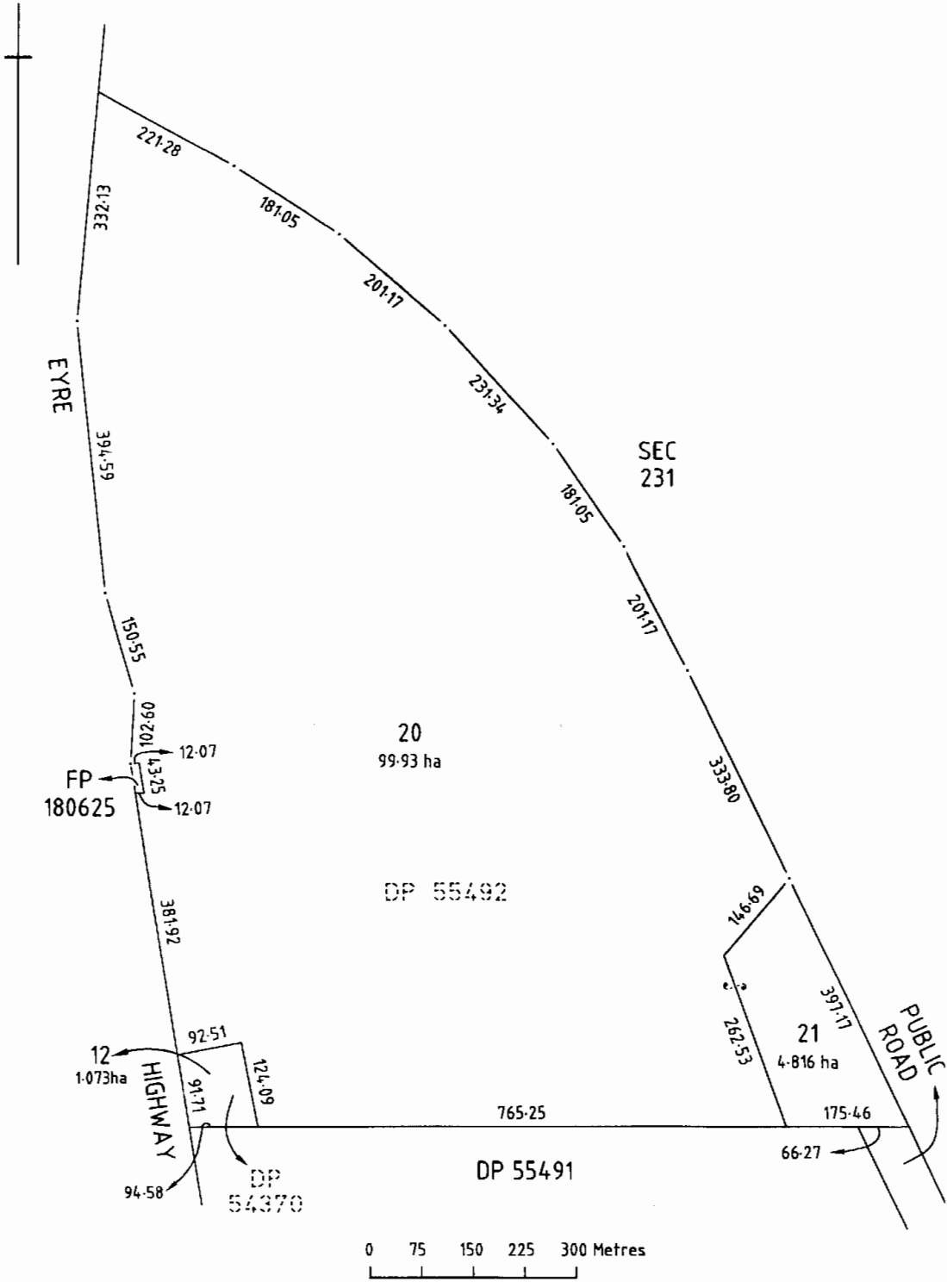
NIL

END OF TEXT. 4

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5830 FOLIO 638

SEARCH DATE : 03/12/2004 TIME: 11:08:36



Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5906 FOLIO 567 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 5835/121
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : SC 9677926
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 13/11/2003
SEARCHED ON : 03/12/2004 AT : 11:08:35	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 22 DEPOSITED PLAN 53902
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

SUBJECT TO EASEMENTS OVER THE LAND MARKED B.A.E.D.F AND C (T 4249305 T 4249306 T 4463473 T 4463474 T 4489132 AND T 4489133 RESPECTIVELY)

SCHEDULE OF ENDORSEMENTS

9792122 CAVEAT BY CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

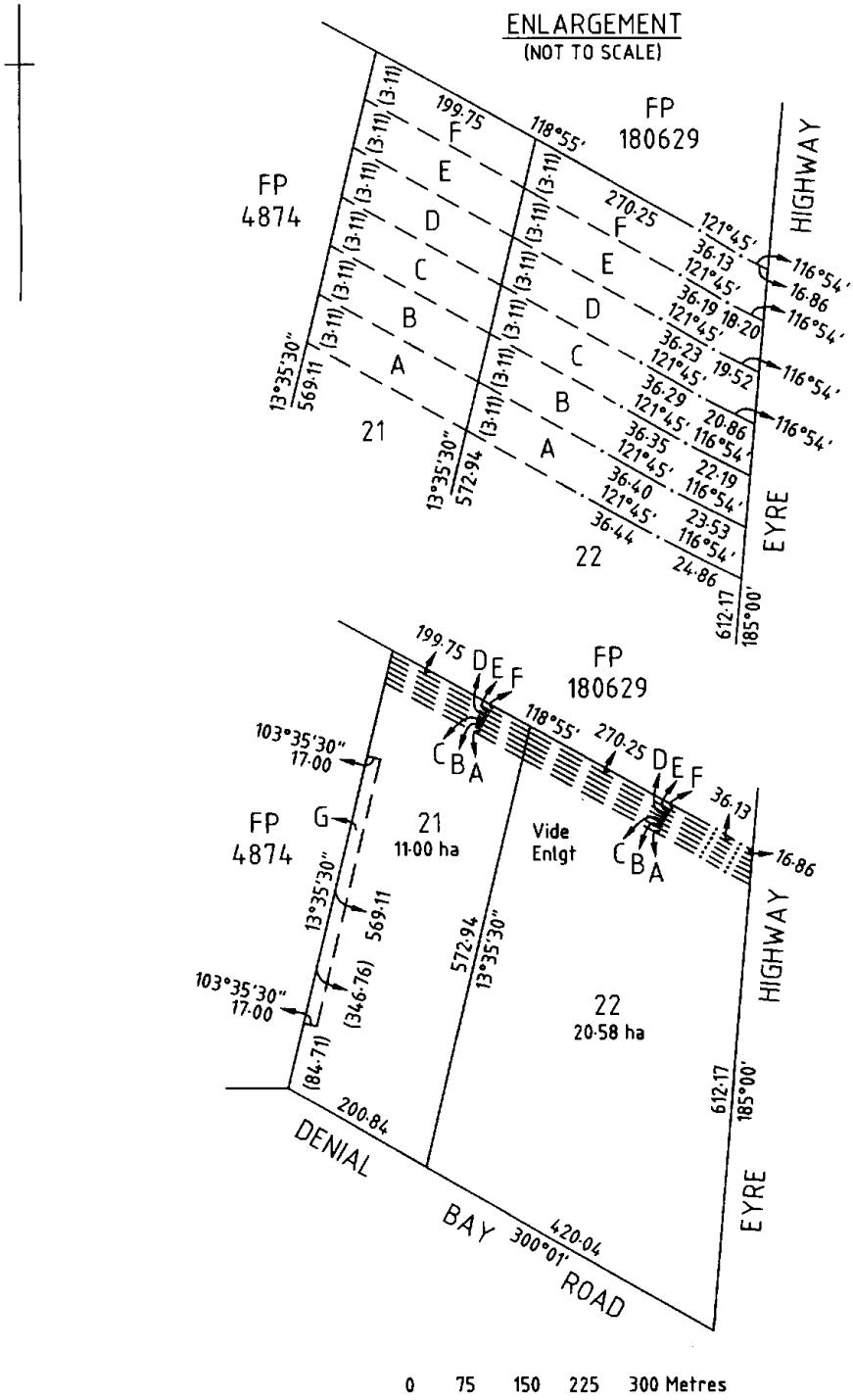
NIL

END OF TEXT.

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5906 FOLIO 567

SEARCH DATE : 03/12/2004 TIME: 11:08:35



Orig. X 9792122

11:31 26-Feb-2004
1 of 1 Fees: $0.00

LANDS TITLES REGISTRATION OFFICE
SOUTH AUSTRALIA

CAVEAT

FORM APPROVED BY THE REGISTRAR-GENERAL

BELOW THIS LINE FOR AGENT USE ONLY

CERTIFIED CORRECT FOR THE PURPOSES OF THE REAL PROPERTY ACT 1886

~~Solicitor~~/Registered Conveyancer/~~Caveator~~
R.G. WHITE

Series No.	Prefix
	X

AGENT CODE

Lodged by:
Robyn White Conveyancing ROBW

Correction to:
Robyn White Conveyancing ROBW

BELOW THIS LINE FOR OFFICE USE ONLY

Date:	Time:
FEE - R.G.O.	

Lands Titl 12:11 26/02/04 181225
REGISTRATION FEE $94.00

Produced on 26 FEB 2004
Noted Names and Addresses Correct
REGISTRAR-GENERAL

CORRECTION	PASSED

ENTERED 2 MAR 2004
AND NOTICES SENT
TO THE CAVEATEE
pro REGISTRAR-GENERAL

Lic. No. 3 Jan 2000

Printed by Robyn White Conveyancing on 26 Feb 2004

CERTIFICATE(S) OF TITLE BEING CAVEATED

The whole of the land comprised in Certificates of Title Register Book VOLUME 5830 FOLIO 638 and VOLUME 5906 FOLIO 567

CAVEATOR - PERSON LODGING CAVEAT (Full Name and Address)

CEDUNA MARINA DEVELOPMENT COMPANY PTY. LTD. ACN 107 044 057
of C/- PO Box 6114 Halifax Street SA 5000

CAVEATEE - REGISTERED PROPRIETOR (Full Name and Address)

THE DISTRICT COUNCIL OF CEDUNA
of PO Box 175 Ceduna SA 5690

THE CAVEATOR CLAIMING

an estate or interest as Purchaser under and by virtue of a certain written Agreement dated the 25th day of November 2003 made between the Caveator and the Caveatee

FORBIDS THE REGISTRATION OF ANY DEALING WITH THE ESTATE OR INTEREST OF THE ABOVENAMED CAVEATEE IN THE SAID LAND * UNLESS SUCH DEALING IS MADE SUBJECT TO THE CLAIM OF THE CAVEATOR.

Address for Services of Notices and Proceedings PO Box 6068 Halifax Street Adelaide 5000

(Insert Address within South Australia)

DATED 26th February 2004

Signed *~~by the Caveator~~ As Agent for the Caveator R G White

W Fraser

Signature of WITNESS - Signed in my presence by the ~~CAVEATOR~~ AGENT who is either personally known to me or has satisfied me as to his or her identity. **

Wendy Joan Fraser

Print Full Name of Witness

2 Macadamia Crt Golden Grove 5125

Address of Witness

Business Hours Telephone No. 8372 7300

DECLARATION If declared by agent with no personal knowledge add "AS I HAVE BEEN INFORMED AND VERILY BELIEVE"

I ROBYN GAY WHITE Registered Conveyancer as agent for the Caveator of PO Box 6068 Halifax Street SA 5000

DECLARE THAT THE ALLEGATIONS IN THE ABOVE CAVEAT ARE TRUE IN SUBSTANCE AND IN FACT AS I HAVE BEEN INFORMED AND VERILY BELIEVE

DECLARED AND SUBSCRIBED AT ADELAIDE, S.AUST

BY THE SAID ROBYN GAY WHITE

R G White

Declarant's Signature

DECLARATION BY CAVEATOR OR HIS/HER AGENT

THIS 26TH DAY OF FEBRUARY 2004

JEFFREY COLIN ROBINSON, J.P.
I.D. 15659
A Justice of the Peace in and for the State of South Australia

BEFORE ME J Robinson J.P. 15659

*NB: Delete the inapplicable ** A penalty of up to $2500 or 6 months imprisonment applies for improper witnessing Guidance Notes available

Printed by Robyn White Conveyancing on 26 Feb 2004

Appendix VII – Diagram book

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

ORIGINAL DIAGRAM - refer to sheet 1 for latest notes

HUNDRED OF BONYTHON

3

REFERENCE

Field Book No. 1791 Pages 20/23, 26, 48, 51, 57/60.

Date Offered	Nos. of Secs.	Areas of Sections	Description	Locality
	13	1755 (Ch 362 p42)	Greater portion Arable Undulating Country high Mallee, large tea-tree, Undergrowth of bushes Soil of a sandy nature from 6 to 18 deep over limestone subsoil of a coarse limestone rubble. Samphire Swamp in S. West corner low Stony Rises with Open Black Grass, light Sandy soil, shallow limestone, low Sandhills along coast in places Stunted Mallee & Tea-tree	N. Westerly from Govt. Tanks abt. 5½ Miles. Adjoining East Boundy. Hd. of MOULE.
	14	1790	About two thirds Arable land, dense Mallee large tea-tree Undergrowth bushes Soil same as No. 13. S. West portion Open Black Grass, light Sandy soil, shallow limestone Samphire Swamp in S. East corner	
	35	1103 ~~1104~~		

Area of Sections	3545
" Roads	160
" Reserves	
Total	3705

IMPROVEMENTS

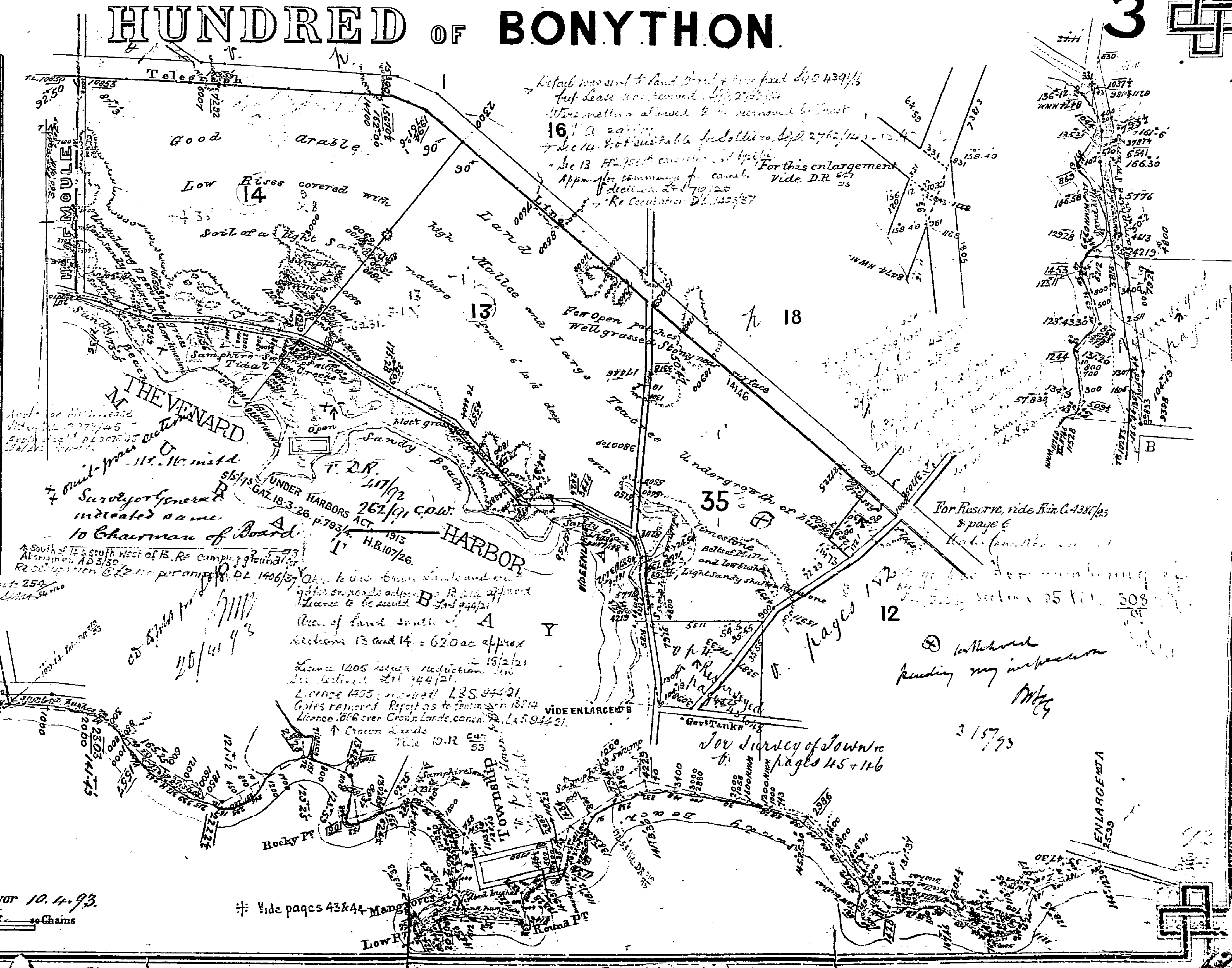
Section	Description	Dimensions	£	s	d

Book 254

I certify that I have personally examined the above sections and have found the same to be properly pegged and trenched and correctly numbered.

N. Mackintosh Surveyor 10.4.93.

SCALE 1 Inch = 400 LKS



Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix VIII – Details of consultants

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Delta Environmental Consulting has a core staff of three, supported by a range of contract and resource personnel, who may be employed for specific projects, on a more permanent basis, or in a resource capacity.

Peri Coleman (M AppSc - Environmental Management and Restoration) has extensive experience in identifying marine and terrestrial flora and fauna of the mainland states and Tasmania, conducting biological surveys, producing reports and educational materials. Her main interests include biological survey work, revegetation and rehabilitation, scientific illustration and desktop publishing, preparation of herbarium and museum specimens, management plans, taxonomy and classification, solar saltfield biology, environmental education programs, computer application development, wetland studies and mangrove and samphire ecosystems.

Peri owns, and is senior consultant for, Delta Environmental Consulting. She is a member of the South Australian Coast Protection Board, Barker Inlet Port Estuary Committee and chair of the Northern Adelaide & Barossa Regional Steering Committee of Waterwatch. Peri has a strong commitment to research, with several recent papers accepted for international publication. She is a fellow of the Royal Society of South Australia and member of the International Society for Salt Lake Research.

Faith Cook (Grad Dip GIS & Remote Sensing, Dip Env Man) is employed by Delta Environmental Consulting to provide technical and consulting services. Faith has strengths in remote sensing, statistics and biometrics. She provides services in the GIS and mapping areas, development of computer database and spreadsheet applications, environmental risk assessments, archival searches, water testing and laboratory work, fieldwork, and desktop design and publishing.

Faith's interests include radio telemetry and she has a Novice (limited) Amateur Radio Operator (WIA) licence and also holds a Marine band licence.

Faith is a fellow of the Royal Society of South Australia and a member of the International Society for Salt Lake Research. Her current research interests include diatom ecological preferences and samphire ecology.

Jenny Larter (B Technology, Forensic and Analytical Chemistry) is employed on a permanent part-time basis to provide laboratory and forensic expertise. Jenny brings a wide understanding of testing methodologies, and legal evidentiary requirements, to her position. When Jenny is not examining samples from assorted drains, or quantifying the minute concentrations of contaminants in water samples, she enjoys choral singing and bushwalking.

For further information on any Delta Environmental Consulting staff member, or information on the projects the company has been involved with, please visit our web site at http://www.deltaenvironmental.com.au

Biodiversity Survey

Ceduna Marina site

Peri Coleman and Faith Cook

01/02/04

LIMITATIONS STATEMENT

The sole purpose of this report and the associated services performed by Delta Environmental Consulting is to conduct an environmental assessment of the proposed Ceduna Keys site in accordance with the scope of services set out in the contract between Delta Environmental Consulting ('Delta') and Eco Management Services ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Delta derived the data in this report primarily from visual inspections, examination of records in the public domain and interviews with individuals with information about the site. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data, analysis and a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Delta has relied upon and presumed accurate certain information (or the absence thereof) relative to the site, provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, Delta has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by Delta in this report are not, and should not be considered, an opinion concerning environmental or operational liability. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions and information in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Delta and the Client. Delta accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Document history:
Draft released for comment: 30/12/2004
Final version printed (edits in avian section and typography): 01/02/2005

Table of Contents

Figures

Tables

1. Introduction

Delta Environmental Consulting was approached by Eco Management Services to conduct a range of biodiversity surveys on a site at Ceduna on the Eyre Peninsula. The site is proposed for use as a marina and residential development. The developers have already submitted a Draft Environmental Impact Statement, dated 11 August 2004 to Planning SA. Planning SA has forwarded comments about the Draft EIS to the proponents, who in turn have requested that Delta Environmental Consulting provide them with information that would enable them to respond to the comments.

The client specifically required the following tasks be undertaken to aid them in preparing a response to feed back on their draft Environmental Impact Statement:

1. Reassessing the current state of vegetation on the non-tidal (terrestrial) subject area, and describing the possible impacts of any development on this vegetation.
2. Discussing any known species that occur in the area that may trigger the EPBC Act or state legislation, and completing appropriate fauna assessments to fill in knowledge gaps to allow a detailed assessment.
3. Calculating the relative area of each terrestrial and intertidal vegetation community type that may be lost, including a description of the condition and/or health of the vegetation. The layout plan of the current proposed development would be laid over this vegetation map to support this information.
4. Assessing any risk that large birds attracted to the site may pose to the nearby airport, including an assessment of current bird usage of the site.
5. Establishing a good baseline level of data related to intertidal flora and fauna, using a repeatable methodology that will allow identification of impacts post-development. Plants and animals growing or living in the intertidal zone should be collected and identified to species level if possible. All methodologies should be documented so that the surveys could be replicated by other organizations if required.

Delta Environmental Consulting committed to undertake the following activities:

1. Assess the history of the site including past uses, clearance dates and past biodiversity.
2. Conduct a full vegetation survey using DEH standard methods and preparation of maps/overlays.
3. Calculate the potentially impacted areas, habitat types, percentages of total area and current vegetation health.
4. Conduct fauna observations, tracks & scats analysis for mammals & reptiles.
5. Conduct diurnal invertebrate sweeps & night-time light trapping of nocturnal insects.
6. Undertake point counts & observations for birds.
7. Assess which birds presently pose a risk to aircraft and whether changes as a result of the proposed development may increase strike risk.
8. Complete 20 quadrats & 20 sediment cores to quantify and identify algae and/or animals present in the intertidal zone (to species level where practicable).
9. Prepare a report summarising the results of surveys or assessments

2. Consultant

Delta Environmental Consulting is an independent South Australian consulting business. The company provides services in the areas of: biological survey work, environmental education programs, saltfield technology and saline wetland ecology, scientific illustration & desktop publishing, preparation of herbarium and museum specimens, taxonomy and classification, revegetation and rehabilitation, and computer application development.

The company is a member of Standards Australia, and its quality assurance management system has been third party certified to the international Q-base standard by NATA Certification Services International. A copy of the scope of certification is available on request.

Delta Environmental Consulting has a policy of continuous improvement in the areas of:

- providing a quality service to our clients
- providing ongoing training and educational opportunities for our consultants
- maintaining high standards in the areas of health, safety and environment both within Delta and while working with our clients

The consultants undertaking this project are detailed in *Appendix VIII - Details of Consultants*.

Water Industry Alliance

QUALITY CERTIFIED COMPANY

3. The site

3.1 Location and landform

The land being investigated is situated on a coastal floodplain on the northern outskirts of Ceduna, around the shores of Murat Bay. The land is owned largely by three organisations - the Crown, the Ceduna Regional Council and the Aboriginal Lands Trust. There are several other stakeholders, in the form of easement owners and lessees.

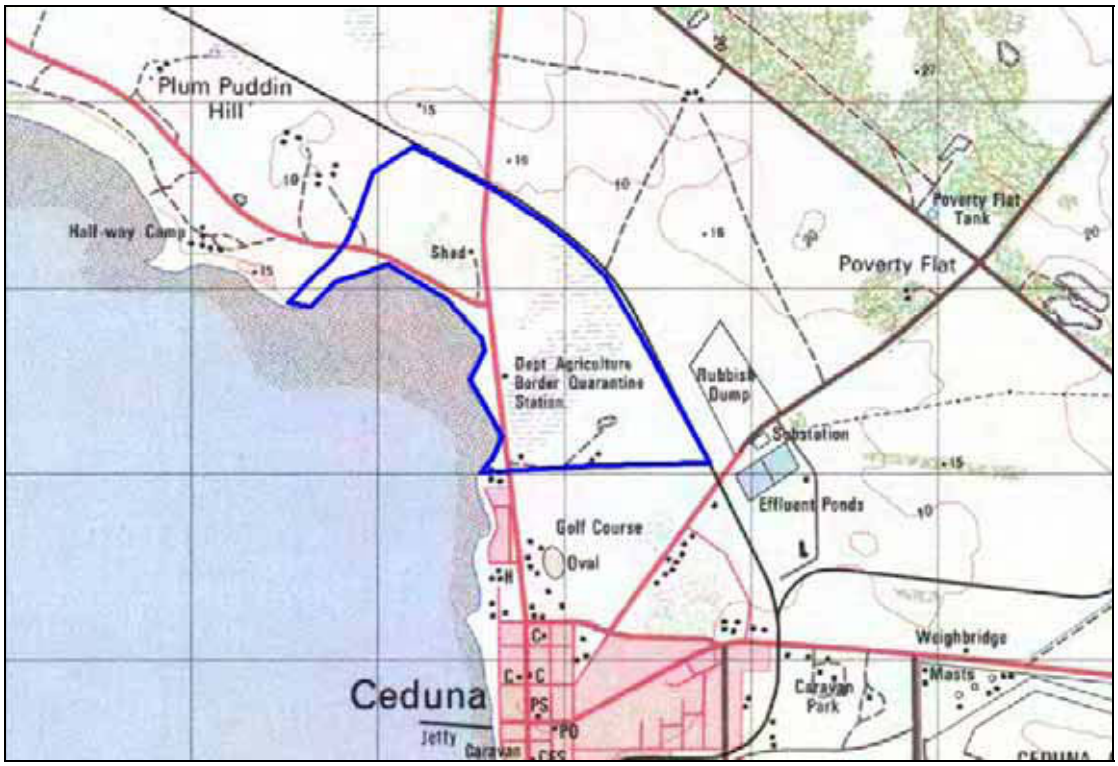


Figure 1 - Approximate boundaries of study site, outlined in blue

Historic aerial photographs of the area reveal that the land has been used for various purposes including sand mining, grazing and rubbish dumping. There has been no attempt to revegetate the site, with most trees currently present on the site pre-dating the 1950's aerial photograph. Existing published species lists for the surrounding areas were also obtained where available, as these aid in assessing the potential for species not in evidence at the time of the survey.

The photograph presented in Figure 2 is an aerial view of the land area being investigated in this survey, overlayed with the proposed development in fine black lines.

Figure 2 - Aerial photograph of the survey site (derived from provided concept plan)

The property occupies a centroid located at approximately Zone 53H 374745 E and 6446831 N (Aust Geodetic Datum 1984). The land comprises a large central stranded tidal saltmarsh surrounded by coastal dunes to the southwest and northwest and cleared farmlands on the landward boundaries of the central basin. The land shows limited signs of being filled, with the only fill sites being located near the fuel station and for rail and road reserves. The block was partially cleared prior to 1949, leaving small stands of trees and the current samphire shrub land.

The main highway was constructed prior to 1950, and the samphire swamp on the claypan was probably cut off from the tide at this time. It is likely that there may be areas of Acid Sulfate Soils within the stranded salt marsh. There will be areas of Potential Acid Sulfate Soils underlying the intertidal saltmarsh and mangrove areas. There may be areas of Potential Acid Sulfate Soils in the seagrass beds of the intertidal and subtidal areas.

The soils on the site are variable, with areas of saltmarsh clays, intertidal sediment, sodic clay and sands. The current saltpan is underlaid with a hard layer, similar to a duripan found in vernal pools, which may be a contributing factor to the continued existence of these samphires. In some locations, areas of this pan have been dug up, possibly in an attempt to drain the pan. In the pits remaining on the pan surface, numbers of sub-fossil shells are visible, including shells of the beaked mussel *Brachiodontes rostratus*, the queen scallop *Chlamys bifrons*, the anemone cone shell *Conus anemone*, and two species that may be

remnants from the last high stand of the sea - a circular cockle, possibly *Circe weedingi*, now only occurring in Gulf St Vincent and Spencer Gulf, and the mud ark or Sydney blood cockle *Anadara trapezia*, now extinct in South Australia.

Prior to clearance and road construction, this area would have resembled the nearby Davenport Creek salt marsh. Further details regarding the land use and vegetation history of the site are included in the site history section of this report.

The nearest weather station to the site (at the Ceduna Airport Meteorological Station) receives an average 300.1 mm of rain a year, with most rain occurring during in winter. Average annual maximum temperatures for the weather station are 23.3^{o}C and average summer maxima are around 28^{o}C.

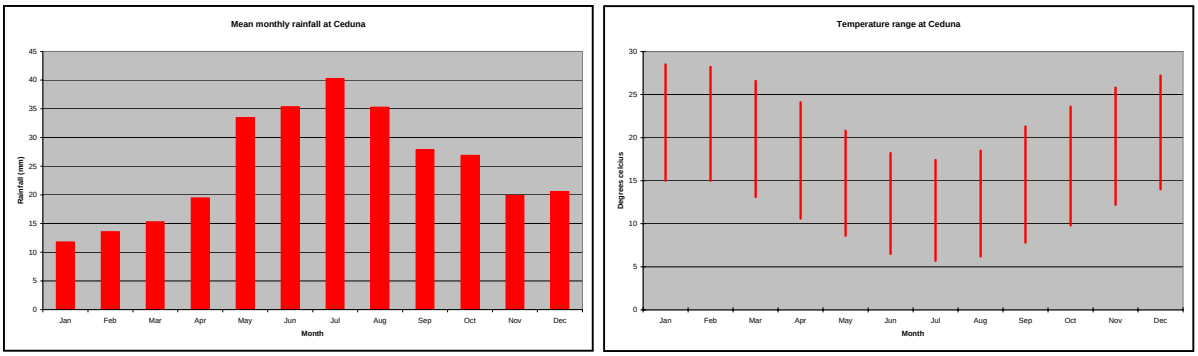


Figure 3 - Monthly rainfall and temperature averages for Ceduna

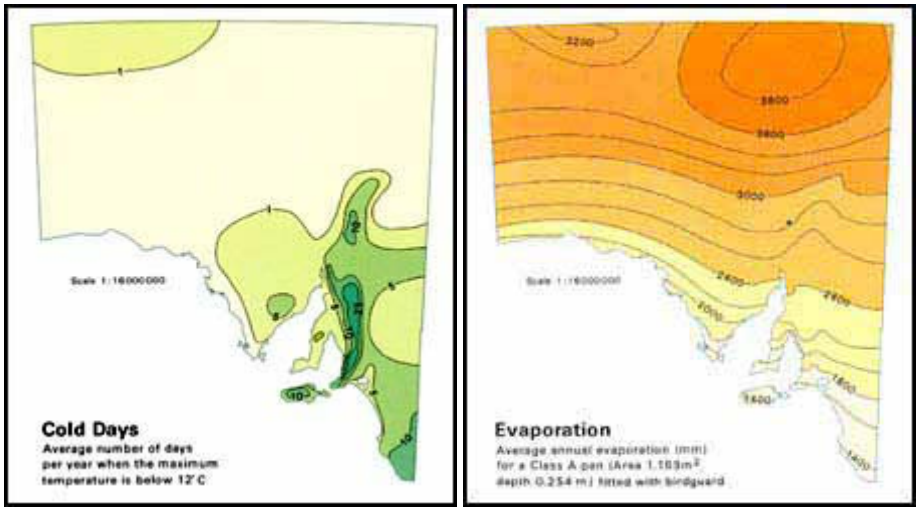


Figure 4 - Cold days and evaporation per year (BOM)

4. The terrestrial vegetation

4.1 Existing vegetation units

The site has several morphological terrestrial vegetation units that occur from the landward edge of the intertidal zone, through salt pans, dunes and cheniers. The more 'marine' of the intertidal vegetation units will be addressed in a separate section on intertidal marine vegetation, while this section only includes the more 'coastal' of the intertidal vegetation units. The unit definitions are based on McDonald *et al* (1990).

The plant associations in the surveyed morphological units are:

- **C1D:** Closed dwarf chenopod shrubland in the intertidal area, dominated by *Sarcocornia quinqueflora* and *Suaeda australis*.
- **C2M:** Mid-dense low chenopod shrubland dominated by *Halosarcia pruinosa, H. pergranulata*, and *H. halocnemoides* often with *Hemichroa diandra* as a sub-dominant.
- **C3S:** Open mid-high chenopod shrubland dominated by *Atriplex* spp., *Maireana* spp. and/or *Frankenia* spp. often with an understorey of *Hemichroa diandra*.
- **C4D:** Closed tall chenopod shrubland in the supratidal area, dominated by *Sclerostegia arbuscula.*
- **D3M:** Mid-dense tall sod grassland dominated by anthropogenic grasses.
- **F2S:** Open mid-high forbland dominated by Ward's weed interspersed with scattered chenopods (*Sclerolaena* spp.and *Salsola* kali).
- **G2S:** Open tussock grassland dominated by *Austrostipa* spp. and *Danthonia setacea*.
- **S3S:** Open mid-high shrubland on dunes and shelly ridges with *Geijera linearifolia, Olearia* spp., *Acacia* spp. and *Pittosporum phylliraeiodes*. Isolated tall shrubs may occur in patches.
- **S3V:** Sparse mid-high shrubland dominated by *Olearia* spp., *Geijera linearifolia, Maireana* and *Cratystylis conocephala*.
- **S41:** Isolated tall shrubs, usually *Melaleuca* spp. or *Acacia* spp.
- **S4D:** Closed coastal dune tall shrubland dominated by *Nitraria billardierei, Atriplex vesicaria* and *Cakile maritima*.
- **T4V:** Open low mangrove woodland in the intertidal area (*Avicennia marina*) with a poor understorey except where the woodland is prograding across the neighbouring low chenopod shrubbery.
- **Y4L:** Isolated clumps of tall mallee shrub or other tall shrubs, usually *Eucalyptus gracilis, Eucalyptus calcareana* or *Melaleuca* spp.

A supervised classification of the various plant associations shown in the 1995 aerial photography is provided in Figure 5, and an A3 sized version is attached to this document in *Appendix 1 – Vegetation associations*. Aerial photographs from 1995 were used in place of more recent data because of their clarity, and the season of the year these images were taken.

Figure 5 - Terrestrial vegetation associations

Habitat code	% of site	Area covered (Hectares)
C1D: Closed dwarf chenopod shrubland (intertidal)	1.3	2.4
C2M: Mid-dense low chenopod shrubland (extratidal)	19.1	34.5
C3S: Open mid-high chenopod shrubland (extratidal)	11.2	20.1
C4D: Closed tall chenopod shrubland (supratidal)	0.4	0.6
D3M: Mid-dense tall sod grassland	6.6	12.0
F2S: Open mid-high forbland	3.1	5.6
G2S: Open tussock grassland	11.2	20.3
S3S: Open mid-high shrubland (dunes, berms)	8.4	15.1
S3V: Sparse mid-high shrubland (dunes, ridges)	4.2	7.5
S41: Isolated tall shrubs	3.9	7.1
S4D: Closed coastal dune tall shrubland (primary dune)	2.5	4.4
T4V: Open low mangrove woodland (intertidal)	0.9	1.6
Y4L: Isolated clumps of tall mallee shrub or other tall shrubs	2.0	3.6
Bare soil	23.9	43.0
Rocky reef	1.5	2.7
Total	100.0	180.4

Table 1 - Percentage cover of each habitat type

Studies by Young (1988) broke the vegetation of the coastal strip along this stretch of the South Australian coast into three broader categories:

- Beach/dune vegetation – cover includes species such as *Olearia axillaris, Nitraria billardierei, Spinifex seriaceus* and other salt-tolerant species.
- Coastal heath vegetation – cover includes *Alyxia buxifolia, Melaleuca lanceolata, Beyeria lechenaultii*, on soils varying from calcareous sands to thin sands overlying calcarenite.
- Sub-coastal scrub – *Melaleuca lanceolata* (coastwards) and *Melaleuca pauperiflora* (inland) with occasional *Eucalyptus oleosa* (*E. gracilis, E. yalatensis, E. calcareana*) and an understorey of *Atriplex paludosa* (coastwards) or *Atriplex vesicaria* (inland).

The study site contains all three of Young's habitats, plus the area of stranded salt marsh.

4.1.1 Impact area

Table 1 detailed the existing percentages and areas of the site covered by each habitat type. The direct impact area of the proposed development, shown below, covers 81% of the site, with no area of the study site being more than 200m from the direct impact site. Those habitats occurring inside the outline are likely to be extirpated completely by residential development or the development of waterways. Those habitats occurring outside the outline may not be immediately impacted, but may be ultimately impacted by weed incursion (terrestrial habitats) or by hydrological/sedimentary process change (intertidal and supratidal habitats).

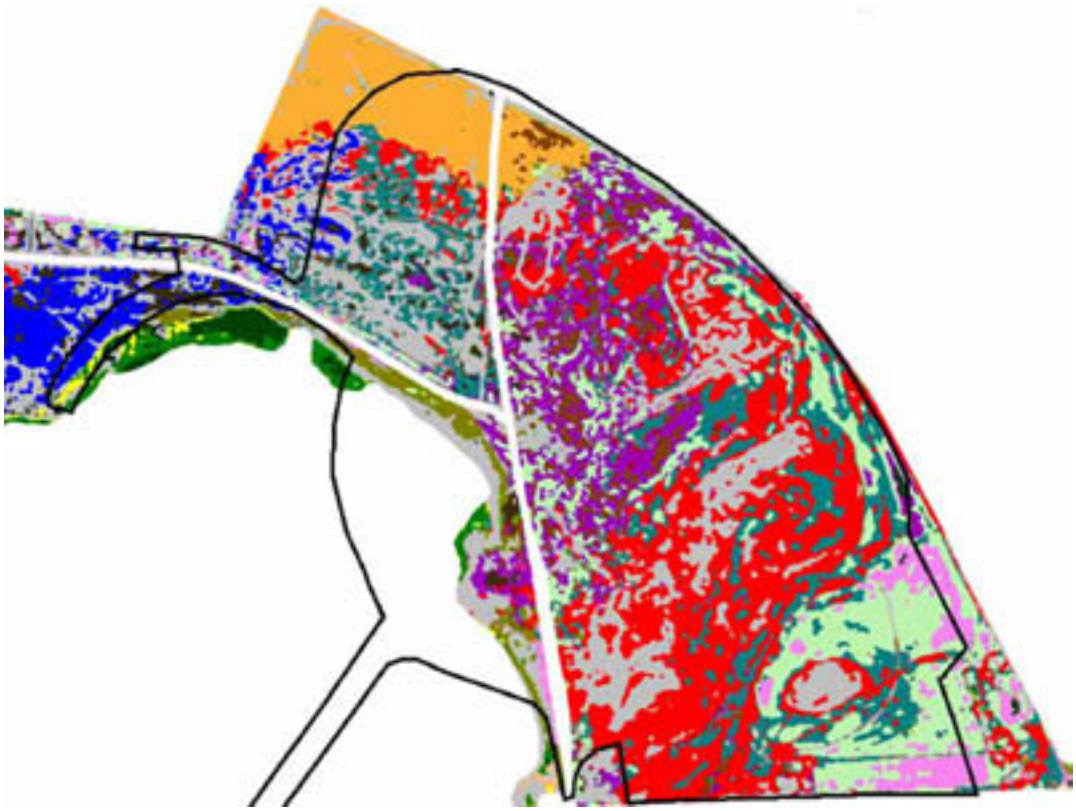


Figure 6 - Approximate impact zone

4.2 Plant species recorded during survey

The survey was conducted by gathering vouchers of each new plant species found on the site, as it was first encountered in a sampling quadrat. Sampling quadrats were reasonably large, being roughly circular, with radii of 30m from the GPS location for each quadrat. Sufficient sampling quadrats were used to ensure representation of all vegetation units occurring on the body of the site. Graphs of new species found at each site (total species and indigenous species) show the reduction in new species encountered at new sample locations as sampling progressed, with occasional increases as new vegetation units were encountered.

At each selected location a GPS was used to record the location (accurate to approximately 5m), the vegetation association was noted (see Table 2), and the quadrat was searched for plants not recorded previously. As a precaution where similar species are difficult to determine in the field, some vouchers were replicates.

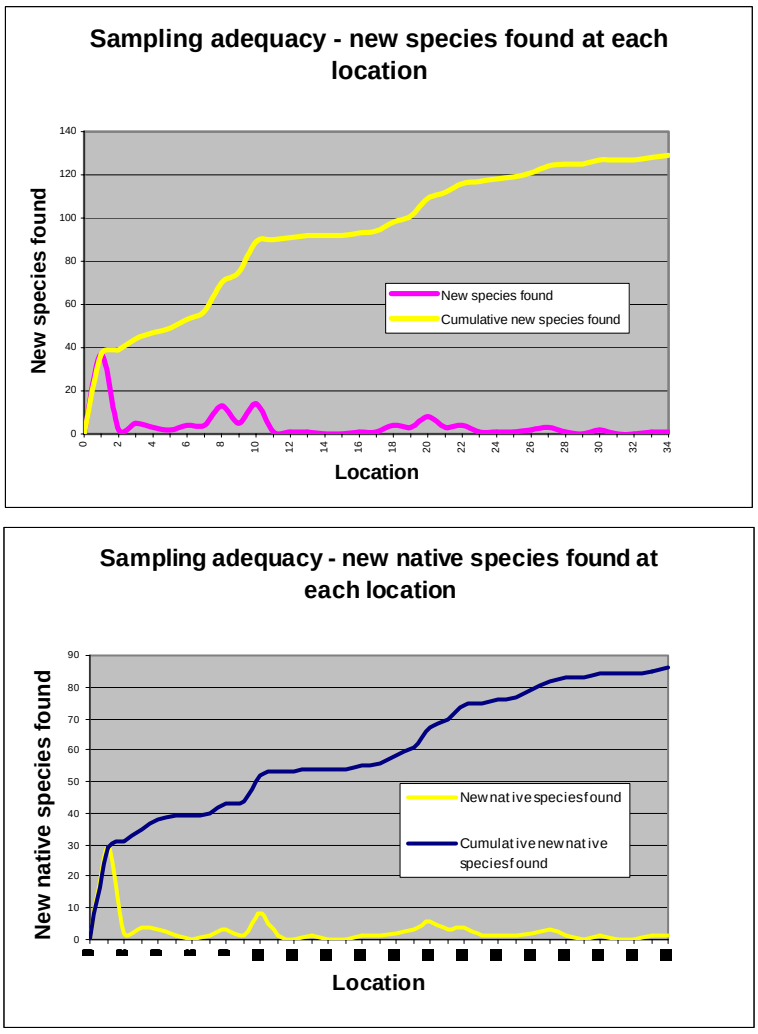


Figure 7 - Adequacy of sampling effort

Figure 8 - Locations sampled during the survey (aerial photography from Mapland, 2003)

At each sampling location a description of the habitat type was recorded, to allow ground-truthing and supervision of the geographic information system's image classification analysis.

One hundred and fifty-one (151) vouchers pairs were collected for later identification. All vouchers were dried, then one of each voucher pair was sent to the Herbarium as required under the collection license (*Appendix 2 – Collection permit*), and the other was retained, to be provided to the client for reference purposes. A list of all vouchers and the locations they were collected from is appended to this document in *Appendix 3 – Flora voucher specimens*.

There were eighty-six (86) indigenous species and forty-three (43) alien species, one hundred and twenty-nine (129) species in all, encountered and collected during the site visit.

Details of the locations sampled, illustrated earlier in Figure 8, are provided along with their co-ordinates and voucher specimen numbers in *Appendix 3*.

Location	Description
1	Limestone cliff/ridge with sand dune. Tall shrubs - *Pittosporum* & *Melaleuca*, low shrubs - *Geijera*, Bladder saltbush, herbaceous understorey
2	Dunes. Taller mallees in small groups, site dominated by bluebush daisy and *Geijera*.
3	Dense band of *Nitraria* backing a sandy beach with a seaward rim of mangroves.
4	Dominant species - Bladder saltbush, *Nitraria*, variable groundsel, *Frankenia*.
5	Sandy chenier on landward side of track, *Sclerostegia* shrubland on seaward side of track.
6	Chenier dominated by *Nitraria*, devolving to a *Sclerostegia* shrubland closer to the sea, then a band of *Sarcocornia*, then mangroves.
7	Weedy roadside vegetation dominated by *Limonium*.
8	Weedy chenier/dune dominated by *Nitraria* near the beach, *Limonium* and *Gazania* nearer the road.
9	Large dune. Mallees with an understorey of *Rhagodia* & *Halosarcia*.
10	Herb and tussock grassland dominated by Ward's weed, Linclon weed, spent *Stipa* and *Danthonia*.
11	Saltpan with cyanobacterial polygons impregnated with gypsum and salt. Dominated by *Halosarcia pergranulata* and *H. pruinosa*.
12	Sodic erodible ridge on surface of saltpan. Mosses dominate.
13	Small dune ridge on surface of saltpan. Dominated by *Frankenia sessilis*.
14	Small dune ridges on surface of saltpan. Dominated by *Frankenia, Maireana* and *Halosarcia*.
15	Patch of *Halosarcia halocnemoides* on the saltpan.
16	Dune ridge on the landward edge of the saltpan. Quadrat dominated by tussock grasses, *Sclerolaena* and *Lycium australe*
17	Dune ridge on the landward edge of the saltpan. Quadrat dominated by Bladder saltbush, *Myoporum, Scaevola* and tussock grasses.
18	Chenier/dune dominated by *Austrostipa*, Bladder saltbush, *Hemichroa, Silene* and *Exocarpos*.
19	Slope dominated by Bladder saltbush on its lower reaches, upper slope dominated by *Stipa*, Ward's weed, *Sclerolaena* & *Salsola*. Crest - *Danthonia*
20	Crest of sandpit and pit itself. Many *Westringia rigida* bushes and some *Kippistia* growing in patches, occasional *Acacia*, herbs.
21	Base of slope near the saltpan. Tussock grasses and single *Allocasuarina*, some balls of foliose lichen.
22	Dune slope. Tussock grassland to small herbland. Scattered shrubs of *Nitraria* and *Zygophyllum*. Scattered *Melaleuca*, mallees and *Pittosporum*.
23	Small shell ridge dominated by *Geijera, Pittosporum* and *Hemichroa*.
24	Dissected saltmarsh dominated by *Halosarcia, Hemichroa* and *Lawrencia*.
25	Shell ridge dominated by Bladder saltbush & *Frankenia*, with an understorey of *Carpobrotus* and occasional clumps of *Austrostipa elegantissima*.
26	Shell ridge dominated by *Hemichroa, Olearia* & *Senna,* with patches of *Melaleuca, Exocarpos* and *Acacia*
27	Sandy slope dominated by *Myoporum, Santalum* and *Acacia* with very large clumps of *Dianella revoluta*.
28	Sandy area with large *Melaleuca* and *Acacia* shrubs, young *Pittosporum* and clumps of *Rhagodia*.
29	Swale along a drainage line, dominated by *Hemichroa* and *Sclerostegia*.
30	Old dump area. Dominated by *Mesembryanthemum*
31	Slope. Single mallee in grassland.
32	Mallee scrub with Bladder saltbush and *Frankenia*
33	Dune with mallees, old *Melaleuca* trees & *Eremophila*
34	Dune with mallees, *Hakea* and *Santalum*.

Table 2 - Details of sampling quadrats

Family	*Species*	Common name	Exotic	Conservation status
Agavaceae	*Agave americana*	Century plant	*	
Aizoaceae	*Carpobrotus rossii*	Karkalla or Ross' noonflower		
Aizoaceae	*Disphyma crassifolium*	Round leaf pigface		
Aizoaceae	*Galenia secunda*	Blanket weed	*	
Aizoaceae	*Mesembryanthemum aitonis*	Angled iceplant	*	
Aizoaceae	*Mesembryanthemum nodosum*	Slender iceplant	*	
Aizoaceae	*Mesembryanthum crystallinum*	Common iceplant	*	
Aizoaceae	*Tetragonia implexicoma*	Bower spinach		
Amaranthaceae	*Hemichroa diandra*	Mallee hemichroa		
Amaranthaceae	*Ptilotus obovatus* var *obovatus*	Silver mulla mulla		
Avicenniaceae	*Avicennia marina*	Grey mangrove		
Boraginaceae	*Heliotropium europaeum*	Potato weed	*	
Caryophyllaceae	*Silene gallica*	French catchfly	*	
Caryophyllaceae	*Silene nocturna*	Mediterranean catchfly	*	
Caryophyllaceae	*Spergularia marina*	Salt sand-spurry	*	
Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak		
Chenopodiaceae	*Atriplex acutibractea*	A saltbush		
Chenopodiaceae	*Atriplex cinerea*	Coast saltbush		
Chenopodiaceae	*Atriplex paludosa* ssp. *cordata*	Marsh saltbush		
Chenopodiaceae	*Atriplex vesicaria*	Bladder saltbush		
Chenopodiaceae	*Atriplex vesicaria* var *variablis*	Bladder saltbush		
Chenopodiaceae	*Beta vulgaris*	Beet	*	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush		
Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
Chenopodiaceae	*Halosarcia pergranulata* var *pergranulata*	Black seed samphire		
Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
Chenopodiaceae	*Maireana appressa/radiata*	A cotton bush with no fruit		
Chenopodiaceae	*Maireana brevifolia*	Small-leaved bluebush		
Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
Chenopodiaceae	*Maireana erioclada/pentatropis*	A maireana with no fruit		
Chenopodiaceae	*Maireana oppositifolia*	Heathy bluebush		
Chenopodiaceae	*Maireana scleroptera*	A maireana		
Chenopodiaceae	*Maireana trichoptera*	A bluebush		
Chenopodiaceae	*Rhagodia candolleana*	Seaberry saltbush		
Chenopodiaceae	*Rhagodia crassifolia*	Fleshy saltbush		
Chenopodiaceae	*Salsola kali*	Buckbush rolypoly	*	
Chenopodiaceae	*Sarcoconia quinqueflora*	Bearded glasswort		
Chenopodiaceae	*Sclerolaena brevifolia* poss. hybrid with *S. obliquicuspis*	A copperburr or bindyii		
Chenopodiaceae	*Sclerolaena uniflora*	Bassia		

Family	*Species*	Common name	Exotic	Conservation status
Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
Chenopodiaceae	*Suaeda australis*	Austral sea-blite		
Chenopodiaceae	*Threlkeldia diffusa*	Coast bone fruit		
Compositae	*Angianthus tomentosus*	Hairy cup flower		
Compositae	*Arctotheca calendula*	Cape weed	*	
Compositae	*Centaurea melitensis*	Maltese cockspur	*	
Compositae	*Conyza bonariensis*	Flaxleaf fleabane	*	
Compositae	*Cratystylis conocephala*	Bluebush daisy		
Compositae	*Gazania linearis*	Gazania	*	
Compositae	*Hedypnois rhagadioloides*	Cretan weed	*	
Compositae	*Helianthus annuus*	Common sunflower	*	
Compositae	*Ixiolaena pluriseta*	A plover daisy		Rare in SA, Unknown for EP
Compositae	*Kippistia suaedifolia*	Kippistia		Rare in EP
Compositae	*Olearia axillaris*	Coast daisy bush		
Compositae	*Olearia exiguifolia*	Small-leaved daisy-bush		
Compositae	*Reichardia tingitana*	False sow thistle	*	
Compositae	*Senecio lautus*	Variable groundsel		
Compositae	*Sonchus oleraceus*	Common sow thistle	*	
Compositae	*Vittadinia cervicularis*	Fuzzweed		
Compositae	*Vittadinia cuneata*	Fuzzweed		
Compositae	*Vittadinia eremaea*	A vittadinia		
Crassulaceae	*Crassula sieberana* var *tetramera*	Austral stonecrop		
Cruciferae	*Brassica tournefortii*	Long fruited wild turnip	*	
Cruciferae	*Cakile maritima*	Sea rocket	*	
Cruciferae	*Carrichtera annua*	Ward's weed or duck-bill burr	*	
Cruciferae	*Diplotaxis tenuifolia*	Lincoln weed	*	
Epacridaceae	*Acrotriche patula*	Shiny ground berry		
Euphorbiaceae	*Euphorbia terracina*	Carnation weed, false caper	*	
Frankeniaceae	*Frankenia pauciflora*	Sea heath		
Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
Gentianaceae	*Centaurium tenuiflorum*	A centaury		
Goodeniaceae	*Scaevola spinescens*	Spiny fanflower		
Gramineae	*Austrostipa drummondii*	Cottony speargrass		
Gramineae	*Austrostipa elegantissima*	Feather speargrass		
Gramineae	*Austrostipa eremophila*	Desert spear-grass		
Gramineae	*Austrostipa flavescens*	A spear-grass		
Gramineae	*Avena barbata*	Bearded oat	*	
Gramineae	*Bromus catharticus*	Prairie grass	*	

Family	*Species*	Common name	Exotic	Conservation status
Gramineae	*Bromus rigidus*	Rigid brome	*	
Gramineae	*Critesion murinum*	Barley grass	*	
Gramineae	*Cynodon dactylon*	Couch grass		
Gramineae	*Danthonia setacea* var *setacea*	Bristly, or small flowered, or mulga wallaby grass		
Gramineae	*Festuca littoralis*	Coastal fescue		
Gramineae	*Lolium perenne*	Perennial ryegrass	*	
Gramineae	*Parafolis incurva*	Curly rye	*	
Gramineae	*Polypogon monspeliensis*	Annual beard-grass	*	
Gramineae	*Tribolium acutiflora*	Desmazeria	*	
Iridaceae	*Gynandriris setifolia*	Thread Iris	*	
Iridaceae	*Romulea minutiflora*	Guildford grass	*	
Labiatae	*Marrubium vulgare*	Horehound	*	
Labiatae	*Westringia rigida*	Stiff westringia		
Leguminosae	*Acacia anceps*	Port Lincoln wattle		
Leguminosae	*Acacia cyclops*	Western coastal wattle		
Leguminosae	*Acacia hakeoides*	Hakea wattle		
Leguminosae	*Medicago polymorpha*	Burr medic	*	
Leguminosae	*Senna artemesiodes*	Desert cassia		
Leguminosae	*Templetonia retusa*	Cockie's tongue		
Liliaceae	*Asphodelus fistulosus*	Onion weed	*	
Liliaceae	*Dianella brevicaulis*	Short fruited black anther flax-lily		
Liliaceae	*Dianella revoluta*	Black anther flax lily		
Liliaceae	*Lomandra collina*	Fibrous mat-rush		
Liliaceae	*Thysanotus baueri*	Mallee fringe lily		
Limoniaceae	*Limonium companyonis*	Sea lavender	*	
Limoniaceae	*Limonium sinuatum*	Notch leaved perennial sea lavender	*	
Loranthaceae	*Amyema melaleucae*	A mistletoe		
Malvaceae	*Lawrencia squamata*	Thorny lawrencia		
Myoporaceae	*Eremophila glabra*	Tar bush		
Myoporaceae	*Eremophila weldii*	Purple emubush		
Myoporaceae	*Myoporum brevipes*	Warty myoporum		
Myoporaceae	*Myoporum insulare*	Boobialla		
Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
Myrtaceae	*Eucalyptus gracilis*	White mallee		
Myrtaceae	*Eucalyptus stoatei*	Scarlet pear gum		
Myrtaceae	*Melaleuca lanceolata*	Moonah		
Myrtaceae	*Melaleuca pauperiflora*	Boree		
Pittosporaceae	*Pittosporum phylliraeoides*	Native apricot		

Family	*Species*	Common name	Exotic	Conservation status
Primulaceae	*Anagallis arvensis*	Blue flowered pimpernel	*	
Proteaceae	*Hakea rugosa*	Dwarf hakea		
Rutaceae	*Geijera linearifolia*	Sheepbush, oil bush or wilga		
Santalaceae	*Exocarpos aphyllus*	Leafless cherry		
Santalaceae	*Santalum acuminatum*	Quandong		
Sapindaceae	*Dodonaea stenozyga*	Desert hopbush		
Solanaceae	*Lycium australe*	Australian boxthorn		
Solanaceae	*Lycium ferocissimum*	African boxthorn	*	
Solanaceae	*Solanum hystrix*	Afghan thistle		
Umbelliferae	*Bupleurum semicompositum*	Bupleurum	*	
Umbelliferae	*Foeniculum vulgare*	Fennel	*	
Zygophyllaceae	*Nitraria billardierei*	Dillon berry or nitre bush		
Zygophyllaceae	*Zygophyllum aurantiacum*	Shrubby twinleaf		
Zygophyllaceae	*Zygophyllum billardierei*	Coast twinleaf		

Table 3 - Species list of plants occurring on the site

Statistics	
Total species	129
Species exotic to Australia	43
Australian indigenous species	86
Eyre Peninsula indigenous species	84
Exotics as percentage of biodiversity	35%
Species of conservation significance	2

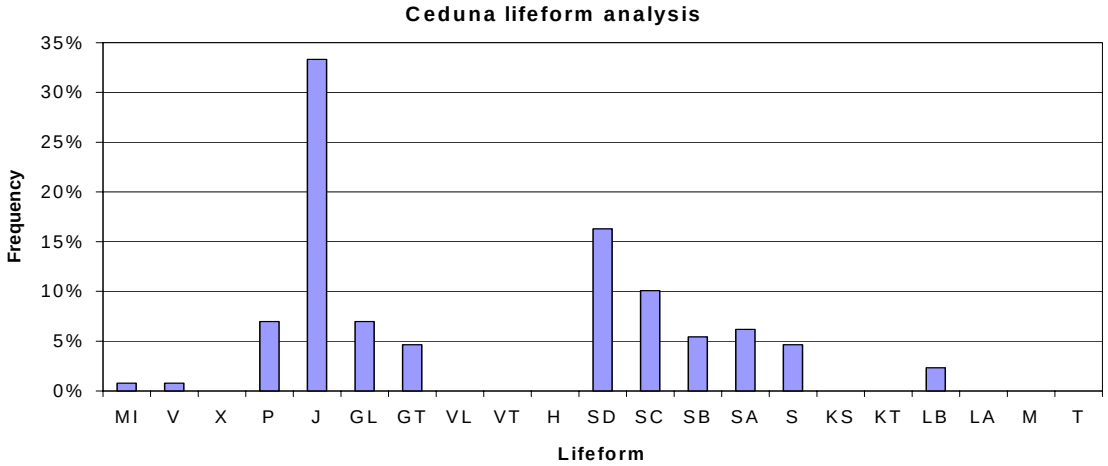
Table 4 - Biodiversity information

No single survey can capture all species found on a site, and this survey was conducted in late spring / early summer, so it may under-represent the winter and spring flowering annuals, orchids and some of the more ephemeral grasses. However the survey would adequately confirm the presence of perennials and the later flowering annuals. In order to address any shortcomings of this survey, a comparison was made between the species found in this survey and those found in surveys of nearby areas, or those conducted previously on the site.

The first quadrat of this survey was located on a cliff top area on the western extremity of the study site. It was a similar quadrat to those reported by Oppermann (1999) in *A Biological Survey of the South Australian Coastal Dune and Clifftop Vegetation*, making it useful site for comparative purposes. There were thirty-seven (37) distinct species found in this quadrat, of which eight (8) were exotic species. Oppermann records that the median number of species for clifftop locations in Eyre Peninsula West is twenty (20), with a maximum of forty (40) and a minimum of five (5). Similar statistics for the next region westward (Head of Bight) are lower, with the median number of species being thirteen (13), the maximum twenty-two (22) and the minimum three (3). From this comparison, it would appear that quadrat 1 represents the higher end of biodiversity for clifftop sites in the region.

Figure 9 - Silver mulla mulla on the site

Oppermann (1999) conducted lifeform analyses along the coastline, using amalgamated data for all sites in each region. Such analysis may be presented as frequency (percentage of species present) or abundance (area of cover) data and Oppermann presented both. The current survey only produced frequency data, so this is all that may be compared. All species located on the study site were classified according to their lifeform, and the frequency



graphed.

Note: MI: Mistletoes, V: Vines and twiners, X: Ferns, P: Mat plants, J: Herbaceous plants, GL: Grasses <0.5m, GT: Grasses >0.5m, VL: Sedges <0.5m, VT: Sedges >0.5m, H: Hummock grass, SD: Shrubs<0.5m, SC: Shrubs 0.5-1m, SB: Shrubs 1-1.5m, SA: Shrubs 1.5-2m, S: Shrubs >2m, KS: Low mallee <3m, KT: Mallee >3m, LB: Trees <5m, LA: Trees 5-10m, M: Trees 10-30m, T: Trees >30m

Figure 10 - Lifeform analysis of the Ceduna site

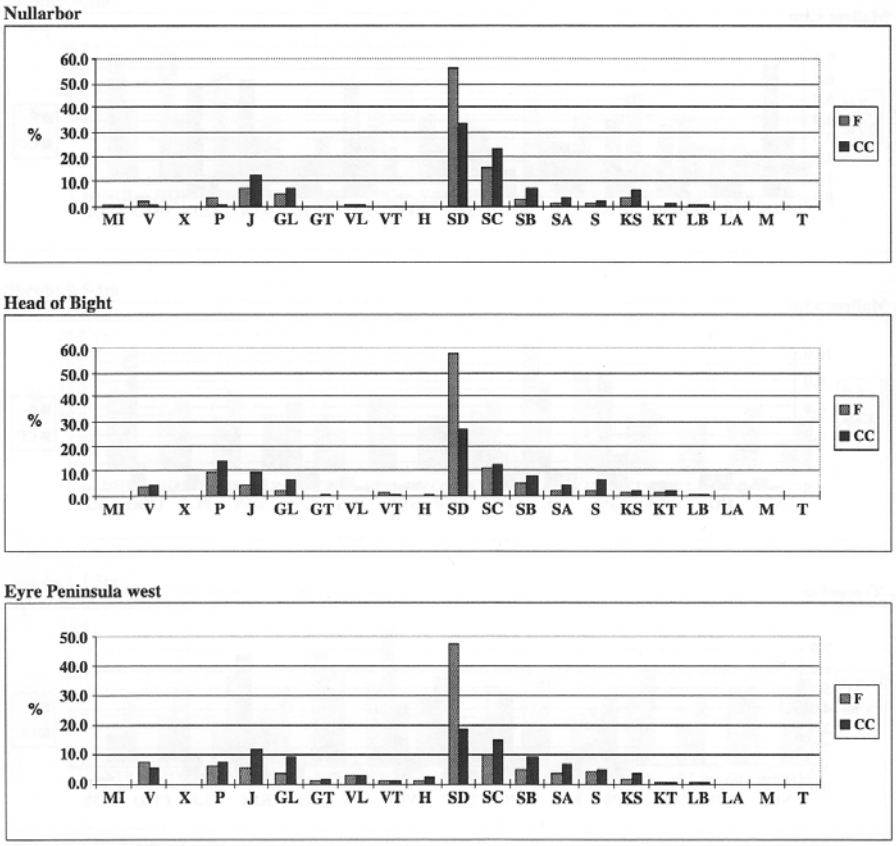


Figure 11 - Lifeform analyses, Eyre Peninsula West to Nullabor (Oppermann, 1999)

In all three of Oppermann's graphs, the dominant lifefoms are the low shrubs, followed by the taller shrubs, forbs, grasses and mat plants. The current survey site contains a much larger percentage of forbs than Oppermann's sites, however the overall lifeform classes and relative distributions are similar to her findings, with a complete lack of large trees, and a paucity of sedges, hummock grasses and ferns, and with the dwarf shrubbery providing the larger variety than the taller shrubbery. The difference may be explained by Oppermann mainly reporting perennial species, which would have resulted in an under representation in her graphs of annuals – these would have occurred largely in the forbs, mat plants and grasses classes.

The comparison above suggests that the site is relatively representative of the vegetation that is normally found in similar sites of the region, even though some of the site has been grazed extensively in the past.

Much of the published data for the coastal zone vegetation of the West Coast concentrates on dune and cliff top vegetation. Salt marsh vegetation is largely unstudied. Unpublished data is available on request from the Department for Environment and Heritage. Departmental staff (Fotheringham, pers.comm.) have recorded plants found in salt marsh areas at Laura Bay, Tourville Bay, Acraman Creek and Cape Missiessy. Thirteen individual site records are available for the four sites and the table below is a compilation of the species recorded across all the sites.

Species	Common name	Distribution
*Bupleurum semicompositum	Hare's Ear	<5%
*Hymenolobus procumbens	Oval Purse	sparsely present
*Parapholis incurve	Curly Ryegrass	<5%
Spergularia diandra	Lesser Sand-spurrey	sparsely present
Atriplex paludosa ssp. cordata	Marsh Saltbush	5-25%
Calandrinia eremaea	Dryland Purslane	sparsely present
Carpobrotus rossi	Native Pigface	<5%
Crassula sieberiana ssp. tetramera	Australian Stonecrop	<5%
Disphyma crassifolium	Round-leaf Pigface	<5%
Frankenia pauciflora var. fruticulosa	Southern Sea-heath	<5%
Frankenia sessilis	Small-leaf Sea-heath	sparsely present
Geijera linearifolia	Sheep Bush	sparsely present
Halosarcia flabelliformis	Bead Samphire	5-25%
Halosarcia halocnemoides	Grey Samphire	5-25%
Halosarcia indica ssp. leiostachya	Brown-head Samphire	25-50%
Hemichroa diandra	Mallee Hemichroa	<5%
Lawrencia squamata	Thorny Lawrencia	5-25%
Maireana oppositifolia	Salt Bluebush	5-25%
Nitraria billardierei	Nitre-bush	sparsely present
Poa fax	Scaly Poa	sparsely present
Rhagodia candolleana	Sea-berry Saltbush	sparsely present
Samolus repens	Creeping Brookweed	sparsely present
Sarcocornia blackiana	Thick-head Samphire	sparsely present
Sarcocornia quinqueflora	Beaded Samphire	5-25%
Sclerostegia arbuscula	Shrubby Samphire	>75%
Senecio glossanthus	Annual Groundsel	sparsely present
Senecio lautus	Variable Groundsel	<5%
Stipa drummondii	Cottony Spear-grass	sparsely present
Suaeda australis	Austral Seablite	5-25%
Threlkeldia diffusa	Coast Bonefruit	sparsely present
Triglochin sp.	Arrowgrass/Water-ribbons	<5%
Wilsonia humilis var. humilis	Silky Wilsonia	sparsely present
Zygophyllum billardierei	Coast Twinleaf	<5%

Table 5 - West Coast intertidal salt marsh species (DEH data, Fotheringham, 2004)

When compared to the salt marsh species found in the current survey, 64% of the species recorded on the Department's regional list were present on the Ceduna study site. Of the twelve species that were not recorded, the majority were specialist plants that would be expected only in specific habitats. For example, *Samolus repens*, *Sarcocornia blackiana* and some *Triglochin* species are found where there is an input of fresh or brackish waters, while *Halosarcia flabelliformis* has very specific soil and hydrological requirements that are not yet completely understood.

4.3 Conservation status of indigenous flora species

Conservation significance of plants occurring on the study site was determined at a regional level using Department for Environment and Heritage (2002), at a State level using the *National Parks and Wildlife Act 1972 of South Australia*, Schedules 7-9, and at a National level using Briggs and Leigh (1996). The latter document forms the basis for listing plants under the Federal *Environment Protection and Biodiversity Conservation Act 1999 of Australia*.

Two species present on the study site, *Ixiolaena pluriseta* and *Kippistia suaedifolia*, have conservation ratings.

Ixiolaena pluriseta (a plover daisy) has a rating of Rare for the State, and a status of Unknown for the Eyre Peninsula. According to Jessop and Toelken (1986) this species has only been collected from Smoky Bay to Fowler Bay, on the Nuyts Archipelago and one specimen from Nullabor Homestead. The plant is found principally on the calcareous sands of low coastal cliffs and the adjacent dunes. The specimens found in this survey were recorded in sampling quadrat 1, on sands overlying a low rocky clifftop.

Kippistia suaedifolia (fleshy miniura) has a rating of Rare for the Eyre Peninsula. It prefers to grow on sandhills, claypans, limestone and gypsum, and was recorded during this survey in quadrat 20, on the crest of the sandpit and within the pit itself.

Previous surveys (EMS, 2004) reported several other species with conservation significance or interest. *Maireana aphylla*, with conservation interest due to its status of Uncommon on the Eyre Peninsula, was not recorded during this survey, although seven other species of *Maireana* were found. The EMS survey noted that these plants were mainly located in the golf course roughs, and this more recent survey did not visit the golf course.

Figure 12 - Hemichroa diandra in a swale on Allotment 22

Trailing hemichroa (*Hemichroa pentandra*) with a rating of Rare for the Eyre Peninsula was not recorded in this survey, although its close relative *Hemichroa diandra* was a co-dominant in many of the quadrats surveyed. The EMS survey noted that the plants were not flowering during their survey. As the two species can be separated most reliably by examining the anthers of the flowers, it is possible that the earlier records were an estimate of the species, rather than a determination.

Under the *Native Vegetation Act 1991*, the District Council of Ceduna is not exempt from the operation of the Act. Therefore clearance of native vegetation requires a permit. While the Act does not apply to any planted specimens on the block, it does apply to natural regeneration that is older than five years, and also applies to plants that form a wetland habitat, as well as to species listed as rare, vulnerable or endangered in the Schedules of the *National Parks and Wildlife Act 1972*. The *National Parks and Wildlife Act 1972* would provide separate protection for *Ixiolaena pluriseta* should that species be found to occur on any land that is not freehold.

The *Environment Protection and Biodiversity Conservation Act 1999 of Australia* includes no South Australian ecological communities at present. Regionally, tussock grasslands are considered to be Threatened on the Eyre Peninsula (DEH, 2002).

Thirty-five percent (35%) of the species found on the site were weed species. This is a low infestation of weeds in comparison to metropolitan coastal sites, which typically average sixty-five percent (65%) exotics as a percentage of biodiversity. Many of the weeds were present in the dunal areas, while the salt marsh areas (dominated by samphires) tended to have a lower percentage of exotics. This is usual, and surveys of other salt marsh areas in the vicinity (see Table 5) suggest that in salt marsh areas the weed infestation is likely to be around twelve percent (12%) of the biodiversity.

Acacia cyclops (the western coastal wattle) tends to provoke debate on whether its status is indigenous or a regional weed. The Biodiversity Plan for Eyre Peninsula states that this species has “a strong western distribution becoming more dominant to the west.”

Another regional aberration was the presence of *Eucalyptus stoatei* (Scarlet pear gum) in the sand pit. This species of marlock has a very restricted distribution east and north-east of Ravensthorpe in Western Australia. The tree was quite possibly planted in its current location.

4.4 Vegetation history

Aerial photography of parts of the site is available from 1950 through to the present. This allows for some examination of the age of some of the mallees and larger shrubs on the site.

Figure 13 reveals that many of the shrubs along the western edge of the coastal strip north of the existing service station have been in existence for at least fifty years. The large dune itself has become steadily more vegetated over that time, but at least one large mallee is still in evidence today that predates the earliest photograph.

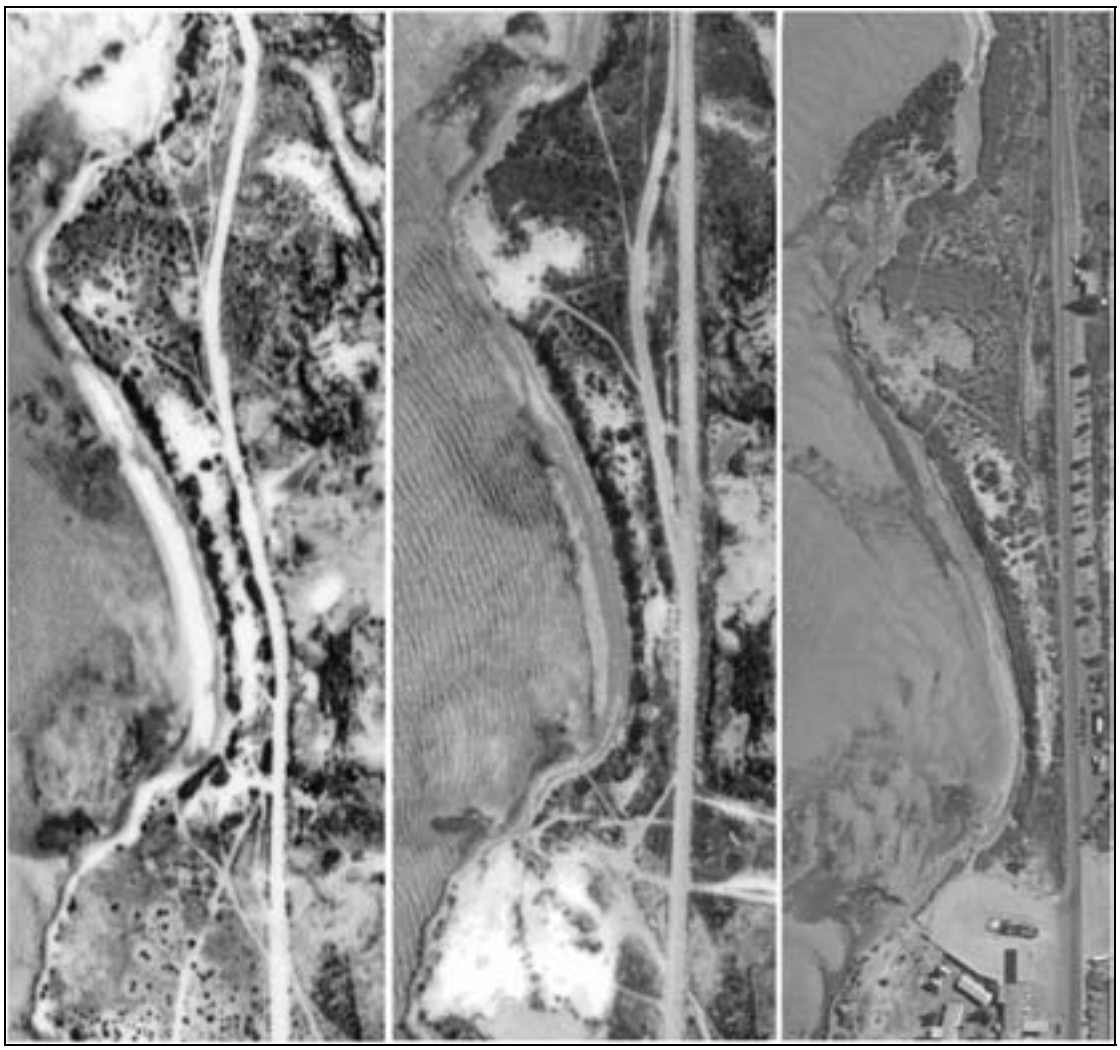


Figure 13 - Southern coastal strip, 1950, 1968 & 2004

Figure 14 - South-eastern hill, 1950, 1968 & 2004

The long sloping hill at the south-eastern corner of the study area was cleared prior to 1950, and has been mined for sand or gravel. Mining started between 1950 and 1968. The presence of native tussock grasses is not unusual in areas cleared for pastoral purposes, if improved pastures have not been seeded over the site, and this block has excellent quantities of

Danthonia setacea and several types of *Austrostipa* still existing between a heavy infestation of noxious and other weeds.

Figure 15 - Southern corner of the north-western block, 1968 & 2004

While much of the north-western block has been cleared, the southern part of the block contains many large shrubs and mallees that can be identified in the 1968 photograph. The coastal strip shows the gradual expansion of mangrove trees. The oldest mangroves are still in evidence in the earlier photographs, but the woodland is now both denser and more extensive than it was 36 years ago.

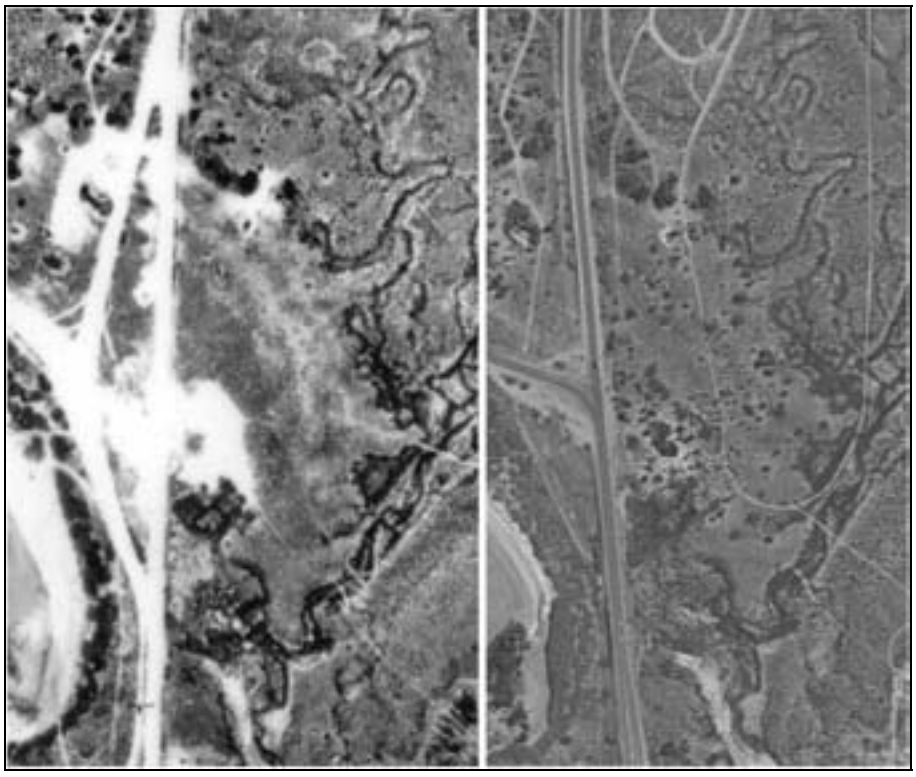


Figure 16 - Small dunes and dissected saltmarsh east of highway, 1968 & 2004

The small dune east of the highway has seen considerable growth of native vegetation in the denuded patch, however there are some older shrubs that are in evidence in both photographs – particularly towards the north of the dune and along its eastern boundary.

Dense *Sclerostegia arbuscula* mark the drainage channels through the salt marsh. Although these shrubs do not attain great stature, they are a long lived species, making it quite possible that the individual shrubs present today have survived the changed conditions since the highway cut off tidal flushing. Adult samphires in general do not tend to immediately die off in altered hydrological conditions (McComb *et al*, 1995), however the reproductive success of the plants is impacted.

In locations where the tide is prevented from flooding across a salt marsh the samphires may turn red (a result of increased salt content in the soil) and may produce little new spring growth each year, but they may survive in this parlous state for very long periods.

