GERALDTON-GREENOUGH COASTAL STRATEGY & FORESHORE MANAGEMENT PLAN

Coastwest

COASTCARE

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ATA Environmental
environmental scientists

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Checked by:	Name:	P. van der Moezel	Date: 16 February 2005
Approved by:	Signed:		
	Name:	P. van der Moezel	Date: 16 February 2005

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1. INTRODUCTION

1.1 Background

Existing coastal management plans for the City of Geraldton and Shire of Greenough were prepared in the early to mid 1980s and are out of date. Management of the coastal area is presently undertaken on an ad hoc basis and largely in response to action by community groups or in response to issues developing at specific sites. A revised and up-to-date management plan for the coastal area that will guide management of the coastal foreshore areas and identify priorities for implementation was needed.

The City of Geraldton and Shire of Greenough in conjunction with Active Community Environmentalists (ACE) with assistance from Coastwest/Coastcare grants commissioned preparation of this Geraldton-Greenough Coastal Strategy & Foreshore Management Plan.

A Steering Committee was formed to oversee preparation of the Geraldton-Greenough Coastal Strategy & Foreshore Management Plan to ensure the plan reflects the common vision of the local authorities and community. The Steering Committee included the following representatives:

- City of Geraldton
- Shire of Greenough
- Active Community Environmentalists (ACE)
- Community Consultative Committee
- Batavia/Gascoyne Coastal Facilitator

1.2 Geraldton-Greenough Coastal Foreshore Area

The Geraldton-Greenough Coastal Strategy & Foreshore Management Plan largely encompasses the coastal area between Drummond Cove in the north and the Greenough River mouth to the south. The study area is shown on Figure 1.

The foreshore area between Batavia Coast Marina and Geraldton Port, including Town Beach, is the subject of a separate detailed study. This area will therefore not be assessed in detail as part of this study, although proposals for this area will be considered in the context of the overall foreshore area and integration with adjoining areas.

1.3 Purpose & Approach

The Coastal Strategy & Foreshore Management Plan will guide decision making in relation to the management, protection and planning of foreshore and coastal areas. The plan will assist in the development of a forward planning strategy for the provision of community facilities and capital works within the coastal precinct, which may then be incorporated into the respective Council's Town Planning Schemes.

Implementation of works for specific uses or areas and appropriate management strategies will need to be consistent with the overall management strategies outlined in this document.

The document comprises Coastal Strategy and Foreshore Management Plan components. The Coastal Strategy outlines broader coastal strategies that relate to general management of the coastal environment including consideration of nearshore waters. The Foreshore Management Plan provides strategies at a more detailed level for the coastal foreshore largely confined to an area up to a maximum of about 150m inland from the beach.

The main focus of this study is the provision of specific management measures for the coastal foreshore area. The description of the characteristics of the area therefore concentrates largely on the coastal foreshore, which includes the beach inland to either the nearest road or about 150m, whichever is closer to the beach. To assist with this the coastline within the study area has been divided into 20 Sectors that combine similar natural features or pressure for recreational use (Figure 1).

1.4 Status

This Management Plan has been prepared on the basis of:

- existing information & previous management plans;
- consultation with the Steering Committee formed to oversee preparation of this document;
- invitation for comments from groups or individuals with an interest in the use or management of the foreshore area;
- discussion with representatives from local community groups and agencies; and
- site inspection of the foreshore areas.

This document was presented for public comment as a draft report, to obtain the comments and opinions of the broader community.

Submissions received following the public comment period were reviewed and the draft report was finalised. The report has been submitted to the respective Councils for adoption.

2. RELEVANT DOCUMENTS, POLICY & LEGISLATION

2.1 Overview

The following literature review focuses on documents and studies that relate specifically to the study area together with the legislation and policies that are applicable at a broader scale that guide or regulate activities and management within the study area.

An overview of the legislative framework and existing plans and studies that relate to the study area and have relevance to the study is outlined below. This is not an exhaustive list but aims to encompass the main legislation and policies and the key documents that will guide, or will provide background information or a basis for, preparation of the Coastal Strategy & Foreshore Management Plan.

There is a variety of resource material and information provided in other studies that are discussed or referred to in latter sections of this report. This includes studies relating to issues such as coastal stability assessments, vegetation, fauna and heritage studies.

2.2 Legislation & Policy

The jurisdiction of the coastal environment in Western Australia is complex, involving both Commonwealth and State legislation, with calls for reform (see for example, Donaldson *et al,* 1995; Barker, 2002). Only the principal Commonwealth and State legislation and policies are discussed in this section due to the complexity of the legislative framework. Further information is available in Boulter (2000).

2.2.1 Legislative Framework

Commonwealth

The legal and constitutional framework for marine areas in Australia is outlined in Australia's Oceans Policy (Commonwealth of Australia, 1998a). The Commonwealth has sovereign power over the coastal waters and seas around Australia including the waters around its external Territories. Australia has declared a range of Maritime Zones including the Australian fishing zone, exclusive economic zone, contiguous zone and territorial seas. Notwithstanding the Commonwealth sovereignty, responsibility for coastal waters out to 3 nautical miles offshore was transferred to the States in 1980 (Boulter, 2000). Beyond that limit the Commonwealth retains primary responsibility.

National action towards integrated coastal zone management by the Commonwealth State and Territory governments is promoted by the (non binding) Commonwealth Coastal Policy 1995 (Commonwealth of Australia, 1995), which was developed in response to the Resource Assessment Commission's Inquiry into the Coastal Zone (1993). The aim of the Commonwealth Coastal Policy is to promote ecologically sustainable use of Australia's coastal zone. The objectives of the policy include sustainable resource use, resource conservation, public participation and knowledge and understanding.

Australia is a signatory to a number of international conventions, treaties and protocols to conventions, including the United Nations Convention on the Law of the Sea (UNCLOS) 1982, which establishes maritime zones and imposes obligations to conserve and manage sustainable living and non living resources in Australian waters. Other international conventions, treaties and protocols have limited relevance to the Geraldton Greenough Coastal Strategy. A full list is provided in Australia's Ocean Policy (Commonwealth of Australia, 1998a) and the Commonwealth Coastal Zone Policy (Commonwealth of Australia, 1995).

There is a range of Commonwealth environmental legislation that indirectly controls activities in the coastal zone. This includes legislation covering the impact of development proposals that need Commonwealth approval to proceed, nature conservation, including endangered species and marine mammals; natural and cultural heritage; dumping of wastes at sea and oil spillage, and matters relating to the seabed and sea installations (Landvision, 2001).

The Commonwealth Government implements a comprehensive range of programs aimed at research, planning, policy making, grants and funding relating to coastal and marine planning and management. The Coastwest/Coastcare program is a joint initiative of the state and Commonwealth Government aimed at involving communities in coastal planning and management. It administers a grants program for community groups wishing to undertake coastal planning and rehabilitation. Coastal facilitators have been appointed for each region, including the Batavia Coast.

State

There is currently no special purpose coastal legislation in Western Australia. The State Government promotes a co-ordinated, non-statutory approach to coastal management through the Coastal Zone Council.

A number of Western Australian Acts impact on coastal management. The jurisdiction of several of the Acts overlap, adding to the complexities of the legislative framework for the coastal environment. State legislation relating to the coastal environment includes:

Environmental Protection Act 1986	• Environmental impact assessment of a new proposal, planning scheme or rezoning. • Control of pollution.
Town Planning and Development Act 1928; *Western Australian Planning Commission Act 1985*	• Regulates local and State government development in coastal areas.
Wildlife Conservation Act 1950	• Protection of native flora and fauna • Fauna includes indigenous fish.
Fisheries Resource Management Act 1994	• Aims to conserve fish stocks and their habitats, develop fishing and aquaculture industries, achieve optimum economic social and other benefits from the use of fish resources and ensure the exploitation of the resource is carried out in a sustainable manner.
Pollution of Waters by Oil and Noxious Substances Act 1987	• Controls pollution by ships in Western Australian Coastal waters. • Is complemented by the (Cwlth) *Protection of the Sea (Powers of intervention) Act* 1981, which controls pollution from ships outside 3 nautical miles.

Port Authorities Act 1999	• Provides for each State Port Authority to prepare a Strategic Development Plan (SDP) each year with a forecast for 5 years. An Environmental Management Plan must be part of the SDP.
Marine Act 1982	• Regulates navigation and shipping. • Includes fishing, pleasure and trading vessels but excludes naval ships.

2.2.2 Policies

Country Coastal Planning Policy (DC 6.1)

The planning, development and management of the coast in regional areas of Western Australia is guided by the Western Australian Planning Commission Development Control Policy No DC 6.1 titled '*Country Coastal Planning Policy'*. This policy requires the preparation of foreshore management plan (FMP) to minimise potential issues resulting from increased recreational pressures on the foreshore as a consequence of the development.

The FMP should focus on the coastal section adjacent to the subdivision and should provide a range of information relevant to identify the site and the natural characteristics of the foreshore together with information on existing land uses and associated issues and management measures such as access, rehabilitation and fencing, and propose a strategy for implementation. Although not a statutory policy, the Country Coastal Planning Policy is used by local authorities to guide coastal development and management.

Draft Coastal Zone Management Policy for Western Australia 2001

A Draft Coast Zone Management Policy for Western Australia (2001) (State of Western Australia, 2001) provides a whole of government framework for setting strategies and plans for the coast. The Draft Coastal Zone Management Policy for Western Australia has not yet been finalised or formally adopted by Government. The policy identifies the various pressures and issues affecting the coast and addresses them based on the principles of:

- ecological sustainability;
- recognising environmental processes and protection of biodiversity;
- meeting the variety of demands for use of the coastal resource;
- public ownership of foreshores;
- appropriate foreshore reserves and coastal setbacks;
- community consultation in coastal planning and management; and
- allowing public access to the coast with controls and management.

State Coastal Planning Policy 2003

A *Statement of Planning Policy: State Coastal Planning Policy* (Coastal SPP) (Western Australian Planning Commission, 2001) has been finalised and was released by the Minister for Planning and Infrastructure in April 2003. The Coastal SPP is consistent with the vision, goal, principles, objectives and policies established in the draft Coastal Zone Management Policy for Western Australia and complements the *Statement of*

Planning Policy: Environment and Natural Resources Policy, which requires planning strategies and schemes to identify and where appropriate, include provisions for the sustainable use of the coast.

Under the provisions of Section 5AA of the Town Planning and Development Act 1928, Regional and Town Planning Schemes will be required to have 'due regard' of the Coastal SPP once it has been formally adopted by Government.

The Coastal SPP applies state-wide and draws on and is supported by DC 6.1. It is intended that DC 6.1 will be reviewed in light of the Coastal SPP and will include more specific guidance measures to support implementation of the Coastal SPP.

The objectives of the Coastal SPP are to provide for:

- protection, conservation and enhancement in areas of landscape, nature conservation, indigenous and cultural significance;
- public foreshore areas and access to these on the coast;
- the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities in appropriate areas; and
- the location of coastal facilities and development that takes into account coastal processes including erosion, accretion, storm surge, tides, wave conditions, sea level change and biophysical criteria.

2.2.3 Other Publications

In addition to the various requirements relating to coastal management contained in the legislation and policies detailed above, guidance is also provided in a range of publications including *Turning the Tide – Integrated Local Area Management for Australia's Coastal Zone* (Brown, 1995), which stresses the need for management of the coastal zone to be integrated through policy, practice, problem-solving and place, the *Coastal Rehabilitation Manual* (Oma *et al,* 1992), which includes sections on the Western Australian coastal environment and coastal processes, outlines the development of a coastal rehabilitation strategy and details rehabilitation techniques, and the *Good Practice Guidelines for Integrated Coastal Planning* (Commonwealth of Australia, 1998b).

2.2.4 Local Government's Role

Local government has a critical role in the local planning and management of the coast. It is responsible for capital works and the formal management of public lands vested in local government, and informal management assistance to other public lands, particularly unvested reserves and Unallocated Crown Land. Local government approves land use and development on and affecting the coast, and is generally responsible for on-the-ground management of the coast in areas outside national parks or not under Aboriginal management. Public infrastructure on the beachfront, including parks, toilets, recreational facilities, roads and drainage is usually provided and managed by local government (Landvision, 2001).

Local government does not have specific coastal management legislation. Instead it implements coastal plans or strategies through a range of legislation, including the *Local Government Act* 1995 and the *Town Planning and Development Act* 1928. Local government prepares coastal management plans for specific areas to balance economic, social and environmental factors and to guide decisions about development. Coastal management plans may include detailed recommendations relating to setbacks for development, as well as designating specific areas for particular uses. The plans may be non statutory or may be incorporated in or referred to local Town Planning Schemes (Landvision, 2001).

2.3 Specific Studies & Planning Documents

2.3.1 Coastal Planning & Management

Batavia Coastal Strategy 2001

The Batavia Coastal Strategy (BCS) provides a non-statutory framework for coastal planning and management at the regional and local level and guide decision-making (Landvision, 2001). The strategy was adopted by the Batavia Coast Coastal Planning Group, the five constituent local authorities and Western Australian Planning Commission in December 2001.

The BCS covers about 260km of coastline between the Shire of Northampton and Shire of Irwin. The strategy provides a regional strategy, local strategies for identified local areas and a management framework. The Geraldton-Greenough study area is encompassed within the Cape Burney and Greater Geraldton local areas of the BCS.

Preparation of the Coastal Strategy and Foreshore Management Plan represents the next stage in coastal planning and management. The Batavia Coast Strategy therefore provides an essential framework to develop more detailed and site-specific recommendations in terms of coastal planning and management within the Geraldton-Greenough study area. The various technical reports prepared as part of the strategy provide background information including summaries of community consultation.

Geraldton Northern Foreshore Study

City of Geraldton, Geraldton Port Authority & Department for Planning & Infrastructure commissioned a study to examine stabilisation and enhancement of beaches within the coastal section between the Town Beach and Sunset Beach. The investigations involved three stages. The first two stages of the project involving investigations of beach sectors and detailed evaluation of the various options for stabilisation and improvements have been completed (MP Rogers & Associates, 2001 & 2002). The final stage will involve determination of final design and provision of cost estimates for preferred options.

Beach nourishment and ongoing sand bypassing involving transporting trapped sediment in the vicinity of Geraldton Port to the northern beaches combined with construction of a groyne near the Batavia Coast Marina and monitoring of Sunset Beach is recommended by the study to maintain or improve the northern beaches.

Town of Geraldton Draft Coastal Management Plan 1984

The Department of Conservation and Environment in 1984 produced the Draft Coastal Management Plan for the coastal foreshore areas within the City of Geraldton (Kerr, 1984). The report provides a general description of the existing environment and coastal processes, documents facilities present at the time and uses and provides general recommendations and prescribes detailed management measures for specific areas at:

- Mahomets Beach.
- Greys Beach.
- Point Moore.
- Pages Beach.
- Town Beach.
- Railway marshalling area.
- St George's Beach.
- Chapman River mouth.
- Sunset Beach.

Detailed recommendations for these sites included provision of access and facilities, fencing and landscaping.

The City of Geraldton has not adopted the report and the document is now outdated in relation to planning and coastal management in the Geraldton area and requires thorough review.

Shire of Greenough Draft Coastal Management Plan 1985

The Draft Coastal Management Plan for the Shire of Greenough foreshore areas was compiled in 1985 (Clayton & Elliott, 1985). The plan aimed to guide development and management of the coastal areas and considered issues such as site suitability, potential conflicts, environmental management issues and responsibilities.

The report describes the natural environment and recreational use and facilities and provides specific recommendations for sites including:

- Tarcoola
- Greenough River Mouth
- Greenough River
- Flat Rocks area

Given that this document was prepared over 15 years ago, the information, approach and recommendations require review and update.

Drummond Cove-Glenfield Beach Outline Development Plan

An Outline Development Plan (ODP) for the Drummond Cove-Glenfield Beach area was prepared in 1990 (Chappell & Lambert, 1990). The ODP encompasses the area extending between the City of Geraldton northern boundary, and the northern extent of the Shire of Greenough. The ODP was prepared to guide and coordinate residential and associated development, and implementation of services and infrastructure within the

area. The ODP includes delineation of a development setback and coastal foreshore reserve along this section of the coast based on an analysis of the coastal characteristics and shoreline stability.

Sunset Beach North

An urban structure plan was prepared in the early to mid 1990s for the area between North West Coastal Highway and the beach north of Whitworth Drive (BSD Consultants, 1994). The plan proposes a largely residential development with some grouped housing and tourist development. The plan includes provision for a coastal setback of 100m or more with the possible exception of some development associated within the tourist site and identification of sites for facilities such as car parking.

Local Scale Management Plans & Coastal Studies

- Point Moore Draft Coastal Management Plan 1994
  This draft plan was prepared for the Point Moore area as part of the Geraldton Port Authority's former proposal for a deepwater port to be constructed at Point Moore. The report provides a description of the area and prescribes management measures to accommodate access and recreational use and protection for the foreshore area (Alan Tingay & Associates, 1994b).

- Greenough River Estuary Management Plan 1994 & 2000 Update
  A management plan together with a concept plan for the Greenough River estuary was prepared on behalf of the Shire of Greenough in 1994 (Martinick & Associates, 1994). This plan has provided the basis for ongoing management of the area and was updated and expanded in 2000 to include additional areas including the coastal foreshore and dunes (Shire of Greenough, 2000).

- Greenough Boat Launching Facilities Study 2000
  This study assessed the feasibility of developing boat launching ramps at Drummond Cove and Southgate and develop concept plans (MP Rogers & Associates, 2000). The study identified a need for additional facilities in the region. The two locations considered do not offer sufficient natural protection for safe boat launching during all conditions. Locations were identified for construction of protected boat ramps.

- Southgate Dunes Coastal Management Strategy 1996
  Prepared on behalf of Landrow Developments as part of a proposed land exchange agreement that would ultimately enable development of Southgate Dunes (Alan Tingay & Associates, 1998). The strategy outlined a program for stabilisation of the dunes and a framework for management of the coastal sector. The strategy delineated a suitable foreshore reserve boundary and proposed a range of facilities for specific sectors of the foreshore.

2.3.2 Broader Studies & Planning Initiatives

Geraldton Region Plan 1999

The Geraldton Region Plan provides regional level strategic planning for the Shire of Northampton, Shire of Chapman Valley, City of Geraldton, Shire of Greenough and Shire of Irwin and a structure plan covering the greater Geraldton area.

The coastal issues and corresponding recommendations within this document have been addressed as part of the Batavia Coast Strategy.

Geraldton Land Development Program 1998-2002

This development program was developed by the Ministry for Planning as part of the Western Australian Planning Commission's requirement to advise Government on land use planning and coordination of land development and infrastructure within WA (Ministry for Planning, 1998). The program focuses on land development and infrastructure requirements between the Buller River to the north, Greenough River to the south and the Mooyoonooka area in the east.

Although this document primarily refers to land release proposed within the 1998-2002 it also identifies parcels of land for future development beyond this timeframe. The program therefore indicates areas within near coastal sectors that are planned for some form of development in the foreseeable future. Appropriate coastal planning and management measures to address potential issues as a result of development at these locations will therefore need to be addressed.

Geraldton & Greenough Public Open Space Study

This study aims to identify existing public open space resources, review the usefulness and adequacy of these resources and outline a strategy for future provision and management of public open space resources within the City of Geraldton and Shire of Greenough (SJB Town Planners, 2002).

The planning and management of foreshore reserves was identified as an important consideration for the local authorities. The report provides an assessment of the adequacy of reserves and facilities and makes recommendations within defined precincts. Some of the recommendations relate to provision of facilities within coastal foreshore areas and reserves and use of these areas for 'local', 'district' and 'regional' open space functions. Some of the community comments presented in the report also relate to the coastal foreshore areas.

Geraldton Southern Transport Corridor

The Southern Transport Corridor project proposes to construct a dedicated transport corridor from the outlying Narngulu Industrial area into Geraldton Port. The plan will involve removal of the railway line along the northern foreshores near Chapman Road and Foreshore Drive, and construction of rail and road routes through Point Moore to the port.

The project will provide opportunities for access and use of the coastal foreshore along Chapman Road and within the CBD area. The project is also likely to have implications in terms of access and community use of beaches and coastal areas in the Point Moore area such as Greys Beach.

Construction of the Southern Transport Corridor is expected to generate an excess of clean fill material. This material is planned to be used largely for beach nourishment purposes as part of proposed enhancements of Town Beach. Any surplus material could also be used for other beaches that may benefit from sand nourishment.

Geraldton Port Enhancement Project

Geraldton Port Authority is proposing to upgrade the existing Geraldton Port to deepen the port and enable ships to leave the port fully laden. The Port Enhancement Project (PEP) involves deepening the harbour basin and the access channel by dredging and disposal of dredge spoil, and creation of additional hard standing area on a reclamation area being constructed on the northern side of the harbour basin.

PEP also includes preparatory engineering works for the planned Town Beach Foreshore Redevelopment Project. GPA will coordinate the engineering design studies and construction works required for the Town Beach Foreshore Redevelopment, such as extension of rock groynes.

Town Beach Foreshore Redevelopment Project

Removal of the existing railway line as part of the Southern Transport Corridor and possible use of fill from the proposed port works provides significant opportunity for enhancement of Town Beach foreshore (Taylor Burrell, 2002).

A strategic concept plan for CBD and Town Beach foreshore enhancements was developed in discussion with relevant agencies and stakeholders during 2001. The City of Geraldton adopted a concept plan for redevelopment of the area in December 2001.

Although the Town Beach foreshore area is excluded from the present study area the works and facilities proposed at this location need to be considered in terms of requirements and/or complementary facilities in nearby coastal foreshore areas.

2.3.3 Riverine Studies

The Water and Rivers Commission has recently published foreshore assessments for sections of the Chapman and Greenough Rivers, which discharge into the ocean within or immediately adjacent to the Geraldton-Greenough coastal study area (Water & Rivers Commission, 2001a & 2001b). These reports outline the results of the foreshore assessment surveys, provide a description of the riverine foreshore, identify major threats and recommend management strategies.

The Chapman River foreshore assessment report relates to the middle and upper reaches of the river system extending roughly between Moonyoonooka and Yuna, some considerable distance inland of the river mouth at Bluff Point.

The foreshore assessment report for the Greenough River includes the lower reaches of the river extending to the river mouth at Cape Burney. Section 1 comprising the river mouth to the Devlin Pool was assessed as being in Very Good condition and assigned the highest rating of 'A' based on visual assessment only.

3. CHARACTERISTICS OF THE COASTAL FORESHORE

3.1 Land Tenure & Zoning

Foreshore Reserves vested with the local authorities for coastal management are not continuous along the length of the coastal foreshore considered in this study. Foreshore Reserves are interrupted at some locations by freehold properties that extend to the high water mark including some owned by the local authority, Vacant Crown Land (VCL) and reserves vested with others for specific purposes such as the railway reserve along Chapman Road in Beresford. Other sections of the coastal foreshore area are reserves vested with the local authority but support residential leases, are for drainage purposes or are undeveloped road reserves.

According to the Shire of Greenough Town Planning Scheme, a continuous portion of coastal foreshore is reserved for Recreation in relevant parts of the study area with the exception of an area between the southern extent of Glenndinning Road and Southgate Dunes.

The Geraldton Town Planning Scheme No 3 shows continuous Landscape and Coastal Protection reserves between Pages Beach and the southern boundary at Tarcoola. In the northern section between the northern Sunset Beach area and the marina, Landscape and Coastal Protection reserves are interrupted by Residential land south of the Chapman River mouth and Railway reservation along Chapman Road toward the marina.

3.2 Land Use

The predominant land use of the coastal sector adjacent to the coastal foreshore is residential development and associated uses such as commercial and tourist development. Within the general Point Moore area however, a high portion of the land use is for industrial facilities and port operations.

Sections of the coastal foreshore extending between Sunset Beach and the settlement at Drummond Cove, and areas extending south of Tarcoola and the Greenough River are as yet undeveloped. Plans for largely residential development have been prepared for all of these areas indicating that ultimately urban development will also abut the foreshore in these areas.

3.3 Climate

The climate of the Geraldton region is considered an extra dry Mediterranean climate and is characterised by a short and mild wet winter and warm to hot, dry and windy conditions for much of the remainder of the year. Average monthly maximum temperatures vary between about 20°C in winter to 32°C in the summer months, with maximum temperatures of about 47°C possible in January and February. Minimum temperatures typically are less than 10°C between July and September and up to 20°C on summer nights but can be as low as about 1°C in winter.

Rainfall is highly seasonal with most being recorded in winter between the months of May and August with monthly averages of roughly 65mm and 110mm of rain. Rainfall is also variable from year to year and averages around 475mm each year.

The Geraldton area is noted for its windy conditions with winds in excess of 30kmh common on summer afternoons. In summer, winds are typically from the south and south-east with a significant portion also from the east and north-east in the morning, while winds are almost constantly from the south and south–west in the afternoon. During winter winds originate largely from the north-east and north in the morning and with winds more variable in the afternoon but the stronger winds in excess of 30km/h are from the north-west to south-west. Wind patterns in the area are discussed in further details in Section 2.5.1.

Dissipating tropical cyclones can have a dramatic affect on climatic conditions during November to April. While infrequent events in the area, cyclones produce gale force winds and intense rainfall.

3.4 Landform & Soils

The Geraldton-Greenough coastal area lies in the northern section of the Perth Basin within the Coastal Belt (Playford *et al*., 1976).

Regional mapping indicates the coastal sections of the Geraldton and Greenough areas consist largely of units associated with the Quindalup and Spearwood Systems (Geological Survey of Western Australia, 2000). The Quindalup System consists of largely westerly facing, gently to moderately inclined dunes with occasional steep areas that have been shaped by primarily aeolian processes and wave action in the coastal zone. The Spearwood System is associated with Tamala Limestone and consists of older dunes typically inland of and overlain by Quindalup units. Deflated dunes and swales that have been formed as a result of the predominant southerly winds and coastal processes and a westerly facing scarp created.

The coastal belt is characterised by highly permeable, unconsolidated, sandy calcareous soils. These soils are highly susceptible to becoming unstable and subsequent erosion, particularly if vegetation is removed. The older dunes have a higher siliceous content and have been weathered and leached forming yellow or red residual quartz sand over calcrete surfaces.

In the northern section of the study area units associated with the Greenough Alluvium System occur in closer proximity to coastal area. This consists of sandy, silty clay over sandy gravel on alluvial plains.

The study area includes the Chapman River mouth and the Greenough River mouth forms the southern boundary of the study area.

3.5 Coastal Processes & Stability

As part of this project specialist coastal engineering firm, MP Rogers & Associates, provided an assessment of the dominant coastal processes and shoreline stability to enable assessment of the appropriate uses, development and management of the foreshore area.

The assessment was based on review of existing research and reports and where appropriate, application of more recent policies on coastal setbacks based on available data and coastal engineering calculations.

Existing reports that provide information or previous assessment in relation to coastal processes and stability for portions of the current study area include:

- Geraldton Northern Foreshore Study (MP Rogers & Associates, 2001 & 2002).
- Southgate Dunes Coastal Engineering Study (MP Rogers & Associates, 1998).
- Geraldton Region Coastal Engineering Study (MP Rogers & Associates, 1996).
- Proposed Port Expansion Coastal Engineering Study (MP Rogers & Associates, 1994).
- Report of Coastal Land-Glenfield Beach, Geraldton (Woods & Associates, 1990).

A summary of the key processes and coastal stability within the study area based on the assessment provided by MP Rogers and Associates for this project is outlined in the following sections.

3.5.1 Meteorological & Oceanographic Conditions

Descriptions of the dominant meteorological and oceanographic conditions can been taken from information provided by or presented in the following:

- Bureau of Meteorology;
- Steedman Science & Engineering (1991);
- MP Rogers & Associates (1994, 1997 and 2001);
- Department of Defence (1999), and
- Coastal Engineering Solutions (2001).

Wind Regime

The wind regime influences coastal processes through the generation of ocean waves and currents as well as feeding dune systems with wind blown beach sand.

The seasonal weather patterns in the vicinity of Geraldton are largely controlled by the position of high-pressure cells, the so-called Subtropical High Pressure Belt. The latitudinal seasonal shift in the centreline position of the high-pressure cells is fundamental to the seasonal wind patterns experienced in the region. The winds at Geraldton are generally easterly in winter and southerly in summer. In addition to these regional scale effects, the land-sea breeze system is commonly experienced at Geraldton and adjacent coastal regions, causing wind variations on a daily time scale. Offshore breezes are experienced in the morning then swing around to the southwest and south in the afternoon.

The wind records at Geraldton Airport indicate that during spring, and particularly summer, the morning winds are typically light (<20km/h) to moderate (20-40km/h) in strength and blow from northeasterly through to southerly directions. The afternoons of these seasons are usually dominated by moderate to strong (>40km/h) southwesterly and southerly winds. The autumn wind characteristics are similar to those experienced during summer with light to moderate northeasterly to southeasterly winds in the morning, and light to moderate southwesterly to southerly winds typically during the afternoon.

Winter meteorology is characterised by storms associated with the passage of low pressure systems and intervening periods of generally light and variable winds. Moderate to strong northerly to northwesterly winds usually signifies the onset of a winter storm. As the low pressure system passes over the site, the winds swing through west, and around to the southwest and south during the tail of the storm. Winds during winter storms are generally strong (>40km/h). As a result of these meteorological patterns, Geraldton experiences winds of variable speed and direction in both the morning and afternoon. Northeasterly winds dominate during the morning.

Wave Climate

Waves that break along the shore are very important in the coastal processes and movement of sediment. Breaking waves can stir up the sediment making it available for movement. Waves breaking with their crests at an angle to the shore can generate currents along the shore. Wave breaking can also move water on to the shore and result in return currents to the nearshore waters. These wave generated currents can move sand along the shore and across the shore, ie onshore to offshore and vice versa.

The waters offshore at Geraldton experience high wave energy. Measurements indicate that, in 20m of water off Point Moore, the significant wave height exceeds 0.5m for 99% of the time, (Steedman Science & Engineering 1991).

The main elements of the offshore wave climate are:

- Locally generated seas that are fetch limited by the extent of the sea breeze system. These waves are typically 0.5m to 1.5m high with periods of 3 to 6 seconds and are generally from the southwest to south.

- Seas generated locally by the passage of cold fronts during winter. The wave heights and periods vary markedly from storm to storm. Often the wave heights exceed 5m and the wave periods reach 6 to 10 seconds. The direction from which the waves approach can range from northwest to southwest during the passage of the storm.

- Swell waves from distant storms in the Southern Indian Ocean continually reach the offshore area. These swell waves often exceed 2m and typical periods are between 8 and 16 seconds. These swell waves commonly approach from the southwest.

- Severe waves caused by dissipating tropical cyclones. These storms are infrequent at Geraldton however when they do occur they cause severe conditions for short periods of time.

Offshore waves are greatly affected by the various reefs and the gaps between the reefs as they travel toward the shore. The reefs and adjacent areas modify the waves by the following physical processes:

- Reflection off the reef faces.
- Depth limited breaking on the reef tops.
- Diffraction through the gaps in the reefs.
- Attenuation due to hydraulic turbulence as the waves travel over the reefs.
- Refraction and shoaling due to variations in bottom topography.
- Regeneration of waves due to winds over local fetches.

Each of these processes act in varying degrees and significantly attenuate the waves as they approach the various beaches. Nevertheless, the resultant waves that break on the beaches are believed to be very important in the transport of sand both along the shoreline, and onshore and offshore.

The nearshore wave conditions have been hindcast and transformed to a number of nearshore sites along the Geraldton shoreline for the 8 years between 1992 and 1999 by Coastal Engineering Solutions (2001). The transformed wave data at several nearshore locations along the study area shoreline were obtained and analysed to determine typical nearshore wave conditions about 300m from the shore. Analysis of the 8 years of wave data indicates that the typical nearshore wave conditions are made up of:

- Locally generated seas fetch limited by the extent of the sea breeze system
    - Typically 0.1m to 0.4m high.
    - Periods of 3 to 6 seconds.
    - Generally from 220º to 250º.
- Seas generated locally by the passage of cold fronts
    - Typically around 1m to 2m high.
    - Periods of 5 to 10 seconds.
    - Range from northwest to southwest.
- Swell waves from distant storms in the Southern Indian Ocean
    - Typically 0.5m in height.
    - Periods of 10 to 16 seconds.
    - Crests reasonably parallel to the shoreline.

The percentage occurrence of waves were analysed in the nearshore zone just north of the Batavia Coast Marina, at Bluff Point, and at Sunset Beach as part of the northern beaches study (MP Rogers and Associates, 2001). The results of the analysis are shown in Table 1.

TABLE 1
PERCENTAGE OCCURRENCE OF WAVES

Significant Wave Height	Batavia Coast Marina	Bluff Point	Sunset
Greater than 0.1 m	100%	100%	100%
Greater than 0.5 m	32%	81%	72%
Greater than 1 m	3%	24%	18%
Greater than 2 m	0%	4%	2%

The results indicate nearshore wave conditions are always greater than 0.1m in significant wave height at all three locations. The nearshore waves just north of the Batavia Coast Marina very rarely exceed 1m in wave height, whilst at Bluff Point and Sunset, the waves exceed 1m around 24% to 18% of the time. The results above and the analysis of the typical nearshore wave conditions indicate that, in general, more wave energy is experienced in the nearshore region at Sunset Beach than at the Batavia Coast Marina. This is because of the sheltering effects of the reefs around Point Moore providing protection to the Batavia Coast Marina. The results clearly demonstrate that offshore and nearshore reefs can provide significant protection from the full force of the offshore wave conditions. These waves will undergo further transformation and attenuation as they travel over and around inshore reefs and reach the shore.

Ocean Water Levels

The astronomical tide is the harmonic and predictable rise and fall of the ocean water levels in response to the gravitational and centrifugal interactions of the Moon and the Sun with the Earth. The astronomic tide can be reliably predicted once measurements have been taken at the site of interest for at least a month but preferably a year.

Suitable tidal measurements have been taken at the Port of Geraldton and predictions are available from a number of sources including the Department of Defence (1999). The astronomical tides at Geraldton are predominantly diurnal (one tidal cycle each day) and relatively limited in range (Department of Defence, 1999). The daily range is typically about 0.7m during spring tides and less than 0.5m during neap tides. The Mean High High Water (MHHW), which is indicative of a typical high tide, is 0.8m above the Tidal Prediction Datum or about 0.2m above Mean Sea Level (MSL). The Highest Astronomical Tide (HAT) is 1.2m above LAT or 0.6m above MSL.

Seasonal shifts in the sea level occur due to meteorological effects. Typically, the mean sea level at Geraldton rises 0.1m during winter and falls 0.1m during summer. During storm events (both winter storms and cyclones) barometric and wind effects can cause significant storm surges. In extreme storms the surge can exceed 1m above the astronomical tide level, (Port & Harbour Consultants, 1989). The highest water level recorded at Geraldton was 2.1m above Chart Datum (CD) (1.5m above MSL), in 1970 and was probably associated with Tropical Cyclone Glynis.

Given the small astronomical tides, the level of the sea would generally have a secondary effect on the sand transport along the beaches, except during storm events when high water levels would enable the waves to attack the rear of the sandy beaches.

Currents

Currents influencing the coastal environment within the Geraldton area include:

- Leeuwin Current.
- Tidal & Wind Driven Currents.
- Wave Induced Currents.
- Density Currents and River Discharge.

Leeuwin Current

- Shallow (less than 300m deep), narrow band (less than 200km wide) of warm, lower salinity, nutrient depleted water that is of tropical origin and flows poleward from Exmouth to Cape Leeuwin and into the Great Australian Bight.

- Large seasonal variation in the flow of the Leeuwin Current with stronger flows experienced through winter, whilst during summer and spring the flows tend to be weaker.

- Generally located in the deeper waters to the west of the continental shelf and would have little effect on the circulation and coastal processes of the nearshore waters of Geraldton.

Tidal & Wind Driven Currents

- Tidal range is quite small therefore nearshore tidal currents are also expected to be small.
- Available measurements for coastal waters off Perth suggest currents generated by astronomical tides at Geraldton would generally be less than 0.05m/s.
- Largest nearshore currents in the study area are expected to result from the action of the wind blowing over the water surface and waves breaking onto the beaches.
- Dominant southerly winds in the Geraldton region will generally create nearshore currents that flow towards the north, but periods of reversal could occur during winter storms.
- Current measurements in the nearshore waters of Perth (WNI Science & Engineering, 1995) the wind driven currents at Geraldton are believed to be typically less than 0.2m/s, but may be amplified by the local bathymetric features. In severe storms the wind driven currents may reach 0.5m/s.
- Eddies and topographic gyres may form nearshore at lower depths where the existence of the submerged reef chain creates a closed boundary to flow.
- Onshore winds can also cause landward currents at the water surface that can move buoyant debris and seagrass wrack on to the beach.
- Flooding of the Greenough River in March 1994 resulted in fresh, turbid water being discharged into the ocean over several days flowing at an average rate of roughly 0.065m/s or 240m/hr, and generally extending from the beach to about 2km offshore in a northward ribbon. The plume turned westward at Separation Point and travelled to the seaward side of Point Moore Reefs before heading northward again and did not travel along Greys Beach. This sort of advective current could transport very fine sediments, especially when significant wave energy was present and provided a mechanism to agitate the bottom sediments.

Wave Induced Currents

- Currents can be generated from waves by several methods including wave induced drift currents, wave pumping on reef structures, longshore currents generated from waves breaking obliquely on the shoreline.
- Wave induced drift currents are usually very small and can be neglected for most practical purposes.
- When waves break on reef structures, flow can be generated from the pressure difference created by the increase in the water level on top of the reef relative to the off-reef water level (Gourlay, 1993), commonly referred to as wave pumping. Based on the results of an investigation of the effect of wave pumping on Whitfords Lagoon (Lord & Hillman, 1995) it is considered unlikely that wave pumping would have significant effect on overall nearshore circulation patterns in the study area, although wave pumping may cause localised currents over areas of reef.
- Most longshore currents are generated by the longshore component of wave motion that obliquely approach the shoreline. Due to the localised nature of longshore currents they would have little effect on the general circulation patterns but would be significant in the nearshore zone.
- Approximate measurements of the wave induced inshore currents at Dawesville (Department of Marine & Harbours, 1987) indicate wave induced currents often exceeded 0.5m/s in the surf zone of exposed ocean coasts. Such currents can be very important in the movement of sediment along the shore.

Density Currents & River Discharge

- Density gradients can be created in several ways such as freshwater discharge from rivers or streams, evaporation and atmospheric heating or cooling of surface waters.
- Evaporation leads to the formation of more saline and hence denser, nearshore waters particularly in shallower regions.
- Differential heating (mainly during summer), creates warmer, less dense nearshore waters whilst differential cooling, creates colder, denser nearshore waters. Shallow waters closer to shore tend to experience wider temperature fluctuations.
- Based on studies in Cockburn Sound (Chiffings, 1987), it is likely that any vertical density gradients created within the study area would be small. Since the area is more exposed, the action of wind and waves would ensure that the water column remains relatively well mixed most of the time.
- As for horizontal density gradients, horizontal advection from wind generated currents are expected to dominate any convective currents formed.
- Greenough and Chapman Rivers discharge into the ocean in the study area when the bars are breached following periods of significant rain and runoff. The relatively fresh discharge water would move out into the nearshore waters as a buoyant jet. There would be significant mixing due to wave breaking and wind driven currents with the saline ocean waters in the nearshore area.
- High river flows that can follow the initial breaching of the bar across the river mouth can be important in transporting sediment from the shore to the nearshore area. Typically, the flow velocity would decrease as the flow spreads out. Eventually, the flow velocity would be too low to transport the sediment and the

sediment settles out in the nearshore area. Once the rainfall and runoff stops and the river discharges have ceased, tidal action can cause flows into and out of the river mouth. These flows provide a mechanism for local sediment movement and add to the complexity of the coastal processes in the vicinity of the river mouths.

Based on the assessments of the physical processes above, the circulation in the study area is believed to be predominantly wind driven. During summer, northerly flow with speeds of around 0.1 to 0.3m/s is expected. In winter, flow direction is expected to be quite variable with a larger tendency for southerly flow. Current speeds of around 0.1m/s, reaching as high as 0.5m/s during strong winter storms, are also expected.

The strong onshore winds can also cause surface currents to flow towards the shore. Such onshore currents can move debris and seagrass wrack on to the shore. As the tide falls, the debris and seagrass wrack may be stranded on the beach or longshore currents may move the material to other locations.

In the wave breaking zone, the action of waves breaking at an angle to the beach can generate significant currents along the shore. For exposed coasts, where wave energy is high, these currents in the surf zone can reach 0.5m/s.

The magnitude of these nearshore currents is such that they will have a minor effect on the movement of sand in the inshore areas except in the presence of breaking waves that would stir up the sand and permit the currents to move the suspended sediment along the beach.

3.5.2 Climate Change

Although the so-called "Greenhouse Effect" has received significant publicity, there is still no definitive evidence available that proves that the Greenhouse changes are occurring or will occur. There is certainly clear evidence that the amount of Carbon Dioxide and other "Greenhouse Gases" has increased dramatically over the last century, and is continuing to rise.

The link to global warming and associated sea level rise has been largely based on predictive numerical models of the global atmospheric and oceanic processes. These general circulation models were initially run on coarse grids with rather rudimentary treatment of ice melting, cloud cover and albedo feed back links and impacts. Pielke (1991) presents a good review of the scientific uncertainty with these early predictions of the "Greenhouse Effect".

In the last decade significant resources have been used to better understand and model the historical changes and possible future changes. The International Panel on Climate Change (IPCC) is a collaborative body with contributions of finance and expertise from many of the developed countries around the world. The research program is ongoing and every few years the IPCC releases an assessment report. In it's latest assessment report, IPCC (2001) states that:

> *"In the light of the new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations. Furthermore, it*

is very likely that the 20th century warming has contributed significantly to the observed sea level rise, through thermal expansion of sea water and widespread loss of land ice."

Some of the possible impacts on the west coast of Western Australia from Climate Change could be:

- changes in storm and cyclone intensity and frequency;
- increase in sea level; and
- changes in the positions of synoptic features causing changed wind and wave climates.

The Institution of Engineers, Australia (1991), put forward suggestions for assessing the impacts of possible climate change on coastal engineering projects. The report is aimed at ensuring that a responsible review of the possible impacts is made. Designs should be robust and minimise future risk. This document does not say that climate change will definitely happen, but that it now seems likely that it will happen, and therefore engineering design and coastal management should take this risk into consideration.

Research from IPCC (1995) provides projections for the future change in sea levels (refer to Table 2 below). The increase in sea level over the next century is projected to be lower than previous estimates. The differences compared to earlier projections are due in large to lower temperature projections and changes to the glacier model used.

TABLE 2
GLOBAL SEA LEVEL RISE - 1995 PROJECTIONS

Scenario	2030	2050	2100
Low Scenario	0.03m	0.06m	0.13m
Medium Scenario	0.11m	0.20m	0.49m
High Scenario	0.23m	0.40m	0.93m

Source: IPCC (1995)

It should be noted that based on work completed by US EPA (1995) it is estimated that there is about a 50% probability that a sea level rise of 0.34m will not be reached or exceeded in the next 100 years. This value is between the Low and Medium Scenario projections for 2100. In view of this, it seems reasonable to use a value of 0.34m for sea level rise by the year 2100.

The Department of Planning and Infrastructure (formerly the Department of Transport and Ministry for Planning) has considered the latest reports from the IPCC and have informally suggested that for planning purposes to 2100, a possible rise in sea level of 0.38m be used.

The issue of possible climate change and resultant effects on coastal processes is quite complex and the impact of a small rise in sea level would be quite site specific. To date there have been no studies done for the west coast of Western Australia. The most relevant of other works are Bruun (1962), which presents the results of some generalised material, and Gordon (1988) that presents some of the results of research on the east coast of Australia. In very coarse and general terms, both papers suggest that a rise in sea level would generally lead to recession of sandy coastlines at a ratio of

roughly 100 to 1. That is, a 0.38m rise in sea level may eventually cause a 38 recession of the sandy coastline. This should be considered an approximate "rule of thumb" only.

Local effects however, could offset the tendency for shoreline recession. For example, some areas experience ongoing accretion due to gradients in longshore drift. This accretion may offset the tendency for erosion that could result from sea level rises caused by Climate Change. Also, rocky coastlines may not erode provided that there is sufficient rock to accommodate the increased sea levels. Even the presence of a rock shelf in front of the beach could reduce the tendency for erosion due to sea level rise. Such situations require site specific assessments.

Changes in the global sea level that could occur due to Climate Change should be considered in assessing set back distances and development levels of coastal buildings and essential infrastructure. For new development of residential and commercial area a planning horizon of 100 years is often considered appropriate.

For the assessment of set back distances for the existing privately owned residential and commercial areas of the study area, a planning horizon of 30 years is suggested. This reduced planning horizon is sustainable on the basis that active management of coastal processes could be implemented if required for existing developments. The aim of the longer planning horizon for new developments is to avoid the need for active management of coastal processes.

For coastal infrastructure such as boat ramps and jetties, the usable life is usually less than 30 years. After such a period, the maintenance requirements are high and it often more economical to rebuild the facility. Consequently, it would be appropriate to consider the impacts caused by Climate Change in the design of the replacement facilities in the decades to come.

3.5.3 Coastal Processes

There are three fundamental mechanisms that can transport sand towards or away from a point on the beach:

- longshore sediment transport;
- cross shore sediment transport; and
- wind blown losses.

In addition to the movement of sediment along and across the shore, the action of the inshore currents, mainly generated by waves and winds, can move seagrass wrack onto, along and off the beaches.

Sediment Transport Along the Shore

The first mechanism is longshore sediment transport. A simplistic description of this mechanism is that in the surf zone of sandy beaches, the breaking waves agitate the sand and place it into suspension. If the waves are approaching the beach at an angle, then a longshore current can form and this can transport the suspended sand along the beach. The suspended load transport is accompanied by a bed load transport where sand is rolled over the bottom by the shear of the water motion. There can be considerable

variation in magnitude and direction of the longshore transport from season to season and year to year.

Winter storms often have strong winds from the northwest quadrant and create storm waves that commonly arrive at the coast from the west-northwest. These waves tend to move sand from the north to the south. At other times in winter, the waves arrive from the west-southwest and tend to move sand along the beaches from the south to the north. In the summer months, the prevalence of the southwest seas during the afternoon sea-breezes causes the longshore transport of sand to be from the south to the north.

Accumulation of sand to the south of the Geraldton Port Authority's main breakwater shows that longshore movement of sand along the study coast is significant. MP Rogers & Associates (1997) calculated from shoreline movement plans and beach profiles that about 20,000 to 30,000m^3/year of sand is moving from the southern beaches to the north, being trapped in the Point Moore and port areas.

Calculations by Coastal Engineering Solutions (2001) indicate that the net movement for the coast from the Batavia Coast Marina to the Chapman River is from south to north. At Sunset the beach has a different alignment and the calculated net movement of sand is from north to south. The coast from the Batavia Coast Marina to the Chapman River is estimated to have the potential for a net movement of sand from south to north of up to 20,000m^3/year. The calculated figure at Sunset is about 10,000m^3/year from the north to the south.

Calculations of the average annual net movement of sand along the northern beaches based on existing conditions and following the Port Enhancement Project predicts impacts on the transport of sand along the northern beaches (Coastal Engineering Solutions, 2001). The calculations suggest there may be increased erosion potential north of the Batavia Coast Marina and south of Chapman River mouth. The area near Mabel Street and Bluff Point may experience an increased tendency for accretion. The calculations of longshore sediment movement do not account for all of the complexity of the real situation. In general, the calculations are likely to be reasonably accurate and within ±100%. This must be borne in mind in determining any sediment budget for the area. Larger errors could be expected at locations where large banks of seagrass wrack are commonly experienced such as between the Chapman River and Bluff Point.

Onshore & Offshore Sediment Transport

The second mechanism is the onshore/offshore movement of beach sand, commonly referred to as cross-shore sediment transport. During storm events the steep waves and high water levels cause sand to be rapidly eroded from the beach and carried offshore. Between storm events, the long, low amplitude swell that persistently arrives at the coast moves sand back onto the beach.

During significant storm events, the strong winds generate high steep waves and an increase in water level known as storm surge. These factors, acting in concert, allow the waves to attack the higher portion of the beach that is not normally vulnerable. The initial width of the surf zone is often insufficient to dissipate the increased wave energy of the storm waves. The residual energy is often spent in eroding the beach face, beach berm and sometimes the dunes. The eroded sand is carried offshore with return water

flow where it is deposited and forms an offshore bar. Such bars can eventually grow large enough to break the incoming waves further offshore, causing the wave energy to be spent in a wider surf zone.

Erosion of sandy beaches during storms can be quite rapid and significant changes can occur in a matter of hours. However, the onshore movement of sand by swell is a much slower process. It may take several years for swell to move sand back onto the beach that was eroded in a few hours or days during a severe storm. Naturally, rocky coasts are affected much less by storm events because of the ability of the rock to resist the erosive forces. Consequently, it is important to include the presence of the inshore reefs in any assessment of storm erosion.

The available information on storm erosion in the study area comprises two types of cross shore erosion modelling. The earlier work was completed for the coast near the Southgate dunes used a simple empirical method based on the concept that an "equilibrium profile" would eventually be formed under the action of storm waves and water levels (MP Rogers & Associates, 1997). This manual method requires information on the beach and nearshore profile, the sediment characteristics, as well as the wave and water level conditions during the storm. The calculations for the Southgate area suggested that about 20 to 40m of dune would be eroded during a storm sequence with a 100 year Average Recurrence Interval.

Just to the north of the Southgate dunes, there is an area that has historically suffered significant erosion. The position of the coastal vegetation line was about 120m further east in the 1956 aerial photograph compared to the 1942 photograph. Subsequent to 1956 the coast prograded back to the 1942 position. This large fluctuation, which was observed only in this area, is largely unexplained. It is suspected that it was associated with a severe storm with waves that overtopped the low coastal dunes and filled the swale behind the dunes with water. This could have affected the local ground water levels and initiated rapid destabilisation of the dune and beach. Empirical calculations of the likely cross shore erosion would not include abnormal ground water levels and longshore drift effects. Consequently, the observed recession of 120m in the 1956 photograph is a more appropriate indicator of the vulnerability of this area.

The second method used in the available reports was a computer based method developed by the US Army Corps of Engineers (1993). This computer model is called SBEACH and it can simulate the cross-shore transport of sand during storm events. This model uses the following inputs to assess the erosion and beach recession during storm events:

- Water temperature.
- Sediment characteristics and location of rock strata.
- Initial beach and nearshore profile.
- Location of rocky strata.
- Wave, water level and wind conditions at the seaward boundary of the model.

The model only calculates the movement of sand across the profile and does not account for possible gradients in movements of sand along the shore. Gradients in longshore transport can also cause erosion during storms.

The SBEACH32 Version 2 model was set up and run to simulate erosion during severe storms at four locations along the northern Geraldton beaches as part of the Northern Foreshore study. The locations were:

- Beach near Mark Street,
- Rundle Park/St George's beach,
- Bluff Point beach near Fuller Street, and
- Sunset beach near the Caravan Park.