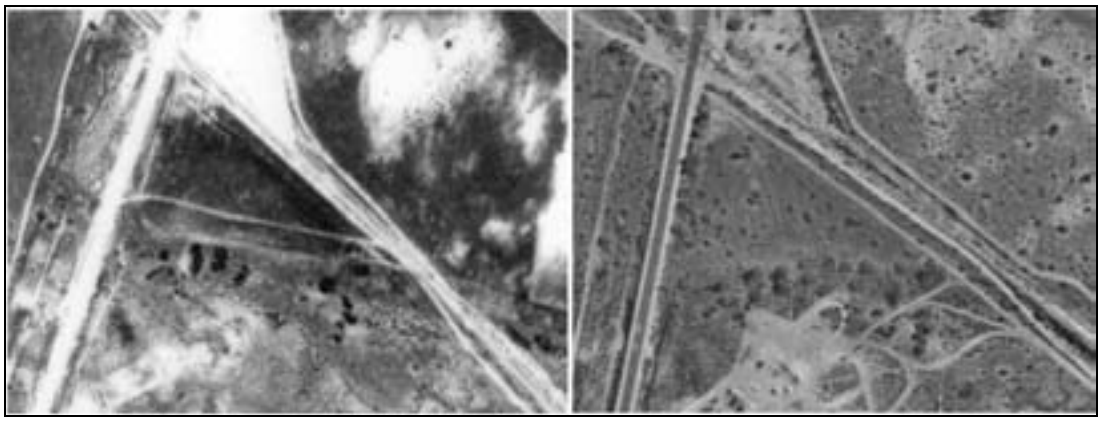


Figure 17 - Northern corner of the eastern block, 1968 & 2004

The trees currently growing along the road reserve on the north-western boundary of the north eastern block are only just in evidence in the 1968 photograph, however the band of tall shrubs and low mallees located along the southerly base of the slope were already mature. The effects of off-road vehicles and mining are clearly visible in the centre of the more recent photograph. This impact is limited in area, with the dunes along the eastern boundary of the block being in good condition. Many of the larger shrubs on these dunes are visible in the early photograph.

5. Terrestrial fauna observations

The following section details the fauna observations that occurred during this study. Additional information on fauna found in the vicinity has been compiled from other published sources.

In South Australia, most vertebrate fauna is deemed ‘protected’ under the provisions of the *National Parks and Wildlife Act 1972 of South Australia*. Under this Act,

> **“protected animal** means-
> *(a)* any mammal, bird or reptile indigenous to Australia; or

(b) any migratory mammal, bird or reptile that periodically or occasionally migrates to, and lives in, Australia; or
(c) any animal of a species referred to in schedule 7, 8 or 9; or
(d) any animal of a species declared by regulation to be a species of protected animals,

but does not include animals of the species referred to in schedule 10 or any animals declared by regulation to be unprotected."

The unprotected species (those listed in Schedule 10) are Zebra Finch *(Poephila guttata)*, Budgerygah *(Melopsittacus undulatus)*, Red Wattlebird *(Anthochaera carunculata)*, Grey-backed Silvereye *(Zosterops lateralis halmaturina)*, Galah *(Cacatua roseicapilla)*, Little Corella *(Cacatua sanguinea)*, Australian Raven *(Corvus coronoides)*, Little Crow *(Corvus bennetti)*, Australian Crow *(Corvus orru cecilae)*, Little Raven *(Corvus mellori)*, and Wild Dog (Dingo) *(Canis familiaris)*.

While most animals are protected, additional protection is provided to species considered to be vulnerable, endangered or rare under Schedules 7, 8 and 9 of the same Act. The *Environment Protection and Biodiversity Conservation Act 1999 of Australia* provides protection for those species of nationwide conservation significance.

5.1 Birds

During the site visits in late November 2004, opportunistic sightings of birds and a 20-minute point observation were recorded. The species are listed below, in Table 6. The days of the field trip were abnormally hot and windy, so the species observed were limited. Terrestrial birds were generally found hiding in vegetation, and water birds were usually out into the water as far as they could manage, or hidden in the mangroves until after sunset, where upon they came back onto the mudflat to feed during the cooler weather.

Species	Common name
Anthus novaeseelandiae	Richard's pipit
Calidris canutus	Red knot
Certhionyx niger	Black honey eater
Charadrius ruficapillus	Red capped dotterel
Chlidonias hybrida	Whiskered tern
Corvus spp.	Ravens
Cygnus atratus	Black swan
Falco cenchroides	Nankeen kestrel
Haematopus fuliginosus	Sooty oystercatcher
Haematopus longirostris	Pied oystercatcher
Larus novaehollandiae	Silver gull
Larus pacificus	Pacific gull
Limosa limosa	Bar-tailed godwit
Malurus spp.	Wrens (female)
Milvus migrans	Black kite
*Passer domesticus**	Sparrow
Pelecanus conspicillatus	Australian pelican
Phalacrocorax varius	Pied cormorant

Pomatostomus superciliosus	White browed babbler
Rhipidura leucophrys	Willie wagtail
Sterna bergii	Crested tern
Sterna caspia	Caspian tern
*Sturnus vulgaris**	Starling
Threskiornis molucca	Sacred ibis
Tringa nebularia	Greenshank
Tringa spp.	Sandpipers

Table 6 - Bird sightings in late November 2004 (Delta staff)

Red knots were seen working the northern reefs for food, while red capped dotterels (plovers) were common along the sandy beaches. Sandpipers and greenshanks foraged across the sand flats, following the tide out.

Figure 18 - Pelican and migratory waders

The unprotected birds one would expect to find on the site are ravens, crows and introduced species. All other birds occurring on the study area and adjacent blocks are protected under State and Federal legislation. The conservation significance of each species is given in the table below, which shows all species recorded by Birds Australia within one degree of the study site.

Members of Birds Australia have recorded 128 species of birds within the wider 1-degree map block surrounding the site. Ceduna is located in the northeastern corner of this block, which extends from Point Brown around the coast to Point Sinclair. This list is provided separately below.

Family	Common Name	*Species name*	Conservation Interest
Phasianidae	Stubble Quail	*Coturnix pectoralis*	
Anatidae	Blue-billed Duck	*Oxyura australis*	Rare (SA NP&WS), EPBC Act, rare EP
Anatidae	Musk Duck	*Biziura lobata*	Rare (SA NP&WS), EPBC Act
Anatidae	Black Swan	*Cygnus atratus*	EPBC Act
Anatidae	Grey Teal	*Anas gracilis*	EPBC Act
Anatidae	Chestnut Teal	*Anas castanea*	EPBC Act
Anatidae	Hardhead	*Anthya australis*	EPBC Act
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	
Podicipedidae	Hoary-headed Grebe	*Poliocephalus poliocephalus*	
Sulidae	Australasian Gannet	*Morus serrator*	
Anhingidae	Darter	*Anhinga melanogaster*	
Phalacrocoracidae	Little Pied Cormorant	*Phalacrocorax melanoleucos*	
Phalacrocoracidae	Black-faced Cormorant	*Phalacrocorax fuscescens*	
Phalacrocoracidae	Pied Cormorant	*Phalacrocorax varius*	
Phalacrocoracidae	Little Black Cormorant	*Phalacrocorax sulcirostris*	
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	
Phalacrocoracidae	Australian Pelican	*Pelecanus conspicillatus*	
Ardeidae	White-faced Heron	*Egretta novaehollandiae*	
Ardeidae	Little Egret	*Egretta garzetta*	Rare SA
Ardeidae	Eastern Reef Egret	*Egretta sacra*	Rare (SA NP&WS), EPBC Act, rare EP
Ardeidae	Great Egret	*Egretta alba*	EPBC Act
Plataleidae	Royal Spoonbill	*Platalea regia*	
Pandionidae	Osprey	*Pandion haliaetus*	Rare (SA NP&WS), EPBC Act, rare EP
Accipitridae	Black-shouldered Kite	*Elanus axillaris*	EPBC Act
Accipitridae	Black Kite	*Milvus migrans*	EPBC Act
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Accipitridae	Spotted Harrier	*Circus assimilis*	EPBC Act
Accipitridae	Swamp Harrier	*Circus approximans*	EPBC Act
Accipitridae	Wedge-tailed Eagle	*Aquila audax*	EPBC Act
Falconidae	Brown Falcon	*Falco berigora*	EPBC Act
Falconidae	Nankeen Kestrel	*Falco cenchroides*	EPBC Act
Turnicidae	Little Button-quail	*Turnix velox*	
Scolopacidae	Bar-tailed Godwit	*Limosa limosa*	EPBC Act
Scolopacidae	Whimbrel	*Numenius phaeopus*	EPBC Act
Scolopacidae	Eastern Curlew	*Numenius madagascariensis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	EPBC Act
Scolopacidae	Common Greenshank	*Tringa nebularia*	EPBC Act
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	EPBC Act
Scolopacidae	Grey-tailed Tattler	*Heteroscelis brevipes*	EPBC Act
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Scolopacidae	Great Knot	*Calidris tenuirostris*	EPBC Act
Scolopacidae	Red Knot	*Calidris canutus*	EPBC Act

Family	Common Name	*Species name*	Conservation Interest
Scolopacidae	Sanderling	*Calidris alba*	EPBC Act
Scolopacidae	Little Stint	*Calidris minuta*	EPBC Act
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	EPBC Act
Scolopacidae	Sharp-tailed Sandpiper	*Calidris acuminata*	EPBC Act
Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	EPBC Act
Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	
Haematopodidae	Sooty Oystercatcher	*Haematopus fuliginosus*	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	EPBC Act
Recurvirostridae	Banded Stilt	*Cladorhynchus leucocephalus*	EPBC Act
Charadriidae	Pacific Golden Plover	*Pluvialis dominica*	EPBC Act
Charadriidae	Grey Plover	*Pluvialis squatarola*	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Charadriidae	Red-capped Plover	*Charadrius ruficapillus*	EPBC Act
Charadriidae	Double-banded Plover	*Charadrius bicinctus*	EPBC Act
Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	EPBC Act
Charadriidae	Greater Sand Plover	*Charadrius leschenaultii*	EPBC Act
Charadriidae	Inland Dotterel	*Charadrius australis*	EPBC Act
Charadriidae	Hooded Plover	*Thinornis rubricollis*	Vulnerable (SA NP&WS), EPBC Act, Vulnerable EP
Charadriidae	Banded Lapwing	*Vanellus ticolor*	EPBC Act
Charadriidae	Masked Lapwing	*Vanellus miles*	EPBC Act
Laridae	Pacific Gull	*Larus pacificus*	
Laridae	Silver Gull	*Larus novaehollandiae*	
Laridae	Caspian Tern	*Sterna caspia*	
Laridae	Crested Tern	*Sterna bergii*	
Laridae	Fairy Tern	*Sterna nereis*	Vulnerable (SA NP&WS), ssp nereis vulnerable EP
Laridae	Whiskered Tern	*Chlidonias hybrida*	
Columbidae	Rock Dove	*Columba livia**	
Columbidae	Common Bronzewing	*Phaps chalocoptera*	
Columbidae	Brush Bronzewing	*Phaps elegans*	
Columbidae	Crested Pigeon	*Ocyphaps lophotes*	
Columbidae	Peaceful Dove	*Geopelia striata*	Rare EP
Cacatuidae	Galah	*Eolophus roseicapilla*	
Psittacidae	Australian Ringneck	*Barnardius zonarius race zonarius*	
Psittacidae	Mulga Parrot	*Psephotus varius*	
Psittacidae	Rock Parrot	*Neophema petrophila*	Rare (SA NP&WS), rare EP
Cuculidae	Pallid Cuckoo	*Cuculus pallidus*	
Cuculidae	Fan-tailed Cuckoo	*Cuculus flabelliformis*	
Cuculidae	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	
Tytonidae	Barn Owl	*Tyto alba*	
Apodidae	Fork-tailed Swift	*Apus pacificus*	EPBC Act
Maluridae	Variegated Fairy-wren	*Malurus lamberti*	
Pardalotidae	Striated Pardalote	*Pardalotus striatus*	
Pardalotidae	White-browed Scrubwren	*Sericornis frontalis*	

Family	Common Name	*Species name*	Conservation Interest
Pardalotidae	Weebill	*Smicrornis brevirostris race brevirostris*	
Pardalotidae	Inland Thornbill	*Acanthiza apicalis*	
Pardalotidae	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	
Pardalotidae	Southern Whiteface	*Aphelocephala leucopsis race maculatus*	
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*	
Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	
Meliphagidae	Yellow-throated Miner	*Manorina flavigula*	
Meliphagidae	Singing Honeyeater	*Lichenostomus virescens*	
Meliphagidae	Purple-gaped Honeyeater	*Lichenostomus cratitius*	
Meliphagidae	White-fronted Honeyeater	*Phylidonyris albifrons*	
Meliphagidae	Crimson Chat	*Epthianura tricolor*	
Meliphagidae	White-fronted Chat	*Epthianura albifrons*	
Petroicidae	Jacky Winter	*Microeca fascinans*	
Petroicidae	Red-capped Robin	*Petroica goodenovii*	
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	
Pachycephalidae	Gilbert's Whistler	*Pachycephala inornata*	Rare EP
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*	
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	
Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	
Dicruridae	Magpie-Lark	*Grallina cyanoleuca*	
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*	
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*	
Campephagidae	Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	
Campephagidae	White-winged Triller	*Lalage sueurii*	
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*	
Artamidae	Grey Butcherbird	*Cracticus torquatus*	
Artamidae	Australian Magpie	*Gymnorhina tibicen*	
Corvidae	Australian Raven	*Corvus coronoides*	
Corvidae	Little Raven	*Corvus mellori*	
Corvidae	Little Crow	*Corvus bennetti*	
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Vulnerable EP
Motacillidae	Richard's Pipit	*Anthus novaeseelandiae*	
Passeridae	House Sparrow	*Passer domesticus**	
Hirundinidae	White-backed Swallow	*Cheramoeca leucosternus*	
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	
Hirundinidae	Tree Martin	*Hirundo nigricans*	
Sylviidae	Little Grassbird	*Megalurus gramineus*	EPBC Act
Alaudidae	Rufous Songlark	*Cincloramphus mathewsi*	
Alaudidae	Brown Songlark	*Cincloramphus cruralis*	
Zosteropidae	Silvereye	*Zosterops lateralis*	
Muscicapidae	Common Blackbird	*Turdus merula**	
Sturnidae	Common Starling	*Sturnus vulgaris**	

Table 7 - Birds Australia records of birds within 1-degree block that includes study site

An expanded version of the Birds Australia species list, which includes the ecological preferences of each species is attached to this report in *Appendix 4*. Counts of waders, conducted in 1984 and 2000 by Birds Australia are provided in Table 8 below.

A point of interest is the Sooty Oystercatcher numbers. It was notable during the November 2004 site visit that while both Sooty Oystercatchers and Pied Oystercatchers were sighted foraging in the study area, only the Pied Oystercatcher was located further south, at Shelly Beach. This may be explained by the Sooty Oystercatcher's preference for reefs, which are present at both extremities of the study area. Watkins (1993) lists Murat Bay as a site of international importance for the conservation of this species.

Common Name	*Species name*	Murat Bay Wader Count (2000)	Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Bar-tailed Godwit	*Limosa limosa*	26		EPBC Act
Eastern Curlew	*Numenius madagascariensis*	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Common Greenshank	*Tringa nebularia*	46		EPBC Act
Common Sandpiper	*Actitis hypoleucos*	3		EPBC Act
Grey-tailed Tattler	*Heteroscelis brevipes*	6		EPBC Act
Ruddy Turnstone	*Arenaria interpres*	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red Knot	*Calidris canutus*	38		EPBC Act
Red-necked Stint	*Calidris ruficollis*	913		EPBC Act
Sharp-tailed Sandpiper	*Calidris acuminata*	271		EPBC Act
Curlew Sandpiper	*Calidris ferruginea*	144		EPBC Act
Pied Oystercatcher	*Haematopus longirostris*	29		
Sooty Oystercatcher	*Haematopus fuliginosus*	107	163	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Grey Plover	*Pluvialis squatarola*	81	123	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red-capped Plover	*Charadrius ruficapillus*	79		EPBC Act
Banded Lapwing	*Vanellus ticolor*	238		EPBC Act
Masked Lapwing	*Vanellus miles*	6		EPBC Act

Table 8 - Birds Australia wader counts in Murat Bay, 1984 & 2000

5.1.1 Possible impacts on bird life

Waders harvest food from the tidal flats. Each bird species has a particular preference – those with heavy beaks, such as Oystercatchers, can split open bivalve shells and would use the mussel top reefs as their major food source. Others, with more slender beaks, probe the sand flats for polychaete worms, sipunculids or small crustaceans. Those with longer beaks are able to obtain organisms that move deep within the sand, while the shorter beaked birds are restricted to those organisms that live close to the surface. These specific ecological preferences mean that the impacts of any development will vary, depending on the species involved.

The areas of possible impact could include:

- the construction of a boating channel and groynes may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, while other areas may drain less well (the newly formed 'pockets' where the groynes meet the beach) and therefore may become hypoxic. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos. This has implications on the availability of appropriate food sources for migratory waders,
- the increased usage of the sand flats as boats enter and leave the marina may disturb the more sensitive species of birds, and
- the *Sclerostegia arbuscula* chenopod shrubland present in the stranded dissected salt marsh currently provides habitat for many small birds such as Thornbills and Chats, and these birds do not utilise deep waterways as habitat.

5.2 Reptiles and amphibians

The sandy areas (dunes and ridges) of the site contained large numbers of small painted dragons (*Ctenophorus pictus*) that ran rapidly for shelter under thorny bushes as they were approached. In the early morning the sandy sections of the site showed tracks of small snakes and lizards. As well as the live lizards noted in the following table, a jaw of a sleepy lizard was found, several lizard holes were noted and a scat from a large lizard that contained plant materials, beetle elytra and white snails was recorded.

Common name	Family: *Species*
Painted dragons	Agamidae: *Ctenophorus pictus*
Sleepy lizards	Scincidae: *Tachydosaurus rugosus*
Small skinks	Scincidae

Table 9 – Lizards sighted

Figure 19 - Snake and lizard tracks

No amphibians were sighted or heard during the site visit. This is not surprising given the salty and dry nature of much of the site. It is possible that some amphibians may occur in

winter in the area near the BP service station where a soak apparently exists. The soak was not evident to the consultants who undertook this visit.

5.3 Mammals

During the site visit a fox (*Vulpes vulpe*s) was sighted and fox tracks and a hole were located. Several rabbits (*Oryctolagus cuniculus*) were seen, a scrape was located and their dung was widespread. The remains of a sheep (*Ovis aries*) and quantities of old sheep dung suggest that it may be some time since sheep were grazed on the site. Fresh horse tracks (*Equus caballus*) were also recorded.

Wallaby tracks were found on the rocky headland to the northwest of the site.

Conservation reserves in the district support populations of spinifex hopping mice (*Notomys mitchelli*) and echidnas (*Tachyglossus acculeatus*). It is possible that the dunal elements to the north and north west of the site may support these species. Other mammals that may possibly be found in the less disturbed portions of the site include the fat tailed dunnart (*Sminthopsis crassicaudata*), little long tailed dunnart (*Sminthopsis dolichura*), western pygmy possum (*Cercatetus concinnus*), western grey kangaroo (*Macropus fuliinosus*), and several species of bats. Strahan (1995) suggests that the area marks the western extremity of the eastern population of the southern forest bat, *Vespadelus regulus*.

5.4 Terrestrial invertebrates

During the vegetation survey, any invertebrates that were present were noted. Several sweeps were also made during the late morning, in a sunny period with a light to moderate wind. Additionally a night time light trap was used to determine the range of nocturnal insects present.

The weather during the site visit was hot, with a northerly wind blowing. In the day-time the small bush flies (*Musca vetustimma*) were in pestilential proportions, and at night they were replaced by the flying stages of termites in similar proportions. The other insect attracted to the light trap at night in large numbers was a small grey and white moth, probably *Protolechia* sp. Many small wasps were visible in the day time, and spiders were harvesting these in webs strung across the samphires and smaller shrubs.

Invertebrates are not protected under the *National Parks and Wildlife Act 1972 of South Australia*. However, some South Australian butterfly species are listed under the federal government's Action Plan for Butterflies (Sands and New, 2002), a document developed under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999 of Australia*. According to the *Biodiversity Plan for Eyre Peninsula* (DEH, 2002) the butterfly groups most likely to contain threatened members are the Skippers, Coppers and Blues. The latter two groups require the attendance of specific any species as well as habitat containing their food, making them particularly vulnerable to ecological disturbance.

The Dinosaur ant (*Nothomyrmecia macrops*) does not have protection under legislation but is only known from seventeen sites on the Eyre Peninsula. It inhabits patchy stands of mallee, including *Eucalyptus gracilis* (present on the site). While no dinosaur ants were observed, this

was expected as the ant is nocturnal. No honey trapping was conducted as the night time temperatures were too high. The ants only forage when the temperature drops to less than 15-18^{o}C (DEH, 2002).

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Insects			
Black longicorn beetles	Coleoptera: Cerambycidae	x	
Ladybirds	Coleoptera: Cocinellidae	x	
Brown scarab beetles (many)	Coleoptera: Scarabaeidae		x
Dragonflies (large grey blue)	Odonata: Libellulidae: poss. *Orthetrum* sp.	x	
Wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus plexippus*	x	
Lesser wanderer butterfly	Lepidoptera: Nymphalidae: *Danaus chrysippus*	x	
Orange/brown butterfly	Lepidoptera: Nymphalidae	x	
Caper white butterfly	Lepidoptera: Pieridae: *Anaphaeis java*	x	
Skipper butterflies	Lepidoptera: Hesperiidae	x	
Blue butterflies on melaleucas	Lepidoptera: Lycaenidae	x	
Case moth	Lepidoptera: Psychidae:poss *Hylarcta* sp.	x	
Feather wing moths	Lepidoptera: Cosmopterigidae		x
Small grey/white moths (many)	Lepidoptera: Gelechiidae: prob *Protolechia* sp.		x
Termites (winged queens) (many)	Isoptera:		x
Green tree hopper	Hemiptera: Membracidae: *Sextius virescens*	x	
Brown & white bugs	Hemiptera: Lygaeidae		x
Stink bug	Hemiptera: Pentatomidae		x
Burrowing bug	Hemiptera: Cydnidae		x
Cotton cushion scale	Hemiptera: Margarodidae	x	
Native bee with blue stripes	Hymenoptera: poss Anthophoridae	x	
Meat ants	Hymenoptera: Formicidae: *Iridomyrmex* sp.	x	
Large inch ant black rear, red body and yellow jaws	Hymenoptera: Formicidae: *Myrmecia* sp.	x	
Flying ant	Hymenoptera: Formicidae		x
Large black/orange heavy built potter wasp	Hymenoptera: Vespidae	x	
Irridescent green small wasps	Hymenoptera	x	
Small yellow wasps	Hymenoptera	x	
Almost microscopic wasps	Hymenoptera: poss Diapriidae		x
Hoverflies	Diptera: Syrphidae	x	
Wait-a-while flies (bush flies, eye flies)	Diptera: Muscidae: *Musca vetustimma*	x	x
Big blue-bottle flies	Diptera: Calliphoridae	x	
Long-leg flies	Diptera: Dolchopodidae		x
Black biting flies	Diptera: Tabanidae	x	
Eucalyptus gall midges	Diptera: Cecidomyidae	x	
Antlions	Neuroptera: Myrmeliontidae	x	
Bush crickets	Orthoptera: Gryllidae	x	
Spiders			
Mexican hat spiders	Araneae: prob Stiphiidae	x	
Sac spider	Araneae: Miturgidae	x	
Garden orb, or wheel weaver spider	Araneae: Araneidae: *Eriophora transmarina*	x	
Green jumping spider	Araneae: Salticidae	x	
Flower spider	Araneae: Thomisidae	x	

Common name	Order:Family:*Species*	Day-time sweeps & observations	Night trap
Other arthropods			
Small red mites	Acarina	x	
Scorpion hole	Scorpionida	x	
Gastropods			
White snails	Molluca: Helicidae: *Cernuella vestita**	x	
Small snails	Molluca: Helicidae: *Cochlicella acuta**	x	

Table 10 - Terrestrial invertebrates recorded on the site

Figure 20 - Spider webs catching the many small flying wasps

6. Intertidal flora and fauna

This study examined only the intertidal zone of the study area. Subtidal areas (those covered by water in the photograph below) were not observed.

6.1 Observations

The study site is a sheltered, calm water coast, and the majority of the bay is taken up by wide sand flats, with rocky platforms confined to the southern and northern extremities. A series of observations was recorded for the intertidal zone. The locations of these observations are shown in Figure 16, over the page.

The rocky portions of the site are dominated by *Hormosira banksii*, with small quantities of other brown macroalgae. The tubeworm *Galeolaria* is often present on these rocky sections, along with ribbed top shells, conniwinks and beaked mussels.

Musseltop reefs, formed by the growth of beaked mussels over limestone or coffee-rock, project out from the shore towards the sandy flats. These are sometimes edged with *Hormosira banksii* and *Enteromorpha intestinalis*.

The sand flats themselves vary. There are firm areas of bare sand, large zones of soft sand with beds of *Zostera* and *Ruppia*, and some firm sand areas supporting *Hormosira* beds. The tidal flat version of *Hormosira* has larger, spherical vesicles (Womersley, 1984) when compared to the same alga growing on the reefs. Few other plants are present. Evidence of sand snails and benthic worms is common. Some areas appear to contain slightly hypoxic sediments, evidenced by the grayish colouration of the underlying sands, but these areas also contain evidence of worm habitation, suggesting that these zones may be organically enriched. Where clean sand occurs in rear reef pools, *Pinna bicolor* can be found.

Figure 21 - Observation points in the intertidal zone

At each observation point the location was recorded using a GPS, and a note made of the species present and any geomorphological features.

Location	Easting	Northing	Mangrove	Samphire	Seagrass	Hormosira	Reef	Rock	Sand	Sulfidic	Worms	Mussels	Comments
1	373882	6446949			Y				Y				Dense *Zostera muelleri* and *Ruppia* bed heading SE from location
2	373838	6446918			Y				Y				Dense *Zostera* and *Ruppia* bed, firmer on higher part of sandbar
3	373724	6446837				Y	Y					Y	Muddy rock reef with mussels and *Hormosira*
4	373704	6446788			Y								Large *Ruppia* bed with some *Zostera*, short billed migratory shorebirds feeding
5	373646	6446773										Y	Musseltop reef
6	373612	6446789			Y	Y							*Hormosira* bed with small amounts of green and brown macroalgae, *Zostera* in gaps
7	373603	6446810			Y								Dense long *Zostera* bed stretching in to shore, pebble crabs
8	373644	6446822							Y				Razorfish in reasonably clear sand
9	374552	6446040	Y	Y									*Sarcocornia* with half a dozen mangroves
10	374552	6446059		Y									Small patch of *Sclerostegia arbuscula*, seaward of mangroves
11	374506	6446052				Y	Y						Seaward of samphires - *Austrocochlea, Ostrea, Hormosira, Galeolaria*
12	374512	6446071					Y	Y					Patch of black rocks within reef area
13	374523	6446126			Y				Y				Tiny blades of *Zostera/Ruppia* protruding through sand in patches about 50cm across
14	374511	6446138				Y	Y	Y				Y	*Hormosira* topped with cast seaweed and some exposed patches of musseltop reef
15	374588	6446134	Y	Y									Area of *Sarcocornia, Suaeda, Sclerostegia* with a dozen small scattered mangroves
16	374559	6446213				Y			Y				Wide sandy bay with *Hormosira* beds on locations 16 and 17
17	374580	6446227				Y			Y				Wide sandy bay with *Hormosira* beds on locations 16 and 17
18	374567	6446256								Y	Y		Area of sulfidic grey sand with wormholes, approximately 6m x 12 m across
19	374538	6446307					Y					Y	Musseltop reef with *Hormosira* on Locations 19 and 20
20	374511	6446325				Y	Y						Musseltop reef with Hormosira on Locations 19 and 20
21	374527	6446358					Y						Areas of bare coffee-rock reef
22	374481	6446421							Y	Y	Y		Beach, small protruding rocks run north to next point, sulfidic areas with worms, approx 50m long near channel
23	374468	6446439							Y	Y	Y		Second sulfidic patch, occurring on megaripples intersecting northerly reef
24	374423	6446517					Y					Y	Exposed coffee-rock with musseltop surround along waterline
25	374437	6446536					Y					Y	Low reef seaward all musseltop, lots of patches of coffee rock, many *Bembicium* & *Nerita*
26	374456	6446563		Y									*Sarcocornia*
27	374465	6446572	Y	Y									*Suaeda* inland to mangroves & *Sclerostegia,* which start at GPS location

Table 11 - Intertidal zone observations

Figure 22 - Pinna bicolor in a rear reef pool

Figure 23 - Pebble crab and brown algae in rear reef pool

6.2 Benthic surface quadrats

Figure 24 - Benthic quadrat and core locations

To obtain baseline information on the inhabitants of the sand flats a transect was laid across the intertidal zone. At twenty (20) locations a quadrat was placed, and a record was made of the numbers of worm holes, snail trails, vegetation or visible animals.

Figure 25 - Shorebirds and protruding polychaete worm tubes

As with the observations recorded in the previous section, the presence of slightly hypoxic sediments was linked to apparently larger numbers of worm holes. The largest numbers of worm holes were located in quadrats nearer the centre of the sampling transects, while snail trails were located towards the edges of the transect.

Quadrat	Easting	Northing	Worm holes/m2	Snail trails/m2	Mussels/m2	Zostera presence	Ruppia presence	Comments
1	374462	6446431	0	0	0			Just bird dabbles & a half buried anemone nearby
2	374434	6446455	32	0	0			Sand black under the surface
3	374409	6446482	84	0	0			*Cymatiella leseuri* (Leseur's sand whelk) in quadrat, lives on intertidal reef & eats compound ascidians
4	374385	6446507	0	28	40			*Brachiodontes rostratus* (Beaked mussel) and *Austrococchlea constricta* (Ribbed top shell) on small rocks protruding through sand
5	374356	6446535	0	0	0	Yes		Very shelly under the surface rippled sand, small patches of *Zostera mucronata* protruding above sand on larger bars
6	374316	6446569	44	0	0	Yes	Yes	About 6% coverage with *Zostera mucronata* with small amounts of *Ruppia tuberosa* between *Zostera* tufts
7	374291	6446594	4	0	0	Yes	Yes	*Zostera mucronata* with small amounts of *Ruppia tuberosa* between *Zostera* tufts
8	374263	6446620	116	0	0			Sand soft, slightly greyish under the surface
9	374233	6446650	176	0	0			
10	374209	6446674	224	0	0			
11	374181	6446702	56	0	0			
12	374150	6446729	108	0	0			
13	374122	6446755	88	0	0			Small rock nearby with large beaked mussels (*Brachiodontes rostratus*)
14	374099	6446789	96	0	0			
15	374069	6446814	84	80	0			Many snail tracks, estimated number as they intersect and overlap
16	374039	6446838	40	12	0			Birds following the tide, further out
17	374010	6446867	32	0	0	Yes		Small lengths of *Zostera mucronata* protruding from the sand
18	373991	6446891	32	0	0			
19	373962	6446911	8	8	0			
20	373944	6446931	8	80	0			Many of the snail trails were short circular tracks, with a few longer tracks

Table 12 - Intertidal quadrats

6.3 Benthic cores

A benthic core of 500 cm^3 was extracted from under each of the twenty (20) quadrats, and returned to base for sieving and processing.

The benthic cores confirmed the surface observations, returning greater numbers of organisms in those cores taken from the centre of the transect line. The majority of the organisms were polychaete worms and peanut worms (sipunculids), however the cores also contained numbers of gastropods, bivalves, crustaceans and ribbon worms.

			Polychaetes		Gastropods							Bivalves	Sipunculids		Crustacea			Nemertea	**Total**
Core	Easting	Northing	*Olganereis edmondsi*	*Nephtys australiensis*	*Mitrella lincolnensis*	*Austrocochlea constricta*	*Clanculus plebejus*	*Diloma* sp.	Cerithiopsidae	*Batillaria* sp.	*Salinator* sp.	*Solemya australis*	*Phascolosoma nodulíferum*	*Themiste* sp.	Gammaridea sp. unk (1)	Gammaridea sp. unk (2)	Callianassidae sp. unk	Nemertea sp. unk	
1	374462	6446431	2																**2**
2	374434	6446455	3																**3**
3	374409	6446482	2																**2**
4	374385	6446507		4	1														**5**
5	374356	6446535		1			1												**2**
6	374316	6446569	1	2		2	1	1					1						**8**
7	374291	6446594		4					1										**5**
8	374263	6446620		3		1													**4**
9	374233	6446650		5									2	3					**10**
10	374209	6446674								1			3		2				**6**
11	374181	6446702		1									4		1	1			**7**
12	374150	6446729		2									1	2			1		**6**
13	374122	6446755		1									2						**3**
14	374099	6446789		1									4						**5**
15	374069	6446814		1															**1**
16	374039	6446838										1	1						**2**
17	374010	6446867		2									1						**3**
18	373991	6446891	1	4															**5**
19	373962	6446911	1	2							3	1						1	**8**
20	373944	6446931									2		1						**3**

Table 13 - Intertidal benthic cores

6.4 Intertidal species – ecological notes

The north western extremity of the site contains several reefs that form fish traps. From the headland it was possible to observe fish in these areas as the tide went out. Mullet, whiting and black finned rays were sighted in the shallows.

Amalgamated lists of all recorded fauna and flora of the intertidal zone, as well as notes on their ecological preferences, is presented in the following two tables.

Group	Species	Common name	Ecological preferences (MacPherson & Gabriel (1962), Shepherd & Thomas (1989), Hale (1976))
Polychaete worms	*Australonereis ehlersi*	Bait worm	Estuarine conditions, hunts from shelter of tough but limp sandy tube
	Galeolaria caespitosa	Tubeworms	On hard substrates such as coffee-rock and limestone
	Nephtys australiensis	A polychaete	Prefers muddy sand, burrows actively using pharynx, associated with seagrass beds
	Olganereis edmondsi	A polychaete	Lives in intertidal sandy areas in a gelatinous sandy tube, only recorded in SA
Gastropods	*Austrocochlea constricta*	Ribbed top shell	Variety of habitats on low to medium energy coastlines
	Batillaria sp.	Mud whelk	Sand and mud flats, feeds by crawling just under the surface
	Bembicium melanostomum	Dark mouthed conniwink	Prefers sheltered bays and mangrove swamps
	Cerithiopsidae	Little creeper	Almost microscopic small shells, no ecological details
	Clanculus plebejus	A clanculus	Littoral reefs in calm waters
	Cymatiella leseuri	Leseur's sand whelk	Intertidal reefs, eats anemones and ascidians
	Diloma sp.	A periwinkle	Rocks and weeds in littoral pools
	Lepsiella flindersi	Flinder's lepsiella	Found in association with *Galeolaria*, mussels and barnacles, its food source, on littoral reefs
	Mitrella lincolnensis	Dove shell	Found on algae or crawling on the surface in the shallows
	Nerita atramentosa	Black nerite	Littoral and supralittoral reefs
	Salinator sp.	Air breather, sand snail	Samphire and mangrove flats as well as back dune swamps
Bivalves	*Brachiodontes rostratus*	Beaked mussel	On "mussel-top" reefs in upper and mid littoral zone, small bivalve *Kellia australis* **always** associated (not observed)
	Katelysia scalarina	Stepped venerid	Sandy shores, lower littoral
	Ostrea sp.	Oyster	On rocky reefs, mid littoral
	Pinna bicolor	Razorfish	In soft sand
	Solemya australis	Southern date shell	Burrows in mud or sand in sublittoral zone
Sipunculids	*Phascolosoma noduliferum*	A peanut worm	In sand or embedded in *Galeolaria* colonies
	Themiste sp.	A peanut worm	Gut contents: sand, shell particles and marine plant detritus
Crustaceans	Callianassidae sp. unk	Sand borer shrimp	Muddy sand flats
	Gammaridea sp. unk (1)	Sea louse	Intertidal sand, detrital feeders
	Gammaridea sp. unk (2)	Sea louse	Intertidal sand, detrital feeders
	Philyra laevis	Pebble crab	Amongst brown algae in shallow pools
Nemertean worms	Nemertea sp. unk	Ribbon worm	Burrows in soft sediments of intertidal zone
Bryozoans	Unknown sp	Lace coral	In shallow back-reef pools

Table 14 - Intertidal fauna list, with ecological preferences

Phyla	Order	Family	Species	Common name	Comments
Cyanophyta			*Rivularia* sp.	Blue green colonies	Attached to rocks
Phaeophyta	Fucales	Cystoseiraceae	*Cystoseira trinodis*		Common in estuaries and sheltered rear-reef pools
			Scaberia agardhi		Cast specimen from deeper water
		Sargasaceae	prob *Sargassum verruculosum*		In sheltered rear-reef pools
		Hormosiraceae	*Hormosira banksii* forma *banksii*	Neptune's necklace	On sheltered platforms or musseltop reefs in sandy/muddy tidal flats
	Ectocarpales	Ectocarpaceae	Unknown species		In sheltered rear-reef pools
Rhodophyta	Cryptonemiales	Corallinaceae	Unknown species of coralline algae		On other macroalgae
Chlorophyta	Ulvales	Ulvaceae	*Enteromorpha intestinalis*	Green guts	On reefs and platforms
Magnoliophyta	Potamogetonales	Zosteraceae	*Zostera mucronata*	Eel grass	Sandy/muddy intertidal flats
			Zostera muelleri	Eel grass	Sandy/muddy intertidal flats
		Potamogetonaceae	*Ruppia tuberosa*	Sea tassels	Sandy/muddy intertidal flats

Table 15 - Intertidal flora list, with ecological preferences

6.4.1 Possible impacts in the intertidal zone

Impacts to the intertidal zone may result from developments that alter the geomorphic and hydrological aspects of the bay:

- the construction of a boating channel may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, drier and better oxygenated. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos, so this type of habitat change could be reflected by a change in the species of invertebrates occupying the benthos.
- where groynes meet the beach the newly formed ‘pockets’ may drain less well, and may accumulate seaweed and seagrass wrack. This could result in the sediments becoming softer, organically enriched and more hypoxic. If accumulation is minor, the benthos may become dominated by species that can tolerate such conditions. If accumulation is major, the rotting organics could produce hydrogen sulfide gases. This has ecological effects, as H_2S can cause the death of benthic organisms, and aesthetic/health effects on air quality.

7. Site usage history

7.1 Aerial photography review

Earliest aerial photography (Survey 49, 1950) covers only the southern portion of the study site. The south eastern part of Allotment 20, including the long sloping hill at the south-eastern corner of the study area, was cleared prior to 1950, with small stands of trees and shrubs remaining and leaving the current samphire shrub land uncleared. The main highway was constructed prior to 1950, although not sealed, and the samphire swamp on the claypan was probably cut off from the tide at this time.

Wood (2004) specifies that a midden is located in the sandhills north of the BP service station, and a burial ground is reputed to be located on the small ridge in the stranded saltmarsh, north of the current border checking station. Both of these areas are visible in this early photograph and show signs of disturbance, with narrow tracks leading to and around them.

By 1968 (Survey 1115) some form of mining was occurring on the south eastern corner of the study site. The Town Camp location was well serviced by tracks and there were several large trees in evidence. Some disturbance, in the form of a rectangular track, appears to be occurring along the old drainage channel from the saltmarsh. This is reputedly where a natural soak occurs. A track, or possibly a fenceline, runs diagonally across the stranded saltmarsh, from the south eastern hill slope. The northern part of Allotment 20 has a small pit, possibly mining of materials for road base. The trees on the ridge at the northern extremity of the stranded saltmarsh appear to be in good condition.

A small building is present on the northern block (Allotment 22), which is only partially cleared (mainly in the north) and contains good stands of trees. Section 197 shows evidence of tracks, and may be grazed, but has not apparently been cleared.

The 1972 photograph (Survey 1399) shows the entire site. Dumping of fill appears to be occurring along the old drainage channel from the saltmarsh. There are buildings where the roadhouse currently is located, and a building at the current location of the border checking post.

By 1979 (Survey 2401) some form of mining appears to be occurring in the sourthern part of Allotment 22. The south eastern corner of Allotment 20, adjacent to the pit, shows evidence of some type of light cultivation, possibly the placing of improved pasture. Further development of the road house is visible and there appears to be an extension of the filled area in the southernmost corner of the stranded saltmarsh.

Survey 4532, flown in 1992 is in colour. Continued expansion of the southern filled area is visible.

The photographs show that the most northerly and south easterly portions of the study area were cleared in the past, however the remainder of the site has only been either lightly cleared or not cleared but simply grazed. The portions of the block that were cleared are visible in the present vegetation associations as predominantly D3M: mid-dense tall sod grassland, F2S: open mid-high forbland and G2S: open tussock grassland.

7.2 Land tenure review

The study area is shown on the original diagram book drawing (attached in *Appendix VII – Diagram book*) as parts of the larger Sections 13 and 35, along with several pieces of coastal reserve. The land is now denominated as Allotment 22 DP 53902, Allotment 20 DP 55492, Allotment 593 FP 180625, Parts of Section 197, Parts of Section 265 and a portion of seabed.

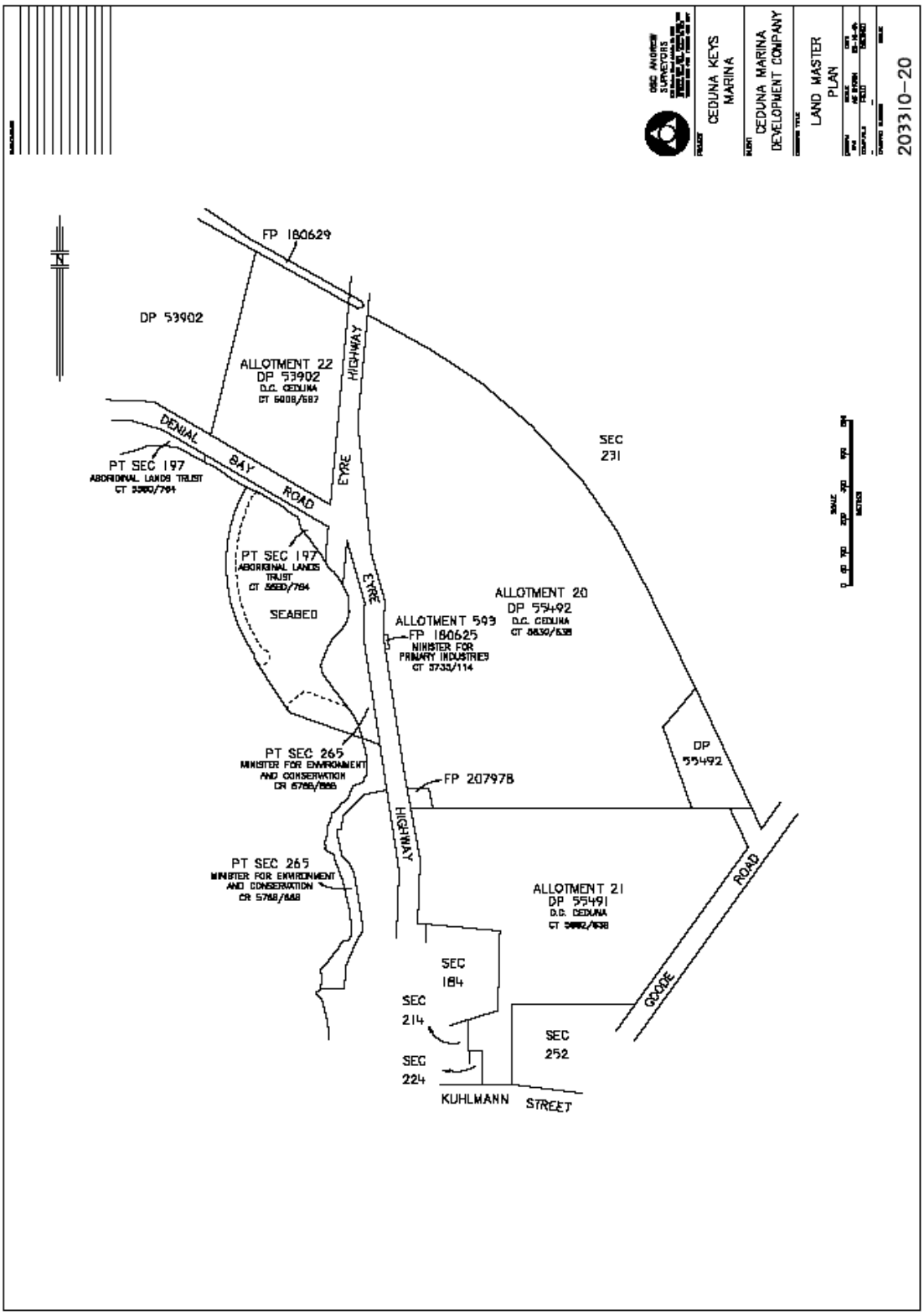


Figure 26 - Cadastral information on study area

7.2.1 Coastal reserve

The coastal reserve along the northern portion of the study site was deemed to be Section 197 in 1972 and granted as a land grant (LG 3969/65) to the Aboriginal Lands Trust. In 1980 it was leased to the Far West Aboriginal Progress Association for a term of 99 years. The lease was surrendered in 1991 and a new lease to the Yarilena Community Incorporated was issued, with an expiry date of 2016. In 1998 a new title (CT 5580/764) was issued.

The coastal reserve along the southern portion of the site was unallocated crown land until 2000 when a new Crown Record was created (CR 5768/868) and Section number 265 was allocated to the land. This land is under the care and control of the Minister for Environment and Conservation.

7.2.2 Section 35

Section 35, which included the land now forming Allotment 20 and the Town Camp, was held as an undated Miscellaneous lease by George Edward Fleetwood, farm labourer until 1903 when Act 830 of 1903 allowed for the creation of Perpetual Lease 11408. In 1928 the lease was transferred to Leo Bernhardt Hughes, farmer. In 1951 the land was transferred to Kenneth Allen Schiverz, also a farmer. Schirvarz partially surrendered the lease in 1963, and transferred portion of the lease to Eric Leslie Baumann in 1965.

In 1968 a new Crown Lease was issued, for all of Part 230, to Water Karl Obersen, service station owner. In 1969 the lease was transferred to Vytuatus Vincentas Patupas, road house proprietor, with the mortgage held by Water Karl Obersen.

In 1970 tile for the land was issued (CT 3684/191) with an encumbrance on it to ESSO Australia Pty Ltd, then was transferred to Water Karl Obersen and finally transferred to Maxwell Robert Christie, Branch Manager. In 1971 the title was apportioned between Vytuatus Vincentas Patupas and Maxwell Robert Christie.

In 1973 portions of the land were discharged from encumbrances, new titles were issued (CT's 4007/699, 4007/700, 4007/701 and 4007/702) and a portion was transferred to the Minister for Agriculture (CT 4007/698, replaced by CT 5735/114) for the border checking station.

In 1998, 4007/702 was reissued as CT 5657/128. In 2000 this title and the others forming Part 230 were amalgamated as CT 5830/129 (with the land now denominated as Allotment 20) and transferred to the District Council of Ceduna, with a caveat by Ceduna Marina Development Co Pty Ltd.

7.2.3 Section 13

Section 13 was a very large section, of which the current Allotment 22 is only a small part. In 1921 an agreement for sale was entered into, between the Commisioner of Crown Lands (George Laffer) and Walter Henry Sedgley and Harold Thomas Sedgley, farmers and graziers. In 1945 Harold Sedgley died. In 1952 Land Grant 2214/182 was issued to Walter Henry Sedgley, butcher and grazier. In 1957 the land was transferred to Ronald Alex Kies and in 1962 it was transferred to his widow, Viola Elsa Kies. Seven years later the land was sold

to Laurence Leopold and Erna Alvira Hoffrichter (farmers), with a caveat by the South Australian Railways Commissioner.
In 1970 the land was transferred to Gilbert Wilfred Anderson and Yvonne Cherie Anderson, who leased it back to the Hoffrichters as a 10 year lease. Yvonne Cherie Anderson transferred her moiety to Gilbert Wilfred Anderson in 1975. A portion of the land was transferred to South Australian Railways as CT 3683/100.

The land was divided in 1978, with portions being transferred to Richard Swinburne Jolly and Helen Fraser Fell (CTs 4139/17 and 4139/16), amongst others, while Gilbert Wilfred Anderson retained what was now Allotment 7 of Section 13, as CT 4139/23. Numerous railway easements were negotiated over the next few years, before the title was reissued as CT 4157/438 in 1980. In 2000 the title was computerised and reissued as CT 5491/351. The title was cancelled and transferred as a Crown Lease to the District Council of Ceduna. In 2003 a new title CT 5906/567 was issued to the District Council of Ceduna subject to 6 railway easements and a caveat by Ceduna Marina Development Co Pty Ltd.

A land tenure summary is attached to this report in *Appendix V – Land ownership summary*, and copies of the results of LTO searches are attached in *Appendix VI – Land tenure documents*.

8. Interaction with airport

The proposed development is located on a site that varies from between 2 and 4 kilometres from the Ceduna airport. Birds can pose a flight hazard near airports, and some sorts of developments may attract large numbers of birds. The twenty most dangerous birds, according to the Australian Transport Safety Bureau (2002) are the following:

Species	Number of strikes (1991-2001)	% resulting in damage to aircraft	% having effect on planned flight	Composite hazard ranking
Eagle	38	55.3	13.2	1
Ibis	39	41.0	17.9	2
Duck	52	26.9	19.2	3
Bat	72	25.0	13.9	4
Galah	154	17.5	14.9	5
Gull	136	15.4	3.7	6
Kite	90	14.4	4.4	7
Hawk	156	12.8	5.1	8
Pigeon	53	16.9	0	9
Owl	19	5.3	10.5	10
Lark	16	12.5	0	11
Starling	17	11.8	0	12
Magpie	117	5.1	5.9	13
Plover	143	6.9	2.8	14
Curlew	31	9.7	0	15
Peewee	18	0	5.6	16
Falcon	18	0	5.6	17
Swallow	66	4.6	0	18
Kestrel	92	1.1	0	19
Sparrow	38	0	0	20

N.B. Due to the nature of birdstrike reporting, general terms are often used to identify the species of bird struck. Therefore, a number of sub-species may be listed under the one common generic name.

Table 16 - Bird strike hazards (ASTB, 2002)

The main hazard appears to be confined to those larger birds that fly in open areas, or that flock. Developments that encourage the presence of ibis, ducks, galahs and gulls would appear to be the most likely to increase the risk of bird strike at an airport.

The existing site is an important wading bird site, and the proposed marina is not likely to increase the numbers of these birds. However, changed land use may attract other species in larger numbers.

Open areas of fresh and brackish (as opposed to saline) wetlands are likely to attract birds such as ducks, ibis and egrets. The evaporation rate at Ceduna is unlikely to permit the development of fresh to brackish wetlands in anywhere other than soaks or in infrastructure areas such as sewage treatment facilities. At Ceduna the town's sewage effluent ponds are located between the development and the airport, and increased numbers of houses and businesses will result in increased capacity requirements for the WWTP works. The expansion of the WWTP may result in a larger area of fresh water lagoons being available for ducks, ibis and egrets.

Galahs may be attracted to open parks and gardens if the grasses include weed species such as guildford grasses (*Romulea* spp.) and *Erodium* sp. (crane's and stork's bills). They also prefer areas where cover is kept less than 15 cm tall.

Open flat areas may provide roosting areas for gulls. Gulls are a particular problem as they are scavengers, and will move to new developments to scavenge from parks, bins, the outside of food processing plants and shopping centres. Gulls tend to be attracted to fishing vessels, and may be attracted to the marina if it is developed as a commercial fishing centre. Besides being attracted to the development itself, gulls may be attracted to the local support infrastructure. At Ceduna the rubbish tip is located between the proposed development and the airport, and increased numbers of houses and businesses will result in increased usage of the tip. Unless the expansion of the tip is managed carefully, larger exposures of waste may occur, and these may attract gulls.

9. Concluding summary

9.1 Current state of vegetation

Reassess the current state of vegetation on the non-tidal (terrestrial) subject area, and describe the possible impacts of any development on this vegetation.

The site has several morphological terrestrial vegetation units that occur from the landward edge of the intertidal zone, through salt pans, dunes and cheniers. These are represented in the map in *Appendix I – Vegetation associations*.

The plant associations in the surveyed morphological units are:

- **C1D:** Closed dwarf chenopod shrubland in the intertidal area, dominated by *Sarcocornia quinqueflora* and *Suaeda australis*. This habitat is in good condition and covers approximately 1.3 percent of the study area, or 2.4 hectares.

- **C2M:** Mid-dense low chenopod extratidal shrubland dominated by *Halosarcia pruinosa, H. pergranulata,* and *H. halocnemoides* often with *Hemichroa diandra* as a sub-dominant. This habitat is within the stranded saltmarsh and covers approximately 19.1 percent of the study area, or 34.5 hectares.
- **C3S:** Open mid-high chenopod shrubland dominated by *Atriplex* spp., *Maireana* spp. and/or *Frankenia* spp. often with an understorey of *Hemichroa diandra*. This habitat is within the stranded saltmarsh and covers approximately 11.2 percent of the study area, or 20.1 hectares.
- **C4D:** Closed tall chenopod shrubland in the supratidal area, dominated by *Sclerostegia arbuscula.* This habitat is in good condition and covers approximately 0.4 percent of the study area, or 0.6 hectares.
- **D3M:** Mid-dense tall sod grassland dominated by anthropogenic grasses. This habitat covers approximately 6.6 percent of the study area, or 12 hectares.
- **F2S:** Open mid-high forbland dominated by Ward's weed interspersed with scattered chenopods (*Sclerolaena* spp.and *Salsola* kali). This habitat is dominated by a weed that is indicative of overgrazing (Mitchell & Willcox, 1998) and covers approximately 3.1 percent of the study area, or 5.6 hectares.
- **G2S:** Open tussock grassland dominated by *Austrostipa* spp. and *Danthonia setacea*. This habitat covers approximately 11.2 percent of the study area, or 20.3 hectares.
- **S3S:** Open mid-high shrubland on dunes and shelly ridges with *Geijera linearifolia, Olearia* spp., *Acacia* spp. and *Pittosporum phylliraeiodes*. Isolated tall shrubs may occur in patches. The majority of this habitat is within the stranded saltmarsh and covers approximately 8.4 percent of the study area, or 15.1 hectares.
- **S3V:** Sparse mid-high shrubland dominated by *Olearia* spp., *Geijera linearifolia, Maireana* and *Cratystylis conocephala*. This habitat is in good condition and covers approximately 4.2 percent of the study area, or 7.5 hectares.
- **S41:** Isolated tall shrubs, usually *Melaleuca* spp. or *Acacia* spp. The majority of this habitat is within the stranded saltmarsh and covers approximately 3.9 percent of the study area, or 7.1 hectares.
- **S4D:** Closed coastal dune tall shrubland occurring along the primary dune, dominated by *Nitraria billardierei, Atriplex vesicaria* and *Cakile maritima*. While primary dune plants are dominated by early colonisers, this habitat is in good condition and covers approximately 2.5 percent of the study area, or 4.4 hectares.
- **T4V:** Open low mangrove woodland in the intertidal area (*Avicennia marina*) with a poor (typical for a mangal) understorey except where the woodland is prograding across the neighbouring low chenopod shrubbery. This habitat is in good condition and covers approximately 0.9 percent of the study area, or 1.6 hectares.
- **Y4L:** Isolated clumps of tall mallee shrub or other tall shrubs, usually *Eucalyptus gracilis, Eucalyptus calcareana* or *Melaleuca* spp. This habitat covers approximately 2 percent of the study area, or 3.6 hectares.

The vegetation association map also displays about 43 hectares of bare earth (either in the pan sections of the stranded saltmarsh or denuded areas of sand in the dunes and ridges), and some small patches of intertidal reef.

A review of historic aerial photography suggests that only the northern extremity and south eastern extremity of the site have been cleared. The remainder of the site has been grazed to varying extents.

Many of the shrubs along the western edge of the coastal strip north of the existing service station have been in existence for at least fifty years. The large dune itself has become steadily more vegetated over that time, but at least one large mallee is still in evidence today that predates the earliest photograph.

The long sloping hill at the south-eastern corner of the study area was cleared prior to 1950, and has been mined for sand or gravel. This block has excellent quantities of *Danthonia setacea* and several types of *Austrostipa* still existing between a heavy infestation of noxious and other weeds.

While much of the north-western block has been cleared, the southern portion of the northern block contains many large shrubs and mallees that can be identified in the 1968 photograph.

The coastal strip shows the gradual expansion of mangrove trees. The oldest mangroves are still in evidence in the earlier photographs, but the woodland is now both denser and more extensive than it was 36 years ago, as it is prograding across the intertidal saltmarsh.

The small dune east of the highway, just north of the border checking station has seen considerable growth of native vegetation in the denuded patch, however there are some older shrubs that are in evidence in early photographs – particularly towards the north of the dune and along its eastern boundary.

Dense *Sclerostegia arbuscula* mark the drainage channels through the stranded salt marsh. Although these shrubs do not attain great stature, they are a long lived species, making it quite possible that the individual shrubs present today have survived the changed conditions since the highway cut off tidal flushing.

The trees currently growing along the road reserve on the north-western boundary of the north eastern block are only just in evidence in the 1968 photograph, however the band of tall shrubs and low mallees located along the southerly base of the slope were already mature. The effects of off-road vehicles and mining are clearly visible in the centre of the more recent photograph. This impact is limited in area, with the dunes along the eastern boundary of the block being in good condition. Many of the larger shrubs on these dunes are visible in the early photograph.

9.2 Area of impact for vegetation

Calculate the relative area of each terrestrial and intertidal vegetation community type that may be lost, including a description of the condition and/or health of the vegetation. The layout plan of the current proposed development would be laid over this vegetation map to support this information.

The direct impact area of the proposed development, shown below, covers 81% of the site, with no area of the study site being more than 200m from the direct impact site. Those habitats occurring inside the outline are likely to be extirpated completely by residential development or the development of waterways. Those habitats occurring outside the outline may not be immediately impacted, but may be ultimately impacted by weed incursion (terrestrial habitats) or by hydrological/sedimentary process change (intertidal and supratidal habitats).

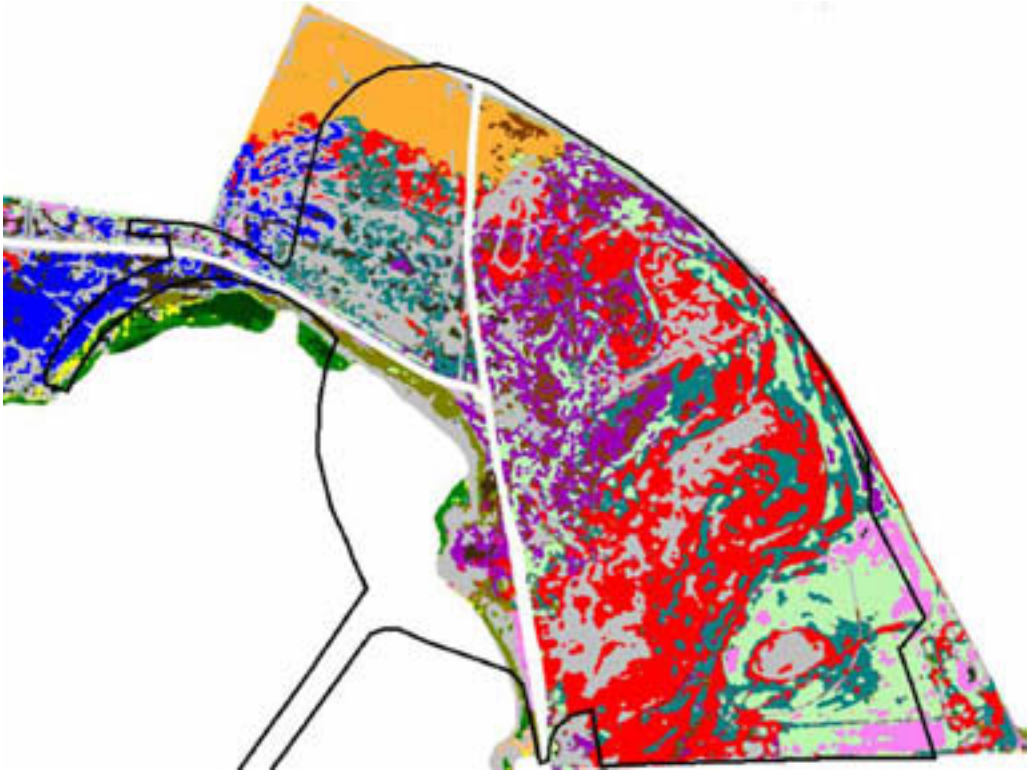


Figure 27 – Vegetation impact area

9.3 Flora that may trigger legislative response

Discuss any known flora species that occur in the area that may trigger the EPBC Act or state legislation.

Two species discovered to be present on the study site during this survey, *Ixiolaena pluriseta* and *Kippistia suaedifolia*, have conservation ratings.

Ixiolaena pluriseta (a plover daisy) has a rating of Rare for the State, and a status of Unknown for the Eyre Peninsula. According to Jessop and Toelken (1986) this species has only been collected from Smoky Bay to Fowler Bay, on the Nuyts Archipelago and one specimen from Nullabor Homestead. The plant is found principally on the calcareous sands of low coastal cliffs and the adjacent dunes. The specimens found in this survey were recorded in sampling quadrat 1, on sands overlying a low rocky clifftop.

Kippistia suaedifolia (fleshy miniura) has a rating of Rare for the Eyre Peninsula. It prefers to grow on sandhills, claypans, limestone and gypsum, and was recorded during this survey in quadrat 20, on the crest of the sandpit and within the pit itself.

Previous surveys (EMS, 2004) reported several other species with conservation significance or interest. *Maireana aphylla*, with conservation interest due to its status of Uncommon on the Eyre Peninsula, was not recorded during this survey, although seven other species of *Maireana* were found. The EMS survey noted that these plants were mainly located in the golf course roughs, and this more recent survey did not visit the golf course.

Trailing hemichroa (*Hemichroa pentandra*) with a rating of Rare for the Eyre Peninsula was not recorded in this survey, although its close relative *Hemichroa diandra* was a co-dominant in many of the quadrats surveyed. The EMS survey noted that the plants were not flowering during their survey. As the two species can be separated most reliably by examining the anthers of the flowers, it is possible that the earlier records were an estimate of the species, rather than a determination.

9.4 Fauna that may trigger legislative response

Discuss any known fauna species that occur in the area that may trigger the EPBC Act or state legislation, and complete appropriate fauna assessments to fill in knowledge gaps to allow a detailed assessment.

Murat Bay is recognised by Birds Australia as a significant wading bird site, and they have conducted wader counts there in 1984 and 2000. The results of those counts is presented in the table following, and includes 15 species of conservation significance ranging from regional to national interest. Additionally the table records that Murat Bay is considered a significant site (either nationally or internationally) for several species – the Ruddy turnstone, Sooty oystercatcher and Grey plover.

Common Name	*Species name*	Murat Bay Wader Count (2000)	Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Bar-tailed Godwit	*Limosa limosa*	26		EPBC Act
Eastern Curlew	*Numenius madagascariensis*	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Common Greenshank	*Tringa nebularia*	46		EPBC Act
Common Sandpiper	*Actitis hypoleucos*	3		EPBC Act
Grey-tailed Tattler	*Heteroscelis brevipes*	6		EPBC Act
Ruddy Turnstone	*Arenaria interpres*	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red Knot	*Calidris canutus*	38		EPBC Act
Red-necked Stint	*Calidris ruficollis*	913		EPBC Act
Sharp-tailed Sandpiper	*Calidris acuminata*	271		EPBC Act
Curlew Sandpiper	*Calidris ferruginea*	144		EPBC Act
Pied Oystercatcher	*Haematopus longirostris*	29		
Sooty Oystercatcher	*Haematopus fuliginosus*	107	163	Site of international importance according to

Grey Plover	*Pluvialis squatarola*	81	123	National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia. Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Red-capped Plover	*Charadrius ruficapillus*	79		EPBC Act
Banded Lapwing	*Vanellus ticolor*	238		EPBC Act
Masked Lapwing	*Vanellus miles*	6		EPBC Act

Table 17 - Birds Australia wader counts, Murat Bay

Waders harvest food from the tidal flats. Each bird species has a particular preference – those with heavy beaks, such as Oystercatchers, can split open bivalve shells and would use the mussel top reefs as their major food source. Others, with more slender beaks, probe the sand flats for polychaete worms, sipunculids or small crustaceans. Those with longer beaks are able to obtain organisms that move deep within the sand, while the shorter beaked birds are restricted to those organisms that live close to the surface. These specific ecological preferences mean that the impacts of any development will vary, depending on the species involved.

While on site, Delta staff recorded two other non-wading species that are listed under the *EPBC Act* – the Black kite and the Nankeen kestrel.

Possible impacts on wading birds could include:

- the construction of a boating channel and groynes may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, while other areas may drain less well (the newly formed 'pockets' where the groynes meet the beach) and therefore may become hypoxic. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos. This has implications on the availability of appropriate food sources for migratory waders,
- the increased usage of the sand flats as boats enter and leave the marina may disturb the more sensitive species of birds, and
- the *Sclerostegia arbuscula* chenopod shrubland present in the stranded dissected salt marsh currently provides habitat for many small birds such as Thornbills and Chats, and these birds do not utilise deep waterways as habitat.

No other species of fauna that have legislated environmental significance were recorded on the site during the site visit.

9.5 Baseline intertidal flora and fauna data

Establish a good baseline level of data related to intertidal flora and fauna, using a repeatable methodology that will allow identification of impacts post-development. Plants and animals growing or living in the intertidal zone should be collected and identified to species level if possible. All methodologies should be documented so that the surveys could be replicated by other organizations if required.

A survey of intertidal flora and fauna was conducted on the site, incorporating observations, surface quadrats and benthic cores. The methodology and data from these surveys in included

in the body of this report, in *Section 6 – Intertidal flora and fauna*. Summary lists have also been prepared, showing the species of flora and fauna recorded, and their ecological preferences.

Impacts to the intertidal zone may result from developments that alter the geomorphic and hydrological aspects of the bay:

- the construction of a boating channel may alter the flushing and draining patterns of the sand flats, resulting in some areas becoming better drained (near the deep channel) and therefore firmer, drier and better oxygenated. The texture of the sand flats is quite likely a determining factor in which species of invertebrates inhabit the benthos, so this type of habitat change could be reflected by a change in the species of invertebrates occupying the benthos.
- where groynes meet the beach the newly formed 'pockets' may drain less well, and may accumulate seaweed and seagrass wrack. This could result in the sediments becoming softer, organically enriched and more hypoxic. If accumulation is minor, the benthos may become dominated by species that can tolerate such conditions. If accumulation is major, the rotting organics could produce hydrogen sulfide gases. This has ecological effects, as H_2S can cause the death of benthic organisms, and aesthetic/health effects on air quality.

9.6 Birds risk to airports

Assess any risk that large birds attracted to the site may pose to the nearby airport, including an assessment of current bird usage of the site.

Open flat areas may provide roosting areas for gulls. Gulls are a particular problem as they are scavengers, and will move to new developments to scavenge from parks, bins, the outside of food processing plants and shopping centres. Gulls tend to be attracted to fishing vessels, and may be attracted to the marina if it is developed as a commercial fishing centre. Besides being attracted to the development itself, gulls may be attracted to the local support infrastructure. At Ceduna the rubbish tip is located between the proposed development and the airport, and increased numbers of houses and businesses will result in increased usage of the tip. Unless the expansion of the tip is managed carefully, larger exposures of waste may occur, and these may attract gulls.

Expansion of the WWTP may result in a larger area of fresh water lagoons being available for ducks, ibis and egrets.

Galahs may be attracted to open parks and gardens if the grasses include weed species such as guildford grasses (*Romulea* spp.) and *Erodium* sp. (crane's and stork's bills). They also prefer areas where cover is kept less than 15 cm tall.

10. References

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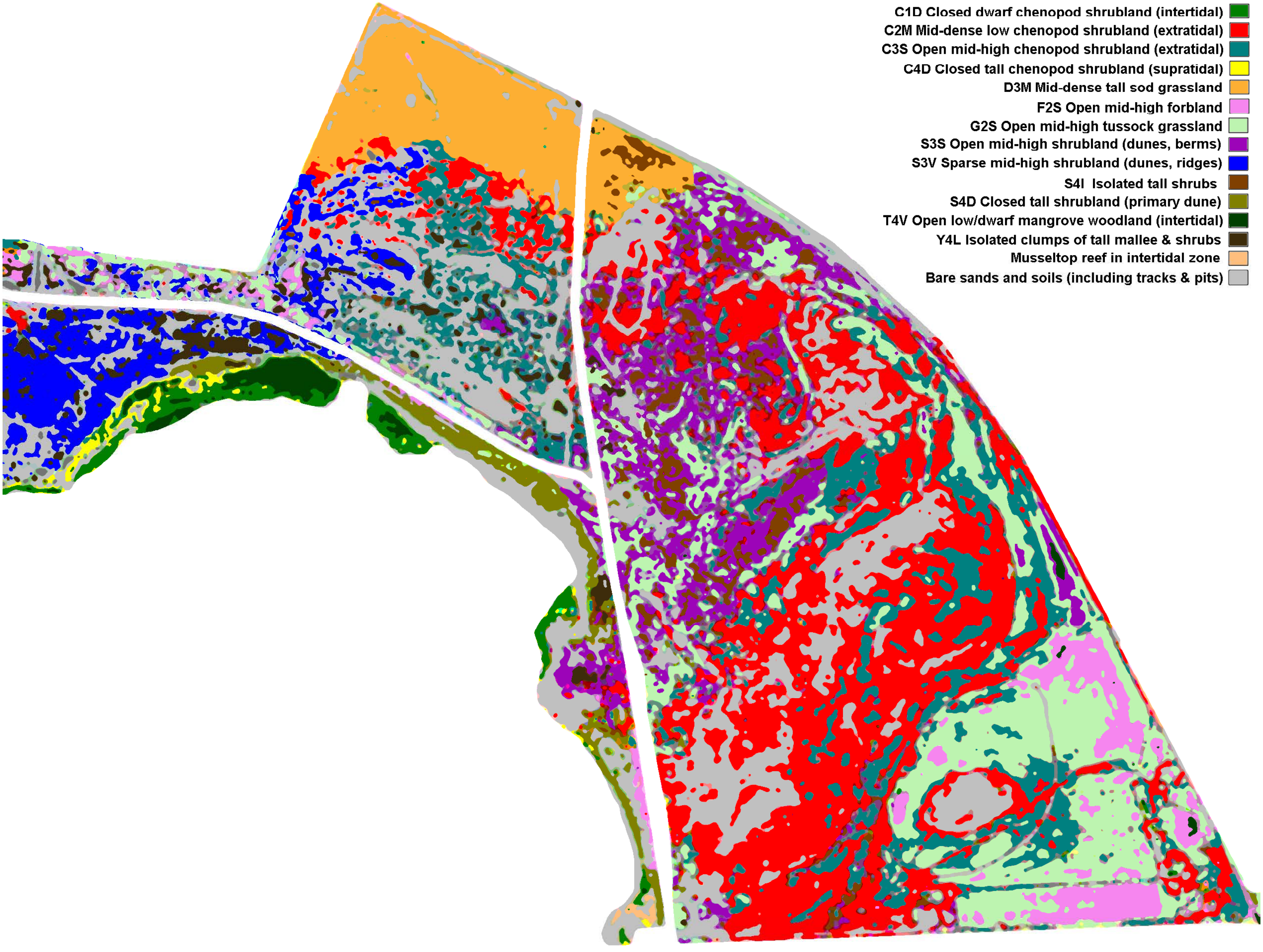
11. Appendices

Appendix I – Vegetation associations

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers


C1D Closed dwarf chenopod shrubland (intertidal)
C2M Mid-dense low chenopod shrubland (extratidal)
C3S Open mid-high chenopod shrubland (extratidal)
C4D Closed tall chenopod shrubland (supratidal)
D3M Mid-dense tall sod grassland
F2S Open mid-high forbland
G2S Open mid-high tussock grassland
S3S Open mid-high shrubland (dunes, berms)
S3V Sparse mid-high shrubland (dunes, ridges)
S4I Isolated tall shrubs
S4D Closed tall shrubland (primary dune)
T4V Open low/dwarf mangrove woodland (intertidal)
Y4L Isolated clumps of tall mallee & shrubs
Musseltop reef in intertidal zone
Bare sands and soils (including tracks & pits)

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix II – Collection permit

Department for Environment and Heritage
Science and Conservation Directorate
Research Permits Section
GPO Box 1047, Adelaide 5001 SA
1 Richmond Road, Keswick 5035 SA (Telephone 08 8124 4700 Fax 08 8124 4719)

YOU MUST CONTACT THE APPROPRIATE REGIONAL STAFF MEMBER BEFORE CONDUCTING FIELD WORK
PLEASE CARRY THIS PERMIT WHEN CONDUCTING RESEARCH

The SA Department for Environment and Heritage encourages scientific research both within the State's system of conservation reserves and on our protected native plants and animals. It is only through increased scientific understanding that we can develop a soundly based system of conservation management for the State.

In carrying out such research projects, you should be conscious that you are manipulating a part of Australia's natural heritage and this carries certain responsibilities. Some of the more obvious responsibilities are outlined under the standard conditions listed below. In addition the Department requires you to always conduct your research project in such a way as to have the smallest possible impact on the natural environment.

The Department for Environment and Heritage trust that this research project will be successful and looks forward to receiving a report of the results in due course.

Permit to Undertake Scientific Research

Title ***Ceduna Keys Marina flora survey***

This permit is valid from **21/10/2004** to **30/11/2004** unless cancelled or revoked.

PERMIT CONDITIONS

The permit is issued subject to the following conditions

1. The permit does not authorise the collection of specimens from private property without the written consent of the landowner granted not more than six months beforehand.
2. The Ranger-in-Charge of parks listed in the permit shall be notified beforehand of the exact dates on which research will be undertaken within approved reserves. Details of any vehicles to be used in field work should also be provided. If, for some reason, dates are changed, the Ranger-in-Charge must be advised accordingly. For research in remote areas, the Ranger-in-Charge must be notified at least 14 days in advance of visiting the area.
3. Upon arrival in a reserve attended by a resident Ranger, the permit shall be shown to the Ranger before research is undertaken.
4. Samples collected shall be limited in size and taken where they will cause the least disfigurement or disturbance.
5. The number of specimens of any one species which may be taken is limited to the number specified in the permit, or where the number is not stated to the minimum required for the approved scientific research.
6. You as the permit holder are responsible for the actions of other persons who may undertake this research or collect spe cimens on your behalf.
7. Specimens collected shall not be exported from this State without the consent of the Director, National Parks and Wildlife.
8. Specimens or the progeny and carcasses of animals taken under the permit may not be sold or transferred without the written consent of the Director, National Parks and Wildlife and all such specimens shall be disposed of in the manner specified in this permit at the termination of the permit or a time specified by the Director.
9. Upon completion of the research, all equipment shall be removed from the reserve, unless specific approval to the contrary has been obtained.
10. Within 14 days of the expiration of the permit, the Director, National Parks and Wildlife must be given a full report (marked 'Attention : Research Permit Section"), including all collection data, on the research carried out under the permit. Numbers and locations of all specimens collected must be supplied, together with a progress report if the project is not complete.
11. If an account of the research is published, or information circulated, a copy of the account or information shall be lodged with the Research Permit Section, within 28 days of its publication or circulation.
12. Any permits involving research on vertebrates will require the approval of an official South Australian Animal Experimentation Ethics Committee as a condition of this permit.
13. When planning and conducting your research, please be aware that your work may intrude on locations or involve species with cultural significance to local Aboriginal communities. As part of your project planning it would be a courtesy, and in some cases a requirement, to consult with local Aboriginal representatives to determine any potential impacts and the means of avoiding or limiting them.
14. This permit will cease to have effect upon a determination that native title exists in any of the lands or waters covered by this permit to the extent that such determination affects those lands or waters.

Permit Holder

Ms PSJ Coleman
Delta Environmental Consulting 12 Beach Rd
ST KILDA 5110 SA

PERMIT NO

Z24911 1

..... Signature of Permit Holder

..... John Hill, MP
MINISTER FOR ENVIRONMENT AND CONSERVATION

Additional Condtions:

GENERAL FLORA SURVEYS
Plant specimens are to be collected when validating a field identification, when a field identification cannot be reliably made, or if the specimen constitutes a new park species record, a significant range extension or an unusual form.

Advice on species likely to fall within these criteria, and recommended number of specimens is to be obtained from the appropriate specialist (eg from the Biodiversity Survey and Monitoring Section, Department for Environment and Heritage or the Plant Biodiversity Centre (State Herbarium). If such advice is not available then the specimen should be the minimum required to authenticate the record, ie one representative plant voucher specimen (representative is taken to mean a sample that includes foliage, flowers, fruits etc of sufficient quantity to meet State Herbarium standards).

In any case no more than ten percent of the visible local population (within an area of continuous habitat) is to be collected.

Collections of plant species classified as endangered, vulnerable or rare under the National Parks and Wildlife Act (SA) 1972, are to be kept to the minimum required to authenticate the record. Collection of additional material from these species must be anticipated prior to collection and specific approval sought.

MINIMUM DATASET
Researchers must collect at least a minimum set of data when carrying out biological studies under a Scientific Permit. The NPWSA Biodiversity Survey and Monitoring Group (BSM) has prepared guidelines, 'Scientific Permit Minimum Dataset', to ensure that the information collected is accurate, comprehensive and has relevance beyond the confines of the project for which it may have been originally intended.

Unless the recommended minimum dataset is collected, the information may be useless and is unlikely to be acceptable for addition into recognised, statewide, environmental databases (eg : DEH Environmental databases of SA (ESDA), South Australian Museum or Plant Biodiversity Centre). It is the responsibility of all researchers to maximise the use of the information they collect. This is especially important where studies involve the handling of and interaction with animals, and the collection of plant and animal specimens.

Specimen:

NSXCODE:

SPECIMEN: All plant species encountered: representative voucher specimens.

NUMBERSIZE: Minimum required.

LOCALITY: Ceduna Keys Marina area.

Notes:
Disposition:

Vouchers will be lodged with the State Herbarium and with the client.

Affiliates

Faith Cook, Renae Eden, Jennifer Larter, all of Delta Environmental Consulting, 12 Beach Road, St Kilda SA 5110.

Please contact these offices when using this Permit:

Far West 11 McKenzie St CEDUNA (08) 8625 3144

Appendix III – Flora voucher specimens

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Ceduna field data Permit: Z24911 1 Delta code: PSC_EMS_11/04

Datum: Aust Geod 84 GPS Zone: 53H GPS accuracy 4m

Location number	Voucher prefix	Voucher number	Date collected	Collector	Easting	Northing	Family	Species	Common name	Exotic	Conservation status
1	PSC_EMS_11/04	1	24/11/2004	COOF/COLP	373559	6446895	Pittosporaceae	*Pittosporum phylliraeoides*	Native apricot		
	PSC_EMS_11/04	2	24/11/2004	COOF/COLP	373559	6446895	Rutaceae	*Geijera linearifolia*	Sheepbush, oil bush or wilga		
	PSC_EMS_11/04	3	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Austrostipa flavescens*	A spear-grass		
	PSC_EMS_11/04	4	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Carpobrotus rossii*	Karkalla or Ross' noonflower		
	PSC_EMS_11/04	5	24/11/2004	COOF/COLP	373559	6446895	Myrtaceae	*Melaleuca lanceolata*	Moonah		
	PSC_EMS_11/04	6	24/11/2004	COOF/COLP	373559	6446895	Liliaceae	*Dianella brevicaulis*	Short fruited black anther flax- lily		
	PSC_EMS_11/04	7	24/11/2004	COOF/COLP	373559	6446895	Epacridaceae	*Acrotriche patula*	Shiny ground berry		
	PSC_EMS_11/04	8	24/11/2004	COOF/COLP	373559	6446895	Primulaceae	*Anagallis arvensis*	Blue flowered pimpernel	*	
	PSC_EMS_11/04	9	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex vesicaria*	Bladder saltbush		
	PSC_EMS_11/04	10	24/11/2004	COOF/COLP	373559	6446895	Labiatae	*Westringia rigida*	Stiff westringia		
	PSC_EMS_11/04	11	24/11/2004	COOF/COLP	373559	6446895	Iridaceae	*Gynandriris setifolia*	Thread Iris	*	
	PSC_EMS_11/04	12	24/11/2004	COOF/COLP	373559	6446895	Cruciferae	*Brassica tournefortii*	Long fruited wild turnip	*	
	PSC_EMS_11/04	13	24/11/2004	COOF/COLP	373559	6446895	Caryophyllaceae	*Silene nocturna*	Mediterranean catchfly	*	
	PSC_EMS_11/04	14	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Danthonia setacea* var *setacea*	Bristly, or small flowered, or mulga wallaby grass		
	PSC_EMS_11/04	15	24/11/2004	COOF/COLP	373559	6446895	Zygophyllaceae	*Nitraria billardierei*	Dillon berry or nitre bush		
	PSC_EMS_11/04	16	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Enchylaena tomentosa*	Ruby saltbush		
	PSC_EMS_11/04	17	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Reichardia tingitana*	False sow thistle	*	
	PSC_EMS_11/04	18	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Centaurea melitensis*	Maltese cockspur	*	
	PSC_EMS_11/04	19	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Threlkeldia diffusa*	Coast bone fruit		
	PSC_EMS_11/04	20	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Tribolium acutiflora*	Desmazeria	*	
	PSC_EMS_11/04	21	24/11/2004	COOF/COLP	373559	6446895	Gramineae	*Festuca littoralis*	Coastal fescue		
	PSC_EMS_11/04	22	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Olearia exiguifolia*	Small-leaved daisy-bush		
	PSC_EMS_11/04	23	24/11/2004	COOF/COLP	373559	6446895	Zygophyllaceae	*Zygophyllum billardierei*	Coast twinleaf		
	PSC_EMS_11/04	24	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Tetragonia implexicoma*	Bower spinach		
	PSC_EMS_11/04	25	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Ixiolaena pluriseta*	A plover daisy		Rare in SA, Unknown for EP
	PSC_EMS_11/04	26	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Cratystylis conocephala*	Bluebush daisy		
	PSC_EMS_11/04	27	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex vesicaria* var *variablis*	Bladder saltbush		
	PSC_EMS_11/04	28	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Atriplex cinerea*	Coast saltbush		
	PSC_EMS_11/04	29	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Sarcocornia quinqueflora*	Bearded glasswort		
	PSC_EMS_11/04	30	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Suaeda australis*	Austral sea-blite		
	PSC_EMS_11/04	31	24/11/2004	COOF/COLP	373559	6446895	Liliaceae	*Dianella revoluta*	Black anther flax lily		
	PSC_EMS_11/04	32	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
	PSC_EMS_11/04	33	24/11/2004	COOF/COLP	373559	6446895	Aizoaceae	*Mesembryanthum crystallinum*	Common iceplant	*	
	PSC_EMS_11/04	34	24/11/2004	COOF/COLP	373559	6446895	Compositae	*Olearia axillaris*	Coast daisy bush		
	PSC_EMS_11/04	35	24/11/2004	COOF/COLP	373559	6446895	Santalaceae	*Exocarpos aphyllus*	Leafless cherry		
	PSC_EMS_11/04	36	24/11/2004	COOF/COLP	373559	6446895	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
	PSC_EMS_11/04	37	24/11/2004	COOF/COLP	373559	6446895	Chenopodiaceae	*Rhagodia candolleana*	Seaberry saltbush		
2	PSC_EMS_11/04	38	24/11/2004	COOF/COLP	373545	6446976	Compositae	*Angianthus tomentosus*	Hairy cup flower		
	PSC_EMS_11/04	39	24/11/2004	COOF/COLP	373545	6446976	Frankeniaceae	*Frankenia pauciflora*	Sea heath		
3	PSC_EMS_11/04	40	24/11/2004	COOF/COLP	373642	6446967	Amaranthaceae	*Hemichroa diandra*	Mallee hemichroa		
	PSC_EMS_11/04	41	24/11/2004	COOF/COLP	373642	6446967	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby samphire		
	PSC_EMS_11/04	42	24/11/2004	COOF/COLP	373642	6446967	Avicenniaceae	*Avicennia marina*	Grey mangrove		
	PSC_EMS_11/04	43	24/11/2004	COOF/COLP	373642	6446967	Chenopodiaceae	*Sclerolaena uniflora*	Bassia		
	PSC_EMS_11/04	44	24/11/2004	COOF/COLP	373642	6446967	Compositae	*Senecio lautus*	Variable groundsel		
	PSC_EMS_11/04	45	24/11/2004	COOF/COLP	373642	6446967	Umbelliferae	*Bupleurum semicompositum*	Bupleurum	*	
4	PSC_EMS_11/04	46	24/11/2004	COOF/COLP	373685	6447023	Chenopodiaceae	*Atriplex vesicaria* (male specimen)	Bladder saltbush		
	PSC_EMS_11/04	47	24/11/2004	COOF/COLP	373685	6447023	Leguminosae	*Acacia anceps*	Port Lincoln wattle		
	PSC_EMS_11/04	48	24/11/2004	COOF/COLP	373685	6447023	Crassulaceae	*Crassula sieberana* var *tetramera*	Austral stonecrop		
	PSC_EMS_11/04	49	24/11/2004	COOF/COLP	373685	6447023	Aizoaceae	*Disphyma crassifolium*	Round leaf pigface		
5	PSC_EMS_11/04	50	24/11/2004	COOF/COLP	373966	6447103	Limoniaceae	*Limonium sinuatum*	Notch leaved perennial sea lavender	*	
	PSC_EMS_11/04	51	24/11/2004	COOF/COLP	373966	6447103	Chenopodiaceae	*Maireana oppositifolia*	Heathy bluebush		
6	PSC_EMS_11/04	52	24/11/2004	COOF/COLP	374218	6447023	Cruciferae	*Cakile maritima*	Sea rocket	*	
	PSC_EMS_11/04	53	24/11/2004	COOF/COLP	374218	6447023	Gramineae	*Avena barbata*	Bearded oat	*	
	PSC_EMS_11/04	54	24/11/2004	COOF/COLP	374218	6447023	Solanaceae	*Lycium ferocissimum*	African boxthorn	*	
	PSC_EMS_11/04	55	24/11/2004	COOF/COLP	374218	6447023	Chenopodiaceae	*Salsola kali*	Buckbush rolypoly	*	
7	PSC_EMS_11/04	56	24/11/2004	COOF/COLP	374479	6446876	Cruciferae	*Diplotaxis tenuifolia*	Lincoln weed	*	
	PSC_EMS_11/04	57	24/11/2004	COOF/COLP	374479	6446876	Chenopodiaceae	*Maireana brevifolia*	Small-leaved bluebush		
	PSC_EMS_11/04	58	24/11/2004	COOF/COLP	374479	6446876	Liliaceae	*Asphodelus fistulosus*	Onion weed	*	
	PSC_EMS_11/04	59	24/11/2004	COOF/COLP	374479	6446876	Cruciferae	*Carrichtera annua*	Ward's weed or duck-bill burr	*	
8	PSC_EMS_11/04	60	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Parafolis incurva*	Curly rye	*	
	PSC_EMS_11/04	61	24/11/2004	COOF/COLP	374642	6446093	Leguminosae	*Templetonia retusa*	Cockie's tongue		
	PSC_EMS_11/04	62	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Lolium perenne*	Perennial ryegrass	*	
	PSC_EMS_11/04	63	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Cynodon dactylon*	Couch grass		
	PSC_EMS_11/04	64	24/11/2004	COOF/COLP	374642	6446093	Compositae	*Gazania linearis*	Gazania	*	
	PSC_EMS_11/04	65	24/11/2004	COOF/COLP	374642	6446093	Myoporaceae	*Myoporum insulare*	Boobialla		
	PSC_EMS_11/04	66	24/11/2004	COOF/COLP	374642	6446093	Leguminosae	*Medicago polymorpha*	Burr medic	*	
	PSC_EMS_11/04	67	24/11/2004	COOF/COLP	374642	6446093	Gramineae	*Bromus catharticus*	Prairie grass	*	
	PSC_EMS_11/04	68	24/11/2004	COOF/COLP	374642	6446093	Umbelliferae	*Foeniculum vulgare*	Fennel	*	
	PSC_EMS_11/04	69	24/11/2004	COOF/COLP	374642	6446093	Compositae	*Helianthus annuus*	Common sunflower	*	
	PSC_EMS_11/04	70	24/11/2004	COOF/COLP	374642	6446093	Agavaceae	*Agave americana*	Century plant	*	
	PSC_EMS_11/04	71	24/11/2004	COOF/COLP	374642	6446093	Euphorbiaceae	*Euphorbia terracina*	Carnation weed, false caper	*	
	PSC_EMS_11/04	72	24/11/2004	COOF/COLP	374642	6446093	Aizoaceae	*Galenia secunda*	Blanket weed	*	
9	PSC_EMS_11/04	73	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Bromus rigidus*	Rigid brome	*	
	PSC_EMS_11/04	74	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	75	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	76	24/11/2004	COOF/COLP	374634	644389	Compositae	*Hedypnois rhagadioloides*	Cretan weed	*	
	PSC_EMS_11/04	77	24/11/2004	COOF/COLP	374634	644389	Compositae	*Arctotheca calendula*	Cape weed	*	
	PSC_EMS_11/04	78	24/11/2004	COOF/COLP	374634	644389	Limoniaceae	*Limonium companyonis*	Sea lavender	*	
10	PSC_EMS_11/04	79	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Polypogon monspeliensis*	Annual beard-grass	*	
	PSC_EMS_11/04	80	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Critesion murinum*	Barley grass	*	
	PSC_EMS_11/04	81	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
	PSC_EMS_11/04	82	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Sclerolaena brevifolia* poss. hybrid with *S. oi*	A copperburr or bindyii		
	PSC_EMS_11/04	83	24/11/2004	COOF/COLP	374634	644389	Labiatae	*Marrubium vulgare*	Horehound	*	
	PSC_EMS_11/04	84	24/11/2004	COOF/COLP	374634	644389	Compositae	*Vittadinia cervicularis*	Fuzzweed		
	PSC_EMS_11/04	85	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Maireana appressa/radiata*	A cotton bush with no fruit		
	PSC_EMS_11/04	86	24/11/2004	COOF/COLP	374634	644389	Gramineae	*Austrostipa eremophila*	Desert spear-grass		
	PSC_EMS_11/04	87	24/11/2004	COOF/COLP	374634	644389	Compositae	*Sonchus oleraceus*	Common sow thistle	*	
	PSC_EMS_11/04	88	24/11/2004	COOF/COLP	374634	644389	Aizoaceae	*Mesembryanthemum nodosum*	Slender iceplant	*	
	PSC_EMS_11/04	89	24/11/2004	COOF/COLP	374634	644389	Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
	PSC_EMS_11/04	90	24/11/2004	COOF/COLP	374634	644389	Aizoaceae	*Galenia secunda*	Blanket weed	*	
	PSC_EMS_11/04	91	24/11/2004	COOF/COLP	374634	644389	Leguminosae	*Acacia cyclops*	Western coastal wattle		
	PSC_EMS_11/04	92	24/11/2004	COOF/COLP	374634	644389	Sapindaceae	*Dodonaea stenozyga*	Desert hopbush		
	PSC_EMS_11/04	93	24/11/2004	COOF/COLP	374634	644389	Boraginaceae	*Heliotropium europaeum*	Potato weed	*	
11	PSC_EMS_11/04	94	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pergranulata* var *pergranulata*	Black seed samphire		
	PSC_EMS_11/04	95	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	96	24/11/2004	COOF/COLP	374692	6446381	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
12	PSC_EMS_11/04	97	24/11/2004	COOF/COLP	374767	6446445	Caryophyllaceae	*Spergularia marina*	Salt sand-spurry	*	
13	PSC_EMS_11/04	98	24/11/2004	COOF/COLP	375003	6446651	Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
14	PSC_EMS_11/04	99	24/11/2004	COOF/COLP	375058	6446671	Frankeniaceae	*Frankenia sessilis*	Small leaved sea heath		
15	PSC_EMS_11/04	100	24/11/2004	COOF/COLP	375154	6446626	Chenopodiaceae	*Halosarcia halocnemoides*	Grey samphire		
16	PSC_EMS_11/04	101	24/11/2004	COOF/COLP	375272	6446858	Chenopodiaceae	*Sclerolaena uniflora*	Bassia		

	PSC_EMS_11/04	102	24/11/2004	COOF/COLP	375272	6446858	Solanaceae	*Lycium australe*	Australian boxthorn		
17	PSC_EMS_11/04	103	24/11/2004	COOF/COLP	375266	6446935	Goodeniaceae	*Scaevola spinescens*	Spiny fanflower		
18	PSC_EMS_11/04	104	24/11/2004	COOF/COLP	374963	6446834	Myoporaceae	*Eremophila glabra*	Tar bush		
	PSC_EMS_11/04	105	24/11/2004	COOF/COLP	374963	6446834	Compositae	*Vittadinia cuneata*	Fuzzweed		
	PSC_EMS_11/04	106	24/11/2004	COOF/COLP	374963	6446834	Caryophyllaceae	*Silene gallica*	French catchfly	*	
	PSC_EMS_11/04	107	24/11/2004	COOF/COLP	374963	6446834	Iridaceae	*Romulea minutiflora*	Guildford grass	*	
19	PSC_EMS_11/04	108	25/11/2004	COOF/COLP	375228	644637O	Amaranthaceae	*Ptilotus obovatus* var *obovatus*	Silver mulla mulla		
	PSC_EMS_11/04	109	25/11/2004	COOF/COLP	375228	644637O	Chenopodiaceae	*Atriplex paludosa* ssp. *cordata*	Marsh saltbush		
	PSC_EMS_11/04	110	25/11/2004	COOF/COLP	375228	644637O	Chenopodiaceae	*Maireana scleroptera*	A maireana		
20	PSC_EMS_11/04	111	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Maireana trichoptera*	A bluebush		
	PSC_EMS_11/04	112	25/11/2004	COOF/COLP	375240	6446324	Compositae	*Kippistia suaedifolia*	Kippistia		Rare in EP
	PSC_EMS_11/04	113	25/11/2004	COOF/COLP	375240	6446324	Primulaceae	*Anagallis arvensis*	Scarlet pimpernel	*	
	PSC_EMS_11/04	114	25/11/2004	COOF/COLP	375240	6446324	Labiatae	*Westringia rigida*	Stiff westringia		
	PSC_EMS_11/04	115	25/11/2004	COOF/COLP	375240	6446324	Leguminosae	*Acacia cyclops*	Western coastal wattle		
	PSC_EMS_11/04	116	25/11/2004	COOF/COLP	375240	6446324	Compositae	*Conyza bonariensis*	Flaxleaf fleabane	*	
	PSC_EMS_11/04	117	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Beta vulgaris*	Beet	*	
	PSC_EMS_11/04	118	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Atriplex acutibractea*	A saltbush		
	PSC_EMS_11/04	119	25/11/2004	COOF/COLP	375240	6446324	Myrtaceae	*Eucalyptus stoatei*	Scarlet pear gum		
	PSC_EMS_11/04	120	25/11/2004	COOF/COLP	375240	6446324	Gentianaceae	*Centaurium tenuiflorum*	A centaury		
	PSC_EMS_11/04	121	25/11/2004	COOF/COLP	375240	6446324	Chenopodiaceae	*Maireana erioclada/pentatropis*	A maireana with no fruit		
21	PSC_EMS_11/04	122	25/11/2004	COOF/COLP	325401	64466592	Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak		
	PSC_EMS_11/04	123	25/11/2004	COOF/COLP	325401	64466592	Gramineae	*Austrostipa drummondii*	Cottony speargrass		
	PSC_EMS_11/04	124	25/11/2004	COOF/COLP	325401	64466592	Zygophyllaceae	*Zygophyllum aurantiacum*	Shrubby twinleaf		
22	PSC_EMS_11/04	125	25/11/2004	COOF/COLP	374602	6447509	Gramineae	*Austrostipa drummondii*	Cottony speargrass		
	PSC_EMS_11/04	126	25/11/2004	COOF/COLP	374602	6447509	Myoporaceae	*Eremophila weldii*	Purple emubush		
	PSC_EMS_11/04	127	25/11/2004	COOF/COLP	374602	6447509	Myrtaceae	*Melaleuca pauperiflora*	Boree		
	PSC_EMS_11/04	128	25/11/2004	COOF/COLP	374602	6447509	Myrtaceae	*Eucalyptus gracilis*	White mallee		
	PSC_EMS_11/04	129	25/11/2004	COOF/COLP	374602	6447509	Rutaceae	*Geijera linearifolia*	Sheepbush, oilbush or wilga		
	PSC_EMS_11/04	130	25/11/2004	COOF/COLP	374602	6447509	Compositae	*Vittadinia eremaea*	A vittadinia		
23	PSC_EMS_11/04	131	25/11/2004	COOF/COLP	374878	6447304	Liliaceae	*Thysanotus baueri*	Mallee fringe lily		
24	PSC_EMS_11/04	132	25/11/2004	COOF/COLP	374855	6447267	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby glasswort		
	PSC_EMS_11/04	133	25/11/2004	COOF/COLP	374855	6447267	Malvaceae	*Lawrencia squamata*	Thorny lawrencia		
25	PSC_EMS_11/04	134	25/11/2004	COOF/COLP	374786	6447134	Gramineae	*Austrostipa elegantissima*	Feather speargrass		
26	PSC_EMS_11/04	135	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Maireana erioclada*	Rosy bluebush		
	PSC_EMS_11/04	136	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Halosarcia pruinosa*	Waxy glasswort		
	PSC_EMS_11/04	137	25/11/2004	COOF/COLP	374683	6447082	Leguminosae	*Senna artemesiodes*	Desert cassia		
	PSC_EMS_11/04	138	25/11/2004	COOF/COLP	374683	6447082	Chenopodiaceae	*Rhagodia crassifolia*	Fleshy saltbush		
27	PSC_EMS_11/04	139	25/11/2004	COOF/COLP	374080	6447244	Leguminosae	*Acacia hakeoides*	Hakea wattle		
	PSC_EMS_11/04	140	25/11/2004	COOF/COLP	374080	6447244	Santalaceae	*Santalum acuminatum*	Quandong		
	PSC_EMS_11/04	141	25/11/2004	COOF/COLP	374080	6447244	Myoporaceae	*Myoporum brevipes*	Warty myoporum		
28	PSC_EMS_11/04	142	25/11/2004	COOF/COLP	374178	6447205	Liliaceae	*Lomandra collina*	Fibrous mat-rush		
	PSC_EMS_11/04	143	25/11/2004	COOF/COLP	374178	6447205	Myoporaceae	*Myoporum insulare*	Boobialla, native juniper		
29	PSC_EMS_11/04	144	25/11/2004	COOF/COLP	374266	6447177	Chenopodiaceae	*Sclerostegia arbuscula*	Shrubby glasswort		
30	PSC_EMS_11/04	145	25/11/2004	COOF/COLP	374358	6447092	Aizoaceae	*Mesembryanthemum aitonis*	Angled iceplant	*	
	PSC_EMS_11/04	146	25/11/2004	COOF/COLP	374358	6447092	Solanaceae	*Solanum hystrix*	Afghan thistle		
31	PSC_EMS_11/04	147	25/11/2004	COOF/COLP	374520	6447551	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
32	PSC_EMS_11/04	148	25/11/2004	COOF/COLP	374367	6447350	Myrtaceae	*Eucalyptus gracilis*	White mallee		
33	PSC_EMS_11/04	149	25/11/2004	COOF/COLP	373964	6447157	Myrtaceae	*Eucalyptus calcareana*	Nundroo mallee		
	PSC_EMS_11/04	150	25/11/2004	COOF/COLP	373964	6447157	Loranthaceae	*Amyema melaleucae*	A mistletoe		
34	PSC_EMS_11/04	151	25/11/2004	COOF/COLP	373657	6447082	Proteaceae	*Hakea rugosa*	Dwarf hakea		

Appendix IV – Birds Australia species list

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Birds Australia site list

Family	Common Name	Species name	Habitat (Simpson and Day)	Nest form / time / location (Gordon & Beruldsen) & (Simpson and Day)	Birds Aust Murat Bay Wader Count (2000)	Birds Australia Murat Bay species of significance identified during Wader Count (1984)	Conservation Interest
Phasianidae	Stubble Quail	*Coturnix pectoralis*	Grasslands.	August to January. Shallow ground scrape.			Unprotected
Anatidae	Blue-billed Duck	*Oxyura australis*	Deep freshwater marshes. Large open lakes, tidal inlets and bays.	Neat bowl of reeds.			Rare (SA NP&WS) EPBC Act, rare EP
Anatidae	Musk Duck	*Biziura lobata*	Permanent swamps with dense vegetation. Large open lakes, tidal inlets and bays.	Loose bowl of reeds with hood.			Rare (SA NP&WS) EPBC Act
Anatidae	Black Swan	*Cygnus atratus*	Large expanses of open water. Pasture, crops and mudflats.	Febuary to April. Thick mattress, occasionally floating.			EPBC Act
Anatidae	Grey Teal	*Anas gracilis*	Any available water. More coastal during dry periods.	Late winter and spring. Variable nest structure and location.			EPBC Act
Anatidae	Chestnut Teal	*Anas castanea*	Disperses to freshwater, tidal mudflats and inlets.	July to October. Hollow on ground in brackish coastal swamps.			EPBC Act
Anatidae	Hardhead	*Anthya australis*	Deep, vegetated swamps, other large open waters.	Neat bowl of reeds.			EPBC Act
Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	Generally freshwater.	October to December. Raft of floating vegetation.			Unprotected
Podicipedidae	Hoary-headed Grebe	*Poliocephalus poliocephalus*	Lakes, swamps; frequently on brackish water or on sea off estuaries.	Does not nest on salt water.			Unprotected
Sulidae	Australasian Gannet	*Morus serrator*	Oceans and bays.	Tasmainan and Victorian offshore islands.			Unprotected
Anhingidae	Darter	*Anhinga melanogaster*	Lakes, rivers, swamps. Rarely coastal.	Prefers inland waters.			Unprotected
Phalacrocoracidae	Little Pied Cormorant	*Phalacrocorax melanoleucos*	Most aquatic habitats.	Seldom breeds in marine saltwater habitats.			Unprotected
Phalacrocoracidae	Black-faced Cormorant	*Phalacrocorax fuscescens*	Off-shore rock stacks, islets; outer harbour beacons.	April to June. Nests are large platforms in colonies.			Unprotected
Phalacrocoracidae	Pied Cormorant	*Phalacrocorax varius*	Prefers large areas of water, coastal or inland lakes, rivers, mangrove lined esturaries.	Autumn. Nests in coastal and tidal stream mangroves.			Unprotected
Phalacrocoracidae	Little Black Cormorant	*Phalacrocorax sulcirostris*	Most aquatic habitats.	Spring and Autumn. Small stick structure in trees 1-20m tall, near water.			Unprotected
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	Most aquatic habitats.	Prefers secluded freshwater streams and lakes.			Unprotected
Phalacrocoracidae	Australian Pelican	*Pelecanus conspicillatus*	Open fresh and salt water.	Bare hollow scraped out in sand or earth. Generally in colonies.			Unprotected
Ardeidae	White-faced Heron	*Egretta novaehollandiae*	Pasture, farm dams, parkland, most wetlands including intertidal flats.	October to December. Platform in fork of tree 5-20m from the ground.			Unprotected
Ardeidae	Little Egret	*Egretta garzetta*	Shallows of wetlands, intertidal mud-flats.	Does not breed near study site.			Rare SA
Ardeidae	Eastern Reef Egret	*Egretta sacra*	Intertidal zone: Rocks, coral reefs, mangroves, mud-flats.	September to December. Platform on rocky ledge or trees on intertidal flat.			Rare (SA NP&WS) EPBC Act, rare EP
Ardeidae	Great Egret	*Egretta alba*	Floodwaters, rivers, shallows of wetlands, intertidal mudflats.	October to December. Platform in tree greater than 20m tall near water.			EPBC Act
Plataleidae	Royal Spoonbill	*Platalea regia*	Shallows of fresh and saltwater wetlands including intertidal flats.	August to November. Platform of sticks in tree.			Unprotected
Pandionidae	Osprey	*Pandion haliaetus*	Mangroves, rivers and estuaries. Inshore seas, coastal islands. Eats fish.	September to October. Generally a pile of seaweed in a tree fork.			Rare (SA NP&WS) EPBC Act, rare EP
Accipitridae	Black-shouldered Kite	*Elanus axillaris*	Open woodlands and tall grasslands. Hunts at dusk and dawn.	July to November. Nest placed in the crown of a Eucalypt tree.			EPBC Act
Accipitridae	Black Kite	*Milvus migrans*	Open plains, timbered water courses, rubbish dumps, abattoirs and cattle yards.	In trees over 10m tall.			EPBC Act
Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Large rivers, fresh and saline lakes, reservoirs, coastal seas, islands.	On ledges of coastal cliffs.			Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Accipitridae	Spotted Harrier	*Circus assimilis*	Hunts over low open grassland, crops and windbreaks.	Flat structure of sticks in tree, within scrub.			EPBC Act
Accipitridae	Swamp Harrier	*Circus approximans*	Hunts low over tall grass, reeds, rushes and crops.	Does not breed near study site.			EPBC Act
Accipitridae	Wedge-tailed Eagle	*Aquila audax*	Most types except closed forest.	Nest in large tree with a wide view.			EPBC Act
Falconidae	Brown Falcon	*Falco berigora*	Most land surface types except closed forest.	Uses old nests of other species, particularly Corvus spp.			EPBC Act
Falconidae	Nankeen Kestrel	*Falco cenchroides*	Most land surface types except closed forest.	Small nest of sticks in tree, on cliffs or in haystacks.			EPBC Act
Turnicidae	Little Button-quail	*Turnix velox*	Dry to arid woodlands, grasslands.	October to January. Shallow ground scrape lined with grass.			Unprotected
Scolopacidae	Bar-tailed Godwit	*Limosa limosa*	Tidal flats, occasionally inland.	Migratory. Breeds in northern hemisphere summer.	26		EPBC Act
Scolopacidae	Whimbrel	*Numenius phaeopus*	Estuaries, mudflats, mangroves, sandspits, occasionally inland.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Eastern Curlew	*Numenius madagascariensis*	Estuaries, mudflats, mangroves, sandspits.	Migratory. Breeds in northern hemisphere summer.	1		Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	Coastal, inland lakes, prefers freshwater.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Common Greenshank	*Tringa nebularia*	Coastal, inland lakes.	Migratory. Breeds in northern hemisphere summer.	46		EPBC Act
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	Banks, rocks near water.	Migratory. Breeds in northern hemisphere summer.	3		EPBC Act
Scolopacidae	Grey-tailed Tattler	*Heteroscelis brevipes*	Estuaries, rocky coasts, reefs.	Migratory. Breeds in northern hemisphere summer.	6		EPBC Act
Scolopacidae	Ruddy Turnstone	*Arenaria interpres*	Rocky shores.	Migratory. Breeds in northern hemisphere summer. Juvenilles may overwinter on rocky coasts.	56	171	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Scolopacidae	Great Knot	*Calidris tenuirostris*	Tidal mudflats, rarely inland.	Migratory. Breeds in northern hemisphere summer. Some overwinter.			EPBC Act
Scolopacidae	Red Knot	*Calidris canutus*	Tidal mudflats, rarely inland.	Migratory. Breeds in northern hemisphere summer. Some overwinter.	38		EPBC Act
Scolopacidae	Sanderling	*Calidris alba*	Beaches, rarely inland.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Little Stint	*Calidris minuta*	Coastal, inland shorelines.	Migratory. Breeds in northern hemisphere summer.			EPBC Act
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	Coastal, inland shorelines.	Migratory. Breeds in northern hemisphere summer.	913		EPBC Act
Scolopacidae	Sharp-tailed Sandpiper	*Calidris acuminata*	Inland waters, coastal.	Migratory. Breeds in northern hemisphere summer.	271		EPBC Act
Scolopacidae	Curlew Sandpiper	*Calidris ferruginea*	Coastal, inland mudflats.	Migratory. Breeds in northern hemisphere summer.	144		EPBC Act
Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	Coastal, prefers sandy beaches, estuaries.	October to December. Hollow scratched in loose sand, seaweed and driftwood.	29		Unprotected

Haematopodidae	Sooty Oystercatcher	*Haematopus fuliginosus*	Coastal, prefers rocky coastline; occasionally estuaries.	October to December. Hollow scratched in loose sand. Usually on offshore island.	107	163	Site of international importance according to National Plan for shorebird Conservation (Watkins, D.) Ranking 5th in Australia.
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	Fresh and saltwater marshes. Flooded paddocks.	August to January.			EPBC Act
Recurvirostridae	Banded Stilt	*Cladorhynchus leucocephalus*	Fresh and saltwater marshes, marine mudflats, large ephemeral lakes.	Usually in Western Australian Inland lakes.			EPBC Act
Charadriidae	Pacific Golden Plover	*Pluvialis dominica*	Beaches, mudflats, may be inland.				EPBC Act
Charadriidae	Grey Plover	*Pluvialis squatarola*	Beaches, mudflats, may be inland.		81	123	Site of national importance according to National Plan for shorebird Conservation (Watkins, D.) EPBC Act
Charadriidae	Red-capped Plover	*Charadrius ruficapillus*	Sandy areas; coastal and inland.	September to December. Scrapes a small hollow in open sandy position.	79		EPBC Act
Charadriidae	Double-banded Plover	*Charadrius bicinctus*	Beaches, mudflats, grasslands, bare ground.				EPBC Act
Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	Shores, marshes, rarely inland.				EPBC Act
Charadriidae	Greater Sand Plover	*Charadrius leschenaultii*	Shores, marshes, rarely inland.				EPBC Act
Charadriidae	Inland Dotterel	*Charadrius australis*	Ploughed ground, open sparse plains and gibber.	August to November.			EPBC Act
Charadriidae	Hooded Plover	*Thinornis rubricollis*	Ocean beaches, sometimes coastal lakes. Inland saltlakes in WA.	September to January.			Vulnerable (SA NP&WS) EPBC Act, Vulnerable EP
Charadriidae	Banded Lapwing	*Vanellus ticolor*	Open grasslands, bare plains and arable land.	July to December. Nest in open areas amoung short stubble or crops.	238		EPBC Act
Charadriidae	Masked Lapwing	*Vanellus miles*	Grasslands, mud-flats, urban parks.	June to December. Shallow hollow scraped in ground.	6		EPBC Act
Laridae	Pacific Gull	*Larus pacificus*	Coastal.	September to December. Hollow scratched into the sand above beach.			Unprotected
Laridae	Silver Gull	*Larus novaehollandiae*	Coastal, inland waters, urban areas.	August to December. Nests in colonies.			Unprotected
Laridae	Caspian Tern	*Sterna caspia*	Coastal; also inland watercourses.				Unprotected
Laridae	Crested Tern	*Sterna bergii*	Coastal.	Nests in colonies on off-shore islands.			Unprotected
Laridae	Fairy Tern	*Sterna nereis*	Coasts, occasionally inland watercourses.	Hollow among debris, close to water. Small colonies on islands or isolated locations.			Vulnerable (SA NP&WS) ssp nereis vulnerable EP
Laridae	Whiskered Tern	*Chlidonias hybrida*	Lakes and estuaries.	Usually nests in areas temporarily under flood waters.			Unprotected
Columbidae	Rock Dove	*Columba livia**	Rainforests and scrub. Occasionally isolated trees.	July to Febuary. Nest in hollows, dead wood and ground debris.			Unprotected
Columbidae	Common Bronzewing	*Phaps chalocoptera*	Dry forest, woodlands, mallee, heath and coastal scrub.	September to January. Small saucer of sticks in tall tree.			Unprotected
Columbidae	Brush Bronzewing	*Phaps elegans*	Woodlands, heathlands and some mallee areas.	Identical to Common Bronzewing.			Unprotected
Columbidae	Crested Pigeon	*Ocyphaps lophotes*	Lightly wooded grasslands near water.	Similar to Common Bronzewing.			Unprotected
Columbidae	Peaceful Dove	*Geopelia striata*	Lightly timbered country near water.	Spring to summer. Platform of twigs in tree or bush 6-8 m above the ground.			Rare EP
Cacatuidae	Galah	*Eolophus roseicapilla*	Woodlands, open shrublands, grasslands and parks.	In any suitable tree hollow.			Unprotected
Psittacidae	Australian Ringneck	*Barnardius zonarius* race *zonarius*	Mallee and Mulga.	August to December. In any suitable tree hollow.			Unprotected
Psittacidae	Mulga Parrot	*Psephotus varius*	Arid shrublands, mallee.	In deep tree hollows, generally in inland areas.			Unprotected
Psittacidae	Rock Parrot	*Neophema petrophila*	Coastal dunes, saltmarsh and rocky islands.	August to November. Bare earth beneath rocks or low vegetation, particularly pigface.			Rare (SA NP&WS), rare EP
Cuculidae	Pallid Cuckoo	*Cuculus pallidus*	Open areas with trees.	August to December. South of latitude 25-26 degrees.			Unprotected
Cuculidae	Fan-tailed Cuckoo	*Cuculus flabelliformis*	Forests and woodlands.	August to January.			Unprotected
Cuculidae	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	Open country.	August to January.			Unprotected
Tytonidae	Barn Owl	*Tyto alba*	Grasslands, farmlands, woodlands. May roost on ground in cave.	Food dependant breeding. Nests in tree hollows.			Unprotected
Apodidae	Fork-tailed Swift	*Apus pacificus*	Aerial, over a variety of habitats. N Asian migrant.	Migratory. Breeds in Northern Hemisphere Summer			EPBC Act
Maluridae	Variegated Fairy-wren	*Malurus lamberti*	Across inland Australia.	July to January. Nests in thick grass.			Unprotected
Pardalotidae	Striated Pardalote	*Pardalotus striatus*	Eucalypt forests, woodlands, in tree crowns.	July to December. Long tunnel drilled into the soil up to 1.5m long into creek banks.			Unprotected
Pardalotidae	White-browed Scrubwren	*Sericornis frontalis*	Dense undergrowth, including urban areas, saltmarshes and heaths.	June to December. Dome nest on ground or near ground in low vegetation.			Unprotected
Pardalotidae	Weebill	*Smicrornis brevirostris race brevirostris*	Dry forest, woodlands, mallee.	August to December. Small nest in tree or shrub of any height.			Unprotected
Pardalotidae	Inland Thornbill	*Acanthiza apicalis*	Dry scrub to coastal heaths.	July to December.			Unprotected
Pardalotidae	Chestnut-rumped Thornbill	*Acanthiza uropygialis*	Dry woodlands, mallee and mulga.	August to December. In small hollow of tree. June to December.			Unprotected
Pardalotidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	Open woods, parklands.	June to December. Built 2-5m from the ground in dense folige.			Unprotected
Pardalotidae	Southern Whiteface	*Aphelocephala leucopsis* race *maculatus*	Open arid country, especially near dead trees.	June to November.			Unprotected
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*	Forests, woodlands and suburbs.	July to Febuary.			Unprotected
Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	Desert, coastal scrubs, mallee, woodland and orchards.	July to December. Built in dense foliage of tree or shrub.			Unprotected
Meliphagidae	Yellow-throated Miner	*Manorina flavigula*	Dry woodlands, especially mallee.	July to December. Frail nest built in foliage of sapling, shrub or vine.			Unprotected
Meliphagidae	Singing Honeyeater	*Lichenostomus virescens*	Arid and coastal shrublands, woodlands and suburbs.	July to January. Grass cup in bush or shrub.			Unprotected
Meliphagidae	Purple-gaped Honeyeater	*Lichenostomus cratitius*	Mallee, woodlands.	July to December . Built in dense shrub or bush.			Unprotected
Meliphagidae	White-fronted Honeyeater	*Phylidonyris albifrons*	Arid sburblands to woodlands.	July to December. Small nest built in bush or small tree.			Unprotected
Meliphagidae	Crimson Chat	*Epthianura tricolor*	Salty areas of inland plains, rocky hills, mallee heath.	July to November. A neat cup in saltbush, bluebush or samphire.			Unprotected
Meliphagidae	White-fronted Chat	*Epthianura albifrons*	Low vegetation in salty coastal and inland areas, crops.	June to January. Cup in centre of samphire and saltbush. Sometimes in rank grasses.			Unprotected
Petroicidae	Jacky Winter	*Microeca fascinans*	Drier country, farmland.	July to December. In fork of tree, 10m or more above ground.			Unprotected
Petroicidae	Red-capped Robin	*Petroica goodenovii*	Drier scrub, woodlands.	July to December. Small cup in fork of shrub or small tree.			Unprotected
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	Drier, more open forests with shrubby understory, mallee, mulga scrubs.	June to December. Enclosed nest in fork of tree. 3-15m above ground.			Unprotected
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	Scherophyll forests and woodlands.	July to December. Nest in vertical dead branches in tall trees.			Unprotected
Pachycephalidae	Gilbert's Whistler	*Pachycephala inornata*	Shrubby woodland, mallee.	September to December. Nest in vegetation less that 2m above ground.			Rare EP
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*	Rainforests, open forests, woodlands, mallee and coastal vegetation.	August to January. Nest in concealing vegetation.			Unprotected
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	Mostly open forest, woodland, mallee and scrub of arid interior.	August to Febuary. Nest in concealing vegetation.			Unprotected

Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	Forest, woodland, scrub, mallee, gardens.	July to Febuary. Nest in hollows, dead wood and ground debris.	Unprotected
Dicruridae	Magpie-Lark	*Grallina cyanoleuca*	Open areas, roadsides, often near water.	Spring to early summer. Any horizontal limb between 3-20m above ground.	Unprotected
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*	Forest and woodlands.		Unprotected
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*	Everywhere except from very wet forests.	July to December. Built on anything suitable, less than 5m above ground.	Unprotected
Campephagidae	Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	Open woodlands and forests.	August to January. Between 10-20m above ground.	Unprotected
Campephagidae	White-winged Triller	*Lalage sueurii*	Open country and woodlands.	September to Febuary. Small nest in fork. Also Magpie-Lark nests.	Unprotected
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*	Open forests and woodlands.	August to January. Fork of tree, between 5-10m above the ground.	Unprotected
Artamidae	Grey Butcherbird	*Cracticus torquatus*	Open forest, woodland, mallee, urban and farmland.	July to December. Fork of tree clear of foliage, up to 5m from the ground.	Unprotected
Artamidae	Australian Magpie	*Gymnorhina tibicen*	Open forest, farms and urban land.	June to December. Fork of tall tree. Between 5-15m.	Unprotected
Corvidae	Australian Raven	*Corvus coronoides*	Most types except closed forest.	July to September. Upright fork of tree/powerpole, over 10m above ground.	Unprotected
Corvidae	Little Raven	*Corvus mellori*	Most types except closed forest.	June to September. Smaller trees/powerpoles. Between 3-10m from the ground.	Unprotected
Corvidae	Little Crow	*Corvus bennetti*	Most types in arid and semi arid zones. Outback towns.	August to January. Fork of a tree, between 1-10m from the ground.	Unprotected
Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	Dry woodland and mallee.	August to December. Mud nest in tree between 3 and 10m from the ground.	Vulnerable EP
Motacillidae	Richard's Pipit	*Anthus novaeseelandiae*	Open country, grassland.	August to December. Grass nest in a depression.	Unprotected
Passeridae	House Sparrow	*Passer domesticus**	Human habitation, farmland, reedbeds.		Unprotected
Hirundinidae	White-backed Swallow	*Cheramoeca leucosternus*	Inland sandy country.	July to December. Tunnel in bank approx 1m long.	Unprotected
Hirundinidae	Welcome Swallow	*Hirundo neoxena*	All kinds, especially near water.	July to January. Nest attatched to vertical support of many kinds.	Unprotected
Hirundinidae	Tree Martin	*Hirundo nigricans*	Open woodland.	July to December. Hollows 1-30m above the ground.	Unprotected
Sylviidae	Little Grassbird	*Megalurus gramineus*	Reeds, tussocks in swamps.	July to December. In herbage or lignum. Less than 1m from the ground.	EPBC Act
Alaudidae	Rufous Songlark	*Cincloramphus mathewsi*	Woodland, parklands, hedges, lightly timbered grassland.	August to December. Nest on ground, often in thick vegetation.	Unprotected
Alaudidae	Brown Songlark	*Cincloramphus cruralis*	Grassland and crops.	August to December. Nest on ground, under grass or cultivated crop.	Unprotected
Zosteropidae	Silvereye	*Zosterops lateralis*	All types, orchards, gardens.	August to December. In shrub or bush.	Unprotected
Muscicapidae	Common Blackbird	*Turdus merula**	Wide variety.	August to April.	Unprotected
Sturnidae	Common Starling	*Sturnus vulgaris**	Urban and country.	August to March. In tall trees.	Unprotected

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix V – Land ownership summary

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

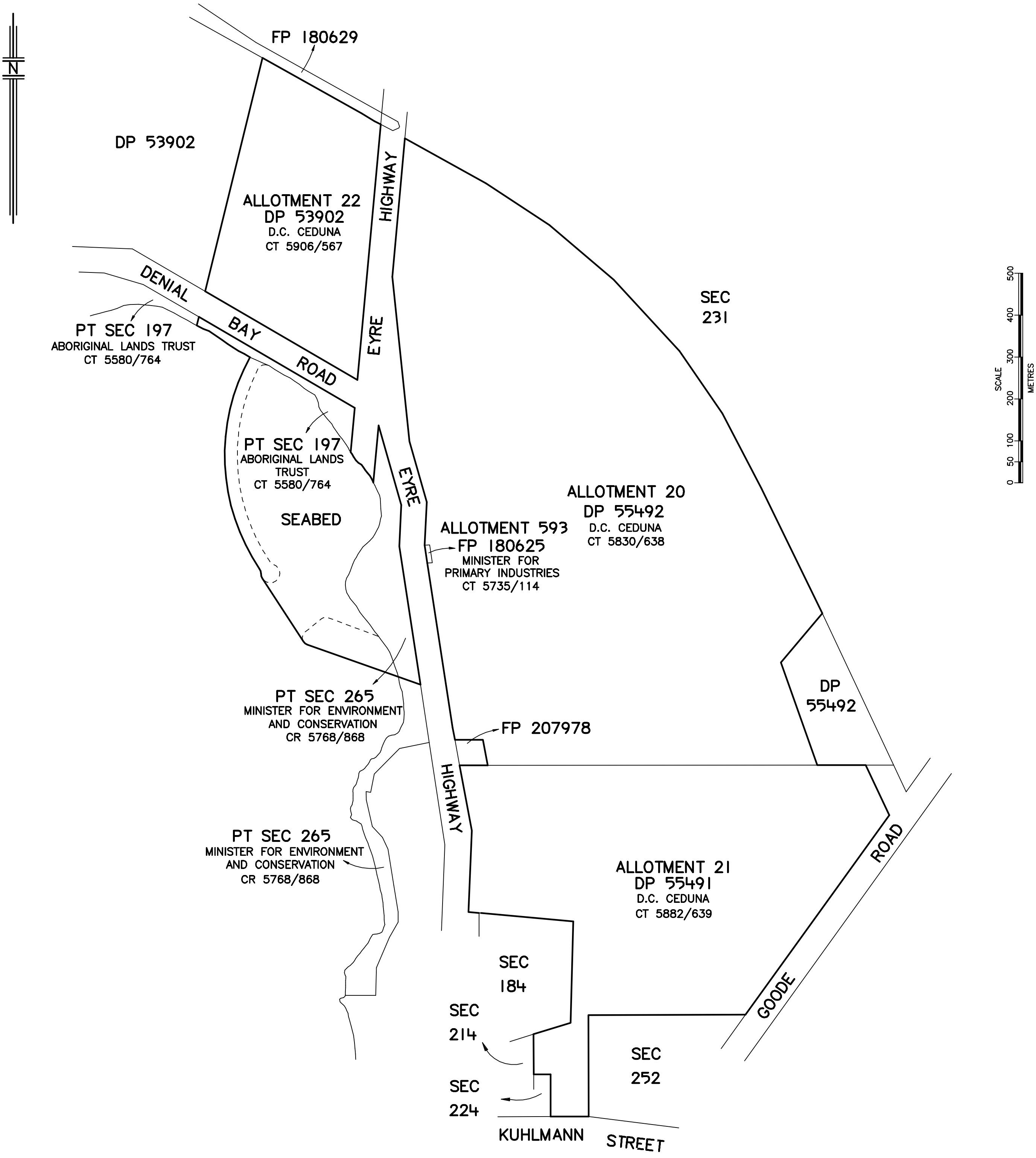
Year	Coastal reserve	Section number 35						Section 13							Coastal reserve
1880															
1881		Not dated. Misc. Lease 7043. George Edward Fleetwood Farm labourer													
1903		Act 830/03 for perpetual lease No. 11408													
1910		Crown Lease 568/96 George Edward Fleetwood Farm labourer													
1920								Agreement for Sale CT 644/108 Walter Henry Sedgley and Harold Thomas Sedgley Farmers and Graziers.							
1928		Transfer No. 1031976 to Leo Bernhardt Hughes													
1929		Agreement for sale and purchase 754/7. Leo Bernhardt Hughs Farmer													
1934		Crown Lease No.16197. CT 885/20 Leo Bernhardt Hughs Farmer													
1949								Transfer 1581093 Wallis Henry Sedgley to William Henry Sedgley, Butcher and grazier							
1951		Transfer No.1694122 Kennith Allen Schivarz Farmer													
1952								Land grant CT 2214/182 to Walter Henry Sedgley, Butcher and grazier							
1959								Transfer 2105283 to Ronald Alex Kies, farmer and grazier.							
1961															
1962								Transfer to Viola Elsa Kies widow							
1963		Partial surrender No.2460577 of Lease No. 16197													
1964								Transfer 2557087 to Laurence Leopold and Erna Alvira Hoffrichter Farmer.							
1965							Transfer of Lease No.16197 to Eric Leslie Baumann								
1968		Partial Surrender No. 2961368 of Lease No.16197. Crown Lease CT1351/12 appears to replace surrendered sections. Walter Karl Obersen service station owner **(Land now called Section 230)**						Caveat 2892526 by South Australian Railways commissioner							
1969		Transfer 3062567 to Vytuatas Vincentas Patupas Road House Proprietor. Mortgaged to Walter Karl Oberden													
1970		3684/191 encumbrance ESSO Australia.Ltd (PriceWaterhouse), Transfer 31226020 to Walter Karl Oberden, Service station proprietor. Transfer 3162126 to Maxwell Robert Christie.						Caveat withdrawn. Part replaced by CT 3683/102 Laurence Leopold and Erna Alvira Hoffrichter Farmer, Road Easement. Transfer 3113300 to Gillbert Wilfred Anderson and Yvonne Cherie Anderson Farmer. 10yr lease 3113303 to Hoffrichters to 5.5.1980							Portion of CT 2214/182 transfer 3070438 to South Australian Railways. new CT 3683/100
1971		Portion to CT 3744/144 Maxwell Robert Christie Branch Manager			Balance portion to CT 3744/145 Vytautas Vincentas Patupas Road House Proprietor			Transfer 3267782 portion to crown for road.							
1972	**Land Grant 3969/65** Aboriginal Lands Trust of 25 Bank Street, Adelaide. Given a **section number 197**. Lease 4549073 to Far West Aboriginal Progress Assoc.Inc. portion of land 99 year lease commencing 1.4.1980	New and balance CT 4007/701	New and Balance CT 4007/699	Portion of within land discharged form encumbrance. Transfer 3534069 to the minister of agriculture new CT for that portion 4007/698	Portion of within land discharged from emcumbrance. Transfer 3534069 portion to Minister for Agriculture new CT for that portion 4007/698	New and Balance CT 4007/700	New and Balance CT 4007/702. Vytautas Vincentas Patupas Road House Proprietor.							
1973															
1974				CT 4007/698											
1975								Transfer 3788933 from Yvonne Cherie Anderson to Gilbert Wilfred Anderson undivided moiety							
1978								Portion to CT 4139/17 transfer 4249305 to Richard Swinburne Jolly and Helen Fraser Fell. Easements set forth in transfer	Portion to CT 4139/18 transfer 4249306 to Richard Swinburne Jolly and Helen Fraser Fell. Easements set forth in Transfer	Portion to CT 4139/19	Portion to CT 4139/20	Portion to CT 4139/21	Portion to CT 4139/22	Balance to CT 4139/23 Gilbert Wilfred Anderson,farmer.	Portion to CT 4139/24	
1979								Easements for Railway: Transfer 4463473 of easement to Edward Mathew Gerovich 1.11.1979. Cancelled with regard to 4157/434, Transfer 4463474 of easement to Geoffrey Roy and Beverley Esther Mitchell 1.11.1979. Cancelled with regard to 5157/435, Transfer 4489132 of easement to Robert Bernhardt Anderson 24.12.1979. Cancelled with regard to 4157/436, Transfer 4489133 of easement to Graeme Neil and Pauline Joan McGuiness 24.12.1979. Canelled with regard to 4157/437							
1980													Gilbert Wilfred Anderson,farmer Balance to CT 4157/438		
1991	Lease No 7082685. Lease 4649073 surrended. Lease 4549073 to Yarilena Community Inc. Expiring 13.3.2016														
1998	**New CT 5580/764.**						CT 5657/129						New CT 5491/351		
1999															
2000				Minister of agriculture Replaced with CT 5735/114		Transfer 8761727 to District Council of Ceduna. Discharge of encumbrance. 5657/129 and others replaced by 5830/638 others may include 4007/701, 4007/699,							Transfer No. 8850523 Crown Lease CT 5835/121		CR 5768/868 Crown Record created with no parent title. New section number 265
2001															
2003													CT 5906/567 District Council of Ceduna Subject to 6 easments running paralell to the northern boarder, consuming approximately 50m. Caveat by Ceduna Marina.		
2004	Contains a range of Registrar-General notes, discussing filed plans and converted titles. Aboriginal Lands Trust of 1 Wright Road, Walkley Heights, SA 5098			5735/114 Minister for Primary Industries of Adelaide SA 5000		5830/638 District Council of Ceduna, PO Box 175 Ceduna, SA 5690. Caveat by Ceduna Marina Development Co. Pty Ltd.									CR 5768/868

Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix VI – Land tenure documents



AMENDMENTS

DSC ANDREW SURVEYORS

PROJECT: CEDUNA KEYS MARINA

CLIENT: CEDUNA MARINA DEVELOPMENT COMPANY

DRAWING TITLE: LAND MASTER PLAN

DRAWN	SCALE	DATE
RAS	AS SHOWN	20-10-04
COMP.FILE	FIELD	CHECKED
-	-	

DRAWING NUMBER: 203310-20

ISSUE

>HIS< Historical Search Enter Title Reference >CR>5768>868 <

HISTORICAL SEARCH OF CROWN RECORD

Title Searched	CR 5768/868	Previous Title	NONE
Title Status	CURRENT	Registration	NUMBER 1
Date of Issue	04/05/2000	Authority	RT 8862636

Produced	Completed	Document	Status	Details
NIL				

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5580>764 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5580/764	Previous Title	CT 3969/65
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	28/09/1998	Authority	CD 6987000

Produced	Completed	Document	Status	Details
05/04/91	11/07/91	7082685	REGD	LEASE YARILENA COMMUNITY INC.

No More Details > <

LIEUTENANT-GOVERNOR
SOUTH AUSTRALIA

South Australia.

Register Book,
Vol. 3969 *Folio* 65

Deputy *Registrar-General*

Land Grant

[IN DUPLICATE]

Certified correct, *Director of Lands*

Exd.

Diagram certified correct, *Surveyor-General*

HIS EXCELLENCY THE GOVERNOR doth hereby in the name of and on behalf of Her Majesty and by virtue of the provisions of the Aboriginal Lands Trust Act 1966-1968 and of a proclamation made pursuant to Section 16 of the said Act and dated the 7th day of December 1972 and all other enabling powers GRANT UNTO the ABORIGINAL LANDS TRUST of 25 Bank Street Adelaide 5000 hereinafter called the Grantee ALL that Section of land containing four hundred and thirty acres approximately situate in the Hundred of BONYTHON County of WAY and numbered 197 and delineated in the public maps deposited in the Department of Lands at ADELAIDE and in the plan in the margin hereof TO HOLD unto and to the use of the Grantee its Successors and Assigns for ever subject to the provisions of the Aboriginal Lands Trust Act 1966-1968

GIVEN under the hand of the Lieutenant Governor and the Public Seal of South Australia this tenth day of October one thousand nine hundred and seventy three

B

BY COMMAND,

THE MINISTER OF LANDS

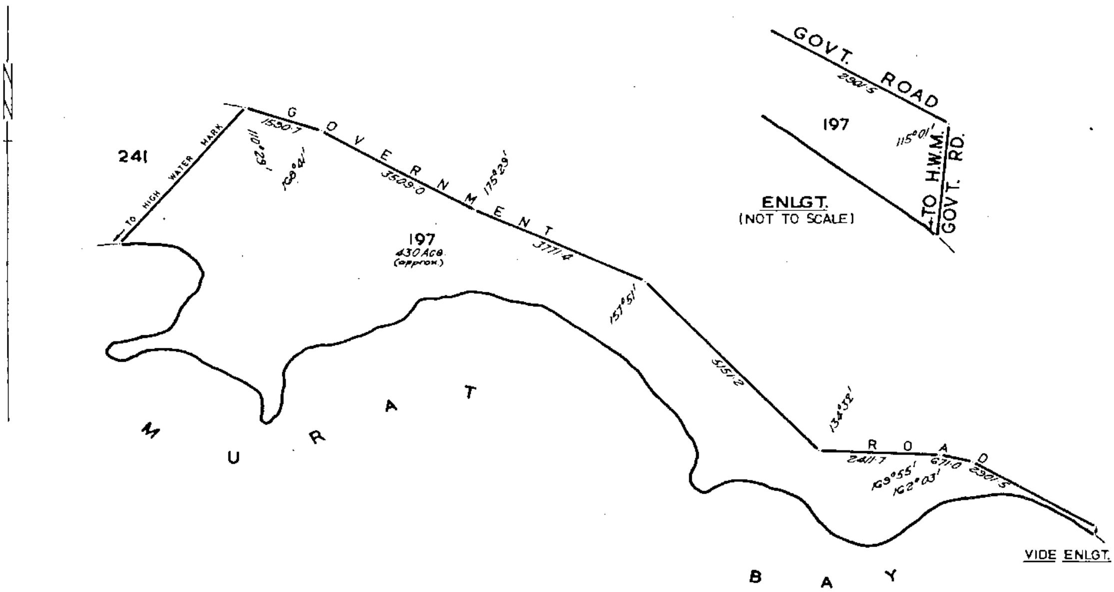
LEASE No. 4649073 to Far West Aboriginal Progress Association Incorporated
portion of
OF THE WITHIN LAND. TERM of 99 years commencing on 1.4.1980
PRODUCED 25.11.1980 AT 2.05 p.m.
(INCLUDING OTHER LAND)

OVER

SURRENDER OF LEASE No. 4649073
VIDE No. 7082684 PRODUCED 5·4·1991 AT 11:30

LEASE No. 7082685 TO
YARILENA COMMUNITY INC.
OF THE WITHIN LAND. TERM OF 25 YEARS
COMMENCING ON 14·3·1991
PRODUCED 5·4·1991 AT 11:30

CANCELLED
CONVERTED TO A COMPUTERISED TITLE



SCALE

CHAINS 20 10 0 10 20 30 40 CHAINS

C·D·O·

>HIS< Historical Search Enter Title Reference >CT>5906>567 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5906/567	Previous Title	CT 5835/121
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	13/11/2003	Authority	SC 9677926

Produced	Completed	Document	Status	Details
26/02/04	02/03/04	9792122	REGD	CAVEAT CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5835>121 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5835/121	Previous Title	CT 5782/655
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 1
Date of Issue	24/01/2001	Authority	DM 8945238

Produced	Completed	Document	Status	Details
09/09/03	14/11/03	9677926	REGD	SUBSTITUTE TITLE/CROWN LEASE

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5782>655 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5782/655	Previous Title	CT 5491/351
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 2
Date of Issue	15/06/2000	Authority	RTU 8803806

Produced	Completed	Document	Status	Details
17/08/00	30/01/01	8945238	REGD	DISCHARGE OF MORTGAGE 8733390
09/03/00	03/07/00	8850523	REGD	TRANSFER DISTRICT COUNCIL OF CEDUNA
16/08/99	25/08/99	8733390	REGD	MORTGAGE AUSTRALIA & NEW ZEALAND BANKING GROUP LT

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5491>351 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5491/351	Previous Title	CT 4157/438
Title Status	TOTALLY CANCELLED	Latest Duplicate	EDITION 3
Date of Issue	14/01/1998	Authority	CD 6987000

Produced	Completed	Document	Status	Details
19/05/00	19/06/00	8892617	REGD	AMENDMENT TO TEXT
14/12/99	20/06/00	8803806	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 53902
16/08/99	25/08/99	8733390	REGD	MORTGAGE AUSTRALIA & NEW ZEALAND BANKING GROUP LT
16/08/99	25/08/99	8733389	REGD	TRANSFER DEAN BRENTON PILMORE ANNETTE RHONDA KARAM

No More Details > <

ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,

Volume 4157 Folio 438

(Comprising 2 Sheets)

New Certificate for the balance of the Land in Vol.4139 Folio 23

GILBERT WILFRED ANDERSON of Ceduna 5690 Farmer is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in ALLOTMENT 7 of portions of Section 13 HUNDRED OF BONYTHON (L.T.R.O. FILED PLAN No.4874) and delineated on the plan hereon by bold black lines SUBJECT to the easements more particularly set forth in Transfers 4249305.4249306.4463473.4463474.4489132 and 4489133 in and over those portions marked A.B.C.D.E and F respectively hereon

In witness whereof I have signed my name and affixed my seal this 18th day of March 1980

Signed the 18th day of March)
1980, in the presence of Absastle)

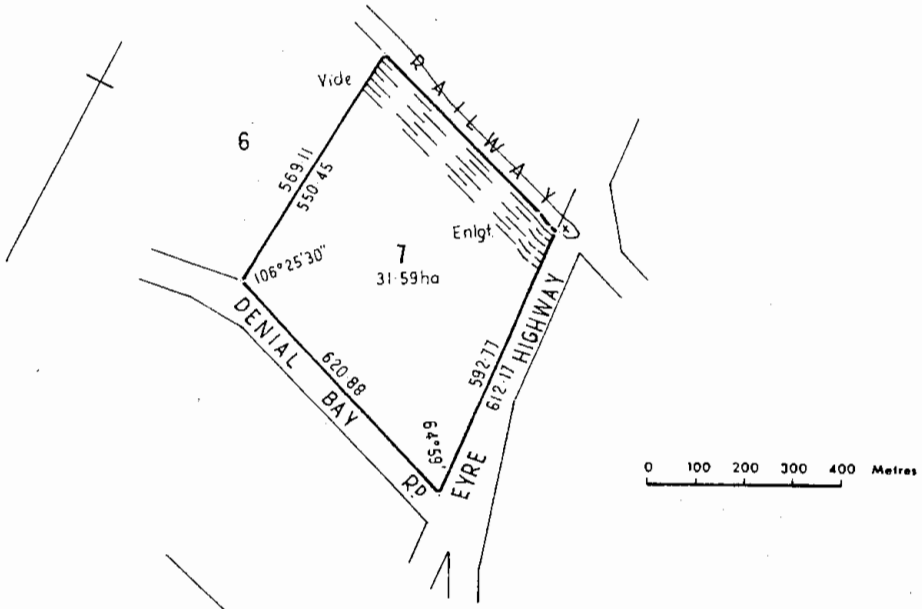
J.W.Hughes

Deputy Registrar-General

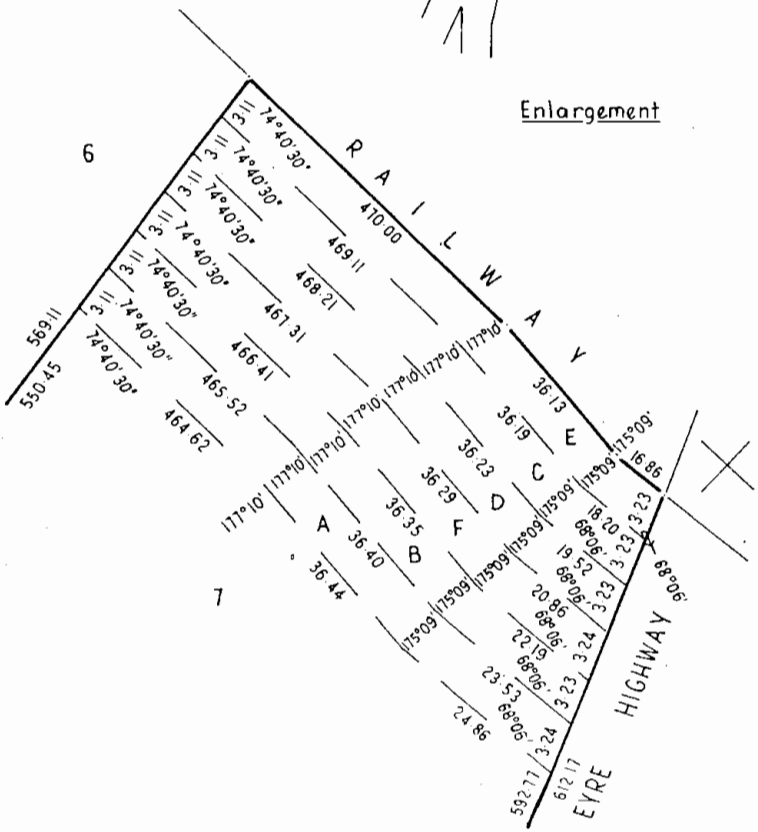
REGISTRAR-GENERAL SOUTH AUSTRALIA

CANCELLED
CONVERTED TO A COMPUTERISED TITLE
REGISTRAR-GENERAL SOUTH AUSTRALIA

SHEET 2



Enlargement



ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4139 Folio 23

New Certificate for portion of the Land in Vol.3683 Folio 102

GILBERT WILFRED ANDERSON of Ceduna 5690 Farmer is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in ALLOTMENT 7 of portions of Section 13 HUNDRED OF BONYTHON (L.T.R.O. FILED PLAN No.4874) and delineated on the plan hereon by bold black lines SUBJECT to the easements more particularly set forth in Transfers 4249305 and 4249306 in and over those portions marked B and A respectively hereon

In witness whereof I have signed my name and affixed my seal this 4th day of April 1979

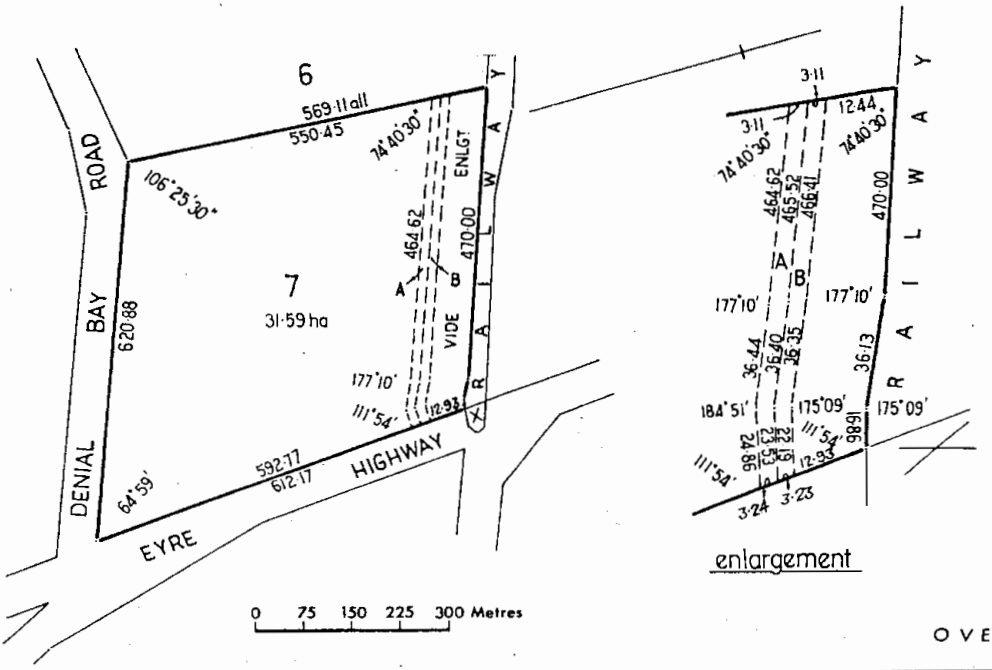
Signed the 4th day of April 1979, in the presence of R. Daniels

J.W. Hughes.

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

F.P. 4874
APPROVED



OVER

LEASE 3113304 to LAURENCE LEOPOLD HOFFRICHTER and ERNA ALVIRA HOFFRICHTER of portion of the within land Term of 10 years from 5.5.1970 Produced 24.6.1970 at 11.30 a.m. (Including other land)

MORTGAGE 4131476 to THE BANK OF ADELAIDE Produced 16.12.1977 at 11.50 a.m. (Including other land)

DH4349017- SE4463472(304)

DISCHARGE of Mortgage 4131476 vide 4349017 Produced 15.3.1979 at 12.20 p.m.

4463472.

SURRENDER of Lease 3113304 vide 4463472 Produced 1.11.1979 at 3.20 p.m.

TRANSFER 4463473 to EDWARD MATHEW GEROVICH of an Easement over PORTION of the within land Produced 1.11.1979 at 3.20 p.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 434

TRANSFER 4463474 to GEOFFREY ROY MITCHELL and BEVERLEY ESTHER MITCHELL of an Easement over PORTION of the within land Produced 1.11.1979 at 3.20 p.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 435

TRANSFER 4489132 to ROBERT BERNHARDT ANDERSON of an Easement over PORTION of the within land Produced 24.12.1979 at 11.30 a.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 436

TRANSFER 4489133 to GRAEME NEIL McGUINNESS and PAULINE JOAN McGUINNESS of an Easement over PORTION of the within land Produced 24.12.1979 at 11.30 a.m.

CANCELLED as regards above land and new C.T. issued VOL. 4157 FOL. 437

CANCELLED

AND Balance CERTIFICATE OF TITLE

ISSUED VIDE VOL 4157 FOL 438

South Australia

CERTIFICATE OF TITLE

Register Book.

Vol. 3683 Folio 102

Balance Certificate of Title from Vol.3214 Folio 182

LAURENCE LEOPOLD HOFFMEISTER of Cadell 5580 Farmer and RINA ALVINA HOFFMEISTER his wife

are the proprietors of an estate in fee simple

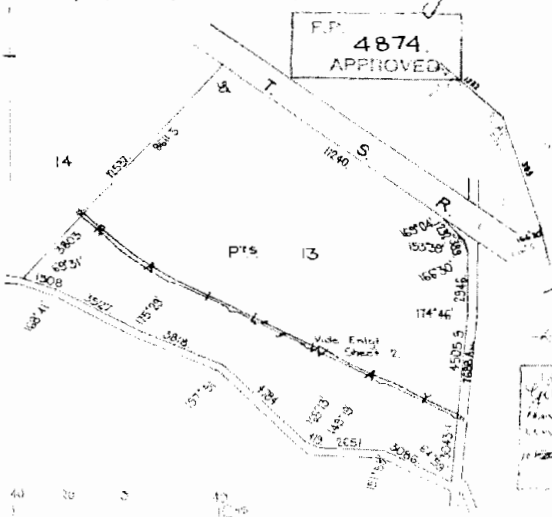
subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THOSE PIECES of land containing together one thousand seven hundred and forty six acres and three roods or thereabouts situated in the HUNDRED OF PONTYPOOL COUNTY OF ALE being PORTIONS OF SECTION 13 more particularly delineated and bounded as appears in the plan in the margin hereof and thereon colored green

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metalliferous minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section 13 delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 17th day of February 1970

Signed the 17th day of February 1970, in the presence of A. McHenry.



Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

to Viola Elsa Kier Produced 9.6.1969 at 11.05 a.m. (Including other land)

Asst. Genl.

Gilbert Wilfred Anderson of Cadell Farmer and Yvonne Grace Anderson his wife as joint tenants

Volume 3683 Folio 102 Page 1 of 4 (Printed at 13:23 on 30/Nov/2004)

DISCHARGE OF MORTGAGE No. 2557088 ... PRODUCED 24-6-1970 11.30am
DEP. REG. GEN.

TRANSFER No. ... from Laurence Leopold Hoffrichter and Erna Alvira Hoffrichter to the within named Gilbert Wilfred Anderson and Yvonne Cherie Anderson of one undivided moiety as tenants in common
... WITHIN LAND PRODUCED 24-6-1970 at 11.20am
DEP. REG. GEN.

MORTGAGE No. ... TO Viola Elsa Kies
PRODUCED 24-6-1970 AT 11.30am INCLUDING OTHER LAND
DEP. REG. GEN.

MORTGAGE No. ...
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED 24-6-1970 AT 11.30am
DEP. REG. GEN.

LEASE No. ... to Laurence Leopold Hoffrichter and Erna Alvira Hoffrichter
PORTION OF ... WITHIN LAND ... of 10 years from 5.5.1970
PRODUCED 24-6-1970 AT 11.30am
DEP. REG. GEN.

portion of
... FROM MORTGAGE
No. 3113302 ... 3267780
7.12.1971 AT 11.20am
DEP. REG. GEN.

portion of
No. 3113303 ... 3267781
7.12.1971 AT 11.20am
DEP. REG. GEN.

TRANSFER No. 3267782
to ... the second of portion
OF THE WITHIN ... PRODUCED 7.12.1971 AT 11.20am
DEP. REG. GEN.

CANCELLED AS REGARDS ...
No. 3267782 ... SAID ...
ACQUIRED BY THE CROWN FOR ROAD ...
DEP. REG. GEN.

3113303 (...)

THE WITHIN LAND IS D... No. 3113302 ...
PRODUCED 6-11-1974 AT 2.30pm (Dup C.T. not prod.)

from Yvonne Cherie Anderson to the within named Gilbert Wilfred Anderson of one undivided moiety in
THE WITHIN LAND PRODUCED ... AT ...
Discharge M3111564

... 3113301 ... BY ...
PRODUCED 1-4-1976 AT 2.55pm

MORTGAGE No. ...
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED 1-4-1976 AT 2.55pm
INCLUDING OTHER LAND
Dis 3895281

MORTGAGE No. 3...
TO THE STATE BANK OF SOUTH AUSTRALIA
PRODUCED 27.5.1976 at 2.20pm

Mortgage ... P Mashy ...
... 56

THE WITHIN LAND IS DISCHARGED FROM MORTGAGE
No. 3895281 and 3871369 VIDE 4131475
PRODUCED 16.12.1977 AT 11.50am

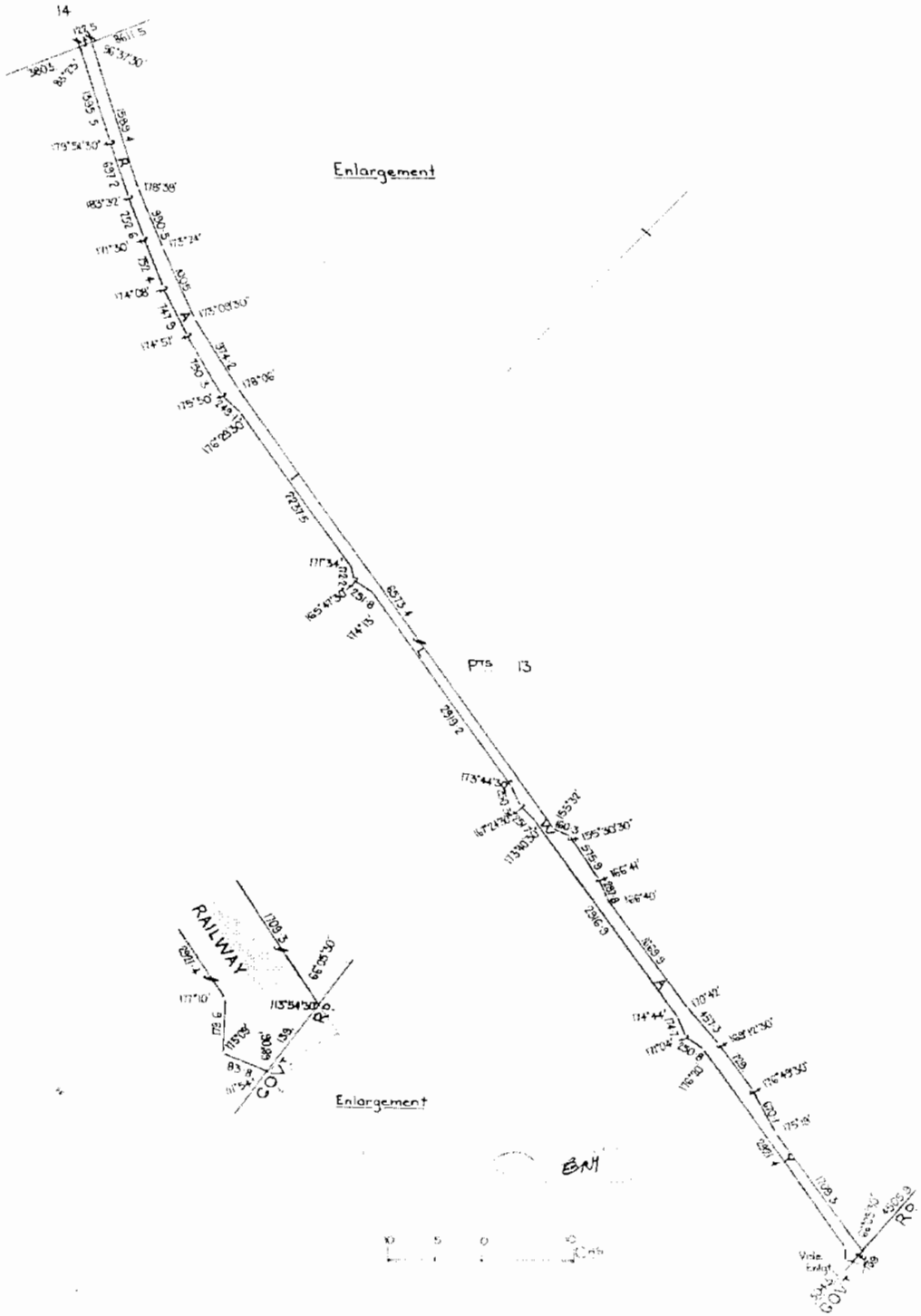
MORTGAGE No. ...
TO THE BANK OF ... PRODUCED 16.12.1977 AT 11.50am
Dis 2185600

Portion of
Transfers with and Reserving Easements (Lots 6 & 5 F.P. 4874)
THE WITHIN LAND IS DISCHARGED FROM MORTGAGE
No. 4131476 4249804
PRODUCED 18.8.1978 11.35am

TRANSFER No. ...
Richard Swinburne Jolly and Helen Fraser Fell of portion
OF THE WITHIN land (Lot 5 F.P. 4874) Together with and Reserving Easements
PRODUCED 18.8.1978 AT 11.35am
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED VOL. 4139 FOL. 17

TRANSFER No. ...
Richard Swinburne Jolly and Helen Fraser Fell of portion
OF THE WITHIN land (Lot 6 F.P. 4874) Together with and Reserving Easements
PRODUCED 18.8.1978 AT 11.35am
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED VOL. 4139 FOL. 18

5 New & Balance
4249306 4874
4139 s 19 to 24 inc.


14
Enlargement
Pts 13
RAILWAY
Enlargement
BM

Register Book.

Vol. 2214 Folio 182

Registrar General

South Australia.

Land Grant.

[IN DUPLICATE.]

(*In lieu of Surrendered* Agreement to Purchase No. 9588 Register Book Volume 644 Folio 103 ———)

His Excellency the Governor in consideration of four hundred and thirty nine pounds (£439: 0: 0) ———

heretofore paid to the Treasurer as appears by the receipt at foot by WALTER HENRY SEDDON of ———

Gentleman Butcher and Grazier ———

hereinafter called the Grantee doth hereby in the name and on behalf of HER MAJESTY GRANT unto the Grantee ALL that ——— Section of land containing one thousand seven hundred and seventy acres ——— or thereabouts situate in the

Hundred of BOOYTHON ——— County of WAY ———

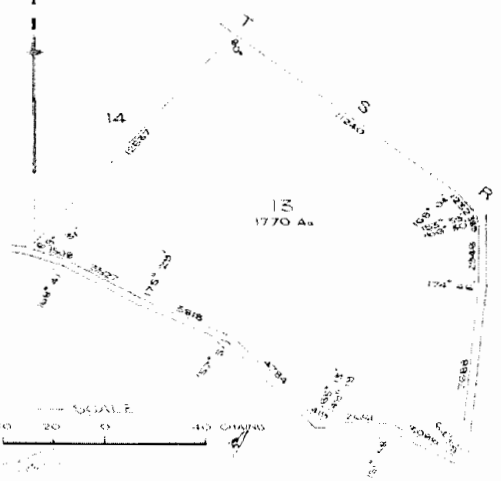
and numbered 13 ———

and delineated in the public maps deposited in the Land Office at ADELAIDE and in the plan in the margin hereof EXCEPT AND RESERVED UNTO HER MAJESTY Her Heirs and Successors all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land and all incidental powers as provided for in the Crown Lands Act 1929-1944 Provided that stone ordinarily used for building or road purposes shall be exempted from this reservation TO HOLD unto and to the use of the Grantee and the Heirs of the Grantee for ever.

GIVEN under the hand of the Governor and the Public Seal of South Australia this fifth ——— day of June ——— one thousand nine hundred and fifty two

BY COMMAND,

The Minister of Lands



Received four hundred and thirty nine pounds ———

£ 439:---0:---0

Public Treasurer

TRANSFER No. 1581093
Walter Henry Sedgley to
William Henry Sedgley of
Eduna Butcher and Grazier
OF AN ESTATE IN FEE SIMPLE IN THE WITHIN LAND
PRODUCED FOR REGISTRATION THE 15th
July 1949 11 a.m.

CAVEAT No 2897526 LODGED BY The South Australian Railways Commissioner
WITHDRAWN
(INCLUDING OTHER LAND)
DEP. REG.

TRANSFER No. 2105283 FROM
William Henry Sedgley to
Ronald Alex Kies of Eduna Farmer and Grazier
OF THE WITHIN LAND. PRODUCED 28/1/1959 AT 12.25 pm
DEP. REG. GEN.

MORTGAGE No. 2105284 FROM
Ronald Alex Kies to
William Henry Sedgley
PRODUCED 28/1/1959 AT 12.25 pm (Including other land)
DEP. REG. GEN.