Modelling based on storm conditions representing the 100 year Average Recurrence Interval (ARI) storm indicate the foreshore near Mark Street would be eroded about 10m in the first storm with little change in the second run of the storm (MP Rogers & Associates, 2001). All of the useable beach would be lost in the severe storm erosion. Because of inshore reef, Rundle Park/St George's would experience only minor erosion during the severe storms. It is estimated that the severe storms would erode the coastal vegetation line about 10m.

At Bluff Point near Fuller Street, the model suggests that without a seawall there would be about 25m recession of the coastal vegetation line. Just north of Fuller Street, there are two houses with a crude seawall. Modelling of the storm erosion with the seawall suggests that the seawall would resist the erosion. The modelling is on the basis of a suitably engineered seawall. The existing seawall would need to be maintained after each storm to protect the private property.

The storm erosion modelling for Sunset indicates this beach is vulnerable to significant erosion during severe storms. During storms most of the beach is lost and there could be about 10m recession to the top of the dune and coastal vegetation line.

Wind Blown Sand

The final mechanism is wind blown sediment transport. This can move sand from the beach into the nearby dunes. This is the mechanism by which coastal dunes are formed and grow. There needs to be careful management of the public use and access through coastal dunes to prevent dune blowouts occurring due to lack of vegetation. The coastal dunes form a natural buffer to accommodate the erosion during severe storms.

Because of the strong prevailing winds at Geraldton, great care is needed to manage wind blown sand during beach nourishment works.

Seagrass Wrack

The seagrass species common to the nearshore waters of Western Australia commonly shed their leaves in the winter months. This is believed to be a biological response to changes in the light conditions on the seabed and due to the increased hydrodynamic loads caused by winter storms. Some seagrass and algae plants are completely removed from the seabed by the increase wave energy during storms.

The seagrass and algal wrack can be slightly buoyant and float at the sea surface. Because of the buoyancy, the prevailing currents can move the wrack. During winter there are often periods of strong onshore winds that cause surface currents that move the

seagrass wrack to the shore. The ocean water levels can also be elevated by storm surge during storms and the wrack can reach the back of the beach berm. As the storm surge dissipates, the ocean water level reduces and the seagrass and algal wrack can be stranded on the beach. Subsequently, the wrack can be remobilised and moved along or offshore by various ocean currents. The seagrass wrack can be quite mobile.

When there is a large bank of seagrass wrack present on a beach, such as Bluff Point beach, the wave energy may be dissipated on the wrack bank rather than in moving the underlying sand. Because of this feature, the calculated values for sediment movement along the various beaches completed by Coastal Engineering Solutions (2001) should be viewed as indicative where there are commonly large accumulations of seagrass wrack, eg Bluff Point Beach and near Mabel Street. Large banks of seagrass wrack at these locations could also protect these beaches from cross-shore erosion during storm activity.

There are a number of aerial photographs of parts of the study area taken over the last 50 years. These aerial photographs were generally taken in spring or summer. Review of the photographs taken in 1942, 1956, 1975, 1995, 1998 and 2001 indicate that at some times large quantities of seagrass wrack have been present on the beaches of the study area. The photographs suggest that wrack is commonly experienced on the beaches north of Southgate Dunes, at Back Beach, Greys Beach and near Point Moore. North of the Batavia Coast Marina the wrack is most commonly present between the Chapman River and Bluff Point, and near Mabel Street. Relatively small quantities have been observed in the embayment immediately north of the Batavia Coast Marina and on Rundle Park/St George's Beach. Seagrass wrack is also known to accumulate in the Drummond Cove area.

The presence of seagrass wrack on a beach can limit some of the recreational uses of an area. However, the wrack is part of the natural ecosystem and may be an important part of the food chain (Cockburn Cement Limited, 2001).

3.5.4 Coastal Stability

Shoreline movement plans based on photogrammetry have been prepared for a number of different projects (Department of Marine & Harbours, 1988 and MP Rogers & Associates, 1994, 1996 & 1997). Together these plans cover the coast from the Greenough River to Drummond Cove and show the position of the coastal vegetation line for photographs taken in late spring/early summer of a number of years between the 1940s and the 1990s. The shoreline movement plans were completed using rigorous photogrammetric control techniques and computer aided drafting ensuring the accuracy of the vegetation line was in the order of ±2m in the horizontal plane.

The Oakajee Port Coastal Engineering Study (MP Rogers & Associates, 1997) provides shoreline movement plots for the coast between the Chapman River and the Oakajee River based on photographs from 1956, 1975 and 1996. This work provides some data on the coastal movements between the Chapman River and Drummond Cove. This coastal area can be separated into five sectors as follows.

- Drummond Cove;
- Drummond Point;

- Glenfield;
- Sunset North; and
- Sunset.

The general trends for each of these sectors as indicated by the shoreline movement plans are provided in Table 3. The figures are the arithmetic averages for each coastal sector. Some areas within the sectors experienced movements of about twice the average value. In addition, this analysis does not mean that there are not short-term fluctuations in the position of the coast in response to storms and seasonal changes. The results of the analysis provide some information on the longer term trends in the changes of position of the shoreline.

This data indicates that the long term trend for the coastline at Drummond Cove, Drummond Point and Glenfield is for accretion and progradation of the beaches. The coast at Sunset North and Sunset have a history of significant erosion.

TABLE 3
SHORELINE ADVANCE OR RETREAT 1956 TO 1996
DRUMMOND COVE TO NORTH OF THE CHAPMAN RIVER

Coastal Locality	Shoreline Advance or Retreat (m)			Rate of Advance or Retreat (m/yr)
	56 to 75	75 to 96	56 to 96	56 to 96
Drummond Cove	4.6	3.2	7.8	0.2
Drummond Point	4.5	0	4.5	0.1
Glenfield	0.3	6.6	6.9	0.2
Sunset North	(8.7)	(4.7)	(12.8)	(0.3)
Sunset	(11.9)	(1.9)	(13.8)	(0.4)

Note: 1. Numbers in brackets indicate recession or erosion of the shoreline.
2. Values are averages for the locality.
3. Some areas at Sunset North and Sunset have experienced erosion at about twice the average in the table.

The second source of shoreline movement data was provided in the Geraldton Port Authority Regional Coastal Study (MP Rogers & Associates, 1996). In this study, the 22km of coastline from the Chapman River to south of the Greenough River was divided into three sectors as outlined:

- Northern Sector - Chapman River to Town Beach;
- Central Sector - Town Beach to Separation Point; and
- Southern Sector - Separation Point to south of the Greenough River.

Various shoreline movement plans were used to measure the advance or retreat of the vegetation line between each set of aerial photographs. To do this a baseline was established at the rear of the beaches (generally the centreline of coastal roads) and it was marked with a reference station every 100m. Then the distance from the baseline to the vegetation line was measured on the various shoreline movement plans representing the position in September 1942, October 1975, January 1988 and October 1992. The difference between these measurements represents the gross advance or retreat of the vegetation line that occurred between the photograph dates.

In all areas, except at the Southgate dunes and the mouth of the Greenough River, the vegetation line was used for the comparison. In some photographs, the coastline at the Southgate and the mouth of the Greenough River did not have a vegetation line at the rear of the beach, so the waterline was used for the comparisons. The use of the waterline introduces the possibility of greater errors due to the influence of varying tides, wave run-up and beach slopes. Results for these areas should be used with appropriate caution.

Table 4 presents the results for the measured accretion and erosion of the coastline between the Chapman River and the area just south of the Greenough River. The figures are the average advance or retreat for each area over the period of time between the aerial photographs. It should be noted that the number of years between the various photographs varies markedly. There are about 33.1 years between the 1942 and 1975 photographs, about 12.2 years between the 1975 and 1988 photographs, and about 4.8 years between the 1988 and 1992 photographs. The measured advance or retreat of the shoreline was divided by the number of years between the photographs to determine the average annual rate of advance or retreat.

For the Northern Sector, the shoreline movement plots indicate that there has been some accretion of the beaches from 1942 to 1975, however from 1988 to 1992 there has been some minor erosion. The Central Sector has accreted significantly between 1942 and 1988, but less movement is observed in the comparison of the 1988 and 1992 photographs. The Southern Sector has generally accreted over the period of the photographs. The beaches in the north of the Southern Sector (Back Beach, Mahomets and Tarcoola) have all accreted significantly from 1942 to 1992. A section of the Southgate dunes northern beach about 500m long, retreated significantly between the 1942 and 1975 photograph. This area has substantially recovered since 1975.

TABLE 4
SHORELINE ADVANCE OR RETREAT - 1942 TO 1992
CHAPMAN RIVER TO GREENOUGH RIVER

Sector	Coastal Locality	Shoreline Advance or Retreat (m)			Rate of Movement (m/yr)
		42 to 75	75 to 92	42 to 92	42 to 92
Northern	Bluff Point	12	(2)	(10)	(0.2)
	Rundle Park/St George's	3	0	3	0.1
	Champion Bay	3	(6)	(3)	(0.1)
Central	Pages	115	5	120	2.4
	Explosives	84	32	116	2.3
	Point Moore	91	15	106	2.1
	Greys	(6)	9	3	0.1
Southern	Back	9	23	32	0.6
	Mahomets	27	19	46	0.9
	Tarcoola	18	11	29	0.6
	Southgate - north	(13)	27	14	0.3
	Southgate - south	13	8	21	0.4
	Greenough River	18	11	29	0.6
	South of Cape Burney	(2)	5	3	0.1

Note: 1. Numbers in brackets indicate recession or erosion of the shoreline.
2. Values are averages for the locality.

These data highlight that there has been significant accretion south of the main breakwater in the port. Historical rates of accretion have been more than 2m per year over almost half a century. Greys Beach and the beach immediately north of the Southgate Dunes have experienced some significant erosion despite a long term trend for accretion. Back Beach, Mahomets and Tarcoola all have a long term trends for accretion.

3.6 Waterways & Wetlands

The area encompassed by this study includes two major waterways of the region. The Chapman River reaches the coast at Bluff Point in the northern portion of the area and the Greenough River mouth is located at the southern extent of the study area. The river systems are highly seasonal and responsive to large rainfall events that may occur in summer as a result of dissipating cyclones or thunderstorms. Sandbars that seasonally block both river systems are generally breached each year following winter rainfall. Additional information regarding the river systems and their condition, particularly of upstream sections, is provided in recent Water and Rivers Commission publications (2001a & 2001b).

Apart from these rivers and their estuaries, there are no wetlands mapped within close proximity of the coastal foreshore area. The site inspections of the area however, revealed a small low lying area that supports typical wetland species is located inland of Greys Beach. This area shows obvious signs of disturbance however, the wetland is considered to be a natural feature. A similar wetland is located further from the coast in Mahomets Flats near the Surf Club.

3.7 Terrestrial Vegetation & Flora

At the regional level, the vegetation of the Geraldton-Greenough foreshore area belongs to the Greenough Vegetation System (Beard, 1976). Beard's maps the coastal vegetation as only one unit, *Acacia* Open Scrub, although clearly his description of Sauer's 1965 vegetation transect at Greys Bay demonstrates a transition of vegetation types from high water mark to the stable inner dunes.

The vegetation of the Geraldton-Greenough foreshore has not previously been studied in its entirety at a small scale. The Coastal Management Plans for the Shire of Greenough (Clayton and Elliot, 1985) and Town of Geraldton (Kerr, 1984) provide very brief descriptions of plant species present in each management area. From these reports and the other published descriptions of portions of this section of coast, the vegetation is clearly more diverse than the broad regional description of Beard depicts. For example, Quilty Environmental (1993) describes the dune vegetation at Tarcoola Beach as predominantly comprising Coast Saltbush (*Atriplex isatidea*). The foreshore management plan for Point Moore, however, describes a range of vegetation types in the coastal dunes, none of which contain Coast Saltbush (Alan Tingay & Associates, 1994b). The coastal vegetation described for Southgate Dunes (Alan Tingay & Associates, 1998) is different from both Tarcoola and Point Moore.
Apart from an illustration of a transect at Greys Bay published by Sauer in 1965 and some unpublished vegetation transect data at Drummond Cove and Greenough River (J.

Brooker, pers. comm., August 2002), there is no other written information available for the study area.

The vegetation of the coastal area for the full length of the study area was surveyed as part of this project. The survey was conducted by traversing the coastal foreshore area on foot and by vehicle and noting the structure and dominant flora in the upper strata. Vegetation types were assigned according to the Specht as modified by Aplin classification system (Table 5). This system describes vegetation according to the dominant species and height and cover percentage of the dominant vegetation stratum (eg *Nitaria billardieri* Closed Heath).

TABLE 5
PLANT COMMUNITIES – MAJOR STRUCTURE FORMATIONS

Lifeform and Height of Tallest Stratum	Foliage Cover of Tallest Stratum (%)	Vegetation Type
Trees over 30m	70-100	High Closed Forest
	30-70	High Open Forest
	10-30	High Woodland
	under 10	High Open Woodland
Trees 10 - 30m	70-100	Closed Forest
	30-70	Open Forest
	10-30	Woodland
	under 10	Open Woodland
Trees under 10m	70-100	Low Closed Forest
	30-70	Low Open Forest
	10-30	Low Woodland
	under 10	Low Open Woodland
Shrubs over 2m	70-100	Closed Scrub
	30-70	Open Scrub
	10-30	High Shrubland
	under 10	High Open Shrubland
Shrubs 1-2m	70-100	Closed Heath
	30-70	Open Heath
	10-30	Shrubland
	under 10	Open Shrubland
Shrubs under 1m	70-100	Low Closed Heath
	30-70	Low Open Heath
	10-30	Low Shrubland
	under 10	Low Open Shrubland
Herbs	70-100	Closed Herbland/Tussock Grassland/Sedgeland/etc
	30-70	Herbland /Tussock Grassland/Sedgeland/etc
	10-30	Open Herbland/Tussock Grassland/Sedgeland/etc
Hummock Grasses	10-30	Hummock Grassland
	under 10	Open Hummock Grassland

Adapted from: Alpin (1979)

Vegetation units have been mapped at a scale of 1:3,000 over a series of 22 sheets (Figure 3). The native and introduced species present were recorded as well as the general condition of the vegetation, particularly with respect to invasive weeds.

3.7.1 Vegetation Types

A total of 16 vegetation types were described and mapped in the study area (Figure 3). The different types are reasonably uniform in their composition but local variations occur. In addition, the vegetation types often grade into each other, forming a mosaic of vegetation types in some areas. Examples of some of the vegetation types occurring within the Geraldton-Greenough foreshore area are shown in Plates 1-8.

In general the vegetation types occur on particular landforms although this is not always strictly adhered to. The most obvious different landform and associated vegetation mapped in the study area is at the mouth of the Chapman River where the estuarine conditions have created a very different environment than the majority of the coastal area. Within the coastal dunes, the vegetation types can be grouped according to their location on foredunes, primary dunes and secondary dunes.

A general description of the different vegetation types is provided in Table 6. More detail on the distribution of each type within beach sectors is provided in Section 6.

3.7.2 Vegetation Condition

The condition of the vegetation in the study area ranges from Completely Degraded to Very Good according to standardised vegetation condition rating (Government of Western Australia, 2000) as outlined in Appendix 1. In general, the vegetation is in Very Good condition, particularly the foredunes and more exposed faces of the primary dunes where the harsh conditions do not allow weed species to grow.

The areas in poorest condition are along unsealed tracks and adjacent to road verges where Capeweed and Wild Oats easily colonise. The inland *Acacia rostellifera* dominated dunes at North Sunset are in poor condition with African Boxthorn (*Lycium ferocissimum*) prevalent. A similar *Acacia rostellifera* vegetation type at Chapman River Mouth west of Nazareth House was in similar condition until recently when a large African Boxthorn eradication program and native species rehabilitation should result in a greatly improved area.

African Boxthorn is common in the more stable landforms throughout the study area. In some areas African Boxthorn is present in low numbers and may not spread rapidly if the native vegetation remains in Very Good condition. In other areas such as at Greys, Back Beach, Tarcoola and Greenough, the density of African Boxthorn has already reached levels that require control.

Several other weed species are not widespread but occur in large numbers in a few particular places. For example, Buffel Grass (*Cenchrus ciliaris*) occurs in one small area of imported fill at the northern end of Beresford Beach. If other coastal soil types are favourable to its growth it may become a serious problem in the foreshore area.

TABLE 6
VEGETATION TYPES

Vegetation Type		Comments
Foredunes		
TdSl	*Tetragonia decumbens/ Spinifex longifolius* Low Open Heathland/ Grassland	Typically occupies the most seaward permanent vegetation on the foredunes. The vegetation is low and has very few species due to the extremely exposed conditions and dynamic sand movement. Other species that can occur in this unit include *Atriplex cinerea* and *Cakile maritima*. The TdSl unit occurs in most beach sectors except for Sunset and Sunset North where erosion has possibly removed the foredune vegetation and Pages Beach where activities on the beach may have removed the TdSl vegetation.
OaSl	*Olearia axillaris* Shrubland over *Spinifex longifolius* Grassland	Often found behind the TdSl unit in the northern part of the study area from Drummond Cove to Bluff Point, with a small occurrence at Point Moore. Other species include *Myoporum insulare, Tetragonia decumbens* and *Threlkeldia diffusa*.
Nb	*Nitraria billardierei* Closed Heath	Nitre Bush (*Nitraria billardierei*) occurs intermittently as a dense hedge about 1-1.5m high, 3m wide and up to 100m long in the foredune, replacing the TdSl unit where it occurs. *Atriplex cinerea* is often a common ground cover in this unit, however its abundance and health is dependent on the frequency of storm events. The occurrence of *Nitraria billardierei* gives the impression that it has colonised previously disturbed areas although the species itself is a native species.
Primary Dunes		
OaScTd	*Olearia axillaris* Shrubland over *Scaevola crassifolia/ Tetragonia decumbens* Low Open Heath	A small unit recorded at Southgate Dunes and the Point Moore/Greys Beach area. It occurs slightly inland from the foredunes in areas where sand accumulation may still be occurring.
AiTd	*Atriplex isatidea* Open Heath over *Tetragonia decumbens* Low Open Heath	Coast Saltbush (*Atriplex isatidea*) occurs naturally in dense stands on the windward slope and ridge of tall primary dunes such as at Glenfields and the Back Beach/Tarcoola area. *Tetragonia decumbens* is a common understorey species in an otherwise species poor unit. On the more sheltered side of the primary dunes, the *Atriplex* unit also contains *Myoporum insulare* at Tarcoola.
AiOaTdSl	*Atriplex isatidea/ Olearia axillaris* Open Heath over *Tetragonia decumbens/ Spinifex longifolius* Low Open Heath/ Grassland	Similar to the AiTd unit and occurs on similar dunes in the Mahomets/Back Beach area with a small occurrence at Greys Beach. The main difference between this unit and the AiTd unit is the prevalence of other species such as *Olearia axillaris* with the *Atriplex isatidea* shrubs.

Vegetation Type		Comments
NbOaMiSl	*Nitraria billardierei/ Olearia axillaris/ Myoporum insulare* Open Heath over *Spinifex longifolius* Grassland	Recorded in the primary dunes for all beaches between Pages Beach, around Point Moore, Greys Beach, Separation Point and Mahomets Beach. Unlike the Nb unit that occurs in the foredunes, the NbOaMiSl unit is situated slightly further back from the beach in the primary and sometimes secondary dunes.
NbSlTd	*Nitraria billardierei* Open Heath over *Spinifex longifolius/ Tetragonia decumbens* Grassland/ Low Open Heath	Restricted to the sheltered side of the tall primary dune in the Glenfield area.
Secondary Dunes		
ArOaSl	*Acacia rostellifera/ Olearia axillaris* Open Heath over *Spinifex longifolius* Grassland	Widespread unit that occurs inland from the coast throughout the study area. In the Point Moore area the unit occurs inland of the coastal road and therefore is effectively not within the foreshore reserve. *Acanthocarpus preissii* is common in the understorey. Other species occasionally found in this unit include *Rhagodia baccata, Myoporum insulare* and *Solanum symonii*.
ArOaSc	*Acacia rostellifera/ Olearia axillaris* Open Heath over *Scaevola crassifolia* Low Open Heath	Similar to the ArOaSl unit but contains *Scaevola crassifolia* rather than *Spinifex longifolius*. This subtle variation generally indicates the area is prone to accumulating sand rather than the more stable ArOaSl unit, such as at Southgate Dune.
Ar	*Acacia rostellifera* Open to Closed Heath	Occurs in only two locations, Chapman River Mouth and Tarcoola North. The unit lacks many of the other species typical of coastal dunes, which is an indication that the soil type is changing to loamy red soils of the inland areas rather than the white sandy coastal dune soils.
ArAiTd	*Acacia rostellifera/ Atriplex isatidea* Open Heath over *Tetragonia decumbens* Low Open Heath	Two occurrences of this unit were recorded, at Tarcoola and Sunset. The vegetation at Tarcoola is inland of the AiTd unit that is common on the primary dunes in this area. The Sunset vegetation has been created by rehabilitation of the dunes about 15 years ago.

Vegetation Type		Comments
Sv	*Sporobolus virginicus* Grassland	A small wetland about 20m in diameter was recorded in the secondary dunes at Greys Beach near the end of Point Street. The wetland contained a low dense cover of *Sporobolus virginicus* with *Isolepis nodosa* and *Atriplex cinerea* also common. An excavated portion of the wetland contained groundwater approximately 0.1m below the surface. The soil of the wetland was sandy. The northern and western sides of the dunes around the wetland have been disturbed by past and present road construction. Examination of 1952 aerial photography indicates that the wetland is natural and not artificially created by earthworks in the past.
MhAr	*Melaleuca huegelii/ Acacia rostellifera* Closed Scrub	One small stand occurs on the inland portion of the foreshore area at the boundary of Tarcoola and Southgate. The presence of *Melaleuca huegelii* suggests the presence of limestone in the soil although none was observed on the surface.
t	Tamarisk (*Tamarix aphylla*) Trees	Tamarisk trees have been planted within the foreshore area to provide shade and protection from the wind. Some Tamarisk plants have self seeded within the native dune vegetation, however these are only minor occurrences and do not appear to pose a threat of becoming an invasive weed.
Estuarine		
Co	*Casuarina obesa* Woodland	Strictly estuarine in the study area and occurs on the northern and southern banks of the Chapman River. The *Casuarina* trees are tall, up to 8m high, and relatively dense in a narrow band fringing the river. The understorey is fairly open due to the dense overstorey and consists of *Atriplex cinerea, Sporobolus virginicus, Alyxia buxifolia* and weed species.
Ac	*Atriplex cinerea* Low Closed Heath	A broad unit as mapped and although dominated by Grey Saltbush (*Atriplex cinerea*) there are other areas where *Juncus kraussii* is common such as on the northern bank of the Chapman River mouth as well as dense *Sporobolus virginicus* grasslands on the southern bank. Other species that are common in this area include Samphire (*Halosarcia halocnemoides*) and *Isolepis nodosa.*

3.7.3 Flora

The vegetation survey of the study area identified a total of 59 plant species during two site visits in August 2002. The total included 33 native species and 26 introduced species. The high percentage of introduced species (44%) is related to the typically low number of native species found in coastal environments and the high degree of development both adjacent to and within the foreshore area.

None of the species present is a Declared Rare or Priority Flora species. No DRF or Priority species are expected to occur in the Geraldton-Greenough coastal area.

Appendix 2 lists the distribution of native flora within the 16 vegetation types. Many of the species are restricted to certain vegetation types, particularly the river and wetland environments. Some of the more widespread species include *Tetragonia decumbens, Atriplex cinerea, Olearia axillaris* and *Spinifex longifolius*.

The most widespread introduced species are African Boxthorn (*Lycium ferocissimum*), Winter Grass (*Poa annua*), Wild Oats (*Avena fatua*), Couch Grass (*Cynodon dactylon*), Ice Plant (*Mesembryanthemum crystallinum*) and Cape Weed (*Arctotheca calendula*).

None of the introduced species is a Declared Plant in the City of Geraldton or Shire of Greenough. Doublegee (*Emex australis*) and Paterson's Curse (*Echium plantagineum*) are Declared Plants in some other municipalities.

3.7.4 Conservation Values

All of the native vegetation in the study area is considered to have conservation value, mostly due to the fact that a large proportion of the vegetation has already been cleared for development. The values also include their use for fauna habitat and important function in stabilising the fragile dunes from coastal erosion and wind erosion.

Areas of highest conservation value are considered to be the following:

- The *Sporobolus virginicus* wetland at Greys Beach. This is the only basin type wetland observed in the Geraldton-Greenough foreshore, and although very small in area, is an unusual vegetation type in very good condition.

- The *Melaleuca huegelii/Acacia rostellifera* Scrub at the northern end of Southgate near the Tarcoola border is the only area within the foreshore of the study area that contains this vegetation type.

- Point Moore/Greys area. This area has a relatively high number of different vegetation types that relate to past and recent erosion and accretion processes. The scientific and educational value of the vegetation in the Point Moore/Greys Beach area is high from this point of view.

- Chapman River Mouth. The mouth of the Chapman River that is within the foreshore area is part of the Chapman River Regional Park. The Park has high ecological, scientific, cultural and recreational values.

- Links to inland reserves. Potential links of the coastal vegetation to inland vegetated areas to protect transition between vegetation are located at Drummond Cove, Glenfields, Tarcoola (southern section) and Southgate (northern boundary and southern area).