Caveat 2897526 3070436 20.1.70 AT 11.35 am

portion of
THE WITHIN LAND IS DISCHARGED FROM MORTGAGE No 2557088 VIDE 3070437
PRODUCED 20.1.70 AT 11.35 am
DEP. REG. GEN.

APPLICATION No. THE WITHIN Land
IS TRANSMITTED TO Bagots Executor and Trustee Company Limited of 195 North Terrace Adelaide
AS THE EXECUTOR NAMED IN THE WILL DATED
OF Ronald Alex Kies WHO DIED 20. 5. 61
VIDE PROBATE DATED 3.10.61 PRODUCED 19.9.1964 AT 11 a.m.
L K D Anderson DEP. REG. GEN.

TRANSFER No. 3070438 to The South Australian Railways Commissioner
of portion
OF THE WITHIN Land
PRODUCED 20.1.1970 AT 11.35 am
CANCELLED AS REGARDS ABOVE LAND AND NEW C.T. ISSUED
VOL. 3683 FOL. 100
DEP. REG. GEN.

TRANSFER No. to
Viola Elsa Kies of Eduna Widow
OF THE WITHIN LAND. PRODUCED 19.9.1964 AT 11 a.m.
L K D Anderson DEP. REG. GEN.

CANCELLED
AND Balance CERTIFICATE OF TITLE
ISSUED VOL. 3683 FOL. 102
DEP. REG. GEN.

The estate of the within named Ronald Alex Kies deceased and his Executor Bagots Executor and Trustee Company Limited are released and discharged from all liability expressed or implied in the within mortgage No 2105284 Vide No 2382764
Produced 19.9.1964 at 11 a.m.
L K D Anderson

CANCELLED
CONVERTED TO A COMPUTERISED TITLE

DISCHARGE OF MORTGAGE No 2105284 BY ENDORSEMENT
PRODUCED 9.1964 AT 11.10 am
L K D Anderson DEP. REG. GEN.

TRANSFER No. 2337283
to Laurence Leopold Hoffrichter of Athena Farmer and Ilona Alvina Hoffrichter his wife
24.8.64 11.25 am

to Viola Elsa Kies
PRODUCED 24.8.64 AT 11.25 am (INCLUDING OTHER LAND)
DEP. REG. GEN.

South Australia.

Agreement for Sale and Purchase

No. 9588

(Made pursuant to the provisions of the "Crown Lands Acts, 1915 to 1919.")

Agreement made this Twenty eighth day of October One Thousand Nine Hundred and Twenty BETWEEN The Honorable George Richard Laffer of Adelaide Commissioner of Crown Lands of and for the State of South Australia herein contracting as a public officer for and on behalf of His Most Gracious Majesty King GEORGE THE FIFTH (hereinafter called "the Vendor") of the one part and Walter Henry Sedgley and Harold Thomas Sedgley both of Waranda Well Farmers and Graziers (hereinafter with his executors administrators and assigns called "the Purchaser") of the other part WHEREBY IT IS AGREED by and between the parties hereto as follows:—

1. The Vendor agrees to sell and the Purchaser agrees to purchase the land hereinafter mentioned and improvements thereon for the sum of eight hundred and seventy eight pounds (£878 0 0) being the price fixed by the Land Board and being ALL N.E. quarter section of land situated in the Hundred of Booyathon County of Way containing one thousand seven hundred and fifty four (1750) acres or thereabouts numbered 13

EXCEPT AND RESERVED all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land to the Vendor and all persons lawfully claiming under or authorised by him with full and free liberty of access ingress egress and regress with or without horses cattle carts drays carriages engines and all necessary implements and things into upon and from the said land for all reasonable purposes and to cut dig sink try search work remove and dispose of all or any of the said excepted and reserved things.

2. The Purchaser shall pay the purchase-money together with interest thereon in sixty half-yearly instalments of twenty three pounds ten shillings and ten pence (£23 10 10) payable in advance on the twenty eighth days of October and April in each year until the whole of the purchase-money together with interest shall be paid: PROVIDED that the Purchaser may complete the purchase of the said land at any time after six years from the date of this agreement on payment of the purchase-money in full and interest to the date of completion of the purchase and provided that the terms covenants conditions and provisions of this agreement have been fully complied with to the satisfaction of the Commissioner of Crown Lands and that improvements equal in value to Five Shillings per acre on the said land have been effected to the satisfaction of the Commissioner by the Purchaser.

3. The Purchaser will pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of [illegible] granted under the "Vermin Acts 1914 to 1919."

4. The Purchaser shall and will during the first five years from the date of this agreement substantially fence the boundaries of the said land with a fence or wall ordinarily capable of resisting the trespass of cattle and will until the completion of the purchase of the said land maintain and uphold such fence in good and substantial repair.

5. The Purchaser shall clear and render available for cultivation 750 acres of the said land.

6. The Purchaser shall and will during the first five years from the date of this agreement clear and render available for cultivation not less than 93½ acres of the said land and will during the second five years clear and render available for cultivation not less than 93½ acres of the said land and will during each succeeding five years clear and render available for cultivation not less than [illegible] acres of the said land until [illegible] acres of the said land have been cleared and rendered available for cultivation and will at all times during the currency of this agreement keep the land so cleared

Secretary for Lands

7. The Purchaser will not without the consent of the Vendor being first had and obtained transfer sub-let encumber or mortgage the said land.

8. The Purchaser will subject to the regulations in force for the time being under "The Mining Act 1893" or any other Act authorising the making of regulations permit every gold or mineral lessee or licensee holding a lease or licence under "The Mining Act 1893" or any other Act for the time being authorising the granting of gold or mineral leases or licences of or respecting any of the said land and all persons authorised by such lessee or licensee to have free and unrestricted access to and egress from the said land comprised in such gold or mineral lease or licence.

9. The Purchaser will insure and during this agreement keep insured in the full insurable value thereof in some Insurance Office in Adelaide to be approved by the Vendor all buildings and erections the property of the Vendor upon the said land or which may thereafter be thereupon against loss or damage by fire such insurance to be in the joint names of such Purchaser and the said Vendor and will forthwith lodge the policy of every such insurance in the office of the said Vendor and will forward to the said Vendor the receipts for the premiums payable in respect of every such policy within seven days after the same shall become due and that if the foregoing covenant shall not be duly observed then the said Vendor shall be at liberty to insure the said improvements in manner aforesaid and it is agreed that all sums of money received under any such insurance shall be and are in reinstating the premises in respect of which the same shall have been received.

10. The Purchaser will destroy all rabbits on the said land and bill up their burrows to the satisfaction of the said Vendor and will forthwith commence to destroy all other vermin on the said land such as are by or under the "Vermin Acts 1914 to 1919" or by or under any other Act for the time being in force in the said State declared to be vermin and will keep the said land free of all vermin to the satisfaction of the Vendor during this agreement and will destroy Bathurst burr and all other noxious weeds growing upon the said land and upon the half width of Government roads adjacent thereto.

11. The Purchaser will neither allow to remain if now existing nor erect nor suffer the erection of any brush fence upon the said land.

12. The Purchaser will and will use agree and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon at any time.

13. And it is hereby expressly agreed that the Vendor may at any time or from time to time hereafter resume possession of all or any part of the said land for roads railways or tramways or for sites for towns or park lands or for mining purposes or for any public purpose whatsoever after the expiration of three calendar months from the giving by the Commissioner of Crown Lands to the Purchaser of notice in writing of the intended resumption and that immediately upon the giving of such notice the right of the Purchaser to complete the purchase shall cease and determine and be void as to all or such of the said lands as shall be specified in such notice and that immediately after the expiration of the said three calendar months this agreement and the right of the Purchaser to possession shall cease and determine and be void as to all or such part of the said lands as shall be specified in such notice anything in this agreement to the contrary notwithstanding PROVIDED that upon any resumption the Purchaser shall except as hereinafter in the next following clause is provided be paid compensation for the loss the Purchaser shall sustain thereby and in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the said Commissioner or the Purchaser in the manner provided by the "Crown Lands Acts 1915 to 1919."

14. The Vendor reserves unto himself the right to construct drains whose course may through the said land and to acquire or resume possession of all or any portion of the said land for any such purpose without any payment to the Purchaser by way of compensation for the same so taken and the Purchaser will when called upon execute a surrender of this agreement as far as regards all land so taken.

15. It shall be lawful for the Vendor and all persons authorised by him at all times unrestrictedly to enter into and upon the said land for any purpose whatsoever before completion of the purchase thereof.

16. The Purchaser shall and will permit the Crown or the owner of any mining claim situated on the land or the holder of any mining lease of the whole or any portion of the said land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease.

17. And it is hereby agreed and declared that if any of the instalments hereby reserved shall be unpaid and in arrear for more than six months after the day whereon the same is hereby made payable the Purchaser having had at least three months' previous notice in writing demanding its payment or if the said Vendor shall be satisfied there has been a breach in the performance of any other of the covenants herein contained or that this agreement is liable to forfeiture the said Vendor may re-enter and take possession of the said land and it shall be lawful for the Vendor before or after re-entry to cancel and determine this agreement and the said Vendor may thereupon insert a notice in the *Government Gazette* declaring this agreement to be forfeited and such notice appearing in the *Government Gazette* shall in all Courts and elsewhere and under all circumstances be taken to be conclusive evidence that this agreement has been legally cancelled and forfeited: PROVIDED that the Vendor shall not (except in the case of an instalment being unpaid and in arrear as aforesaid or of a breach of clause 7 hereof) exercise the powers expressed in this clause in case of a breach of covenant before the expiration of the period of three months after notice has been given to the Purchaser of such breach and requiring the performance of the covenant: PROVIDED NEVERTHELESS that if notice has been given to the Purchaser of any breach of a covenant no notice of any future breach of the same covenant or of the continuance of the same breach thereof shall be necessary before the exercise of such powers: PROVIDED also that the Vendor instead of exercising such power of forfeiture or cancellation as aforesaid may impose on the Purchaser a penalty of such sum as may be fixed by the Land Board constituted under the "Crown Lands Acts 1915 to 1919" and such penalty shall be recoverable in the same manner as the instalments of purchase-money or/and interest under this agreement are recoverable when in arrear.

18. And it is hereby expressly declared that any notice to be served on [illegible] shall be deemed to have been duly served and given if the same be sent [illegible] addressed to the Purchaser at any address stated in any recent application [illegible] usual or last known place of abode in the said State or to the care of any [illegible] Purchaser's behalf in the particular matter in respect whereof such notice is given and [illegible] been served on the [illegible] and time shall run from the day of the posting thereof.

IN WITNESS whereof the hand and seal of the Commissioner and the hand of the Purchaser [illegible] the Seventh day of March 1927

Signed and sealed by the said Vendor in the presence of

[illegible]

H. H. Sedgley

Signed by the said Purchaser in the presence of

Percy G. Crafter

H. H. Sedgley

H. T. Sedgley

A440352

MORTGAGE No: FROM

Walter Henry Sedgley and Harold Thomas Sedgley

The Bank of Adelaide

PRODUCED FOR REGISTRATION THE 28 DAY OF July 1927 AT [illegible]

[illegible]

DEP. REG. GENL.

A.D. 1495480

DEATH. The within named Harold Thomas Sedgley died on the 15 day of August 1945 as appears by Certified Copy of Certificate of Death No. 1495480 Produced for registration this 27 day of March 1947 at 11 01 a.m.

[illegible]

of Dep Reg Gen.

SURRENDER OF THE within Lease 2588 WAS REGISTERED AND [illegible] SOLD FOR REGISTRATION THE 25 DAY OF September 1941 AT 2.20 p.m.

[illegible]

DEP. REG. GENL.

[illegible] DAY OF [illegible]

[illegible]

[illegible]

DISCHARGE OF THE within Mortgage No. 1295116 1450711 PRODUCED FOR REGISTRATION THE 24 DAY OF February 1926 AT 11.30 a.m.

[illegible]

Dep Registrar

[illegible] THE WITHIN MORTGAGE

[illegible] DAY OF [illegible] AT 12.15 p.m.

[illegible]

DEP. REG. GENL.

>HIS< Historical Search Enter Title Reference >CT>5830>638 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5830/638	Previous Title	CT 5657/129 & OTHERS
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	19/12/2000	Authority	RTU 8933987

Produced	Completed	Document	Status	Details
26/02/04	02/03/04	9792122	REGD	CAVEAT CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

No More Details > <

>HIS< Historical Search Enter Title Reference >CT>5657>129 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched CT 5657/129 Previous Title CT 4007/702
Title Status TOTALLY CANCELLED Latest Duplicate EDITION 2
Date of Issue 27/05/1999 Authority CD 6987000

Produced	Completed	Document	Status	Details
12/09/00	20/12/00	8959552	REGD	DISCHARGE OF ENCUMBRANCE 3118879
26/07/00	20/12/00	8933987	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 55492
22/02/00	20/12/00	8840914	REGD	APPLICATION FOR DEPOSIT OF DP - UNCERT. D 54370
01/10/99	15/03/00	8761727	REGD	TRANSFER THE DISTRICT COUNCIL OF CEDUNA
14/07/70	14/07/70	3118879	REGD	ENCUMBRANCE ESSO AUSTRALIA LTD.

No More Details > <

ORIGINAL

CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4007 Folio 702

Comprising 2 sheets

New Certificate for the balance of the Land in Vol.3744 Folio 145

VYTAUTAS VINCENTAS PATUPAS of Streaky Bay Road Ceduna 5690 Road House Proprietor is the proprietor of on estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in PORTION OF SECTION 230 HUNDRED OF BONYTHON delineated by bold block lines on the plon hereon

In witness whereof I have hereunto signed my name and affixed my seal this 10th day of January 1974

Signed the 10th day of January 1974, in the presence of a. Wheatley.

B. L. Nairn

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

ENCUMBRANCE 3118879 to ESSO AUSTRALIA LIMITED
Produced 14.7.1970 at 10.40 a.m. (Single copy only)
(Including other land)

B. L. Nairn
Dep.Reg.Genl.

MORTGAGE 3217438 to THE BANK OF ADELAIDE
Produced 1.7.1971 at 11.35 a.m. (Including other land)

B. L. Nairn
Dep.Reg.Genl.

D4458724

The within land is discharged from Mortgage 3217438 vide 4458724 Produced 23.10.1979 at 11.15 a.m.

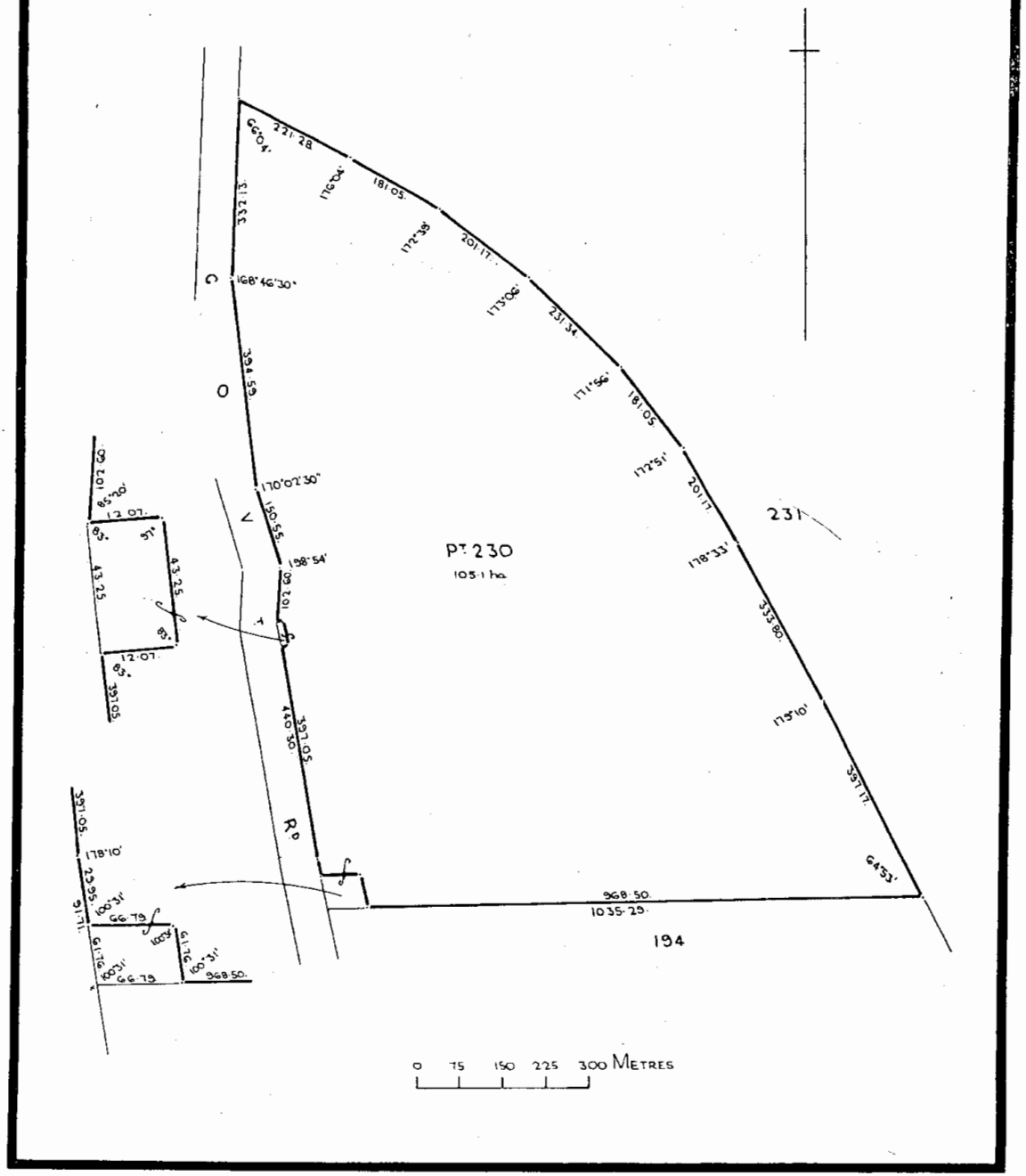
---------M5296877--

MORTGAGE 5296877 to WESTPAC BANKING CORPORATION
Produced 6.9.1984 at 10.10 a.m.

The within land is discharged from Mortgage 5296877 vide 8102543 Produced 23.4.1996 at 9:00

CANCELLED
CONVERTED TO A COMPUTERISED TITLE

ONE UNDIVIDED MOIETY



>HIS< Historical Search Enter Title Reference >CT>5735>114 <

HISTORICAL SEARCH OF CERTIFICATE OF TITLE

Title Searched	CT 5735/114	Previous Title	CT 4007/698
Title Status	CURRENT	Latest Duplicate	EDITION 1
Date of Issue	17/02/2000	Authority	CD 6987000

Produced	Completed	Document	Status	Details
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NIL

No More Details > <

ORIGINAL
CERTIFICATE OF TITLE

South Australia

Register Book,
Volume 4007 Folio 698

Pursuant to Transfer 3534069 Registered on Vol. 3744 Folios 144 and 145

THE MINISTER OF AGRICULTURE is the proprietor of an estate in fee simple subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in PORTION OF SECTION 230 HUNDRED OF BONYTHON delineated by bold black lines on the plan hereon

In witness whereof I have hereunto signed my name and affixed my seal this 10th day of January 1974

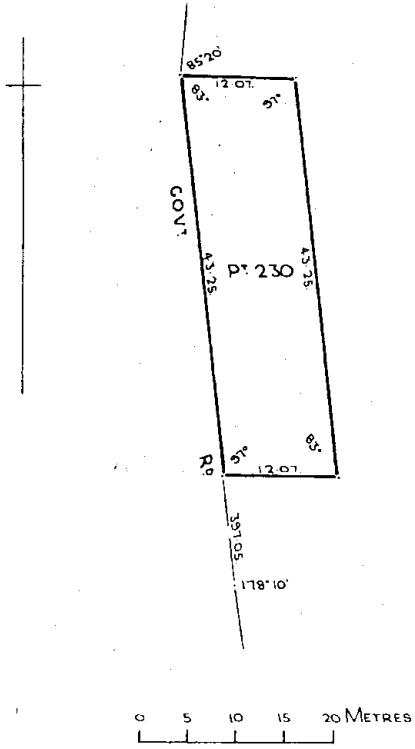
Signed the 10th day of January)
1974, in the presence of a. Wheatley.)

B. A. Nairn

Deputy Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

CANCELLED
CONVERTED TO A COMPUTERISED TITLE
REGISTRAR-GENERAL SOUTH AUSTRALIA



South Australia

CERTIFICATE OF TITLE

Register Book,
Vol. 3744 *Folio* 144

Pursuant to Memorandum of Transfer No.3162126 Registered on Vol.3684 Folio 191

MAXWELL ROBERT [illegible] of Ceduna 5690 Branch Manager

is the proprietor of an estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THAT SECTION of land containing two hundred and sixty one acres or thereabouts situated in the HUNDRED OF BONYTHON COUNTY OF WAY NO. 230 and bounded as appears in the plan in the margin hereof

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metals ore minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section is delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 8th day of January 1971

Signed the 8th day of January 1971, in the presence of N. Spear [illegible signature]

Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

... to Esso Standard Oil (Australia) Limited Produced 14.7.1970 at 10.40 a.m. (Single copy only) (including other land)

[illegible signature] Reg.Genl.

5534 OCC

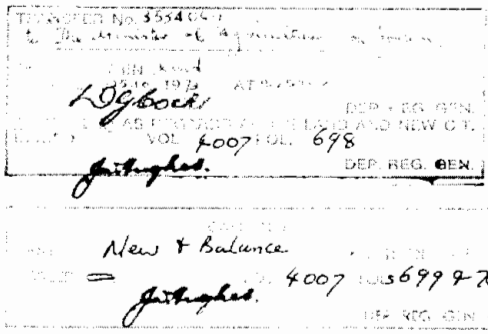
... to Esso Australia Ltd of c/- [illegible] (Nominees) S.A.) Pty Ltd of [illegible] street Adelaide 5000

[illegible signature]

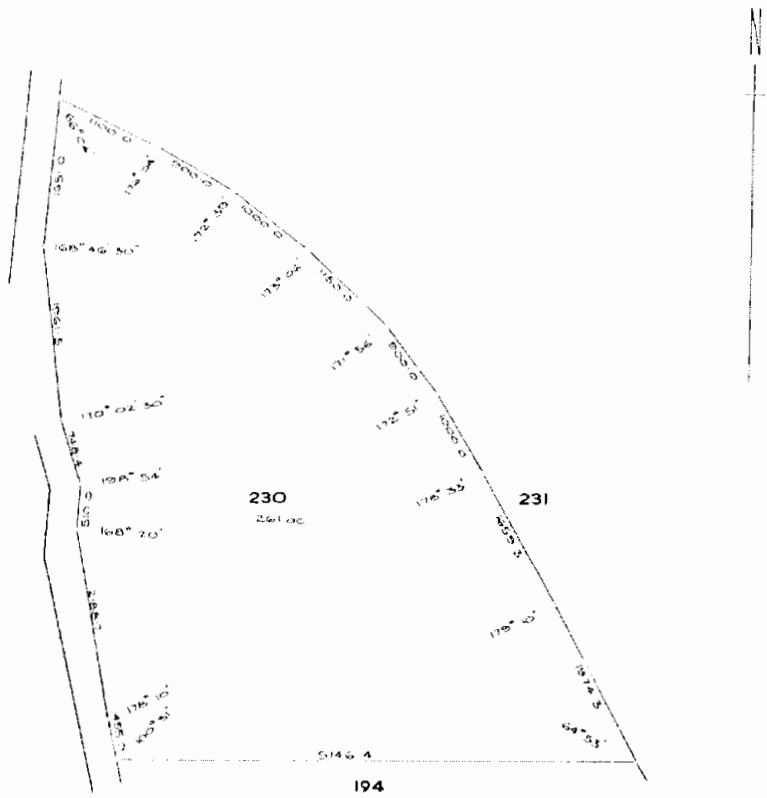
THE WITHIN LAND [illegible]

[illegible signature]

DEP. REG. GENL.


TRANSFER No. 555406
LOGbook
VOL 4007 FOL. 698
DEP. REG. GEN.
J.H.
New + Balance
4007 fols 699 + 701
J.H.
DEP. REG. GEN.

ONE UNDIVIDED MOIETY



South Australia

CERTIFICATE OF TITLE

Register Book,
Vol. 3744 *Folio* 145

Balance Certificate of Title from Vol.3658 Folio 171

VYTAUTAS VINCENTAS PATUPAS of Streaky Bay Road Ceduna 5690 Road House Proprietor

is the proprietor of an estate in fee simple IN ONE UNDIVIDED MOIETY subject nevertheless to such encumbrances liens and interests as are notified by memorial underwritten or endorsed hereon in THAT SECTION of land containing two hundred and sixty one acres or thereabouts situated in the HUNDRED OF BONYTHON COUNTY OF WAY NO.230 and bounded as appears in the plan in the margin hereof

EXCEPT AND RESERVED unto Her Majesty Her heirs and successors all gold silver copper tin and other metals ore minerals and other substances containing metals and all gems and precious stones coal and mineral oil in and upon such land and all incidental powers referred to in the original Land Grant for the within land.

Which said Section is delineated in the public map of the said Hundred deposited in the Land Office at Adelaide.

In witness whereof I have hereunto signed my name and affixed my seal this 8th day of January 1971

Signed the 8th day of January 19 71, in the presence of W. Spears

Registrar-General

REGISTRAR-GENERAL SOUTH AUSTRALIA

[illegible] to Esso Standard Oil (Australia) Limited Produced 14.7.1970 at 10.40 a.m. (Single copy only) (Including other land)

Reg.Genl.

MORTGAGE No. [illegible]

TO THE BANK OF ADELAIDE. PRODUCED 1-7 1971 AT 11.35

[signature] pro DEP. REG. GEN.

[signature]

D/A 3149443

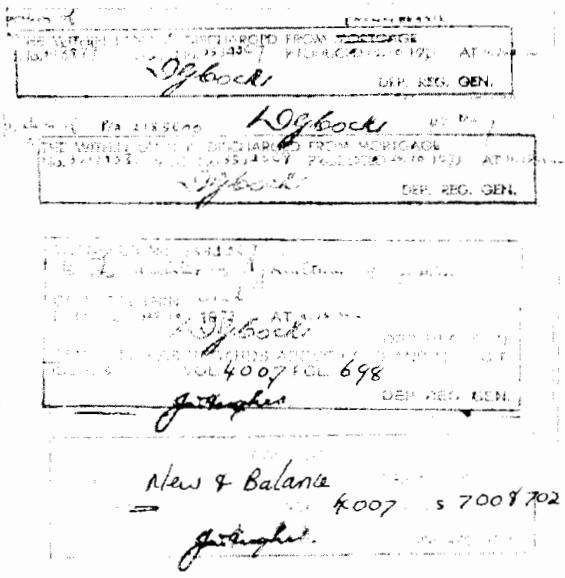
[illegible] OF NAME 3534000

[illegible]

AT [illegible]

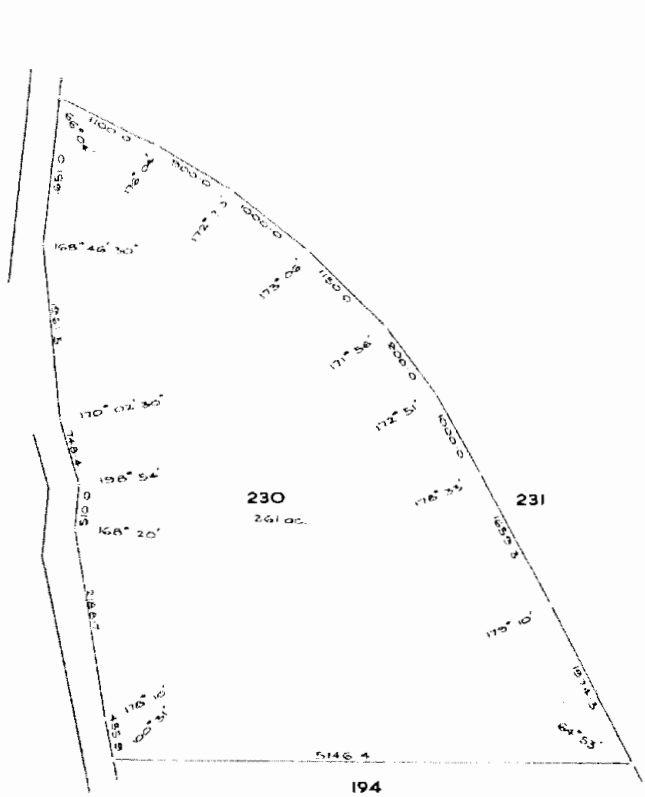
[signature]

[illegible]



SHEET No. 2 ATTACHED

ONE UNDIVIDED MOIETY



South Australia

Register Book,

Vol. 3684 Folio 191

Registrar-General

Land Grant.

[IN DUPLICATE]

(*In lieu of Surrendered* [illegible])

His Excellency the Governor in consideration of [illegible]

[illegible]

heretofore paid to the Treasurer as appears by the receipt at foot by [illegible]

[illegible]

hereinafter called the Grantee doth hereby in the name and on behalf of HER MAJESTY GRANT unto the Grantee ALL [illegible] Section of land containing [illegible] or thereabouts situate in the Hundred of [illegible] County of [illegible] and numbered [illegible] and delineated in the public maps deposited in the Land Office at ADELAIDE and in the plan in the margin hereof EXCEPT AND RESERVED UNTO HER MAJESTY Her Heirs and Successors all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils upon in or under the said land and all incidental powers as provided for in the Crown Lands Act 1929-~~1960~~, Provided that stone ordinarily used for building or road purposes shall be exempted from this reservation TO HOLD unto and to the use of the Grantee and the Heirs of the Grantee for ever.

GIVEN under the hand of the Governor and the Public Seal of South Australia this [illegible] day of [illegible] one thousand nine hundred and [illegible]

BY COMMAND,

The Minister of Lands

~~Received~~

~~purchase-money as before expressed.~~

Under Treasurer [illegible] *Treasurer*

Certified correct, *Director of Lands*

Fwd. B D.L. 2279/37.

Diagram certified correct, *Surveyor-General*

TRANSFER No. 3086... to Vytautas Vincentas Patupas of Streaky Bay Road Ceduna 5690 Road House Proprietor

OF THE WITHIN LAND PRODUCED 16.12.1969 AT 2.55 pm

DEP. REG. GEN.

MORTGAGE No. 306... to Walter Karl Oberdan

PRODUCED 16.12.1969 AT 2.55 pm

DEP. REG. GEN.

TRANSFER No. 3091599 from to Alliance Acceptance Co. Limited of 50 Grenfell Street Adelaide mortgage no. 3062569

OF THE WITHIN LAND PRODUCED 8/4/1970 AT 11.5 AM

DEP. REG. GEN.

ENCUMBRANCE No. 3118879

PRODUCED .../.../1970 AT ... (single copy only)

DEP. REG. GEN.

TRANSFER No. 3122602 to Walter Karl Oberdan of ...

mortgage No 3062568

OF THE WITHIN LAND, PRODUCED ... AT ...

DEP. REG. GEN.

DISCHARGE OF MORTGAGE No. 3062568

VIDE No. 3122603 PRODUCED 28/1/1970 AT 11...

DEP. REG. GEN.

TRANSFER No. 3162126 to ... Robert Unsted of an ... undivided moiety in the within land

PRODUCED 17.12.1970 AT 11.28 am

CANCELLED ... CERTIFICATE ISSUED

VOL. 3744 FOL. 144

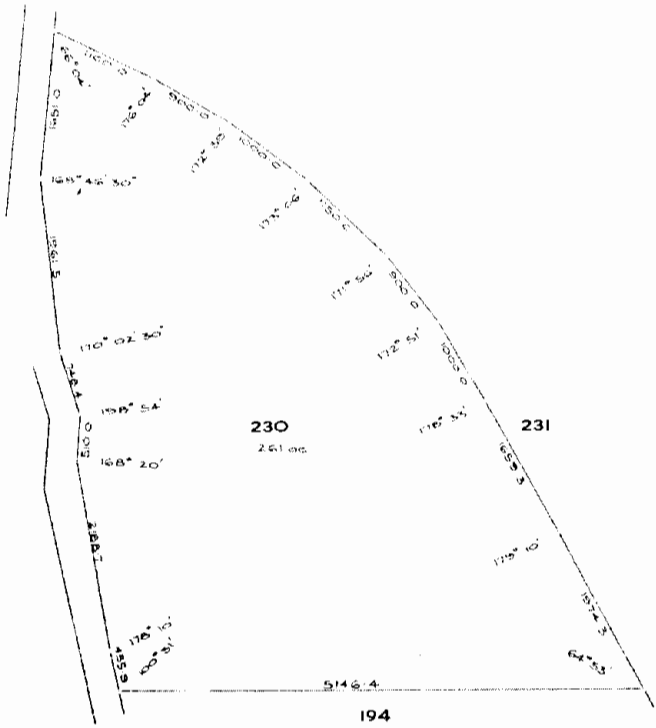
DEP. REG. GEN.

Balance

3744 FOL. 145

DEP. REG. GEN.

SHEET No. 2



Chains 10 5 0 Scale 10 20 Chains

South Australia

Register Book,

Vol. 1351 Folio 12

K. London Deputy Registrar-General

Crown Lease

(PERPETUAL, No. 16197A)

In lieu of Surrendered Perpetual Lease 16197 *(part of) Reg. Vol.* 885 *Folio* 20

PERSONAL RESIDENCE

Her Majesty the Queen doth hereby lease to WALTER KARL OBERSEN of Ceduna 5690 Service Station Proprietor

herein designated by the term "Lessee" all that land containing approximately two hundred and sixty one (261) acres ~~or thereabouts~~ and being Section No. 230

in the Hundred of BONYTHON County of WAY as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held in perpetuity at the yearly rent of five dollars and sixty cents ($5-60) to be paid in advance on the second day of May commencing the twenty fifth day of November One Thousand Nine Hundred and ~~sixty eight~~ 1987 with such penalties as are provided for by the Crown Lands Act 1929 ~~1969~~, added thereto in case any of such rents is in arrear and subject to the reservations covenants and conditions shortly stated below and some of which are more fully set out in the Crown Lands Act 1929-1937

The Minister of Lands.

By command,

Director of Lands.

Certified correct,

RESERVATIONS

1. There are reserved to the Crown all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils with incidental powers of search and mining AND ALSO the right to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use where required without any payment to the Lessee by way of compensation

COVENANTS

2. The Lessee must—

I. Enclose the land with cattle-proof fence before the end of the first year of the lease and during the remainder of the term hereby granted maintain and uphold such fence in good and substantial repair

II. Keep in good repair all Crown improvements (if any) on the land

III. Pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of loans repayable under the Vermin Act 1931-1950 or any Act amending or extending that Act or substituted therefor

IV. ~~Clear so as to render available for cultivation or so as to improve the grazing capacity thereof acres of the land~~

V. ~~During the first two years clear so as to render available for cultivation or so as to improve the grazing capacity thereof not less than one-eighth of the area specified in that behalf in the lease and will during the second two years clear as aforesaid not less than one-eighth of the area so specified and will during each succeeding year clear as aforesaid not less than one-eighth of the area so specified until the whole of the area so specified has been cleared and will at all times keep available for cultivation or grazing as the case may be the land so cleared~~

VI. Insure and keep insured in the full insurable value thereof against loss and damage by fire storm and tempest all buildings erections and other improvements the property of the Crown upon the leased land in the joint names of The Minister of Lands (hereinafter called the Minister) and the Lessee in some Insurance Office in Adelaide to be approved of by the Minister and forthwith lodge the policy of every such insurance in the office of the Minister and forward to the Minister the receipts for the premiums payable in respect of such policy within seven days after the same shall become due. The Minister may insure on default by the Lessee and recover all amounts paid for such insurance in like manner as the rent is recoverable

EXD.

E ~~(c)~~ (b4)
P.R.
Act 1929-1937
~~D.L., 1810/36.~~
8901/50.
~~Subdivision forms R. of Pr.~~

COVENANTS—continued

VII. Personally reside on the land for nine months in each year

VIII. Permit the Minister and his authorized agents at all times to enter upon the land to search and mine for minerals on the land and remove therefrom any minerals or other things reserved and belonging to the Crown and also to permit the owner of any mining claim situated on the land and the holder of any mining lease of the whole or any portion of the land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease

IX. Set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon

X. ~~IX.~~ Set apart and keep reserved for the purpose of preventing soil erosion such areas of the land comprised in this lease being areas covered with natural scrub growth as the Minister or his servants shall notify to the Lessee and will not destroy or permit to be destroyed any natural scrub growth growing on the said areas; the said areas will be of the respective sizes and in the respective positions notified to the Lessee by the Minister or his servants provided that the total area of the said areas shall not exceed one-tenth of the area of the land comprised in this lease or such greater area as the Minister on the recommendation of the Land Board may determine The land to be set apart and kept reserved pursuant to this covenant shall be in addition to the land required to be set apart and reserved pursuant to covenant ix. hereof

XI. Forthwith commence to destroy and to keep the land and the adjoining half width of all public roads adjacent thereto free from vermin and noxious weeds to the satisfaction of the Minister during the lease and fill up all burrows on the land and the said half width of road

~~XI. Pay the balance of arrears of rent and interest thereon due under the former Lease to the~~ ~~day of 19 viz:~~ ~~together with interest thereon at the rate of~~ ~~per centum per annum in equal annual instalments of~~ ~~(being instalments of principal and interest) on the day of~~ ~~in each year the first of such instalments to be paid on the day of~~ ~~19 such instalments shall be payable and recoverable in the same manner as the rents to become due hereunder~~

~~Provided that in the event of any such instalment being in arrear the Lessee must pay interest thereon at the rate of Five Pounds per centum per annum from the date such instalment became due until the date of payment thereof~~

~~Provided also that the Lessee shall have the right to pay off the whole or any portion of the said arrears together with interest then due at any time~~

And the Lessee must not—

XII. Transfer sublet encumber or mortgage without the written consent of the Minister first had in each case

XIII. Erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS

3. The lease shall be liable to forfeiture in the following cases:—

I. If default be made in payment of any rent in arrear for six months after the same falls due the Lessee having had at least three months previous notice in writing demanding its payment or if

II. Default be made in the performance of any covenant or if

III. The land shall be transferred sublet or mortgaged without the written consent of the Minister first had in each case or if

IV. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use or if

V. The Lessee shall refuse to permit the Minister and his authorized agents and the owner of any mining claim and the holder of any mining lease to exercise the liberty hereinbefore mentioned or if

VI. The Lessee shall not set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land or if the Lessee shall destroy or permit or suffer to be destroyed any timber trees growing thereon or if

VII. The Lessee shall not set apart and thereafter keep reserved for the purpose of preventing soil erosion such areas of the land comprised in this lease being areas covered with natural scrub growth of the respective sizes and in the respective positions notified to the Lessee by the Minister or his servants or if the Lessee shall destroy or permit to be destroyed any natural scrub growth growing on the said areas or if

VIII. The Lessee shall erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS—continued

4. The land may be resumed by the Crown for mining or for any public work or purposes full compensation being made to the Lessee for his loss Provided that immediately upon the giving of a notice to the Lessee by publication in the *Government Gazette* of intended resumption of the whole or any portion of the said land the right of the Lessee to purchase the land comprised in this lease as provided in condition 5 hereof shall cease and determine and be void as to all or such parts of the said lands as shall be specified in such notice

5. The Lessee shall have the ~~right subject nevertheless to the provisions lastly hereinbefore contained~~ subject to the covenants conditions and provisions thereof at any time during the currency of this lease to purchase and obtain the fee simple of the land comprised in this lease on payment of the sum of two hundred and twenty five dollars and seventy nine cents ($225–79)

~~being at the rate of~~
~~per acre in addition to all arrears of rent (if any) and the balance for the time being of the arrears of rent (if any) under the former lease and interest thereon.~~

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the sixteenth day of January 19 69

Signed sealed and delivered by the above-named Lessee in the presence of

L. S.

L. S.

SURRENDER OF LEASE VIDE No. 3050960

16193A
6.11.69 AT 12.5 p.m.
SUB. REG. GEN.

Tom Duggan

South Australia.

Register Book,

Vol. 885 Folio 20

W. Playford Registrar-General.

76

Crown Lease.

(PERPETUAL, No. 16197).

In lieu of Surrendered Agreement to Purchase No. 11725 *Reg. Vol.* 754 *Folio* 7

PERSONAL RESIDENCE.

His Majesty the King doth hereby lease to LEO BERNHARDT HUGHES of Ceduna Farmer

herein designated by the term "Lessee" all that land containing one thousand one hundred and three (1103) acres or thereabouts and being Section No. 35

in the Hundred of BONYTHON County of WAY as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held in perpetuity at the yearly rent for the first ten years of the term hereof of nine pounds ten shillings and eight pence(£9:10:8) and thereafter of such amount as shall be fixed by the Land Board and approved by the Commissioner of Crown Lands hereinafter called the Commissioner pursuant to the Crown Lands Act 1929-1937 to be paid in advance on the second day of May commencing the second day of May One Thousand Nine Hundred and thirty four with such penalties as are provided for by the Crown Lands Act 1929-1937 added thereto in case any of such rents is in arrear and subject to the reservations covenants and conditions shortly stated below and which are more fully set out in the Crown Lands Act 1929-1937.

Commissioner of Crown Lands.

RESERVATIONS.

1. There are reserved to the Crown all gold silver copper tin and other metals all ores and other substances containing metals all minerals and all gems and precious stones coal and mineral oils with incidental powers of search and mining **AND ALSO** the right to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use where required without any payment to the Lessee by way of compensation

COVENANTS.

2. The Lessee must—

I. Enclose the land with cattle-proof fence before the end of the fifth year of the lease

II. Keep in good repair all Crown improvements (if any) on the land

III. Pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of loans repayable under the Vermin Act 1931-1936 or any Act amending or extending that Act or substituted therefor

IV. Clear so as to render available for cultivation or so as to improve the grazing capacity thereof Nil acres of the land

V. During the first two years clear so as to render available for cultivation or so as to improve the grazing capacity thereof not less than one-eighth of the area specified in that behalf in the lease and will during the second two years clear as aforesaid not less than one-eighth of the area so specified and will during each succeeding year clear as aforesaid not less than one-eighth of the area so specified until the whole of the area so specified has been cleared and will at all times keep available for cultivation or grazing as the case may be the land so cleared

VI. Insure and keep insured in the full insurable value thereof all buildings the property of the Crown upon the leased land in the joint names of the Commissioner and the Lessee in some Insurance Office in Adelaide to be approved by the Commissioner and forthwith lodge the policy of every such insurance in the office of the Commissioner and forward to the Commissioner the receipts for the premiums payable in respect of such policy within seven days after the same shall become due with a power for the Commissioner to insure on default by the Lessee and to recover the amount paid for such insurance in like manner as the rent is recoverable

Director of Lands.

Exd. (b4) 464

(Surrender.)

P.R. 1929-1937. 1937/34. A first ten years.

COVENANTS—continued.

VII. Personally reside on the land for nine months in each year

VIII. Permit the Crown or the owner of any mining claim situated on the land or the holder of any mining lease of the whole or any portion of the land under any law in force for the time being relating to mining with or without workmen full and free liberty of access ingress egress and regress into upon and from the land comprised in such claim or lease

IX. Set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land and shall not and will not destroy or permit or suffer to be destroyed any timber trees growing thereon

X. Forthwith commence to destroy and to keep the land and the adjoining half width of all public roads adjacent thereto free from vermin and noxious weeds to the satisfaction of the Commissioner during the lease and fill up all burrows on the land and the said half width of road

And the Lessee must not—

XI. Transfer sublet encumber or mortgage without the written consent of the Commissioner first had in each case

XII. Erect brush fence or suffer or permit the same to be erected or to remain on the land

CONDITIONS.

3. The lease shall be liable to forfeiture in the following cases:—

I. If default be made in payment of any rent in arrear for six months after the same falls due the Lessee having had at least three months previous notice in writing demanding its payment or if

II. Default be made in the performance of any covenant or if

III. The land shall be transferred sublet or mortgaged without the written consent of the Commissioner first had in each case or if

IV. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and/or pipe tracks and/or to lay pipes and/or to conserve water for public use or if

V. The Lessee shall refuse to permit the Crown or the owner of any mining claim or the holder of any mining lease to exercise the liberty hereinbefore mentioned or if

VI. The Lessee shall not set apart and reserve for the growth of timber at least five acres of every two hundred and fifty acres of the said land or if the Lessee shall destroy or permit or suffer to be destroyed any timber trees growing thereon or if

VII. The Lessee shall erect brush fence or suffer or permit the same to be erected or to remain on the land

4. The land or any portion thereof may be resumed by the Crown for roads railways tramways or for sites for towns or for park lands or for mining purposes or for any public work or purpose upon the Commissioner giving three calendar months notice to the Lessee by publication in the *Government Gazette* of such intended resumption and that immediately from and after the expiration of three calendar months after such notice shall have been given as aforesaid this lease and the demise hereby made shall cease determine and be void as to all or such parts of the said lands as shall be mentioned and described in such notice anything in this lease to the contrary notwithstanding Provided that full compensation shall be made to the Lessee for his loss except where the land shall be resumed for the construction of drains and/or pipe tracks and/or the laying of pipes and/or for the conservation of water for the public use in which case no compensation shall be payable Provided that in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the Commissioner or the Lessee in the manner provided by section 289 of the Crown Lands Act 1929-1937 and provided that immediately upon the giving of a notice to the Lessee by publication in the *Government Gazette* of intended resumption of the whole or any portion of the said land the right of the Lessee to purchase the land comprised in this lease as provided in condition 5 hereof shall cease and determine and be void as to all or such parts of the said lands as shall be specified in such notice

5. The Lessee shall have the right at any time during the currency of this lease subject to the covenants conditions and provisions thereof to purchase the fee simple of the land comprised herein for the sum of four hundred and seventy six pounds twelve shillings and two pence (£476: 12: 2)

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the twenty first day of September 1938.

Signed sealed and delivered by the above-named Lessee in the presence of

[signature] L.S.

CERTIFICATE NO. 1432044 of the Minister of LANDS THAT ON REVALUATION OF THE WITHIN LEASE NO. 16197 THE RENT HAS BEEN FIXED AT £ 11 : 18 : 4 PER ANNUM FROM THE 2 DAY OF May 1944 PRODUCED FOR REGISTRATION THE 8 DAY OF June 1945, AT 3 P M.

DEP. REG. GENL.

T1694122

TRANSFER No. 1694122 FROM Leo Bernhard Hughes to Kenneth Allen Schwarz of Box 11 Ceduna Farmer OF THE WITHIN Lease No. 16197

PRODUCED FOR REGISTRATION THE 16 DAY OF [illegible] 1957 at 2.35 pm

DEP. REG. GENL.

PARTIAL SURRENDER NO. 2405 [illegible] THE WITHIN LEASE No. 16197 IS SURRENDERED AS REGARDS 29 [illegible] 33p ACRES AND THE AREA REDUCED TO 1100 ACRES AND THE amount required to purchase the fee simple under condition 5 of the lease is REDUCED TO £ 475 : 12 : 2 FROM 30/7/1963 PRODUCED 16/8/1963 AT 10.45 am

DEP. REG. GEN.

TRANSFER No. 2628002 to Eric Leslie Baumann of Ceduna Share - Farmer OF THE WITHIN LAND Lease No. 16197 PRODUCED 17-5-1965 AT 12.10 pm

DEP. REG. GEN.

MORTGAGE No. 2628003 to Kenneth Allen Schwarz

PRODUCED 17-5-1965 AT 12.10 pm

DEP. REG. GEN.

PARTIAL SURRENDER No. 2961368 THE WITHIN LEASE No. 16197 IS SURRENDERED AS REGARDS 29 3/4 ACRES AND THE AREA by recalculation REDUCED TO 1072 ACRES AND THE ANNUAL RENT REDUCED ~~RENT REDUCED TO~~ £ TO $23 and the purchase money under conditions 5 to be reduced to $928-50 FROM 20·11·1968 PRODUCED 22·11·1968 at 11 am.

DEP. REG. GEN.

SURRENDER OF lease No. 16197 VIDE No. 2970694 PRODUCED 31 - 1969 AT 2.35 pm

DEP. REG. GEN.

Australia.

Registrar-General.

Agreement for Sale and Purchase.

No. 11725

(Made pursuant to the provisions of the "Crown Lands Acts, 1915 to 1928.")

PERSONAL RESIDENCE.

(In lieu of Surrendered Perpetual Lease 11408 *Reg. Vol.* 568 *Folio* 96 *)*

ement made this first day of May One Thousand Nine Hundred and twenty nine BETWEEN The Commissioner of Crown Lands of and for the State of South Australia herein contracting as a public officer for and on behalf of His Most Gracious Majesty King GEORGE THE FIFTH (hereinafter called "the Vendor") of the one part and

LEO BERNHARDT HUGHES of Ceduna Farmer

(hereinafter with his executors administrators and assigns called "the Purchaser") of the other part WHEREBY IT IS AGREED by and between the parties hereto as follows:—

1. The Vendor agrees to sell and the Purchaser agrees to purchase the land and improvements thereon for the sum of five hundred and fifty two pounds (£552: 0: 0)

being the price fixed by the Land Board

and being ALL that Section of land situated in the Hundred of BONYTHON

County of EYRE containing one thousand one hundred and four (1104)

acres or thereabouts numbered 35 Near Ceduna

EXCEPT AND RESERVED all gold silver copper tin and other metals all ores and other substances containing metals minerals and all gems and precious stones coal and mineral oils upon in or under the said land to the Vendor and persons lawfully claiming under or authorised by him with full and free liberty of access ingress egress and regress with or without horses cattle carts drays carriages engines and all necessary implements and things into upon and from said land for all reasonable purposes and to cut dig sink try search work remove and dispose of all or any of the said excepted and reserved things.

2. The Purchaser shall pay the purchase-money together with interest thereon at the rate of three (3) pounds per centum per annum in sixty half-yearly instalments of thirteen pounds sixteen shillings and six pence (£13: 16: 6)

payable in advance on the first days of May November in each year until the whole of the purchase-money and interest shall be paid: PROVIDED the Purchaser may complete the purchase of the said land at any time after six years from the date when such land originally taken up on payment of the balance of the purchase-money and interest to the date of the completion of the purchase and provided that the terms covenants conditions and provisions of this agreement have been fully complied with to the satisfaction of the Commissioner of Crown Lands.

3. The Purchaser will pay and discharge all rates taxes assessments impositions and outgoings which shall become payable in respect of the said land and will also pay all amounts due or which may hereafter become due on account of the said land granted under the "Vermin Acts 1914 to 1928."

4. The Purchaser shall and will during the first five years from the date of this agreement substantially fence the boundaries of the said land with a fence or wall ordinarily capable of resisting the trespass of cattle and will until the completion of the purchase of the said land maintain and uphold such fence in good and substantial repair.

5. The Purchaser will during this agreement keep and maintain in good and tenantable repair and condition all improvements on the said land.

6. The Purchaser will not without the consent of the Vendor being first had and obtained transfer sub-let encumber or charge the said land.

7. The Purchaser will subject to the regulations in force for the time being under "The Mining Acts 1893 to 1922" and authorising the making of regulations permit every gold or mineral lessee or licensee holding a lease or license under the Mining Acts 1893 to 1922" or any other Act for the time being authorising the granting of gold or mineral leases or licences of

8. The Purchaser will insure and during this agreement keep insured in the full insurable value thereof in some Insurance Office in Adelaide to be approved by the Vendor all buildings and erections the property of the Vendor upon the said land or which may thereafter be thereupon against loss or damage by fire such insurance to be in the joint names of such Purchaser and the said Vendor and will forthwith lodge the policy of every such insurance in the office of the said Vendor and will forward to the said Vendor the receipts for the premiums payable in respect of every such policy within seven days after the same shall become due and that if the foregoing covenant shall not be duly observed then the said Vendor shall be at liberty to insure the said improvements in manner aforesaid and it is agreed that all sums of money received under any such insurance shall be laid out in reinstating the premises in respect of which the same shall have been received.

9. The Purchaser will destroy all rabbits on the said land and fill up their burrows to the satisfaction of the said Vendor and will forthwith commence to destroy all other vermin on the said land such as are by or under the "Vermin Acts 1914 to 1923" and by or under any other Act for the time being in force in the said State declared to be vermin and will keep the said land free of all vermin to the satisfaction of the Vendor during this agreement and will destroy Bathurst bur and all other noxious weeds growing upon the said land and upon the half width of Government roads adjacent thereto.

10. The Purchaser will personally reside on the said land for nine months at least in every year during the currency of this agreement.

11. The Purchaser will neither allow to remain if now existing nor erect nor suffer the erection of any brush fence upon the said land.

12. It shall be lawful for the Vendor and all persons authorised by him at all times unrestrictedly to enter into and upon the said land for any purpose whatsoever before completion of the purchase thereof.

13. And it is hereby expressly agreed that the Vendor may at any time or from time to time hereafter resume possession of all or any part of the said land for roads railways or tramways or for sites for towns or park lands or for mining purposes or for any public purpose whatsoever after the expiration of three calendar months from the giving by the Commissioner of Crown Lands to the Purchaser of notice in writing of the intended resumption and that immediately upon the giving of such notice the right of the Purchaser to complete the purchase shall cease and determine and be void as to all or such of the said lands as shall be specified in such notice and that immediately after the expiration of the said three calendar months this agreement and the right of the Purchaser to possession shall cease and determine and be void as to all or such part of the said lands as shall be specified in such notice anything in this agreement to the contrary notwithstanding: PROVIDED that on any resumption the Purchaser shall except as hereinafter in the next following clause is provided be paid compensation for the loss the Purchaser shall sustain thereby and in case of dispute the amount of such compensation shall be determined by the Land Board or at the option of the said Commissioner or the Purchaser in the manner provided by the "Crown Lands Acts 1915 to 1928."

14. The Vendor reserves unto himself and all persons and bodies authorised by him full right and liberty without any payment to the Purchaser by way of compensation from time to time and at all times hereafter with or without beasts of draught or burden or any vehicles whatever to enter into and upon the said land for the purpose of laying pipes or a pipe track in along over or under the said land and to view the condition of and to cleanse relay repair and maintain the said pipes or pipe track and to allow water to be in and to flow through the said pipes or pipe track and to construct drains and pipe tracks and to lay pipes where required in along over or under the said land and to view the condition of and cleanse relay repair and maintain the said drains and pipe tracks and pipes and to allow water to be in and to flow through the said drains pipe tracks and pipes.

15. And it is hereby agreed and declared that if any of the instalments hereby reserved shall be unpaid and in arrear for more than six months after the day whereon the same is hereby made payable the Purchaser having had at least three months' previous notice in writing demanding its payment or if the said Vendor shall be satisfied there has been a breach in the performance of any other of the covenants herein contained or that this agreement is liable to forfeiture the said Vendor may re-enter and take possession of the said land and it shall be lawful for the Vendor before or after re-entry to cancel and determine this agreement and the said Vendor may thereupon insert a notice in the *Government Gazette* declaring this agreement to be forfeited and such notice appearing in the *Government Gazette* shall in all Courts and elsewhere and under all circumstances be taken to be conclusive evidence that this agreement has been legally cancelled and forfeited: PROVIDED that the Vendor shall not (except in the case of an instalment being unpaid and in arrear as aforesaid or of a breach of clause 6 hereof) exercise the powers expressed in this clause in case of a breach of covenant before the expiration of the period of three months after notice has been given to the Purchaser of such breach and requiring the performance of the covenant: PROVIDED NEVERTHELESS that if notice has been given to the Purchaser of any breach of a covenant no notice of any future breach of the same covenant or of the continuance of the same breach thereof shall be necessary before the exercise of such powers: PROVIDED also that the Vendor instead of exercising such power of forfeiture or cancellation as aforesaid may impose on the Purchaser a penalty of such sum as may be fixed by the Land Board constituted under the "Crown Lands Acts 1915 to 1928" and such penalty shall be recoverable in the same manner as the instalments of purchase-money or/and interest under this agreement are recoverable when in arrear.

16. And it is hereby expressly declared that any notice to be served or given to the Purchaser under this agreement shall be deemed to have been duly served and given if the same be sent through the post office enclosed in an envelope addressed to the Purchaser at any address stated in any recent application letter or document received from him or at his usual or last known place of abode in the said State or to the care of any Solicitor Attorney or Agent acting in the Purchaser's behalf in the particular matter in respect whereof such notice is given and such notice shall be deemed to have been served or given on and time shall run from the day of the posting thereof as aforesaid.

IN WITNESS whereof the hand and seal of the Commissioner and the hand of the Purchaser were hereunto set the Sixth day of September 1929

Signed and sealed by the said Vendor in the presence of

C Parry

Geo. F. Jenkins

L B Hughes

Signed by the said Purchaser in the presence of

L B Hughes

~~M1109505~~

MORTGAGE No. 1109505 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 3 DAY OF November 1930 AT 11.20 am (Including other land)
E[illegible]
DEP. REG GENL.

~~M1168512~~

MORTGAGE No. 1168512 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 17 DAY OF May 1934 AT 11.30 a.m.
(Including other land)
H Whitewood
DEP. REG GENL.

MORTGAGE No. 1203308 FROM Leo Bernhardt Hughes to The Bank of Adelaide
PRODUCED FOR REGISTRATION THE 18. DAY OF December 1935 AT 11 a.m.
Including other land.
G Pinkerton & Sg DEP. REG GENL.

~~DM1109505 DISCHARGE OF THE within MORTGAGES~~

DISCHARGE OF THE within MORTGAGES
Nos. 1109505, 1168512 and 1203308
~~BY ENDORSEMENT THEREON~~
PRODUCED FOR REGISTRATION THE 17 DAY OF May 1937 AT 11.35 a.m.
G Pinkerton
DEP. REG. GENL.

~~E127955~~

SURRENDER OF THE within Agreement
No. 11725 BY MEMORANDUM No. 1270551
PRODUCED FOR REGISTRATION THE 11 DAY OF August 1938 AT 3 pm
A J Sidebottom
DEP. REG. GENL.

Day. H. Bosanquet

South Australia.

Register Book, Vol. 568 Folio 96

M Giles Registrar-General.

Crown Lease.

(PERPETUAL, No. 11408 .)

PERSONAL RESIDENCE.

(In lieu of Surrendered [illegible]).

[H]is Majesty the King doth hereby lease to George Edward Fleetwood & Murat Bay Dune [illegible] herein designated by the term "Lessee" all that land containing one thousand one hundred and four (1104) acres or thereabouts and being Section No 35 Near Ceduna in the Hundred of Bonython County of Way as the same is delineated in the public maps deposited in the Land Office in the City of Adelaide to be held **in perpetuity** at the yearly rent of [illegible] and five shillings (£7.5.0) to be paid in advance on the first day of January commencing the first day of January One Thousand Nine Hundred and ten and at a further rent of Five Pounds per centum per annum on any rent in arrear subject to the reservations covenants and conditions shortly stated below and which are more fully set out in "The Crown Lands Act 1903"

RESERVATIONS.

1. There are reserved to the Crown all gold silver copper tin and other metals ores minerals and other substances containing metals and all gems and precious stones coal and mineral oil with incidental powers of search and mining **AND ALSO** the right to enter upon the land hereby leased to construct drains and pipe tracks and to lay pipes and to conserve water for public use where required

COVENANTS.

2. The Lessee must—

i. Enclose the land with cattle-proof fence before the end of the fifth year of the lease and

ii. Keep in good repair all Crown improvements (if any) on the land

iii. Forthwith commence to destroy and to keep the land free from vermin to the satisfaction of the Commissioner during the lease

iv. Insure and keep insured in the full insurable value thereof all buildings the property of the Crown upon the leased land in the joint names of the Commissioner and the Lessee in some Insurance Office to be approved by the Commissioner and forthwith lodge the policy of every such insurance in the office of the Commissioner and to forward to the Commissioner the receipts for the premiums payable in respect of such policy within seven days after the same shall become due with a power for the Commissioner to insure on default by the Lessee and to recover the amount paid for such insurance in like manner as the rent is recoverable

v. Personally reside on the land for nine months in each year

And the Lessee must not—

vi. Transfer sublet encumber or mortgage without the written consent of the Commissioner of Crown Lands first had in eachcase

By command, [signature] [illegible] Commissioner of Crown Lands.

Certified correct, [signature] Surveyor-General.

R.O. Surrendered. P.R. (2)

CONDITIONS.

3. The lease shall be liable to forfeiture in the following cases and no others:—

i. If default be made in payment of any rent in arrear for six months after written notice requiring its payment or if

ii. Default be made in the performance of any covenant for three months after notice of its non-performance requiring its performance or if

iii. The land shall be transferred sublet or mortgaged without the written consent of the Commissioner of Crown Lands first had in such cases or if

iv. The Lessee shall refuse to permit the Crown by its officers or servants to enter upon the land hereby leased to construct drains and pipe tracks and to lay pipes and to conserve water for public use or if

v. The Lessee does not reside on the land for nine months in each year

4. The land may be resumed by the Crown for mining or for any public work or purpose full compensation being made to the Lessee for loss except where the land shall be resumed for the construction of drains or pipe tracks and the laying of pipes or for the conservation of water for the public use in which cases no compensation whatever shall be made to the Lessee

IN WITNESS whereof the Public Seal of the State of South Australia and the hand and seal of the said Lessee were hereunto set the 26 day of July 1907

George Edward Fleetwood

Signed sealed and delivered by the above-named Lessee in the presence of

Wal. Warren.

Mortgage No 548701 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 5 day of May 1910 at 11 hour Vernon H Edwards Dep Reg Gen

Mortgage No 540612 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 8 day of August 1911 at 11 hour Vernon H Edwards Dep Reg Gen

Mortgage No 486549 from George Edward Fleetwood to the Advances to Settlers Board Produced for registration the 25 day of April 913 at 11 50 am Vernon H Edwards Dep Reg Gen

DISCHARGE OF THE within MORTGAGE NO. 548701 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 12 DAY OF May 1910 AT 11 M
Robt Rowe
DEP. REG. GENL.

DISCHARGE OF THE within MORTGAGE NO. 540612 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 20 DAY OF May 1918 AT 3 10 M
Robt Rowe
DEP. REG. GENL.

DISCHARGE OF THE within MORTGAGE NO. 486549 BY RECEIPT ENDORSED THEREON PRODUCED FOR REGISTRATION THE 18 DAY OF April 1923 AT 3 02 M
Robt Rowe
DEP. REG. GENL.

Transfer No 103196 from George Edward Fleetwood to Leo Bernhardt Hughes of Veduna Farmer of the within lease No 11408 Produced for registration the 22 day of March 1928 at 12.15 pm
Dep Reg Genl

SURRENDER OF THE within lease No 11408 BY MEMORANDUM No. 107356 PRODUCED FOR REGISTRATION THE 14 DAY OF June 1927 AT 3 pm

Computer Register Search

LANDS TITLES OFFICE, ADELAIDE

For a Certificate of Title issued pursuant to the Real Property Act, 1886, refer to certification overleaf.

REGISTER SEARCH OF CROWN RECORD * VOLUME 5768 FOLIO 868 *

COST : $15.10 (GST exempt)
REGION : GROUND FLOOR, L.T.O.
AGENT : GRFL BOX NO : 000
SEARCHED ON : 03/12/2004 AT : 11:09:01

NO PARENT TITLE
AUTHORITY : RT 8862636
DATE OF ISSUE : 04/05/2000
REGISTRATION : 1

OWNER

THE CROWN

CUSTODIAN

MINISTER FOR ENVIRONMENT AND CONSERVATION OF ADELAIDE SA 5000

DESCRIPTION OF LAND (UNALIENATED)

SECTION 265
HUNDRED OF BONYTHON
IN THE AREA NAMED CEDUNA

TOTAL AREA: 4.96 HECTARES APPROXIMATE

EASEMENTS

NIL

SCHEDULE OF INTERESTS

NIL

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

NIL

ADMINISTRATIVE INTERESTS AND CROWN NOTES

NIL

END OF TEXT. 2

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5580 FOLIO 764 *

COST	: $15.10 (GST exempt)	PARENT TITLE	: CT 3969/65
REGION	: GROUND FLOOR, L.T.O.	AUTHORITY	: CONVERTED TITLE
AGENT	: GRFL BOX NO : 000	DATE OF ISSUE	: 28/09/1998
SEARCHED ON	: 03/12/2004 AT : 11:08:34	EDITION	: 1

REGISTERED PROPRIETOR IN FEE SIMPLE

ABORIGINAL LANDS TRUST OF 1 WRIGHT ROAD WALKLEY HEIGHTS SA 5098

DESCRIPTION OF LAND

SECTION 197
HUNDRED OF BONYTHON
IN THE AREA NAMED CEDUNA

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

7082685 LEASE TO YARILENA COMMUNITY INC. COMMENCING ON 14.3.1991 AND EXPIRING ON 13.3.2016

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

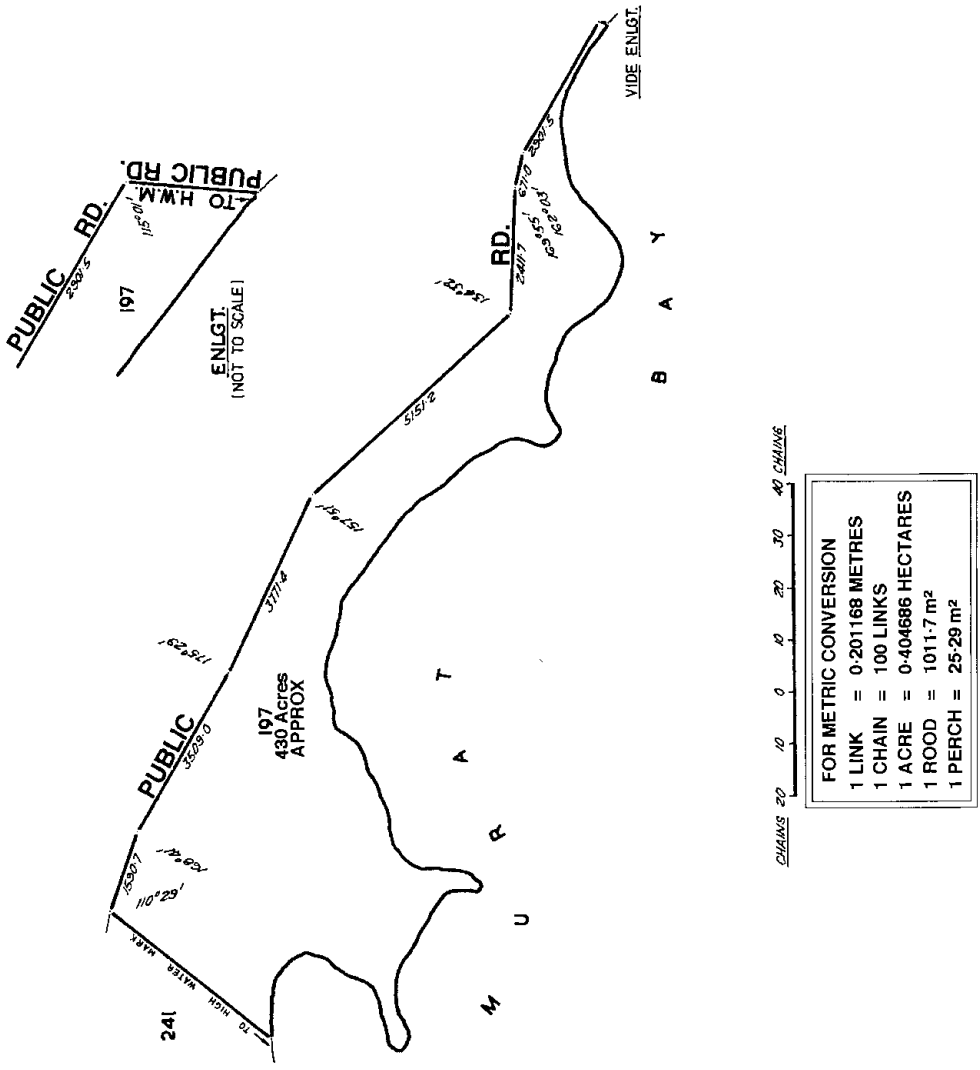
APPROVED FILED PLAN NO UNIQUE IDENTIFIER FX41295
CONVERTED TITLE-WITH NEXT DEALING LODGE CT 3969/65
COMPARE ADDRESS FOR SERVICE OF NOTICE WITH 7082685

END OF TEXT. 8

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5580 FOLIO 764

SEARCH DATE : 03/12/2004 TIME: 11:08:34



Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5735 FOLIO 114 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 4007/698
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : CONVERTED TITLE
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 17/02/2000
SEARCHED ON : 03/12/2004 AT : 11:08:35	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

MINISTER FOR PRIMARY INDUSTRIES OF ADELAIDE SA 5000

DESCRIPTION OF LAND

ALLOTMENT 593 FILED PLAN 180625
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

NIL

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

CONVERTED TITLE-WITH NEXT DEALING LODGE CT 4007/698

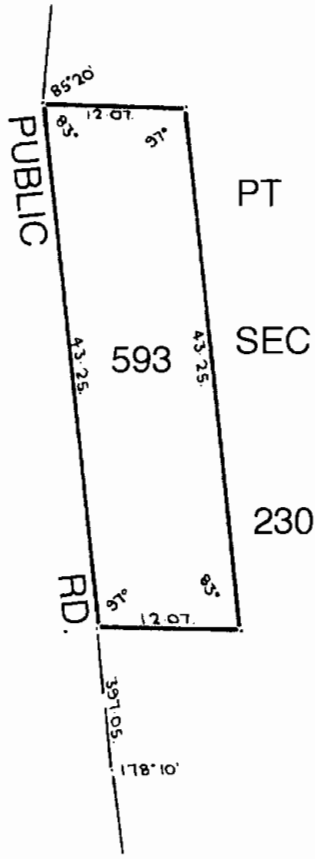
END OF TEXT.

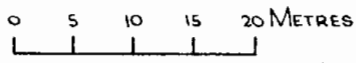
LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5735 FOLIO 114

SEARCH DATE : 03/12/2004 TIME: 11:08:35

THIS PLAN IS SCANNED FOR CERTIFICATE OF TITLE 4007/698





8761727

Series No.	Prefix
2	T

LANDS TITLES REGISTRATION OFFICE
SOUTH AUSTRALIA

MEMORANDUM OF TRANSFER

FORM APPROVED BY THE REGISTRAR-GENERAL

CERTIFIED CORRECT FOR THE PURPOSES OF THE REAL PROPERTY ACT 1886

Solicitor/Registered Conveyancer/~~Transferee~~

S. KAYANAGH

NOTES

1. Use this form for simple transfers. If insufficient space use Form T.2. Use Form T.3. for transferring a mortgage, encumbrance or lease.
2. State whether the whole or portion of the land comprised in the Certificate of Title and or Crown Lease. If portion only, specify.
3. Insert estate in fee simple or estate as Crown Lessee (as the case may be) and quantum being transferred.
4. If tenants in common in unequal shares, then specify shares. If a transferee is a minor state date of birth.
5. If the executing party is a natural person execution should read "SIGNED by the transferor/transferee in the presence of....." The witness must be a disinterested person. If the executing party is a body corporate execution must conform to any prescribed formalities relating to the affixing of the common seal.

No. 1 is Regd

BELOW THIS LINE FOR OFFICE USE ONLY

Date	- 1 OCT 1999	Time	13-18
FEES			
R.G.O.	POSTAGE	NEW C.T.	
12 50			

010CT1999 B10035967L.T.O. 1:250.00

EXAMINATION

CORRECTION	PASSED

BELOW THIS LINE FOR AGENT USE ONLY

AGENT CODE

Lodged by: BWJO

Correction to: BWJO

TITLES, CROWN LEASES, DECLARATIONS ETC. LODGED WITH INSTRUMENT (TO BE FILLED IN BY PERSON LODGING)

1. CT 4007/700
2. CT 4007/702
3.
4.
5.

Assessor

PLEASE ISSUE NEW CERTIFICATES OF TITLE AS FOLLOWS

1.
2.
3.
4.
5.

DELIVERY INSTRUCTIONS (Agent to complete)
PLEASE DELIVER THE FOLLOWING ITEM(S) TO THE UNDERMENTIONED AGENT(S)

ITEM CT/CL REF.	AGENT CODE
CT 4007/700	BWJO
CT 4007/702	BWJO
CT 4007/701	BWJO
CT 4007/699	BWJO

Form T.1
(See Note 1)

TRANSFER

NOW WHOLE OF THE LAND IN C.T. VOL 5737 FOL 376

LAND DESCRIPTION (See Note 2)	The whole of the land comprised in Certificates of Title Register Book VOLUME 5657 FOLIOS 128 & 129
ESTATE AND INTEREST (See Note 3)	Estate in Fee Simple
ENCUMBRANCES	Encumbrance No. 3118879 to Esso Australia Ltd.
TRANSFEROR Full Name and Address	**MAXWELL ROBERT CHRISTIE** of 3 Iluka Place Semaphore Park SA 5019 of 1 undivided 2nd part and **VYTAUTAS VINCENTAS PATUPAS** of Streaky Bay Road Ceduna SA 5690 of 1 undivided 2nd part
CONSIDERATION In words and figures	**THREE HUNDRED THOUSAND DOLLARS ($300,000.00)**
TRANSFEREE Full Name and Address and mode of holding (See Note 4)	**THE DISTRICT COUNCIL OF CEDUNA** of PO Box 175 Ceduna SA 5690

THE TRANSFEROR ACKNOWLEDGES RECEIPT OF THE ABOVE CONSIDERATION TRANSFERS TO THE TRANSFEREE THE ESTATE AND INTEREST HEREIN SPECIFIED IN THE LAND ABOVE DESCRIBED SUBJECT TO THE ABOVE ENCUMBRANCES

DATED 23rd September 1999

TRANSFEROR

EXECUTION AND ATTESTATION (See Note 5)

SIGNED by the TRANSFEROR

.....

.....

in the presence of:

Witness:.....

Full names of Witness:.....

Address:.....

.....

Daytime Phone No.....

TRANSFEREE-ACCEPTED

The Common Seal of The District Council of Ceduna was hereunto affixed in the presence of:

THE DISTRICT COUNCIL OF CEDUNA

.....
Mayor

.....
Chief Executive Officer

REGISTERED 14 MAR 2000

REGISTRAR-GENERAL

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5830 FOLIO 638 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 5657/129 & OTHERS
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : RTU 8933987
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 19/12/2000
SEARCHED ON : 03/12/2004 AT : 11:08:36	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 20 DEPOSITED PLAN 55492
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

NIL

SCHEDULE OF ENDORSEMENTS

9792122 CAVEAT BY CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

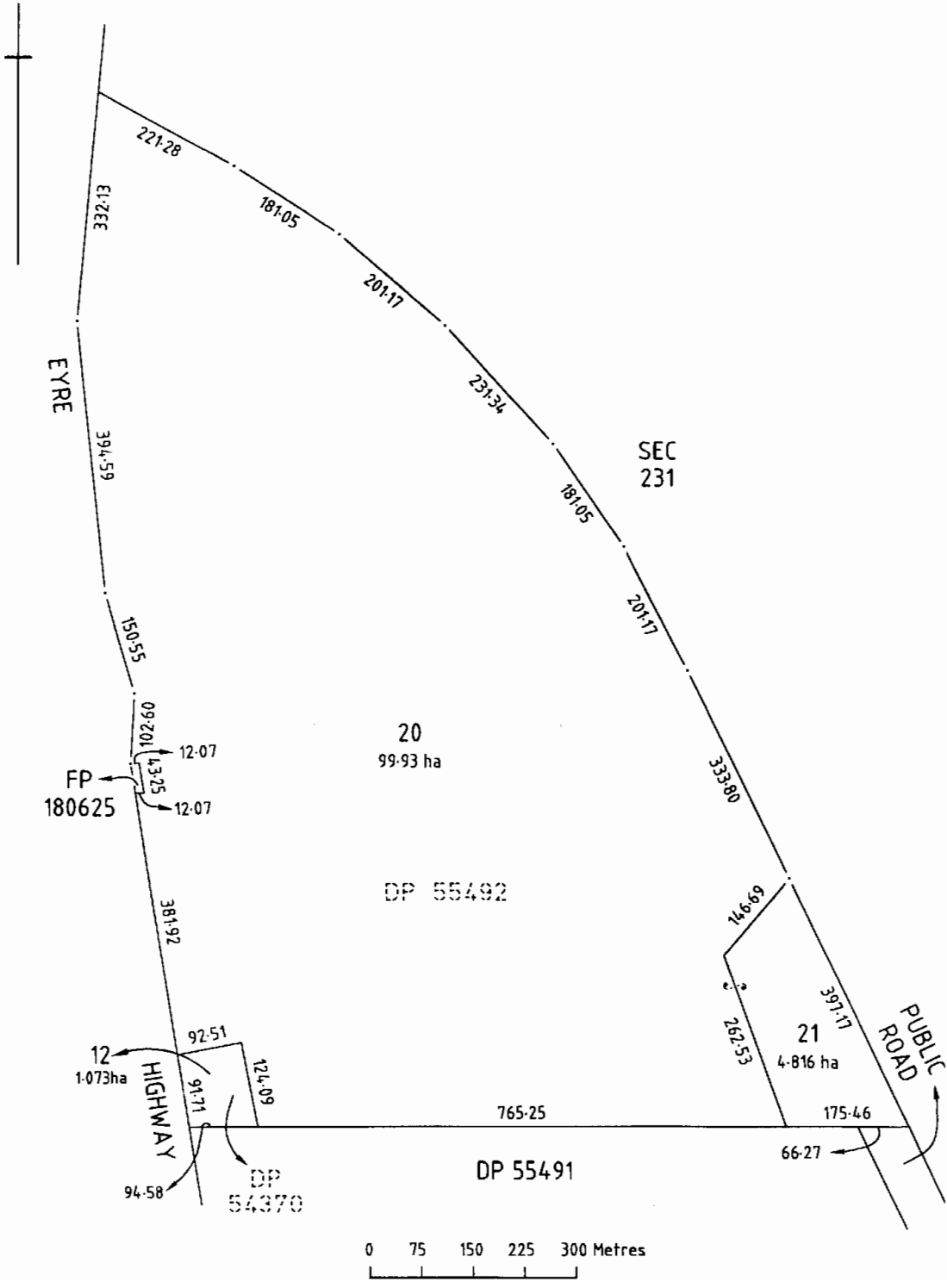
NIL

END OF TEXT. 4

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5830 FOLIO 638

SEARCH DATE : 03/12/2004 TIME: 11:08:36



Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886 and certified overleaf

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5906 FOLIO 567 *

COST : $15.10 (GST exempt)	PARENT TITLE : CT 5835/121
REGION : GROUND FLOOR, L.T.O.	AUTHORITY : SC 9677926
AGENT : GRFL BOX NO : 000	DATE OF ISSUE : 13/11/2003
SEARCHED ON : 03/12/2004 AT : 11:08:35	EDITION : 1

REGISTERED PROPRIETOR IN FEE SIMPLE

THE DISTRICT COUNCIL OF CEDUNA OF PO BOX 175 CEDUNA SA 5690

DESCRIPTION OF LAND

ALLOTMENT 22 DEPOSITED PLAN 53902
IN THE AREA NAMED CEDUNA
HUNDRED OF BONYTHON

EASEMENTS

SUBJECT TO EASEMENTS OVER THE LAND MARKED B.A.E.D.F AND C (T 4249305 T 4249306 T 4463473 T 4463474 T 4489132 AND T 4489133 RESPECTIVELY)

SCHEDULE OF ENDORSEMENTS

9792122 CAVEAT BY CEDUNA MARINA DEVELOPMENT CO. PTY. LTD.

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

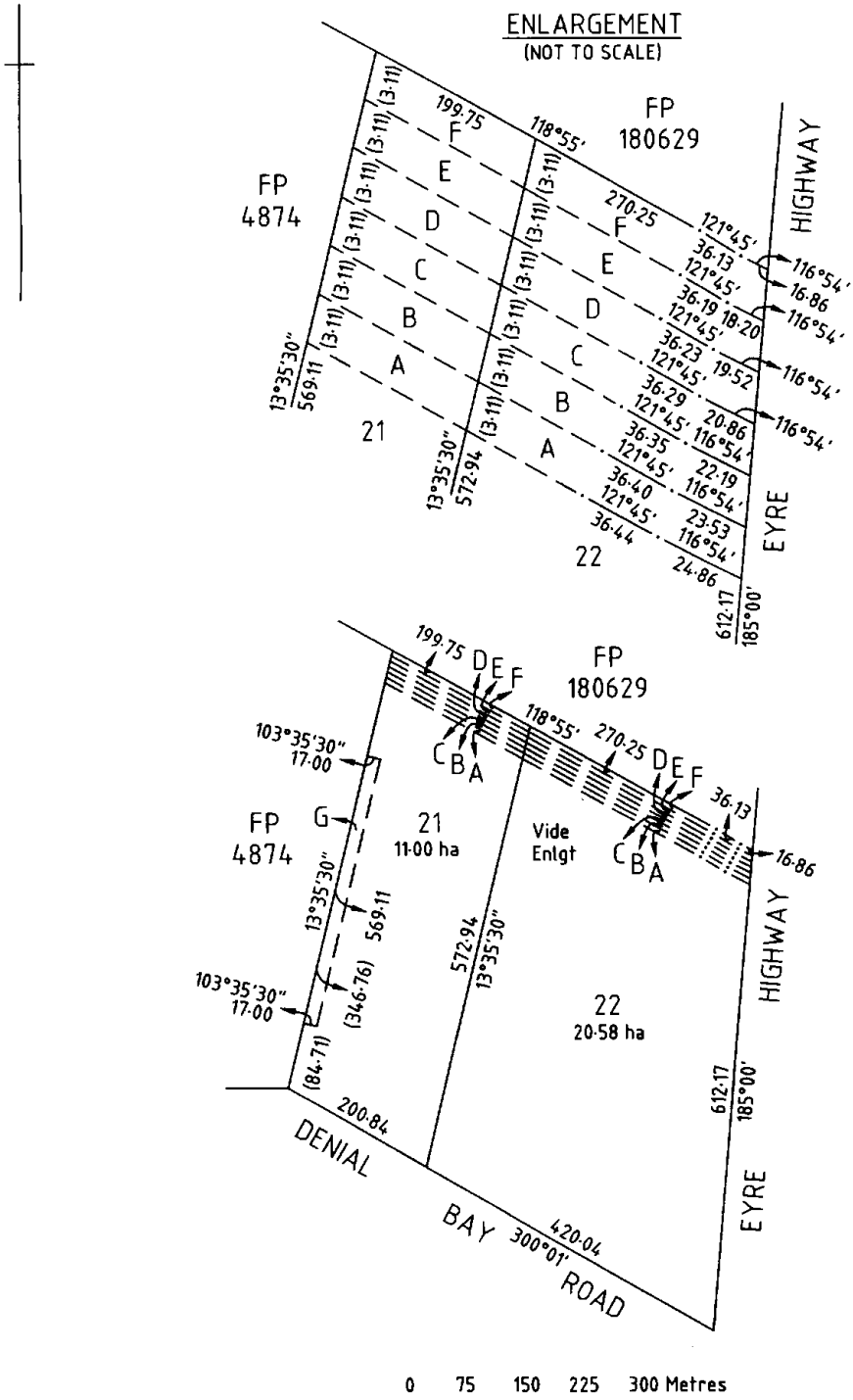
NIL

END OF TEXT.

LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5906 FOLIO 567

SEARCH DATE : 03/12/2004 TIME: 11:08:35



Orig. X 9792122

11:31 26-Feb-2004
1 of 1 Fees: $0.00

LANDS TITLES REGISTRATION OFFICE
SOUTH AUSTRALIA

CAVEAT

FORM APPROVED BY THE REGISTRAR-GENERAL

BELOW THIS LINE FOR AGENT USE ONLY

CERTIFIED CORRECT FOR THE PURPOSES OF THE REAL PROPERTY ACT 1886

~~Solicitor~~/Registered Conveyancer/~~Caveator~~
R.G. WHITE

Series No.	Prefix
	X

AGENT CODE

Lodged by:
Robyn White Conveyancing ROBW

Correction to:
Robyn White Conveyancing ROBW

BELOW THIS LINE FOR OFFICE USE ONLY

Date:	Time:
FEE - R.G.O.	

Lands Titl 12:11 26/02/04 181225
REGISTRATION FEE $94.00

Produced on 26 FEB 2004
Noted Names and Addresses Correct
REGISTRAR-GENERAL

CORRECTION	PASSED

ENTERED 2 MAR 2004
AND NOTICES SENT
TO THE CAVEATEE
pro REGISTRAR-GENERAL

Lic. No. 3 Jan 2000

Printed by Robyn White Conveyancing on 26 Feb 2004

CERTIFICATE(S) OF TITLE BEING CAVEATED

The whole of the land comprised in Certificates of Title Register Book VOLUME 5830 FOLIO 638 and VOLUME 5906 FOLIO 567

CAVEATOR - PERSON LODGING CAVEAT (Full Name and Address)

CEDUNA MARINA DEVELOPMENT COMPANY PTY. LTD. ACN 107 044 057
of C/- PO Box 6114 Halifax Street SA 5000

CAVEATEE - REGISTERED PROPRIETOR (Full Name and Address)

THE DISTRICT COUNCIL OF CEDUNA
of PO Box 175 Ceduna SA 5690

THE CAVEATOR CLAIMING

an estate or interest as Purchaser under and by virtue of a certain written Agreement dated the 25th day of November 2003 made between the Caveator and the Caveatee

FORBIDS THE REGISTRATION OF ANY DEALING WITH THE ESTATE OR INTEREST OF THE ABOVENAMED CAVEATEE IN THE SAID LAND * UNLESS SUCH DEALING IS MADE SUBJECT TO THE CLAIM OF THE CAVEATOR.

Address for Services of Notices and Proceedings PO Box 6068 Halifax Street Adelaide 5000

(Insert Address within South Australia)

DATED 26th February 2004

Signed *~~by the Caveator~~ As Agent for the Caveator R G White

W Fraser

Signature of WITNESS - Signed in my presence by the ~~CAVEATOR~~ AGENT who is either personally known to me or has satisfied me as to his or her identity. **

Wendy Joan Fraser

Print Full Name of Witness

2 Macadamia Crt Golden Grove 5125

Address of Witness

Business Hours Telephone No. 8372 7300

DECLARATION If declared by agent with no personal knowledge add "AS I HAVE BEEN INFORMED AND VERILY BELIEVE"

I ROBYN GAY WHITE Registered Conveyancer as agent for the Caveator of PO Box 6068 Halifax Street SA 5000

DECLARE THAT THE ALLEGATIONS IN THE ABOVE CAVEAT ARE TRUE IN SUBSTANCE AND IN FACT AS I HAVE BEEN INFORMED AND VERILY BELIEVE

DECLARED AND SUBSCRIBED AT ADELAIDE, S.AUST

BY THE SAID ROBYN GAY WHITE

R G White

Declarant's Signature

DECLARATION BY CAVEATOR OR HIS/HER AGENT

THIS 26TH DAY OF FEBRUARY 2004

JEFFREY COLIN ROBINSON, J.P.
I.D. 15659
A Justice of the Peace in and for the State of South Australia

BEFORE ME J Robinson J.P. 15659

*NB: Delete the inapplicable ** A penalty of up to $2500 or 6 months imprisonment applies for improper witnessing Guidance Notes available

Printed by Robyn White Conveyancing on 26 Feb 2004

Appendix VII – Diagram book

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

ORIGINAL DIAGRAM - refer to sheet 1 for latest notes

HUNDRED OF BONYTHON

3

REFERENCE

Field Book No. 1791 Pages 20/23.26.48/51.57/60.

Date Offered	Nos of Secs	Areas of Sections	Description	Locality
	13	1755	Greater portion Arable Undulating Country high Mallee, large tea-tree, Undergrowth of bushes. Soil of a sandy nature from 4 to 18 deep over limestone subsoil of a coarse limestone rubble. Samphire Swamp in S. West corner, low Stony Rises, with Open Black Grass, light Sandy soil, shallow limestone, low Sandhills along Coast in places, Stunted Mallee & Tea-tree	N. Westerly from Govt Tanks abt 5½ Miles. Adjoining East Boundary Hd of MOULE.
	14	1790	About two-thirds Arable land, dense Mallee, large tea-tree, Undergrowth bushes. Soil same as No. 13.	
	35	1103 / 1104	S. West portion Open Black Grass, light Sandy soil, shallow limestone, Samphire Swamp in S. East corner.	

Area of Sections	3545
" Roads	160
" Reserves	
Total	3705

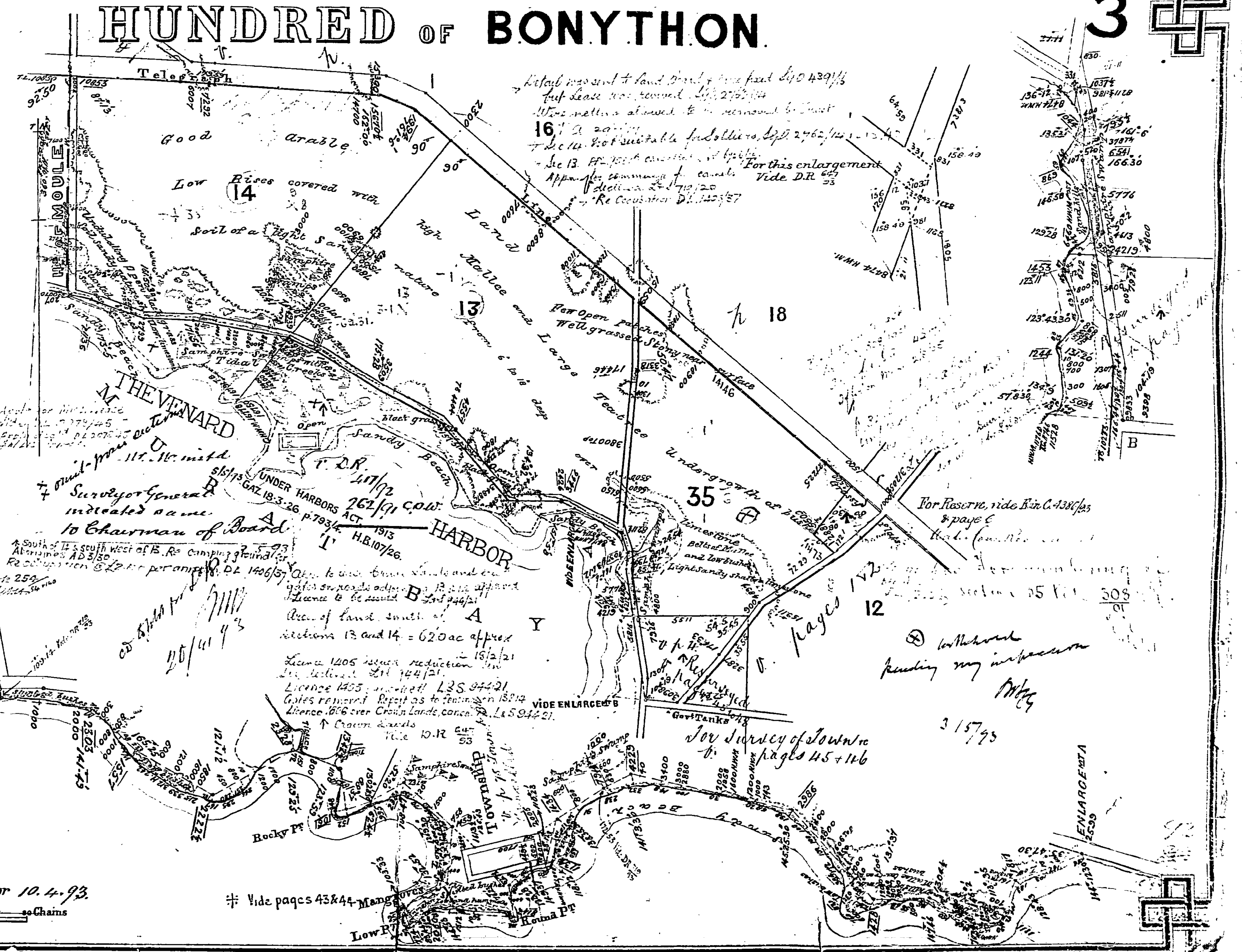
IMPROVEMENTS

Section	Description	Dimensions	£	s	d

I certify that I have personally examined the above sections and have found the same to be properly pegged and trenched and correctly numbered.

N. Mackintosh
Surveyor 10.4.93.

SCALE 1 Inch = 40 Chains



Cedunna Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Appendix VIII – Details of consultants

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

Delta Environmental Consulting has a core staff of three, supported by a range of contract and resource personnel, who may be employed for specific projects, on a more permanent basis, or in a resource capacity.

Peri Coleman (M AppSc - Environmental Management and Restoration) has extensive experience in identifying marine and terrestrial flora and fauna of the mainland states and Tasmania, conducting biological surveys, producing reports and educational materials. Her main interests include biological survey work, revegetation and rehabilitation, scientific illustration and desktop publishing, preparation of herbarium and museum specimens, management plans, taxonomy and classification, solar saltfield biology, environmental education programs, computer application development, wetland studies and mangrove and samphire ecosystems.

Peri owns, and is senior consultant for, Delta Environmental Consulting. She is a member of the South Australian Coast Protection Board, Barker Inlet Port Estuary Committee and chair of the Northern Adelaide & Barossa Regional Steering Committee of Waterwatch. Peri has a strong commitment to research, with several recent papers accepted for international publication. She is a fellow of the Royal Society of South Australia and member of the International Society for Salt Lake Research.

Faith Cook (Grad Dip GIS & Remote Sensing, Dip Env Man) is employed by Delta Environmental Consulting to provide technical and consulting services. Faith has strengths in remote sensing, statistics and biometrics. She provides services in the GIS and mapping areas, development of computer database and spreadsheet applications, environmental risk assessments, archival searches, water testing and laboratory work, fieldwork, and desktop design and publishing.

Faith's interests include radio telemetry and she has a Novice (limited) Amateur Radio Operator (WIA) licence and also holds a Marine band licence.

Faith is a fellow of the Royal Society of South Australia and a member of the International Society for Salt Lake Research. Her current research interests include diatom ecological preferences and samphire ecology.

Jenny Larter (B Technology, Forensic and Analytical Chemistry) is employed on a permanent part-time basis to provide laboratory and forensic expertise. Jenny brings a wide understanding of testing methodologies, and legal evidentiary requirements, to her position. When Jenny is not examining samples from assorted drains, or quantifying the minute concentrations of contaminants in water samples, she enjoys choral singing and bushwalking.

For further information on any Delta Environmental Consulting staff member, or information on the projects the company has been involved with, please visit our web site at http://www.deltaenvironmental.com.au

SOUTH AUSTRALIAN
CENTRE FOR ECONOMIC STUDIES
ADELAIDE AND FLINDERS UNIVERSITIES

An Assessment of Ceduna Keys and Ceduna Coastal Centre Development Plan

VOLUME 1 — MAIN REPORT

Prepared for:
The District Council of Ceduna

Prepared by:
The SA Centre for Economic Studies

February, 2001

PO BOX 125, RUNDLE MALL, SOUTH AUSTRALIA 5000
PHONE (08) 8303 5555 FAX (08) 8232 5307
FOURTH FLOOR, LIGERTWOOD BUILDING, UNIVERSITY OF ADELAIDE

Contents

This report was prepared by the following researchers:

Mr Michael O'Neil, Director
Ms Janine Molloy, Research Economist
Mr Steve Whetton, Research Economist
Mr Anthony Kosturjak, Research Economist

Summary and Overview

Ceduna Keys (Marina Development)

The concept proposal for the Ceduna Keys on the western edge of Ceduna currently comprises the following:

- a marina for up to 75 commercial and recreational vessels;
- an initial 100 residential blocks with waterfront aspect (potential to increase to 200 allotments) with private mooring facilities;
- an all weather boat ramp;
- provision for investment in serviced/managed apartments;
- fisherman's wharf (commercial operation) to service local and visiting fishing fleet, including refuelling, power, ice and fresh water provisions, maintenance and repairs, transport and storage facilities; and
- small scale facilities to service the residents, tourists and those using the marina facilities.

Ceduna Coastal Centre (Interpretive and Commercial Centre)

The concept proposal for the Ceduna Coastal Centre adjacent to the marina on the western edge of Ceduna currently comprises the following features:

- Interpretive Centre featuring Aboriginal heritage/culture and displays, and to include coastal, aquaculture, marine wildlife displays, film and visual information on Head of the Bight and Southern Right Whale;
- a lake system with access to recreational park, and water based activities on lake (e.g., canoeing);
- convention and conference facilities;
- tourist information centre to be located within the Centre;
- theatre facilities;
- restaurant and tourist retail outlet;
- commercial aspects including serviced offices, art and craft sales/displays, point of ticket sales;
- access to 18 hole golf course/country club;
- access to walking trails, boardwalks to marine facilities and displays, revegetated mangroves and native coastal vegetation, beach areas; and
- administration and parking.

The final concept plans are likely to also provide for motel/café facilities.

The 'Interpretive-Cultural-Coastal' Centre seeks to promote Aboriginal cultural tourism — with heritage/culture, art, craft, visual displays, oral and written history — blended with the natural assets of the region, including the Nullarbor, Head of the Bight, coastline and cliffs, the nearby islands, national parks, aquaculture and marine life.

The South Australian Centre for Economic Studies has adopted fairly conservative assumptions throughout the report, in estimating the economic impact of the Ceduna Keys and Ceduna Coastal Centre development on Ceduna. This applies to potential users of the marina, where we have not included the possible relocation and use of the marina by tuna boat operators, supporting feeder boats or other potential commercial operators. Tourist visitor nights have been assumed to increase based principally on road block statistics, and do not include airline passengers or other visitors to Ceduna. They also are based on existing trend growth and do not assume increased tourism numbers due to improvements in accommodation, local services and marketing. In addition, we have not assumed any significant impacts from the mining sector. Should the Yumburra exploration result in even a small gold mine being established, then this would immediately impact on the construction sector, housing, school infrastructure and retail trade. The impact of the marina construction is based on 200 residential waterfront allotments and does not include non-waterfront sites that may become available.

Impacts of Construction

- construction expenditure of $23.6 million in Year 1 and $10.9 million in Year 2, total of $42 million on construction over five years;
- gross value added of $13.6m in Year 1, $5.9m in Year 2 (Table 1.12); and
- employment impact of 237 FTE employees in Year 1 and 104 in Year 2, predominantly in construction sector, wholesale and retail trade and manufacturing.

Impact of Additional Visitor Nights

- additional visitor nights of 14,000 as a result of improved amenity with a gross value added of $0.6 million and 11 FTE employment gain;
- additional visitor nights increasing to 21,000, by encouraging one additional night stay of current stop-overs: gross value added of $0.9 million and 17 FTE employment gain, principally in accommodation sector, wholesale and retail trade, culture, recreation and personal services; and
- actual numbers of new employees would be greater than FTE figures, due to part-time and casual employment.

Impact of Marina Operations

- the direct and indirect effects of marina operations increase employment in Ceduna on an on-going basis by between 6 to 9 FTE employees;
- no impacts have been modelled for "possible or other likely events" such as location of tuna pens, possible use of marina by some (unspecified number) tuna boats, tuna-feed boats, yachts, charter boats, fishers and change over teams residing in Ceduna;

- each trawler of the scale proposed by Raptis and Sons operated out of Ceduna (currently two, a third is proposed) increases local economic activity by $600,000.

No impacts have been modelled for the mining industry including exploration in the Bight, Yumburra Conservation Park or the Challenger Mine, although we consider potential sources of impact and economic benefits (i.e., employment, accommodation, fly-in/fly-out, potential for mineral processing).

Potential Expansion

The marina facility and Coastal Centre provides for high quality residential accommodation and a focal point for tourism as necessary infrastructure to support industry development, in aquaculture, retail services, property and business services. Other sources of potential expansion and hence sustainability of current industry associated with the proposed development include:

- employment and output in the aquaculture industry, notably oysters, but including tuna pen location, deep sea trawlers and new-fish species, such as yellow tail, king fish;
- expansion of aquaculture sector based on trend growth in world demand for seafood and hence export growth;
- continued employment growth in Eyre Region oyster farms, consolidating the 3.5 per cent employment growth (1997-99) and output growth of 6.6 per cent over the same period, with employment growth from new investment in leases granted, packing, transport and export services;
- employment in retail services and supplies to trawler fleet, to potential mining sector and from growth in residential and tourism numbers;
- trend to retirement at coastal locations, and growth in building and construction sector with additional employment in Property and Business Services to support land and property sales; and
- professional office suites in the Coastal Centre, such as for accounting services.

The existing infrastructure, for tourists and residents, in Ceduna is relatively tired and dated. Because of this tourism opportunities are underdeveloped and lacking a strategic focus, while physical infrastructure is insufficient or inadequate to support tourism, other industry sectors, accommodation and community aspirations. We consider the following are currently underdeveloped and represent market opportunities.

Tourism

- whale watching, coastal tourism, aspect of coast line and cliffs;
- eco-tourism such as bird watching;
- off-shore islands, tours and aquaculture site visits;

- big-game fishing, charter boat activities;
- aboriginal heritage, cultural tourism;
- promotion of Davenport Creek;
- co-ordination and inter-linking of existing facilities and natural attractions such as golf course with big-game/recreational fishing. Need to improve tourist and residential accommodation;
- central location for tourist information centre, retail outlet, point of ticket sales, restaurant/café;
- fly-in/fly-out visits for 'experience' such as big game fishing, whale watching requires accommodation and services apartments; and
- growth in retirees making 'around Australia trip' with time to spend at attractions.

Physical Infrastructure: Industry

Improvements to the physical infrastructure of Ceduna, some of which will benefit from the marina and coastal development include:

- presenting a highly visible, attractive gateway to South Australia;
- streetscape and CBD upgrade required for commercial and retail sector;
- inadequate infrastructure for local and relocating fishing industry including commercial wharf facilities;
- expansion of aquaculture industry and potential location of tuna pens requires facilities for feeder boats to service tuna pens; and
- facilities for local, regional and hopefully, international conferences and smaller conventions.

Physical Infrastructure: Accommodation, Housing

- a rental shortage;
- currently a capacity constraint within existing accommodation at certain times;
- minimum utilisation of coastal location for retirement industry, investment and residential lifestyle based around boat ownership and water location; and
- no managed/service apartments for short stays/holidays.

Physical Infrastructure: Road, Schools, Other

- foreshore development, alignment and upgrade, including improving attractiveness of CBD, motels/accommodation;
- improvements to airport taxiway and apron for fly-in/fly-out teams, and special tours;

- upgrade and improvements to Ceduna Area School are required; and
- establishment of over-night transit centre for the Yalata Community.

Local Government and Directions for Regional South Australia

The Ceduna Keys and Ceduna Coastal Centre represents a significant industry development proposal — specifically for tourism, the aquaculture and fishing industry and cultural and recreational services — demonstrating the strategic management role and exercise of functions by local government under the new Local Government Act (1999). The Act specifically enables local government to assume a leading role in regional economic development, *inter alia*:

- services and facilities that benefits its area ... and visitors to its area (Act (1999) Section 7b);
- to provide infrastructure for its community and for development within its area (Act (1999), Section 7f); and
- to promote its area and to provide an attractive climate and location for the development of business, commerce, industry and tourism.

The Ceduna Keys and Ceduna Coastal Centre project supports regional, state and national objectives for industry and regional economic development, integrating economic, social, cultural and environmental concerns within the proposal.

"Directions for Regional South Australia – A Framework for Action" sets out the response of the State government to the Report of the Regional Development Task Force. The goal of this statement is "... improving the economic, social, cultural and environmental well-being of South Australia's regions by assisting regional communities and their people to develop their potential fully."

The proposed Ceduna Keys Marina and Ceduna Coastal Centre developments would seem to fit well with many of the goals of this statement, suggesting that state government involvement in, and funding of, the development would be an appropriate mechanism for fulfilling the state government's objectives in the west coast region. The development meets the requirement of the New Local Government Act (1999) that the strategic management plans of Council are related to state and national objectives. We briefly assess the proposed Ceduna Keys and Coastal Centre against the goals for regional development.

Goal: Planning and Infrastructure Building

Objective: Expand and Improve the Reliability, Efficiency and Competitiveness of Inter and Intra Regional Infrastructure; Improve Social Infrastructure.

- *Identify regional infrastructure needs and future requirements to support key industry sectors.*

  In the case of Ceduna, the District council, in a process stretching back to 1996[1] has already identified the regional infrastructure needs required to facilitate the key industry sectors of tourism, fishing and aquaculture. Management plans include significant upgrade of existing facilities in the CBD, with public and private investment.

- *Seek innovative funding mechanisms and financial and other incentives for infrastructure development.*

  The developments at Ceduna would seem to have strong case for the provision of state government incentives, as this would facilitate involvement from private sector investors, Aboriginal organisations, the District Council and possibly the Federal governments.

Goal: Stronger Communities

Objective: Sustain and Promote Leadership to Drive Growth and Change in Regional Communities

- *Identify and support the skilling and training of local and regional leaders and communities.*

  The proposed integration of training for locals in the development (both in its construction and ongoing operation), particularly focussing on improving the skill levels of Aboriginal persons, suggests that it is worthy of support as an educational, as well as infrastructure, initiative. There would also seem to be a significant role for the state government providing training for local residents in those areas identified in this report as key areas of future employment growth. Social development including improvements in race relations and fostering reconciliation are also significant to this proposal.

Objective: Improve the Capacity of Regional Communities to Generate for Themselves Better Social and Economic Futures

- *Develop an integrated approach to underpin the improvement of conditions and opportunities for Aboriginal people.*

  A significant cultural tourism component and employment outcomes are integrated into the commercial and cultural emphasis of the Ceduna Coastal Centre. Proposals to improve the management and facilities for whale watching and assistance to the Yalata community (through ATSIC) support this objective.

1 Nicholas Clark and Associates (1996), "Economic Development Plan for the Communities of Ceduna".

Objective: Developing Skills and Education - the pathway to Jobs

- *Build regional skills bases by increasing the number of young people completing apprenticeships and traineeships.*

  Finding sufficient work placements for persons undertaking VET studies and CDEP training has been identified as a barrier in Ceduna to improving the skills of people in the region. This is something the marina and housing construction, plus on-going employment in the Coastal Centre would play a role in addressing.

Objective: Improve Culture and Leisure Options Within Regional South Australia

- *Develop clusters of cultural and heritage enterprises to contribute to the growth of regional tourism.*

  Increasing regional tourism is a key driver of the proposed development at Ceduna, with a particular goal of attracting a larger share of tourists who pass through the town to stay a night. Providing an increased range of attractions, and better and more accessible information about the existing attractions in the region is a key to achieving this goal.

- *Provide all regional South Australians with relevant school sport, recreational and cultural facilities and activities.*

  The inclusion in the proposed development of improved recreational facilities for local residents, such as the swimming centre, suggests another way in which state government support of the development could assist in meeting its stated goals for regional South Australia in the West Coast. Preserving and learning about Aboriginal culture and history are integral to the proposal.

Goal: Economic Generation

Objective: Expand Existing Industry, Attract New Strategic Investment and Facilitate Diversification

- *Support industry diversification and business retention and expansion.*

  The proposed marina and coastal Centre development have a significant role to play as facilitating infrastructure for further development of the key tourism, aquaculture, and fishing industries, which would allow Ceduna to continue to reduce its dependence on broadacre agriculture, a principal generator of economic activity. Currently there are no suitable facilities in Ceduna for unloading and refuelling fishing boats, or launching facilities to allow tourism operators to take advantage of the region's off-shore ecotourism, and fishing opportunities. The experience of Lincoln Cove is that the provision of infrastructure attracted interstate investors in housing and for recreational and charter boats, in addition to existing commercial boats. The planned Ceduna Marina allows for 25 per cent each of existing fishing boats (tuna, deep sea trawlers, local fleet), fast speed feeder boats to service the fish farms, charter class and big game fishing and finally, recreational craft.

- *Increase visitor attraction to regional areas.*

  As mentioned above this development is the centrepiece of the District Council's strategy to increase the number of visitors to the region. As well as the benefits of the coastal Centre in providing an additional attraction for visitors and better information about existing attractions, the marina also should assist in increasing visitor numbers by broadening the scope of services which can be provided to them. For example, without a marina there is not currently adequate facilities in Ceduna to allow it to be used as a base for taking visitors on fishing trips in local waters, or for marine based ecotourism such as visits to some of the region's islands. This development and the increased services it would provide to visitors to Ceduna also integrates with the Eyre Peninsula tourism strategy to increase visitor numbers to the whole region.

Objective: Provide Economic Development Which Creates Indigenous Employment Opportunities

- *Promote indigenous economic development.*

  From the start this development has had significant involvement from local Aboriginal communities, and other representative bodies such as ATSIC. The intention for the cultural centre to have a strong focus on local Aboriginal culture, the employment of Aboriginals in its construction and operations, and sale of local crafts etc. makes it a potentially significant factor in improving regional employment opportunities for Aboriginal persons.

- *Develop an indigenous business training programme.*

  ATSIC has indicated support to mount such programs with the assistance of the local TAFE and other specialist providers.

Objective: Improve Regional Training and Employment Opportunities

- *Maximise the provision of publicly funded training in regions to meet short term as well as longer term skill shortages.*

  The Cultural Centre will provide an essential focus for Aboriginal economic development, diversifying into tourism and cultural awareness. It is important to expand the range of employment opportunities (now including in aquaculture, farming, community management, construction) for Aboriginal persons, but also for the Ceduna population.

Funding of Marinas

The recent experience of marina developments in South Australia has been reasonably consistent. The cost of the marina itself, particularly where it is dual commercial recreational use, seems to be too high to be reasonably supported by residential land sales, particularly as land sales do not generally commence until construction of the marina is essentially finished. As marinas seem to be a significant form of local infrastructure which enables activities such as commercial fishing, and various marine centred forms of tourism there would seem to be justification for part or full government funding of the marina stage of the development. This has often happened in the case of other developments in South Australia. For example the Lincoln Cove marina was

provided with assistance of $14 million for stage 1, which involved 180 blocks, 60 commercial berths and 100 recreation berths, principally supported for tourism and regional growth, with the secondary objective of developing a service industry for the tuna boats. Wirrina Cove was provided with improved infrastructure (such as access roads) during its redevelopment, and the Hindmarsh Island Marina has been provided with a bridge to the island.

Development generally seems to be progressive with the land sold in stages, each stage funding the subdivision expenses of the subsequent stage. It would be expected that development in Ceduna would proceed in a similar fashion. The developer[2] has indicated that there are likely to be 200 residential blocks with marina frontage, and that sale of these blocks will be able to start in the third year of the development, once the marina has been completed. Given the current size of Ceduna's population and current residential building activity the Centre would expect these blocks would take 8 to 10 years to sell, probably in four stages.

The justification for the Marina cannot primarily be the increased amenity it provides for the residential blocks in the development, as to justify the cost of the marina (and indeed to cover its construction cost) would require roughly $60,000 per block, for the marina alone with the subdivision costs and the developers profit being additional to this. Given waterfront blocks in the Copper Cove Marina, which is within driving distance of Adelaide a factor likely to increase their price, are selling in the region of $65,000 there would seem to be little scope for residential land sales to cover the cost of marina construction. For Ceduna too the benefits of the development do not stem primarily from increased amenity for residents, and possibly higher populations, but from increased opportunities, and activity, in tourism, commercial fishing and aquaculture. These industries could develop in ways not enabled by the current, restrictive, marine infrastructure. The citing of the development provides South Australia with a highly visible and attractive gateway to the State, while completing the third link in the Eyre Peninsula tourism triangle.

The Major Projects Group

Another way in which the state government provides assistance to developments is by facilitating the approvals process through the Major Projects Group. The Major Projects Group is responsible for managing major project initiatives on behalf of the Government working with project proponents, the Government and its agencies to facilitate major development initiatives in South Australia.

The Major Projects Group has three main roles:

1. To manage Government major development projects, which are complex and do not fall within normal agency arrangements. Examples include the Patawalonga Project, Riverbank Precinct, Adelaide Convention Centre expansion, and Adelaide Shores Boat Haven.

2 Mr David Kelsey.

2. To facilitate and manage the Government's interests in major and complex development projects in which the private sector is the key driver. Current and recent projects include Holdfast Shores Development, Copper Cove Marina, Southern Vales Pipeline, Virginia Pipeline, Barossa Valley Resort and various Aquifer Storage and Recovery Projects.

3. To manage the Industrial and Commercial Premises Corporation's program to construct premises for firms establishing or expanding in the State. The Major Projects Group delivers services for the Industrial and Commercial Premises Corporation (ICPC) as a key element of the Government's economic development strategy for South Australia. The Corporation assembles land, building and finance packages to assist companies to establish or expand in South Australia, in conjunction with the Department for Industry and Trade (DIT). Recent and current examples include Motorola, Bankers Trust and Gerard Industries Pty Ltd.

An example of a project similar to Ceduna which has received facilitation assistance from the State government's major projects Group was the Copper Cove Marina at Wallaroo, being developed by Crystal Corp Pty Ltd. In terms of total construction expenditure this as a similarly sized project to the Ceduna Keys development ($30 million in construction expenditure), although it is more focussed on residential rather than commercial use, with 462 housing allotments (275 of which are water front). The Major Project Group describes its role as having been "to coordinate and facilitate the development with various Government agencies, the District Council of the Copper Coast, the developer and its consultants." The development received Development Act approvals in December 1998 and March 1999 (following acceptance of the Environmental Impact Statement) and flooding of the waterways commenced in February 2000.

Economic Study

- Economic Profile of the Ceduna Region
- Sustainability of Current Industry
- Economic Impact of the Development
- Prospects for Aquaculture
- The Mining Industry and Future Prospects
- The Building and Construction Industry

Economic Study

Economic Profile of the Ceduna Region (Appendix 1.1)

Ceduna is the gateway to South Australia, situated on the Eyre Highway on the fringe of the Nullarbor Plain. It has a population of around 3,500 people of whom 22 per cent are indigenous Australians. The main industries of the region are agriculture and aquaculture which produce significant proportions of these industry's state total production. Like most rural areas, unemployment is an increasing problem. Major employing industries are Health and Community Services, Agriculture, Forestry and Fishing and Retail Trade. About 91 per cent of all businesses employ less than 10 persons with 79 per cent employing less than 5. The mean taxable income is around 85 per cent of the average mean taxable income for the State.

Tourism contributes to the local economy and the town has four motels and six caravan parks which mainly cater for travellers stopping over on their way across the Nullarbor rather than actually holidaying in Ceduna.

Ceduna is adjacent to the Port of Thevenard where the major export commodities are grain (wheat, barley and oats) and minerals (gypsum and salt). With the exception of gypsum which is mainly exported to interstate markets, the local produce loaded at Thevenard are for international export markets.

Sustainability of Current Industry (Appendix 1.2)

The current industry profile and current employment growth rates are presented in Appendix 1.2. National projected growth rates, and historical data for Ceduna were used as the basis for projections of employment growth rates to 2005.

Industry sectors with the largest projected proportionate growth in employment are: Property and Business Services, Health and Community Services and Cultural and Recreational Services. The largest projected decline is in the Utilities sector. These estimates should be regarded as the base case for Ceduna's employment prospects, prior to the impact of the Ceduna Keys development (or any of the other developments in Ceduna such as the expansion of the Community Hotel, CBD upgrade, Port of Thevenard development) being factored in.

Economic Impact of the Development (Appendix 1.3)

Assessing Economic Impacts

Economic impacts resulting from a particular activity are both direct and indirect. In the case of Ceduna Keys and Ceduna Coastal Centre development, the direct impact relates to:

- the actual construction work in developing the marina and all the associated infrastructure of the marina and the coastal interpretive centre.

- operational expenditure related to the existence of the development, for instance the expenditure related to the boats using the marina which did not impact on the region previously, such as additional fuel purchases, and any funding which is external to the region and which is directed towards the operation of the coastal interpretive centre.
- the expenditure of additional visitors to Ceduna who decide to stay, or to stay longer, because of the existence of any part of this development.
- any future housing construction at the site which has been generated from outside the region because of the development and is not a transfer from another potential Ceduna location to the marina area.

The indirect impacts will be in the form of:

- indirect production activity which is induced as the initial direct impact flows through to other industries
- induced effects as a result of household and (potentially) government incomes which have been generated by the direct and indirect impacts being spent locally, which then generates another round of activity.

The social benefit to residents is far more difficult to evaluate and does not form part of this consulting brief.

The construction phase of this project will be short-lived and will vanish once the initial construction is complete (which has been estimated as four years from commencement). The impact of the other components assumes that the development can occur without causing losses to the existing fishing and aquaculture industries in Ceduna. The economic impact measured here is the impact of the development on the Ceduna region compared to the situation if the entire development did not go ahead and there was no significant initiative to boost tourism numbers beyond the current growth rate.

Construction Phase

As the funding for the construction phase of the development is to be sourced outside of the Ceduna DC, all of the activity in this phase can be considered as a benefit for the region. It has been assumed, based on information supplied, that the majority of the employment is local (including training where necessary) and that all equipment and supplies needed are purchased through local retailers/wholesalers so that the retail margin remains in the Ceduna region.

The employment impact of the construction phase is initially very strong (240 FTE employees in the first year), but declines rapidly, falling to 47 employees in year 3 and 18 in year four. Skills in the construction industry are also required for the commercial and housing construction phase. These skills will be in demand for other projects such as for the planned streetscape program, expansion of the Community Hotel, undergrounding of overhead cables, golf course redevelopment and the Yalata Overnight Centre. While employment in the Ceduna Keys and Coastal Centre development declines rapidly after the initial heavy construction phase, there will be further opportunities for on-going employment in related sectors, including landscaping, housing services, parks and gardens and the progressive development of the Ceduna industrial park behind the

existing golf course. Should the Yumbarra mine proceed then employment of skilled construction personnel will be assured. Many of these newly trained employees may move further afield because they now have more marketable skills. It is also possible (if the rate of housing construction in Ceduna were to increase) that ongoing demand for housing at the marina site would provide employment in the construction industry for some of these ex-marina construction employees, as would any other significant developments in the Ceduna region.

Increased Tourist Numbers

The Ceduna Keys and Ceduna Coastal Centre development is likely to lead to an increase in tourist numbers (and possibly increases in the length of stay of existing tourists) by increasing the amenity of, and recreational facilities available in, Ceduna. In calculating the impact of this effect the Centre has modelled an increase in visitor nights of between 14,000 and 21,000, due to an increased number of tourists visiting the town, and an increase in the number of nights spent in the town by existing visitors. The long-term employment impact of this increase in tourism is an increase of between 11 and 17 FTE employees (although this may be unevenly distributed through the year due to the current seasonal nature of the tourism industry). It is not expected that this increase in tourism will be fully realised until 4 to 5 years after the completion of the redevelopment. See Appendix 1.3.

Marina Operations

The estimate for the impact on Ceduna of on-going marina operations is based on Raptis and Sons locating two or three fishing trawlers in Ceduna (currently they are refuelling and unloading at Thevenard, but indicated they would shift to the marina when it becomes available). The direct and indirect effects of marina operations increase employment in Ceduna on a ongoing basis by between 6 and 9 FTE employees. This employment impact would be higher if any of these fishermen were to reside in Ceduna, or if any tuna farming activity were to be based out of the marina. At this point although several suitable sites for tuna pens have been identified near Ceduna, no estimate of the potential impact of tuna farming has been included in this report.

Prospects for Aquaculture (Appendix 1.4)

Employment growth was 3.5 per cent (1997-99) and output growth 6.6 per cent (1997-99) in Eyre Region Oyster Farms, with a significant concentration of this industry at Denial Bay and Smoky Bay. The aquaculture park and new boat ramp at Smoky Bay illustrate the infrastructure required to support this fast growing industry. Employment is expected to increase with additional leases taken up (it is estimated 3 persons are employed for each 5 hectares of licence), and investment in the aquaculture park. Deep sea trawlers are now operating out of the Port of Thevenard (average 10 person crew) with the prospect of a third trawler to commence in 2001. We conclude that the provision of a marina with wharf facilities could attract commercial interest from tuna boat owners (suitable sites for tuna pens are found off-shore) and other commercial fishing interests although the benefits of this have not been included in the Centre's modelling.

The Mining Industry and Future Prospects (Appendix 1.5)

Mining exploration activity features strongly in future plans for the Ceduna region. The main areas for this activity include petroleum exploration in the Great Australian Bight by a Woodside Energy consortium, the Challenger gold exploration by Dominion Mining Ltd north of Ceduna and the early stage exploration by the Dominion Mining Ltd and Resolute Resources Ltd joint venture in Yumbarra Conservation Park, nearer to Ceduna, for nickel, copper, zinc and gold. There are also other companies operating within the Gawler Craton area north of Ceduna.

The reality is that both in South Australia and worldwide, there is a problem in raising 'greenfield prospecting capital'. The Challenger mine represents the most likely prospect with immediate implications for Ceduna, offering the prospect of fly in/fly out, family accommodation and some provision of goods and services (10-15 persons).

Support for offshore seismic surveys in the Bight Basin could be supplied from Ceduna (a potential competitor is Port Lincoln). Refuelling equipment is required, a site to locate this, less exposed berthing than at Thevenard, the provision of general supplies and more limited demand for accommodation appears to be the most optimistic scenario. Fly-in/fly out change over teams of 35 persons are estimated to be required over the next two years.

Should the Yumbarra exploration lead to mining activity then Ceduna would directly benefit in terms of additional employment (50 persons are the estimated minimum), through demand for accommodation and operating and support services.

The Building and Construction Industry (Appendix 1.6)

There has been some recent growth in new dwelling construction in Ceduna while there is a shortage of rental accommodation. This trend does indicate some potential benefits for the marina subdivision development but the current rate of growth will mean that without some catalyst the subdivision will take many years to fully establish. The coastal location and the prospect of higher quality residential housing with waterfront citing and private mooring will be an incentive to the retirement industry and those seeking recreational boating facilities. Those two groups have high consumption expenditures based on lifestyle and income (i.e., wealth and/or superannuation) and are largely absent from the population profile of Ceduna at this time.

There are however other potential catalysts such as increased housing demand from the fishing industry if some refuelling, restocking and service facilities are established within the marina complex or from the mining industry if mineral exploration currently underway proves profitable.

Marketing Study

- Estimating Tourist Numbers
- Employment in the Tourism Industry
- Aboriginal Issues and Cultural Tourism
- Impact of the Development and Tourism Marketing

Marketing Study

Estimating Tourist Numbers (Appendix 2.1)

There is a commonly held view (based on Nicholas Clark[3]) that around 400,000 potential tourists pass through Ceduna in a year. This is a total figure and includes truck drivers and passengers on buses travelling on the Adelaide-Perth route. Detailed Quarantine Road Block statistics from both sides of the Nullarbor (which exclude local traffic) indicate that there are around 70,000 vehicles per annum travelling in ***each*** direction. Passenger information from the Eucla roadblock indicate an average of 1.9 passengers per vehicle, including the driver. This provides a total annual estimate of well under 300,000. To consider potential ***tourists*** only, it is necessary to exclude those persons associated with freight vehicles. The potential tourists currently passing through Ceduna are therefore estimated to be no more than 240,000 per annum.

The consultant's research therefore does not support the Clark assertion (which is neither referenced nor explained) and all estimates of economic impact are based on attracting an additional share of the 240,000 potential tourists or to induce those who do stay to stay for an additional day. Air traffic totals only just over 10,000 per annum and a large proportion of this would be local residents or business or government employees, so tourists arriving by air will not boost the potential number of tourists very significantly. Detailed information in support of this lower total estimate is contained in Appendix 2.1.

Accommodation Capacity Constraints

Data for caravan park usage has been both more limited in the frequency of collection and more restricted than that for hotels and motels but it is estimated that around 64,000 persons do stay at least one night in Ceduna. These numbers are roughly evenly distributed between caravan parks and hotel/motel accommodation.

Strong seasonal patterns in accommodation occupancy occur in Ceduna which means that accommodation capacity constraints do occur in popular periods and this is something which will need to be addressed if more tourists are to be enticed to stay (or stay longer) because undoubtedly, they will tend to be attracted at similar times to current visitors either because of good travelling weather, the timing of school holidays, or the enjoyment of Oysterfest or whale watching in the region. The continuing attraction of a high quality coastal interpretive centre will help spread the demand for accommodation but the additional factors such as weather and school holidays cannot be changed.

It is understood that some current accommodation providers are currently planning extensions. This would seem to be a good decision because just as good 'word of mouth' publicity is reported by The Bureau of Tourism Research (BTR) as the most common source of tourist information/publicity, bad 'word of mouth' publicity in terms of inadequate accommodation can spread very rapidly among potential future tourists. The local tourism industry cannot rely solely on the planned new accommodation within the marina and interpretive centre development.

3 Nicholas Clark and Associates (1996), "Economic Development Plan for the Communities of Ceduna".

Demand for Marina Facilities

The demand for marina facilities will rely on both commercial and recreational users. Use by commercial fishermen has been somewhat difficult to establish. The Tuna Boat Owners Association has indicated that it is highly unlikely that the tuna boats would make use of the Ceduna Keys marina because there are no suitable sites near Ceduna to establish tuna feeding pens which also implies there is no need for a refuelling facility. The Centre is somewhat more optimistic than this. Firstly, it is our understanding that there are suitable sites close to Ceduna (identified in other studies) with shelter and conditions suitable for tuna pens. Second, that in terms of risk management given the uncertainty of the Louthe Bay location on environmental grounds, it is highly prudent for tuna fishermen to look at other sites. Our assessment is that commercial operators will use the facility, certainly for refuelling and supplies and that this includes tuna boats, deep sea trawlers, and exploration vessels.

On the other hand Raptis and Sons have indicated an intention to relocate trawler boat operations in the area commencing in 2001, initially at Thevenard. Increasing the size of the fleet in the area and also some refuelling are planned.

From the recreational perspective, current boat ramps in the area are deemed inadequate. With the provision of new marina facilities, current charter boat operations could be upgraded to provide larger boats with sleeping accommodation which could then, in turn, cater for longer trips and other possible new packages. Cruising boats are also often observed among the islands but there is currently nothing in the area to enable a suitable land based stop to be made. Although not large in number, these visiting boats would boost tourism expenditure if they could be attracted to stay for a short period in the marina.

It is problematic whether improved boat launching facilities will lead to a much increased demand in boat charter activity in itself but the potential is there for an increase in the number of tourists staying even one additional night in Ceduna and this could lead to an increase in the demand for boat tourism and charter boat activity. The Ceduna Keys and Ceduna Coastal Centre development should be the catalyst for such an increase in tourism. More detail is given in Appendix 2.1.

Demand for Conference Facilities

The provision of conference facilities within the development provokes images of outback tranquillity but there are some constraints which need to be overcome before such a centre becomes a profitable enterprise. Not the least is the transport of delegates to Ceduna.

As reported in Appendix 2.1, the Ceduna airport can only take aircraft with a passenger capacity of up to 34 persons. While the runway structure can take slightly larger aircraft (48-50 seaters), the taxiway and apron structure would require special permission to be sought for every landing of these aircraft. Multiple trips of the permissible size of aircraft to cater for even a small conference would probably be strategically impossible. Further research on this aspect would be required. The relatively high airfare compared to major domestic routes would also add to delegate costs. Bus or car transport would really be out of the question because of the travel time required.

Given these constraints, some multi-purpose facility might be more appropriate. More localised conferences, particularly relating to the Eyre Peninsula or nearby regions might be more appropriate in the planning strategy. For these reasons, potential economic benefits from the use of conference facilities have not been included in the economic impact study presented here.

Employment in the Tourism Industry (Appendix 2.2)

Tourism as an industry is not defined but the major industry sectors in Ceduna in terms of tourism activity would include Accommodation, Cafes and Restaurants, Retail Trade, Transport, Cultural and Recreational Services and Personal Services. Detailed data for sub-groups within each of these sectors is only available from the 1996 Census and is now somewhat dated with a new census due on mid 2001.

Most employment would be generated in the Accommodation, Cafes and Restaurants sector where 42 per cent of this sector's labour force were employed within the Pubs, Taverns and Bars sub-group and 37 per cent in the Accommodation sub-group in 1996. The former sub-group would cater to both locals and visitors, the latter group would be almost entirely reliant on visitors. It is estimated that in 1996 around 65 persons were employed within this industry sector as a result of tourism.

Employment in the other sectors named would be reliant on tourism to a much lower degree. For the Retail Trade sector, tourist expenditure would be mainly found in supermarkets, food stores, including takeaways, sport and camping equipment, pharmacy lines and motor vehicle related expenditure including fuel, parts and repair services. Cultural and Recreational Services sector employment in Ceduna was very low in total in 1996 and a small part of the employment in the Transport and Personal Services sectors would be tourism generated.

Comparing 1996 with earlier censuses leads us to say that in total, employment in tourism related industries in Ceduna is neither high nor growing rapidly. There is plenty of scope for growth which can be generated by the Ceduna Keys and Ceduna Coastal Centre development, even thought the numbers themselves may not be very high.

Aboriginal Issues and Cultural Tourism (Appendix 2.3)

A significant component of the Ceduna Coastal Centre development is concerned with Aboriginal cultural tourism. This represents a new venture for the region with good potential but many pitfalls to be avoided along the way. Business failures in cultural tourism have mainly been caused by lack of management skills, lack of commitment, insufficient assessment of the potential market and lack of business planning. While Aboriginal art and craft is just one component, the current establishment of an art and craft centre in Ceduna will create opportunities for training, management, planning and co-ordination. This art and craft centre should be relocated in the new Ceduna Coastal Centre.

The potential strengths/opportunities for the development of cultural tourism include:

- a focus in the Centre to incorporate promotion and learning with the intention of preserving and protecting Aboriginal culture;
- Ceduna Coastal Centre to combine commercial facilities with cultural activities, such as film, art, dance, displays, written and oral history;
- specific activities such as whale watching, recreational and big-game fishing, art and craft development and sales, ecotourism packages; and
- potential to capture increased visitor nights of those travelling through region.

The weaknesses/threats most consistently referred to include:

- lack of co-ordination with fragmentation and poor networking between local Aboriginal communities;
- difficulties associated with business incubation, business management and training, and obtaining practical information on tourism business start-up;
- complexities related to obtaining finance;
- integrating Aboriginal cultural tourism into mainstream tourism management, advertising/promotion; and
- overcoming community uncertainty and poor knowledge of the tourism industry, by developing on going training and supportive infrastructure.

Critical success factors in the development of Aboriginal cultural tourism enterprises include:

- need for business management skills and appropriate tourism industry training;
- strong tourism industry support, which is based on business reliability, marketing funding and industry networking;
- the activities must be authentic, high quality and provide a meaningful learning experience; and
- indigenous groups need to cooperate and set up a single management structure for decision-making, strategy, business development, reliability and long-term commitment.

Impact of the Development and Tourism Marketing (Appendix 2.4)

The Tourism Component of the Economic Impact

Is the planned development likely to increase the number of tourists by around 6 per cent of the total passing through and to increase the average length of stay by one day for 10 per cent of those visitors who already stay overnight in Ceduna? These are the assumptions which form the basis of the impact of the Ceduna Keys and Ceduna Coastal Centre development on the local economy through tourism.

The realistic estimate of the number of potential tourists passing through Ceduna each year is around 240,000. Around 64,000 tourists each year currently stay in caravan parks or hotels/motels. An increase of just 14,000 tourists from among those who pass through but don't stay is in reality around 8 per cent of those who don't stay. Since already around 27 per cent do stay at least one night, this increase in potential tourists as a result of the existence of, and the attractions offered by, the interpretive centre and the experiences offered in the marina environment does not seem unattainable given appropriate marketing activity.

Enticing just over 10 per cent of those who do stay, to spend another day in Ceduna will require strong marketing of the attractions of the new development. The current average length of stay is 1.3 days. However, some of the large number who stay only one day could well be enticed to stay another day, especially if they were fully informed about other local attractions in addition to the interpretive centre, such as Davenport Creek or a trip out to one of the nearby islands. The existence of the marina will enable charter boat operators to launch craft with larger passenger carrying capacity which perhaps could be expected to have some impact on reducing prices for day trips to the islands and thus increasing demand among tourists. It would seem that the target is achievable, given appropriate marketing.

At the moment, however, the busiest period is over the period of the Oysterfest. For the quarter which includes this festival and Christmas there were around 10,000 guests in hotels/motels alone and an estimated similar number in caravan parks. So long as they don't all arrive in the same quarter, there is suitable accommodation capacity available to cope with the combined increase of 21,000 visitor nights across the year.

The Visitor Survey indicates that the majority of those responding stayed one or two nights although a small proportion stayed in excess of one week. Those already staying the longer period would be able to include a visit to the interpretive centre during their stay and are unlikely to be induced to stay longer.

The development of the planned Heritage Trail through the West Coast, in line with the Tourism and Recreation objectives of the GAB 1000 West Coast Strategy, can also serve as a marketing tool for the Ceduna attractions so that interested persons will plan to take more than one day to absorb the history and heritage of the area along with the natural attractions.

One word of caution relates to the number who make the crossing both ways and who are therefore being considered as potential tourists twice. This can have both advantages and disadvantages. If the first stop-over experience is enjoyable, the tourist may consider stopping again on the return trip, especially if the alternative stop-over destinations are not as enticing. Others may wish to stop-over at another destination irrespective of the initial experience, just to experience something different. Not all travellers would make two crossings but the potential in terms of individuals may be more like 150,000 and if this is true then an increase of 14,000 represents 16 per cent of those who currently don't stay. This would mean that the marketing needs to be quite aggressive to attract a larger share of these individuals to stop-over and to really establish Ceduna as 'the' place to stop when crossing the Nullarbor.

Marketing Requirements

The newly developed Ceduna Keys and Ceduna Coastal Centre cannot just rely on attracting travellers who pass along the Eyre Highway and see the development. Ideally, they must know about it before they leave home and have planned it as part of their itinerary. At the moment the publicity about the region is very inadequate.

Visitors are reported to arrive in Ceduna from the West and claim to have had no knowledge of the Head of Bight Whale Watching Centre and the opportunity to view the whales from the cliff-top viewing platform.

Clearly if visitors are to be attracted, then promotion activity needs to be well planned and professionally undertaken with adequate funds available. The South Australian Tourism Commission should be a co-operative partner in this promotion along with the Eyre Peninsula Tourism Association. Areas which should be targeted will include:

- National travel trade fairs and exhibitions which are directed towards the tourism operators and travel agents. It is essential that these industry operators are knowledgeable and have accurate information about whale watching, the Ceduna Keys and Ceduna Coastal Centre development, the planned Eyre Peninsula Heritage Trail, if it is developed, and any other attractions along the route.
- National travel trade fairs and exhibitions which are directed towards the general public especially people who plan their holidays without the assistance of travel agents.
- Motoring organisations, such as the RAA in this state — they need to have the appropriate pamphlets to hand out to members and to feature the attractions in their member magazines.
- Pamphlets in hotels, motels, caravan parks and local visitor information centres in other towns, especially those *en route*. The existence of particular attractions, and/or sufficient of them, may make the difference between a decision to drive rather than fly. Domestic tourism is very important to South Australian regions. An estimated 396,000 people visited Eyre Peninsula in 1998 and stayed an average of 3.5 nights each[4]. These visitors were estimated to have spent $73 per night on average. This represents additional total expenditure in the Eyre Peninsula region of $101 million.
- Western Australian tourism offices and information centres, together with motels and caravan parks, are currently apparently lacking information in relation to the whale watching opportunities — at least half of Ceduna's visitors are therefore currently not fully informed of the attractions found along the Eyre Highway.
- Ceduna also has the opportunity to align itself with the attractions along both the routes from the East ie. the Eyre Highway through Wudinna and Whyalla or the slightly longer coastal route via Port Lincoln and Streaky Bay. Such publicity will associate Ceduna's attractions and new development with a

[4] Henrick B and Robins P., (2000), "Tourism in Regional South Australia". Paper presented at Conference 2000 *Economic Potential of Regional South Australia and its impact on the National Economy*, Renmark.

choice of inland or coastal attractions. The West Coast Heritage Trail which is part of the region's Recreation and Tourism strategy[5] is a positive way of linking the tourist attractions of the smaller coastal and inland towns along the way.

- The publicity section of the SATC should provide the detailed opportunities for such promotion but, before 'word-of-mouth' has had the opportunity to spread the word, the publicity and promotion activity cannot be skimped. Sufficient funds must be available to ensure success in the early years.
- While only 10,000 international visitors came to Eyre Peninsula in 1998, it is worth noting that 27 per cent of visitors to regional South Australia went because of 'word-of-mouth' recommendation. Nature based activities attracted 14 per cent, 11 per cent went because they wanted to visit rural or outback areas and 26 per cent went because they had friends or relatives living there. Given the 'word-of-mouth' publicity is so significant, it is essential to provide stimulus to attract visitors in the early stages in order to generate the 'word-of-mouth' publicity, hence again it is stressed that initial promotion expenditure is very important.
- Three-quarters of international visitors to Eyre Peninsula came from Europe/UK which has been the major source of immigrant settlement in South Australia. This is consistent with the high level of international visitors who visit because of friends and relatives. The BTR reports[6] that marketing targeted at South Australian residents may also increase the number of interstate and international visitors to a region because the local residents either accompany them or recommend the destinations.
- Detailed background information to help target specific markets can be obtained from the BTR.
- Specific eco-tourism opportunities which are developed along with the interpretive centre will need to be marketed to the relevant target groups. Some specific birdwatching opportunities are discussed (see Appendix 2.4.3). This is something which will take time in the planning both from the environmental protection aspect and also the education and training required to provide suitable guides so that the birdwatching becomes a truly memorable experience. Such activities are in line with the stated objectives for Tourisin and Recreation under the GAB 1000 West Coast Strategy and the actions necessary to ensure that both the wildlife species and the environment are adequately protected are outlined in the Priority Actions for Tourism and Recreation within that strategy.

5 The Great Australian Bight 1000 West Coast Strategy.
6 Henrick and Robins (2000), *op cit.*

Employment Study

- Employment and Skills Profile
- Employment and Training Strategy

Employment, Skills and Training

Employment and Skills Profile (Appendix 3.1)

Local Indigenous Employment, Skills and Education

One of the main objectives of the Ceduna Keys and Ceduna Coastal Centre development is to 'maximise employment and education opportunities for local Aboriginal people and the wider community". Employment opportunities are expected to increase especially in the construction phase and later in the operation of the Ceduna Coastal Centre as a cultural and interpretive centre to inform visitors of Aboriginal culture and heritage. The extent to which Aboriginal people will become involved in the development and operation of the site will depend on their existing skills and employment experience and on the opportunities for training which are offered in timely fashion to cope with the demands for the various skills as the development proceeds.

Appendix 3.1 explains the apparent high levels of employment among Aborigines in terms of the participants in the Community Development Employment Projects (CDEP) which offer training in the community towards developing important skills and gaining vital work experience. The participation level in the CDEP scheme is considerably higher in Ceduna than the State average. This is an encouraging sign for indigenous participation in employment arising from the Ceduna Keys and Ceduna Coastal Centre development, however appropriate training to culminate at the right time will need to be delivered to all who wish to be employed within the project.

Most Aboriginal people are currently employed in the Health and Community Services sector, to a fairly significant extent through CDEP. Education is also important in terms of employment but at a much lower level. It is also noted that in 1996, ten of the 17 industry sectors did not employ any indigenous workers however, the situation seems to have changed slowly since then.

The Ceduna DC has an Aboriginal earthmoving gang who are training to handle the equipment as they undertake council work. This group will be ready to move to the development when construction commences. The company with an interest in the development has indicated an intention to bring trainers to the site both to undertake the large excavations required but also to train other workers, mainly indigenous in the skilled use of this very heavy equipment. This action was successful in the construction of the marina in Port Lincoln.

Most Aboriginals in employment in 1996 were classified to the occupation of labourers although there were over 10 per cent in both the professional occupations and in intermediate clerical, sales and service occupations. Again, there has been progress and change since 1996.

There are noted differences between the age at which Ceduna residents left school and the South Australian average which is in line with the dominance of the agricultural sector in the region and the reliance on labouring skills and learning through experience. There is very little difference between the indigenous and non-indigenous people in

Ceduna in terms of the age at which they left school. There has been an increased tendency for indigenous people to stay at school longer between 1991 and 1996 which is the latest data.

The level of qualifications among the Ceduna population is roughly in line with the State average but the level among the indigenous people is significantly lower, except for basic vocational qualifications where the incidence roughly approximates the State average. The available data indicate that a significant degree of training will be required for the Aboriginal people to be able to staff and manage the Ceduna Coastal Centre. It is worth noting however that the areas in which the indigenous people held qualifications was strongest in Business and Administration and in Society and Culture which are very relevant to the proposed development.

Construction of the Ceduna Keys and Ceduna Coastal Centre project should also have a substantial impact on employment within the local construction industry. The Ceduna DC construction industry in employment terms is smaller relative to the size of the industry at the State level. Given the large scale of the project, it would appear that without some substantive training program, a significant proportion of construction employees may need to be sourced from outside the region. However, our assessment is that there are 100 indigenous persons with the necessary skills as machine operators, back-hoe operators, light truck and bob-cat operators and in occupations related to earthmoving, pipeline construction, building, roadworks and concreting who are who currently available to the marina construction project. In addition, the Ceduna DC has established an Aboriginal earthworks gang.

Potential indigenous employees have previously worked on the Ceduna-Denial Bay and Koonibba-Penong pipelines, have been employed as building teams at Koonibba and Yalata, and up to 12 persons have workforce and training experience with heavy earthmoving equipment. There are currently 145 indigenous persons in training and employment with the CDEP at Tjutjunaku Worka Tjuta Inc. (TWT).

With the stated profile of required employees in the initial construction stage of the marina (5 per cent professional, 5 per cent managerial/technical and 90 per cent semi-skilled operators/labourers), it is most likely that the workforce requirement can be met from indigenous and non-indigenous locals. Ceduna TAFE has recently conducted a training needs analysis to enable them to plan the upgrading of current accreditation.

TWT is currently conducting training in machine operations, licenced truck operation, and back-hoe and fork-lift. In July 2001 courses in building and construction (roadworks, concrete pouring) and landscaping are planned. A Level 1 Certificate in Building Construction has been introduced by Ceduna TAFE in 2001 as part of their Aboriginal Education Program.

We find that there is also a group of up to 15 indigenous persons with basic bookkeeping and retailing skills, although not at a high level, available for employment. Training in the use of computers would improve current employability.

Employment and Training Strategy (Appendix 3.2)

The Ceduna Keys and Ceduna Coastal Centre development is intended to generate additional employment in Ceduna. Employment will occur both in the construction stage and in the operation stage. This will result in a range of jobs and while the aims of the developers are to employ as many local people as possible including a proportional share of Aboriginal people, if the local people do not have the training for this range of jobs, employees will need to be brought in from elsewhere. It is therefore imperative that training strategies be developed immediately and that the locals undergo appropriate training so that they are appropriately prepared at the time the jobs are created in the various stages of the development.

TAFE Ceduna has indicated that training can be organised and undertaken for almost all jobs with the main exclusion being the operation of large heavy earth-moving equipment. Staff can be brought in from outside who will be both operators and trainers and sufficient staff can be trained to operate this heavy equipment on a continuous 24-hour basis. Other training strategies are discussed below.

Construction Stage:

- *Large excavation earthworks* — workmen are currently gaining experience with the Ceduna DC in the use of smaller earthmoving equipment and these employees would have the potential to undertake the more advanced training provided by the operators of the bigger equipment.
- *Smaller earthworks* — this will be ongoing work in a range of areas including the maintenance of the wetlands and the overall landscaped areas. There is the opportunity for more workers to be trained within the Ceduna DC and by specialist earthmoving operators.
- *Construction* — construction work will be required in the development of infrastructure such as marina wharves, service buildings, fuel suppliers, roadworks etc. and also after the initial work, in the construction of residential housing, the interpretive centre buildings and the conference facilities, theatres, motel type accommodation facilities to support the conference centre, etc. Within this construction there will be a broad range of trade skills required and it is in the interests of future employment for appropriate courses to be planned now. It is also essential that opportunities are made available for these students to gain work experience preferably as apprentices or trainees. The practical experience also serves as a means to reinforce the course learning. Gathering potential opportunities for work experience should be part of the planning strategy. Perhaps it would be possible for early training in civil construction skills to be conducted in association with CDEP which would provide opportunities for workshop and on-site assessments by TAFE trainers.
- *Developmental Earthworks and Outdoor Construction* — this will include the subsequent development such as the wetlands, the construction of walkways, fences, viewing platforms, the landscaping of the surrounding areas etc. These tasks will also require skills in horticulture and landscape. TAFE can structure the courses to suit the work being undertaken but the planning must be done well in advance and the training co-ordinated so that the students have completed their training at the time that the actual work will become available.

- *Transport* — if the development goes ahead, the transport sector will deliver appropriate materials and equipment, especially in the construction stage. Transport employment, not only includes driving but also loading/unloading and clerical work as well as refuelling or repair services. The co-ordination of appropriate training and the provision of work experience opportunities are essential to this range of employment.

Operational Stage:

- *Retail Trade and Services* — there is no plan to replicate retail and other services already available in the town centre, but there will still be a need for staff in the marina related activities, such as selling fuel and marina stores and repairs etc. It may be difficult to provide appropriate work experience to co-ordinate with the training and this must be considered within the training strategy.

- *Food services* — within the interpretive centre and ultimately, the venues associated with the operation of the conference centre, there will be a need for a variety of food services, from quick snacks and coffee to restaurant meals. Trained and experienced chefs will probably come from elsewhere but kitchen-hands and waiting staff can be trained locally as can staff associated with over-the-counter sales. The training strategies for the varying jobs need to plan ahead to co-ordinate with the availability of the jobs. Well trained staff in these areas are important to creating the right atmosphere to ensure that the visitors return and that they contribute to the positive 'word of mouth' publicity.

- *Accommodation services* — staff to provide services in accommodation will also be required once accommodation supporting the conference centre is provided. Again the planning strategy needs to co-ordinate training requirements with the demand for employment. Relevant work experience can perhaps be co-ordinated with existing accommodation providers.

- *Property and Business Services* — existing property agents could be expected to handle land and property sales within the development but they would probably need to increase the level of support staff and there are other areas which would require staff with clerical and basic computing skills. These classes are already in demand in TAFE but it is important to have an effective planning strategy which relates the level of employment demand to the training so that many are not disappointed when they cannot find employment on completion of the course.

- *Cultural and Recreational Services* — the completion of the interpretive centre will provide employment especially for Aboriginal people, although it should not be exclusively Aboriginal. Indoor and outdoor guides, demonstrators and sellers of Aboriginal arts and crafts, tellers of stories and providers of information etc all need to be Aboriginal to ensure the authenticity of the experience. In this instance, Aboriginal heritage will take precedence over qualifications. Tribal elders and Aboriginal leaders may need to consult to determine which stories can be told and there is need for consistency among guides and interpretive officers in terms of what is told. Training in presentation and clear speech are important aspects of this work. However, there is scope for non-Aboriginal involvement both in front and behind the scenes. Planning strategies for this

type of employment are crucial. Staff need to be selected for their suitability to the specific job and appropriately trained. TAFE training in Tourism studies offers good choices in modules which will be very relevant to employment in the centre. It is important to understand how other successful indigenous cultural centres have selected and trained appropriate staff for the different types of visitor contact.

A range of programs are available through TAFE's Aboriginal Employment Education Development Branch which may be suitable for first stage training. For instance, Entry Level Training Certificates are for people who have not been to school for a long time or for those who feel they need to upgrade their skills. Such courses can assist students to gain entry into other TAFE courses.

Discussions with TAFE indicate that they would be able to provide the following flexibility and range of courses:

- Tourism, hospitality and business studies - could easily expand if necessary
- Programs could be tailored to satisfy special needs - usually need a minimum of 10 students
- Traineeships are provided for but in some instances the trainees are not attached to an employer
- Courses in retail studies and horticulture can also be undertaken. Mechanical studies could be easily undertaken as there is a big workshop within TAFE which is currently underutilised.
- Courses in the community service area are currently offered. These would flow indirectly from any development such as the marina e.g., child care, youth workers, aged care workers and other community service areas.

Changing TAFE programs tends to be fairly flexible and response times for change are usually good although introducing new programs sometimes tends to take time However, training courses for Aborigines are generally approved quite rapidly as they are funded externally. Ceduna TAFE should be able to provide the necessary training for employment in the marina and interpretive centre development ranging from horticulture/gardening, wetlands construction (eg. pathways) and maintenance, interpretive centre staff to talk about the Aboriginal culture and homelands, retail, hospitality (including front of house, maintenance, kitchen etc), marine and mechanical services etc. TAFE also stresses that it is important to gain work experience to go with the training and in fact, most courses emphasise the practical work as well as the theoretical and in some cases the practical has the greater emphasis.

Fees apply to these TAFE courses but many students are eligible for financial assistance through AUSTUDY, ABSTUDY or Youth Allowance. All courses mentioned in more detail in Appendix 3.2 are approved for study under these allowances.

Assistance may also be available from the Federal Government through the *New Apprenticeships Scheme*. New Apprenticeships could enhance the skills base and provide real employment opportunities to benefit both employers and young people in

rural and regional Australia. Although the focus is on agriculture and horticulture, including automotive and electrical training, regional communities also involve work in sectors as diverse as information technology, retail trade, tourism, hospitality, property and business services, community services and health, finance and communication. The Federal Government supports New Apprenticeships with financial incentives of up to $4,400 for New Apprenticeships employers, with an additional $1,100 incentive for employers in areas where there is an identified skill shortage in rural and regional Australia. Financial incentives are available for CDEP placement, with an initial $700 upon signed application and a further $1,500 after 20 weeks.

Potential Sources of Government Funding

There may be avenues to access some government funding for specific components of the Ceduna Keys and Ceduna Coastal Centre development. Mention is made in the section on employment and training with regard to the New Apprenticeships scheme to help employers take on apprentices.

There are two Federal programs specifically directed towards Regional Australia which may provide an opportunity to apply for assistance with infrastructure components namely, the Regional Solutions Programme and the Rural Transactions Centre Programme. In addition the latest South Australian Budget outlined a range of funding allocations for Regional South Australia which are allied to the Directions Framework issued in response to the Regional Development Taskforce.

The Regional Solutions Programme is aimed at helping implement community initiatives including community infrastructure. Non-profit organisations or local government may apply but there must be strong support from the community. It is designed to target communities which have experienced some form of economic stagnation or lack of diversity in economic activities and are in need of employment opportunities.

Grants are available for both large and small-scale projects. Under the large-scale grants, the programme will support infrastructure development that will promote social or economic benefits e.g., *a community owned tourism facility or exhibition centre.*[7] Grants for infrastructure range from $200,000 to $500,000 in total over three years. Among other things, the application needs to demonstrate the degree of disadvantage and need in the local community or region — and this will be directly related to the interpretive centre and its advantages for tourism, for increasing knowledge in relation to Aboriginal culture and heritage (an important factor towards reconciliation) and very importantly, to provide employment for local Aboriginal people in a community which has positively set about trying to create a range of employment opportunities. Demonstrating the significance and benefit of the proposal to the local community, including the economic benefit, are areas which have been covered in this report. *Strategic plans might identify, for example, opportunities for economic growth and community capacity building, or for enhancing tourism based on a community's location.*[8] Applicants may be part of a consortium involving other groups.

The Rural Transactions Centre Programme may be less applicable although Ceduna certainly fits within the population guidelines. The funds may be used for capital costs to provide a centre for the community to access services which are not currently available in the community. However, the types of services can include tourism and involvement in employment schemes.

Funds to local councils for road funding resulting from the recent Federal Government decision to 'hand back' some part of the CPI/GST indexed tax impost on petrol may also be applied to the project.

7 Precise wording from web page Fact Sheet.
8 Precise wording from Guidelines on web pages.

The following highlights from the South Australian Government's Regional Statement (2000-2001 Budget Paper 7) have some relevance to the Ceduna planned developments. Further information on each of the issues will need to be sought from the relevant department or from the local MP. Each of the goals outlined in the "Directions for Regional South Australia" document can be associated with one or more of the budget allocation categories.

Regional Highlights

- $5.5m for the Regional Development Infrastructure Fund targeting areas where infrastructure requirements are impeding development;
- $1.7m to improve aquaculture farming techniques and opportunities throughout the state;
- $8.0m to upgrade marine facilities; and
- $5.95m to improve and upgrade assets within the State's national parks and walking trails across the State.

Employment, Education and Training

- $57.0m for the provision of vocational education and training by TAFE institutes and other providers outside the school sector, to enable training opportunities to be expanded through new apprenticeships and a comprehensive range of training and employment programs which meet the needs of industry and individual clients;
- $6.4m to support employment programs and initiatives targeted to improve employment outcomes to support South Australia's 60,000 small businesses. A major initiative this year will be to merge most of the employment programs accessed by Regional Development boards into a single, more flexible funding structure for the boards. The development of a Regional Employment Strategy will ensure the regions have greater autonomy in planning and decision making based on local knowledge and needs and build a shared commitment to improve employment outcomes in regions and outcomes for youth in regions; and
- $1.1m for Regional Aboriginal Apprentice Program.

Health and Related Infrastructure in Indigenous Communities

- $1.01m to increase the number of apprenticeships available to Aboriginal people and to expand the range of sustainable employment opportunities that assist their community;
- $50,000 to encourage Aboriginal enterprise development; and
- $100,000 for site verifications, conservation and protection of Aboriginal heritage.

Stronger Communities

- $3.0m for the introduction of a new scheme, known as High Performance Enterprising Communities (HPEC), to be applied across regional South Australia; The HPEC model seeks to integrate many local practices into a holistic community based development approach and aims to promote best practice by demonstrating how education and training provision can be linked to growth industries, the local economy and new civic initiatives that offer young people employment.

Arts and Culture

- $150,000 for general upgrade of cultural facilities; and
- $650,000 contribution to the improvement of regional museums.

Industry and Enterprise Improvement

- $150,000 to improve investment briefs describing industry value adding opportunities in the regions; and
- $1.7m to manage and improve farmed seafood techniques which includes a range of programs including Regional Advisory Services, Shellfish Quality Assurance and the implementation of sustainable farm management practices.

Research and Development

- $5.0m to fisheries and aquaculture research programs.

Infrastructure Building

- $5.5m for the Regional Development Infrastructure Fund targeting areas where infrastructure requirements are an impediment to industry development;
- $48.0m to enable water storage, treatment and distribution for domestic, commercial and industrial purposes; and
- $430,000 to undertake improvements to Thevenard Wharf.

Tourism

- $2.74m to fund major tourism projects and infrastructure;
- $1.0m to continue the Minor Infrastructure Fund which provides $ for $ assistance (up to $50,000 per project) for the development of supporting tourism infrastructure including boardwalks, lookouts and additional accommodation;
- $537,000 to continue the Tourist Road Grant Program which provides $ for $ assistance to councils for the upgrading of minor roads of tourism significance;
- $2.5m on regional tourism marketing which supports the 12 tourism regions;

- $600,000 to support regional festivals and events;
- $175,000 to upgrade the role and capability of visitor information centres; and
- $160,000 to develop and market key tourism product.

Understanding Our Regions

- $60,000 to create a welcome message at the gateways to the State with a display of pride at State borders and regional towns.

Native Title

- $6.89m to enable greater harmony and understanding in all areas of the South Australian community with regard to access to land and its resources which may be subject to a native title claim.

Efficient Transport

- $3.3m for grants to councils for recreational boating projects and maintenance of fishing facilities.

National Parks and Wildlife

- $42.0m to manage South Australia's national parks and reserves to achieve a comprehensive, adequate and representative reserve system, including the provision of visitor education and information services; and
- $100,000 to develop community based trails in regional South Australia.

Planning Land Use

- $110,000 to provide partial funding grants to councils to undertake suitable projects to better define the role of centres and promote a broader range of functions within regional centres/zones; and
- $350,000 for partial grants for projects that provide passive recreational opportunities which contribute to the presentation, enhancement and enjoyment of open space areas.

It has not been possible to provide similar information on other funding sources, but representatives of ATSIC and CDEP can assist the Ceduna DC in this regard. In the course of this study it was mentioned that several Aboriginal groups may commit to the project in a sponsorship capacity (e.g., Maralinga tribe) to support their component of the cultural content in the proposed Ceduna Coastal Centre. The exact details of this have not been able to be verified.

Cedunca Keys

ENVIRONMENTAL IMPACT STATEMENT

Working Papers

SOUTH AUSTRALIAN
CENTRE FOR ECONOMIC STUDIES
ADELAIDE AND FLINDERS UNIVERSITIES

An Assessment of Ceduna Keys and Ceduna Coastal Centre Development Plan

VOLUME 2 – APPENDICES

Prepared for:
The District Council of Ceduna

Prepared by:
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- Port Lincoln TAFE;
- Tourism industry representatives
  - — Gateway Visitor Information Centre
  - — Hotel and Motels management
  - — Caravan Parks management
  - — Perry Will, Boat Charters;
- Other Local industry
  - — building construction
  - — transport
  - — equipment and materials suppliers

Contents

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Overview of the Proposed Development

1. Introduction

The Ceduna Keys and the Ceduna Coastal Centre — a marina and interpretive centre — is a significant undertaking in the infrastructure development planned for Ceduna and the wider region. Other activities and projects listed here are intended as components of an overall strategic plan to "promote sustainable economic development opportunities" in the region:

- Ceduna Keys and Ceduna Coastal Centre;
- Streetscape Program and Master Plan to upgrade the CBD of Ceduna, including rehabilitation of the shoreline and foreshore development;
- upgrade of the Community Hotel and Caravan Park;
- Airport upgrade;
- Port of Thevenard upgrade;
- establishment of overnight accommodation and centre for the Yalata Community travelling to and from Ceduna; and
- upgrade and maintenance of physical infrastructure including the citing of industrial parks (e.g., aquaculture park at Smoky Bay), boat ramps and access roads.

Economic development opportunities, leaving aside tourism for the moment, also include:

- off-shore exploration in the Bight Basin;
- mineral exploration in the Gawler Craton region, but specifically exploration in the Yumburra Conservation Park; and
- continued expansion of the aquaculture industry.