3.8 Fauna

3.8.1 Habitats

Within the coastal dunes area the natural heathlands and shrublands are expected to support faunal diversity typical of coastal environments in the region. The vegetation is relatively uniform and lacks vertical complexity. The small wetland area located within the foreshore area may provide limited seasonal habitat for fauna such as frogs. The occasional stands of planted trees or invasion of introduced tree species provides additional habitat that would typically not be present in the coastal foreshore area.

Large bare sand dunes occur in the area north of Sunset Beach and at Southgate. These bare sand areas have limited value for native fauna as these do not provide sufficient resources such as shelter and food for most species. The presence of small areas of bare sand amongst the vegetation however, is important habitat particularly for reptiles.

There is a lack of native vegetation on the dunes along some sections of the foreshore in the study area, thus limiting the fauna populations able to be supported and the value of the foreshore as a wildlife corridor for movement and dispersal. Fauna presently persisting in the foreshore areas is highly vulnerable to disturbance and species are susceptible to local extinction because of the limited opportunity for re-establishment from adjoining areas of bushland.

Sensitive fauna habitats within the Geraldton–Greenough near coastal area include:

- Sand dunes – provide habitat for a range of largely terrestrial vertebrate fauna. Sand dunes are highly sensitive to foot and vehicle traffic. Vegetation on the sand dunes is essential in ensuring stability of these areas.

- Beaches – seabirds and waders as well as other species such as the Australian Sea Lion will visit beaches for activities such as resting, feeding or breeding.

- Rock platforms – pools of water and loose rocks provide habitat and protection for a range of fauna, many that specialise in living in intertidal habitats.

- River estuaries – these are important seasonal and permanent habitat for an array of non-marine waterbirds, wading birds, fish and other fauna.

3.8.2 Assemblages & Species

The Geraldton area lies within the transition zone between northern limit of typical south-western species and southern extent of fauna associated with arid areas. The fauna along the coast however is considered fairly uniform given that the geology, soils

and climatic conditions are reasonably similar over large distances (Dames & Moore, 1993).

There is virtually no information relating to systematic observations or surveys of fauna within the coastal foreshore area of the study area. Previous studies in the region include a biological survey of the Greenough Front Flats (McMillan and Foulds, 1980), herpetofauna surveys in the Geraldton region (Storr *et al*., 1983) and surveys of coastal areas in the Shire of Dandaragan region (Chapman *et al*., 1977; and Crook *et al.*, 1984).

Within the Geraldton region there have been several specific investigations including the Burma Road Reserve (Foulds and Perth 1988), North-west Coastal Highway realignment (Bowman Bishaw Gorham, 1992), and within Chapman River Regional Park (Aplin *et al*., 1993; Mitchell McCotter and Ecologia, 1993). An assessment of fauna likely to occur within the proposed Oakajee industrial estate has been completed (Dames and Moore, 1993). None of the surveys however, specifically relate to the fauna occurring within the coastal foreshore and on the beaches in the study area although surveys for the Chapman River Regional Park include records from the river estuary and nearby beaches.

The earlier draft coastal management plan for the Shire of Greenough provides some information on near coastal fauna based on previous limited surveys in the region (Clayton and Elliott, 1985). The surveys indicate a limited diversity of mammals in the region. Nine mammal species have been recorded while an additional 13 species comprising several bat species could occur. The herpetofauna (reptiles and amphibians) of the coastal zone within the region is considered relatively diverse. Twenty–six species are listed as being recorded in the region or likely to occur based on distribution. Mammals and herpetofauna identified as having been recorded in the near coastal areas in the Geraldton region or considered likely to occur according to information presented in the earlier Greenough coastal management plan are listed in Appendix 3.

The Geraldton-Greenough region is considered relatively rich in avifauna. A total of 64 bird species were recorded during surveys of the Greenough Flats area (McMillan and Foulds, 1980). Recently, as part of the Chapman Wildlife Corridor Project, bird observation activities have been undertaken at the Chapman River mouth. Avifauna using the estuarine sections of the river and the nearby coastal foreshore area were recorded (John Braid, pers comm, 2002). The species recorded as part of these activities are listed in Appendix 3.

An assessment of vertebrate fauna undertaken for the proposed Oakajee industrial estate located near the coast about 5-10km north of the boundary of the current study area, recorded 34 species of vertebrate fauna within the industrial site (Dames & Moore, 1993). These are also listed in Appendix 3. A list of species predicted to occur within the vicinity of the industrial site and within the range of habitats available at the site is provided in Dames & Moore (1993).

Fauna observed during the site inspection and previous observations in the coastal area in the Geraldton-Greenough foreshore area were noted as part of this study. These are identified in Appendix 3.

Discussion with the local CALM office did not identify any fauna of particular conservation significance known to inhabit the coastal foreshore area (A. Desmond, CALM Midwest Region, pers. comm., August 2002). Prominent species such as the Osprey (*Pandion haliaetus*), which breeds in the area, is of public interest in the area. In addition, the Australian Sea-lion (*Neophoca cinerea*) is known to occur on rock breakwaters within the port area and to occasionally haul-out on local beaches. This species is listed on Schedule 4 of the *Wildlife Conservation Act 1950*.

3.8.3 Conservation Values

All of the remaining areas of habitat within the Geraldton-Greenough coastal foreshore area are considered to be of some conservation significance given that extensive areas have been cleared or substantially modified. Specific comments in relation to the conservation significance of the fauna and its habitat are as follows:

- There is limited area of fauna habitat remaining within the coastal sector and therefore all remaining areas are important.

- Connection between the foreshore area to reasonably large areas of vegetation further inland at locations such as Drummond Cove and to the north, Glenfield, southern portion of Tarcoola and Southgate is expected to be assisting in sustaining local faunal diversity and populations by facilitating migration and dispersal.

- The Point Moore and Greys Sectors support reasonably wide and large areas of native coastal vegetation, and together with additional vegetated areas that adjoin the coastal foreshore, provide significant areas of habitat for fauna.

- The Chapman River Mouth provides important habitat for aquatic species in combination with typical coastal habitats thereby supporting a relatively high faunal diversity.

- The *Sporobolus virginicus* wetland at Greys Beach and *Melaleuca huegelii/Acacia rostellifera* Scrub at the northern end of Southgate are limited habitat types within the study area. Although very small in area, these sites offer different habitat and may support additional fauna species.

3.9 Nearshore Environment

3.9.1 Habitats

The Geraldton-Greenough area falls with a region that is considered to have a high diversity of seagrass species, and a diverse macroalgal community (URS Australia, 2001). A variety of both temperate and tropical fish species occur in the region and a diverse invertebrate community is supported.

Habitats within the Geraldton-Greenough region have been investigated in several studies particularly in relation to the marina, Geraldton Port and identification of other

potential port sites (URS Australia, 2001; Monaghan Rooke & Robinson, 1993 and 1994; Masini, 1998).

The available survey reports indicate the habitats in the Geraldton-Greenough area largely consist of sand sheets, limestone pavements with or without a sand veneer, sections of reef, seagrass meadows and sandy beaches. In addition, artificial habitats within the region include breakwaters and groynes, and deep dredged areas.

The majority of these habitats support seagrass and macroalgal growth. Seagrass communities consist primarily of a mix of meadow or mosaic of less diverse small patches. Major seagrass species recorded within the area include *Amphibolis griffithii, A. antarctica, Posidonia sinuosa* and *P. australis*. Colonising species such as *Halophila ovalis*, *Syringodium* and *Herterozostera* occur in sandier patches. Algae such as *Caulerpa cacatoides* and *Sargassum* also occur within the seagrass meadows and reef areas.

The natural habitats of the region and associated species occur throughout the broader region. The seagrasses in the area are considered relatively common and generally characteristic of the region.

Significant marine fauna include a small non-breeding colony of the Australian Sea Lion (*Neophoca cinerea*), which often rest on rock walls around the port and occasionally along the beaches, dolphins and migrating whales such as the Humpback Whale (*Megaptera novaeangliae*) and Southern Right Whale (*Eubalaena australis*). The Western Rock Lobster is a major commercial fishery in the region.

3.9.2 Water Quality

Monitoring undertaken by the Port of Geraldton over several years in association with progressive expansion of the port indicates the nearshore waters within Champion Bay are of acceptable quality although waters within and around the port periodically record elevated levels of some parameters (GPA & ATA Environmental, 2000).

Numerous stormwater drains from nearby development areas discharge onto the beach and into the ocean. Stormwater from residential areas typically contains elevated levels of pollutants and other contaminants such as nutrients, heavy metals, herbicides, litter, hydrocarbons and fine particulates. The stormwater disperses and is diluted by ocean waters.

Water quality with the nearshore coastal environment is affected by the seasonal flows from the Chapman and Greenough Rivers. Both river systems have highly modified catchments that have been largely cleared for agricultural related activities. As a result the waters discharging into the ocean from both of these rivers contains a relatively high fine sediment load and increased levels of pollutants such as nutrients. This is often clearly evident by muddy plumes of water that can been seen in the nearshore waters after the sandbars have been breached. Increased levels of nutrients and sediment have the potential to smother seagrass meadows and fill in and cover rock holes and reefs and affect the local marine diversity and populations.

3.10 Aboriginal Heritage

Sites of significance to the Aboriginal community are often concentrated near river or wetlands and coastal dunes. These areas are therefore of significance in general regardless of the identification of artefacts or archaeological material because they traditionally attracted a high level of usage or served a specific function.

A search of the Department of Indigenous Affairs' Register of Aboriginal Sites revealed 12 sites occurring within or close to the coastal foreshore area in the study area. These are presented in Table 7.

It is acknowledged that not all Aboriginal sites are registered. The location of unregistered sites was beyond the scope of this report. It is strongly recommended that any person or group proposing works in the foreshore area liaise with the Heritage Section of the Department of Indigenous Affairs for updated data on Aboriginal sites.

TABLE 7
REGISTERED ABORIGINAL SITES
LOCATED IN OR NEAR THE COASTAL FORESHORE

Site No	Site Name	Reliability	Type	General Location
S02774	Drummond Cove Shell Midden	Unreliable	Midden/ Scatter	Drummond Point
S0006	Chapman River Mouth	Unreliable	Burial	Chapman River mouth, Bluff Point/Sunset Beach
S00132	Bluff Point Midden	Unreliable	Midden/Scatter	Kempton Street, Bluff Point
S01965	Kempton St Midden	Reliable	Midden/Scatter	Kempton Street, Bluff Point
S02850	Greenough River Midden	Unreliable	Ceremonial; Artefact; Midden/Scatter	Southgate Dunes, Greenough
S02851	Southgate Dune	Unreliable	Artefact	Southgate Dunes, Greenough
S01009	Southgate Burial Site	Unreliable	Burial, Artefact	Southgate Dunes, Greenough
-	SGS-1	Reliable	?	Southgate Dunes, Greenough
-	SGS-2	Reliable	?	Southgate Dunes, Greenough
-	SGA-1	Reliable	Artefact, Midden/Scatter	Southgate Dunes, Greenough
S02854	Greenough River Well	Unreliable	-	Greenough River
S02280	Greenough Mouth	Unreliable	Artefact (Midden/Scatter)	Greenough River mouth

There may be other sites within the coastal area that have not yet been uncovered. Due to the mobile nature of the coastal dunes and changes that occur over time it is highly possible that historical artefacts or burials occur within the foreshore area. It is likely that these will remain undiscovered unless the dunes become unstable, earthworks or development occurs within the dunes or the coastline erodes.

The area being considered within this study is covered by the Naagjua Native Title claim.

3.11 Recreational Use & Facilities

3.11.1 Recreational Use

The range of recreational activities undertaken in an area typically reflects the characteristics of a particular section of the coast and the various features or zones available within the coastal sector. The typical activities that occur within sections of the coastal sector are presented in Table 8.

TABLE 8
TYPICAL ACTIVITIES IN THE COASTAL SECTOR

Water-related	Reef-related	Beach-related	Dunes & Foreshore
Boating	Snorkelling	Fishing	Picnics/BBQs
Windsurfing	Scuba Diving	Walking	Walking
Swimming	Spear Fishing	Jogging	Jogging
Surfing	Reef Fossicking	Dog exercising	Cycling
Wading	Abalone fishing	Sunbathing	Sand boarding
Boogie boarding	Amateur Cray Pot fishing	Surf life Saving	ORV use
Jet skis		ORV use	Viewing scenery
Kite surfing		Relaxing	Nature based
		Sporting activities	
		Boat launching	

ORV: off road vehicle

Usage of certain sections of the coastal environment is related to the availability and quality of each of these main features. Usage is also related to access and the facilities such as parking, boat launching ramps and access paths that are available.

The Geraldton-Greenough coastal area experiences a high level of small boat usage and the area is known internationally as an area for windsurfing. Off road vehicle (ORV) use whether associated with access for boat launching, fishing or surfing or as an activity in itself appears to be highly popular in the Geraldton-Greenough area.

The key recreational pursuits and use of the actual foreshore areas and beaches within the study area appear to be as follows:

- Access for windsurfing, kite surfing surfing, swimming and diving.
- Boat launching, particularly associated with amateur crayfishing.
- ORV use.
- Beach fishing.
- Dog exercising.
- Walking.
- Exercising – jogging and cycling.
- Picnics/BBQs.
- Reef exploring.
- General relaxing & enjoyment of the views and amenity.

The use and amenity value of the foreshore and beach in the study area is affected by the climatic conditions. The region experiences relatively warm and sunny conditions for many months of the year, which increases the potential use and range of activities undertaken. The hot weather and high temperatures experienced during summer can

however, be a deterrent to spending long hours recreating within the coastal foreshore and at the beach. The strong, consistent winds during the summer months in the region can substantially reduce the suitability and enjoyment level for some activities such as sunbathing or picnics, but significantly enhances opportunities for others such as windsurfing.

The coastal environment with its dunes, vegetation and ocean glimpses or panoramas is of significant value. The coastline within the study area offers a mix of river systems, headlands, bays, sandy beaches, rocky shores and large sand drifts.

There is very limited data on levels of beach usage and activities within the study area. A survey of recreational uses of beaches within the Point Moore area was undertaken between December 1993 and January 1994 as part of the investigations for a deepwater port at Point Moore (Alan Tingay & Associates, 1994a). Some information was also gathered during preparation of the draft Coastal Management Plan for the Shire of Greenough (Clayton & Elliott, 1985).

The Point Moore study involved surveys at various times of day on weekdays and weekends during the summer months at Point Moore, Explosives and Pages, as well as a specific survey of the use of Point Moore for windsurfing in comparison to Rundle Park/St George's, Sunset and Coronation (located outside the current study area). The data suggest Pages was the most utilised beach in terms of numbers in the Point Moore area with an average of 35 to 45 people per day during the survey period, followed by Point Moore and then Explosives. Many people using Pages however, were recreating within the parkland rather than the actual beaches and this location was popular with family groups. Activity was generally greatest between 10am and 3pm with the exception of Point Moore, which was most actively used between 12 noon and 5pm primarily due to the windsurfing activities. The 1993/1994 survey data indicate the Point Moore area is more regularly used for windsurfing than Sunset and Rundle Park/St George's, with Rundle Park/St George's having the least activity. The study did not provide an analysis of the use, demand and adequacy of facilities.

The previous management plan for the Shire of Greenough includes results of recreation survey largely involving interviews of users of Drummond Cove, Tarcoola/Southgate, Greenough River mouth, Lucy's Beach and Flat Rocks. The survey found that the majority of users lived in the region while 38.5% were visitors. The main attractions of the coastline were the activities that can be undertaken (ie fishing, surfing), peaceful nature and remoteness of the coast and good facilities and pleasant environment of the beaches. Around 50% of participants at the time suggested facilities were adequate. Suggestions made during the survey included upgrade of facilities (eg. BBQs, toilets, shelters, boat ramps), improve access and parking, restrict 'undesirable' activities such as ORV access, trail bikes and netting and permit camping.

A summary of the main recreational activities within each defined Sector as assessed as part of this study and review of available information is presented in Table 9. It is acknowledged that each of the foreshore areas and beaches are likely to be used for a greater variety of recreation activities however, these activities may occur relatively infrequently or usage is at a more local level.

3.11.2 Existing Facilities & Infrastructure

There is a range of facilities provided within the coastal sector of the study area. Facilities are concentrated in areas where substantial development for residential purposes has been undertaken. Locations on the margins of the urban extent and areas where no development has been undertaken tend to provide fewer facilities. This generally reflects the level of demand from adjoining residential areas.

The range of key facilities noted within each Sector within the study area is identified in Table 10. A greater variety of facilities is available within the Drummond Cove, Sunset, Rundle Park/St George's, Pages and Back Beach Sectors compared to other Sectors.

There appears to be a lack of information relating to the level of usage of facilities and assessment of the current supply and demand. Discussion with the local authorities and consultation with stakeholders however, did not identify any major overcrowding issues associated with existing facilities, with the exception of boat launching ramps. According to a study commissioned by the Shire of Greenough, there is presently insufficient boat launching facilities in the region (MP Rogers & Associates, 1998). The only all weather launching area is located at the Batavia Coast Marina with other constructed facilities at Rundle Park/St George's, Town Beach and Drummond Cove. Informal boat launching also occurs directly over the beach at several locations however launching activities at these locations are restricted to when weather conditions are suitable.

A continuous pathway or DUP is not provided along the coastal foreshore within the study area. Where paths are provided, such as within the Marina to Beresford and Bluff Point Sectors, these appeared to be popular and frequently used.

Grassed areas, which are used to assemble/disassemble equipment, have been mentioned as being in short supply at key windsurfing locations such as at Sunset. A lack of shade within the foreshore area has also been mentioned during consultation with the community.

There does not appear to be a totally consistent design of infrastructure and facilities within Geraldton-Greenough coastal foreshore area. For example, formalised car parking areas include bitumen and gravel surfaces, and fencing and facilities have been constructed using a range of designs and materials. Within the local authorities, there is some consistency in relation to certain aspects such as signage within the City of Geraldton, and the use of gravel for many car parking areas and access paths and style of low barrier fencing within the Shire of Greenough. A consistent approach of individual design has been adopted within some specific foreshore areas however, such as the recently installed facilities at Sunset Beach and dog litter disposal bins at Tarcoola. Use of a consistent design within the specific foreshore areas , but perhaps non-uniform design throughout the local authority, can add to the local identity and individual flavour of an area.

TABLE 9
RECREATIONAL USE AND ACTIVITIES WITHIN EACH SECTOR

Recreational Use/ Activities	Drummond Cove	Drummond Point	Glenfield	Sunset North	Sunset	Chapman River Mouth	Bluff Point	Rundle Park/ St George's	Beresford	Marina	Pages	Point Moore	Greys	Separation Point	Mahomets	Back Beach	Tarcoola North	Tarcoola	Southgate	Greenough River
Swimming	✓				✓		✓	✓		✓	✓	✓	✓			✓	✓	✓		✓
Surfing		✓	✓		✓	✓	✓					✓			✓	✓				✓
Windsurfing					✓	✓		✓				✓		✓						
Recreational Boating[1]	✓							✓			✓	✓							✓	
Recreational Fishing	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓				✓	✓
Walking	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Exercising[2]						✓	✓		✓	✓										
Dog exercising	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓
ORV access/use	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓			✓	✓
Sandboarding				✓															✓	
Free beach				✓[5]																
Picnics	✓	✓						✓		✓	✓					✓				
Snorkelling/Diving		✓										✓		✓						
Surf life saving																✓				
Views[3]	✓				✓	✓	✓	✓	✓			✓		✓						
Nature based[4]						✓			✓			✓								

1. Recreational boating – locations where formal and informal boat launching occurs
2. Exercising – includes jogging, cycling, rollerblading, etc within the foreshore
3. Views - includes where ocean/coastal features are highly visible from adjoining road, where people often park to enjoy coastal scenery or lookout facilities are provided.
4. Nature based - includes activities such as bird watching, bush walking or reef fossicking.
5. Not legal activities

TABLE 10
EXISTING FACILITIES WITHIN EACH SECTOR

Facilities	Drummond Cove	Drummond Point	Glenfield	Sunset North	Sunset	Chapman River Mouth	Bluff Point	Rundle Park/ St George's	Beresford	Marina	Pages	Point Moore	Greys	Separation Point	Mahomets	Back Beach	Tarcoola North	Tarcoola	Southgate	Greenough
Formal access paths	✓	✓			✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓		✓
Formal parking	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Dual use path							✓		✓	✓								✓		
Boat ramp[1]	✓							✓												
ORV access point[2]	✓	✓	✓	✓							✓	✓		✓		✓			✓	✓
Shelters	✓				✓				✓	✓	✓	✓				✓				✓
Grassed area	✓				✓	✓		✓	✓	✓	✓	✓				✓		✓		
BBQs	✓							✓		✓	✓									
Picnic tables/seating	✓				✓			✓	✓	✓	✓	✓				✓	✓	✓		
Showers					✓			✓			✓			✓		✓	✓			
Toilets	✓				✓			✓			✓	✓				✓				✓
Play equipment	✓							✓			✓					✓				
Surf Life Saving Club																✓				
Sporting facilities[3]	✓				✓															

1. Boat ramp – constructed facilities
2. ORV access point – where ORV vehicle access to the foreshore or beach is provided or regularly occurs
3. Sporting facilities - includes volleyball, basketball, tennis courts etc.

3.12 Community Views

3.12.1 Consultation Program

Preparation of this report involved requesting input from a selected list of agencies, community groups and individuals with an interest in coastal area, and holding meetings with and discussing issues or specific sites in greater detail with specific groups or community representatives.

Consultation undertaken in preparation of this plan specifically involved the following aspects:

- Liaison and discussion with the Steering Committee made up of relevant local authority staff and community representatives.

- Circulation of a summary of the project together with a form for the provision of comments to a wide variety of identified stakeholders including Government agencies, local businesses, interest and activity groups, community action groups and individuals.

- Meetings and on-site discussions with Government agencies, relevant Native Title claimants, community action groups and individuals.

- Telephone conversations with local interest groups or individuals.

A list of the agencies, groups and individuals contacted in relation to the preparation of this report is presented in Appendix 4 together with a copy of the information and comments form that was circulated to each party.

Meetings and discussions were held with a number of groups and individuals to obtain specific information about certain sections or issues of the Geraldton-Greenough foreshore area. Meetings or discussions were held with representatives from the following groups:

- Chapman River Wildlife Project
- Friends of Bluff Point
- Tarcoola Progress Association
- Department of Conservation and Land Management
- Sunset Beach Coast Care
- Greenough/Cape Burney Progress Association
- Naaguja Native Title Claim Working Group
- Midwest Development Commission
- Shire of Greenough
- Geraldton Boardriders
- TAFE

Meetings were also scheduled with the Geraldton Angling Club and Geraldton Windsurf Club, unfortunately, however representatives from these groups were unable to meet. Several other groups or individuals were contacted by telephone to offer an

opportunity to meet and discuss relevant issues and comments, however no response was received.

3.12.2 Comments & Issues Raised

A list of the respondents is provided in Appendix 4. The list of respondents includes those that provided written comments, verbally discussed issues and/or with whom meetings were held.

Based on comments received and discussion with members of the local community, the local coastal environment is considered to be of high value and fundamental to the establishment of communities within the area. This is reflected in preferential subdivision and development of land located close to the coast and residential expansion being focussed to the north and south of existing development.

A summary of the main comments provided by the community is as follows:

Values

- Extremely important asset of Geraldton that provides local identity.
- Integral part of the local lifestyle.
- Very high aesthetic and recreational value.
- Foreshore vegetation and habitat has ecological value and provides linkage to other areas.
- Economic value associated with import and export industries.
- Important aspect of local tourism industry.

Uses

- Access for surfing, windsurfing, snorkelling, diving.
- Recreational activities include picnics, general play area, dog exercising, ORV access and use, cycling, fishing, swimming, walking and boat launching.
- Educational training and raising public awareness of environmental issues.
- Gathering place for the local community.

Issues

<u>Dunes & Beaches</u>

- Foreshore erosion and stabilisation.
- Protection of natural dune systems from degradation.
- Maintain quality of the beaches.

<u>Access</u>

- Rationalise and improve cycleway/path network for improved access along and within the foreshore.
- Potential conflicts of access and uses (ie ORV, dog exercising, swimming).
- Need for improved control for ORV access and use.
- Access needs to be controlled by means such as signage, fencing and barriers.
- Improved access for the elderly and handicapped.

Facilities
- Beautification and re-establishment of park areas affected by erosion.
- Improved areas for picnics and BBQs.
- Need for improved boat launching facilities.
- Limited shade is available.
- Visible and well-lit car parking areas.

Vegetation & Habitat
- Protection of local dune vegetation and revegetation of degraded areas.
- Protection of habitat and enhancement of ecological linkages.
- Potential introduction and spread of weeds through foreshore works and dumping of garden waste.
- Weed management strategy and active coordinated weed management is required.

Management
- Community action groups require greater support.
- Increased public education and availability of information needed.
- Development has been allowed to occur close to the beach.
- Ensure works along the coast are of a similar, high standard.
- Use of appropriate sand material for dune renourishment.
- Works within or adjacent to the foreshore need to be restricted and controlled.
- Security for vehicles and property within foreshore parking areas particularly where there are limited residential areas overlooking car parks or vehicles are not visible from the beach such as at Tarcoola, Greenough, Back Beach and Drummond Point.
- Coordination of activities within and between local authorities.

Specific comments in relation to certain foreshore areas and beaches have been noted separately in following sections of this report.

Comments raised by the Naaguja Native Title Claim Working Group are summarised as follows:

- Coastal dunes environment may support historical burial sites, artefacts and camping areas (particularly in areas adjacent to rivers or freshwater).
- River systems including the Chapman and Greenough Rivers were focal points for Aboriginal people.
- Request recognition of association with the area including naming rights for areas and features such as reserves.
- Would like improved availability of bush foods and medicines.
- Might be opportunities for dedicated areas of bush foods and tours with Aboriginal involvement and employment.
- Concern regarding erosion and development and possible uncovering of burial sites.
- Disturbance of the area should be minimised and conservation of the natural environment promoted.
- Undertake assessment and monitoring of areas prior to ground disturbing works.