Under the 'banner of tourism', industry development and identified projects include, *inter alia*:

- the Ceduna Keys and Ceduna Coastal Centre;
- the implementation of the Great Australian Bight 1000 West Coast Strategy for Coastal Management;
- Ceduna/Thevenard walking track;
- development of whale watching at the Head of the Bight;
- big game fishing, recreational fishing, island tourism;
- aboriginal heritage and cultural tourism;
- a fishing services industry through the existing Port of Thevenard and the planned marina;
- upgrade of the Davenport Creek Road;
- promotion of eco-tourism, specifically bird watching tours; and

- the promotion of natural attractions such as Davenport Creek and the off-shore islands of St Peter, St Francis and the Nuyts Archipelago and the aquaculture industry located at Denial Bay and Smoky Bay.

Special events such as the solar eclipse in 2002 and the on-going and very successful Oysterfest are critical elements in promoting the tourism industry.

This overview, or snapshot, of proposed developments and projects identifies and locates the Ceduna Keys and Ceduna Coastal Centre as only one, albeit a significant project, in the necessary upgrading of the physical, residential amenity and social infrastructure of Ceduna and the region. It is generally recognised that the current infrastructure in Ceduna is dated, somewhat 'tired' and provides limited opportunities for expansion.

Improving residential infrastructure, tourism, accommodation and recreational facilities and facilities for commercial and recreational fishing vessels is identified by the Ceduna District Council (DC) as an important catalyst for investment and growth. The Ceduna DC notes that:

> 'infrastructure remains one of the most crucial factors to regional development ... and that the Ceduna Keys and Ceduna Coastal Centre project is unique ... with potential to capture more of the tourism market, fishing/aquaculture industries and real estate'.[1]

Ceduna currently lacks a focus for tourism activities, with the result that despite its natural attractions, coastal location, and a wealth of recreation opportunities, there is not currently an environment that encourages additional tourists nor acts to entice existing tourists to extend their stay in the town for a longer period of time. While Ceduna is a gateway to South Australia, it is more of a 'transit location rather than a destination' on the Eyre Peninsula — whereas it has the potential to be an equal part of the triangle of Port Augusta/Whyalla, Port Lincoln and Ceduna.

1.1 About the Proposal

The Ceduna Keys and Ceduna Coastal Centre has been proposed as a multi-faceted entity to address tourism needs, accommodation and waterfront real estate, a cultural centre with commercial and other facilities and an industry supporting role providing major servicing facilities.

The Site

A site for the proposed Ceduna Keys (marina) and Ceduna Coastal Centre (see concept outlined below) has been selected on National Highway One, west of the existing township adjacent to Murat Bay and close to the existing Quarantine Station and Road Traffic Block. The Council acquired a 105ha parcel of land for the Coastal Centre development adjacent to the proposed site for the Ceduna Keys. The large area of low lying salt pan will enable the flooding and restoration of the tidal movement into the area to create a lake system. Site investigations have been completed and initial concept

[1] Ceduna DC, (2000) 'Annual Report', p. 21.

drawings proposed, although it is expected that the development plan will change as required. The proposed site is located close to:

- the Ceduna golf course;
- a major recreational oval/sports complex;
- treatment water ponds for irrigation; and
- the existing Emu farm complex.

These are all able to be integrated into the overall projects (e.g., upgrade and greening of golf course to country club, visitation to Emu Farm, etc.).

Aims and Objectives

The Great Australian Bight through to Port Lincoln — including Ceduna, Smoky Bay, Streaky Bay and Elliston — represents a significant coastal asset.

The project aims to develop and capitalise on this coastal asset, to increase thoroughfare and establish Ceduna as a major tourism, residential, marina and coastal centre. It is intended that Ceduna will become the third point in the Eyre Peninsula Tourism triangle (a *destination*), will continue to be promoted as the link between the east coast and west coast of Australia (a *transit centre*), and the status of Ceduna will be reinforced as a *gateway* to South Australia, the Head of the Bight and coastal tourism. 'Improving gateways to the State', with the objective of regional promotion, has recently received endorsement by the South Australian government.[2]

A principal focus of the development is on tourism potential but this is not considered to be an exclusive focus. There are significant commercial and industry development objectives in the proposal, including *inter alia*:

tourism:	recreational fishing, whale watching, visits to aquaculture sites, charter boats, wildlife, including bird watching, recreational activities, festivals (Oysterfest);
commercial:	fishing, both tuna and deep sea trawlers, commercial marina with services to fishing and recreational boats, fuel provision and supplies, conventions and theatre, office suites, etc.;
industry:	development of aboriginal cultural tourism with educational, interpretive and commercial aspect, sale of art and crafts, service industries such as landscaping, serviced apartments, maintenance, transport, etc.

Ceduna Keys (Marina Development)

The concept proposal for the Ceduna Keys on the western edge of Ceduna currently comprises the following:

[2] Office of Regional Development, (2001), "Directions for Regional South Australia: A Framework for Action", p. 34.

- a marina for up to 75 commercial and recreational vessels;
- an initial 100 residential blocks with waterfront aspect (potential to increase to 200 allotments) with private mooring facilities;
- an all weather boat ramp;
- provision for investment in serviced/managed apartments;
- fisherman's wharf (commercial operation) to service local and visiting fishing fleet, including refuelling, power, ice and fresh water provisions, maintenance and repairs, transport and storage facilities; and
- small scale facilities to service the residents, tourists and those using the marina facilities.

Ceduna Coastal Centre (Interpretive and Commercial Centre)

The concept proposal for the Ceduna Coastal Centre adjacent to the marina on the western edge of Ceduna currently comprises the following features:

- Interpretive Centre featuring Aboriginal heritage/culture and displays, and to include coastal, aquaculture, marine wildlife displays, film and visual information on Head of the Bight and Southern Right Whale;
- a lake system with access to recreational park, and water based activities on lake (e.g., canoeing);
- convention and conference facilities;
- tourist information centre to be located within the Centre;
- theatre facilities;
- restaurant and tourist retail outlet;
- commercial aspects including serviced offices, art and craft sales/displays, point of ticket sales;
- access to 18 hole golf course/country club;
- access to walking trails, boardwalks to marine facilities and displays, revegetated mangroves and native coastal vegetation, beach areas; and
- administration and parking.

The final concept plans are likely to also provide for motel/café facilities.

The 'Interpretive-Cultural-Coastal' Centre seeks to promote Aboriginal cultural tourism — with heritage/culture, art, craft, visual displays, oral and written history — blended with the natural assets of the region, including the Nullarbor, Head of the Bight, coastline and cliffs, the nearby islands, national parks, aquaculture and marine life.

A very important component of the Ceduna Coastal Centre is the potential to develop, protect and preserve Aboriginal culture, and to learn and educate younger Aboriginals and others about this heritage, while also supporting tourism and employment. This is examined in a later section.

SECTION ONE

Economic Study

Appendix 1.1

Economic Profile of The Ceduna Region

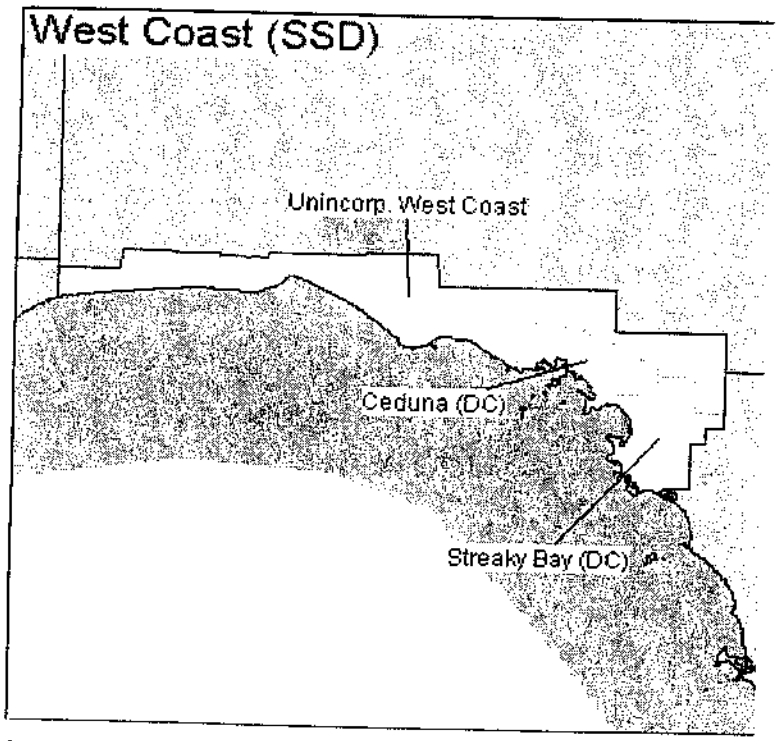
1.1.1 Ceduna Economic Profile

The following section presents an economic profile of the Ceduna region of South Australia. For the purposes of the economic profile the Ceduna Region has been defined as the Ceduna DC Statistical Local Area (SLA). Given the sparsely distributed nature of both the population and economic activity throughout the region, it is recognised that this definition may prove unacceptably narrow for certain aspects of the analysis. For example, there are a number of remote aboriginal communities located in unincorporated areas adjacent to the Ceduna DC region which rely on services provided in the Ceduna DC region and may also contribute significant cultural content to the Coastal Interpretive Centre. These communities should therefore arguably be included in any economic profile of the Ceduna region. Where appropriate, wider definitions of the Ceduna Region have been adopted to capture both populations and economic activity which are present beyond the borders of the Ceduna DC.

1.1.2 Population and Geography

As illustrated in Figure 1.1, Ceduna is the western most centre on the West Coast of the Eyre Peninsula of South Australia and is the last significant town before the Nullarbor Plain and the Western Australian boarder. It is located approximately 800 kilometres west of Adelaide and encompasses an area of 5,423 square kilometres.

Figure 1.1
Map of the West Coast of South Australia



Source: ABS, Integrated Regional Database (IRDB).

Ceduna is situated on coastal Eyre Peninsula on the major Eyre Highway (National Highway 1) such that it is frequently described as "linking the east coast to the west coast". The Eyre Peninsula region has a strong primary industry base with the regions top four industries being agriculture (grain, wool), seafood (fishing and aquaculture), business services and tourism. It is estimated that the region produces 30 per cent of South Australia's grain and upwards of 60 per cent of the State's seafood harvest. Potential on-shore and off-shore mining opportunities are subject to intensive exploration at this time. As a tourist location, the low population ensures a relatively unspoilt and uncrowded experience to enjoy the marine environment, flora and fauna.

The population of Ceduna itself was 3,599 at the time of the 1996 Census. More recent estimates indicate that Ceduna's total population has remained effectively unchanged since 1996. Table 1.1 presents the estimated total population of Ceduna, South Australia and non-metropolitan South Australia for various years. Ceduna's population is estimated to have declined marginally to 3,556 by 1999. Although annual average population growth is estimated to have been stronger for both South Australia and non-metropolitan South Australia over the period of the analysis (1993-1999 as shown in Table 1.1), in 1999, population growth for Ceduna at 1.6 per cent was stronger than for either South Australia (0.4 per cent) or the non-metropolitan area (0.4 per cent). Thus the most recent estimate indicates a renewed momentum for growth (due to reasons we explore later), but indicate inter alia, expansion of the fishing industry, agriculture, tourism and population shifts to coastal locations.

Table 1.1
Population Growth
Ceduna DC, Non-Metropolitan and South Australia - Selected Years

	1993	1994	1997	1998	1999	Annual average Growth rate: 1993 to 1999
	Persons					*Per cent*
Ceduna DC	3,530	3,623	3,524	3,500	3,556	0.1
Non-metropolitan SA	392,058	394,466	397,241	398,708	400,217	0.3
South Australia	1,460,674	1,466,138	1,479,676	1,486,418	1,493,074	0.4

Source: Department of Employment, Workplace Relations and Small Business (DEWRSB).

Selected population characteristics drawn from the 1996 Census are shown in Table 1.2 for Ceduna and South Australia. The most unique aspect of Ceduna's population profile is the large relative size of the indigenous population. Indigenous people account for approximately 22.4 per cent of the Ceduna population compared to only 1.4 per cent for South Australia. This unique aspect of the population profile presents Ceduna DC with special challenges, but also underscores the significant potential for cultural and aboriginal development, employment and local industries such as cultural tourism, community management and training.

The presence of a relatively large indigenous population also has an important impact upon the age structure of the Ceduna community. Because the indigenous population is younger than the non-indigenous population (the Ceduna indigenous population had a median age of only 19 years compared to 36 years for the non-indigenous population in 1996), the Ceduna population age profile is relatively younger than the South Australian age profile. For example, approximately 25 per cent of Ceduna's population was aged 14 years or less compared with 21 per cent for South Australia in 1996. Furthermore, Ceduna had a lower share of persons of post retirement age. Despite the younger age profile, both Ceduna and South Australia possessed working age populations (persons aged 15 to 64) of equivalent relative sizes (65 per cent).

Not surprisingly, a larger proportion of the Ceduna population lives in rural areas (27 per cent) than does the South Australian population (11 per cent). This population distribution of course reflects that agriculture is an important sector of the local economy, and also the existence of significant Aboriginal communities located outside the Ceduna township.

Table 1.2
Selected Population Statistics
Ceduna DC and South Australia - 1996 Census

	Ceduna DC	South Australia	Ceduna DC	South Australia
	Persons		Per cent of total population	
Total Population	3,559	1,427,936	100.0	100.0
Aged 14 and less	898	294,133	25.3	20.7
Aged 15 to 64 years	2,324	931,124	65.4	65.5
Aged 65 years and over	333	197,265	9.4	13.8
Indigenous	796	20,444	22.4	1.4
Born in Australia	3,190	1,077,533	89.6	75.5
Live in:				
Urban Areas	2,599	1,269,619	73.0	88.9
Rural Areas	961	158,317	27.0	11.1
			Participation rate	
In The Labour Force	1,726	661,066	67.0	60.0
Not In The Labour Force	860	447,290		
			Unemployment/employment rate	
Unemployed	120	68,559	7.0	10.4
Employed	1,606	592,507	93.0	89.6
Population Density (ps/km^2)	0.7	1.5		

Source: ABS, Integrated Regional Database (IRDB).

1.1.3 Employment and Income

The employment statistics[3] recorded in Table 1.3 show a very strong labour market for Ceduna in 1996. Not only was a larger proportion of Ceduna's working age population engaged in the labour force than South Australia's (Ceduna had a participation rate of 67 per cent versus 60 per cent for South Australia), Ceduna's unemployment rate of 7 per cent was substantially lower than South Australia's unemployment rate of 10.4 per cent at the time of the Census.

Table 1.3 compares trends in employment and unemployment for Ceduna DC and South Australia for the four years to September 2000. According to DEWRSB employment data, unemployment in Ceduna has risen from 7.0 per cent in the year to the September quarter 1997 to 10.9 per cent in 2000. By comparison, South Australia's unemployment rate has fallen from 9.6 per cent to 8.1 per cent over this period. The rise in unemployment for Ceduna reflects declining levels of employment over the period to September 1999.

Table 1.3
Employment and Unemployment
Ceduna DC and South Australia - Year Average to September Quarter, 2000

	Unemployed				Employed			
	Persons		Unemployment Rate (%)		Persons		Change from previous year (%)	
	Ceduna	SA	Ceduna	SA	Ceduna	SA	Ceduna	SA
September 1997	131	70,050	7.0	9.6	1,740	659,622	-	-
September 1998	156	71,800	8.0	10.0	1,732	648,008	-0.5	-1.8
September 1999	160	63,700	9.2	8.8	1,585	658,102	-8.5	1.6
September 2000	194	59,325	10.9	8.1	1,589	675,309	0.2	2.6

Source: Compiled by SACES from DEWRSB, Small Area Labour Markets data, various issues.

We note that this experience is not unique to Ceduna, but in fact rural Australia, regional South Australia and non-metropolitan Provincial Cities all experienced slow population growth, loss of employment and high rates of unemployment in the mid 1990s. Cut backs in the public sector, wide ranging microeconomic reforms, job losses through public and private organisations (rail, banks, communications, utilities) and downturns in commodity prices were hard felt in rural and regional Australia. More recently, there have been signs of a turn around as many regions have diversified their economic base, strengthened export performance and reversed population decline. Investment in new sectors — aquaculture and tourism are two examples — have begun to generate employment and income in the regions.

[3] This discussion does not include Aboriginal employment in CDEP scheme, which is discussed elsewhere in the report.

More recent labour market data suggests an improvement in Ceduna's labour market performance. Following a sharp 8.5 per cent decline in the level of employment through the year to the September quarter 1999, the number of employed persons has increased by a modest 0.2 per cent over the year to September 2000. This represents a turnaround in Ceduna's employment growth which had declined continually since 1996. If employment growth can be sustained and strengthened into the future, then unemployment can be expected to fall over the short term.

An individual's income represents an important measure of their relative economic affluence. In this respect, Table 1.4 reports individual taxable income details for various regional classifications including Ceduna DC. The mean individual taxable income of Ceduna taxpayers was $25,896 in 1997-98. This compares with $30,474 for South Australia and $28,468 for South Australian non-metropolitan taxpayers. The lower mean taxable income on average for Ceduna individuals is probably largely explained by the lower socio-economic status of the indigenous population. For example, 1996 Census data indicates that the mean weekly individual income of Ceduna's indigenous persons was $169 compared to $288 for the non-indigenous population, in part, this is a reflection of the extensive use of the CDEP training and employment program. Lower educational qualifications and poorer health which together reduce employment opportunities for indigenous people are two important factors that explain the lower economic status of indigenous Australians.

Table 1.4
Summary of Individual Taxation Details
By Region – 1994-95 and 1997-98

	Persons with Taxable Income Number	Total Taxable income $m	Mean taxable income $	Per cent of South Australian mean taxable income
	1994-95			
Ceduna DC	1,558	36.155	23,206	84.7
Metropolitan	478,625	13,423.227	28,045	102.3
Non-Metropolitan	153,612	3,905,680.	25,426	92.8
South Australia	634,855	17,396.930	27,403	100.0
	1997-98			
Ceduna DC	1,792	46.405	25,896	85.0
Metropolitan	490,709	15,278.966	31,137	102.2
Non-Metropolitan	159,849	4,550,582.	28,468	93.4
South Australia	653,124	19,903.565	30,474	100.0
	Changes 1994-95 to 1997-98 (Per cent)			
Ceduna DC	15.0	28.3	11.6	-
Metropolitan	2.5	13.8	11.0	-
Non-Metropolitan	4.1	16.5	12.0	-
South Australia	2.9	14.4	11.2	-

Source: Australian Taxation Office, Australian Taxation Statistics, 1994-95 and 1997-98.

Although the mean taxable income of Ceduna taxpayers was significantly lower than for South Australian taxpayers in 1997-98, Ceduna incomes over time have grown broadly in line with State averages. Between 1994-95 and 1997-98, the mean individual taxable income for Ceduna individuals rose by 11.6 per cent compared to 11.2 per cent for South Australia as a whole. More significantly however, total taxable income for Ceduna rose by 28 per cent ($10.2m) between 1994-95 and 1997-98 compared to 14 per cent for South Australia as a whole. This substantial rise is explained by a significant increase in the number of taxpayers over this period (we note some expansion of CDEP during this time), and would represent a significant injection into the local economy through increased purchases of local goods and services. Given that employment growth in Ceduna has been weak since 1997, it is unlikely that total taxable income has increased significantly since 1997-98.

1.1.4 Industry

The industry structure of the Ceduna economy can be ascertained from Table 1.5 which records the number of business locations by industry for both Ceduna and South Australia. The data is drawn from the Australian Bureau of Statistics Business Register and relates to the year 1997.

The broad industry classification of Agriculture, Forestry and Fishing accounts for 37 per cent of all businesses within the Ceduna region compared to 22 per cent for South Australia. A disproportionate share of business locations from this industry for Ceduna reflects the position of grain growing as the dominant economic activity within the region. Australian Bureau of Statistics data reveals that there were 99 Agricultural establishments within the Ceduna DC region in 1996, of these 85 (86 per cent) were classified as establishments whose primary activity was grain growing. For comparative purposes we note that approximately 24 per cent of all South Australian Agricultural establishments in 1996 were primarily grain growing establishments.

The other main industries for Ceduna in order of importance according to their share of business locations are Retail Trade (13 per cent), Construction (7 per cent), Transport and Storage (6 per cent), Accommodation, Cafes and Restaurants (6 per cent) and Personal and Other Services (6 per cent).

Apart from Agriculture, Forestry and Fishing, other industries which account for a disproportionately larger share of Ceduna's businesses in comparison with South Australia's industry profile structure are Transport and Storage, and Accommodation, Cafes and Restaurants. The greater importance of the Transport and Storage industry for Ceduna reflects Ceduna's position as South Australia's first major regional centre along the Eyre Highway road transport link between Western Australia and South Australia. Furthermore, operations at the Port of Thevenard and local mining activity which requires rail transportation of gypsum to Thevenard for bulk loading would also contribute to Ceduna's larger share.

There are several industries which account for a lower share of Ceduna businesses relative to South Australia. The most distinct is Property and Business Services which accounts for 13 per cent of South Australian businesses compared to 4 per cent for

Ceduna. Other important differences in shares occur for the Wholesale Trade and Manufacturing sectors.

Table 1.5
Number of Businesses by Industry
Ceduna DC and South Australia - 1997

Industry	Ceduna DC	South Australia	Ceduna DC	South Australia
	Number		Per cent	
Agriculture, Forestry and Fishing	123	16,873	37.0	22.0
Mining	2	201	0.6	0.3
Manufacturing	8	4,055	2.4	5.3
Electricity, Gas and Water Supply	2	162	0.6	0.2
Construction	24	5,805	7.2	7.6
Wholesale Trade	11	5,154	3.3	6.7
Retail Trade	43	11,603	13.0	15.2
Accommodation, Cafes and Restaurants	19	2,896	5.7	3.8
Transport and Storage	21	3,045	6.3	4.0
Communication Services	3	401	0.9	0.5
Finance and Insurance	4	2,729	1.2	3.6
Property and Business Services	13	9,678	3.9	12.6
Government Administration and Defence	8	812	2.4	1.1
Education	11	1,870	3.3	2.4
Health and Community Services	18	6,063	5.4	7.9
Cultural and Recreational Services	3	1,561	0.9	2.0
Personal and Other Services	19	3,662	5.7	4.8
Total	**332**	**76,570**	**100.0**	**100.0**

Source: ABS, Integrated Regional Database.

Finally, considering the proposed development of the Ceduna Keys and Ceduna Coastal Centre, it is interesting to note that there were only three Cultural and Recreational Services business locations within the Ceduna region in 1997. Given the very significant indigenous population, the diversity and richness of the indigenous cultural history and the growth in international and domestic tourism, there appears to be good reason to seriously examine potential opportunities for new cultural tourism developments at this time. Recreational fishing, big game fishing, the natural attractions of the off-shore islands, bird watching and whale watching are all available in Ceduna, or in close proximity so there are very sound reasons in support of the claim that business opportunities and employment are under-developed in this industry sector.

Table 1.6 examines industry structure in further detail by reporting employment by industry for Ceduna and South Australia.

The Agriculture, Forestry and Fishing industry sector accounts for almost 18 per cent of all employment within the Ceduna region. This compares with only 6 per cent at the State level. Employment data for important sub-components of the Agriculture, Forestry and Fishing industry have been provided in Table 1.6. Agriculture excluding Forestry and Fishing employs 13 per cent of the Ceduna workforce. The other main industry within this subgroup is Aquaculture which employs approximately 3 per cent of the Ceduna workforce. Of the 207 people employed in Agriculture, 95 (46 per cent) were employed in agricultural activities relating to grain growing. However, this figure is likely to be an underestimate since the agricultural activity of employment was undefined for a large number of people employed within the industry.

Table 1.6
Employment by Industry
Ceduna and South Australia - 1996

Industry	Persons		Percentage	
	Ceduna DC	South Australia	Ceduna DC	South Australia
	Number		Per cent	
Agriculture, Forestry and Fishing	286	33,107	17.7	5.6
Agriculture	*207*	*20,8883*	*12.8*	*4.9*
Services to Agriculture	*7*	*1,549*	*0.4*	*0.3*
Commercial Fishing	*18*	*1,000*	*1.1*	*0.2*
Aquaculture	*48*	*311*	*3.0*	*0.1*
Mining	32	3,506	2.0	0.6
Manufacturing	51	88,645	3.2	15.0
Electricity, Gas and Water	11	4,630	0.7	0.8
Construction	60	29,301	3.7	4.9
Wholesale Trade	48	33,581	3.0	5.7
Retail Trade	186	79,007	11.5	13.3
Accommodation, Cafes and Restaurants	101	25,050	6.3	4.2
Transport & Storage	97	21,782	6.0	3.7
Communication Services	15	10,551	0.9	1.8
Finance and Insurance	25	19,306	1.5	3.3
Property and Business Services	59	49,878	3.7	8.4
Government Administration and Defence	67	24,994	4.1	4.2
Education	140	43,442	8.7	7.3
Health and Community Services	276	67,057	17.1	11.3
Cultural and Recreational Services	9	12,835	0.6	2.2
Personal and Other Services	63	23,488	3.9	4.0
Non Classifiable/Not Stated	89	22,347	5.5	3.8
Total Persons Employed	1,615	592,507	100.0	100.0

Source: ABS, (1998) Integrated Regional Database.

The Agricultural, Forestry and Fishing industry is only marginally the largest employing sector within the Ceduna region. A similar share of the Ceduna workforce is employed within the Health and Community Services sector (17 per cent). Although the Health and Community Services sector accounts for a larger proportion of South Australian businesses (8 per cent) than for Ceduna businesses (5 per cent), it employs a smaller proportion of the South Australian workforce (11 per cent) relative to the Ceduna workforce. This higher level of employment probably relates to the need to provide health services to remote indigenous communities located in the surrounding regions of Ceduna. For example, approximately 163 (60 per cent) of the 273 employees within Health and Community Services were employed in the Non-Residential Care Services sector.

The remaining major industries for Ceduna ranked according to their share of employment are Retail Trade (12 per cent), Education (9 per cent), Accommodation, Cafes and Restaurants (6 per cent) and Transport and Storage (6 per cent).

Industries which account for a lower share of employment in Ceduna than for South Australia are Mining, Property and Business Services and Wholesale Trade. The most pronounced difference occurs for Manufacturing which represents 5 per cent of South Australian businesses compared to 2 per cent for Ceduna, however it employs 15 per cent of the South Australian labour force compared to only 3 per cent of the Ceduna labour force. It is likely that employment in manufacturing has increased in the last six to twelve months (a period not covered in the tables), through expansion of the steel fabrication sector and in manufacturing/processing at the local fish factories (i.e., processing and packaging of the catch from the local fishing fleet). Steel fabrication and the manufacture of pipes, pumps and irrigation equipment have experienced employment and sales growth. Local knowledge confirms our interviews with employers that in steel fabrication, fish processing, aquaculture, construction and commercial fishing, there has been increases in employment in the period 1999-2001. In aquaculture, where employment is shown at 48 persons in 1996 (Table 1.6), there are now 30 person employed at Ceduna and 60 at Smoky Bay — nearly double the 1996 estimate. A larger share of employment within the Property and Business Services sector for South Australia reflects the substantially larger size of this sector at the State level in terms of business numbers (see above).

The larger size of the Ceduna Accommodation, Cafes and Restaurants sector relative to the corresponding South Australia sector partly highlights the importance of tourism to the local economy but also the geographical location of the township. A detailed profile of the tourism industry for Ceduna is presented in Section 2, Marketing and Tourism.

Finally, Mining is also an important sector of the Ceduna regional economy. However, the analysis of employment and businesses by industry, which does highlight that the mining industry is relatively larger in Ceduna than South Australia, still does not clearly illuminate the substantial relative size of this industry. The following discussion presents data on exports through the Port of Thevenard and more clearly highlights the importance of the mining industry to the local economy.

Before proceeding to the analysis of exports, Table 1.7 shows a profile of Ceduna and South Australian businesses ranked according to their number of employees. Not surprisingly, the business profile of Ceduna is skewed towards smaller businesses. Approximately 26 per cent of all Ceduna businesses reported having no employees compared to 14 per cent of all South Australian businesses. Ceduna had lower representation relative to South Australia for all other businesses size classifications.

Table 1.7
Businesses by Number of Employees
Ceduna DC and South Australia - 1997

Number of employees	Number		Per cent	
	Ceduna	South Australia	Ceduna	South Australia
0	86	10,721	25.9	14.0
1-4	175	45,638	52.7	59.6
5-9	40	10,792	12.0	14.1
10-19	21	4,971	6.3	6.5
20-49	7	2,802	2.1	3.7
50-99	2	981	0.6	1.3
100+	1	665	0.3	0.9
Total	**332**	**76,570**	**100.0**	**100.0**

Source: ABS, (1998) Integrated Regional Database.

1.1.5 Exports

Located in the Ceduna DC, the Port of Thevenard services those primary industries located in the surrounding regions of Ceduna DC and consequently represents a major point of industrial activity within the region. Export data for the port therefore provides important information on trends in local economic activity and the structure of the local economy. Overseas, interstate and total exports of major export commodities are presented in Table 1.8. Total exports are also illustrated graphically in Figure 1.2.

Port of Thevenard total exports have grown from 1.3 million tonnes in 1993-94 to 1.6 million tonnes in 1999-00. Ranked according to weight (tonnes), the most important commodity exports in 1999-00 were gypsum (1.5m tonnes), salt (71,009 tonnes) and wheat (43,842 tonnes). In non-drought years, wheat has traditionally been the second most important export commodity behind gypsum. The commodity breakdown of exports highlights the importance of both mining (gypsum and salt) and agriculture (wheat, barley and oats) to the Ceduna regional economy.

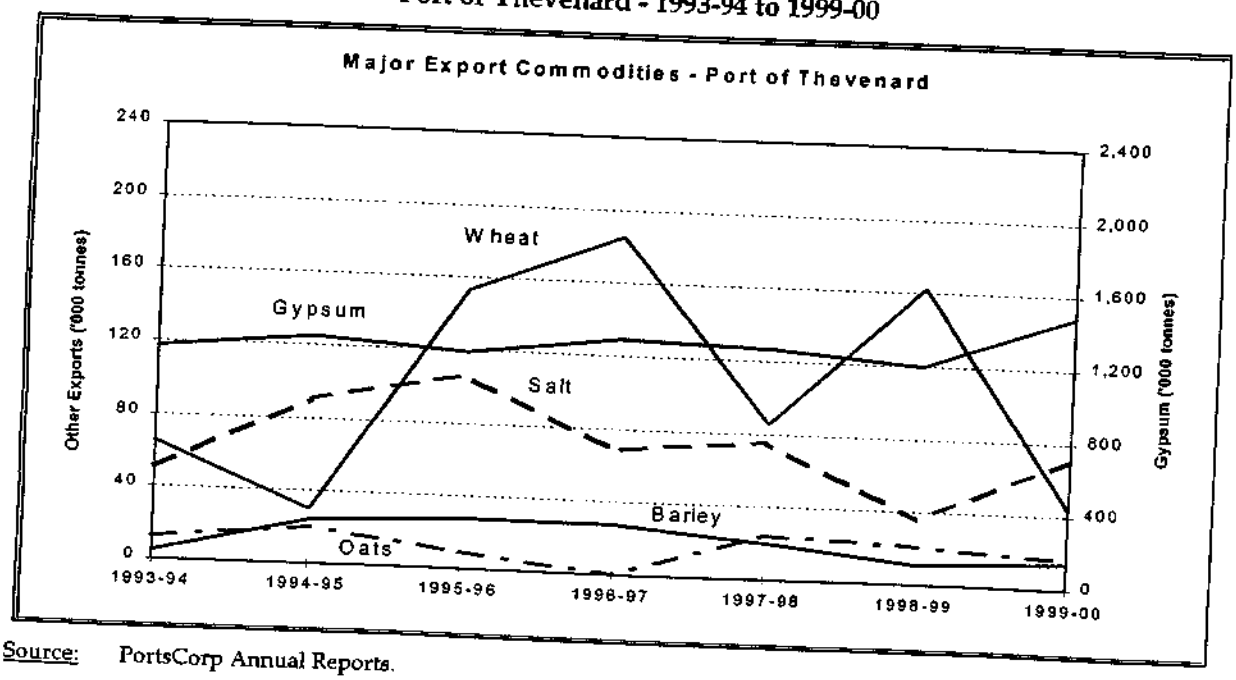
Trends in commodity exports have fluctuated significantly over time (see Figure 1.2), this is especially true for agricultural commodities which are heavily influenced by seasonal patterns in South Australia, interstate and overseas. For example, Thevenard overseas exports which are composed mainly of agricultural commodities have tended to be more variable over time relative to interstate exports which are comprised almost exclusively of mineral exports (gypsum). Despite these fluctuations, the composition of Thevenard's exports appears to have remained relatively steady over time.

Table 1.8
Major Export Commodities (tonnes)
Port of Thevenard - 1993-94 to 1999-00

Commodity	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Overseas							
Wheat	65,777	30,140	153,431	185,186	85,703	163,071	43,842
Barley	5,322	15,398	27,692	27,452	19,920	11,000	13,850
Oats	12,225	0	9,378	0	23,962	21,000	15,800
Gypsum	259,580	240,045	248,273	294,397	225,718	150,459	256,206
Salt	51,064	72,480	88,013	52,064	68,772	36,175	71,009
Total	393,968	358,063	526,787	559,099	424,075	381,705	400,707
Interstate							
Wheat	0	0	0	0	0	0	0
Barley	0	9,266	0	0	0	0	0
Oats	0	20,015	0	0	0	0	0
Gypsum	917,920	1,014,456	943,967	1,000,410	1,045,425	1,052,119	1,231,564
Salt	0	17,869	18,254	16,975	6,898	0	0
Total	917,920	1,061,606	962,221	1,017,385	1,052,323	1,052,119	1,231,564
Total							
Wheat	65,777	30,140	153,431	185,186	85,703	163,071	43,842
Barley	5,322	24,664	27,692	27,452	19,920	11,000	13,850
Oats	12,225	20,015	9,378	0	23,962	21,000	15,800
Gypsum	1,177,500	1,254,501	1,192,240	1,294,807	1,271,143	1,202,578	1,487,770
Salt	51,064	90,349	106,267	69,039	75,670	36,175	71,009
Total	1,311,888	1,419,669	1,489,008	1,576,484	1,476,398	1,433,824	1,632,271

Source: PortsCorp Annual Reports.

Figure 1.2
Major Export Commodities
Port of Thevenard - 1993-94 to 1999-00



Source: PortsCorp Annual Reports.

The location of the Port of Thevenard in the vicinity of Australia's most important gypsum mine (Lake Macdonnell) accounts for the large share of gypsum exports. The importance of gypsum exports to Thevenard gives the port a unique geographical distribution in terms of export markets. While the majority of exports from South Australia's other regional ports are destined for overseas export markets, the predominance of gypsum exports at Thevenard gives the port an interstate focus as gypsum is primarily exported to interstate markets.

Appendix 1.2

Sustainability of Current Industry

1.2.1 Current Employment and Business Profile

In the following analysis we consider the sustainability of employment and industry based on current local, state and national trends and consider likely projections into the future. In doing so, we seek to establish a base-line case leaving aside the impact of proposed developments in Ceduna, the most significant of which is the Ceduna Keys and Coastal Centre, but also includes other investment and major public works projects (e.g., Community hotel extension/refurbishment, road traffic management, main street beautification, development of airport, etc.).

In order to assess the sustainability of current activity it is first necessary to examine the current profile of economic activity in Ceduna and compare this profile with the labour market performance of the appropriate sectors over the past few years, and with projections about future trends in labour market demand. Based on 1996 data Table 1.9 outlines (in descending order of importance) the five most important sectors in terms of employment for Ceduna, and the relative proportions that these sectors comprise in the overall South Australian labour market. More detailed profiles of the labour market in Ceduna are provided in Appendices 1.1 (Economic Profile of the Ceduna Region) and in later analysis on employment, skills and training (Appendices 3.1 and 3.2).

Table 1.9
Most Important Employing Sectors for Ceduna, 1996

Industry Sector	Ceduna (persons)	Ceduna (%)	SA Total (%)
Agriculture, forestry and fishing	286	17.7	5.6
Health and community services	276	17.1	11.3
Retail trade	186	11.5	13.3
Education	140	8.7	7.3
Accommodation, cafes and restaurants	101	6.3	4.2
Sub-total	989	61.3	41.7
Total persons employed	1,615		

Source: Derived from ABS, Census 1996.

The rural character of much of the district council, and the increasing importance of aquaculture are both reflected in the fact that Agriculture, Forestry and Fishing is the largest sector by employment.

Identifying the sectors which are currently the key employers in the Ceduna region is the first stage in assessing how sustainable the current pattern of employment and industry is, as it identifies the key sectors for consideration. Although we will examine the prospects of all sectors of Ceduna's economy we will particularly focus on these five most significant sectors as they account for over 60 per cent of Ceduna's employment.

1.2.2 Projections as to Future Growth

In preparing predictions as to likely future employment prospects we will be using two sources of estimate; national employment growth projections produced by DEWRSB[4] (and published in "Job Outlook") and projections based on the historical trends in employment in Ceduna. Again, we reiterate that these projections **do not** take into account the projected impact of the proposed development, nor do they include the impact of any mineral/oil discovery in the region. As such they should be viewed as a possible "base case" scenario, to which the impacts of the development can be added to provide an overall estimate of likely future employment prospects.

Table 1.10
Employment Growth Rates by Industry

	Australia		Ceduna
	Growth 1995-2000 (per cent)	Projected Growth (per cent p.a.)	CAGR 91-96 (per cent p.a.)
Agriculture, forestry and fishing	1.6	0.3	1.9
Mining	-1.5	-1.2	13.5
Manufacturing	0.4	0.1	4.0
Electricity, gas and water Supply	-5.4	-2.0	-6.0
Construction	3.4	1.4	-9.2
Wholesale trade	-1.0	0.5	-1.6
Retail trade	2.1	2.1	-2.5
Accommodation, cafes and restaurants	2.8	2.7	1.0
Transport and storage	1.0	1.2	0.6
Communication services	3.2	1.5	-23.7
Finance and insurance	1.2	0.4	-10.7
Property and business services	5.2	4.2	6.5
Government admin & defence	-1.3	0.3	4.0
Education	1.3	1.8	3.5
Health & community services	2.6	2.2	12.4
Cultural & recreational services	2.6	2.5	5.2
Personal & other services	3.0	2.3	-3.4
Total	1.8		

Note: CAGR = compound annual growth rate.
Source: DEWRSB and ABS.

[4] Department of Employment, Workplace Relations and Small Business.

As can be seen from Table 1.10, there have been some significant changes in Ceduna's employment profile which are at odds with national trends but which seem to make sense in the context of a regional centre. The most striking change in employment for an industry sector in Ceduna was that of Communications, where employment fell from 58 in 1991 to 15 in 1996, an annual average fall of 24 per cent. This makes sense in terms of the technical change in the Telecommunications sector, with a switch away from labour intensive microwave transmission for interstate telecommunications to fibre-optics which require no local maintenance facilities. National projected growth is significantly lower than that experienced from 1995-2000. This effect was magnified in Ceduna due to the closure of the OTC satellite ground station, also due to technical change.

Agriculture, Forestry and Fisheries

Turning to the key private sectors in terms of employment, the largest of these (and the largest overall employer) is Agriculture, Forestry and Fisheries. This has achieved reasonable growth in Ceduna over the period 1991 to 1996, creating 26 new jobs over this period. DEWRSB is projecting nationally that this sector will only achieve employment growth of 0.3 per cent per annum. There is good reason, however, to believe that Ceduna will be able to achieve growth in this sector which is significantly closer to its historical rate of 1.9 per cent rather than the national projections. This is because whilst broadacre agriculture is likely to achieve little or no employment growth over the next few years, aquaculture is also a reasonably significant employer in Ceduna, and is likely to maintain strong employment growth over the next five to ten years as growth in the Australian and the world demand for seafood continues to be strong. The prospects for aquaculture are discussed in more detail in Appendix 1.4.

Health and Community Services and *Education*

Of the five largest employing sectors in Ceduna, it should be noted that two of these - Health and Community Services and Education — are based on the provision of government services. Despite the growth which they have enjoyed over recent times this suggests that in future they are more likely to grow at a rate broadly in line with the national or state average (unless for some reason the number of persons requiring either of these two types of services grows at a faster rate in Ceduna than in the rest of South Australia).

Retail Trade

The historical performance of employment in the Retail Trade sector, Ceduna's third largest sector of employment with 186 employees in 1996, has been somewhat puzzling. Nationally, Retail Trade over the period 1995 to 2000 has enjoyed strong employment growth, however in Ceduna from 1991 to 1996 employment in the sector declined markedly. SACES considers that it is unlikely that this trend will continue into the future, but rather that it was caused by specific historical factors (such as the decline in population over this period). Instead we would suggest that DEWRSB's national prediction of 2 per cent per annum growth into the future would be a better predictor of future levels of activity.

Essentially this suggested increase in employment in Retail Trade would be supported by increases in the overall level of economic output in Ceduna. Possible sources of growth in the region include supplies and services to the trawler fleet relocated to the Port of Thevenard, minerals and petroleum exploration activity (for example

expenditure in Ceduna by personnel involved in off-shore petroleum exploration and off-shore fishing activities), gradual increases in tourist numbers, and growth in the aquaculture industry. Population growth and some expansion in building and construction industry in Ceduna and at Smoky Bay are additional reasons for remaining optimistic about employment growth in the Retail Sector.

Accommodation, Cafes and Restaurants

This sector has enjoyed moderate growth (roughly 1 per cent per annum) in Ceduna over the period for which we have data, although growth has been approximately half that of the country as a whole. In the absence of the development of the Marina and Coastal Centre, it is believed that the historical growth in employment would be a good predictor of future growth.

The structure of employment in the Accommodation, Cafes and Restaurants sector in Ceduna is quite unusual, namely the proportion of employment in Pubs, Taverns and Bars (42 per cent). This supports the use of local historical growth rates rather than national projections which are largely driven by employment trends in Cafes and Restaurants and tourism related growth in Accommodation.

Historical growth rates while a good predictor of future growth, may still understate future prospects, due to the growth in casual and part-time employment which has been supported in South Australia by the introduction of the poker machine in hotels. It is likely that employment growth in the period 1996-2000 was higher than the 1.0 per cent recorded here. Again, be reminded that these projections **do not** take into account the projected impact of the proposed development.

All Sectors

Table 1.11 provides a basic guide as to the potential employment prospects (and hence sustainability of current levels of activity) for each of the sectors in the Ceduna region. The information is presented in a graphical fashion, with the projected growth potential represented by a number of pluses or minuses. A graphical method of presentation was used rather than actual numerical estimates, as the SA Centre for Economic Studies possessed enough information to determine whether historical Ceduna data or DEWRSB's national employment growth rate projections were a better guide to an industry's potential in Ceduna, but we did not have sufficient information to produce actual projections for Ceduna itself, hence the indicative chart.

The number of signs equates to a range of annual average growth rates according to the key or scale below:

Scale:	
+	0.1 to 0.5
++	0.5 to 1.0
+++	1.0 to 2.0
++++	2.0 to 3.0
+++++	3.0 to 5.0
++++++	5.0 to 10.0
+++++++	10.0+

Whilst this table should not be regarded as a definitive indicator as to the level of likely employment growth in individual sectors of Ceduna's economy, it should be able to provide guidance as to areas in which training could be best focused to meet potential future employment needs. It could also give guidance to the council as to industries which are likely to require transition strategies to assist persons employed in the sector to cope with structural change, particularly by providing training which enables them to change their sector of employment.

It should be noted that the table also provides indications as to likely 5 year trends, abstracting to a large degree from the short-term economic cycle. For example we are projecting a slight average increase in construction employment over the next five years, however in the absence of the proposed developments it is likely that the construction sector in Ceduna, like the rest of the country, will face a downturn in activity over the current financial year, due to residential construction having been brought forward to "beat" the introduction of the GST. This suggests that employment in construction is likely to decline in the 2000-01 financial years, with growth in the remaining years being slightly stronger than that predicted.

Table 1.11
Projected Indicative Annual Employment Growth Rates by Industry: 2000 to 2005
Approximate Size

	DEWRSB projections (national)	Ceduna growth 1991-96	SACES projection for Ceduna
Agriculture, forestry & fishing	+	+++	++
Mining	--	+++++++	++
Manufacturing	unchanged	+++++	unchanged
Electricity, gas and water Supply	----	------	----
Construction	++	------	+
Wholesale trade	+	---	-
Retail trade	++++	----	++
Accommodation, cafes and restaurants	++++	++	++
Transport and storage	++	++	++
Communication services	++	-------	--
Finance and insurance	+	-------	---
Property and business services	+++++	++++++	+++++
Government admin & defence	+	+++++	+
Education	+++	++++	++
Health & community services	++++	+++++++	++++
Cultural & recreational services	++++	++++++	++++
Personal & other services	++++	-----	--

Source: ABS and DEWRSB, Calculations SACES.

Appendix 1.3

Economic Impact of the Proposed Development

In the following discussion, we focus on the economic impacts of the Ceduna Keys and Ceduna Coastal Centre developments.

1.3.1 Assessing Economic Impacts

In any assessment of the economic contribution of a particular activity to the State's economy, the direct impacts of its related expenditures are only part of the story. There are further impacts in the form of:

- indirect effects, as the production activity induced by the direct impacts flows through other industries; and
- induced effects, as household and (potentially) government incomes arising from the direct and indirect impacts are spent, with further impacts on economic activity.

For this study, indirect and induced effects have been estimated using multiplier analysis based on input output tables. National input output tables have been tailored to better reflect the structure of the local economy in the Ceduna region, and are then used to calculate the total economic impacts of the expenditure associated with the Ceduna Keys and Coastal Centre. A brief description of input-output analysis is included here at 1.3.2.

There are several potential sources of economic impact to the local region from the Ceduna Keys and Ceduna Coastal Centre developments. One of these, the impact of the construction phase of the project, will only be short lived and will vanish once the construction phase is complete (four years after commencement based on the information supplied to the Centre). The other two impacts — increased tourist expenditure through increased visitor nights, and the expenditures (on fuel, food, etc.), of new fishing trawlers/tuna boats making use of Ceduna once the marina becomes available — are ongoing benefits and will indicate the true economic impact of the project to the region.

For the purposes of this analysis it has been assumed that residential construction activity in the Ceduna Keys development is transferred from other areas of the township, as the marina becomes the preferred area for new housing construction, with total activity remaining broadly constant. This is a somewhat conservative assumption as it is possible that the demand for new housing in Ceduna will increase once land becomes available in the marina. As it was not possible to obtain a reasonable estimate of any potential increase in demand none has been modelled. These impact calculations rely on one important assumption, that the development can occur without causing losses to the fishing and aquaculture industries of Ceduna. The following sections quantify the multiplier effects of this expenditure on the Ceduna regional economy.

It is worth noting that this section of the report is concentrating on calculating the economic impact of the development on the region. The economic impact is only going to form part of the total economic benefit to the region. The other area of benefit from the project is an increase in urban amenity and services to the residents of Ceduna, increasing their quality of life. This also has an economic value, but is far more difficult to evaluate. It is relevant to benefit cost analysis which is not part of this consulting brief. However, some of the social benefits accruing to local residents are mentioned at various points in this report.

In order to properly conduct an economic impact analysis it is necessary to be very clear as to what is being used as the alternative scenario (also known as the counterfactual). The scenario used should be considered to be the most likely if the event being analysed did not occur, and this should be clearly identified. In evaluating the Ceduna Keys and Ceduna Coastal Centre development we have assumed as the base scenario, that if this particular development did not occur there would be no alternative marina development in the near-term future, nor would there be any significant initiative to increase tourist numbers beyond their current organic growth rate.

1.3.2 Input-Output Analysis

An input-output table presents a breakdown of the economy into a number of producer sectors. Data is presented for each sector indicating what inputs the sector uses to produce its outputs, and indicating what sectors it sells its output to. Coughlin and Mandelbaum (1991) describe an input-output table as " ... [a] mathematical description of how all sectors of an economy are related."

Inputs for a sector include a range of intermediate inputs, produced by other firms in the region, and several primary inputs such as imports, wages and salaries, profits and taxes. Outputs can be sold as intermediate inputs to other producers or to various final demand uses such as final consumption, investment and exports.

Input-output tables can be used to estimate the indirect and induced impacts (as well as direct impacts) on output, income and employment arising from the purchase of goods and/or services produced in a region. They therefore can be used to estimate the likely economic impacts of various activities, such as a major construction project or export initiative (it should be noted that from the point of view of regional analysis any sales outside the region, such as tourists from Adelaide, are considered as exports).

The direct, or "initial", multiplier measures, for a primary or intermediate input supply group, the first round supply response required when the output of a purchaser industry or final demand changes by one unit.

The second level of impact known as "indirect impacts", measure increased production by intermediate suppliers in the economy to meet the demand generated by the increase in expenditure of the initial impact. These intermediate suppliers then increase their demand for products provided by their intermediate suppliers, and so on. This process could be continued ad infinitum, but in practice the later round effects rapidly converge towards zero.

These increases in activity in the economy also act to increase local incomes through wages and salaries and for local profits. This increase causes the third level of impacts (consumption induced impacts), as at least some of this increased income is spent locally increasing economic activity. These impacts also potentially continue ad infinitum, but in practice converge toward an insignificant level fairly quickly.

As the Australian Bureau of Statistics only publishes input-output tables for Australia as a whole, these tables have been adjusted to better reflect the structure of the Ceduna regional economy. The adjustment was performed using the "location quotients" technique, which involves altering the national input-output table to indicate higher import propensity in certain sectors to the extent that a region lacks the capacity to meet input demands from local production. The adjusted table better approximates the region's specific industrial structure.

1.3.3 The Economic Impact of the Initial Construction Phase

As the funding for the construction phase of the Ceduna Keys and Ceduna Coastal Centre development is to be sourced outside of the Ceduna District Council, all of the activity in the construction phase of the project can be considered as a benefit for the region. This makes assessing the gross benefits of the project much simpler as all construction expenditure spent locally can be taken into account. The remaining complication in the assessment process is how much of the construction labour and subcontracting will be sourced locally. The stated periods for nominated expenditures are not related to specific years as, at present it is uncertain precisely when construction will commence; hence all timing is relative to the year in which construction starts. In assessing the impact of the construction phase of the project it has been assumed that the majority of the employees will live in Ceduna during their employment on the construction phase and that all equipment and supplies needed are purchased through local retailers/wholesalers so that the retail margin remains in the Ceduna region. The distribution of the expenditure on construction is $23.6 million in year 1 (plus $1 million in equipment purchases), $10.9 million in year 2, $5.0 million in Year 3, $1.9 million in year 4 and $0.5 million in year 5.

Table 1.12 details the distribution of increases in Gross Value Added due to the project's construction expenditure between various industry sectors. As would be expected almost all of the benefits occur in the Construction sector, however Wholesale & Retail Trade and Repairs; Manufacturing; and Transport are also significant beneficiaries.

It is clear from Table 1.13 that the employment impact, both direct and indirect, of the construction phase declines very swiftly. This poses a dilemma for the District Council given their stated objective of having as much as possible of the construction activity undertaken by locals with training provided to many of them. If all the 190 positions in the construction sector required in the first year of the construction were sourced locally the question would remain as to what they would do as employment on the project declined, falling to 4 by the fifth year. Given that the current employment in the construction industry (as indicated by the latest ABS data on the IRDB database) is 61 it would seem unlikely that many of them would be able to find employment in the construction industry in Ceduna even if there were an increase in housing completions due to the development.

Table 1.12
Economic Impact of the Construction Phase
Gross Value Added ($'000)

	Year 1	Year 2	Year 3	Year 4	Year 5
Primary Production	181.3	83.3	38.2	14.5	4.1
Manufacturing	620.6	282.7	129.7	49.3	13.8
Utilities	77.1	32.4	14.9	5.6	1.6
Construction	10,547.2	4,871.0	2,234.4	849.1	238.3
Wholesale and retail trade and repairs	1,058.5	270.6	124.1	47.2	13.2
Accommodation, cafes and restaurants	44.0	18.6	8.5	3.2	0.9
Transport	392.4	164.8	75.6	28.7	8.1
Communications Services	86.5	34.0	15.6	5.9	1.7
Finance and Insurance	134.0	57.4	26.3	10.0	2.8
Property and Business Services	286.2	117.8	54.0	20.5	5.8
Government, education, health and community services	99.2	43.2	19.8	7.5	2.1
Cultural, recreational and personal services	34.6	14.9	6.8	2.6	0.7
Total	**13,561.7**	**5,990.9**	**2,748.1**	**1,044.3**	**293.1**

Source: SACES calculations.

Table 1.13
Employment Impact of the Construction Phase
FTE Employees

	Year 1	Year 2	Year 3	Year 4	Year 5
Primary Production	1.23	0.56	0.26	0.10	0.03
Manufacturing	9.31	4.25	1.95	0.74	0.21
Utilities	0.43	0.18	0.08	0.03	0.01
Construction	187.74	86.70	39.77	15.11	4.24
Wholesale and retail trade and repairs	24.27	6.21	2.85	1.08	0.30
Accommodation, cafes and restaurants	1.11	0.47	0.22	0.08	0.02
Transport	5.24	2.26	1.04	0.39	0.11
Communications Services	0.87	0.34	0.16	0.06	0.02
Finance and Insurance	1.17	0.50	0.23	0.09	0.02
Property and Business Services	3.55	1.46	0.67	0.25	0.07
Government, education, health and community services	1.81	0.79	0.36	0.14	0.04
Cultural, recreational and personal services	0.67	0.29	0.13	0.05	0.01
Total	**237.41**	**104.02**	**47.71**	**18.13**	**5.09**

Source: SACES calculations.

PIRSA[6]) found several prospective sites in the Ceduna region which, from a technical perspective, would appear to have good potential as sites for tuna pens. For example, the Port James region (approximately 30km west of Ceduna) received an aggregate score of 40 for its suitability as an offshore aquaculture site, equal highest of any region in the state. Of course, just because a site is technically suitable does not mean that it will necessarily be developed. The cautious approach suggested by Mr Jefferies to the potential of the Ceduna region may indicate that there are no plans amongst existing operators to make use of these prospective sites at the present time. Consequently, in the absence of any evidence to suggest that tuna pens are being considered by any existing operators, no tuna farming based out of the marina has been included in the economic impact calculations.

This discussion suggests that any benefit to Ceduna from the ongoing marina operations would be most likely to come from one or more commercial fishing boats switching to Ceduna from another port in the region, or from recreational use of the facilities by non-local boat owners. Current calculations of the economic impact of marina operations are based on discussions with Raptis and Sons, and estimates are calculated on the basis that Raptis will base two or three of their trawler boats out of Ceduna from this year (initially using the Port of Thevenard for refuelling and unloading, although it is suboptimal) on the understanding that the marina will be constructed and available for use within 3 to 4 years. No estimate has been made due to a lack of information of use of the marina by yachts, other fishing trawlers or charter boats, however some net increase in activity of this type (beyond the use currently made of boat ramps and facilities at the Port of Thevenard) is likely to occur. The Centre's interviews with owners of boats based at Streaky Bay and used for shark and lobster catch, confirm that Ceduna would be used more frequently as a refuelling stop were "a fisherman's wharf" included in the development. Potential benefits of increased stop-overs include greater utilisation of the two fish processing plants for off-loading packed and chilled fish and increased demand for transport of goods to Port Lincoln and Adelaide.

Raptis and Sons indicated that they anticipated annual local expenditure per trawler of just under $0.5 million, with the majority of this ($400,000) being spent on refuelling. Once the multiplier effects of this expenditure are taken into account each trawler of the scale proposed by Raptis operated out of Ceduna increases local economic activity by $600,000. This contribution to Ceduna's economy would be even greater if some or all of the fishers decided to live in Ceduna. However, for the economic impact calculation it has been assumed that the trawlers' employees will operate on a "fly in fly out" basis, residing in Adelaide or a major regional centre.

1.3.6 Timing of Impacts

As well as the level of impact, and the sectors in which they are felt, another significant issue is the timing of these impacts, which is particularly important with regards to the provision of training. The timing is largely driven by the construction schedule of the project as, for example the Ceduna Coastal Centre cannot increase tourism numbers until it is completed. In determining the timing of impacts it has been assumed that the impact of the Coastal Centre on tourist numbers phases in over 4 years, with the full

[6] Petrusevics, P., (1988), "Key Sites for Off-Shore Aquaculture Development in South Australia", March.

impact being achieved in the fifth year of its operations. Employment impacts over time are given in Table 1.15.

Table 1.16 differs from Table 1.15 in one respect only, in that a slower construction period is assumed stretching out over six years, so that the employment impacts are also spread out over this period. This provides a 'richer picture' of the impacts where the major site preparation, marina design and construction, lake building and related capital works flow into the third year.

Table 1.15
Timing of the Employment Impact of the Development
Full-time Equivalent Employment

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Construction	237.4	104.0	47.7	18.1	5.1	n.c.e	n.c.e	n.c.e	n.c.e	n.c.e
Tourism (upper bound)	-	-	-	-	3.37	6.75	10.12	13.50	16.88	16.88
Tourism (lower bound)	-	-	-	-	2.25	4.50	6.75	9.00	11.25	11.25
Marina operations (upper bound)	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Marina operations (lower bound)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total (upper bound)	246.7	113.3	57.0	27.4	17.8	16.1	19.4	22.8	26.2	26.2
Total (lower bound)	243.6	110.2	53.9	24.3	13.6	10.7	13.0	15.2	17.5	17.5

n.c.e Not currently estimated. Whilst there is no direct impact estimated once construction work for the development ceases, there will be construction activity in the residential development. At this point in time it has been assumed that (at least initially) this will be a transfer of activity from other areas of Ceduna rather than a net increase.

Table 1.16
Timing of the Employment Impact of the Development, Slower Construction
Full-time Equivalent Employment

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Construction	129.6	117.4	117.4	70.6	41.0	15.3	n.c.e	n.c.e	n.c.e	n.c.e
Tourism (upper bound)	-	-	-	-	3.37	6.75	10.12	13.50	16.88	16.88
Tourism (lower bound)	-	-	-	-	2.25	4.50	6.75	9.00	11.25	11.25
Marina operations (upper bound)	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Marina operations (lower bound)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total (upper bound)	131.2	119.0	119.0	57.0	30.8	21.2	19.4	22.8	26.2	26.2
Total (lower bound)	128.1	115.9	115.9	53.9	26.6	15.8	13.0	15.2	17.5	17.5

n.c.e Not currently estimated. Whilst there is no direct impact estimated once construction work for the development ceases, there will be construction activity in the residential development. At this point in time it has been assumed that (at least initially) this will be a transfer of activity from other areas of Ceduna rather than a net increase.

Appendix 1.4

Prospects for Aquaculture

1.4.1 Introduction

The aquaculture industry is dominated (in terms of South Australian exports) by the tuna industry which accounted for 52 per cent of the value of all seafood exports in 1999-2000.[7] This is a remarkable export success story over the last decade, when in the early 1990s, the tuna industry was approaching receivership. The advent of tuna farming is widely acknowledged as the saviour of the industry. Recent growth in the aquaculture industry (and in export values) can be attributed to a more diverse industry, which includes lobster, oysters, prawns, abalone and other marine fish. The industry receives strong support from Primary Industries SA (PIRSA), is closely connected with research bodies (e.g., SARDI, Lincoln Marine Science Centre of Flinders University located at Port Lincoln, and for water quality research) and maintains high levels of commercial R&D and investment. A new Co-operative Research Centre (CRC) for Sustainable Aquaculture of Finfish to be located Adelaide was recently announced.[8]

An example of infrastructure development following the growth of the aquaculture industry (and initial export success) is the boat ramp facilities and the aquaculture park at Smoky Bay, situated some 40 kilometres south-east of Ceduna. The South Australian government recently contributed $250,000 to construct the aquaculture park (to be paid back over 15 years) with oyster growers to contribute a further $500,000 plus. More than three-quarters of the allotments have been taken up by an industry estimated to produce 25 per cent of this State's oysters. The aquaculture park will centralise harvesting, processing, packaging and transport activities, providing necessary power, water, refrigeration and other shared facilities. The local industry is intent on a consolidation, improving product quality and improving marketing to current export destinations including Japan, Singapore, UK and several eastern European countries. (Smoky Bay accounts for 15 per cent of South Australian oyster exports). The largest lease is 10 hectares with many smaller leases at 1-3 hectares. While protecting water quality and feed quality of the water, the Growers Association estimate potential expansion of 20 per cent (i.e., leases to be developed) in Smoky Bay. The population of Smoky Bay has increased from 80 in 1996 to approximately 200 in 2000 with the expansion of the oyster industry and because of the coastal retirement amenity.

1.4.2 Current Activity, Future Prospects

Before examining the oyster industry in more detail, we note that deep sea trawlers are operating all year round from the Port of Thevenard (although this is clearly sub-optimal), while favourable locations for expansion of aquaculture include Cape Adieu-

[7] SA: Food for the Future Council.

[8] Commonwealth CRC funding. South Australia has been chosen by the Federal Government as the site for a new $70m Co-operative Research Centre for Sustainable Finfish Aquaculture, with the tuna and salmon industries to be the key stakeholders. Funding for the centre, to be called Aquafin, will be a collaborative initiative between the Federal and State governments as well as private enterprise. The focus of Aquafin will be the southern bluefin tuna industry aimed at improving feed and nutrition, animal health, product quality and to assess environmental issues.

Port James (Isles of St Francis) with appropriate water depth and shelter from the prevailing south-westerlies and in Smoky Bay between Franklin Islands and Goalen Reef. Opportunities for land based aquaculture are also being researched. Other species of fish — yellow tail, king fish — have also been referred to, whereby the industry around Ceduna, and along the West Coast generally, is assessed as having very favourable growth prospects.

This section on aquaculture will predominantly focus on the Oyster Industry as this is the predominant form of aquaculture in Ceduna. Establishing the current scale of aquaculture in the Ceduna DC area is somewhat difficult as the data available is reported at the level of the Eyre Peninsula and West Coast as a whole. However Gray (1996, quoted in EconSearch 1997, p. 16) reports that, of the 75 leases for oyster production issued by 1996, 33 were in the Ceduna DC region (19 at Denial Bay in Ceduna and 14 in Smoky Bay). A spokesman for PIRSA indicated there were now 36 licenced operators at Smoky Bay. This suggests that perhaps 40 to 50 per cent of oyster farming occurs in Ceduna.

Turning to oyster production for the Eyre region overall, the best available data is EconSearch (1999) and (1997), which combined SARDI gross value of production data with surveys of oyster farms to provide estimates of employment, gross value added and household income. This data is set out in Table 1.17. It is worth noting that employment is expressed in terms of FTE, rather than actual persons employed, and includes proprietors. As a guide to the actual persons employed in the industry, EconSearch estimates that in 1998-99 total persons employed was approximately 250.

Table 1.17
Own Employment and Output of Eyre Region Oyster Farms

	1994-95	1995-96	1996-97	1997-98	1998-99	CAGR
Employment (FTE)	130	n/a	n/a	201	208	12.5
Output ($m)	3.87	3.95	5.8	6.1	6.5	13.8
Gross Value Added ($m)	2.28	n/a	n/a	3.5	3.8	13.6
Household income ($m)	2.3	n/a	n/a	3.8	4.1	15.5

Note: CAGR = compound annual growth rate.
Source: EconSearch, 1997 and 1999, Calculations SACES.

The boom in oyster farming over recent years is evident in the table, although the 1997-98 and 1998-99 data shows that this growth has slowed somewhat, particularly in terms of employment growth. This is consistent with a period of consolidation which oyster farmers report, prior to any additional investment and the further development of necessary infrastructure. Growth from 1997-98 to 1998-99 was 3.5 and 6.6 per cent for employment and output respectively. A somewhat anomalous feature of this data is the very low value of output per employee, $29,800 in 1994-95 increasing to $31,250 in 1998-99. Similarly the Household income per employee (wages and proprietor's profit) was only $19,700 per full-time equivalent employee, an amount which would be below the federal minimum wage.

The combination of this low output per employee with sharp but slowing growth, suggests that due to the time it takes between a farm's establishment and its first batch of oysters reaching marketable size, employment to date has been growing ahead of the output which will fund it. This has implications for the sources of increased employment in the region as it suggests that expansions in output of existing farms over the next few years will only lead to minimal increases in direct employment, as output increases to match current employment levels.

There will, however, be several sources of increased employment in the region from aquaculture: in related sectors, such as suppliers, packaging and transport; induced by investment expenditure of oyster farm proprietors; additional leases granted but not yet taken up; and from any new farms which are established. PIRSA's *Far West Aquaculture Management Plan - 31 May 1996* identifies a range of areas[9] within the Ceduna DC where further aquaculture development can occur. This suggests that the availability of suitable areas is not likely to be a barrier to the establishment of new oyster farms, and hence the extent of future development will be determined by commercial conditions in the oyster market. The PIRSA website suggests that currently demand for SA oysters exceeds supply, indicating that new development may well occur.

As a guide to the potential impact of any such expansion, EconSearch (1997) suggest that an average oyster farm employs directly in its on-farm operations 2 full-time equivalent employees (or 3 persons employed) for each 5 Ha of licences. Therefore an expansion in licences being operated of 40 Ha would increase direct employment in aquaculture by 24 persons, and increase employment in the Agriculture, Forestry and Fishing sector by 8.4 per cent. If this scale of expansion in the oyster industry could be achieved within the next ten years, (and on balance, we believe this is feasible leaving aside entirely any proposals for land-based aquaculture) this would meet the SACES projection of employment growth in the Agriculture, Forestry and Fishing sector for the decade.

9 The management plan indicated that the following areas had potential for expansion: Murat Bay (initially research only), Saint Peter Island (initially research only), Decres Bay (up to 40 Ha in total including existing developments), Waterwitch (up to 80 Ha in total including existing developments). Denial Bay and Smoky Bay aquaculture regions had apparently reached capacity in terms of developed and approved licences at the time the management plan was prepared, and the plan indicated that no new developments were likely to be approved.

Appendix 1.5

The Mining Industry and Future Prospects

1.5.1 Introduction

In this proposal, the principal focus is estimating the economic and employment impact of the Ceduna Keys and Ceduna Coastal Centre development. The relationship of the mining industry and any future development of mining to the proposed Ceduna development is in the demand for accommodation, support services such as refuelling, provisions, mining equipment and repairs, airport services, family support services, medical services and employment and training. Assessment of the potential for mining activity also relates to the diversification of the industrial base of Ceduna and potential exports through the Port of Thevenard, but principally we are concerned with the single question: *What is most likely to occur in the mining sector that would support the economic and commercial viability of the Ceduna Keys and Ceduna Coastal Centre development?*

Development in the mining industry and potential impacts on a region, city, town or locality are inherently uncertain. The industry is characterised by long lead times; from mapping and survey analysis, initial discovery, exploration and sampling through to the final assessment of economic viability. The industry is subject to many factors, *inter alia*, international fluctuations in world commodity prices, environmental legislation, securing development and venture capital and longer term economic cycles. Estimating the flow on effects is that much more hazardous when there can be no certainty in regard to potential mining activities. At the very early exploration stage, estimating the future impacts and flow on effects is even more uncertain. Statements such as "our best guess", "it has potential" or it is "too early to say as we are only at the early stages of exploration" are intended to convey both positive expectations and, sound a note of caution.

The Centre conducted face to face and telephone interviews with mining, investment and exploration companies, geological survey specialists, petroleum geologists and other specialist staff especially at PIRSA to gain an overview of the potential for mining prospects in the region. What has emerged from these discussions and interviews is that the level of exploration, both onshore and offshore is higher than it has been for some time and that there are prospects for the provision of support services out of Ceduna, while awaiting confirmation of any mineral or petroleum discoveries. We stress that much of the exploration activity is clearly at a very early stage.

Table 1.18 shows a non-exhaustive list of current and proposed future activities which may have implications for employment, housing and expenditure within Ceduna.

Table 1.18
Mining Exploration in the Ceduna Region

Activity	Location	Output
Exploration, seismic survey	Bight Basin	Petroleum*
Exploration	Duntroon Basin	Petroleum
Gypsum: mining and export	Lake MacDonnell	Gypsum, agricultural gypsum, fertilisers
Salt: mining and export	Lake MacDonnell	Salt, agricultural products
Exploration	Yumbarra Conservation Park	Nickel, copper, zinc and gold
Exploration & development	Challenger Mine	Gold project

* Three exploration petroleum permits (EPPs) were granted to Woodside Energy Ltd, Anadarko Australia Co. Pty Ltd PanCanadian Petroleum Ltd.

1.5.2 Gypsum/Salt

South Australia accounts for about half of Australia's gypsum output and supplies for most of Australia's domestic plaster product requirements. Gypsum is used for plasterboard products, agricultural gypsum to treat soils and for fertiliser products either in bulk or bags. Lake MacDonnell is Australia's largest gypsum mine and has been operated by Gypsum Resources of Australia Pty Ltd since 1984. The output from Lake MacDonnell is railed the 64 kilometres to the Port of Thevenard and is loaded by conveyor for bulk shipping to local markets, refineries, South-East Asia and New Zealand. Gypsum represents the most significant export commodity in terms of weight (tonnes) exported form the Port of Thevenard. Salt is also loaded at Thevenard for shipment to markets including South-East Asia and New Zealand and the Cheetham company plant in Geelong.

1.5.3 Bight Basin and Duntroon Basin

Three exploration petroleum permits (EPPs 28,29,30) have been awarded for the Bight Basin following a national release of eight offshore areas in April 1999. The three permits are about 320km south west of Ceduna in the Great Australian Bight. The three exploration areas were included in the 1999 release of offshore petroleum exploration acreage. The areas were offered under the work program bidding system of the *Petroleum (Submerged Lands) Act 1967*, with a closing date for bids of 6 April 2000.

All three exploration licences have been awarded to Woodside Energy (Perth based: 40 per cent) in consortium with Anadarko Australia Company Pty Ltd (Houston, Texas based: 30 per cent) and PanCanadian Petroleum (based in Calgary, Alberta: 30 per cent) in July 2000. Exploration permits for the three areas have been awarded for a period of six years. Under the work program bidding system, applicants are required to nominate a guaranteed minimum 'dry hole' exploration program for each of the first three years of the permit term and a 'secondary' program for the remaining three years. Each component of the program must be completed in the designated year or earlier. A further five areas received no bids, but will be re-released.

The offshore licence commitments for 2000 to 2006 are as set out below:

In permit EPP28, the consortium has proposed a guaranteed work program over the first three years comprising seismic survey work and geological/ geophysical studies at an estimated total cost of $5 million. The consortium has also proposed a secondary program, comprising additional seismic work and studies, at an estimated total cost of $7 million.

In permit EPP29, the consortium has proposed a guaranteed work program over the first three years of seismic survey work, geological/ geophysical studies and an exploration well at an estimated total cost of some $27 million. The secondary program proposed comprises additional seismic work and studies, at an estimated total cost of $11 million.

In permit EPP30, the guaranteed work program for the first three years proposed by the consortium covers seismic survey work and geological/ geophysical studies at an estimated total cost in excess of $6 million. The secondary program proposed by the consortium comprises additional seismic work and studies and an exploration well, at an estimated total cost of more than $32 million.

The bulk of expenditure in the initial years is to be spent on seismic surveys which will commence in December 2000 and extend until May 2001. A Norwegian company *Schlumberger Geko-Prakla* has been contracted by Woodside to do the survey work using their seismic survey vessel, the *Geco Angler*. Minimum guaranteed investment in the Bight Basin, as a condition of exploration licences is $39m in the primary work program. The secondary work program (years 4-6) is estimated at a further $50m, which is dependent on the success of the first term or primary work program. Overall, the consortium is expected to invest over the next six years $90m on exploration activities such as seismic survey work, office based geological and geophysical studies and well drilling.

Economic impacts in the fist phase are dependent on Ceduna being chosen as the 'staging base' for off-loading and transportation of tubing, drilling samples, refuelling, general supplies and air transport services for change over teams of 35 personnel. Refuelling would require additional equipment while Woodside Company personnel expressed a view that the Port of Thevenard was 'a bit exposed' and the proposed marina could offer more sheltered berthing and improved refuelling facilities'.

In the Duntroon Basin situated offshore from Port Lincoln, BHP had two licences for exploration in the period 1990-1996 and are estimated to have spent $50m on exploration activities, including crew changes, refuelling and catering operating out of Port Lincoln. A further three blocs are to be gazetted in mid-year 2001. Exploration history for the Great Australian Bight actually dates back to 1967 where, since that time, twelve exploration wells have been drilled in the Eyre, Duntroon and Bight Basins although none of the wells has proven to be commercially viable.

1.5.4 Yumbarra Conservation Park

Legislation has recently been passed to re-proclaim Yumbarra Conservation Park some 30 kilometres northwest of Ceduna from single use (conservation only) to multiple use which can include mining but these uses will have very stringent environmental and cultural conditions imposed on them. The Gawler Joint Venture (GJV), comprising Dominion Mining Ltd and Resolute Resources Ltd has submitted a proposal to commence ground based exploration. A biological survey has been completed over the main anomaly as a requirement under the proclamation. This survey has been used as a basis to determine the necessary environmental management procedures required to conduct exploration activity and to provide baseline information for monitoring the environmental impact of the exploration program. Although the area is environmentally significant, no endangered flora or fauna has been identified.

There is a reasonable level of mineral exploration in the Gawler Craton general area at the moment but given exploration has been at an all time low level, the current level of exploration is really not very high. Exploration in Yumbarra Conservation Park is at a very early stage (ie., it is simply an exploration program at this time). Samples of surface soils have only just been taken but as yet no drilling samples. Only 1/1,000 drill holes are successful so expectations cannot be high. Early indicators are that there may be some technical success; that is, there is some form of mineralisation but the chances of a second Olympic Dam sized discovery would have to be considered as extremely low. The most likely minerals would be nickel, copper, zinc and gold.

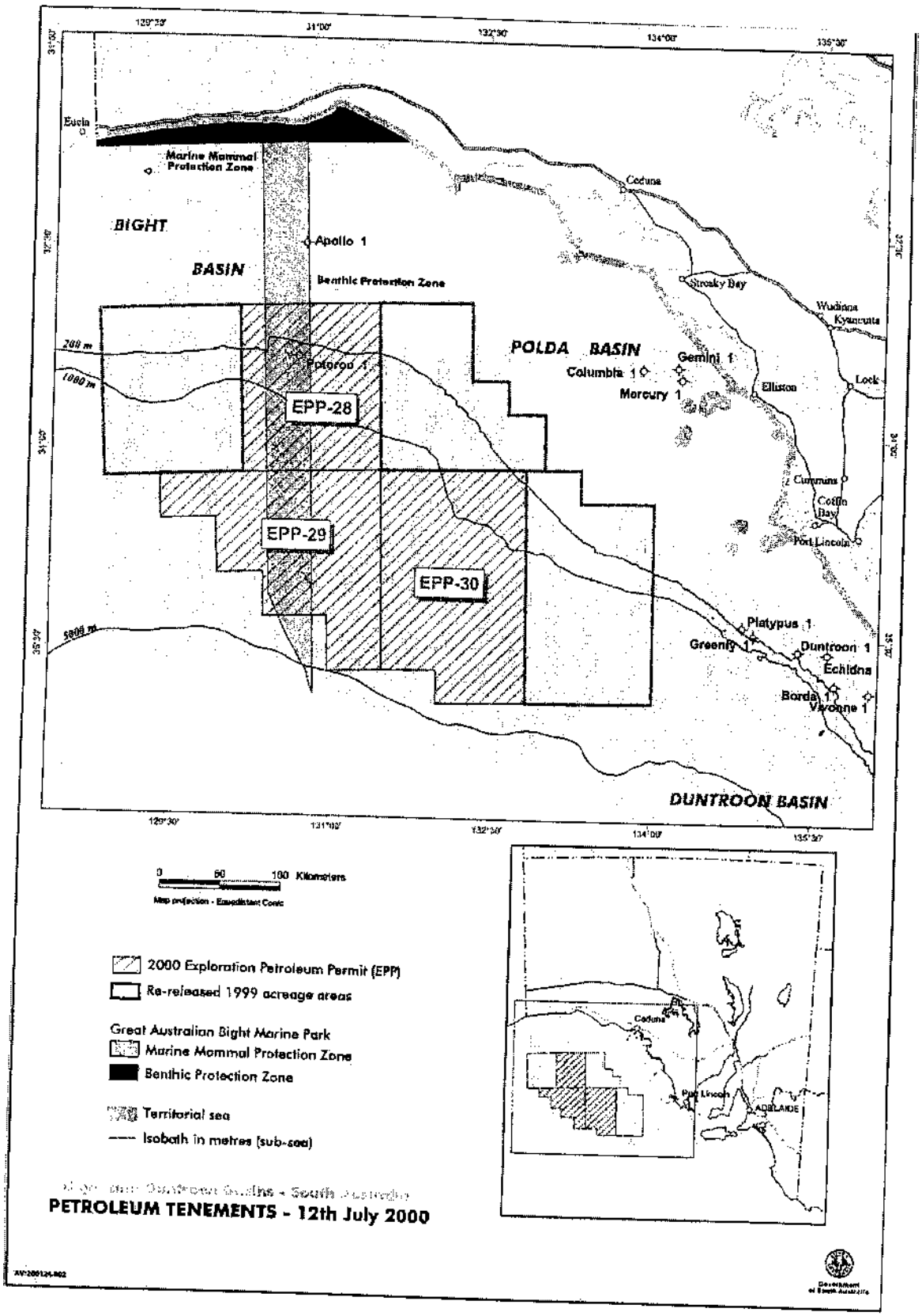
At this stage, Aboriginal approval is required before drilling can commence in late 2000. Further feasibility studies would be expected to take another year and a further year would be required to gain all the appropriate approvals. If at this stage, the prospects are good, then things will move much faster and production could be occurring by the end of the second year. In other words, it will be at least two years before anything substantial happens even if the drilling and feasibility results are good.

Most mining sites are not labour intensive although the construction stages have much higher employment levels in the short term. Operations tend to be conducted on a fly-in/fly-out basis which could conceivably be from Adelaide unless closer places such as Ceduna had sufficient attractions. However, in return for assistance provided by the Ceduna DC to bring about the re-proclamation of Yumbarra, the joint venture has agreed to use Ceduna as its base and for mineral processing if mining proceeds.

There is however an expectation that some local activity will be generated in the Ceduna region during the exploration stages. If a discovery is made, then exploration in the area shifts up a gear. There is demand locally for vehicle hire, equipment, supplies, etc., and possibly some short-term accommodation.

There seems to be a high level of expectation within the Ceduna community but geologically, the expectation of a significantly sized discovery which would be financially advantageous to mine would have to be very low — but drilling may prove otherwise.

Figure 1.3
Petroleum Exploration Leases



Source: PIRSA, Petroleum Division.

Company spokesperson said that it was 'too early to say as we are only in the very early stages of exploration at Yumbarra' and it is not possible to assess whether the deposits will be economic. However, the survey and on-going sampling have been 'quite successful' to date, but it is likely that any mining activity would be more than two years away (2002-2003). The consensus seems to be 'the region has potential'. The joint venture partners have already clearly indicated that Ceduna is considered the logical place to base people as it has the facilities, including schools, shopping and personal services, the lifestyle and the ability to commute to the mining site.

The joint venture has experience in employing trainees, in mine training programs and has experience in subcontracting out work to mining support companies (staffed by Aborigines and whites). Employment opportunities were also envisaged in environmental areas such as within Parks and Wildlife as environmental officers, management of rehabilitation and park protector functions (given people currently do not pay an access fee to enter the park). Both companies, Resolute and Dominion strongly support the establishment of training programs for Aboriginal workers for future employment and it is possible to 'tie this into employment and training requirements for the marina development'.

The most optimistic assessment is that any future mining operations would take 'four to five years before they could be up and running'. If copper, nickel and gold deposits were discovered then on current estimates it is possible that mining could employ up to 90 to 100 people at Yumbarra,[10] who would all be based at Ceduna. The most direct and immediate impact would be the demand for accommodation.

1.5.5 Challenger Mine

Challenger Mine is 130km northwest of Tarcoola. Drilling commenced in 1992 when gold deposits were discovered. The Dominion Company website (www.dml.com.au) refers to the Challenger Mine as follows: "A key growth opportunity lies in the development of Dominion's more advanced projects into cash flow operations. These include the Company's 50 per cent interest in the Challenger Gold Project in South Australia's Gawler Craton, where a resource of more than 500,000 ounces has been defined". Dominion is currently investigating the option for buying out their joint partner for 100 per cent interest.

A more optimistic outlook was provided to the consultants on the future of the Challenger Mine than for the current exploration activity at Yumbarra. Challenger is estimated to be one year away from operation with a guaranteed life of two years open cut mine and a further 5-7 years of underground mining. A potential mine site operation of 50 persons was envisaged, 'with a significant number of operating personnel to be sourced from Ceduna, and some from Adelaide'. Currently, drilling is occurring while the need to source a secure water supply and settle native claims are current priorities. It is possible, according to a company spokesperson, that family stays and fly in/fly out could be based at Ceduna provided accommodation and services were available. The most immediate impact on Ceduna would again be accommodation, airport and personal services. The provision of quality accommodation within the

[10] A small mining operation with output of gold of 50,000oz per annum (where an oz = a troy ounce) typically employs a 100 person workforce. Data provided to Ceduna DC by Woodward Clyde, May 1999.

Ceduna Keys development, may however not be finalised within the time-frame required. It will be worth monitoring the mining development closely in preparation to fast-track some accommodation development if required.

1.5.6 Summary: Implications for Ceduna

Mining exploration is not confined to Yumbarra and Challenger mine, or indeed for offshore petroleum, as within the Gawler Craton area there are other exploration companies currently operating. One example, with significant implications for the entire West Coast were it to be successful, is diamond exploration on Flinders Island, 37km offshore from Elliston. Geophysical work and sample drilling is to be conducted commencing in April 2001 and extending into 2002.

We note that the gold mining sector is generally downsizing in Australia overall, while it is difficult to attract exploration activity to the Gawler Craton area (i.e., there is significant international competition for the exploration dollar). The reality is that worldwide and in South Australia, there is a problem in raising 'greenfield prospecting capital' (in the recent past, equity and capital markets have favoured dot.coms and biotechnology firms and start-ups). PIRSA has adopted a relatively aggressive stance, particularly in the supply of aerial magnetic mapping, geological information, the granting of licences, etc., in support of companies wishing to undertake exploration in the Gawler Craton area.

The Challenger mine represents the most likely prospect with immediate implications for Ceduna, offering the prospect of fly in/fly out, family accommodation and some provision of goods and services (10-15 persons). Support for offshore seismic surveys in the Bight Basin could be supplied from Ceduna (a potential competitor is Port Lincoln) and the benefits have been outlined earlier. Refuelling equipment is required, a site to locate this, less exposed berthing than at the Port of Thevenard, the provision of general supplies and more limited demand for accommodation appears to be the most optimistic scenario. Fly-in/fly out change over teams of 35 persons are estimated to be required over the next two years. Should the Yumbarra exploration lead to mining activity then Ceduna would directly benefit in terms of additional employment (50 persons are the estimated minimum), through demand for accommodation and operating and support services.[11]

[11] Principal information sources and interviews included:
Ms Sue Daly, Senior Geologist and Gawler Craton Team Leader, Mineral Resources, PIRSA;
Mr Tony Hill, Acting Branch Manager, Petroleum Program;
Ms Prue Freeman, PIRSA Minerals Group;
Mr David Cairns, Resolute Mining, based in Western Australia;
Mr Peter Alexander, Dominion Mining, based in Western Australia; and
Mr Mark Schuster, Exploration Manager, Woodside Energy Ltd, based in Western Australia.

Appendix 1.6

Building and Construction

1.6.1 Recent Trends

One of the important features of the Ceduna Keys and Ceduna Coastal Centre development proposal is that it will generate an expansion of housing construction in the subdivisions forming part of the development. There is alleged to be a shortage of accommodation within Ceduna, especially for rental accommodation, and it is hoped that development will be in terms of both new rental accommodation and the upgrading by residents to newer accommodation within the marina subdivision, thus freeing up existing accommodation for rental. It is also hoped that new owners will come from outside the Ceduna local government area to take advantage of the opportunity for waterfront or near waterfront accommodation.

Statistics on building approvals are given in successive *Ceduna Statistics Profiles* for the period 1995-96 to 1999-2000. While ABS data is based on data provided by local government, there are significant differences in the data presented by the two sources in some years which may relate to a difference in definition. Table 1.19 represents the data provided by the Council while, Table 1.20 gives the published ABS data for the Ceduna Region for the period 1994-95 to early 2000-01 (first quarter only).

As can be seen by comparing the two sets of data, there are major differences both in terms of the total value of building construction and in the movements of the total value between years. There is also variation in the number of approvals in the different categories.

The available ABS data on dwelling approvals as shown in Table 1.20 and illustrated in Figure 1.4 does reveal recent growth in new dwelling approvals and the first quarter of 2000-01 is indicative of continued growth. As would be expected with values shown in current terms, there has also been strong growth in the value of these dwellings (which in almost all instances are separate houses) with the average value rising from $66,200 in 1994-95 to $97,200 in 1999-00. This increase has incurred during a period of low inflation and represents a growth in value in excess of 30 per cent above the inflation level for the period. While there may be other factors influencing this increase in value, part of the increase would definitely reflect an increase in the quality of the house including an increase in the size. A subtle and often neglected factor behind this growth is the preference for a coastal location combined with retirement decisions, already evident in Smoky Bay, such that the demand for higher quality housing can be expected to grow. This lends further support to the preference for a marina location.

Table 1.19
Ceduna DC — Building Approvals — 1995-96 to 1999-2000

	1995-96	1996-97	1997-98	1998-99	1999-00
New Residential (no)	11	16	54	na	24
New Residential ($'000)	844	1,212	4,465	1,738	2,134
Residential Alterations/Additions ($'000)	261	347	628	411	568
Total Non-Residential Building Jobs (no)	22	44	26	na	16
Total Non-Residential Building Jobs ($000)	603	2,853	1,628	1,164	317
Total Value of Building	1,707	4,411	6,721	3,313	3,019

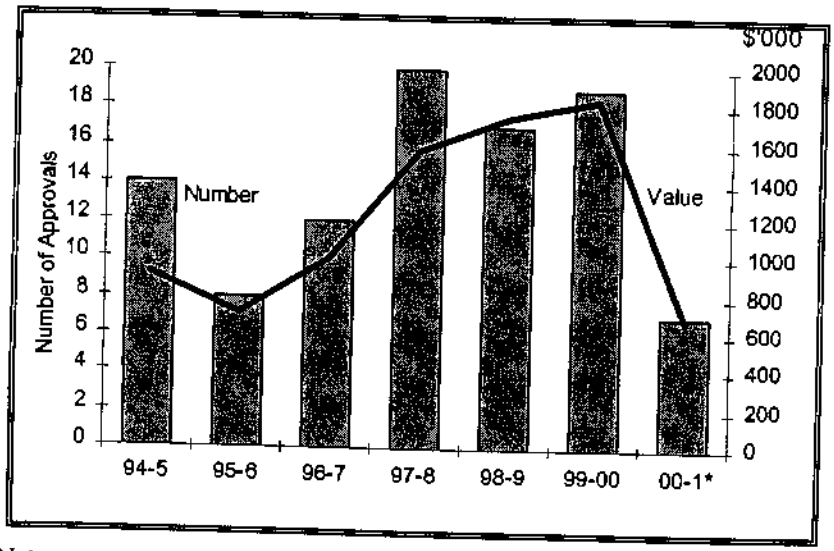
Note: Total building approvals for 1998-99 were 91.
Source: Ceduna DC, *Statistics Profile*, two recent publications (undated).

Table 1.20
Ceduna DC — Building Approvals — 1995-96 to 2000-01

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01*
New Residential (no)	8	12	20	17	19	7
New Residential ($'000)	718	1,004	1,577	1,748	1,847	680
Residential Alterations/Additions ($'000)	34	201	258	187	222	27
Total Non-Residential Building Jobs (no)	5	7	na	na	na	na
Total Non-Residential Building Jobs ($000)	2,526	3,030	616	654	202	206
Total Value of Building	3,278	4,235	2,451	2,589	2,271	913

Note: * September Qr 2000 only
Source: ABS, IRDB and *Building Approvals, South Australia* (8731.4)

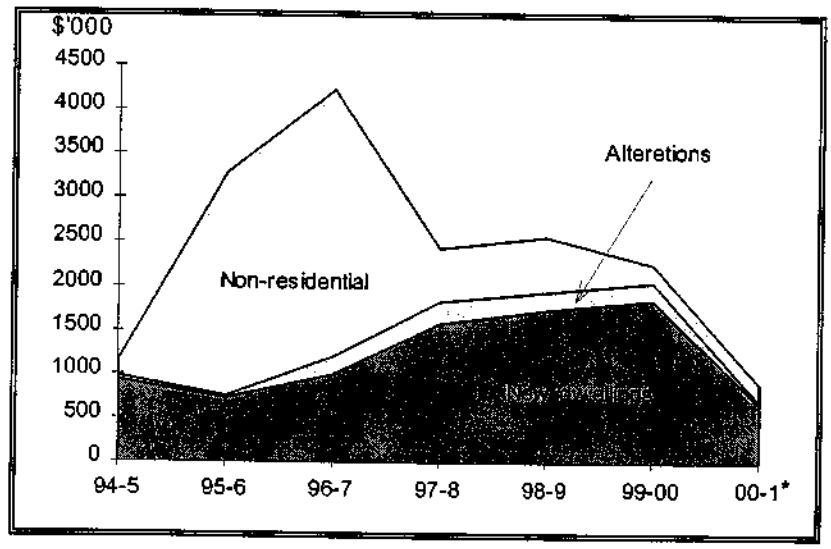
Figure 1.4
Dwelling Approvals - Ceduna DC
1994-95 to 2000-01



Note: * Data in 2000-01 is for the September quarter only.
Source: ABS, IRDB and *Building Approvals, South Australia* (8731.4)

Residential alterations and additions are somewhat erratic but over the most recent four year period do not provide an indication of substantial growth although these recent years represent a very large increase over the first two years and this is illustrated in Figure 1.5. The non-residential construction is also by its nature rather lumpy and is evidenced by substantial work in 1995-96 and 1996-97 with far less significant contributions in other years.

Figure 1.5
Value of Building Construction - Ceduna DC
1994-95 to 2000-01



Note: * Data in 2000-01 is for the September quarter only.
Source: ABS, IRDB and *Building Approvals, South Australia* (8731.4)

With the planned foreshore development, the upgrading and extension of the Community Hotel and Caravan park and the construction of the Yalata Over-Night facility, non-residential construction is expected to turn strongly upwards in 2001-2002.

The trend in housing construction indicates potential benefits for the marina subdivision development but the current rate of growth will mean that without any other catalyst the subdivision will take many years to fully establish. There are however other potential catalysts such as increased housing demand from the fishing industry if some refuelling, restocking and service facilities are established within the marina complex or from the mining industry if mineral exploration currently underway proves profitable. In summary, there is a current shortage of rental accommodation and this would be exacerbated if mineral exploration proved to be successful. The lack of accommodation restricts Ceduna from securing 'fly-in and fly-out' personnel both for mining teams and change over crews on the fishing trawlers. Without higher quality accommodation the retirement industry cannot grow and the coastal location will remain an under-utilised asset.

SECTION TWO

Marketing Study

Appendix 2.1

Estimating Tourist Numbers

2.1.1 Introduction

The Eyre Regional Development Board introduces the Eyre Peninsula as:

> "one of the few places in Australia which can still promote an unspoilt, uncrowded and uniquely different brand of tourism product ... to the rapidly growing nature based and eco-tourism market segment; backpackers, marine based, country conventions, farm study and overseas visitation ... with the region attracting over 300,000 visitors per year, generating over $55 million into the regional economy, supporting an estimated 800 jobs".[12]

Marketing the Eyre Peninsula region and its attractions is increasingly more sophisticated and has achieved an increase in domestic visits and nights spent in the region. It is estimated that the domestic market currently accounts for 75 per cent of nights in the region and the interstate market, some 21 per cent.[13]

In this section we consider the opportunities, performance and scope for expansion of the tourism industry within Ceduna, the quality of existing accommodation and tourism infrastructure, and the impact of the Ceduna Keys and Coastal Centre on tourism and marketing of the region.

2.1.2 Visitor Survey Data

The Council organised visitor survey is available in accommodation venues but it is up to the individual motel or caravan park to decide on the best location for the survey, whether it be reception area or individual rooms.

The *Statistics Profile* publication of the Ceduna DC also notes that the survey periods are April/May and September/October each year. It is noted that these periods generally exclude the major whale watching period each year and while it is known that the whales do not attract a high percentage of the total number of persons who travel the Eyre Highway, it is clearly not getting information from the majority of whale watchers who are the sort of people who are likely to be interested in visiting an interpretive centre. The whale watching period is generally accepted to be May to October so there is some coverage but for the April/May survey period in 2000, no respondents had gone whale watching. These two periods were selected because they were periods of good weather, school holidays and they included either Easter or Oysterfest. The whale watching is covered to some extent in the later period. Published tourist accommodation data confirm that the period in the middle of the year is not busy and this is backed up by transport data from the quarantine checkpoint.

12 ERDB, (undated), "Investment in the Eyre Region in South Australia", pp. 11-12.
13 *op. cit.*, p. 11.

The total number of responses received for each two month period is "up to 50". No predictions of total tourist numbers can be made from the number of responses (and given the favourable timing periods selected). Response analysis is mainly in percentage terms hence gives a rough guide only. Major observations are:

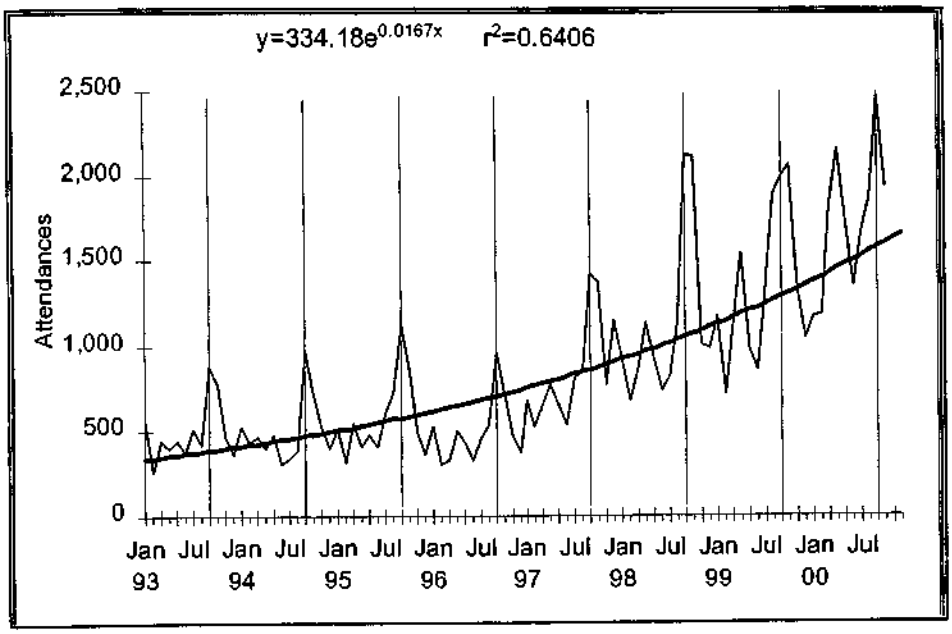
- most respondents are from SA (26 per cent so far in 2000, 32 per cent in 1999 and 19 per cent in 1998) — followed by WA then Vic and Qld(equal) in that order in 2000 but previous years provided a different pattern e.g., 1999 shows in order NSW, Vic, WA and Qld and 1998 is different again. This variation suggests patterns are either not predictable (unlikely) or that the number of respondents are low (not stated but most likely explanation).
- the majority of respondents stayed one night (33 per cent in 2000 with 41 per cent in 1999), followed not far behind by those staying 2 nights. Again data is erratic with 18 per cent staying 3-6 nights in 1999 but only 5 per cent in 2000 yet those staying for 1 week or for 2 or more weeks have increased dramatically. Again the variation is probably due to the very low numbers of respondents.
- most respondents stayed at caravan parks (66 per cent in 1998, 58 per cent in 1999 and only 5 per cent in the April/May period in 200), with perhaps motels second although again the data is very erratic over time.
- most popular local attractions visited, apart from Ceduna itself, were Thevenard, Denial Bay and Smoky Bay with Penong and Cactus Beach a little less popular. Again, each year gives a very different percentage share to each of these attractions.
- Streaky Bay was the most popular of the more distant attractions. It is noticeable that these are all towns rather than other physical attractions in the region (such as the off-shore islands, Yumburra Conservation Park, etc.).
- more than half of the respondents travelled via the shorter route from Port Augusta via Wudinna but around 40 per cent travelled via Port Lincoln and Streaky Bay.
- around half of the respondents treated Ceduna as a travel stop but other reasons given included visiting local attractions, fishing, fuel stop, shopping and general recreation (multiple responses were permitted). Visiting whales featured very low in this list as mentioned above.
- the main facilities seen as important for tourists in Ceduna were toilets (28 per cent), interpretive/tourist signs (28 per cent), walking/bike trails (20 per cent), interpretive/cultural centre (15 per cent) and seating (10 per cent) (Multiple responses were permitted.

2.1.3 Gateway Visitor Information Centre

The Visitor Information Centre monitors the number of visitors through its doors - but of course these do not all stay in Ceduna but it is some indication of those who stop and therefore those who may be interested in the Ceduna Coastal Centre. The pattern is quite strongly seasonal but the period over which the data has been collected illustrates a strong upward trend in people making use of the Visitor Information Centre as shown

in Figure 2.1 where an exponential trend line has been fitted to the data. This trend has an r^2 value of 0.64 which is quite high given the highly seasonal pattern exhibited.

Figure 2.1
Ceduna Gateway Visitor Information Centre
1993 to 2000 - Number of Attendances



The major peak each year in the early 1990s was during September and October but by 1996 a series of minor variations had developed into two lower level peaks, namely January and April. By 1999 the January peak had all but disappeared and April had become a serious challenge to the September peak.

Understanding the reasons underlying these peaks will help to estimate the impact on tourism of the proposed development especially the interpretive centre. As has already been noted the peaks coincide with the Easter school holiday period and the September/October school holiday period with the latter period also including Oysterfest as an added attraction. At both of these times of the year the weather is also very pleasant. The weather would certainly be a deterrent for tourists to be planning to drive across the Nullarbor in mid-summer, however, with the advent of the marina and increased opportunities for boat hire and/or charter trips to the islands in the Nuyts Archipelago Conservation Park, the hot summer weather could become less of a deterrent.

There is an increasing trend for retirees to make a leisurely trip around Australia and these tourists are not limited by school holidays while additionally they have the time to spend at attractions (although at times they are somewhat budget minded, especially when towing a caravan). For the older persons in this group, hot summer weather may be seen as a disadvantage.

2.1.4 Other Visitor Data

It is reported (Nicholas Clarke, 1996) that around 400,000 people pass through Ceduna in a year. This is a total figure which includes truck drivers and passengers on buses travelling on the Adelaide-Perth route. The road block statistics (from the Fruit Fly Quarantine checks) represent around 70,000 vehicles each way per annum. These also tend to peak in the March/April and September/October periods. The average number of passengers per vehicle is 1.90 (including driver) based on passenger data collected by the Eucla roadblock. This provides a total annual estimate of well under 300,000 (see discussion 2.1.5). These figures are reported to exclude all local traffic so there should be no distortion to the count.

Even an annual total of 20,000 in the Visitor Information Centre (which may well be achieved in 2000) represents only 6.7 per cent of the estimated maximum of 300,000.

There are around 32,000 annual guest arrivals who stay in hotels/motels in Ceduna (ABS data). With around the same number estimated to stay in caravan parks, this accounts for around 65,000 visitors in a year - far more than visit the Information Centre. This represents less than 25 per cent of *all* people who pass through Ceduna.

Caravan Park data is released only on a tri-ennial basis. Unfortunately, due to confidentiality limitations, there has been no ABS data available in the past for Ceduna in relation to caravan parks. However, commencing with the September quarter 2000, data will be released. Although it is for one quarter only at this stage, given what is already known about the seasonal pattern some annual estimates can be made thus enabling a better estimate of total annual tourist numbers. However, the two sets of data are not strictly comparable since for caravan parks the measurements is of site nights rather than persons. However, since stays could be expected to be of more than one night and sites could be expected to support more than one person on average, the site nights can serve as a useful proxy for tourist numbers (and probably a proxy which slightly underestimates the true representative figure).

The official figures for 1999 indicate 18,868 tourists visited the Head of the Bight and this count excludes children and buses. Any marketing plan which links staying in Ceduna with a visit to see the whales during the appropriate season will benefit both areas. In the past, access to the Head of the Bight has been stopped outside of the whale watching season but there are moves afoot to ensure its availability year round because of its spectacular scenery and the availability of the viewing platform to enable better views and photographs to be taken. It is worth remembering that holiday photographs which are shown around are probably on a par with word of mouth publicity - and at zero marginal cost to the Ceduna region.

Currently the airport is serviced on a daily basis by Kendell Airlines using a 19 seat maximum aircraft which is not always full. The runway has the capability to support aircraft seating up to 50 passengers but the taxiway and apron have a lesser capacity. The airport could however take aircraft with a seating capacity of up to 34.

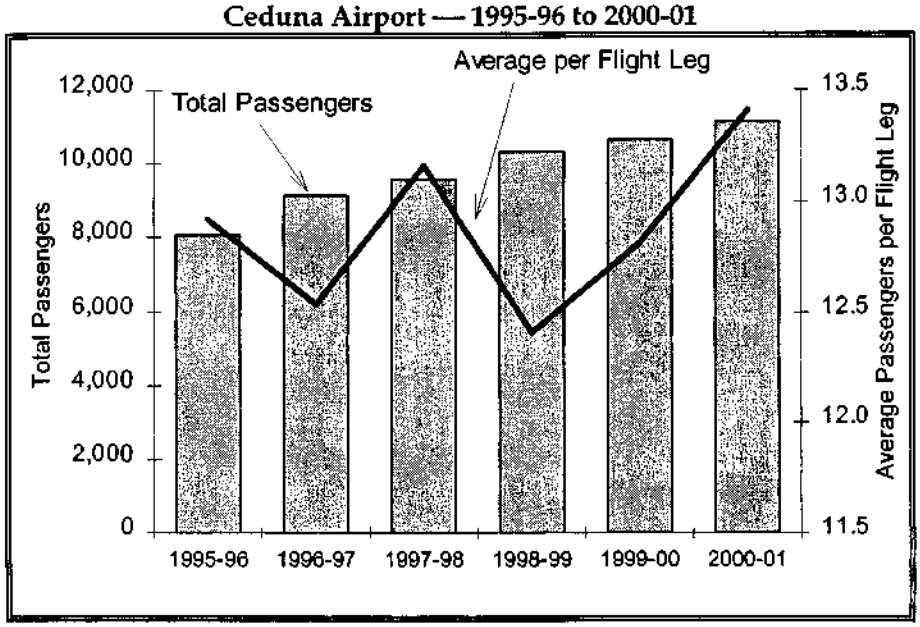
Airport passenger statistics indicate passenger movement in 2000 of around 10,000 annually (but exhibiting steady growth). Many of these may well be locals or business and government employees especially since the peaks in passenger movement do not coincide well with those already described. Data from 1995-96 is included in Table 2.1 and Figure 2.2. Children represent between 4 and 5 per cent of total passengers. The number of flight legs per week has been increased from 12 to 16 over the period (i.e., 2 legs represent a return flight) and this is indicated on the graph by the drop in the average number of passengers per leg which is then followed by growth until an additional return flight is introduced.

Table 2.1
Annual Passenger Movements
Ceduna Airport — 1995-96 to 2000-01

Year	Total Passengers
1995-96	8,062
1996-97	9,122
1997-98	9,581
1998-99	10,324
1999-00	10,656
2000-01(e)	11,160

Note: (e) = estimate.
Source: Passenger data supplied by Ceduna DC.

Figure 2.2
Total Passengers and Average Per Flight Leg
Ceduna Airport — 1995-96 to 2000-01



Source: Passenger data supplied by Ceduna DC.

The council has recently commissioned Airport Technical Services Pty. Ltd., to prepare a Ceduna Airport Master Plan with the draft report being completed in January 2001. The average annual increase in passenger numbers since 1990 has been 8.2 per cent per annum but using a higher rate from more recent periods the predicted passenger movements for 2020 are around 65,000 which is around six times more than current levels. Total regional aircraft movements for the same year are estimated to be 7,300 which are over eight times the current levels without any change in aircraft type being predicted. This would appear to allow for additional capacity within the planned flight program as these numbers imply only nine passengers on average per flight leg in 2020. This is possibly in line with the forecast opportunities to develop air freight packages, particularly from the aquaculture and fishing industries.

The report indicates that recent growth in general aviation aircraft numbers show an average increase of 13 per cent per annum.

The Master Plan recommends development of a new north/south runway of a length to satisfy future commuter line requirements with allowances for visits by larger aircraft, expansion of the passenger apron and new taxiway for the existing main runway and a new general aviation apron facility, new terminal building with a new connecting road from the Eyre Highway, helicopter parking facilities, new storage location for fuel and new storage facility for freight and a powerhouse to cope with additional lighting. The South Australian Minister of Transport has had a study undertaken to assess the State's strategic airports and Ceduna has been assessed as strategic within these guidelines. It is anticipated that the new runway and supporting taxiway and apron should be commenced within five years subject to satisfactory financial arrangements being made.

2.1.5 Visitor Numbers Based on Road Traffic Measurement

Nicholas Clark and Associates in their 1996 report to the Ceduna DC quote a figure of 400,000 visitors passing through Ceduna each year. This number is neither sourced nor substantiated and it is difficult to reproduce it, although it has been taken on face value in various reports the Centre cited and quoted in a variety of information sources about Ceduna.

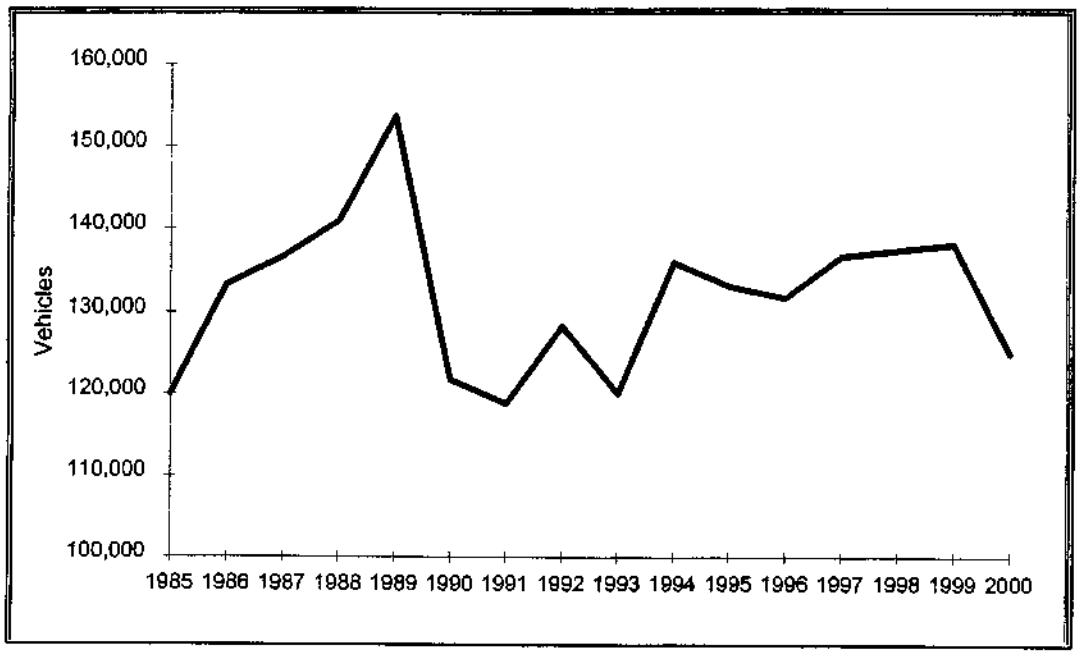
The existence of the Quarantine Station and Road Traffic Block operated by PIRSA's Horticultural Branch on the outskirts of Ceduna has provided a valuable measurement of traffic passing through Ceduna. Locals are not included in the count. The block measures traffic approaching Ceduna from the west and a similar Western Australian road block at Eucla measures traffic travelling to the west which would have needed to pass through Ceduna on its way across the Nullarbor along the Eyre Highway. Although data is provided from the South Australian road block over a longer period, it has been noted that there is very little difference between the two sets of data over a year so a doubling of the Ceduna data provides a very good guide to the total traffic measurement.

Figure 2.3 graphs data for the period 1985 to 1999 on an annual total basis. This reveals a steady steep climb to a peak in 1989. This peak of just over 150,000 vehicles is followed by a steep fall in 1990 and a more gradual rise again to the latest data although within that climb there are minor peaks and troughs.

The peak in 1989 is attributable to the increase in traffic during the long-running pilots' strike. It could also be that 1986 and 1987 were above average, perhaps due to the America's Cup Challenge which was sailed off Fremantle in 1986-87 but which entailed extensive preparations in the lead-up period including many restoration and development projects in the area — no doubt requiring the transport of materials and equipment from the eastern states. There may also have been some increase in tourist travel with many wanting to participate in some part of the long event. The post-strike decline in 1990 may have been exacerbated by the introduction of cheap air fares which resulted from the deregulation of the airline industry. This occurred in October 1990 and may have been sufficient for some travellers to choose the air option rather than drive across the Nullarbor or even to defer the trip until the cheaper fares became available.

The 1989 peak represents around 300,000 persons based on the Western Australian passenger data from the checkpoint with an average of just under two per vehicle (including driver) over a four year period. Since subsequent years have been considerably lower than this peak, it is difficult to justify the 400,000 visitor figure quoted.

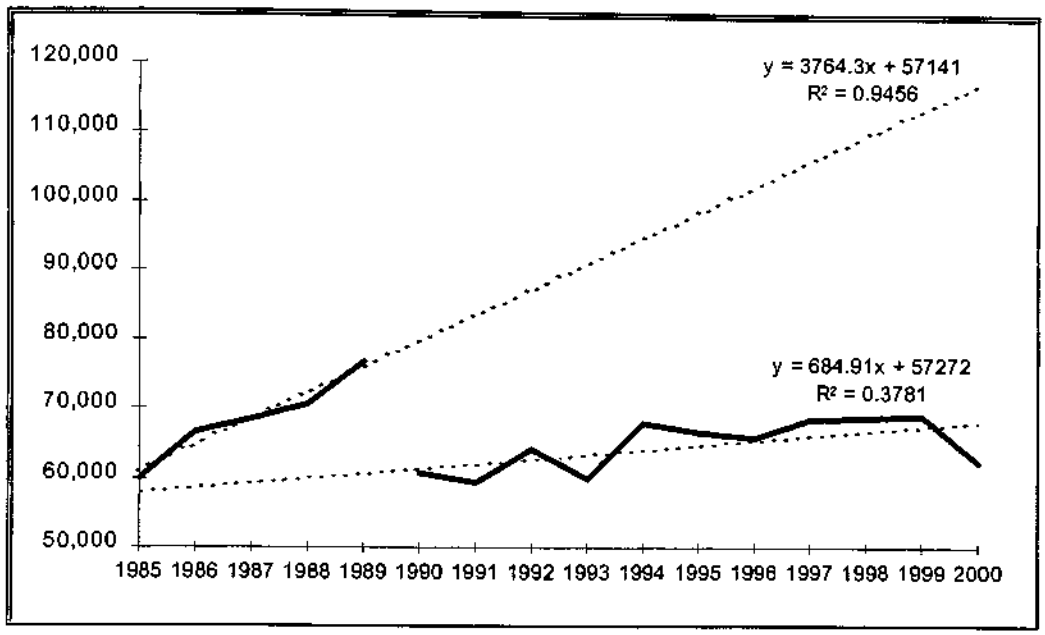
Figure 2.3
Estimated Total Roadblock Traffic Count - Both Directions
1985 to 2000



Source: Ceduna Quarantine Roadblock, Transport SA.

The Ceduna data can be graphed as two separate sets of data with the break between 1989 and 1990. Each period has a strong trend as shown in Figure 2.4, so it is important to know the reasons why the change has occurred. As can be seen from the graph, the rate of increase is much slower for the later period and from a lower starting point. If the lower trend continues, we can expect that by 2005 there will be around 145,000 vehicles in total passing through Ceduna.

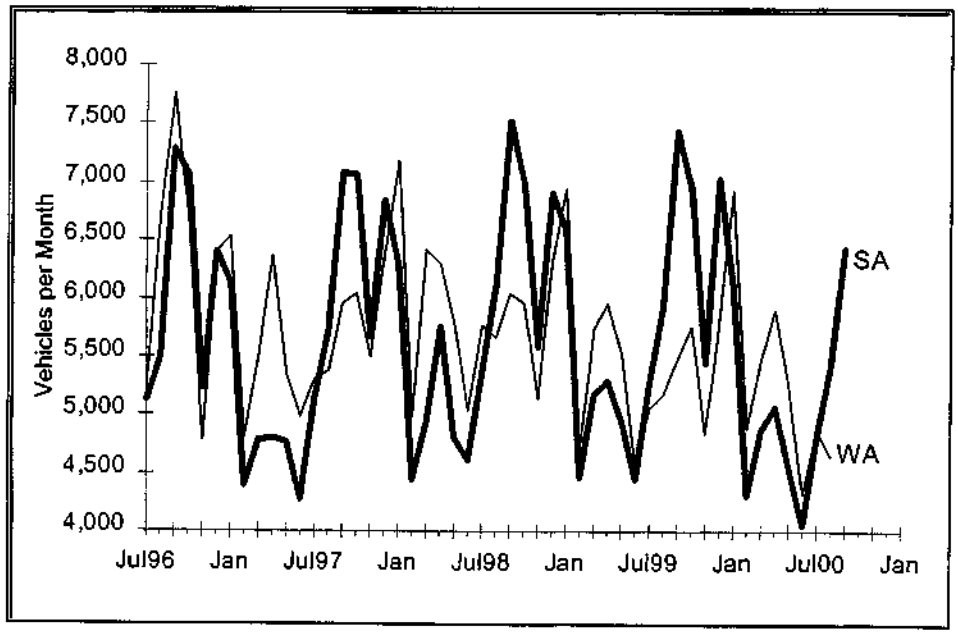
Figure 2.4
Trends in Ceduna Roadblock Traffic Count
1985 to 1989 and 1990 to 2000



Source: Derived from data from Ceduna Quarantine Roadblock, Transport SA.

Data is also available from the Western Australian roadblock at Eucla and this tracks the South Australian data very closely over the period 1997 to 1999 for freight transport and buses but for cars (including 4WDs), which may also be towing caravans or trailers, different seasonal patterns are evident although the annual totals are very similar. These seasonal patterns are reflected in the monthly totals as shown in Figure 2.5.

Figure 2.5
Total Roadblock Traffic Counts
Ceduna, SA and Eucla, WA - July 1996 to September 2000

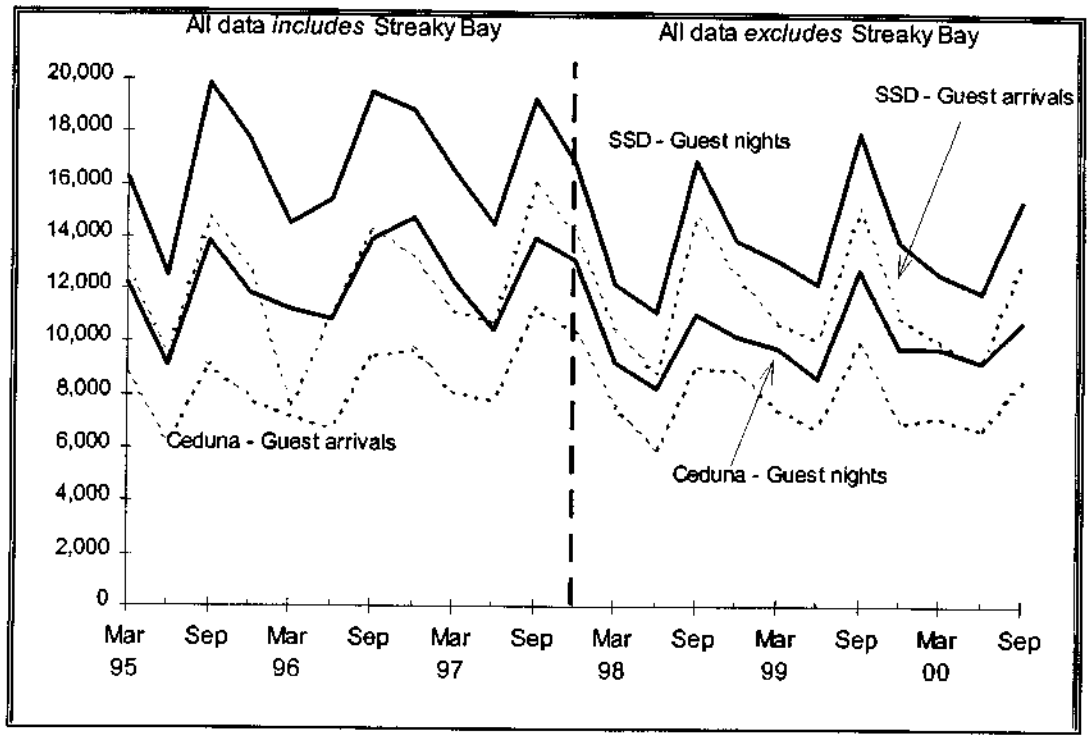


Source: PIRSA, Ceduna Quarantine Roadblock and Agriculture WA, Eucla Quarantine Roadblock.

2.1.6 Historical Detail on Hotel/Motel Accommodation Statistics

Figure 2.6 provides a guide to the seasonal pattern in hotel/motel accommodation since 1995. There is however a break in the data because for the period to December 1997, accommodation in the Streaky Bay area was included with Ceduna. The graph presents guest nights and guest arrivals for both the Ceduna area and the total West Coast Statistical Subdivision (SSD) which covers the far west of Eyre Peninsula.

Figure 2.6
Hotels, Motels etc., Guest Nights and Guest Arrivals - Original Data
Ceduna (DC) and West Coast SSD[1] - 1995 to 2000



1 Streaky Bay data is included to the left of the vertical line (December 1997) but not to the right of that line.

Source: ABS *Tourist Accommodation, South Australia (8635.4)* and *Tourist Accommodation Small Area Data South Australia (8635.4.40.001)*

The following observations can be made about the data presented in the graph:

- Tourist accommodation in hotels, motels reveals a highly seasonal pattern, peaking in the September Qr each year.
- This also coincides with the best time of the year to cross the Nullarbor and also a significant part of the whale viewing season. An added attraction is the annual Oysterfest which is held on the long weekend in October. In some years this is early in the month and a number of early visitors can spill over back to September.
- June Qr is the least popular time each year with tourists. It is probably just as good for travelling, although quite windy, often tends to include Easter holidays and covers the beginning of the whale watching season.

- The data does not include visitors who stay in caravan parks in Ceduna and nearby. Local surveys infer that 58 per cent of all respondents stay in caravan parks in the area. ABS caravan park data is collected only on a triennial basis. Data for Ceduna in the 2000 collection is only available from the September quarter 2000.
- Ceduna hotel/motel tourism accommodation is a major contributor to the total for the West Coast SSD.
- Guest nights for Ceduna only are more closely allied with guest arrivals than when the Streaky Bay data is included with Ceduna. The implication of this is that guests tend to stay longer on average in Streaky Bay than in Ceduna.
- The drop in numbers when Streaky Bay is excluded is not very large.
- Average length of stay estimated from the data is 1.3 nights for the Ceduna only data from the beginning of 1998 and 1.4 for the earlier period which also included Streaky Bay. This measurement is consistent with the Visitor Survey results indicating that the majority stayed only one night.

2.1.7 Realistic Estimates of Potential Tourists

If the number of 300,000 is accepted as a maximum for the annual number of persons passing through Ceduna, how many of these people are potential real tourists? It would seem reasonable to disregard the numbers relating to freight transport. The average monthly figure for transport vehicles from data available for the past four years is 4,700 vehicles giving an annual vehicle figure of 56,500. Assuming there is an average of just over one driver for these vehicles, this reduces the potential tourist numbers to below 240,000 per annum.

To aim for an increase of 10 per cent in tourist numbers is to aim for an additional 24,000 tourists, or more realistically, tourist nights which includes the option of increasing tourism by encouraging visitors to stay longer. Given current visitation levels, this could mean increasing total accommodation usage by up to one-third which is quite a significant increase. The estimation of economic impact (see Appendix 1.3) is based on an increase of an additional 6 per cent of new visitors and 10 per cent of existing visitors extending their stay for one more night — a total increase of around 21,000 visitor nights.

Not only will there need to be suitable attractions to entice these travellers to stay an additional night, and the accommodation capacity to meet their requirements, there will also need to be an increase in the capacity of food outlets particularly but also in other service areas.

2.1.8 Current Accommodation Capacity in Ceduna

Current ABS statistics reveal that the four hotel/motels in Ceduna provide 149 rooms and 430 bed spaces. Recently released ABS data in relation to caravan parks covers only four parks but local information suggests that the six caravan parks around the town have 74 cabins and over 500 sites between them. This gives a maximum possible capacity of around 1500 persons but family groups do not come in flexible package sizes so in reality the maximum is not attainable.

For Ceduna, current average hotel/motel room occupancy rates are 45 per cent and bed occupancy rates would be expected to be lower (for South Australia the room occupancy rate is 60 percent and the bed occupancy rate is 36 per cent — evidence of the variability in group size within each room). For caravan parks, the South Australian average site occupancy rate is 35 per cent and based on the hotel/motel information we could expect the Ceduna rate to be lower. Based on available 2000 data for Eyre Peninsula and Ceduna a rate of 24 per cent is assumed. This leads to an average current utilisation level of around 67 rooms and 120 caravan or cabin sites. If we assume the average passenger size of 1.9 per vehicle for the cabin/caravan sites and hotel/motel rooms (roadblock data), this provides an estimated total of 355 persons on average. The seasonal pattern of accommodation usage indicated in Figure 2.6 means that in some quarters the average usage is higher than this and at certain times within those quarters (e.g., Oysterfest period) the current capacity must be near full.

If Ceduna wishes to attract more tourists to stay overnight, and a proportion of the existing level of tourists to stay another night longer, then there would currently be capacity constraints within the accommodation providers at certain times and this will need to be addressed to expand the tourism industry. Additional tourists do not just come when there is excess accommodation capacity available, but they are drawn to the area for the same reasons as the current visitors and will therefore come when there is already some pressure on accommodation unless the available capacity is increased. The attraction of a high quality coastal interpretive centre will help spread the demand for accommodation but the pressure on capacity will still be there during periods of peak demand.

Appendix 2.2

Employment in the Tourism Industry

2.2.1 Employment in the Tourism Industry

The Tourism industry is not clearly defined within the industry classification commonly in use for statistics and ABS has responded to a need for statistics in relation to the Tourism industry by preparing Tourism Satellite Accounts within the Australian National Accounts. However these are national accounts only. From Ceduna's perspective, the most important industry sectors are Retail Trade, Accommodation, Cafes and Restaurants, Transport, Cultural and Recreational Services and Personal Services, although of course there is a lot of non-tourism related activity which is generated within these sectors and this is one of the things which makes it very difficult to isolate just what is the contribution of tourism to a region.

Detailed employment data for Ceduna is only available from the Population Census which, with the next Census due in just over six months, is now rather outdated. Only two of the listed tourism related sectors have exhibited growth in employment over the period 1986 to 1996. These are the Personal Services and Cultural and Recreational Services sectors with the others experiencing a clear fall in employment over the period. In 1986, three of these sectors, namely, Retail Trade, Accommodation, Cafes and Restaurants and Transport, were among the top five sectors in terms of employment but by 1996 the group represented three in the top six with the Health and Community Services sector growing rapidly to be virtually the largest employing sector. Employment growth has also occurred in the non-tourism sectors of Manufacturing, Property and Business Services and Wholesale Trade.

Looking at the tourism sectors in more detail, the sub-groups in the Accommodation, Cafes and Restaurants with the most employment were Accommodation (37 per cent) and Pubs, Taverns and Bars (42 per cent) with Cafes and Restaurants much lower with 10 per cent. While the Accommodation group employment should be almost entirely reliant on tourism, the other groups would provide services to both locals and tourists. Allowing for a 50/50 split it could be said that around 65 persons are employed in this sector as a result of tourism but this may well be the upper limit.

With Retail Trade there are a number of sub-groups which would have some impact from tourism. These would include Food and Supermarket Retailing including Takeaway Food (29 per cent of all Retail employment), Sport and Camping Equipment and Pharmaceutical and Toiletries. There are also the sub-groups relating to motor vehicles including Fuel Retailing, Smash Repairing, Tyre Retailing and Automotive Repair Services which together account for 31 per cent of total retailing employment. In all of these sub-groups the activity would be mostly generated by locals but a proportion of the activity would be tourist generated and so a small proportion of the total 126 jobs represented by the groups would be tourist generated.

Sub-groups in the Personal Services sector which may cater for tourists include Laundries and Drycleaners and Hairdressing and Beauty Salons. Between them these two groups accounted for just over 20 per cent of the total sector employment in 1996 but it is hard to say just how much of this employment is directly reliant on tourism. The Transport sector covers mostly freight operations but some small proportion of the Long Distance Bus sub-group, Short Distance Bus and Services to Air Transport would be tourism related but since these represent only 9 jobs (around 10 per cent of the total Transport sector), the total impact of tourism would be very small. The Cultural and Recreational Services sector is very low in total which probably means that employment in this sector mainly represents second jobs rather than main jobs for those persons. An expansion in tourist numbers may well influence this situation.

In terms of the size of these tourism important sectors in Ceduna relative to the total West Coast SSD, Ceduna has a dominant share of employment within the Transport and Storage and Personal Services sectors with more than 70 per cent of the SSD total. However, these sectors would be dominated by non-tourism activity within Ceduna. The Accommodation, Cafes and Restaurants sector in Ceduna has only 50 per cent of the total and the Cultural and Recreational Services sector somewhat more.

This analysis leads to the conclusion that employment in tourism related industries in Ceduna is neither high nor growing rapidly. There is plenty of scope for growth which can be generated by the Ceduna Keys and Ceduna Coastal Centre proposed development, even though the numbers themselves may not be very high.

2.2.2 Boat Ramp Statistics

The following analysis is based on 1995-96 data resulting from SARDI survey and is the latest available, as shown at Table 2.2. The total number of trips is certain to have increased in the intervening period, with expansion of the aquaculture industry and the utilisation of the new boat ramp at Smoky Bay which was officially opened in April 2000.

Table 2.2
Ceduna Region - Boat Ramp Statistics 1995-96 (Excludes Denial Bay and Nadia Landing)

Location	Total Trips	Recreation Fishing Trips	Recreation Fishing %	Commercial Fishing %	Other %	Total %	Share of Total Usage %	Average Weekly Trips	Average Daily Trips
Ceduna	2,879	1,792	62.2	31.6	4.0	97.8	29.0	55.4	7.9
Smoky Bay	3,136	2,022	64.5	31.6	4.0	100.0	31.6	60.3	8.6
Thevenard	3,913	978	25.0	68.8	6.3	100.0	39.4	75.3	10.7
Area Total	9,928	4,792	48.3				100.0	190.9	27.2

Source: SARDI, *Use of Boat Launching Facilities in South Australia*, 30 June 1996.

Thevenard boat ramp is used mostly for commercial fishing (69 per cent) and only 25 per cent for recreation. Thevenard also has the highest total usage of the three boat ramps listed. Ceduna and Smoky Bay have very similar shares of commercial and recreation usage but the total usage in Smoky Bay is greater than in Ceduna (32 per cent of total compared with 29 per cent).

What does this tell us about demand for marina facilities?

Excluding Thevenard which is dominated by commercial operations, there are only 16.5 trips per day from Ceduna and Smoky Bay. Will the advent of the marina and boat ramp access increase this number substantially? The launching facility used by charter boat operator, Perry Will, between Thevenard and Ceduna is deemed inadequate. Either it needs upgrading or a new facility in the marina is needed. He would prefer the latter and is prepared to wait for 2-3 years to achieve this. Without it, the boat-ramp needs a major upgrade.

With the marina, charter boat operators, including Mr Perry Will, could use larger boats with sleeping accommodation and therefore make longer trips (Mr Will's current boat is licensed to take 9 passengers). A range of possible new packages could be offered. Cruising boats are often observed among the islands but there is nothing in the area to enable a suitable land based stop to be made. The availability of mooring facilities would enhance Ceduna as a destination for stop-overs for recreational craft.

Certainly, the indication is there that charter boat operations are desperately in need of better boat launching facilities. It is however problematic whether the improved boat launching facilities will lead to a much increased demand in boat charter activity in itself but rather the potential for an increase in the number of tourists staying even one additional night in Ceduna is more likely to lead to an increase in the demand for boat tourism and charter boat activity.

Thevenard averages 10.7 trips per day and 7.1 of these relate to commercial fishing. Raptis and Sons indicated they would definitely off-load and refuel at any new mooring site as the Port of Thevenard is clearly sub-optimal due to limited times for access, the prevailing winds and the bulk handling activities at Thevenard. The local fishing fleet would also use any marina off-loading facilities, while tuna crews would do likewise, if attracted to locate at the marina. Feeding boats to service tuna pens would also use the marina if tuna feed lots were established in the area.

Table 1.12
Economic Impact of the Construction Phase
Gross Value Added ($'000)

	Year 1	Year 2	Year 3	Year 4	Year 5
Primary Production	181.3	83.3	38.2	14.5	4.1
Manufacturing	620.6	282.7	129.7	49.3	13.8
Utilities	77.1	32.4	14.9	5.6	1.6
Construction	10,547.2	4,871.0	2,234.4	849.1	238.3
Wholesale and retail trade and repairs	1,058.5	270.6	124.1	47.2	13.2
Accommodation, cafes and restaurants	44.0	18.6	8.5	3.2	0.9
Transport	392.4	164.8	75.6	28.7	8.1
Communications Services	86.5	34.0	15.6	5.9	1.7
Finance and Insurance	134.0	57.4	26.3	10.0	2.8
Property and Business Services	286.2	117.8	54.0	20.5	5.8
Government, education, health and community services	99.2	43.2	19.8	7.5	2.1
Cultural, recreational and personal services	34.6	14.9	6.8	2.6	0.7
Total	**13,561.7**	**5,990.9**	**2,748.1**	**1,044.3**	**293.1**

Source: SACES calculations.

Table 1.13
Employment Impact of the Construction Phase
FTE Employees

	Year 1	Year 2	Year 3	Year 4	Year 5
Primary Production	1.23	0.56	0.26	0.10	0.03
Manufacturing	9.31	4.25	1.95	0.74	0.21
Utilities	0.43	0.18	0.08	0.03	0.01
Construction	187.74	86.70	39.77	15.11	4.24
Wholesale and retail trade and repairs	24.27	6.21	2.85	1.08	0.30
Accommodation, cafes and restaurants	1.11	0.47	0.22	0.08	0.02
Transport	5.24	2.26	1.04	0.39	0.11
Communications Services	0.87	0.34	0.16	0.06	0.02
Finance and Insurance	1.17	0.50	0.23	0.09	0.02
Property and Business Services	3.55	1.46	0.67	0.25	0.07
Government, education, health and community services	1.81	0.79	0.36	0.14	0.04
Cultural, recreational and personal services	0.67	0.29	0.13	0.05	0.01
Total	**237.41**	**104.02**	**47.71**	**18.13**	**5.09**

Source: SACES calculations.

There are several implications from this 'demand for labour' scenario. In the first instance, training in the use and maintenance of heavy machinery (earthmoving, canal construction, etc) is required, while skills in the construction industry are also required for the commercial and housing construction phase. These skills will be in demand for other projects such as for the planned streetscape program, expansion of the Community Hotel, undergrounding of overhead cables, golf course redevelopment and the Yalata Overnight Centre. While employment in the Ceduna Keys and Coastal Centre development declines rapidly after the initial heavy construction phase, there will be further opportunities for on-going employment in related sectors, including landscaping, housing services, parks and gardens and the progressive development of the Ceduna industrial park behind the existing golf course. Should the Yumbarra mine proceed then employment of skilled construction personnel will be assured. It is also possible, as was the experience of the Lincoln Cove development, that skilled and trained employees were able to relocate to more urbanised areas or to centres where their marketable skills were in demand (Roxby Downs, other marina developments such as Wallaroo and Tumby Bay and boat launch construction sites).

While some potentially skilled employees may leave Ceduna at the completion of the initial construction phase, it is still considered desirable for Council, through ATSIC, the CDEP group, DETE and DEWRSB to sponsor skills training in the construction sector overall. New TAFE training courses in building construction have commenced in Ceduna in 2001 (see Appendix 3.2).

1.3.4 The Economic Impact of Additional Visitors

The economic benefits of the construction phase of the project do not produce any ongoing benefit for the region but are, instead, a once-off shock. Because the residential and amenity construction phase may be extended over time then there is likely to be higher levels of construction beyond the period modelled here. Notwithstanding, it is the potential for the project to attract an increased proportion of those travelling across the Nullarbor to spend a night in Ceduna, and to encourage those who do stay in Ceduna to remain for longer than they otherwise would have which produces the true on-going benefit for the region. This benefit will begin to be achieved once the construction of the Coastal Centre is complete, currently estimated to be two years after the construction phase has started.

The potential impact of additional visitor nights was estimated using both expenditure data and estimated tourist numbers. Bureau of Tourism Research surveys of domestic tourism provided estimates of expenditure in regional South Australia. Stated expenditure excludes items purchased outside the region (in this case, Ceduna) such as package tours and interstate travel. Average total expenditure per visitor night for Eyre Peninsula was $73.[5] The broader impact of this increased expenditure on the Ceduna region was then projected using an Input-Output table modified to reflect the distribution of activity in Ceduna using the locational quotient method.

[5] Herrick, B. and Robins, P., (2000), "Tourism in Regional South Australia". Paper presented at Renmark Paringa Conference 2000, *Economic Potential of Regional South Australia and its impact on the National Economy*, Renmark. Average visitor expenditure estimated for Eyre Peninsula, 1998.

Analysis to estimate potential tourist numbers (see Appendix 2.1) suggests that a minium of 64,000 persons per annum currently spend at least one night in Ceduna. This is just over 25 per cent of the potential 240,000 visitors to Ceduna. In order to model the potential impact of the development on Ceduna, two scenarios have been used. The first scenario assumes that the Coastal Centre encourages an additional 6 per cent of those driving past to "overnight" in Ceduna, increasing annual visitor nights by 14,000. The second scenario not only assumes the 6 per cent increase in persons visiting Ceduna, but also assumes that 10 per cent of those who would have stayed in Ceduna without the Coastal Centre now spend an extra night there, increasing visitor nights by a further 7,000 to 21,000.

Table 1.14
Annual Impact of Additional Visitor Nights
$'000 and Full-time Equivalent Employment

	Additional 14,000 Visitor nights		Additional 21,000 Visitor nights	
	GVA Impact ($'000)	Employment Impact	GVA Impact ($'000)	Employment Impact
Primary Production	5.1	0.08	7.62	0.12
Manufacturing	7.6	0.10	11.40	0.15
Utilities	12.3	0.07	18.5	0.10
Construction	2.3	0.04	3.39	0.06
Wholesale and retail trade and repairs	118.3	2.71	177.42	4.07
Accommodation, cafes and restaurants	193.9	4.88	290.81	7.32
Transport	106.8	0.92	160.20	1.37
Communications Services	9.3	0.09	13.93	0.14
Finance and Insurance	7.3	0.06	10.92	0.10
Property and Business Services	19.3	0.24	29.00	0.36
Government, education, health and community services	20.6	0.38	30.90	0.56
Cultural, recreational and personal services	86.8	1.69	30.90	2.50
Total	**589.5**	**11.25**	**884.30**	**16.88**

Source: SACES calculations.

Unlike the impact of the construction phase of the project the impacts outlined in Table 1.14 are ongoing and sustainable, i.e. the employment effect represents a permanent increase in employment. As can be seen from Table 1.14, the employment impact of increased visitor nights is concentrated in the Accommodation, Cafes and Restaurants and Wholesale and Retail Trade and Repairs sectors. There are also lesser, but still noticeable, impacts in the Cultural, Recreational and Personal Services and Transport sectors. This suggests that these are additional areas where any efforts by the Ceduna (DC) and training authorities to improve the skill base of the region should be focused. The distribution of impacts between the two scenarios is identical, it is only the scale of

the impacts which is different. A more detailed analysis of training and skill requirements is addressed in Appendix 3.2.

It should be noted that the estimated employment impacts are in terms of full-time equivalent employment numbers, rather than in terms of employees. The actual number of persons employed is likely to be greater than this, as the impact on business in the region is not going to be spread in such a fashion that any business which experiences an increase in turnover is likely to expand sufficiently to take on an additional full time employee. Instead it is likely to lead to an increase in part-time employment with an overall increase in the number of persons employed greater than the estimated increase in FTE employment for the sector.

Of course as the tourism industry is highly seasonal it is likely that this impact will be concentrated in those months which already record peaks in tourist numbers, namely April, September and October. This means that more persons will actually have to be trained than are indicated by these estimates to ensure there are sufficient potential employees to meet demand at peak periods. The downside of this is that there will be a pool of skilled employees who only have the opportunity to use their skill in employment for a proportion of the year and are at risk of unemployment for the remainder of the year. It may be necessary to train potential tourism employees who are in industries with labour peaks at other times of the year (farming, fishing and aquaculture would seem to be potential prospects) or to provide training to older students to take advantage of the fact that the tourism peaks generally coincide with school holiday periods.

1.3.5 The Economic Impact of Marina Operations

In discussions with representatives of the Ceduna District Council it was suggested that the ongoing operations of the marina could produce a positive economic impact on the region for several reasons. First, it was considered that the presence of marina facilities would enable the development of tuna farming in the Ceduna region, with the operators being based out of the Ceduna marina. Second, it was asserted that the marina would also generate revenue through acting as a refuelling point for tuna boats which were fishing, saving them from having to return to Port Lincoln to refuel. Finally, it was suggested that the marina could act as a refuelling facility for other types of fishing boats active in the region, and could possibly attract one or more non-tuna fishermen to base their fishing operations out of Ceduna.

Discussions with Mr Brian Jefferies of the Tuna Boat Owners Association have indicated that it is unlikely that tuna boats would make use of the Ceduna Keys marina if it were constructed. Mr Jefferies based this view on two grounds. First he indicated that a recent study had found no sites in the Ceduna area which were considered to be suitable for the establishment of tuna pens. Second, he suggested that current tuna boats do not need to refuel on their trips to harvest tuna for fattening in pens, and hence would not use Ceduna as a refuelling facility. Whilst it would seem that modern tuna fishing boats would not need to refuel at Ceduna, the contention that there are no sites which are potentially suitable for tuna farming does not appear to be supported by other sources. The study referred to by Mr Jefferies (conducted by Oceanique Perspectives on behalf of

PIRSA[6]) found several prospective sites in the Ceduna region which, from a technical perspective, would appear to have good potential as sites for tuna pens. For example, the Port James region (approximately 30km west of Ceduna) received an aggregate score of 40 for its suitability as an offshore aquaculture site, equal highest of any region in the state. Of course, just because a site is technically suitable does not mean that it will necessarily be developed. The cautious approach suggested by Mr Jefferies to the potential of the Ceduna region may indicate that there are no plans amongst existing operators to make use of these prospective sites at the present time. Consequently, in the absence of any evidence to suggest that tuna pens are being considered by any existing operators, no tuna farming based out of the marina has been included in the economic impact calculations.

This discussion suggests that any benefit to Ceduna from the ongoing marina operations would be most likely to come from one or more commercial fishing boats switching to Ceduna from another port in the region, or from recreational use of the facilities by non-local boat owners. Current calculations of the economic impact of marina operations are based on discussions with Raptis and Sons, and estimates are calculated on the basis that Raptis will base two or three of their trawler boats out of Ceduna from this year (initially using the Port of Thevenard for refuelling and unloading, although it is suboptimal) on the understanding that the marina will be constructed and available for use within 3 to 4 years. No estimate has been made due to a lack of information of use of the marina by yachts, other fishing trawlers or charter boats, however some net increase in activity of this type (beyond the use currently made of boat ramps and facilities at the Port of Thevenard) is likely to occur. The Centre's interviews with owners of boats based at Streaky Bay and used for shark and lobster catch, confirm that Ceduna would be used more frequently as a refuelling stop were "a fisherman's wharf" included in the development. Potential benefits of increased stop-overs include greater utilisation of the two fish processing plants for off-loading packed and chilled fish and increased demand for transport of goods to Port Lincoln and Adelaide.

Raptis and Sons indicated that they anticipated annual local expenditure per trawler of just under $0.5 million, with the majority of this ($400,000) being spent on refuelling. Once the multiplier effects of this expenditure are taken into account each trawler of the scale proposed by Raptis operated out of Ceduna increases local economic activity by $600,000. This contribution to Ceduna's economy would be even greater if some or all of the fishers decided to live in Ceduna. However, for the economic impact calculation it has been assumed that the trawlers' employees will operate on a "fly in fly out" basis, residing in Adelaide or a major regional centre.

1.3.6 Timing of Impacts

As well as the level of impact, and the sectors in which they are felt, another significant issue is the timing of these impacts, which is particularly important with regards to the provision of training. The timing is largely driven by the construction schedule of the project as, for example the Ceduna Coastal Centre cannot increase tourism numbers until it is completed. In determining the timing of impacts it has been assumed that the impact of the Coastal Centre on tourist numbers phases in over 4 years, with the full

6 Petrusevics, P., (1988), "Key Sites for Off-Shore Aquaculture Development in South Australia", March.

impact being achieved in the fifth year of its operations. Employment impacts over time are given in Table 1.15.

Table 1.16 differs from Table 1.15 in one respect only, in that a slower construction period is assumed stretching out over six years, so that the employment impacts are also spread out over this period. This provides a 'richer picture' of the impacts where the major site preparation, marina design and construction, lake building and related capital works flow into the third year.

Table 1.15
Timing of the Employment Impact of the Development
Full-time Equivalent Employment

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Construction	237.4	104.0	47.7	18.1	5.1	n.c.e	n.c.e	n.c.e	n.c.e	n.c.e
Tourism (upper bound)	-	-	-	-	3.37	6.75	10.12	13.50	16.88	16.88
Tourism (lower bound)	-	-	-	-	2.25	4.50	6.75	9.00	11.25	11.25
Marina operations (upper bound)	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Marina operations (lower bound)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total (upper bound)	246.7	113.3	57.0	27.4	17.8	16.1	19.4	22.8	26.2	26.2
Total (lower bound)	243.6	110.2	53.9	24.3	13.6	10.7	13.0	15.2	17.5	17.5

n.c.e Not currently estimated. Whilst there is no direct impact estimated once construction work for the development ceases, there will be construction activity in the residential development. At this point in time it has been assumed that (at least initially) this will be a transfer of activity from other areas of Ceduna rather than a net increase.

Table 1.16
Timing of the Employment Impact of the Development, Slower Construction
Full-time Equivalent Employment

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Construction	129.6	117.4	117.4	70.6	41.0	15.3	n.c.e	n.c.e	n.c.e	n.c.e
Tourism (upper bound)	-	-	-	-	3.37	6.75	10.12	13.50	16.88	16.88
Tourism (lower bound)	-	-	-	-	2.25	4.50	6.75	9.00	11.25	11.25
Marina operations (upper bound)	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
Marina operations (lower bound)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total (upper bound)	131.2	119.0	119.0	57.0	30.8	21.2	19.4	22.8	26.2	26.2
Total (lower bound)	128.1	115.9	115.9	53.9	26.6	15.8	13.0	15.2	17.5	17.5

n.c.e Not currently estimated. Whilst there is no direct impact estimated once construction work for the development ceases, there will be construction activity in the residential development. At this point in time it has been assumed that (at least initially) this will be a transfer of activity from other areas of Ceduna rather than a net increase.

Appendix 2.3

Aboriginal Issues and Cultural Tourism

2.3.1 Introduction

We examine Aboriginal issues within the context of participation in the Ceduna Keys and Ceduna Coastal Centre development, and hence our analysis is concentrated on defining participation, aspirations of local communities, constraints, opportunities, employment, training and skills formation.

A significant component of the Ceduna Coastal Centre development is concerned with Aboriginal cultural tourism, and thus we begin by summarising previous research[14] on this topic to draw out issues for future attention. We then summarise our own discussions and interviews with interested and relevant parties.

A final concept for the Ceduna Coastal Centre involving Aboriginal cultural tourism has not yet been agreed. Studies into the potential for Aboriginal Cultural Tourism, interstate site visits and study tours have been undertaken, but a final concept is still being debated.

Most important is that the Ceduna Coastal Centre is planned to incorporate a significant Aboriginal component as a learning centre, to learn about, preserve and protect Aboriginal culture and heritage and then to share this with others through art, dance, displays, written and oral history. Other cultural centres in Australia share this objective — the survival of Aboriginal culture — which is incorporated with commercial activities, training, employment and other functions. The Ceduna Coastal Centre is planned to:

- provide a learning centre for visitors to learn about Aboriginal culture, customs and traditions, to store and display cultural and heritage items and to share this heritage with visitors to the Centre;
- combine with, *inter alia*, commercial activities including film, dance, nature boardwalks, convention and conference facilities, retail outlet, art and craft production, display and sale and water/recreation activities; and
- present a visible, attractive and high quality gateway to South Australia.

A general assessment of other cultural centres in Australia is that relatively few of them make money (profit:revenue over and above operating expenses) although there are examples of some centres successfully covering operating expenses through commercial activities. Offering a high quality tourist attraction combined with a commercial presence appears to be the most successful development combination. Notwithstanding, it is frequently held that Aboriginal cultural centres are "not there to make money but they are established so that Aboriginal culture will survive". In that respect they are no different from art and cultural museums established by "the white fella", which usually

14 Tonge, R. and Associates, (1996), "Aboriginal Cultural Tourism Strategy: Eyre Peninsula, South Australia, September.

are dependent on government and private subsidy. In this regard, the Tjapukai Aboriginal Cultural Park near Cairns provides for the safe storage (security system, fire system), protection and secure display of Aboriginal artefacts and sacred items. The Dreamtime Cultural Centre (Rockhampton) has successfully combined commercial activities and cultural attractions within the mainstream tourism industry.

2.3.2 Developments in the Tourism Market

The 'new tourism market' is defined as specialised products for niche markets, with a particular emphasis on culture, the environment and education. The 'new tourism' market is said to be segmented and highly specialised, one component of which — ecotourism — stresses environmental and cultural understanding and appreciation. This market is characterised by:

- a strong emphasis on culture, environment and education;
- involvement by local communities, authenticity and effective interpretation; and
- personalised, individual, interactive visitor experiences with an emphasis on regional/local histories.

An analysis of the range of Aboriginal cultural tourism experience shows to date, that they have tended to concentrate on guided tours and arts/craft, but activities may also include tours, art galleries, dance groups, cultural centres, restaurants, demonstrations of traditional lifestyle and weapons, opportunities to meet indigenous people, dreamtime stories and heritage and bush food and medicines.

A detailed study into the potential for Aboriginal cultural tourism on the Eyre Peninsula, conducted by Robert Tonge (1996) concluded:

> "In the development of commercial enterprises, Aboriginal communities face significant barriers in obtaining funding, appropriate training, gaining knowledge of start-up requirements, marketing, and distribution systems. As well, there are constraints imposed by remoteness, layers of bureaucracy, local and regional politics, changes in government policies and priorities, and difficulties in gaining knowledge and understanding of the tourism industry.
>
> "Nevertheless, there are a number of highly successful indigenous tourism enterprises around the nation, the development of these ventures being based on the basic principles of sound management, and the establishment of a strong working partnership with the tourism industry.
>
> "Where business failures have occurred, this has mainly been caused by lack of management skills, lack of commitment, insufficient assessment of the potential market, and lack of business planning.
>
> "These issues highlight the need to underpin the development of Aboriginal cultural tourism ventures with strong, skilled management and advisory support which can not only assist individuals and communities through the maze of organisational impediments, but can provide this support on an ongoing basis. Given this support, Aboriginal cultural tourism has the potential to be a high quality product which can generate substantial economic, employment, and other benefits for communities." [15]

15 Tonge, R. and Associates (1996), *op. cit.*, p. 10.

Linking Aboriginal tourism (and Aboriginal involvement in the tourism industry) and the mainstream tourism industry, two important barriers or concerns were raised:

- that Aboriginal tourism ventures are often regarded as a "fringe component of the industry"; and
- that the full range of potential employment opportunities in the tourism and hospitality industry are often not fully appreciated by Aboriginal communities.

Specifically, in relation to the Eyre Peninsula, community consultations (Tonge, 1996) canvassed the major impediments to the development of Aboriginal cultural tourism across the Eyre Peninsula, including:

- limited access to finance;
- lack of management skills and business experience;
- the number of organisations involved;
- cultural obligations which may impose constraints on viability of tourism operations;
- negative attitude of the wider tourism industry;
- loss of culture;
- lack of networking; and
- inappropriate training programs.

Notwithstanding the need to address these issues, the determination of Aboriginal communities to achieve financial and personal independence can be facilitated by addressing concerns raised in the consultation process conducted by Tonge (1996), specifically:

- training issues;
- the need for business start-up advice and guidance;
- cultural constraints on tourism operators and intellectual property issues;
- constraints on further development of Head of Bight whale watching;
- improving networks and communication between communities. (Tonge, 1996: p. 10).

ATSIC has set a framework within which national cultural and tourism strategies should be developed, *inter alia*,

- that the separation of art and culture is inappropriate;
- the importance of small business training, understanding and skills;
- the establishment and nurturing of small business enterprises requires seed funding, and appropriate training in business management, marketing, distribution systems; and

- training providers need to develop tourism and business training programs that are appropriate for the needs of the communities (we note ATSIC funded effort in this regard in bookkeeping, financial management, computer literacy skills) and current efforts to improve the management at the Yalata community.

It was also acknowledged that tourism and "indigenous tourism" cannot be separated, that the benefits, training and income flowing from indigenous tourism will be "maximised if integrated into the mainstream [tourism] distribution and marketing networks". (Tonge, 1996: p. 20). The Ceduna Coastal Centre proposal is designed to maximise this integration, by promoting Aboriginal culture, teaching and learning, and display within the coastal centre, co-located and closely linked to other businesses and services and supported by employment and business training programs.

The South Australian Tourism Commission (SATC) have promoted their "Aboriginal Tourism Strategy", with the primary goals of raising the profile of Aboriginal tourism, increasing the number of viable Aboriginal tourism products, raising demand and achieving excellence in product delivery. SATC expressed a commitment to increase access to advice and funding programs, develop employment programs and tourism training and to negotiate contracts and leases. The Ceduna Coastal Centre proposal recognises the potential to "mainstream Aboriginal tourism", but will rely on the type of assistance (advice, funding, appropriate training, integrating other services) referred to in the Aboriginal Tourism Strategy.

Commercial facilities located within the Ceduna Coastal Centre are likely to be required to support the viability of the planned centre. We note the intention to require the location of an office in Ceduna of the successful accounting firm to provide regional accounting services to the ATSIC funded Wangka Wilurrara Regional Council, which may provide an opportunity to lease out commercial premises.[16]

Prior to undertaking interviews for this project we summarised the findings of Tonge and others on cultural tourism opportunities and activities that would need to be implemented to maximise the viability of cultural tourism businesses. We then interviewed Aboriginal representatives and others on progress to date (since 1996) and specific issues that would need to be addressed in regard to maximising Aboriginal employment in the tourism industry.

The potential strengths/opportunities for the development of cultural tourism include, *inter alia*,

- specific activities such as whale watching, recreational and big-game fishing, art and craft development, ecotourism packages, development of the Emu Farm for training and display;
- potential to capture increased visit or nights from those travelling through region and to increase the length of stay of current visitors;
- opportunity to have a focus to co-ordinate and promote Aboriginal culture from among the diverse Aboriginal groups within the Ceduna DC and its surrounds;

16 See Addendum: Registration of Interest, attached.

- total upgrade of Yalata Roadhouse to make it amenable to tourists; and
- Ceduna Coastal Centre to combine commercial facilities with cultural activities, information and Aboriginal history and heritage, recreation, education, wildlife displays, point of ticket sales for whale watching and promotion of tourism opportunities.

The weaknesses/threats most consistently referred to include, *inter alia,*

- lack of co-ordination with fragmentation and poor networking between local Aboriginal communities;
- difficulties associated with business incubator, business management and training, obtaining practical information on tourism business start-up;
- complexities related to obtaining finance;
- difficulty in integrating Aboriginal cultural tourism into mainstream tourism management, advertising/promotion; and
- overcoming community uncertainty and poor knowledge of the tourism industry - this will require development of ongoing training and supportive infrastructure and education of the local residents (both indigenous and non-indigenous) about the benefits of tourism and the preservation of local tourism assets.

Others, including Tonge (1996), ATSIC (1996) have emphasised the critical success factors in the development of Aboriginal cultural tourism enterprises, specifically:

- need for basic business management skills and appropriate tourism industry training;
- strong tourism industry support, which is based on business reliability, marketing funding and industry networking;
- the activities must be authentic, high quality and provide a meaningful learning experience; and
- indigenous groups need to cooperate and set up a single management structure for decision-making, strategy, business development, reliability and long-term commitment.

Recent discussions with Aboriginal representatives concerning the Ceduna Keys and Ceduna Coastal Centre development confirm the findings of Tonge (1996) in that there is general understanding of strengths/weaknesses and obstacles to be overcome. More significantly, the improved race relations in Ceduna, the support for reconciliation, the desire to create meaningful employment while promoting and preserving Aboriginal culture, the development of the art/craft centre by Eleanor Coleman (supported by ATSIC) and the capacity to organise appropriate management training and business support to develop Aboriginal tourism all indicate a commitment to the Coastal Centre.

Business and employment opportunities in the construction phase and in art/craft production and sales, guided tours, ticket sales, land management (using the Emu Farm complex), landscaping and maintenance, horticulture and bookkeeping/accounting have been identified and some training courses are already in place.

2.3.3 Sustainability of Cultural Centres

The experience of cultural centres interstate is that unless they are very favourably located, such as the Uluru/Kata Tjuta Cultural Centre with high tourism traffic, including a significant international component, it is very difficult to break-even. This experience would suggest that the Ceduna Coastal Centre should be treated as a property development in its own right, and combine cultural aspects with commercial undertakings in hospitality, convention, restaurant, theatre, outdoor activities (walking trails, boardwalks, recreation, etc.), art and craft and sales outlets.

The Ceduna Coastal Centre and its proponents recognise the necessity of 'blending local Aboriginal culture/heritage/learning together with the unique natural assets of the region, including *inter alia*, the Head of the Bight, Nullarbor, the coastline, islands, national parks, aquaculture and marine life.

The Ceduna Coastal Centre will provide a necessary and significant boost to tourism infrastructure — which is either currently lacking or in need of substantial upgrade — and a focus for tourism generally and opportunities for Aboriginal people and will provide an exciting gateway to South Australia. The development of the existing golf course should be integrated into the Coastal Centre complex, while the tourism information centre and office space for selected government agencies such as Parks and Wildlife could be incorporated. Income generating facilities and activities will be important to the on-going utilisation of the Centre.

Appendix 2.4

Impact of the Development and Tourism Marketing

2.4.1 Projections of the Impact of the Development on Tourism Numbers

Is the development likely to increase the number of tourists by around 6 per cent of the total passing through and to increase the average length of stay by one day for 10 per cent of those visitors who already stay overnight in Ceduna? These are the assumptions which form the basis of the impact of the interpretive centre on the local economy through tourism as outlined in Appendix 1.3.

As has been noted in Appendix 2.1.7, a realistic estimate of the number of potential tourists passing through Ceduna each year is around 240,000. We know that already around 32,000 tourists each year stay in hotels/motels. There are also estimated to be around 32,000 annual site nights in caravan parks and this is the best proxy for caravan park tourists. Together this gives a total number of 64,000. An increase of just 14,000 tourists for one night from among those who pass through but don't currently stay is in reality around 8 per cent of those who don't stay. Since already at least 27 per cent do stay at least one night, an assumed increase of another 6 percentage points because of the attraction of the interpretive centre and the experiences offered in the marina environment does not seem unattainable given appropriate marketing activity.

Summary Table 2.3

	Persons	Per Cent of Current Potential
Current Potential Tourist Numbers	240,000	100
Current Stays	64,000	27
Additional Visitor Increases	14,000	6

At the moment, however, the busiest period is over the period of the Oysterfest. For the quarter which includes the festival and Christmas there were around 10,000 guests in hotels/motels alone. So long as they don't all arrive in the same quarter, there is suitable accommodation capacity available to cope with the increase of 14,000 across the year. However as pointed out in Appendix 2.1.8, tourists are often attracted to visit at the same time. Marketing strategies may therefore have to spread the interest unless additional accommodation infrastructure will be provided very early in the development. For instance, any attempt to link the interpretive centre with whale watching would seem to be a good strategy but it does limit the additional visitation to only half of the year with consequent potential capacity constraints.

What about those who already stop-over in Ceduna? Can 10 per cent of them be induced to stay one more day? This is around 6,500 additional nights per annum. The average length of stay is 1.3 nights. The Visitor Survey indicates that the majority of those responding stayed one or two nights although a small proportion stayed in excess

of one week. Those already staying the longer period would be able to include a visit to the interpretive centre during their stay and are unlikely to be induced to stay longer. However, some of the significant number who stay only one day could well be enticed to stay another day, especially if they were fully informed about other local attractions in addition to the interpretive centre, such as Davenport Creek or a trip out to one of the nearby islands. The existence of the marina will enable charter boat operators to launch craft with larger passenger carrying capacity which could be expected to have some impact on reducing prices for day trips to the islands and thus increasing demand among tourists. It would seem that the target increase in visitor nights is achievable, given appropriate marketing and supported by the apparent trend increase in vehicles passing through Ceduna (see Appendix 2.1.5).

One word of caution relates to the number who make the crossing both ways and who are therefore being considered as potential tourists twice. This can have both advantages and disadvantages. If the first stop-over experience is enjoyable, the tourist may consider stopping again on the return trip, especially if the alternative stop-over destinations are not as enticing. Others may wish to stop-over at another destination irrespective of the initial experience, just to experience something different. Not all travellers would make two crossings but the potential in terms of individuals may be more like 150,000 and if this is true then an increase of 14,000 represents 16 per cent of those who currently don't stay. This would mean that the marketing needs to be quite aggressive to attract a larger share of these individuals to stopover.