4. COASTAL STRATEGY

4.1 Overview

This section outlines broad principles and general management directions to guide development and management of the coastal zone within the Geraldton-Greenough region in order to minimise the potential for significant issues arising in the future and maximise retention of the natural physical and biological characteristics.

4.2 Management Principles & Objectives

Major principles in relation to coastal planning based on a review of the relevant literature and policies are summarised as follows:

Environmental

- Natural habitats, particularly areas of high biological productivity, should be protected.
- Disturbance to vegetation should be minimised.
- Indigenous plants should be utilised to encourage regeneration, where required.
- Places of unique landscape, scientific and cultural significance should be conserved and managed, including geomorphological, ecological, anthropological and historic sites.

Coastal

- Beach, between the water line and the vegetation line, is stable and can accommodate high levels of human use.
- Development should be separated from the coast by a foreshore reserve.
- Coastal land should be retained in public ownership.

Developmental

- Public access to the beach should be provided in a sustainable manner.
- Development that is in harmony with the sensitive nature of the coast should be encouraged.
- Development should be concentrated in nodes.
- Development should not cast shadows on the beach or increase wind velocities.
- New developments should be fully serviced, including sewerage and drainage.
- Development should not result in effluent discharges that may pollute the beach.
- Priority should be given to development that is required to be by the coast.
- Signs should be limited in number and placed so as to avoid blocking views.
- Service facilities should be designed to minimise impact on the foreshore.

Based on the general principles outlined above the broad objectives of the strategy for the Geraldton-Greenough coastal area should be as follows:

- ⇨ Conserve natural elements of the coastal area.
- ⇨ Protect development and infrastructure located along the coast.
- ⇨ Provide recreational opportunities consistent with the natural characteristics of the coastal area.

4.3 Coastal Stability & Development Setback

Prior to development adjacent to the coast, coastal engineering studies should be undertaken to confirm development setbacks. Any development along the coast should involve assessment of the coastal processes and stability together with consideration of the environmental values of the area.

It is noted that the previous planning documents for large areas of presently undeveloped land involved assessment of the coastal processes and stability however, some of these were completed more than 10 years ago or relied on documentation for adjoining coastal sections. Assessments that have been undertaken should be reviewed by qualified coastal specialists and be updated prior to subdivisional approval being granted and development proceeding. This will ensure the assessment is based on the latest available information and guidelines for establishing a setback to development and foreshore reserve.

Requirements for coastal assessment should be incorporated into standard planning and development procedures as part of the approval processes for the respective local authorities. Where there is limited local expertise to adequately review coastal stability and engineering assessment advice should be sought from the Department for Planning and Infrastructure's Perth office.

4.4 Planning & Land Tenure

The coastal environment and proximity to the coast have been identified as important aspects to the community. Demand for residential development and housing is likely to be relatively high within areas along the coast. Together with increasing populations along the coast and within the region there will be increased pressure and demand for adequate access to the foreshore and beaches and facilities. Planning for future expansion along the coast therefore needs to carefully consider the level of access and locations where activities and facilities could be focussed and the ability of the coastal environment to sustain such use.

Planning and approval procedures within the respective local authorities should ensure that no further development occurs immediately adjacent to the coast without an adequate setback for protection from coastal processes. There are examples within the study area of private properties extending to or close to high water mark with little if any setback to protect these properties from coastal processes. Also, current best practice typically involves the provision of a road or pathway to clearly demarcate the boundary of the foreshore reserve and private property.

Future development of areas adjacent of the coast should involve the ceding of freehold land within the foreshore area to the Crown for vesting and management by the appropriate agency, typically the local government. This area should form part of a coastal foreshore reserve and contain the area extending from the beach to the development setback or reserve boundary established on the basis of coastal engineering and environmental assessments.

Preparation of a detailed management plan for the foreshore area fronting a proposed development, and implementation of the strategies contained in the plan, is subject to negotiation between the local authority and the developer. In many instances a developer will contribute, at least partly, to the implementation of works. In the longer term, responsibility for implementation of subsequent measures and active management typically rests with the local authority.

Development within the coastal foreshore area and particularly those that propose structures within the nearshore environment should be thoroughly examined before approval is granted. Modifications to the foreshore could have significant consequences in terms of stability of the vegetation and dunes and structures within nearshore marine area have the potential to substantially disrupt coastal processes creating imbalance within the local system and resulting in greater erosion and risk to development. Facilities such as safe boat launching sites may be highly desired by the community, and therefore consideration of such facilities may be warranted. Facilities however, should be appropriately designed and managed in the long term to ensure the impacts on other sections of the coast are acceptable. Proposed development may not always be most appropriate close to the coast and impacts as a result of operation of the facility such as access and drainage disposal need to be considered as part of the approval process.

4.5 Retention of Significant Values & Features

Due to the general demand for residential properties within the near coastal areas of the local authorities there is the potential for the environmental and cultural values and features within this sector to experience significant pressure, be substantially modified or lost from the local area.

Planning within the City of Geraldton and Shire of Greenough and particularly for development along the fringes of existing development should consider the retention of representative portions of the coastal sector inland of the actual foreshore. Considerations should be given to:

- Retention of vegetation communities inland of the foreshore.
- Maintaining habitat connectivity and wildlife linkage between the foreshore and inland bushland areas.
- Protection of representative coastal dune landforms.
- Conservation of poorly represented vegetation, habitat or wetlands.

These areas should be protected within local reserves and public open space and be managed by the local authorities to preserve the environmental values and characteristics.

Consideration of significant values and features should be given during the formulation of concept plans for development and during the early subdivisional approval stages particularly where revisions to earlier development plans are proposed. It is relatively common practice within the Perth Metropolitan Region for environmental impact assessment reports to be prepared for development sites where it is possible for

significant environmental values or features to be present. The City of Geraldton and Shire of Greenough could require similar assessments to be undertaken by suitably qualified professionals to identify key features as part of the development approvals process, particularly where the site supports reasonable areas of vegetation or less common landform features.

4.6 Potential Impacts & Management Issues

Loss of vegetation and fauna habitat within the coastal sector for the purpose of development can significantly alter the local ecological communities and make the communities and species vulnerable to irreparable damage and/or local extinctions. Although the retention of a narrow corridor of coastal foreshore is typically protected as part of any development, the reduction in the area of vegetation and loss of surrounding habitat can substantially deplete populations making it difficult for local flora and fauna to be sustained. Only the more resilient and introduced species tend to survive in the longer term, particularly without adequate planning, management and control. Planning should ensure connectivity between the foreshore and larger areas of bushland or inland areas, while management and control should limit disturbance from activities such as uncontrolled pedestrian access, ORV access and refuse dumping and actively encourage regeneration of vegetation where necessary.

Discharges into the marine environment, particularly of untreated effluent, from development areas within the coastal area or nearshore waters should be avoided. Residential development along the coast has often, in the past, involved direct discharge of stormwater effluent to the beach or ocean and sewerage treatment plant effluent is often discharged to the nearshore waters. Discharge of effluent has the potential to degrade the local water quality and interfere with recreational use and amenity of an area.

The respective local authorities should require future residential development on the coast to accommodate stormwater within the development through the approvals processes. If approval is granted for stormwater to be discharged to the ocean there should be at least some pre-treatment of stormwater prior to discharge such as gross pollutant traps and capture of first flush stormwater.

Inappropriate development or level of use could cause destabilisation of the coastal dunes making them susceptible to erosion and coastal processes which could cause undermining of adjacent infrastructure and buildings and ongoing management problems. It is important to provide a level of access and facilities suitable for the particular coastal area. Encouraging a high level of use at a particular location by means such as constructing a large car parking area, kiosk or surf life saving club could result in sufficient pressure at the site for damage to the vegetation and dunes to occur that may cause instability.

Activities may be acceptable at some locations but unsuitable due to the characteristics or values of a site at others. The local characteristics such as the susceptibility of the dunes to instability and erosion and values for flora and fauna should be considered during identifying placement of development and facilities.

Disturbance within the coastal foreshore area, discharges and the importation of material not natural to the coastal areas can increase the potential for weed species to proliferate and may encourage populations of introduced species such as rabbits and rats to increase. These in turn, affect the ability of the bush to regenerate, create competition with native flora and fauna and can increase the risk of fire.

5. FORESHORE MANAGEMENT PLAN

5.1 Key Management Issues & Strategies

Management measures and recommendations to address issues that are relevant to the entire coastal foreshore area in the study area are provided in the following sections. This section of the report provides additional discussion and recommendations in relation to some of the broad principles and issues raised in the preceding section.

5.2 Land Tenure & Use

Presently the foreshore area investigated as part of this study includes a variety of reserves as well as VCL and freehold properties. While it is unlikely to be feasible or achievable to purchase freehold property in private ownership to create a clearly identifiable foreshore reserve, the existing reserves could be rationalised to ensure more simplified land tenure and reservation that reflects the value of the land for coastal foreshore protection.

Each of the Sectors identified for the purposes of this study as been assigned a Management Priority based on the natural characteristics of the foreshore area and recreational use and potential. The categories applied to each of the Coastal Sectors within the Geraldton-Greenough study area are listed in Table 11.

TABLE 11
MANAGEMENT PRIORITIES

Management Priority	Management Principles	Coastal Sectors
Conservation	Focus on protection of the dunes and vegetation as a priority while providing only limited facilities and controlled access.	Chapman River Mouth Greys
Conservation/ Recreation	Focus on protection of the dunes and vegetation while integrating a range of compatible recreational activities and access in suitable, more disturbed areas.	Drummond Point Glenfield Sunset North Sunset Bluff Point Point Moore Separation Point Mahomets Tarcoola North Tarcoola Southgate Greenough
Recreation	Focus on provision of recreational facilities and access while minimising disturbance on the dunes and good quality vegetation as much as possible.	Drummond Cove Rundle Park/St George's Beresford Marina Pages Back Beach

It is acknowledged that all areas have some conservation and recreation value and that there is a fundamental need to protect the integrity of the foreshore vegetation and the landform as well as provide access and facilities for recreational use. The Management Priority aims to identify those areas where the focus of management should by conservation, or where there is a higher level or potential of recreation use or demand that requires a range of facilities and greater level of access.

Strategies

- Rationalise reserves within the foreshore area by closing undeveloped road reserves and combining these reserves and adjacent reserves within the coastal foreshore.

- Reserve areas presently zoned Residential that are owned by the City of Geraldton that lie within the foreshore area for Coastal and Landscape Protection.

- Negotiate transfer of Railway Reserve along Chapman Road to City of Geraldton for management as Coastal and Landscape Protection reserve after removal of the rail line.

- Assign a Management Priority to each Sector and undertake management of the coastal areas in accordance with these.

5.3 Protection of Vegetation & Habitat

The Geraldton-Greenough coastal foreshore area presently supports areas of native vegetation but also many areas devoid of natural vegetation. Damage to coastal vegetation has been caused by clearing associated with development and provision of infrastructure, pedestrian and vehicular traffic, weed invasion, wind erosion and localised clearing in the vicinity of residences. Faunal habitats have been similarly degraded by urbanisation and other development, uncontrolled vehicular access, weed invasion, feral animals and rubbish dumping.

At some locations lawn has been established and non-local species have been planted such as palms and tamarisk. Landscaping using introduced species and turf is beneficial in high use areas by enabling certain activities and "beautifying" the amenity of the area. Landscaped areas however, should be restricted and introduced species should not be permitted to replace native foreshore vegetation, which has a capacity to capture sand and establish in areas subject to sand movement and coastal processes.

Further loss or degradation of coastal foreshore vegetation and habitats through clearing for land development, uncontrolled access and weed infestation could result in further loss and fragmentation of habitat causing local extinction of more susceptible species. It is important to maintain the current diversity of habitats and range of local variation, ensure at least some portions of the coastal foreshore experience less disturbance and connectivity and linkage is maintained or improved.

Strategies

- Develop work procedures for local authority operators and contractors working in the foreshore area or adjoining land (eg road reserves) to ensure any works (eg maintenance of facilities and access, clearing or mowing road verges, etc) are undertaken with minimal or no disturbance to vegetation and soil and that measures (eg spreading of brush) to minimise weed growth are implemented following the works.

- Ensure no clearing of native vegetation within the coastal foreshore area is undertaken unless associated with specific approved works such as to develop facilities, for maintenance or associated with weed control.

- Areas of coastal vegetation communities abutting the foreshore area or adjoining an area of vegetation that provides linkage and habitat between the foreshore and hinterland should be retained and restored.

5.4 Weed Control

In general, areas of intact vegetation, specifically where overstorey vegetation as well as understorey vegetation are undamaged, are resistant to weed invasion. The areas most prone to weed invasion are those that been physically disturbed by clearing or access. Management should therefore aim to minimise disturbance and maintain or improve the quality of the vegetation through revegetation by managing access and controlling works within the foreshore area.

Weed control efforts should focus on areas that support highly invasive species such as African Boxthorn and areas of native vegetation that are presently in reasonable condition but are adjacent to weed infestations and therefore prone to invasion, and progressively control weeds in adjacent weedier sections.

The disturbed nature of portions of the foreshore together with the surrounding land uses ensure that weeds such as grasses and small herbs will continuously require active management.

Resources should be focused towards eradicating introduced plants that have the greatest potential to invade into other areas and compete with native species and in areas where these are presently scattered within the foreshore. Within the Geraldton-Greenough foreshore area this includes African Boxthorn, Ice Plant, Century Plant, Wild Oats, Geraldton Carnation Weed, and Buffel Grass.

It is not considered a high priority to remove established exotic trees such as the Tamarisk within the foreshore. This species has established in certain locations over a long period of time and although this plant might have spread a little, this species does not pose a major immediate risk to the native vegetation.

Weed control should be undertaken in concert with revegetation works. Revegetation should commence almost immediately after weed control measures to minimise

regrowth of weed species and maximise plant establishment while there is reduced competition from weed species.

An overview of methods to eradicate and control the major problem weed species within the coastal foreshore area is presented in Appendix 5. Additional information on weeds and control methods can be obtained from various publications including Brown & Brookes (2003), Moore & Wheeler (2002), Hussey *et al.* (1997) and Scheltema & Harris (1995). Latest control techniques and herbicides should be checked with agencies such as the Department of Agriculture and Environmental Weeds Action Network prior to implementing control methods.

It is recommended that the local authorities jointly prepare a regional Weed Management Strategy for the coastal foreshore areas and adjoining reserves. The Weed Management Strategy would aim to:

- Identify all weed species.
- Prioritise management of weed species.
- Prioritise areas for weed control.
- Outline suitable weed control procedures.
- Determine initial control measures and ongoing works.
- Identify timing and frequency of control measures.
- Develop a detailed yearly program of works for at least a 5 year period.
- Identify an implementation strategy.
- Ensure integration of efforts and timing between local authorities.
- Identify a process to continually map weed infestations.
- Discuss opportunities for training and maintaining knowledge of latest up-to-date control methods.
- Encourage community involvement.
- Identify prevention of weed invasion.

Specific programs for the most prevalent or damaging weed species such as the African Boxthorn should be developed immediately. Community groups are currently undertaking weed control and eradication programs within specific areas, however the success of these programs to some extent relies on control measures in nearby areas. This is particularly the case for species such as African Boxthorn that are spread by birds and therefore can be introduced to areas distant from the source.

Based on the site inspections carried out for this study, the highest priority weed species are African Boxthorn and Geraldton Carnation Weed. Any control program of these species should also consider control measures in areas adjoining the foreshore to reduce the source for possible reinfestation.

To assist management of the coastal foreshore area, each of the Coastal Sectors has been prioritised in terms of the need for weed control based on the assessment undertaken as part of this project (Table 12). Priotitisation of the Sectors considered the current condition and value of the bushland, current active involvement or interest in management of the Sector, level of recreational use and ongoing disturbance and proximity to good quality bushland areas. Assigned priorities do not reflect the areas

with greatest weed infestation but those where active weed control measures are most appropriate to enhance native bushland and conservation values.

TABLE 12
PRIORITIES FOR WEED CONTROL

Coastal Sector	Priority	Comments
Drummond Cove	2	Relatively high level of use and disturbance
Drummond Point	2	Relatively high level of use and disturbance
Glenfield	3	Limited access
Sunset North	3	Limited access
Sunset	2	Highly modified system, subject to erosion, active community group, adjacent to high conservation value area
Chapman River Mouth	1	High conservation value, active community group and project officer
Bluff Point	1	Reasonably low level of continual disturbance, active community group
Rundle Park/St George's	2	High level of use, limited native vegetation, adjacent to relatively good bushland, active community group
Beresford/Champion Bay	3	Limited native vegetation, not adjacent to quality bushland
Marina	3	Limited native vegetation, high public use area, not adjacent to quality bushland
Pages	2	High public use area, highly modified area
Point Moore	1	High conservation value, bushland in good condition
Greys	1	High conservation value, bushland in good condition
Separation Point	1	Bushland in good condition, adjacent to high conservation area
Mahomets	1	Bushland in good condition
Back Beach	2	High public use area, bushland in good condition
Tarcoola North	2	Bushland in good condition
Tarcoola	2	Bushland in good condition
Southgate	3	Limited vegetation and access
Greenough/Cape Burney	2	High public use area, bushland in good condition

Note:
Priority 1
Priority 2
Priority 3

Strategies

- Develop and implement a Weed Management Strategy for the coastal areas in the region to ensure an integrated approach and appropriate prioritisation of resources.

- Develop and implement specific control or eradication programs African Boxthorn and Geraldton Carnation Weed throughout the coastal areas. The program should consider suitable target-specific vermin control measures prior to weed control of African Boxthorn as these plants are known to harbour introduced rats.

- Undertake weed management according to priorities assigned to each Sector.

- Provide technical and resource support for community groups undertaking weed control in specific areas.

5.5 Rehabilitation & Revegetation

Rehabilitation and revegetation works are important components of effective foreshore management. Restoring native vegetation on coastal dunes enhances stability and minimises further erosion, enhances ecological values and linkage, limits areas where nuisance species and weeds may become established and proliferate and may discourage random pedestrian and vehicle access.

The first stage of a successful rehabilitation program is to eliminate the disturbance factors such as uncontrolled access and weed growth. Fencing and weed control therefore may need to precede, or be undertaken in conjunction with, revegetation works.

Initial rehabilitation efforts, often combining weed control and revegetation, should focus in disturbed areas that adjoin areas where the vegetation is presently in reasonable condition and should be extended further as areas become revegetated. Special attention should also be given to the edges of bushland where these abut a constant source of potential weed invasion, such as grassed areas. Ensuring the areas within several metres of the weed source are densely vegetated with sedges or shrubs should minimise the risk of weed invasion.

An effective method used commonly in foreshore areas is to cover exposed areas with brush material. Application of brush reduces wind flow over the sand and reduces the movement of sand and subsequent loss of seed and smothering of seedlings trying to establish. Brush enables the capture of wind blown seed and provides conditions that promote establishment, often restrict grazing by rabbits and create microhabitat for fauna. Brush material should be sourced from native vegetation from areas adjoining the foreshore area to maximise the seed source and limit the potential introduction of weeds.

Where planting is undertaken, local native species should be used in the areas requiring revegetation wherever possible. If local seedlings or seed are not available a local nursery or community group could collect seed from the site or nearby according to the native species found in the local area. Appendix 2 provides a list of native species found within the Geraldton-Greenough study area in each vegetation type which should be used for revegetation of the foreshore area.

Planting should generally occur in late autumn to early winter to take advantage of the following winter/spring rainfall, after initial rainfall has thoroughly moistened the soil. Additional planting may be required to replace any losses until adequate growth and cover is achieved. Seedlings should be planted into relatively weed free areas and planted randomly to achieve a natural effect. Care should be taken to minimise the risk of introducing disease and pathogens into the area by limiting the introduction and movement of soil and vegetation.

Strategies

- Progressively rehabilitate degraded areas by implementing weed control as required, followed by the application of brush with direct seeding and planting of appropriate local species according to the surrounding vegetation types in large, highly degraded areas.

- Concentrate initial revegetation works in areas within or adjacent to areas of reasonable quality vegetation.

- Establish locally occurring native species densely adjacent to pathways to prevent divergence from paths and minimise potential weed invasion.

- Utilise native vegetation cleared from surrounding areas as brush and/or mulch in rehabilitation works.

5.6 Coastal Protection & Sand Replenishment

Erosion of beaches and dunes is a natural event that is often associated with storm surges during winter months. The replenishment of sand following an erosion event by natural sand accretion and shaping of the dunes by wind and water can occur relatively slowly and in some locations the rate of sand loss during storm events is more rapid than renourishment.

Imported fill is a potential management and rehabilitation tool that can be used to prevent erosion events during storm surges and to replace sand that was removed during severe erosion events where facilities or infrastructure are threatened or amenity of the area is seriously affected. The fill must be selected to be of suitable grading similar to the natural beach sand and free of pollutants.

The Southern Transport Corridor project (STC) will create a large surplus of sand from the proposed excavation. Much of this material is considered suitable for sand nourishment of the beaches in Geraldton. The City of Geraldton, Main Roads WA, Geraldton Port Authority and the Department for Planning & Infrastructure are working together and plan to use the surplus sand from STC for nourishment of the following beaches.

- Town Beach;
- north of Batavia Coast Marina; and
- Sunset Beach.

Sand renourishment should be undertaken using land based equipment including trucks and bulldozers to spread the sand onto the existing beach and form a wide beach berm. Initially the sand nourishment may be in a berm 30 to 40m wide and some brush material should be placed on the landward portion to help control the wind blown sand. The seaward face of the sand nourishment will be placed by simply pushing the sand over the edge of the berm. Initially the material will form a steep slope, perhaps 1 to 1.5. Over time, the action of the ocean tides, currents and waves will rework this

material and distribute it into the zone of active coastal processes. This will take place by the seaward slope flattening in response to the action of the tides, currents and waves. Eventually, the seaward face will become a gentler slope of around 1 to 20.

To some people the action of the ocean redistributing the sand nourishment indicates that the exercise has been a waste of time and money. Much of the sand however, is redistributed to the nearshore waters and not lost from the system even though it is no longer visible. Over time, the coastal processes that move sand along and across the shore will remove the sand nourishment and the beach will become narrower.

Sand nourishment exercises rarely provide a permanent solution. The additional sand is eventually moved away. It may still be the most cost-effective means of providing the protection required. Other longer term options such as the construction of groynes or sea walls to protect beaches and foreshore areas involve significant cost and can interfere with natural coastal processes and are often considered undesirable from the community and environmental perspective. Ongoing sand nourishment is used at many famous beaches around the world including the following.

- Surfers Paradise on the Gold Coast in Queensland;
- Miami Beach, Florida, USA; and
- The Italian Riviera, Italy.

In foreshore areas where large banks of seagrass wrack have accumulated, the seagrass wrack may afford protection for these beaches from cross-shore erosion during storm activity. Seagrass wrack may also form an important part of the ecological system of the coastal foreshore area. It is a common practice in the Geraldton-Greenough area for seagrass wrack to be collected from the beaches and used as mulch by local residents and local authorities. This practice however, could significantly deplete the natural buffering capacity of certain beaches to storm events and coastal processes. In areas where there is a high level of usage such as at Pages Beach and Back Beach it might be appropriate to occasionally remove built up seagrass wrack off beaches to improve the aesthetics and recreational amenity.

In some beach locations, where tall dunes obstruct views to the beach, there is sometimes a desire to remove or lower the dunes to improve views. For beaches that experience a large amount of sand accumulation (the very process that has created the dunes), lowering of dunes has proven to be of short-term benefit only. Dune lowering was attempted at Secret Harbour in the City of Rockingham only to find that the natural processes built the primary dunes back to their original height.

Strategies

- Undertake ongoing active sand replenishment within sections of eroding coastline to stem the damage to the beaches and dunes and minimise the risk to adjacent infrastructure and development.

- Ensure suitable graded and clean sand material is used in all dune reconstruction and beach renourishment exercises.

- Minimise and discourage the harvesting of seagrass wrack from foreshore areas, particularly where the material forms mounds and buffers the beaches from coastal processes, by limiting access and through public education.

- Lowering of dunes within the coastal foreshore should be avoided, and only considered following detailed coastal engineering assessment and estimation of likely works and associated costs to maintain the dunes at the desired height.

5.7 Development Setbacks

Along much of the coastline within the Geraldton-Greenough study area the foreshore reserve has been determined and is set by established residential areas and constructed infrastructure. The Glenfield, Sunset North and Southgate areas are however, largely undeveloped and the foreshore reserve is not defined by existing development.

Assessment of the setback to development provided within areas where development has taken place will provide an indication of the buffer to storm damage and erosion afforded by the foreshore area and security of facilities within the foreshore. This will aid in planning of facilities and encouraging usage of the foreshore area as well as providing an indication where issues such as erosion and storm damage could arise. Active management within the foreshore may be necessary in areas where the foreshore area and setback to development is considered too narrow to account for storm erosion and longer term trends. Development of facilities within these areas may also require special consideration in terms of design, materials and maintenance.

The following assessment of setback distances within the Geraldton–Greenough is based on advice provided by coastal engineers, MP Rogers and Associates, as part of this project.

Criteria

The Western Australian Planning Commission has recently published guidelines for the determination of appropriate set back distances for private residential development along the coast of Western Australia (State Coastal Planning Policy, 2003). These guidelines supersede those provided in Policy DC 6.1 – Country Coastal Planning Policy.