The development of the planned Heritage Trail through the West Coast can also serve as a marketing tool for the Ceduna attractions so that interested persons will plan to take more than one day to absorb the history and heritage of the area along with the natural attractions. This is a stated objective of the GAB 1000 West Coast Strategy.

Again there may be constraints on accommodation capacity if those visitors who are enticed to spend an additional day, do so at the busiest periods. Once potential guests are turned away through lack of suitable accommodation, the negative word-of-mouth publicity starts to swing into action. It may be reflected in "you have to book early if you want to stay at Ceduna" but the more likely result, especially from the large numbers who do not plan that far ahead, "too crowded — don't stay there" with the results that the potential favourable word-of-mouth publicity about the Ceduna Coastal Centre may be much reduced. The accommodation situation needs to be monitored very carefully as more tourists are attracted to stay overnight.

In summary, there is a trend increase in tourism numbers, potential to attract additional stay overs (14,000 or increase of 6 per cent of all potential tourists) and increase the length of stay by one night (10 per cent would be 6,400 additional nights). This is the base-line, conservative estimate, which the Centre considers is achievable and which the marina location and Coastal Centre will contribute to achieving.

There are additional factors which can contribute to this conservative estimate being exceeded. They include, the attraction of whale watching, promotion of other natural assets, the implementation of the GAB1000 West Coast Strategy, improved local, regional and State tourism promotion, the promotion of tourist activities such as recreational fishing, the expansion of the aquaculture industry, and promotion of special

events and flow-on from these events (Solar Eclipse, Oysterfest). If managed properly, there are good reasons to expect the conservative estimate as presented here, of additional tourists/additional nights can readily be exceeded.

2.4.2 Thoughts on Promotion and Marketing for Ceduna

The newly developed Ceduna Keys and Ceduna Coastal Centre cannot just rely on attracting travellers who pass along the Eyre Highway and see the development. Ideally, they must know about it before they leave home and have planned it as part of their itinerary. At the moment the publicity about the region is very inadequate. The Ceduna Gateway Visitor Information Centre advises that visitors arriving in Ceduna from the West have claimed to have had no knowledge of the Head of Bight Whale Watching Centre and the opportunity to view the whales from the cliff-top viewing platform. At least those travelling to the West will be informed about the opportunity *if* they visit the Information Centre, but less than 10 per cent of potential tourists (excluding transport drivers) passing through Ceduna avail themselves of this opportunity. The actual representation would be somewhat higher because it is only necessary for one person in a group to gather the knowledge.

Clearly if visitors are to be attracted then promotion activity needs to be well planned and professionally undertaken with adequate funds available. The South Australian Tourism Commission should be a co-operative partner in this promotion along with the Eyre Peninsula Tourism Association. Areas which should be targeted will include:

- National travel trade fairs and exhibitions which are directed towards the tourism operators and travel agents. It is essential for these industry operators to be knowledgeable about diversions and local attractions for travellers crossing the Nullarbor Plain by motor vehicle. They need to have accurate information on whale watching, the Coastal Interpretive Centre in Ceduna, the planned Eyre Peninsula Heritage Trail, when it is developed, and any other attraction along the route.
- National travel trade fairs and exhibitions which are directed towards the general public. There are many people who plan their holidays without the assistance of travel agents and therefore there must be avenues to disseminate information on local attractions to these travellers.
- Motoring organisations interstate as well as the RAA in this State, need to identify the attractions on their local maps, to be provided with the appropriate pamphlets to cover these attractions in the tourism literature which they hand out to members on request and to enable feature articles to be written in their member magazines.
- Pamphlets in motels, local visitor information centres in other towns, especially those en route, and caravan parks (since a large number of travellers are towing caravans) are simple cost effective ways of generating publicity. Even to be able to find such a pamphlet away from the route at some interstate location, gives potential travellers the opportunity to think and plan ahead for a future trip. The existence of certain attractions, or sufficient of them, may make the difference between a decision to drive rather than fly.

- Western Australia tourism offices and information centres, together with motels and caravan parks in that state, are currently apparently lacking information in relation to the whale watching opportunities. Since half of Ceduna's visitor's approach from the West (even if they are returning to the East) it is equally important that they are fully informed on the attractions found along the Eyre Highway.

- Ceduna also has the opportunity to align itself with the attractions along both the routes from the East i.e., the Eyre Highway through Whyalla and Wudinna or the slightly longer coast route via Port Lincoln and coast road to Ceduna. Such publicity can associate Ceduna's attractions (including the Coastal Interpretive Centre) and those further west with a choice of inland or coastal attractions for more variety.

- The publicity section of the SATC should provide the detailed opportunities for such promotion but in the early days, before "word-of-mouth" has had the opportunity to spread the word, the publicity and promotion activity cannot be skimped on. Sufficient and adequate funds must be made available to ensure the venture's success.

- While international visitors are not considered to be a large proportion of the total visitors to Ceduna, it is worth noting that 27 per cent of international visitors to **regional** South Australia went because of word-of-mouth recommendation. The BTR reports an estimated 10,000 international visitors to Eyre Peninsula in 1998 - 3.4 per cent of total international visitors to South Australia, and a Ceduna based charter boat operator reports frequent enquiries from international visitors. Nature based activities attracted 14 per cent, 11 per cent went because they wanted to visit rural or outback areas and 26 per cent went because they had friends or relatives living there. At the same time, these visitors claim not to be highly influenced by advertising. The BTR finds some conflict in these results and suggests a general inclination of people to underestimate the extent to which their behaviour is influenced by marketing.[17] Given that the word-of-mouth publicity is very significant, it is essential to provide some stimulus to get people to visit in the early stages in order to generate the word-of-mouth publicity, hence again it is stressed that initial promotion expenditure is very important even though it may be quite high.

- The fact that 26 per cent of the international visitors to Eyre Peninsula went because of friends or relatives in the region is consistent with the origin of the international visitors because 75 per cent of them came from Europe/UK which has been the major source of immigrant settlement in South Australia. The BTR reports[18] that marketing targeted at South Australian residents may also increase the number of interstate and international visitors to a region because the local residents either accompany them or recommend the destinations. The implication of this for regions which are quite some distance from Adelaide, as the main population centre, are not as clear as for the regions which are closer to Adelaide.

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17 Henrick, B. and Robins, P., (2000) "Tourism in Regional South Australia". Paper presented at Conference 2000 *Economic Potential of Regional South Australia and its impact on the National Economy*, Renmark.

18 *Ibid.*

- Domestic tourism is much more important to South Australian regions. An estimated 396,000 people visited Eyre Peninsula in 1998 and stayed an average of 3.5 nights each[19]. The length of stay is somewhat higher than for Ceduna alone but is not inconsistent with the local estimate given that the figure of 3.5 nights refers to the entire Eyre Peninsula region. These visitors were estimated to have spent $73 per night on average - an estimated total of $101 million.
- Detailed background information to help target specific markets can be obtained from the BTR.

2.4.3 Thoughts on Eco-tourism Opportunities

Clearly, cultural and eco-tourism form part of the potential opportunities for the planned interpretive centre development to increase local tourism. Planning such opportunities should be part of the long term tourism strategy of the interpretive centre and its planners but we don't make specific comment on what is required because specialised expertise with wide local knowledge is needed.

Our Centre however takes this opportunity to make comments based on observations from experienced birdwatchers in this State who have spent time in the Ceduna area and who have some experience of taking international visitors to sites where they are almost guaranteed to see the bird(s) they seek. The market is not large but international visitors are generally prepared to spend money to see something special.

Ceduna has a number of these special offerings which would attract visiting birdwatchers but making these opportunities available requires careful planning and long term strategies in conjunction with the local National Parks and Wildlife Service.

There are opportunities to see colonies of seabirds on the islands, particularly St Peter Island where there are large colonies of Short-tailed Shearwaters (Mutton Birds) and White Faced Storm Petrel. The Shearwaters provide a spectacular sight as they come in to roost as darkness falls and again as they take off at dawn. In order to best view these birds, basic overnight accommodation, which conforms to the principles of ecological soundness, needs to be provided on the island. The other large colony is that of the White Faced Storm Petrel. Colonies of this size have great appeal to naturalists and are big attractions for foreign naturalists, especially Americans and especially birdwatchers.

The existing building on the island could be developed in conjunction with some accommodation and serve as an interpretive centre on island wild life. There are of course also a wide variety of other sea and shore wading birds together with animals such as bettongs and snakes including a rare adder which add a further dimension to tourism demand. The prevalence of snakes would make the island unsuitable for children but to careful naturalists with sharp eyes, their presence should not be a distraction.

19 *Ibid.*

Clearly, the National Parks and Wildlife Service (NPWS) would need to be involved in any plan to develop these opportunities, not only because the island is under its control, but because of the need to minimise any risk to the delicate environment which currently suits the birds so well. It would also seem appropriate to undertake an education program for all local residents so that they fully understand the implications of overuse of such an environment but also the great natural asset which they hold in their hands and which can be very readily lost through vandalism and/or unplanned exploitation.

Existing charter boat operations could be expanded to provide transport for these naturalist tourists to this and other islands close to the coast but numbers would probably need to be controlled. The existence of the marina would facilitate such charter boat operations.

Of possibly even greater importance to the area is the existence in Yumbarra Conservation Park of a small colony of Scarlet Breasted Parrots a rare bird which is difficult to locate in the wild and whose brilliant plumage makes it a special delight to bird-watchers. There is also a known habitat far out in the Great Victorian Desert but the Yumbarra site is far more easily accessible to Ceduna. Not a lot is known about the habits, feeding etc of this bird but it is hoped that further research will be undertaken in the near future. Again there is fear that vandals may destroy both the bird and its habitat. However, true naturalists would be prepared to pay a high price to be given the opportunity to view such a bird in its natural surroundings by means of an overnight guided camping trip.

The mining exploration currently underway in Yumbarra is sufficiently distant that no harm would be expected to the known habitat. It could be that there are other colonies within the vast reserves in the area but until further research is undertaken, the extent of this rare parrot's habitat will not be known. There is also a range of mallee birds in the region which would be of interest to bird-watchers together with the local bustards which are currently shot by aborigines to provide food. Continued shooting may in fact be leading to the eventual loss of this natural tourism asset.

Aborigines with a knowledge of birdlife and the locations of known habitats would provide excellent guides for such trips because their additional local knowledge and skills in relation to the landscape would be an added bonus for the tourist, especially if the tourist was permitted to visit significant cultural sites which are not part of the normal tourism trail.

Current research on eco-tourism is being undertaken[20] in Adelaide, where the tourism potential of bird-watching is one of the topics being specifically addressed.

Birdwatching is not very prevalent within Australia with only around 8,000 members of birdwatching associations nationally with 500 of them being within South Australia. However it is extremely popular in both the UK and the USA. Given the high proportion of international visitors to South Australia originating in these countries, especially UK, it would seem to be an intelligent strategy to attract them to the Ceduna region.

[20] Geoff Evans (telephone: 8353 2322) of Anne Matthews Market Research.

Discussions with the staff of the NPWS in Ceduna reveal that any decisions in relation to people staying overnight on St Peter Island or organising tours into Yumbarra would need to seek permission from the Port Lincoln Regional Office. This is not an area for immediate decisions but it is, we believe, worth further discussion. Planning such opportunities to effectively extend and expand eco-tourism from Ceduna should be part of the tourism strategy of the interpretive centre.

It is also significant that the GAB 1000 West Coast Strategy specifically mentions the appropriate encouragement of such wildlife related activities within its stated objectives in terms of Tourism and Recreation. The actions necessary to ensure that both the wildlife species and the environment are adequately protected are outlined in the Priority Actions for Tourism and Recreation within that strategy.

SECTION THREE

Employment Study

Appendix 3.1

Employment and Skills Profile

3.1.1 Introduction

One of the main objectives of the Ceduna Keys and Ceduna Coastal Centre project is to "maximise employment and education opportunities for local Aboriginal people and the wider community". Employment opportunities are expected to arise through both the construction phase and subsequent operation of the project. For example, the development of an Aboriginal cultural tourism centre should generate ongoing employment opportunities for the local Aboriginal community within the sphere of the cultural heritage interpretation and cultural tourism industry.

The extent to which the local indigenous and non-indigenous population can immediately take advantage of employment opportunities presented by the development will depend heavily upon their current qualifications and skills. In this respect the following section examines the employment and skills profile of the local population. Data is presented separately for the indigenous population. The analysis is based on 1996 Census data which remains the most comprehensive (and indeed only) source of information for detailed indigenous employment characteristics within regional areas.

The employment and skills profile has been developed for three separate regions: Ceduna District Council region, Ceduna ATSIC region (AR) and South Australia. The decision to include the Ceduna AR region is based on the fact that there exist remote Aboriginal communities outside the boundaries of the Ceduna DC area that will likely provide considerable content for the cultural interpretive centre. Although the Ceduna AR region is substantially larger than the Ceduna DC region (355,696 square kilometres compared to 5,423 square kilometres), the indigenous population for Ceduna AR is not substantially larger in relative terms. The indigenous population of the Ceduna AR was 1,867 in 1996 compared to a indigenous population of 793 for Ceduna DC.

3.1.2 Employment Profile

The labour force status of the indigenous and total population of Ceduna and South Australia as at 1996 is shown in Table 3.1 and Table 3.2. Unemployment among the indigenous population was higher than for the non-indigenous population in all regions in 1996. However, unemployment among the indigenous populations of Ceduna DC (11.3 per cent) and Ceduna AR (14.9 per cent) was significantly lower than for the total South Australian indigenous population (24.5 per cent). On the surface this suggests that indigenous people in Ceduna have been more successful in seeking employment relative to their South Australian counterparts. However, a substantial proportion of indigenous employment in Ceduna is subsidised through the Community Development Employment Projects (CDEP). These projects, which are administered by indigenous community organisations funded by ATSIC, are designed to provide indigenous people with temporary employment enabling them to develop important skills and gain vital work experience which assists them in finding permanent employment.

Table 3.1
Labour Force Status - Persons
Ceduna and South Australia - 1996

	Employed			*Unemployed*	*Total labour force*	*Not in labour force*	*Not stated(d)*	*Total*
	CDEP(a)(b)	*Other(c)*	*Total*					
Ceduna DC								
Indigenous	125	125	250	32	282	171	28	481
Non-indigenous	0	1,339	1,339	90	1,429	655	9	2,093
Total	125	1,484	1,609	122	1,731	864	77	2,672
Ceduna AR								
Indigenous	189	324	513	90	603	431	33	1,067
Non-indigenous	0	15,114	15,114	1,571	16,685	9,235	174	26,094
Total	189	15,572	15,761	1,674	17,435	9,957	638	28,030
South Australia								
Indigenous	740	3,789	4,529	1,471	6,000	5,124	1,250	12,374
Non-indigenous	0	584,550	584,550	66,628	651,178	428,692	6,274	1,086,144
Total	740	591,767	592,507	68,558	661,065	447,290	20,033	1,128,388

Note: (a) Community Development Employment Projects scheme.
(b) CDEP data were collected in the Census for the first time in 1996. As a specific question was not asked to determine CDEP employment, these data should be interpreted cautiously, as their reliability is variable.
(c) Includes all other employed persons.
(d) Labour Force Status not stated.

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The classification of CDEP participants as employed subsequently masks the true extent of unemployment among Aboriginal communities. This is especially true among remote Aboriginal communities where employment opportunities are severely limited. CDEP is a particularly important source of employment for Aborigines in the Ceduna region with approximately one half of all Aboriginal employment in Ceduna DC being accounted for by CDEP. By comparison, 37 per cent of the indigenous workforce in Ceduna AR and 16 per cent in South Australia were employed through the CDEP scheme. Without such projects indigenous unemployment would be substantially higher in the Ceduna region.

Another positive aspect of the greater prevalence of CDEP in the Ceduna region is that it encourages a larger share of the Ceduna indigenous population to participate in the workforce than would otherwise be the case. In 1996 the participation rate for the indigenous populations of Ceduna DC and Ceduna AR was 62 and 58 per cent respectively compared to 54 per cent for South Australia. The Ceduna indigenous population is therefore more likely to engage in employment activities relative to the South Australian indigenous population. This is an encouraging sign for indigenous participation in employment activities arising from the Ceduna Keys and Ceduna Coastal Centre development.

Table 3.2
Labour Force Status - Selected Indicators
Ceduna and South Australia - 1996

	Employed			*Unemployment rate*	*Participation rate*
	CDEP(a)(b)	*Other(c)*	*Total*		
	Per cent of total employment				
Ceduna DC					
Indigenous	50.0	50.0	100.0	11.3	62.3
Non-indigenous	0.0	100.0	100.0	6.3	68.6
Total	7.8	92.2	100.0	7.0	66.7
Ceduna AR					
Indigenous	36.8	63.2	100.0	14.9	58.3
Non-indigenous	0.0	100.0	100.0	9.4	64.4
Total	1.2	98.8	100.0	9.6	63.6
South Australia					
Indigenous	16.3	83.7	100.0	24.5	53.9
Non-indigenous	0.0	100.0	100.0	10.2	60.3
Total	0.1	99.9	100.0	10.4	59.6

Note: (a) Community Development Employment Projects scheme.
(b) CDEP data were collected in the Census for the first time in 1996. As a specific question was not asked to determine CDEP employment, these data should be interpreted cautiously, as their reliability is variable.
(c) Includes all other employed persons.

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

Participation rates for the non-indigenous population of Ceduna were also higher than for the South Australian non-indigenous population. A stronger labour market in Ceduna at the time of the Census (the unemployment rate for non-indigenous Ceduna DC population was 6.3 per cent versus 10.2 per cent for South Australia) is the most likely explanation for higher participation rates of non-indigenous populations in Ceduna. As was observed in the economic profile of Ceduna (Appendix 1.1), unemployment within the region has increased since the 1996 Census.

An industry breakdown of indigenous and total employment is shown in Table 3.3 with a percentage breakdown presented in Table 3.4. The industry breakdown reveals than an overwhelming majority of the Ceduna indigenous population is employed within the Health and Community Services sector. Of the 249 Aboriginal people employed in Ceduna DC in 1996, 156 (63 per cent) were employed in Health and Community Services. The substantial indigenous employment within this sector which is also apparent for the Ceduna AR (47 per cent) and South Australia (27 per cent) probably reflects the need to provide extensive health and welfare services to Aboriginal communities and the establishment of local organisations to provide these services. Training through CDEP is an important way of improving these services.

Table 3.3
Employment by Industry (persons)
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
Agriculture, forestry and fishing	7	22	184	285	3,692	33,107
Mining	0	0	29	34	831	3,506
Manufacturing	0	9	318	53	674	88,645
Electricity, gas and water supply	0	0	15	11	137	4,631
Construction	0	15	135	62	856	29,301
Wholesale trade	0	0	87	48	601	33,581
Retail trade	3	10	259	188	1,767	79,007
Accommodation, cafes and restaurants	0	10	123	103	834	25,050
Transport and storage	0	7	100	94	624	21,782
Communication services	0	0	134	16	193	10,551
Finance and insurance	0	0	33	23	248	19,306
Property and business services	9	21	275	59	720	49,878
Government administration and defence	13	22	351	68	723	24,994
Education	25	81	539	139	1,156	43,442
Health and community services	156	239	1,241	276	1,388	67,057
Cultural and recreational services	0	3	119	3	167	12,835
Personal and other services	11	27	292	66	437	23,488
Non-classifiable economic units	7	7	52	17	164	5,417
Not stated	18	34	243	75	541	16,930
Total	249	507	4,529	1,620	15,753	592,508

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The other main industry sectors employing indigenous workers for the Ceduna DC region are Education (10 per cent), Government Administration and Defence (5 per cent), Personal and Other Services (4 per cent), and Property and Business Services (4 per cent). Significantly, indigenous persons were not represented in 10 of the 17 industry classifications at the District Council level suggesting that employment opportunities for indigenous persons are severely limited in the Ceduna region. Indigenous employment was consequently significantly under represented in a number of industries with the main being Agriculture, Forestry and Fishing which employs almost 18 per cent of the total Ceduna DC workforce but only 3 per cent of the indigenous workforce. Local knowledge informs us that Aboriginal employment is likely to have increased since the last census in the Agriculture, Forestry and Fishing sector, due to one successful joint venture in oyster farming and several farms now operated by Aboriginal persons, who received CDEP training in farm skills/farm management. In several cases, farms previously considered as non-viable are now operating successfully. Indigenous employment was also substantially under represented in the retail sector which accounts for only 1 per cent of indigenous employment but 12 per cent of total employment.

The Aboriginal cultural interpretive centre represents a significant opportunity to develop the cultural tourism industry within Ceduna, while protecting Aboriginal culture and heritage. At the time of the Census there were no indigenous people employed within the Cultural and Recreational Services sector and only three people in total for Ceduna DC. On one hand the relatively smaller size of the industry within Ceduna suggests that there is definite scope for expansion, however it does raise concerns about the availability of qualified personnel in the region to effectively manage and market such a centre.

Table 3.4
Employment by Industry (per cent)
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
Agriculture, forestry and fishing	2.8	4.3	4.1	17.6	23.4	5.6
Mining	0.0	0.0	0.6	2.1	5.3	0.6
Manufacturing	0.0	1.8	7.0	3.3	4.3	15.0
Electricity, gas and water supply	0.0	0.0	0.3	0.7	0.9	0.8
Construction	0.0	3.0	3.0	3.8	5.4	4.9
Wholesale trade	0.0	0.0	1.9	3.0	3.8	5.7
Retail trade	1.2	2.0	5.7	11.6	11.2	13.3
Accommodation, cafes and restaurants	0.0	2.0	2.7	6.4	5.3	4.2
Transport and storage	0.0	1.4	2.2	5.8	4.0	3.7
Communication services	0.0	0.0	3.0	1.0	1.2	1.8
Finance and insurance	0.0	0.0	0.7	1.4	1.6	3.3
Property and business services	3.6	4.1	6.1	3.6	4.6	8.4
Government administration and defence	5.2	4.3	7.8	4.2	4.6	4.2
Education	10.0	16.0	11.9	8.6	7.3	7.3
Health and community services	62.7	47.1	27.4	17.0	8.8	11.3
Cultural and recreational services	0.0	0.6	2.6	0.2	1.1	2.2
Personal and other services	4.4	5.3	6.4	4.1	2.8	4.0
Non-classifiable economic units	2.8	1.4	1.1	1.0	1.0	0.9
Not stated	7.2	6.7	5.4	4.6	3.4	2.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

Construction of the Ceduna Keys and Ceduna Coastal Centre project should also have a substantial impact on employment within the local construction industry. The Ceduna DC construction industry in employment terms is smaller relative to the size of the industry at the State level. Given the large scale of the project, it would appear that without some substantive training program, a significant proportion of construction employees may need to be sourced from outside the region. However, our assessment is that there are 100 indigenous persons with the necessary skills as machine operators, back-hoe operators, light truck and bob-cat operators and in occupations related to

earthmoving, pipeline construction, building, roadworks and concreting who are who currently available to the marina construction project. In addition, the Ceduna DC has established an Aboriginal earthworks gang.

Potential indigenous employees have previously worked on the Ceduna-Denial Bay and Koonibba-Penong pipelines, have been employed as building teams at Koonibba and Yalata, and up to 12 persons have workforce and training experience with heavy earthmoving equipment. There are currently 145 indigenous persons in training and employment with the CDEP at Tjutjunaku Worka Tjuta Inc. (TWT).

With the stated profile of required employees in the initial construction stage of the marina (5 per cent professional, 5 per cent managerial/technical and 90 per cent semi-skilled operators/labourers), it is possible that the workforce requirement can be met from indigenous and non-indigenous locals. In some cases, accreditation has not been conferred, but this can be achieved with short courses to assess competency and to upgrade skills. Ceduna TAFE has recently conducted a training needs analysis to enable them to plan the upgrading of current accreditation (see Appendix 3.2.2).

TWT is currently conducting training in machine operations, licenced truck operation, and back-hoe and fork-lift. In July 2001 courses in building and construction (roadworks, concrete pouring) and landscaping are planned. TWT claim that many indigenous persons are "the most over trained group in the world", some on CDEP for up to eleven years. The pathway from training to accreditation to employment in the Ceduna Keys and Ceduna Coastal Centre development (and in construction and landscaping of the Yalata Over-Night Centre) would provide 'that light at the end of the tunnel'. A Level 1 Certificate in Building Construction has been introduced by Ceduna TAFE in 2001 as part of their Aboriginal Education Program. This is discussed more fully in Appendix 3.2.2.

We find that there is also a group of up to 15 indigenous persons with basic bookkeeping and retailing skills, although not at a high level, available for employment.

There is clearly a wonderful opportunity for TWT, the Ceduna DC, Spencer Institute of TAFE, ATSIC and the marina developers to organise selected courses to upgrade skills, to confer competency and employ a large indigenous workforce. Ongoing employment flowing directly from the construction stage alone, in residential building, landscaping, maintenance services, signage installation, wharf services, groundsmen and irrigation works are also feasible.

A further deconstruction of indigenous employment by industry sector is displayed in Table 3.5. The table reaffirms the importance of both CDEP initiatives and the public sector to indigenous employment. In 1996, the private sector employed only 27 per cent of the indigenous workforce in Ceduna DC compared to 49 per cent for South Australia. The limited success of indigenous people in finding employment within the Ceduna private sector raises important concerns over the prospects of indigenous people successfully obtaining permanent employment within the region without further assistance from the public sector, or support to establish eco-tourism ventures, income generating businesses and employment through the Ceduna Keys and Coastal Centre

project. However, the value of experience in the real workforce cannot be underestimated.

Table 3.5
Indigenous Employment by Sector and Level of Government
Ceduna and South Australia - 1996

	Ceduna (DC)	Ceduna (AR)	South Australia
Persons			
Commonwealth government	15	30	453
State/Territory government	31	61	763
Local government	3	9	152
Private sector	71	196	2232
CDEP(a)	124	189	741
Not stated	17	23	187
Total	261	508	4528
Per cent			
Commonwealth government	5.7	5.9	10.0
State/Territory government	11.9	12.0	16.9
Local government	1.1	1.8	3.4
Private sector	27.2	38.6	49.3
CDEP(b)(c)	47.5	37.2	16.4
Not stated	6.5	4.5	4.1
Total	100.0	100.0	100.0

(a) Community Development Employment Projects Scheme.
Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

Table 3.6 shows an occupational distribution of employment for the Ceduna and South Australian regions. The occupational profile for the Ceduna DC population is broadly similar to that of South Australia's, however there are some distinct differences. Ceduna has disproportionately lower shares of persons employed as Professionals (12 per cent) and Intermediate Clerical, Sales and Service workers (12 per cent) than South Australia (17 and 16 per cent respectively). Meanwhile, a larger share of Ceduna's population is employed as Managers and Administrators (17 per cent) and Labourers and related workers (17 per cent) relative to South Australia (10 per cent each). These last two classifications represent the largest forms of employment within the Ceduna region and serve to illustrate a distinct difference that exists between the indigenous and non-indigenous populations. That is, indigenous persons are disproportionately employed in relatively lower skilled occupations compared to non-indigenous workers. For example, approximately 43 per cent of all indigenous workers are employed as labourers and related workers but only a minority (4 per cent) are employed as managers and administrators. However, the occupation Manager includes farm managers which in a dominant agricultural region, would be expected to be high and in the main, also non-indigenous. We have indicated some gradual progress in this regard with several farms

under Aboriginal management. Indigenous representation among the professional and associate professional occupations remains on par with that for the Ceduna population as a whole.

Table A3.6
Employment by Occupation
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
Number						
Managers and Administrators	9	20	212	265	3,246	58,604
Professionals	27	52	538	186	1,834	97,943
Associate professionals	23	45	393	172	1,615	63,858
Tradespersons and related workers	9	35	498	169	2,153	76,827
Advanced clerical and service workers	8	14	91	52	481	22,116
Intermediate clerical, sales and service workers	29	67	839	192	1,750	96,104
Intermediate production and transport workers	8	24	333	135	1,445	52,436
Elementary clerical, sales and service workers	19	38	340	114	1,026	50,262
Labourers and related workers	107	183	1,001	269	1,755	59,855
Inadequately described	7	18	122	22	141	4,714
Not stated	3	19	162	30	316	9,788
Total	249	515	4,529	1,606	15,762	592,507
Per cent						
Managers and Administrators	3.6	3.9	4.7	16.5	20.6	9.9
Professionals	10.8	10.1	11.9	11.6	11.6	16.5
Associate professionals	9.2	8.7	8.7	10.7	10.2	10.8
Tradespersons and related workers	3.6	6.8	11.0	10.5	13.7	13.0
Advanced clerical and service workers	3.2	2.7	2.0	3.2	3.1	3.7
Intermediate clerical, sales and service workers	11.6	13.0	18.5	12.0	11.1	16.2
Intermediate production and transport workers	3.2	4.7	7.4	8.4	9.2	8.8
Elementary clerical, sales and service workers	7.6	7.4	7.5	7.1	6.5	8.5
Labourers and related workers	43.0	35.5	22.1	16.7	11.1	10.1
Inadequately described	2.8	3.5	2.7	1.4	0.9	0.8
Not stated	1.2	3.7	3.6	1.9	2.0	1.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The Australian Bureau of Statistics does not publish breakdowns by part-time and full-time employment within the indigenous profile for the Ceduna regions. However, an appreciation for the extent to which indigenous persons are employed in full-time employment can be ascertained from Table 3.7 which shows indigenous employment by hours worked.

Table 3.7
Indigenous Employed Persons by Hours Worked
Ceduna and South Australia - 1996

	Ceduna (DC)	Ceduna (AR)	South Australia
Number			
15 hours or less	107	133	909
16-24 hours	25	52	421
25-34 hours	10	49	465
35-39 hours	71	154	1283
40 hours	15	48	670
41 hours or more	13	42	558
Not stated	20	30	222
Total	261	508	4528
Per cent			
15 hours or less	41.0	26.2	20.1
16-24 hours	9.6	10.2	9.3
25-34 hours	3.8	9.6	10.3
35-39 hours	27.2	30.3	28.3
40 hours	5.7	9.4	14.8
41 hours or more	5.0	8.3	12.3
Not stated	7.7	5.9	4.9
Total	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The ABS defines full-time employees as persons who usually work 35 hours or more per week in their job with those working less than 35 hours per week classified as part-time employees. On this basis, approximately 38 per cent of the Ceduna DC indigenous workforce was engaged in full-time employment while 54 per cent were employed part-time in 1996. By comparison, approximately 62 per cent of the total Ceduna DC workforce was employed on a full-time basis with 35 per cent employed part-time. Interestingly, full-time employment was also significantly higher among the indigenous workforces of the Ceduna AR (48 per cent) and total South Australia (55 per cent).

The decreased level of full-time employment among indigenous persons in the Ceduna DC reflects the increased importance of CDEP employment within the region given the limited indigenous employment opportunities currently available within the community. The CDEP scheme traditionally only provides employment of a short-term and transitory nature. This is especially demonstrated by the fact that approximately 41 per cent of indigenous persons within the Ceduna DC worked less than 15 hours per week compared to 20 per cent of South Australian indigenous workers.

It is pertinent to note that the Federal Government recently introduced changes to the CDEP scheme designed to encourage program participants to move into longer-term employment. The CDEP placement incentive programme was announced in September 2000 and provides a $2,000 payment to CDEP organisations who place their participants into permanent jobs outside the program. If effective, the program has the potential to increase full-time employment among the indigenous working population of Ceduna as well as providing additional funds to the local CDEP office.

Changes in indigenous employment by hours worked over time are shown for the Ceduna ATSIC Region in Table 3.8. Due to a substantial decrease in the number of non-responses, the proportion of indigenous persons engaged in part-time and full-time employment both increased between 1991 and 1996. The proportion working full-time hours increased from 40 to 48 per cent while those working part-time hours increased from 40 to 46 per cent.

Table 3.8
Indigenous Employed Persons by Hours Worked
Ceduna ATSIC Region - 1991 and 1996

	Persons		Per Cent	
	1991	1996	1991	1996
15 hours or less	76	133	22.4	26.2
16-24 hours	43	52	12.7	10.2
25-34 hours	18	49	5.3	9.6
35-39 hours	81	154	23.9	30.3
40 hours or more	55	90	16.2	17.7
Not stated	66	30	19.5	5.9
Total	339	508	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

3.1.3 Skill and Education Profile

We now turn to a more detailed analysis of the educational and skills profile of the Ceduna population. The age at which the population left school provides a general indication of the educational status of the workforce. Table 3.9 shows a percentage breakdown of the age at which the Ceduna and South Australian indigenous and non-indigenous populations left school. Generally speaking, the Ceduna population profile

is skewed towards people leaving school at younger ages. For instance, 25 per cent of the Ceduna population had left school by age 15 compared to 20 per cent of the South Australian population. In part, the tendency for the Ceduna population to have left school at earlier ages largely reflects the industry structure of the Ceduna economy; employment is concentrated within the agriculture, forestry and fishing industry which traditionally requires minimal formal training.

Table 3.9
Age Left School (per cent of population)
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
14 years and under	12.3	13.2	15.0	17.7	17.1	15.9
15 years	30.7	28.1	21.2	24.7	22.4	19.5
16 years	21.2	24.8	20.4	23.5	24.5	22.7
17 years	13.8	14.6	121.8	17.5	18.8	20.8
18 years	4.9	3.2	4.8	4.4	5.1	7.2
19 years and over	2.3	1.2	2.1	1.5	1.5	2.9
Still at school	4.4	4.9	5.5	3.8	4.4	4.4
Never attended school	0.6	1.4	2.5	0.5	0.3	0.6
Not stated	9.7	8.7	15.7	6.3	5.9	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The educational attendance profile of Ceduna's indigenous population is somewhat mixed when evaluated against the entire population. A relatively smaller proportion of indigenous persons left school aged 14 years or under, whereas a larger percentage departed at 15 years of age. On balance the indigenous population tended to receive shorter periods of schooling than the non-indigenous population. However, over time, there is a trend for indigenous people to spend longer periods in education. Table 3.10 provides a proportional breakdown of the ages at which the indigenous population of the Ceduna ATSIC region left school in 1991 and 1996. The data show that smaller proportions of indigenous persons left school at younger ages in 1996 than in 1991.

A more thorough understanding of both the educational attainment and skills profile of the Ceduna population can be obtained from Table 3.11 which shows the Ceduna and South Australian populations according to their respective qualification details.

Table 3.10
Indigenous Population - Age Left School
Ceduna ATSIC Region - 1991 and 1996

	Persons		Per cent	
	1991	1996	1991	1996
14 years and under	138	141	15.5	13.2
15 years	264	301	29.7	28.1
16 years	224	266	25.2	24.8
17 years	91	156	10.2	14.6
18 years	31	34	3.5	3.2
19 years and over	9	13	1.0	1.2
Still at school	29	52	3.3	4.9
Never attended school	20	15	2.2	1.4
Not stated	84	93	9.4	8.7
Total	890	1,071	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

In some respects the Ceduna population is relatively less qualified than the South Australian population. A larger proportion of the Ceduna DC population (68 per cent) reported having no post-school qualifications than did the South Australian population in 1996 (62 per cent). Furthermore, Ceduna had lower representation among all post-school qualifications listed in Table 3.11. The relatively less qualified nature of the Ceduna population is again largely a symptom of the structural focus of the Ceduna economy towards rural industries which inherently place reduced importance on employees having post-school qualifications. One would expect a similar distribution of qualifications for any other remote regional community in Australia.

Looking more closely at Ceduna's population with post-school qualifications, 9 per cent of the total District Council population had skilled vocational qualifications, 4 per cent had a bachelor degree, 3 per cent basic vocational qualifications and 3 per cent an undergraduate diploma. This sequential distribution of qualifications was broadly in-line with the State pattern of qualification distribution.

Another factor explaining the proportionally lower representation of the Ceduna population amongst post-school qualification levels is the less qualified status of the Ceduna indigenous population. Approximately 78 per cent of all indigenous persons within the Ceduna DC region had no post-school qualifications in 1996. This corresponds with the previously observed characteristic that indigenous persons tend to leave school at earlier ages than non-indigenous persons. Where indigenous persons did have post-school qualifications, there is a tendency for these qualifications to be concentrated towards the lower end of the post-school qualification profile with only minor representation of the indigenous population. For example, the main qualification of indigenous persons in the Ceduna DC region was basic vocational which represented

only 4 per cent of the indigenous population. This was followed by persons with skilled vocational (2 per cent), associate diploma (2 per cent) and undergraduate diploma qualifications (1 per cent). Some of this is compounded by the difficulty, after receiving training, of securing employment to satisfy the skills, competency and accreditation requirement which some occupations demand.

Table A3.11
Qualification (Highest) Level
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
Number						
Higher degree	0	3	16	7	104	11,632
Postgraduate diploma	3	3	31	13	205	12,539
Bachelor degree	3	13	186	109	1,110	72,855
Undergraduate diploma	6	11	148	78	909	38,659
Associate diploma	7	11	156	45	381	24,761
Skilled vocational	11	29	528	243	2,847	119,024
Basic vocational	18	29	350	81	1,011	35,518
Inadequately described	3	3	47	22	206	8,296
Not qualified	373	846	8,599	1,820	18,540	694,480
Not stated	52	122	2,314	245	2,718	110,625
Total	476	1,070	12,375	2,663	28,032	1,128,389
Per cent						
Higher degree	0.0	0.3	0.1	0.3	0.4	1.0
Postgraduate diploma	0.6	0.3	0.3	0.5	0.7	1.1
Bachelor degree	0.6	1.2	1.5	4.1	4.0	6.5
Undergraduate diploma	1.3	1.0	1.2	2.9	3.2	3.4
Associate diploma	1.5	1.0	1.3	1.7	1.4	2.2
Skilled vocational	2.3	2.7	4.3	9.1	10.2	10.5
Basic vocational	3.8	2.7	2.8	3.0	3.6	3.1
Inadequately described	0.6	0.3	0.4	0.8	0.7	0.7
Not qualified	78.4	79.1	69.5	68.3	66.1	61.5
Not stated	10.9	11.4	18.7	9.2	9.7	9.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

The proportion of the indigenous population with qualifications has increased over time. Table 3.12 shows that the proportion of indigenous persons within the Ceduna ATSIC region with no post-school qualifications has decreased from 84 per cent in 1991 to 79 per cent in 1996. Encouragingly, growth in the number of indigenous persons with qualifications has not been concentrated solely towards the lower end of the post-school qualification scale. For instance, there were no indigenous persons with a bachelor degree in 1991, by 1996 there were 13.

Table 3.12
Indigenous Population - Qualification Level
Ceduna ATSIC Region - 1991 and 1996

	Persons		Per cent	
	1991	1996	1991	1996
Higher degree	3	3	0.3	0.3
Postgraduate diploma	0	3	0.0	0.3
Bachelor degree	0	13	0.0	1.2
Undergraduate diploma	10	11	1.1	1.0
Associate diploma	0	11	0.0	1.0
Skilled vocational	17	29	1.9	2.7
Basic vocational	18	29	2.0	2.7
Inadequately described	3	3	0.3	0.3
Not qualified	743	846	83.8	79.1
Not stated	93	122	10.5	11.4
Total	887	1,070	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

Table 3.13 shows the field in which the Ceduna and South Australian indigenous and total populations hold their qualifications. With the Ceduna DC population having proportionally lower representation among the various qualification levels relative to the South Australian population, it follows that Ceduna has disproportionately lower representation among a majority of the qualification fields reported in Table 3.13. The most important fields for Ceduna ranked according to their share of the total population are Engineering (6 per cent), Education (4 per cent), Business and Administration, and Health (both 3 per cent).

The unqualified status of an overwhelming majority of the indigenous population also minimises their representation within the various qualification fields relative to the total population. In particular, the indigenous population has lower representation within the Engineering, Education and Health fields. The most important fields for indigenous qualifications are Business and Administration (4 per cent), and Society and Culture (3 per cent).

Table 3.13
Qualification (Highest) Field
Ceduna and South Australia - 1996

	Indigenous			Total		
	Ceduna (DC)	Ceduna (AR)	SA	Ceduna (DC)	Ceduna (AR)	SA
Number						
Business & administration	18	25	318	81	716	51,098
Health	5	10	171	80	990	47,783
Education	6	18	149	95	1,006	36,001
Society and culture	14	23	337	73	505	40,377
Natural and physical sciences	3	0	39	13	237	18,603
Engineering	5	18	298	148	2,075	93,502
Architecture and building	6	10	119	46	545	23,569
Agriculture and related fields	3	5	74	27	475	7,841
Miscellaneous fields	3	9	147	67	753	25,233
Inadequately described	3	0	23	13	72	3,716
Not qualified(a)	373	846	8,599	1,820	18,540	694,480
Not stated	39	103	2,101	206	2,114	86,184
Total	478	1,067	12,375	2,669	28,028	1,128,387
Per cent						
Business & administration	3.8	2.3	2.6	3.0	2.6	4.5
Health	1.0	0.9	1.4	3.0	3.5	4.2
Education	1.3	1.7	1.2	3.6	3.6	3.2
Society and culture	2.9	2.2	2.7	2.7	1.8	3.6
Natural and physical sciences	0.6	0.0	0.3	0.5	0.8	1.6
Engineering	1.0	1.7	2.4	5.5	7.4	8.3
Architecture and building	1.3	0.9	1.0	1.7	1.9	2.1
Agriculture and related fields	0.6	0.5	0.6	1.0	1.7	0.7
Miscellaneous fields	0.6	0.8	1.2	2.5	2.7	2.2
Inadequately described	0.6	0.0	0.2	0.5	0.3	0.3
Not qualified(a)	78.0	79.3	69.5	68.2	66.1	61.5
Not stated	8.2	9.7	17.0	7.7	7.5	7.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

(a) Includes persons with a qualification outside the scope of the ABS Classification of Qualification.
Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

For the observed increase in the number of indigenous people with qualifications between 1991 and 1996 (see Table 3.12), Table 3.14 reveals how the composition of indigenous qualifications by field have changed over this time for the Ceduna ATSIC region. Growth in qualifications for the indigenous population was concentrated in the fields of Society and Culture, and Business and Administration, both fields representing approximately 2 per cent of the indigenous population in 1996. More modest gains have

occurred for the fields of Engineering and Education. The number of indigenous persons with qualifications within the Natural and Physical Sciences and Health fields declined between 1991 and 1996.

Table 3.14
Indigenous Population - Qualification (Highest) Field
Ceduna ATSIC Region - 1991 and 1996

	Persons		Per cent	
	1991	1996	1991	1996
Business & administration	11	25	1.2	2.3
Health	12	10	1.3	0.9
Education	14	18	1.6	1.7
Society and culture	10	23	1.1	2.2
Natural and physical sciences	3	0	0.3	0.0
Engineering	10	18	1.1	1.7
Architecture and building	7	10	0.8	0.9
Agriculture and related fields	5	5	0.6	0.5
Miscellaneous fields	8	9	0.9	0.8
Inadequately described	0	0	0.0	0.0
Not qualified(a)	743	846	83.5	79.3
Not stated	67	103	7.5	9.7
Total	890	1,067	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

3.1.4 Income Profile

Australia Taxation Office data presented in the Ceduna Economic Profile (Appendix 1.1.3) showed that in 1997-98 the mean taxable income of Ceduna's taxpayers ($25,896) was lower relative to the state average ($30,474). That incomes among the Ceduna population are lower is not surprising given both the relatively less qualified nature of the Ceduna workforce and the presence of a large indigenous population which is primarily engaged in part-time employment with significant public sector support. A more detailed analysis of Ceduna and South Australian incomes based on 1996 Census data follows.

Table 3.15 summarises the mean weekly individual income of indigenous and non-indigenous persons in Ceduna and South Australia. As was indicated by the Australian Taxation Office data, the mean individual weekly income for Ceduna DC ($259) was lower relative to South Australia ($267). The differences in individual incomes appears to be entirely due to the lower economic status of the Ceduna indigenous population as the Ceduna DC non-indigenous population possessed a higher mean individual income ($288) compared to the South Australian non-indigenous population ($270). Mean

individual income for non-indigenous persons was slightly lower at the ATSIC regional level, however.

The reasons for the lower economic status of Ceduna's indigenous population have been stated previously but in summary relate primarily to the limited employment opportunities available for indigenous persons in remote communities and their lack of necessary skills and work experience. In this respect the Ceduna Keys and Ceduna Cultural Centre presents an ideal opportunity for indigenous persons to gain work experience, to apply the skills that many have acquired, to learn new skills, and ultimately improve their standard of living through seeking employment outside the CDEP scheme.

Table 3.15
Mean Weekly Individual Income ($)
Ceduna and South Australia - 1996

	Indigenous	Non-indigenous	Total
Ceduna DC	169	288	259
Ceduna AR	174	267	261
South Australia	191	270	267

Source: ABS, Ceduna and South Australian Indigenous Community Profiles, 1996 Census of Population and Housing

The differences in indigenous and non-indigenous incomes are reaffirmed by Table 3.16 which shows the distribution of individuals by weekly income level for Ceduna DC and South Australia. Looking at the two income brackets which represent the largest population shares, Ceduna's indigenous representation in the lower $120-199 income bracket was higher relative to South Australia (40 per cent in Ceduna versus 29 per cent of total State indigenous persons), whereas the reverse held true for the higher income bracket of $200-399 (18 per cent versus 23 per cent). In other words, weekly individual incomes for indigenous residents of Ceduna tend to be more heavily skewed to the lower levels than the state average for indigenous persons. It is interesting to note that indigenous representation among the highest income levels was marginally higher in Ceduna than for South Australia. The distribution of all individuals by income level was broadly similar for both Ceduna DC and South Australia.

Table 3.16
Weekly Individual Income
Ceduna (DC) and South Australia - 1996

	Indigenous		Total	
	Ceduna (DC)	SA	Ceduna (DC)	SA
Number				
Neg/Nil income	22	743	150	63,648
$1-$119	50	1,274	218	103,357
$120-$199	194	3,566	669	274,205
$200-$399	86	2,787	636	249,032
$400-$599	36	1,352	464	197,005
$600-$799	26	524	215	99,694
$800-$999	9	154	90	43,531
$1,000 or more	12	134	57	41,401
Not stated	51	1,842	152	56,516
Total	486	12,376	2,651	1,133,255
Per cent				
Neg/Nil income	4.5	6.0	5.7	5.6
$1-$119	10.3	10.3	8.2	9.1
$120-$199	39.9	28.8	25.2	24.2
$200-$399	17.7	22.5	24.0	22.0
$400-$599	7.4	10.9	17.5	17.4
$600-$799	5.3	4.2	8.1	8.8
$800-$999	1.9	1.2	3.4	3.8
$1,000 or more	2.5	1.1	2.2	3.7
Not stated	10.5	14.9	5.7	5.0
Total	100.0	100.0	100.0	100.0

Source: ABS, Ceduna DC, Ceduna AR and South Australian Indigenous Profiles, 1996 Census of Population and Housing.

Appendix 3.2

Employment and Training Strategy

3.2.1 Introduction

The Ceduna Keys and Ceduna Coastal Centre development is intended to generate additional employment in Ceduna. As discussed in Appendix 1.3.1, employment will occur both in the construction stage and in the operation stage. This will result in a range of jobs and while the aims of the developers are to employ as many local people as possible including a proportional share of Aboriginal people, if the local people do not have the training for this range of jobs, employees will need to be brought in from elsewhere. It is therefore imperative that training strategies be developed immediately and that the potential local employees undergo appropriate training so that they are prepared for when the jobs are created in the various stages of the development.

Discussions with TAFE in Ceduna have indicated that training can be organised and undertaken for almost all jobs with the main exclusion being the operation of large heavy earth-moving equipment. During the development of the Port Lincoln marina, this work was undertaken by personnel who were both operators and trainers from Civil Skills and sufficient staff were trained to operate the equipment on a continuous 24-hour basis. Other training strategies are discussed under the appropriate headings below.

3.2.2 Construction Stage:

- *Large Excavation Earthworks* - workmen are currently gaining experience with the Ceduna DC in the use of smaller earthmoving equipment and these employees would have the potential to move to the more advanced training provided by Civil Skills for the bigger equipment.
- *Smaller Earthworks* — this will be ongoing work in a range of areas including the maintenance of the wetlands and the overall landscaped areas, and there is the opportunity for more workers to be trained within the Ceduna DC workforce. Local preliminary training can be conducted by TWT in conjunction with that provided by Civil Skills. Early stage discussions with Civil Skills will be necessary as part of the training planning strategy.
- *Construction* — construction work will be required in the development of infrastructure such as marina wharves, service buildings, fuel suppliers, roadworks etc., and also after the initial work, in the construction of residential housing, the interpretive centre buildings and the conference facilities, theatres and other infrastructure including motel type accommodation facilities to support the conference centre. Within all this construction there will be a broad range of trade skills required and it is in the interests of future employment for appropriate courses to be planned now. Certificate II in Civil Construction is available through the Port Lincoln TAFE campus. This course provides core competencies for work on construction sites including scaffolding, excavation and support, laying pipes, concreting, use of power tools etc.. Training and assessment is carried out with the focus on the project situation and as

Accredited Workplace Assessors, staff can assist in workshop and on-site assessments. There is the possibility that this early training can be conducted in association with CDEP which would provide opportunities for the workshop and on-site assessments.

Most of the early stage growth in employment has been shown to be in the building and construction sector (see Appendix 1.3.3). TAFE have conducted a training needs analysis within the Ceduna region from Smoky Bay to Yalata to help in determining appropriate courses to be offered. In anticipation of the growth in building construction and as part of the TAFE Aboriginal Education program, a Level I Certificate in Building Construction is commencing in 2001 in Ceduna. It will be supported ultimately by the Aboriginal Housing Authority, DEWRSB, CDEP and TAFE with the Housing Authority providing the opportunity for practical training. The aim is to assess all students and provide credit for existing skills, provide training to fill the gaps and then the students will have an accredited qualification and the opportunity to move on to higher level certificates in their chosen area of specialisation within the building trade. This particular course is for Aboriginal students only. Non-Aboriginal students wishing to gain qualifications in the building trades must study in Adelaide although a general pre-vocation course in the building construction field could be available in Ceduna.

Gathering other potential opportunities for work experience should be part of the planning strategy. Existing builders and constructors will be able to take advantage of any increase in local construction, but more are likely to be required in the short-term.

- *Developmental Earthworks and Outdoor Construction* — and by this we mean, the subsequent development following from the earlier earthworks such as the development of the wetlands, the construction of walkways, fences, viewing platforms, the landscaping of the surrounding areas, irrigation and golf course upgrading, horticulture, etc.. Training in civil construction would also be advantageous in this area. Relevant core competencies in the Level II course include site drainage/dewatering, carrying out measurements and calculations, reading and interpreting plans, spreading and compacting materials, concreting and pavement work, etc.. Training has a focus on the actual project situation.

- *Horticulture and Natural Resource Management* — the outdoor development will also require skills in horticulture and landscape as well as the more obvious tasks. TAFE offers a range of courses from the Port Lincoln Campus but workshops would be conducted in Ceduna for students. A range of courses are offered but it would be anticipated that most work would require Level II or Level III training. Within these Certificate Level courses, there are a range of specialisations offered which include landscape, arboriculture, parks and gardens, nurseries and turf. Additional work is planned to upgrade the golf course and specialised experience in turf horticulture would be required there. Work would also be available which requires training in natural resource management, plant identification and revegetation.

  There is currently a group of trainees undergoing horticultural training in Ceduna under the instruction of Port Lincoln staff. With the establishment of the Ceduna Coastal Centre there will be the opportunity for ongoing traineeships in a broad range of horticultural and natural resource management

areas. Additional staff are expected to join the horticulture staff at Port Lincoln early in first semester 2001 which will facilitate the offering of additional courses. In terms of timing, quick response to increased demand is usual and where funding by ATSIC is concerned, the funding response time is quite fast. Training is based on open learning delivery with practical skills workshops and the conduct and delivery of any course is quite flexible and courses are designed to suit the project and to enable staff to work with the project.

More senior horticultural staff will probably need to be recruited from further afield to plan the development work, unless these skills are available within Ceduna at the appropriate time. Although TAFE can structure the courses to suit the work being undertaken, the planning must be done well in advance and the training co-ordinated so that the students have completed their training at the time that the actual work will become available. Work experience within the training period is also important here.

- *Transport* — this is an area which will probably expand a little even without the development. Growth in aquaculture will automatically feed into growth in the transport sector to ensure production reaches its markets. If the development goes ahead, the transport sector will also assist in the delivery of appropriate materials and equipment, especially during the construction stage. Transport employment, not only includes driving but also loading/unloading and clerical work as well as refuelling or repair services. The co-ordination of appropriate training and the provision of work experience opportunities are essential to this range of employment. Short forklifting training courses are available on demand from Port Lincoln TAFE, and can be offered through TWT.

3.2.3 Operational Stage:

- *Retail Trade and Services* — although there is no plan to replicate retail and other services already available in the town centre, there will still be a need for staff in the marina related activities, such as selling fuel and marina stores and repairs etc.. These jobs will require some skilled knowledge and therefore the provision of appropriate training will be important. Modules within the TAFE Certificate in Retail Studies which are available in Ceduna through the Open Learning System would be appropriate. If some of these anticipated retail activities do not currently exist in the Ceduna region, it will be difficult to provide appropriate work experience to co-ordinate with the training and so this will need to be considered within the training strategy. TAFE staff could contribute to this planning.

- *Food Services* — within the interpretive centre and ultimately, the venues associated with the operation of the accommodation and conference centres, there will be a need for a variety of food services, from quick snacks and coffee, to conference catering, to restaurant meals. Trained and experienced chefs will probably come from elsewhere but kitchen-hands and waiting staff can be trained locally as can staff associated with quick over-the-counter sales. The training strategies for the varying jobs need to plan ahead to co-ordinate with the availability of the jobs. Well trained staff in these areas are very important in creating the right atmospliere to ensure that the visitors return and that they tell others about the great experience that they had.

Training is available within the Hospitality Program for work in this area. This training is based in Port Lincoln where up-to date kitchen facilities are provided and necessary since the courses have their emphasis largely on practical work. There are Certificate courses on Hospitality Operations which include waitering and in Kitchen Operations and Commercial Cookery. All new apprenticeships are required to undertake appropriate courses for these nationally recognised Certificate qualifications. TAFE can customise courses for group employers. Each qualification in the Hospitality Training Package signifies the achievement of industry recognised competence.

- *Accommodation Services* — staff to provide services in accommodation providers will also be required once accommodation supporting the conference centre is provided. Again the planning strategy needs to co-ordinate training requirements with the demand for employment. Relevant work experience can perhaps be co-ordinated with existing accommodation providers.

- *Property and Business Services* — this area of jobs has already experienced growth prior to any development commencing so the expectation for even more jobs in the area is quite strong. Existing property agents could be expected to handle land and property sales within the development but they would probably need to increase the level of support staff and there are other areas which would require staff with clerical skills. These classes are already in demand in TAFE but it is important to have an effective planning strategy so that too many do not take on the course resulting in some being disappointed when they cannot find employment on completion of the course.

  Courses in Office Computing are available in Ceduna via the Open Learning System. The program offers modules from the National Office Skills curriculum and the modules can be studied individually or as part of an award. They form part of the Office Administration awards and include such topics as word processing, spreadsheets, database operations, desktop publishing and electronic mail and the internet.

- *Cultural and Recreational Services* — the completion of the interpretive centre will provide employment especially for Aboriginal people, although it should not be exclusively Aboriginal. Indoor and outdoor guides, demonstrators and sellers of Aboriginal arts and crafts, tellers of stories and providers of information, etc., all need to be Aboriginal to ensure the authenticity of the experience. However, there is scope for non-aboriginal involvement both in front and behind the scenes. Planning strategies for this type of employment are crucial. Staff need to be selected for their suitability to the specific job and appropriately trained. Guides who do not speak clearly are a disappointment to visitors especially those who are a little hard of hearing. Training in presentation and clear speech should be important aspects of this work. It is important to understand how other successful indigenous cultural centres have selected and trained appropriate staff for the different types of contact which will be made with visitors. It is understood that some information along these lines was gathered when the group looked at interpretive centres around Australia.

  There is a diverse range of programs available through TAFE's Aboriginal Employment Education Development Branch which some potential employees may choose as a first stage. For instance, Entry Level Training Certificates are

for people who have not been to school for a long time or for those who feel they need to upgrade their skills. Such courses can assist students to gain entry into other TAFE courses.

The TAFE Certificate in Tourism offered in the Open Learning System is based on a national curriculum developed to meet industry needs. It is offered in seven areas of specialisation, most of which will be very relevant to work in the Ceduna Coastal Centre, especially in relation to the operation of visitor information centres, tourist attractions/parks and tour leading. Training covers a wide range of relevant areas from financial transactions, to marketing and brochure preparation, to preparing and presenting tour commentaries and presenting interpretive activities, to researching and updating local and tourism industry knowledge, and to dealing with conflict situations.

It is important for all potential employees to undertake some of this training to help them understand the broad application of tourism and to enable them to participate more fully in the wide range of potential opportunities in the operation of the new development.

Fees apply to these TAFE courses but many students are eligible for financial assistance through AUSTUDY, ABSTUDY or Youth Allowance. All courses mentioned here are approved for study under these allowances.

Increased job generating activity which is induced by the initial development and its multiplier impacts may not in fact impact on training because some of the increase in employment may be represented as improvements in productivity or increased hours for existing staff. Consequently no comment is made on the training strategies required for any increase in employment generated in this manner. Since the jobs are likely to be in areas where jobs already exist, training is probably currently available.

Although not strictly a direct impact of the Ceduna Keys and Ceduna Coastal Centre development, it has been noted that the regional ATSIC council is seeking an accounting firm to provide a comprehensive range of accounting services and professional support to ATSIC organisations between Port Lincoln and Yalata. A condition of the appointment is that the selected firm is required to establish an office in Ceduna. It is envisaged that some local knowledge would be required to assist in effectively providing the required accounting services but the local knowledge will need to be provided by someone who can also offer bookkeeping and accounting skills. This should create some opportunity for Aboriginal person(s) with bookkeeping qualifications or currently undergoing accounting training. These will be ongoing employment positions, likely to require office computing skills.

Discussions with TAFE indicate that they would be able to provide the following flexibility and range of courses:

- Tourism, hospitality and business studies — could easily expand if necessary although class sizes of less than 8-10 students cause some difficulties.

- Programs could be tailored to satisfy special needs — usually need a minimum of 10 students but it can be done for smaller groups although this will tend to incur higher fees/charges. TAFE is currently beginning to do this e.g., for ATSIC specified courses.
- Traineeships are provided for but in some instances the trainees are not attached to an employer because some employers are not willing to take on trainees for a variety of reasons including the trainee being seen ultimately as competing for available work. For instance, there is a building trades program beginning in 2001 - involves modules from the apprenticeship course but students will not necessarily be linked to an employer.
- Courses in retail studies and also horticulture can also be undertaken and can be flexible in their operation (although currently they would need to bring in someone from another campus to teach horticulture or alternatively, expand their staff in Ceduna). Mechanical studies could also be easily undertaken as there is a big workshop within TAFE which is currently very underutilised. With any new courses offered to satisfy demand from an employer or group, the general community can then gain access to any unfilled places up to a maximum size.
- Courses in the community service area which would flow indirectly from any development such as the marina are currently offered e.g., child care, youth workers, aged care workers and other community service areas.

TAFE offers flexibility in what can be taught and how it can be taught e.g., using open learning, video conferencing, flexible timing schedule (short courses or longer than usual) with e-learning on the internet coming very shortly.

Aboriginal education courses are provided free to students and funded externally and courses in women's education are subsidised externally. Adult evening and short term community courses e.g., a range of art and craft courses, are also provided by TAFE.

Changing TAFE programs or introducing new ones sometimes tends to take time, but training courses for Aborigines are generally approved - the external funding rather than competition for internal funds helps hasten the approval. Ceduna campus of TAFE should be able to provide all the necessary training over a variety of jobs in the marina and interpretive centre development ranging from horticulture/gardening, wetlands construction (e.g., pathways) and maintenance, interpretive centre staff to talk about the Aboriginal culture and homelands, retail, hospitality (including front of house, maintenance, kitchen etc), marine and mechanical services etc.. TAFE also stresses that it is important to gain work experience to go with the training. The training provided at the former emu farm site also has the potential to give Aboriginal students hands on practical experience.

Assistance may be available from the Federal Government through the New Apprenticeships Scheme. A media release by Minister Kemp in October 2000 launched a major national communications campaign to regional and rural Australia. Employers and young people in rural and regional Australia would be targeted with information about how New Apprenticeships could enhance their skills base and provide real employment opportunities. Focusing on key rural and regional industries of agriculture,

automotive, electrical and production horticulture, the communications campaign drives home the messages to both employers and young people of the benefits of the flexible, nationally recognised training available under New Apprenticeships. Regional communities are also about more than agriculture and there are New Apprenticeships in sectors as diverse as information technology, retail trade, tourism, hospitality, property and business services, community services and health, finance and communication. The Federal Government supports New Apprenticeships with financial incentives of up to $4,400 for New Apprenticeships employers, with an additional $1,100 incentive for employers in areas where there is an identified skill shortage in rural and regional Australia.

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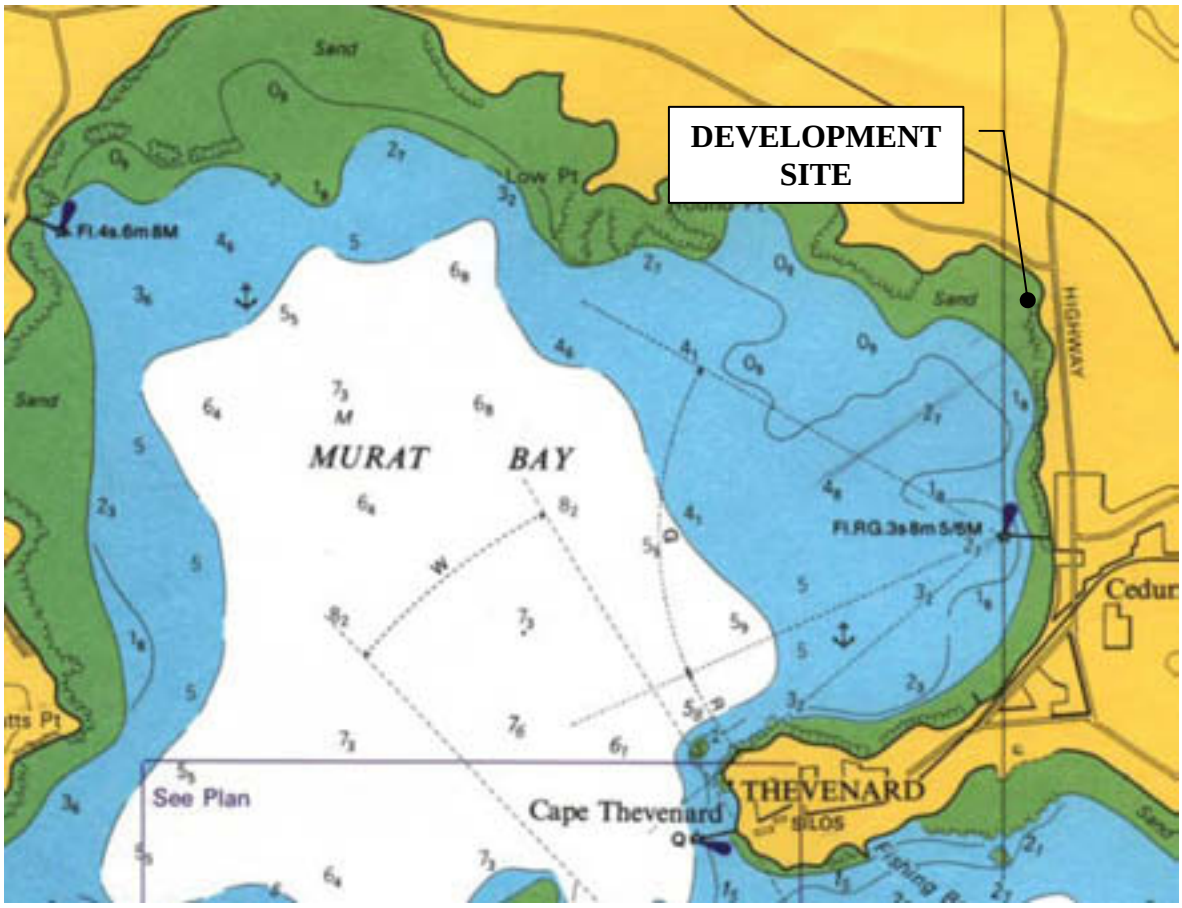
Ceduna Keys

COASTAL ENGINEERING STUDY



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PRELIMINARY STUDY OF BREAKWATER LOCATION AND HEIGHT,

SAND AND SEAGRASS MOVEMENTS AND

ENTRANCE CHANNEL STABILITY

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1. AIM OF STUDY

The aim of the study is to provide advice on the layout and construction of the breakwaters and to comment on the workability of the entrance channel.

The document prepared by DSC, studying wave conditions at the site and detailing water levels, has been used as a basis for this study.

Considerations regarding the breakwaters are: how far out they should extend and how high they should be to achieve protection while not creating too great a visual obstruction.

Comment is required on sand and seagrass movements in Murat Bay and how these will effect the proposed structures and inlet channel.

2. DATA SUPPLIED

- Study by DSC, engineering assessment for EIS, August 2004
- Reports by Eco Management Services, Draft Environmental Assessment, August 2004
- Water circulation patterns SA Coastal Seas, University of Adelaide, March 1998
- Drawing of proposed development overlaid on aerial photograph.

3. SITE INSPECTION

A site inspection was carried out on 10th December 2004, with a view to reaching a better understanding of the coastal processes.

The following locations were visited around the Murat bay, see Figure 1, **Cover Page**:
1. Eastern side of the bay at Thevenard,
2. Boat Launching ramp,
3. Yacht club,
4. Beach at development site,
5. Westside of above Beach.

Observations made at each site are described below.

Site 1 - Thevenard.
The rocky cliffs were noted and the lack of any substantial sand sources, some erosion from wave action was evident.

Site 2 – Boat Ramp

The rock fill approach to the boat ramp crosses a fairly narrow sandy beach. It was noted that there was a small accretion of sand on the west side of the approach, indicating some small eastward movement of sand.
Some dead seagrass was noted at the top of the beach.

Site 3 – Yacht Club

A concrete boat ramp has been built across the beach and there is a small accretion of sand against the ramp on the southern side, indicating a small drift in the northerly direction. A sample of sand was collected.

Site 4 – Beach at development site

The beach upon which the breakwaters will be constructed is very flat extending out approximately 500 meters to low tide level. At the top of the beach modest amounts of dead seagrass have collected and at the end of the beach mangroves are growing.

Small sand ripples occur, showing there is some disturbance of the sand by wave action. Fresh dead seagrass was in evidence halfway down the beach.

At low tide I excavated some small holes in the beach at several locations and noticed that only the top 50 mm of the sand was clean, after this shell grit and sand of a darker color occurred indicating only the top layer was being disturbed.

I then walked out to the start of the seagrass beds and at this point there was an increase in the slope of the beach. At the stop of the slope I was able to probe down approximately a metre and clean sand extended a fair way below the surface, indicating a greater movement of sand. I collected a sample of sand in this area.

Site 5 – On the western side at Round Point.
Mangroves are growing in the area. I walked out to the start of the seagrass and collected a sample of sand in a sandy patch. There were no signs of significant sand movement.

Nature of Sand

The sand collected from all the locations around the bay were very fine which would enable quite small waves to disturb and move it.

The overall impression formed was that there are small movements of sand around the bay, and that modest quantities of dead seagrass accumulate on most beaches .

Currents in Murat Bay

Tidal changes and wave action cause currents in the bay, which tend to move both sand and dead seagrass.

The University of Adelaide have carried out computer modeling of currents along the coastline and reported their results in: ‘Water Circulation patterns in South Australian Coastal Seas caused by tides and meteorological effects’. Section 2.2.1 of the Report discusses currents in Murat Bay and these are illustrated on Figure 2.24 reproduced below as Figure 2. The diagram on Figure 2 is for an incoming tide and a Southerly wind. Reasonable currents in the entrance to the bay are shown, but the currents indicated on the breakwater site are small and directly onshore and thus unlikely to cause transverse sand movements.

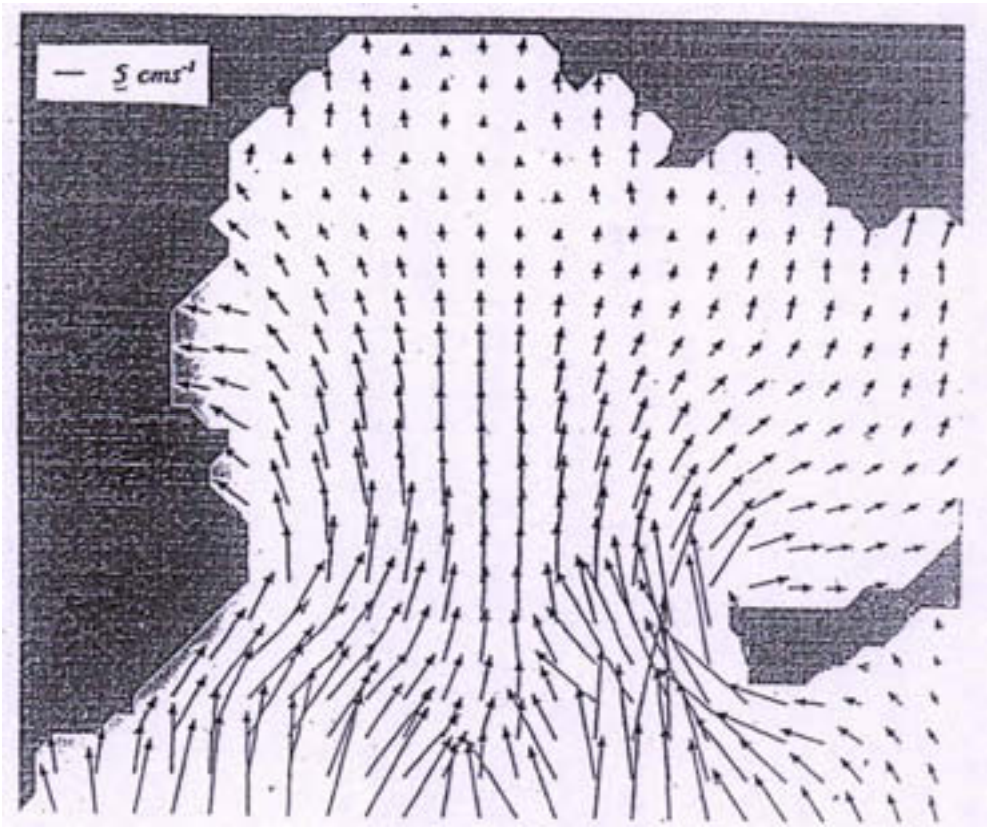

Figure 2 – Predicted Currents, Murat Bay

4. BREAKWATER ENTRANCE LOCATION

The location of the breakwater entrance is currently shown some distance back from the weed line.

Based on the observations set out in Section 3, I recommend the entrance be extended past the junction of sand and seagrass by approximately 30 metres.

By moving further out a greater natural depth is reached before starting on the dredge channel. There is always less sand movement in the deeper water. In the present location the natural depth is such that breakers would occur at very low tides and it is the waves breaking that cause disturbance of the sand with the possibility of sand movement.

To achieve the requirement above, the breakwaters themselves could be moved seawards or Training Walls could be extended alongside the channel as shown on Figure 3.

5. BREAKWATER SLOPES AND HEIGHT

The appropriate height of the breakwaters is based on determining the highest predicted water level and the run-up of the waves.

The sea level rise predicted by some authorities need not be factored into considerations of breakwater height as these can be raised if it becomes essential.

DSC found a maximum significant wave height of 1.9 metres, and an extreme tide level of RL +2.3 metres AHD, 100 year ARI storm.

Excessive overtopping is undesirable but a certain amount under very severe conditions is acceptable, and on this basis I am recommending a breakwater height at the entrance and extending along to the East which covers the section which is subject to the largest waves, of RL +4.0 metres related to AHD.

The Western breakwater can reduce in height as it heads towards to the shore, and could finish at RL +3.0 metres.

To reduce run up and improve long term stability of areas most exposed to wave action I recommend a slope of 1 in 3 in these areas which include the outer face of the western and southern breakwaters at the seaward end.

6. ENTRANCE CHANNEL

Based on the Admiralty Chart soundings the channel will need to extend out approximately a further 1000 metres from the end of the training walls.

To make appropriate comment on how the channel would perform we need to find out the type of material and so determine excavation method and channel slopes.

The area may be rocky with sand patches in which case the main problem will be excavation and side slopes could be quite steep for example 1 in 2, 1 vertical 2 horizontal, and if the area turns out to be fine sand then flatter slopes would be needed and most likely rock protection to prevent sideways erosion of the sea floor due to the wash from vessels.

An alternative to rock protection may be sand filled sacks or some type of geotextile container. It would be best if these arrangements allowed seagrass to repopulate the side slopes.

The other consideration is the possible infilling of the channel with sand or dead seagrass.

On the basis of present knowledge provided the channel sides are stabilised either naturally or with rock protection deposition of sand will be minimal but some seagrass accumulation can be expected.

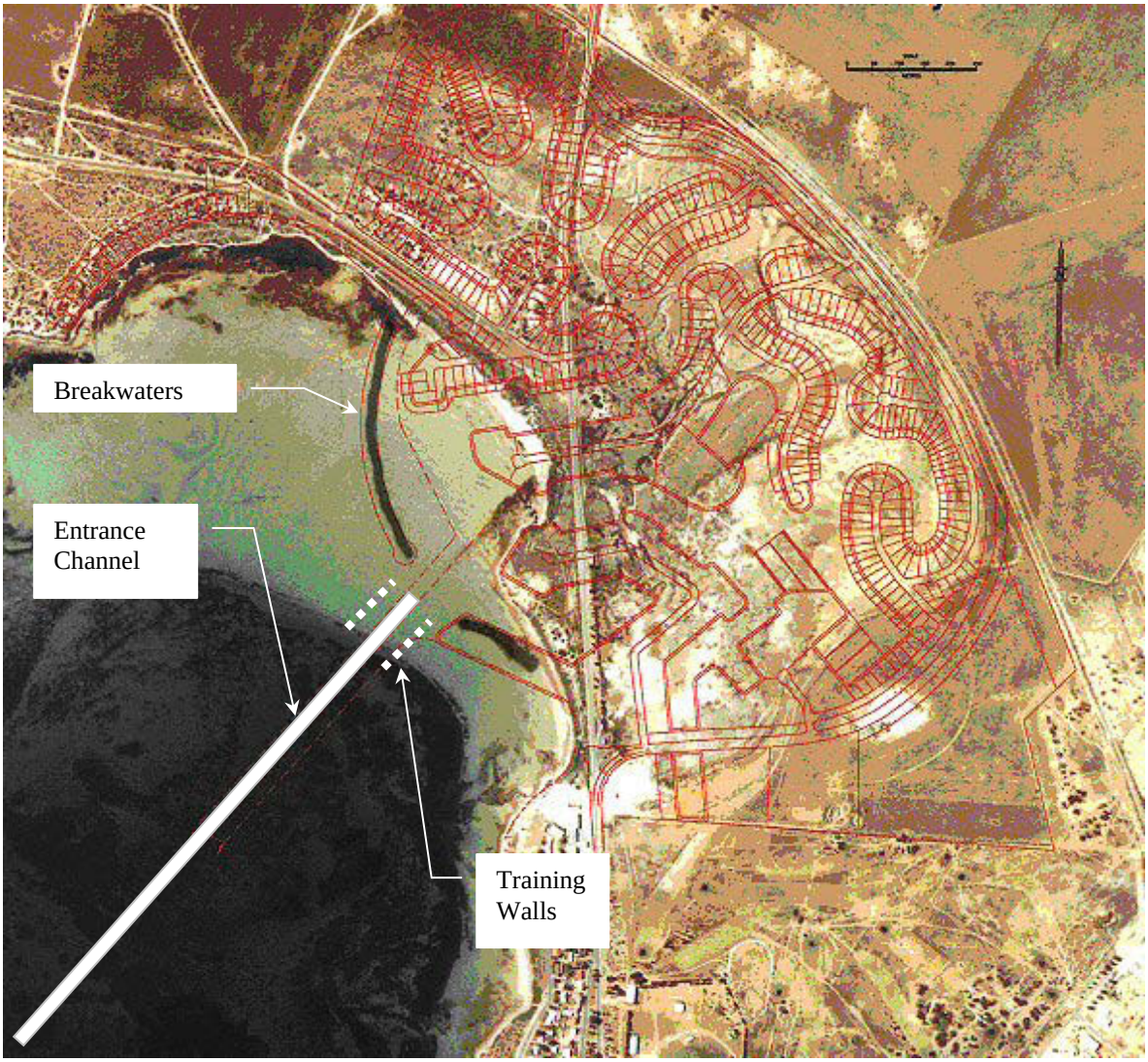

Figure 3 – Breakwaters and Channel Layout

7. CONDITIONS INSIDE THE HARBOUR

The entrance faces approximately South-West and with South-Westerly winds, the waves will approach the entrance directly and will travel through into the harbour. After passing through the entrance they will fan out and reduce in height. Some loss of energy will occur in the entrance and the 1 in 3 slopes which I am recommending in section 5, will also increase the dissipation of energy.

With Westerly winds, because the waves will approach the mouth at an angle and with the presence of training walls, a much greater dissipation of energy will occur and conditions inside will be very acceptable.

Although as described above waves created by South-Westerly winds will directly enter the entrance I still would not recommend making any changes to the entrance such as overlapping breakwaters to reduce input of wave energy because I think it is important that the access to the sea be direct and also it must be remembered that very bad conditions occur infrequently.

8. TRAINING WALLS

The training walls recommended in Sections 5 and 7 would be of similar construction to the breakwaters but the top level could be lower at approximately RL +3 metres.

The slopes on both faces should be 1 in 3 with appropriate armouring rock on both sides and top. Vessel wash and the effect of waves running along their faces needs to be allowed for.

The training walls have a further advantage that they will tend to cause sand or seagrass to be trapped in the re-entrant corners where they join the breakwaters rather than this material moving into the entrance and into the marina basin itself.

Accumulations in these corners would also be more accessible for periodic removal by land based equipment.

9. AERIAL PHOTOGRAPHS

Aerial photographs were obtained from Mapland extending back to 1958.

The following dates were obtained: 4/12/1958, 29/4/1980, 26/5/1998, 24/3/2004

The photographs were studied with special interest in the beach at the breakwater site and although it is not possible to reach a definite conclusion from such data, there is no obvious significant coastal changes.

10. FURTHER INVESTIGATION SUGGESTED

1. Soundings of the area covering the entrance channel
2. Penetrometer survey of the sea floor for preliminary determination of material and the depth of sand.
3. Tube sampling along the line of the channel, to detect changes in the material.

11. CONCLUSION

Murat Bay is a relatively sheltered bay and hence the coastal process are fairly benign.

It is our opinion that serious problems will not be encountered with sand or seaweed movement but care will be needed to properly establish the entrance channel.

It is our firm recommendation that the training wall arrangement outlined should be adopted because of its benefits in improving harbour tranquility, taking the protected channel into deeper water and in providing pockets to capture floating seagrass.

Figure 4 – Site of Breakwaters