The Policy states that the required setback should incorporate measures to protect development from erosion of the coast and also to provide for the protection of ecological values and the requirements for public use of the foreshore. The Policy includes formulas for determining a minimum setback for coastal protection based on a 100 year planning time frame. As a general guide, the Policy recommends a total setback in the order of 100m.

In determining the coastal stability of a green-field residential development site and the appropriate set back distance, the following factors should be taken into account:

- S1 = Short term erosion caused by a series of severe storms with elevated water levels – DPI suggests the use of the SBEACH model using three repeats of the severe storm experienced at Perth in July 1996 or equivalent.

- S2 = Long term trends caused by the coastal dynamics of the area – DPI suggests that 100 times the average annual historical erosion trend as measured from shoreline movement plots prepared from historical aerial photographs over more than 40 years, preferably longer. This would provide a buffer for the coming 100 years. A factor of safety of 20m should be allowed on stable sandy shores. Exceptions may apply in long-term accreting shorelines.

- S3 = Long term trends caused by possible changes caused by Greenhouse Gases and associated Climate Change – DPI suggests that an allowance of 38m recession of a sandy beach be allowed to accommodate the likely recession to 2100.

This method is based on a planning horizon of 100 years and is suitable for new private residential developments such as those they are intended to occur in the Glenfield, Sunset North and Southgate Sectors. The aim of this planning horizon for new private developments is to avoid the need for active management of coastal processes.

For the assessment of setback distances for existing residential and commercial areas such as within much of the Geraldton-Greenough study area, a planning horizon of 30 years is suggested. This reduced planning horizon is sustainable on the basis that active management of coastal processes could be implemented if required for the existing developments. The assessment of the existing setback provisions for the Geraldton-Greenough study area should use a planning horizon of 30 years and acceptance of the increased risk of the need for active management of the coastal processes.

The following criteria are recommended for the assessment of the desirable set back distance from the coastal vegetation along the foreshore of the study area.

- S1 = Short term erosion caused by a series of severe storms with elevated water levels – use the SBEACH model using two repeats of a severe storm with an estimated Average Recurrence Interval of 100 years.

- S2 = Long term trends caused by the coastal dynamics of the area – The calculation is based on the average annual historical erosion trend as measured from shoreline movement plots prepared from historical aerial photographs over more than 20 to 30 years. This would provide a buffer for the coming 30 years.

- S3 = Long term trends caused by possible changes caused by Greenhouse Gases and associated Climate Change – use an allowance of 0.1m rise in sea level and a 10m recession of a sandy beach to accommodate the likely recession to 2030.

The use of these criteria will result in a setback distance that will provide a reasonably low risk of coastal erosion threatening the area in the coming 30 years. If the existing development has less than the recommended set back, then it would be possible to

manage the risk by either structural change or active management of the coastal processes.

The calculated setback distance with the 30 year planning horizon would also be suitable for the assessment of setback requirements for development in the foreshore area that needs to be close to the shoreline. This includes surf clubs and foreshore car parking areas. Such facilities should where possible be kept in the control of either the State or Local Government as there is an increased risk that active coastal management may be required in the future.

Desired Setback Distance

The following is an assessment of the appropriate setback distance to allow for the likely coastal erosion of the various coastal sectors in the coming 30 years. This can be used to assess the need or otherwise for active management of the coastal processes to provide a lower risk of coastal erosion threatening the existing residential and commercial development along the study area. The recreational facilities in the foreshore reserve can be located within this setback distance and will have a higher risk of being threatened by coastal erosion in the coming 30 years.

S1 – Allowance for Severe Storm Erosion

The allowance for erosion during severe storms can be based on the results of the SBEACH modelling undertaken in the previous study for the Northern Foreshore as discussed in preceding sections. Site specific calculations of the extreme storm erosion have also been completed for the Southgate area although a more conservative method was used. The various coastal sectors have quite different protection from the inshore reefs and the allowance should vary accordingly.

The following allowances are recommended:

- Batavia Coast Marina to Mabel Street 10m
- Rundle Park/St George's 10m
- Bluff Point 25m
- Bluff Point near Fuller St with adequate seawall 0m
- Sunset 10m
- Southgate 20-40m

For other areas, it would be advisable to allow 40m for severe storm erosion until site specific calculations are completed.

S2 – Allowance for Long Term Trends

Based on the information concerning shoreline movement together with the assumption that significant ongoing sand bypassing is completed by the Geraldton Port Authority to nourish the foreshore areas north of the port, it is assessed that the likely future long term trends are as follows for the coast north of Batavia Coast Marina:

- Drummond Cove 30 years x 0m/year 0m
- Drummond Point 30 years x 0m/year 0m
- Glenfield 30 years x 0m/year 0m

- Sunset North 30 years x 0.7m/year 21m
- Sunset 30 years x 0.7m/year 21m
- Batavia Coast to Mabel Street 30 years x 0m/year 0m
- Rundle Park/St George's 30 years x 0m/year 0m

These numbers should be rounded to the nearest 5m, eg the allowance at Sunset Beach should be rounded to 20m.

The coast south of Geraldton Port has been assessed to have the no net erosion as the long term trend in the coming 30 years. This is based on shoreline movement data and the assumption that structures and activities changing the coastal processes will not be built or occur without adequate management to mitigate the impact on the adjacent beaches.

According to the Coastal Planning Policy formula, a factor of safety of 20m should be added to those beaches which have no net erosion trend.

S3 – Allowance for Climate Change

Over the coming 30 years the affects of Climate Change may cause about 10m erosion due to changes in storm activity and sea level. This allowance is recommended for all coastal sectors considered in this study. At Bluff Point near Fuller Street, the property owners have made a rubble seawall. Provided that this seawall is maintained and upgraded as required, then there would not be the need for an allowance for Climate Change.

Suggested Minimum Setback Distance

Using each of the above factors, the suggested minimum setback distance within coastal sectors is presented in Table 13 below. These setback distances are suggested on the understanding that there may be the need for active management of the coastal processes in the future should excessive erosion occur. The calculations have been made on the basis that the Geraldton Port Authority and the City of Geraldton complete adequate initial and ongoing sand bypassing to properly feed sand to the beaches north of Batavia Coast Marina.

TABLE 13
SUGGESTED MINIMUM SETBACK DISTANCE FOR EXISTING RESIDENTIAL & COMMERCIAL DEVELOPMENT AND FUTURE DEVELOPMENT IN THE FORESHORE AREA FOR COASTAL SECTORS WITHIN THE STUDY AREA

Coastal Locality	Set Back Distance Component (m)			
	S1 Storm Erosion	S2 Erosion Trend	S3 Climate Change	Total Set Back[1]
Drummond Cove	40_3	20^5	10	70
Drummond Point	40_3	20^5	10	70
Glenfield*	40_3	20^5	10	70
Sunset North*	10	40	10	60
Sunset Beach	10	40	10	60

Coastal Locality	Set Back Distance Component (m)			
	S1 Storm Erosion	S2 Erosion Trend	S3 Climate Change	Total Set Back[1]
Bluff Point (Frederick St)	25	20[5]	10	55
Bluff Point (Fuller St)[2]	0	20[5]	0	20
Bluff Point	25	20[5]	10	55
Rundle Park/St George's	10	20[5]	10	40
Marina to Mabel St	10	20[5]	10	40
Pages	40[3]	20[5]	10	70
Explosives	40[3]	20[5]	10	70
Point Moore	40[3]	20[5]	10	70
Greys	40[3]	20[5]	10	70
Back Beach	40[3]	20[5]	10	70
Mahomets	40	20[5]	10	70
Tarcoola	40	20[5]	10	70
Southgate – north*	120[4]	20[5]	10	150
Southgate – south*	40	20[5]	10	70

Note: 1. Setbacks should be measured from current day vegetation line.
2. Provided crude seawall at Fuller Street is maintained and upgraded as necessary.
3. Site specific calculations of S1 have not been completed.
4. S1 Storm Erosion estimate for Southgate - north is based on the largely unexplained rapid recession and recovery for a small area of the coast immediately north of Southgate dunes.
5. Includes factor of safety of 20m on stable shoreline.
* Coastal sectors with currently undefined foreshore areas.

These recommended distances are the minimum from a coastal engineering point of view and they are made on the basis that the foreshore is properly managed. This would include stabilisation of any blowout areas and appropriate control of public access to the beach. The setback distances should be measured from the current seaward line of permanent vegetation for the sandy coast.

The allowance for S1 Storm Erosion for the beaches south of Mahomets has been taken from older work using the Swart technique (Swart, 1976). This may provide a very conservative estimate and it may be appropriate to complete new calculations using the SBEACH computer program.

Strategies

- Provision or major upgrade of facilities within the foreshore area should consider the calculated minimum setback distances (based on 30 year timeframe) for the relevant coastal sector and associated risks prior to implementation.

- Respective local authorities should acknowledge the potential need for active management and maintenance at locations where the foreshore area does not meet the calculated minimum setback distance.

5.8 Access

Access within the foreshore area and to the beaches should be well defined and controlled to prevent random and indiscriminate access and subsequent damage and deterioration of the vegetation and dunes. It is important to provide adequate access in conjunction with facilities such as car parking, and to locations where there is a demand for access. If not, there is a tendency for beach users to create informal access paths.

Where possible, paths should be aligned in response to the topography (ie. along lines of least topographic variation) and wind conditions to prevent excessive maintenance. It is common practice to align beach access paths near the exit on the beach perpendicular to prevailing summer winds to limit the potential accumulation of wind blown sand and undercutting of the path. Steps or ramps may be required at the dune face fronting the beach and other areas where the gradient is steep in order to provide sustainable access to the beach.

At present, Dual use Paths (DUPs) are provided within only some of the Coastal Sectors and connectivity between foreshore areas is limited. The DUPs provided at locations such as Bluff Point and Beresford appear to be well used. Improved connectivity between areas with paths and construction of additional paths within the foreshore or along the abutting road is likely to enable increased use of the foreshore area and mobility throughout the region.

ORV access to the beach and within the foreshore area has the potential to degrade and remove vegetation and destabilise coastal dunes. In addition fauna can be killed or injured or nesting interrupted. ORV use can also often conflict with other beach uses such as swimming and sunbathing, dog exercising and walking. ORV use should be restricted to areas where there are likely to be less conflict with other recreational users and where damage to the dunes and vegetation is less likely to be significant.

Strategies

- Pedestrian and ORV access points onto the beach should be clearly defined possibly through the use of fencing, and signposted to prevent general degradation of adjacent dunes and vegetation.

- Provide a network of Dual Use Paths that provide a relatively continuous access along the coastal foreshore area and provide improved connectivity between existing paths within the foreshore.

- Limit and control ORV access within the foreshore and along the beaches to avoid the dunes and vegetation, which are sensitive or susceptible to degradation, or where there are conflicts with other beach uses.

5.9 Facilities

Discussion with the stakeholders and community identified the need for additional boat launching facilities. Boat launching often takes place informally within the region

directly from the beach at several locations such as Drummond Point, Point Moore and Southgate. During rough conditions however, launching from the beach is often not possible. Boat launching ramps are provided at locations such as Drummond Cove, Rundle Park /St George's, Batavia Coast Marina and Town Beach, with only some of these providing protection from structures and breakwaters during rougher conditions for safe launching. A study undertaken to investigate the need for and possible locations of protected boat launching sites identified Drummond Cove and Southgate as suitable areas. Facilities at these locations would provide reliable access in the northern and southern areas of the Geraldton-Greenough study area. Further consideration should be given to providing additional or improved facilities within the region.

Future land development adjacent to the coastal foreshore should involve the preparation of detailed plans and provision of facilities related to access and recreational use. This may include facilities such as seating, toilets and showers.

Strategies

- Pursue development of additional boat launching facilities or improvement of existing facilities to meet the current and future needs of the community.

- Ensure appropriate facilities are provided within foreshore areas in conjunction with new developments adjacent to the coast.

5.10 Signage

Signage is an important factor in managing recreation use, and minimising the conflicts between recreation and conservation as a means of directing people or guiding people to do certain actions and refrain from others.

There are a number of forms signage can take including:

- Directional – e.g. indicate location of paths and facilities and points of interest.

- Interpretative – e.g. describe environmental and cultural values and features, identify management issues and provide rationale for prohibitive measures (such as access and dog controls).

- Public safety – e.g. warnings of known hazards such as cliffs, snakes and ORV use.

Signage should be suitably located and clearly visible but should not detract from the aesthetic appeal of the foreshore area or viewsheds. Signage should convey positive messages.

Signage offers the opportunity to acknowledge cultural features of the coastal area including Aboriginal and non-Aboriginal historical affiliation and events.

Strategies

- Install signage as appropriate to inform and guide people using the foreshore area.

- Ensure a uniform approach to signage within the local authorities and ensure the design, and location of signage do not obstruct views and detract from the appeal of the foreshore area.

- Where possible, incorporate cultural information about particular coastal areas on signs.

6. DETAILED FORESHORE MANAGEMENT MEASURES

6.1 Introduction

Specific management recommendations for each Coastal Sector identified within the Geraldton-Greenough study area are outlined together with a summary of relevant information for each Coastal Sector in following sections.

Each of the management recommendations is assigned a 'Priority' rating to indicate the relative importance of implementing the recommended management measure between the various Coastal Sectors and within each sector. The following Priority rating has been used:

- High [H] primary importance
- Medium [M] secondary importance
- Low [L] least importance

Information and recommendations for each Coastal Sector is provided in order from north to south, separated into Shire of Greenough northern and southern beaches and City of Geraldton northern and southern beaches.

6.2 Shire of Greenough – Northern Beaches

DRUMMOND COVE Sheets 1 and 2

Management Priority: Recreation

Description

Foreshore Area:

Local Government:	Shire of Greenough
Area covered:	Between Shire of Greenough northern boundary and Seahaven View, Glenfield.
Width:	Mostly 60m, varies between 20m to 80m
Setback (30 yrs):	Recommended 60m
Includes:	Reserve 40581
	Reserve 24738
	Reserve 42813 Drainage
	Reserve 43315
	Reserve 43360
	Road reserve Part Whitehill Road

Areas adjacent include:

- existing and future residential; and
- reserves that currently include houses which are planned to be freehold east of Whitehill Road only, cleared parkland areas, drainage provisions and native vegetation.

Physical Characteristics:

- Generally low, gently undulating dunes that are well vegetated. Taller dunes reaching to less than 5mAHD occur south of car park located opposite Seacrest Way.
- Sandy beach with areas of nearshore reef and rock platforms. Some seagrass wrack accumulates along the beach particularly in the northern portion.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Low foredunes	Very Good	Some patches of Century Plant
OaSl	Toward inland boundary of foreshore	Very Good	
Nb	Middle section of foredune	Very Good	
ArOaSl	Toward inland boundary of foreshore; *Rhagodia baccata* common	Very Good	Some Wild Oats, Carnation Weed, Ryegrass, Winter Grass

Fauna habitat:

- The undeveloped area of reserve 24378 east of Whitehill Road contains coastal wattle and is generally in good condition although boxthorn is prevalent and some areas have been cleared.
- Relatively narrow section of low coastal habitat with some areas of vegetation up to about 2m high.
- Planted trees along road verges and nearby parkland areas provide added structural diversity for fauna.
- Currently a narrow connection exists to native vegetation/habitat to inland areas.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Recreational boating Recreational fishing Walking Dog exercising ORV access [permitted north of the area and south of Seacrest Way]	Constructed parking [gravel and bitumen] Formal pedestrian access [fenced] ORV access point Boat launching ramp Toilets Fish cleaning area Seating Shelters Lawn areas Community hall Sporting [basketball and tennis courts, skate ramp] DUP along part of road

Key Features:

- Provides a reasonably protected area for a range of activities with sandy areas suitable for swimming.
- Important boat launching area and selected site for a protected district boat launching facility.

- Sporting and community facilities are provided.
- Views over low coastal vegetation and from elevated sections to the south.
- A narrow bushland connection from the foreshore area to inland areas exists.

Key Issues:

- ORV access to the beach presently conflicts with other beach users.
- Boat launching and parking is not presently sufficient for community needs in the area/region and current facilities require maintenance or upgrade.
- Possible construction of a protected district boat launching facility will require works within the foreshore area such as the provision of adequate access and trailer parking and possibly increased demand for other recreational facilities such as picnic areas.
- Planned development abutting to the east and south will result in increased demand and pressure on the foreshore and facilities such as boat launching areas, and there will be increased potential for conflicting use.
- Foreshore area, west of Whitehill Road includes houses that will be leased for the next 15 or so years but will ultimately become foreshore reserve.
- Current Leasehold land east of Whitehill Road will be changed to freehold to enable residential development to remain and further developments to take place.

Management

Current/Proposed:

- Access provided by several formalised [gravel and bitumen] carparks and designated access tracks.
- Signage provided to identify location of facilities and appropriate beach use.
- ORV access along the beach controlled by use of rocks/boulders placed across the beach near the boat launching ramp.
- A protected district boat launching facility has been proposed at this location in a study commissioned by the Shire of Greenough.

Recommendations:

	Access	Priority	Management Responsibility
DC1	Restrict ORV access along the beach from the car park on Seacrest Way by placing rocks across the beach and provide alternative access further south within Drummond Point. Need to continue access for informal boat launching from this area until facilities are fully upgraded to the north to meet community needs.	H	Shire of Greenough
DC2	Progressively upgrade paths and fencing to match standard of the facilities at the end of Waterfront Close.	M-L	Shire of Greenough
Facilities			
DC3	Regularly maintain and upgrade existing boat launching ramp.	H	Shire of Greenough
DC4	Limited facilities such as BBQs and picnic areas could be catered for in the cleared reserves immediately east of Whitehill Road as the demand for facilities increases.	M-L	Shire of Greenough

Access	Priority	Management Responsibility
Access	Priority	Management Responsibility
DC5 Actively monitor community needs and pursue installation of protected district boat launching facilities as proposed in the previous feasibility study and then close the existing ramp and informal launching areas.	H	Shire of Greenough
DC6 Develop foreshore area for recreational purposes upon removal of lease cottages west of Whitehill Road	M	Shire of Greenough
DC7 Lease Cottages to be removed	M	Shire of Greenough
Vegetation & Habitat		
DC8 Undertake weed control and rehabilitation of isolated degraded areas near parking areas and facilities.	H-M	Shire of Greenough
DC9 Control illegal dumping of garden and household refuse.	H	Shire of Greenough
DC10 The northern portion of adjacent portion of Reserve 43315 should be retained in its natural state to maintain linkage with vegetation in Foreshore Reserve & to compliment adjacent areas of POS and community facilities.	H	Shire of Greenough

Future Considerations:

If the protected district boat launching area is constructed the current access parking area near the community hall will need expansion and improvement to cater for increased boat trailer parking. It may be appropriate to modify the road configuration east of the site by relocating Whitehill Road further east allowing additional area for parking and facilities close to the boat launching facility and minimising clearing of dune vegetation.

Potential construction of a district boat launching ramp at this location raises the potential for and applicability of low key tourist development nearby such as chalets and/or licensed cafes. Tourist development could be considered in areas designated within reserves but which currently support leased housing as these are already cleared and built on and views over the water could be achieved.

Future recreational nodes and picnic areas could be focussed in the foreshore area south of the existing boat ramp that presently supports houses when the leases expire. This area could be developed as the focal point for a range activities making use of established trees and creating an area similar to Rundle Park in Bluff Point.

A detailed concept plan for the area should be developed as part of any plans to construct the district boat launching facilities to identify parking, DUPs, pedestrian access and complementary facilities such as picnic areas and toilets.

DRUMMOND POINT Sheets 2 and 3

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: Shire of Greenough
Area covered: Between Neptune Corner, Glenfield and the car park at Drummond Point.
Width: Roughly 80m to 120m in the northern portion, not defined in the southern portion.
Setback (30 yrs): Recommended 60m
Includes: Reserve 43360

Areas adjacent include:

- Existing and future residential and planned future residential.
- Areas cleared for residential development, or that support native vegetation.

Physical Characteristics:

- Relatively low, undulating and well-vegetated dunes ranging up to less than 5mAHD.
- Areas of inshore reef and rock platforms occur close to the beach.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
OaSl	Low foredunes	Very Good	
ArOaSc	Low plain behind foredunes; *Rhagodia baccata* common	Very Good	

Fauna habitat:

- Relatively wide section of coastal habitat with some areas of dense vegetation up to about 2m high.
- Connection to large area of native vegetation/habitat inland.

Recreation:

Main Uses/Activities	*Existing Facilities*
Surfing Recreational fishing ORV access and/or use Camping	Constructed parking ORV access point

Key Features:

- Provides a reasonably protected area in the north for a range of activities with some sandy areas suitable for swimming.
- Includes a key surfing area to the south.
- Bushland connection from the foreshore area to inland areas exists.
- Views from development areas over low coastal vegetation in the north.
- Series of informal ORV tracks exist.
- Camping occurs at Drummond Point.

Key Issues:

- Direct access to Drummond Point surfing area is partly along private access (Water Corporation track).
- Increasing numbers of ORV on beach between Seacrest Way car park and the point and increasing potential conflicts.
- Series of ORV tracks have been created through the dunes and onto the beach.
- Some security issues associated with the parking area at the surfing beach.
- Camping at Drummond Point raises management issues with rubbish, fires and wood collection.
- Illegal dumping of garden refuse.

Management

Current/Proposed:

- Limited current management although there has been attempts to control ORV use by closing some access points with logs and defining the southern carpark area with low barrier fencing.
- Residential development is currently underway within the northern portion and associated with this are plans to provide access and parking within the adjoining foreshore.

Recommendations:

Access		Priority	Management Responsibility
DP1	Construct formal access paths to the beach from the developing residential area using existing ORV tracks wherever possible.	H	Shire of Greenough
DP2	Construct a small car parking area near the southern limit of the residential area currently being developed.	H	Shire of Greenough
DP3	Provide an improved access track, with added material such as limestone where necessary, to the Point surfing area for vehicles along existing tracks within the foreshore, extending from the carpark to be created near the developing residential area.	H-M	Shire of Greenough
DP4	Tracks and exits points onto the beach should be rationalised with those considered unnecessary for access to the Point or sections of the coast being blocked using barriers such as logs, boulders or bollards and signage, and then revegetated.	H-M	Shire of Greenough
DP5	Install DUP along boundary of Foreshore Reserve and development that connects with the DUP along Seahaven View	M	Shire of Greenough
Vegetation & Habitat			
DP6	Undertake revegetation works around the parking area at the Point to discourage random ORV and pedestrian access within the foreshore area.	M	Shire of Greenough
DP7	Development of the nearby areas within Drummond Point coastal sector should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	M-L	Developer of Adjoining Land and Shire of Greenough

DP8	Control illegal dumping of garden and household refuse	H	Shire of Greenough
DP9	Coastal Rubbish, wood collection and fires associated with camping	H	Shire of Greenough

Future considerations:

As development of the Drummond area continues and expands to the south there will be a need to limit ORV access and use to avoid conflicts with other users. Access to the popular surfing location should be re-routed as development progresses to reduce the area that ORV can access the foreshore and beaches. The current access track through the foreshore should then be closed to ORV and used as a DUP or pedestrian pathway, or revegetated.

GLENFIELD Sheets 3, 4 and 5

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: Shire of Greenough
Area covered: Between the car park at Drummond Point and Shire boundary with City of Geraldton northern boundary.
Width: Not defined along most of the sector, 100-120m adjacent to the wastewater treatment plant in the southern portion.
Setback (30 yrs): Recommended 60m
Includes: Reserve 45528

Areas adjacent include:

- Wastewater treatment plant.
- Planned future residential, public open space and treatment plant buffer.
- Native vegetation and blowout areas.

Physical Characteristics:

- Tall, steep dunes extending along the foreshore immediately backing the beach up to about 5mAHD.
- Dunes are relatively well vegetated but susceptible to damage and wind erosion.
- Sandy, sloping beach that seasonally becomes quite narrow.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Windward side of northern tall primary dune	Very Good	
AiTd	Windward side of southern tall primary dune	Very Good	
NbSlTd	Sheltered side of tall primary dune	Very Good	
OaSl	Stabilising mobile dunes to the south	Very Good	
ArOaSc	West side of inland plain	Very Good	Some Boxthorn
ArOaSl	East side of inland plain	Very Good	Some Boxthorn

Fauna habitat:

- Relatively wide section of coastal habitat with some areas of dense vegetation up to about 2m high.
- Connection to large area of native vegetation/habitat inland.

Recreation:

Main Uses/Activities	*Existing Facilities*
– Surfing – Recreational fishing – ORV access and/or use – Camping	– ORV access point

Key Features:

- Includes large blowout and bare areas that extend over 300m inland from the beach.
- Foreshore area connected to undeveloped inland areas supporting vegetation and habitat in the northern portion.

Key Issues:

- Blowout and exposed areas require stabilisation.
- Random ORV access causing damage to dunes and vegetation.
- Access track to wastewater treatment plant also provides to the coastal foreshore for uncontrolled ORV use.
- Structure plan has been prepared for the area indicating future development for residential purposes.
- Illegal dumping of garden and household refuse
- Camping in dunes raises management issues with rubbish, fires and wood collection.

Management

Current/Proposed:

Nil

Recommendations:

Access	Priority	Management Responsibility
GL1 Install signage requesting ORV users to use existing tracks and avoid damage to the dunes and vegetation.	H	Shire of Greenough
Vegetation & Habitat		
GL2 Remove African Boxthorn	H	Shire of Greenough
GL3 Control illegal dumping of garden and household refuse	H	Shire of Greenough
GL4 Development of the nearby areas within Drummond Point coastal sector should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	L	Developer of Adjoining Land and Shire of Greenough
GL5 Coastal Rubbish, wood collection and fires associated with camping	H	Shire of Greenough

Future considerations:

Development of the area and preparation of subdivision plans should involve preparation of a detailed foreshore management plan for the coastal foreshore based on the principles outlined in this report, including justification for the Foreshore Reserve boundary and identification of access and facilities and stabilisation of the dunes.

The existing tracks and degraded areas should be used to provide access locations and facilities wherever possible to avoid further damage and degradation of the dunes and vegetation.

6.3 City of Geraldton – Northern Beaches

SUNSET NORTH Sheets 5 and 6

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between Shire of Greenough and City of Geraldton northern boundary to Whitworth Drive, Sunset.
Width: Not defined
Setback (30 yrs): Recommended 50m
Includes: Reserve 41198 Landscape & Coastal Protection
Freehold Undeveloped

Areas adjacent include:
- Planned future residential.
- Native vegetation and blowout areas.

Physical Characteristics:
- Relatatively steep dunes extending along the foreshore immediately backing the beach up to about 5-10mAHD, rising to over 15mAHD within the large blowout.
- Dunes are relatively sparsely vegetated close to the beach and susceptible to damage and wind erosion.
- Sandy, sloping beach that seasonally becomes quite narrow.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
AiTd	Tall primary dune	Very Good	
OaSl	Southern stable dunes	Good	Boxthorn
ArOaSc	stabilised parts of northern blowout	Good	
ArOaSl	stable southern secondary dunes	Poor	Boxthorn

Fauna habitat:
- Relatively wide section of coastal habitat with some areas of dense vegetation up to about 2m high.
- Connection to large area of native vegetation/habitat inland.

Recreation:

Main Uses/Activities	*Existing Facilities*
Recreational fishing ORV access and/or use Sandboarding Informal free beach Walking Dog exercising	Nil

Key Features:
- Includes large blowout.
- Foreshore area connected to undeveloped inland areas supporting vegetation and habitat.

Key Issues:
- Large blowout requires stabilisation.
- Foredunes sparsely vegetated.
- Uncontrolled ORV use causing degradation of the area.
- Adjacent section of coast is actively eroding.
- Proposal for a nominated free beach area recently rejected by Council.
- Structure plan has been prepared for the area indicating future development for residential purposes. Structure Plan will be revised prior to subdivision approval.
- Gravel pits.
- Illegal dumping of garden and household refuse.
- Some camping.

Management:

Current/Proposed:
- Structure plan for Sunset Beach North residential development outlines proposed foreshore reserve/development setback and the general location of access tracks and parking. Structure Plan will be revised prior to subdivision approval.

Recommendations:

Access		Priority	Management Responsibility
SN1	Install signage requesting ORV users to use existing tracks and avoid damage to the dunes and vegetation.	H-M	City of Geraldton
SN2	Close and rehabilitate tracks close to existing residential areas.	M-L	City of Geraldton
Vegetation & Habitat			
SN3	Progressively revegetate foredunes extending from the Sunset sector to improve stabilisation.	M-L	City of Geraldton
SN4	Development of the adjacent area should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	L	Developer of Adjacent Land and City of Geraldton

Future considerations:

Development of the area and preparation of subdivision plans should involve preparation of a detailed foreshore management plan for the coastal foreshore based on the principles outlined in this report, including justification for the Foreshore Reserve boundary with particular regard to the erosion experienced in this area, identification of access and facilities and stabilisation of the dunes.

SUNSET Sheet 6

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between Whitworth Drive and Swan Drive, Sunset	
Width:	Mostly about 30m, but up to 180m north of Triton Place.	
Setback (30 yrs):	Recommended 50m	
Includes:	Reserve 41198	Landscape & Coastal Protection
	Reserve 27322	Landscape & Coastal Protection
	Closed Road	Portion of Swan Drive
	Freehold Property	Undeveloped & supporting facilities

Areas adjacent include:
- Caravan Park.
- Existing residential.

Physical Characteristics:
- Tall, steep dune face immediately backing the beach rising sharply up several metres due to active erosion. Soil at the top of dune is imported clay and sand.
- Sandy, sloping beach that is subject to erosion.
- Dunes are relatively well vegetated, partly undergoing revegetation.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
OaSl	Northern primary dunes	Good	Boxthorn
ArAiTd	Ongoing rehabilitation on reconstituted dunes	Poor – Good	Boxthorn Ice Plant Winter Grass Thistle
ArOaSl	Stable northern secondary dune	Poor	Boxthorn

Fauna habitat:
- Relatively narrow section of coastal habitat with some areas of dense vegetation up to about 2m high.
- Connection to adjoining Chapman River system.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Surfing Windsurfing Recreational fishing	Constructed parking [bitumen & gravel] Formal pedestrian access [fenced] Toilet facilities Grassed areas Seating Lookout Shower Volleyball court Interpretive signage

Key Features

- Internationally reknowned windsurfing location
- Views of and easy access to the adjacent Chapman River mouth.
- High use area by tourists given the location of the caravan park, conditions for windsurfing and proximity of the river.
- Eroding coastline.

Key Issues:

- Man-made coastal dunes limit beach access and do not have a natural appearance.
- Erosion causing cliffing of dunes and loss of amenity and truncation of beach access paths. Safety may be a concern.
- Large car parking area at Bosley Street appears under-utilised due to lack of facilities and poor beach access at this location and could be better used, particularly for windsurfing activities.
- Facilities such as shade and access should be improved to better accommodate regular use for windsurfing.
- Proposed sand deposition to restore eroded dune face and to provide added protection for facilities may require modification and damage to dunes to gain access for machinery which provides opportunity for other works to access and facilities to be undertaken.
- Portions of the foreshore area are not reserved and are zoned as residential development including the Triton Place car park and area to the north.
- Reserve (41198) located between Triton Place and Bosley Street is presently largely unappealing and under-utilised.
- Reserve 27322 contains a large area of grass with some trees and toilets and is unappealing and under-utilised.

Management

Current/Proposed:

- A range of facilities and controlled access have been implemented.
- Rehabilitation and weed control is ongoing and undertaken by the Sunset Beach Coast Care Group.
- Upgrade of access and facilities near Triton Place recently completed by the Sunset Beach Coast Care Group.
- Plans to modify the currently truncated path near Bosley Street to provide improved access to the beach.
- Water Corporation intends to reinstate the dune vegetation in areas disturbed by construction of deep sewerage pipework.

Recommendations:

Access		Priority	Management Responsibility
S1	Assess safety and make changes to dunes and pathways between the river mouth and north of Triton Place. Access paths through the dunes should be restored and lowered to ensure better access, particularly at Bosley Street, should erosion and cliffing of the frontal dunes occur.	H	City of Geraldton

Access		Priority	Management Responsibility
S2	All access paths should be sufficiently wide for access for windsurfers with low removable bollards installed to prohibit vehicle access but enable access for maintenance vehicles.	H	City of Geraldton
S3	Provide improved access along the foreshore by defining and upgrading a dual use path connecting from the Chapman River and running from Swan Drive to Triton Place in front of the caravan park and through the drainage reserve.	H-M	City of Geraldton
S4	Block ORV access from Triton Place parking area and adjoining degraded area, along tracks entering from adjoining northern foreshore sector and from Swan Drive.	H-M	City of Geraldton
Facilities			
S5	Install extra shade and grassed areas to assemble windsurfing equipment particularly near Bosley Street car park and in front of the caravan park as part of the works to restore access.	H-M	City of Geraldton
S6	Enhance the drainage reserve between Bosley Street and Triton Place through planting and landscaping with facilities such as shade, seating and BBQs to create an attractive area for relaxation and picnics that is sheltered from dominant southerly/south-westerly winds.	M	City of Geraldton
S7	Parking and access area off Swan Drive near Chapman River could be modified by relocating parking further back from the river and beach, providing greater areas of turf for laying out windsurfing equipment and relaxing, improving shade by building structures or planting trees, developing picnic areas within Reserve 27322 and maximising viewing opportunities over the river.	M-L	City of Geraldton
S8	Potential for a small interpretive area for Aboriginal culture by establishing local plants traditionally used as a food or medicinal resource close to a current tourist destination and access to the Chapman River area in Reserve 27322 should be considered.	M-L	City of Geraldton
S9	Formalise the existing carpark at Triton Place to discourage undesirable behaviour.	M	City of Geraldton
Coastal Stability			
S10	Develop management plan for erosion control of dune. Plan should include a long-term monitoring program of the dunes to assess erosion and determine appropriate management measures such as the deposition of sand and when works needs to be implemented.	H	City of Geraldton
Vegetation & Habitat			
S11	Ensure revegetation using local species is undertaken following completion of the works to deposit sand and modify dunes to restore access.	H	City of Geraldton
S12	Rehabilitate degraded area north of Triton Place and east of the parking area.	L	City of Geraldton
S13	Control Boxthorn in Reserve 41198 north of Triton Place	M	City of Geraldton

Access	Priority	Management Responsibility
Tenure		
S14 Amend the City of Geraldton Town Planning Scheme to ensure the entire foreshore area is appropriately reserved. This may include resuming land north of Triton Place and east of existing carpark.	H-M	City of Geraldton

Future Considerations:
Ongoing works will be required in the future to actively manage issues associated with erosion and protect infrastructure and facilities.

If there is a demand, the area identified for rehabilitation east of the Triton Place car parking area could be developed as a skate park or BMX facility rather restoring the native vegetation.

Council is negotiating with the caravan park operator a planned retreat option where the western boundary of the caravan park is relocated east of its current alignment should the coastline be eroded. In such an event, the security of the sewerage pipe along the western boundary of the caravan park and in the foreshore reserve would also need to be determined by the Water Corporation.

CHAPMAN RIVER MOUTH

Sheet 7

Management Priority: Conservation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between Swan Drive, Sunset and Fuller Street, Bluff Point	
Width:	50m to 120m near Nazareth House.	
Setback (30 yrs):	Recommended 45m	
Includes:	Reserve 41198	Landscape & Coastal Protection
	Road reserves	Kempton Street/River Road
	Freehold Property	Developed and undeveloped

Areas adjacent include:

- Nazareth House.
- Existing residential.

Physical Characteristics:

- Chapman River breaches the sandbar generally every year usually meandering to the south but in high flows breaching close to Sunset and removing the sand bar.
- Large constant accumulation of seagrass wrack in southern portion typically south of where the river breaches.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	In front of southern carpark	Very Good	
ArOaSl	Northern bank of Chapman River	Good	Couch Soursob
Ar	West of Nazareth House Currently undergoing rehabilitation	Poor (subject to recent control)	Boxthorn Soursob Couch Doublegee
Ac	Bank of river mouth	Very Good	Carnation Weed Oats
Co	Bank of river, upstream	Good	Boxthorn Winter Grass

Fauna habitat:

- Important habitat area including a range of features such as the river, sand bar and riverine and near-coastal vegetation that are not provided along most of the coastal foreshore.
- Supports a diverse range of fauna, particularly avifauna, due to the range of habitats.

Recreation:

Main Uses/Activities	*Existing Facilities*
Nature based activities [eg Birdwatching] Surfing Walking Dog exercising Viewing area Recreational fishing	Constructed parking [gravel] Informal walking tracks

Key Features

- Important ecologically diverse area.
- High aesthetic and amenity value.
- Forms connection between inland sections Chapman River Regional Park and the coast.

Key Issues:

- Car park frequently used for antisocial behaviour [vehicles] and is unappealing.
- Chapman River mouth needs intensive work remove weeds and restore native vegetation and habitat.
- Interruption of foreshore area by established houses and freehold properties that extend to coastal high water mark.
- Insufficient buffer from private land along river margins.
- Uncontrolled, limited ORV access to the beach from existing carpark.
- Potential for disturbance or injury of wildlife by dogs and vehicles.
- Foreshore area interrupted by existing residences and freehold property extending to High Water Mark.
- Property west of Kempton Street is at threat during severe storms.
- ORV access in front of Nazareth House.

Management

Current/Proposed:

- Active management is being undertaken by Friends of Bluff Point and as part of the Chapman River Wildlife Corridor Project.
- Weeding and revegetation works are being implemented to the south and east of the river channel.
- Car parking facility has been modified to improve amenity, provide greater separation from the beach and control access.

Recommendations:

Access		Priority	Management Responsibility
CR1	Maintain and improve existing walk trails from the Kempton Street car parking area to the southern bank of the river.	H-M	City of Geraldton
CR2	Block ORV access in front of Nazareth House to the foreshore from the car parking areas using rocks, bollards or logs to prevent disturbance of wildlife.	H	City of Geraldton

Facilities	Priority	Management Responsibility
CR3 Install interpretive signage at the northern end of the car parking area regarding access and minimising impacts such as disturbance of wildlife and vegetation.	M	City of Geraldton
CR4 Install interpretive signage regarding values of the river and the Chapman River Regional Park at the beginning of the walk trails.	M	City of Geraldton
Vegetation & Habitat		
CR5 Continue weed control and revegetation work to restore local occurring native species in areas to the south and east of the river.	H	City of Geraldton
Coastal Stability		
CR6 Maintain or improve crude seawall in front of residences to provide added security of property.	M	Adjacent Landowners
Tenure		
CR7 Consider purchasing properties west of Kempton Street when and if these properties are up for sale and reserve land for foreshore protection.	L	Adjacent Landowners and City of Geraldton

BLUFF POINT **Sheets 7 and 8**

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between Fuller Street and Rundle Park, Bluff Point	
Width:	40m to 80m	
Setback (30 yrs):	Recommended 10-45m	
Includes:	Reserve 20127	Landscape & Coastal Protection
	Reserve 24111	Landscape & Coastal Protection
	Reserve 43205	Landscape & Coastal Protection
	Road reserves	Part Fuller, Hosken and Kempton Streets

Areas adjacent include:

- Existing and future residential.
- Bluff Point Primary School and Bluff Point Camp School.
- Partly cleared and developed areas, and areas of native vegetation in reserves.
- Reserve for an Aboriginal heritage site near Hosken Street.

Physical Characteristics:

- Low, relatively flat foredunes that gently rise to about 5 or 6mAHD along Kempton Street.
- Inshore reef and seagrass meadows.
- Accumulation of seagrass wrack along most of the beach.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	*Atriplex cinerea* common	Very Good	
Nb	Small section of foredune	Very Good	
OaSl	Low primary dune north Some rehabilitation	Very Good	Ice Plant Oats Winter Grass Carnation Weed
OaScTd	Low primary dune south	Very Good	Oats
ArOaSl	Some rehabilitation	Very Good	Oats Winter Grass Sunflower Carnation Weed

Fauna habitat:

- Low dunes with generally, narrow and limited vegetation but area is being actively revegetated.
- Provides a range of habitats from low open heath, to taller denser shrubs and a range of trees.
- Nearshore reef systems occur along part of the area.
- Seals occasionally rest along the beach.

Recreation:

Main Uses/Activities	*Existing Facilities*
Recreational fishing Walking Exercising Dog exercising	Constructed parking [gravel] Formal pedestrian access DUP [gravel]

Key Features:

- Views through trees over low dunes and vegetation to ocean from Kempton Street.
- Pathway along foreshore is popular.
- Inshore reef and seagrass limit the recreational use and potential of the area.

Key Issues:

- Considerable effort has been made to remove weeds and restore the local native species.

Management

Current/Proposed:

- Active management including weeding and revegetation works is being undertaken by Friends of Bluff Point.

Recommendations:

Vegetation & Habitat	Priority	Management Responsibility
BP1 Continue to undertake regular weed control and revegetation works.	H	City of Geraldton

RUNDLE PARK/ST GEORGES Sheet 9

Management Priority: Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between Lighthouse Monument and southern end of Kempton Street
Width: 30m to 70m
Setback (30 yrs): Recommended 30m
Includes:

Reserve 20127	Landscape & Coastal Protection
Reserve 38438	Landscape & Coastal Protection
Reserve 23177	Landscape & Coastal Protection
Road reserve	Part Kempton Street

Areas adjacent include:

- Existing and future residential.
- Scout Hall.
- Largely cleared reserves.

Physical Characteristics:

- Low flat dunes that have been largely modified to create parking and parkland.
- Inshore reef and rock platforms present with a narrow, gently sloping sandy beach.
- Some seagrass wrack accumulation.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	*Atriplex cinerea* common	Very Good	
ArOaSl	Low inner dunes at north and south ends Planted *Melaleuca lanceolata* shrubs common in north part	Good	Oats

Fauna habitat:

- Low dunes with narrow and limited vegetation and habitat.
- Parkland trees provide additional habitat.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming	Constructed parking [bitumen]
Windsurfing	Boat launching ramp
Recreational boating	Grassed areas
Walking	BBQs
Dog exercising	Picnic tables/seating
Picnics	Toilets
Views	Play equipment

Key Features:

- Popular park for recreation and picnics.
- Windsurfing location.
- One of few areas with a constructed boat launching ramp.

Key Issues:

- No direct pedestrian access between main parkland and beach without crossing vehicle access within parking area.

Management

Current/Proposed:

Nil

Recommendations:

Access		Priority	Management Responsibility
RP1	Consider modifying car park to create direct access from parkland to beach for pedestrians or install traffic calming measures such as raised, paved area for safer pedestrian crossing.	M-L	City of Geraldton

BERESFORD/CHAMPION BAY Sheets 9 and 10

Management Priority: Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between southern end of Kempton Street and 330m north of Phelps Street
Width: Mostly 20-45m, but up to roughly 100m north of Mabel Street
Setback (30 yrs): Recommended 30m
Includes: Reserve 5660 Landscape & Coastal Protection
Railway reserve
VCL
Freehold Property Undeveloped

Areas adjacent include:

- Mariner Motel
- Existing and future residential.
- Existing and vacant commercial areas.

Physical Characteristics:

- Inshore reef that is often exposed during low tide.
- Very narrow low dunes to about 2mAHD back the beach.
- Dunes further inland of the beach have been flattened and highly modified to support railway line.
- Foreshore in the southern portion is subject to erosion.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Narrow foredune	Good	Capeweed Clover Oats Winter Grass
Nb	Small section in north end	Very Good	
ArOaSl	Small section in north end	Good	Buffel Grass

Fauna habitat:

- Very limited vegetation and habitat.

Recreation:

Main Uses/Activities	*Existing Facilities*
Walking Exercising Nature based activities [eg reef exploring] Views Dog exercising	Shelters DUP [bitumen] Picnic tables/seating Bike racks

Key Features:

- DUP is popular for exercising.
- Offers important visual amenity from Chapman Road.

Key Issues:

- Very limited foredune vegetation.
- As part of the STC project the rail line along the foreshore will ultimately be removed.
- DUP does not connect with adjoining St George's/Rundle Park sector along the foreshore because of freehold title between the two areas.
- Southern portion of the foreshore is subject to erosion, which creates a steep dune face and disrupts access.

Management

Current/Proposed:

- As part of the STC works, the railway line will be removed.
- Sand re-nourishment program of some beach areas has commenced between Trigg and Dean Streets and in front of the Beaurepaires building.

Recommendations:

Access		Priority	Management Responsibility
B1	Pursue installation of DUP through freehold property to provide direct connection from Beresford to Rundle Park/St George's.	H	City of Geraldton and Landowner
Facilities			
B2	Elevated, degraded site opposite Mabel Street could be modified to create a lookout and resting site off the DUP.	M-L	City of Geraldton
B3	Prior to, or in conjunction with, removal of the railway line prepare a landscape plan for the foreshore area to enhance the visual amenity and increase use of this area by landscaping and installing additional facilities such as discrete grassed areas, shade and feature trees and parking.	L	City of Geraldton
Vegetation & Habitat			
B4	Progressively revegetate areas between the beach and DUP with suitable low coastal species.	M-L	City of Geraldton
Coastal Stability			
B5	Regularly replenish coastal sand to maintain foreshore and beach	H	City of Geraldton
Tenure			
B6	Railway land should become part of the coastal foreshore reserve once the rail line has been removed.	M-L	City of Geraldton

MARINA Sheet 10

Management Priority: Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between 330m north of Phelps Street to northern rock wall of the marina
Width: 40m to 100m
Setback (30 yrs): Recommended 30m
Includes: Reserve 42069
Reserve 42070

Areas adjacent include:

- Existing and future residential.
- Partly cleared and developed areas, and areas of native vegetation in reserves.

Physical Characteristics:

- Small section of wider, sandy beach area has been created as a result of the marina and rock wall configuration backed by a narrow section of reasonably well vegetated low dunes.
- Northern portion is narrow and edge between the sandy beach and foreshore landform rises steeply about 2m to a highly modified, flat landscape.
- Beach configuration and rock wall provide protection from wind and waves.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Foredune southern end	Very Good	

Fauna habitat:

- Very limited vegetation and habitat.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Walking Exercising Picnics	Constructed parking [gravel] Dual Use Path [bitumen] Grassed area Shelters Barbecues Picnic tables/seating Controlled vehicle access point

Key Features:

- Popular recreation node close to the city centre that provides a relatively sheltered beach suitable for swimming.
- Car park regularly used by variety of users particularly for access to use the DUP.

- Flat landscape and low vegetation provides scenic ocean views from Chapman Road.
- Foreshore area has been highly modified and therefore presents greater opportunities than many other areas.

Key Issues:
- Erosion, cliffing of foreshore and truncating of access.
- Vehicle access currently via Stella Maris Drive within the marina complex with no direct access off Chapman Road for users from the northern end.
- Railway line current presents a barrier to access and opportunity for recreation use and facilities.
- Pressure for ablution facilities from beach users, however some opposition from local residents.

Management

Current/Proposed:
- As part of the STC works, the railway line will be removed.
- Sand is planned to be regularly deposited as part of the Geraldton Port sand-bypassing program.

Recommendations:

Access	Priority	Management Responsibility
BCM1 Reinstate access paths following sand replenishment.	H-M	City of Geraldton
BCM2 Consider creating direct vehicle access off Chapman Road to the parking area following removal of the railway line.	L	City of Geraldton
Facilities		
BCM3 Prior to, or in conjunction with, removal of the railway line prepare a landscape plan for the foreshore area to enhance the visual amenity and increase use of this area by landscaping and installing additional facilities such as discrete grassed areas, shade and feature trees, parking and ablutions.	L	City of Geraldton
Vegetation & Habitat		
BCM4 Brush or revegetate the sand replenishment areas to stabilise sediment in conjunction with reinstating access paths.	H	City of Geraldton
Coastal Stability		
BCM5 Regularly replenish coastal sand in southern section to maintain foreshore and beach as part of the GPA sand bypassing.	H-M	City of Geraldton
Tenure		
BCM6 Railway land should become part of the coastal foreshore reserve once the rail line has been removed.	M-L	City of Geraldton and Westrail

6.4 City of Geraldton – Southern Beaches

PAGES Sheet 11

Management Priority: Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between easternmost port rock wall and groyne to the east	
Width:	Generally about 120m to 200m	
Setback (30 yrs)	Recommended 60m	
Includes:	Reserve 29729	Landscape & Coastal Protection/Recreation
	Road reserve	Part Willcock Drive

Areas adjacent include:
- Geraldton Port and associated commercial and industrial facilities.
- Caravan Park.
- Industrial uses.
- Cleared reserves.

Physical Characteristics:
- Low, undulating, dune backing a relatively wide sandy beach and shallow water.
- Largely well vegetated foredune backed by flat, cleared parkland areas.
- Some seagrass wrack accumulation.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
Nb	Low foredunes	Very Good	
NbOaMiSl	*Atriplex cinerea* common Some planted Cotton Palms	Good	Boxthorn Oats Flat Weed Capeweed

Fauna habitat:
- Wide sandy beach.
- Relatively dense, low foreshore vegetation.
- Adjacent to larger area of habitat to the west.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming	Constructed parking [bitumen & gravel]
Walking	Formal pedestrian access [fenced]
Picnics	Boat launching [informal]
Recreational boating	Toilet facilities
Dogs prohibited	Play equipment
Parkland used for concerts	Shelters
Horse exercising	Seating
Beach fishing	Barbecue
	Grassed area

Main Uses/Activities	*Existing Facilities*
	Parkland ORV access point

Key Features:

- Developed recreational facilities and picnic areas provided.
- Expansive cleared areas.
- Adjacent to tourist accommodation.
- Relatively safe, sandy and sheltered beach suitable for swimming.
- Prograding beach therefore a lower risk of erosion and damage or loss of facilities.

Key Issues:

- Some accumulation of seagrass wrack affecting aesthetics of the beach.
- The City of Geraldton has undertaken seagrass wrack removal in the past to improve aesthetics at Pages Beach, however this proved to be unfeasible in the long term.
- Harvesting of beach sand by the Geraldton Port Authority is undertaken periodically as part of sand bypassing strategies needs to be undertaken appropriately to ensure aesthetics and use of the beach are not significantly impacted.
- Underutilised given that it is an attractive recreational area with sheltered, shallow, safe beach with good amenities.
- Potential conflicts with between beach users, horse exercising and ORV users/boat launching although boat launching is presently restricted during most of the day.
- STC alignment will encroach significantly into reserve 29729 with new road & rail works.
- STC will affect access points to this popular beach and may increase safety issues for family groups and visitors from surrounding tourist accommodation.
- Pages Beach suitable for disabled access.

Management

Current/Proposed:

- Access provided by several formalised [gravel and bitumen] carparks and designated access tracks.
- Signage provided to identify location of facilities and appropriate beach use.
- Boat launching controlled by signage.

Recommendations:

Access		Priority	Management Responsibility
P1	Block ORV access at western end near the existing groyne by placing rocks or bollards across the current access point.	M	City of Geraldton
P2	Liaise with relevant parties in relation to the STC to ensure easy access to this beach and safety for users are maintained or improved.	H	City of Geraldton

Facilities			
P3	Provide improved shade through tree planting and/or installation of shade structures within parkland areas adjacent to car parking area to maximise use of the area for picnics and family groups	H	City of Geraldton
P4	Upgrade unsealed access as a sealed access way. Internal alignment / may need re-design of access way.	M	SCT Authority
Vegetation & Habitat			
P5	Undertake weed control and rehabilitation of degraded areas within the eastern foreshore area.	M-L	City of Geraldton
Beach & Coastal Dunes			
P6	Liaise with Geraldton Port Authority regarding extraction of beach sand and assess impacts on the beach during and after activities.	H	City of Geraldton and Geraldton Port Authority

Future Considerations:

Opportunities for improving regional boat launching facilities in the Geraldton-Greenough region should be investigated. Current informal boat launching activities could then be stopped by blocking current access for vehicles and installing signage indicating closure and location of alternative facilities to minimise potential conflicts with other beach users.

The seagrass wrack accumulation could be utilised by the community of Geraldton as garden mulch or for stabilising beach accessways where seagrass wrack is limited (eg. Tarcoola Beach). The economic feasibility of cartage and storage of the seagrass wrack to other sites within Geraldton would need to be considered.

POINT MOORE Sheets 11 and 12

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between Pages groyne to east of the Point and south of the lighthouse
Width: About 160-220m in the northern portion, 40-120m in southern portion
Setback (30 yrs): Recommended 60m
Includes: Reserve 2562 Landscape & Coastal Protection
Road reserve Part Willcock Drive

Areas adjacent include:

- Caravan Park
- Existing leased residential
- Lighthouse
- Sea Rescue Headquarters
- Commercial [cafe]
- Cleared and vegetated reserves

Physical Characteristics:

- Wide sandy beach and shallow water.
- Area of inshore reef and rock platforms.
- Undulating, well vegetated dunes to about 3m high.
- Nearshore seagrass/seagrass wrack and reef.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	On tall recent primary dune at southern point	Very Good	
Nb	Dominant on primary dune	Very Good	
OaSl	Low primary dunes	Very Good	
OaScTd	Low primary dunes	Very Good	
NbOaMiSl	Low secondary dunes	Very Good	Boxthorn, Sunflowers (along road edge mainly)

Fauna habitat:

- Wide area of relatively diverse foreshore vegetation.
- Wide sandy beach with diversity of nearshore habitat.
- Connects with adjoining foreshore areas and adjacent vegetated reserves.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Surfing	Constructed parking [gravel] Formal & informal pedestrian access

Main Uses/Activities	*Existing Facilities*
Windsurfing Kite surfing Recreational boating Boat launching [informal] Recreational fishing Amateur Cray Pot fishing Walking Exercising Dog exercising ORV access and/or use Snorkelling/diving Nature based	Toilet facilities Grassed area ORV access point Volunteer Sea Rescue Facilities

Key Features:

- Wide sandy beach.
- Wide and well vegetated foreshore area providing relatively wide area of habitat.
- Popular ORV use area.
- Internationally reknown windsurfing destination.
- Tourist accommodation nearby.
- Accreting beach but some evidence of erosion near south-west point.
- Nearshore reef and seagrass, and exposure to predominant winds reduce the appeal of the area for typical activities such as swimming and sunbathing.

Key Issues:

- High level of use and range of activities that places pressure on the natural environment.
- Potential conflict between land based and sea based recreational uses.
- High level of ORV access and use within foreshore and on beach with some evidence of damage to vegetation during adverse conditions such as when the tracks are wet and boggy.
- Speed of ORV often excessive, over 25kph.
- STC may affect ease of access to this popular area.

Management

Current/Proposed:

- Access provided by several formalised carparks and designated access tracks.

Recommendations:

Access		Priority	Management Responsibility
PM1	Maintain access for ORVs to the beach but undertake works to improve access such as adding crushed limestone to minimise widening of tracks and damage to adjacent vegetation.	H-M	City of Geraldton
PM2	Install speed limit signs at ORV access points	H	City of Geraldton
PM3	Install fencing along either side of vehicle access and informal car parking areas to define tracks and parking and minimise damage to adjacent vegetation.	M	City of Geraldton

PM4	Close tracks through the foreshore area to vehicles by placing rocks or bollards across the tracks and maintain as walking trails, undertaking improvements such as the addition of crushed limestone where needed.	H-M	City of Geraldton
PM5	Liaise with relevant parties in relation to the STC to ensure easy access to this area is maintained.	H	City of Geraldton
Vegetation & Habitat			
PM6	Undertake weed control to improve condition of foreshore	H	City of Geraldton
PM7	Use sand trapping fences to primarily encourage foredune formation and regeneration of coastal species and to control ORV and pedestrian access.	M	City of Geraldton
Facilities			
PM8	Erect signage indicating ORV access points and tracks.	M	City of Geraldton
PM9	Interpretive signage could be installed along walk trails and access points outlining some of the natural characteristics of the area and local flora and fauna to raise public awareness.	M-L	City of Geraldton

GREYS Sheets 12 and 13

Management Priority: Conservation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between east of Point Moore to Separation Way, Beachlands	
Width:	Generally 60-120m, but 30-40m in western portion and up to 200m near Port Way	
Setback (30 yrs):	Recommended 60m	
Includes:	Reserve 2562	Landscape & Coastal Protection
	Reserve 27529	Landscape & Coastal Protection
	Road reserves	Part Willcock Drive and Port Way
	VCL	

Areas adjacent include:
- Industrial uses largely associated with Geraldton Port.
- Undeveloped reserves.
- Native vegetation.

Physical Characteristics:
- Sloping sandy beach.
- Cliffed, steep frontal dunes rising to about 3-5m along the beach.
- Away from the beach, dunes undulate and vary between 2m and 8m.
- Relatively well vegetated dunes but with numerous tracks and susceptible to becoming unstable.
- Two cleared areas near corner of Willcock Drive and Portway.
- Cleared section of primary dune.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Wide primary dune in eastern part	Very Good	
NbOaMiSl	Wide primary dune	Very Good	
OaScTd	Tall secondary dune	Very Good	
AiOaTdSl	Small primary dune eastern part	Very Good	
ArOaSc	Secondary dune eastern part	Very Good	Boxthorn
Sv	Small wetland in secondary dune	Very Good	
t	Small stand of planted trees in eastern part		

Fauna habitat:
- The northern section of bushland between the road pavement and the beach is within the road reserve rather than the foreshore reserve.
- Relatively well vegetated tall dunes supporting a range of vegetation types.
- Includes unusual wetland area.
- Connects with adjacent vegetated reserves.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Recreational fishing Walking Dog exercising ORV access and/or use	Constructed parking [bitumen & gravel] Formal pedestrian access

Key Features:

- Limited nearby residential areas and therefore demand for access and facilities is not high.
- Relatively tall and steep dunes that are generally well vegetated.
- Reasonably exposed beaches.
- Includes small wetland area not found in any other sections of the coastal foreshore. The wetland is a site of Aboriginal significance.
- Several isolated highly degraded areas.
- Good views to the west to south-east from elevated dune near where Portway deviates to the south.

Key Issues:

- Evidence of erosion from cliffed dune faces and truncation of access paths to beach particularly in the western section.
- ORV use through the foreshore and along the beach is causing damage to vegetation and dunes.
- STC will directly impact on the foreshore area in the eastern half and will have implications in terms of access to the area from surrounding areas.
- Works for the STC could impact on the small wetland.
- Development of the marine research facility at Separation Point has the potential to increase visitors to this section of coast and create added pressure.

Management

Current/Proposed:

- Access provided by several formalised carparks and designated access tracks.

Recommendations:

Access		Priority	Management Responsibility
G1	Prohibit access for ORV within the foreshore to limit damage to vegetation and destabilisation of the dunes by blocking tracks with bollards and/or brush and erecting signage.	M	City of Geraldton
G2	Rationalise and provide better-defined pedestrian access by blocking some tracks with brush and rehabilitating, and fencing others and realigning to avoid wind scouring wherever possible.	M	City of Geraldton
G3	Improve steep sloping access from existing parking area opposite Point Street.	H-M	City of Geraldton

Access		Priority	Management Responsibility
G4	Restore and improve truncated and scoured paths in western section.	H-M	City of Geraldton
G5	Control access from western parking area by installing fencing to define parking and erecting directional signage.	H-M	City of Geraldton
G6	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton
Facilities			
G7	Close carpark at end of Point Street and relocate further west in accordance with STC plans	H	STC Authority
Vegetation & Habitat			
G8	Rehabilitate cleared area of primary dune by applying brush and possibly planting and dispersing seed.	M	City of Geraldton
G9	Closely monitor works associated with the STC to ensure minimum loss of native vegetation and protection of the small wetland area and dunes.	H	City of Geraldton

Future considerations:

Development of the marine research facility at Separation Point should involve implementation of better control of access for pedestrians and vehicles, as recommended above, at the same time or before.

Small wetland is an unusual feature of the Geraldton coastal foreshore area and is also an area of Aboriginal significance. Further investigations in relation to hydrology (seasonal water levels) and ecology could be undertaken, possibly be TAFE.

SEPARATION POINT Sheet 14

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton
Area covered:	Between Separation Way and Crowther Street alignment, Beachlands
Width:	Generally 120m to 240m
Setback (30 yrs)	Recommended 60m
Includes:	Reserve 27529 Landscape & Coastal Protection Road reserves Part Willcock Drive

Areas adjacent include:
- Former caravan park.
- Undeveloped reserves supporting native vegetation.

Physical Characteristics:
- Wide sandy beach with some inshore reef and rock platforms.
- Relatively low, well vegetated dunes to 3-5m along Willcock Drive, but rising to 9m at the point.
- Dune in southern portion susceptible to becoming unstable.
- Seagrass wrack accumulation point.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Toe of northern primary dune	Very Good	
Nb	Primary dune on Point	Very Good	
NbOaMiSl	Secondary dune	Good to Very Good	Capeweed Oats Boxthorn

Fauna habitat:
- Relatively well vegetated dunes with limited diversity.
- *Connects with adjacent vegetated reserves.*

Recreation:

Main Uses/Activities	*Existing Facilities*
Windsurfing Recreational fishing Walking Dog exercising ORV access and/or use Snorkelling/diving Views	Constructed parking [gravel] Formal pedestrian access ORV access point Showers

Key Features:

- Elevated dune provides good viewing opportunities.
- Nearshore reef and reasonably exposed conditions.
- Wide gently sloping beach.

Key Issues:

- Marine research facility proposed adjacent to the foreshore area. The facility has the potential to increase visitors to this section of coast and create added pressures on the foreshore environment. Physical disturbance to dunes possible due to infrastructure associated with marine facility (ocean pipeline). Access to foreshore for the general public may be disrupted due to road changes associated with the facility.
- STC will have implications in terms of access to the area from surrounding areas. Wilcock Drive will be a cul-de-sac at the northern end in front of the former caravan park site.

Management

Current/Proposed:

- Access and facilities provided by limited formalised carparks and access tracks.

Recommendations:

Access		Priority	Management Responsibility
SP1	Prohibit access for ORV within the foreshore to the north to limit damage to vegetation and destabilisation of the dunes by blocking tracks with bollards and/or brush and erecting signage and maintain as walking trails.	M	City of Geraldton
SP2	Construct direct, controlled beach access from the memorial at the lookout.	L	City of Geraldton
SP3	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton
SP4	Provide improved delineated access from Beachlands locality to the foreshore as part of the STC works.	H-M	City of Geraldton
Facilities			
SP5	Enhance lookout with improved shelter/shade, marked parking bays and landscaping.	M-L	City of Geraldton
SP6	Erect additional interpretive signage perhaps identifying local features that can be readily seen or locations of specific reefs or wrecks.	L	City of Geraldton
Vegetation & Habitat			
SP7	Maintain connectivity to adjoining coastal sectors and adjacent reserves.	M	City of Geraldton

Future considerations:

Development of the marine research facility at Separation Point should incorporate improved access to the foreshore for pedestrians and vehicles, as recommended above. The facility should complement the marine and coastal environment without compromising the natural foreshore environment or the opportunities for local and tourist uses of the area.

MAHOMETS Sheets 14 and 15

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton
Area covered:	Between Crowther Street alignment, Beachlands and Hadda Way, Mahomets Flats
Width:	Generally 45 to 80m, up to 150m near Hadda Way
Setback (30 yrs)	Recommended 60m
Includes:	Reserve 20195 Landscape & Coastal Protection Road reserves Part Willcock Drive and Hadda Way

Areas adjacent include:
- Undeveloped reserves supporting native vegetation.
- Holiday accommodation located adjacent to southern boundary.

Physical Characteristics:
- Sandy beach backed by relatively steep frontal dune.
- Reasonably well vegetated dunes between about to 3m and 5m.
- Frontal dunes susceptible to becoming unstable.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Toe of primary dune	Very Good	
AiOaTdSl	Primary dune	Very Good	
NbOaMiSl	Secondary dune	Good	Boxthorn
ArOaSl	Behind secondary dune	Very Good	Boxthorn
t	Planted dense strip west of Hadda Way		

Fauna habitat:
- Relatively well vegetated dunes.
- Established trees provide greater structural diversity.
- Connects with large adjacent vegetated reserves.

Recreation:

Main Uses/Activities	*Existing Facilities*
Surfing Recreational fishing Walking Dog exercising ORV access and/or use	Constructed parking [gravel] Formal pedestrian access [fenced]

Key Features:
- Foreshore area backed by large vegetated reserves that together provide large setback to development and significant area of remnant vegetation and habitat.
- Residential areas adjoining the foreshore are limited therefore recreational pressure is not high. However, there is a caravan park planned for this area.

- Dunes generally well vegetated.
- Reasonably exposed wide sandy beaches.

Key Issues:
- Parking areas not well defined or easily accessed.
- Largely uncontrolled pedestrian-access at several locations through dunes to the beach.
- STC will directly impact on vegetated reserve adjacent to the foreshore area particularly in the western section and will have implications in terms of access to the area from areas to the north.

Management

Current/Proposed:
- Access and facilities provided by limited gravel car parking areas and several access tracks.

Recommendations:

Access		Priority	Management Responsibility
M1	Improve car parking areas by providing easier access off the road and defining the area using bollards or fencing.	M-L	City of Geraldton
M2	Close small informal carpark in central part of Mahomets	M	City of Geraldton
M3	Upgrade carpark to east of carpark to be closed	M	City of Geraldton
M4	Rationalise access to the beach by closing some informal paths and identifying dedicated access points.	M	City of Geraldton
M5	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton
M6	Prohibit ORV access from parking area off Hadda Way by blocking tracks with bollards and/or brush and erecting signage.	M-L	City of Geraldton
Vegetation & Habitat			
M7	Maintain connectivity to adjacent vegetated reserves.	H	City of Geraldton
M8	Rehabilitate degraded areas and closed tracks through brush application and possible planting or seed dispersal	M	City of Geraldton

Future considerations:

Development of the STC is expected to affect access to the foreshore area and there may be a need for crossing locations to be identified. These should be provided along similar alignment to beach access paths to provide direct easy access to the beach.

BACK BEACH Sheet 15

Management Priority: Recreation

Description

Foreshore Area:

Local Government:	City of Geraldton	
Area covered:	Between Hadda Way and Mahomets Flats/Tarcoola Beach locality boundary	
Width:	Between 60m and 180m	
Setback (30 yrs):	Recommended 60m	
Includes:	Reserve 20195	Landscape & Coastal Protection
	Reserve 31671	Landscape & Coastal Protection
	Reserve 30063	Landscape & Coastal Protection
	Road reserves	Part Hadda Way
	Freehold Property	

Areas adjacent include:
- Existing residential.
- Commercial [local shop].
- Undeveloped lots supporting modified native vegetation.
- Holiday accommodation located adjacent to northern boundary.

Physical Characteristics:
- Sandy beach.
- Some seagrass wrack accumulation on the beach.
- Low developing dune on the beach backed by tall dunes typically reaching 5m and varying between 4m and 10m further back from the beach.
- Dunes reasonably well vegetated with some localised bare areas.
- Inland sections cleared and modified for facilities and parkland.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Toe of the primary dune, undergoin rehabilitation	Good	
AiOaTdSl	Primary dune, northern section	Good to Very Good	Boxthorn
Nb	Behind primary dune	Good to Very Good	Boxthorn
AiTd	Primary dune, southern section	Good to Very Good	Boxthorn Iceplant Capeweed Century Plant

Fauna habitat:
- Relatively well vegetated tall dunes.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Surfing Walking Dog exercising ORV access and/or use Surf life saving activities	Constructed parking [bitumen & gravel] Formal pedestrian access [fenced] Shelters ORV access point Grassed area Picnic tables/seating Showers Toilets Play equipment Surf life saving club

Key Features:

- Main regional recreational beach area.
- Patrolled beach area (summer only).
- Foreshore area generally well vegetated.

Key Issues:

- Facilities area is generally aesthetically unappealing particularly given that this is a main recreational beach attracting locals and visitors.
- Issues with the need for permanent readily available access for surf life saving vehicles/rescue onto and off the beach.
- ORVs are able to access and use this beach creating potential conflicts given the high level of recreational use.
- Security issues for vehicles and belongings at southern parking area.
- Stormwater drains possibly causing local erosion and maintenance problems.

Management

Current/Proposed:

- Evidence of management activities such as brush application to stabilise bare areas.
- Intention to upgrade and expand current surf life saving club.
- Back Beach Improvement Group active in managing the area.

Recommendations:

Access		Priority	Management Responsibility
BB1	Identify dedicated access to the beach for surf life saving and maintenance ORVs that is suitable and accessible year round. Consider using movable log and chain at the exit point to prevent becoming bogged.	H	City of Geraldton
BB2	Prohibit general ORV access to the beach by using bollards or fencing.	M	City of Geraldton
Facilities			
BB3	Improve visual appearance and appeal by modifying parking areas to include verges and islands planted with trees to provide shade.	H	City of Geraldton

Access		Priority	Management Responsibility
BB4	Plant shade trees and/or provide additional shelters within existing grassed areas, possibly providing windbreaks at the same time.	H	City of Geraldton
BB5	Upgrade and improve toilet/shower facilities and regular maintain in good condition.	H	City of Geraldton
BB6	Pursue redevelopment and improvement of the surf life saving club facilities.	H	City of Geraldton and Geraldton Surf Club
BB7	Upgrade and possibly expand the southern car parking area to create a more formal and attractive area that will be used by greater number of visitors to increase potential surveillance and reduce security issues.	H-M	City of Geraldton
Beach & Coastal Dunes			
BB8	Stormwater outlet needs improvement (extension) and scoured area needs to be reinstated with suitable sand and the area revegetated.	H-M	City of Geraldton

Future considerations:
Proposed redevelopment of the surf life saving club facilities should involve preparation of a detailed concept plan for the entire area outlining the possible redevelopment and integration of all facilities.

The Back Beach Improvement Group (BBIG) have plans to reshape the dunes in front of the surf club as part of the redevelopment of the whole area. The proposal includes:

- lowering the dunes in front of the surf club to provide visual continuity between the surf club and grassed areas and the beach;
- creation of a terraced lawned viewing area in front of the carpark;
- installing large limestone blocks as a retaining wall for the lawned area and as a barrier to trap sand drift;
- periodic removal of sand drift from in front of the limestone blocks; and
- constructing a dual use path next to the limestone wall between South Pipe and North Pipe for optimum viewing of the beach and surf.

This report supports further investigations on the BBIG proposals at Back Beach. However, any proposed modification to the dunes should be fully examined to ensure reasonable security for the facilities created in the foreshore. Experience in other areas of the coast in W.A. in reducing the height of sand dunes in a sand-accumulating area such as Back Beach have resulted in the dunes regaining their height over a short period of time. To lower the height of the dunes at Back Beach will therefore require on-going management to reduce sand from the lowered dunes and to clean up sand that may blow inland across the lowered dunes. This may be considered by Council to be an acceptable cost if the social benefits of the proposal are warranted.

Any proposal for an artificial surfing reef at Back Beach should include a study to determine the impact of the reef on altering sand deposition patterns and coastal processes in the bay.

TARCOOLA NORTH Sheet 16

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: City of Geraldton
Area covered: Between Mahomets Flats/Tarcoola Beach locality boundary and City of Geraldton/Shire of Greenough boundary
Width: Between 60m and 80m
Setback (30 yrs): Recommended 60m
Includes: Reserve 42292 Landscape & Coastal Protection
Road reserves Part Willcock Drive

Areas adjacent include:
- Existing residential.
- Commercial [restaurant/motel].
- Cleared reserve.

Physical Characteristics:
- Sandy beach.
- Low developing dune on the beach backed by tall dunes typically reaching 5m and varying between 5m and 12m further back from the beach.
- Dunes reasonably well vegetated with some localised bare areas.
- Some seagrass wrack accumulation on the beach in southern portion.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Toe of primary dune	Very Good	
AiTd	Main vegetation on tall dunes. *Myoporum insulare* also common.	Very Good	
Ar	Small strip adjacent to inland reserve	Good	

Fauna habitat:
- Relatively well vegetated dunes with limited diversity.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Walking Dog exercising	Constructed parking [gravel] Formal pedestrian access [fenced] Grassed areas Picnic tables/seating Showers

Key Features:
- Wide sandy beach.
- Relatively popular district level beach.
- Foreshore area generally well vegetated.

Key Issues:

- Limited facilities for the level of use.
- Tall sandy dunes may be susceptible to destabilisation.

Management

Current/Proposed:

- Evidence of management activities such as brush application to stabilise bare areas.

Recommendations:

Access	Priority	Management Responsibility
TN1 Prohibit ORV access to the beach by installing bollards or fencing and/or applying brush material.	M	City of Geraldton
Facilities		
TN2 Consider installing toilets along this section	M	City of Geraldton
Vegetation & Habitat		
TN3 Stabilise and revegetate, through brush application and possible planting and seed dispersal, exposed areas within the dunes and near the beach.	M-L	City of Geraldton

6.5 Shire of Greenough - Southern Beaches

TARCOOLA Sheets 16, 17 and 18

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government:	Shire of Greenough
Area covered:	Between City of Geraldton/Shire of Greenough boundary and about 80m south of southern end of Glendinning Road
Width:	Mostly between 60m and 100m
Setback (30 yrs):	Recommended 60m
Includes:	Reserve 34973 Recreation Reserve 39738 Recreation Reserve 35488 Recreation

Areas adjacent include:
- Existing residential.
- Parkland reserve [Glendinning Park].

Physical Characteristics:
- Sandy beach.
- Low developing dune on the beach backed by tall dunes typically reaching 5m and varying between 5m and about 10m further back from the beach.
- Dunes reasonably well vegetated with some isolated clearing near the road.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Toe of primary dune	Very Good	
AiTd	Primary dunes; *Myoporum insulare* common	Good to Very Good	Boxthorn Iceplant
ArOaSl	Within inland reserve	Good to Very Good	
ArAiTd	Inland from AiTd	Weedy on road batter	Sunflower Capeweed

Fauna habitat:
- Relatively well vegetated dunes.
- Localised clearing to create parkland has reduced overall area of habitat.
- Connects with vegetation further inland and undeveloped land to the south.
- Drainage sump near southern boundary provide different habitat (ie wetland)

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming Walking Dog exercising	Constructed parking [gravel] Formal pedestrian access [fenced] Dual Use Path Grassed areas Picnic tables/seating

Key Features:

- Wide sandy beach.
- Foreshore area generally well vegetated.
- Adjacent park is popular for picnics and barbecues.

Key Issues:

- Security of vehicles and belongings within southern parking area.
- Parking areas and aesthetics of the foreshore area could be improved with localised treatments.
- Adjacent Glendinning Park is popular with local and visitors and is expected to increase pressure on the nearby foreshore area.
- Possible incursion of landscaping/gardens from residential lots into foreshore area.
- Residents wish to protect or improve ocean vistas.

Management

Current/Proposed:

- Works have recently been implemented to improve the northern parking area and repair storm damage.
- Tarcoola community groups are proposing beautification works and creation of passive recreation pockets over a 9 year period along Glendinning Road.
- Shire proposing to modify and landscape drainage sump at end of Glendinning Road.

Recommendations:

Access		Priority	Management Responsibility
T1	DUP along Glendinning Road should be upgraded and widened to encourage greater usage.	H-M	Shire of Greenough
T2	DUP should be installed connecting Glendinning road path to Willcock Drive and delineating the boundary of the foreshore area and lots with some grade separation between houses and path.	H	Shire of Greenough
T3	Install a walk trail between lot boundaries and foreshore area between Lockyer and Watterson Road with some grade separation between houses and path, and provide defined beach access paths along this section.	H-M	Shire of Greenough
T4	Access path to beach near Glendinning Park should be relatively level and maintained in good condition.	M	Shire of Greenough
T5	Consider installing traffic calming features such as raised paved areas or potential road closure (based on vehicle and pedestrian numbers) to allow improved pedestrian movement between Glendinning Park and the foreshore.	M	Shire of Greenough
Facilities			
T6	Degraded area near northern parking area should be landscaped to provide small parkland or be revegetated.	M-L	Shire of Greenough
T7	Cleared area opposite Glendinning Park should be enhanced through additional landscaping and provision of facilities such as seating and shelters.	M	Shire of Greenough
T8	Large existing cleared area near Sander Street and parking area near Buchanan Place could be redesigned	M-L	Shire of Greenough

Access		Priority	Management Responsibility
	and enhanced by additional tree planting, and provision of extra facilities such as seating and shade, and possibly picnic tabes.		
T9	Southern parking area and degraded area should be redeveloped to provide improved facilities such as grassed areas, shelters, BBQ's, toilets and better beach access, and an attractive passive recreation area.	H-M	Shire of Greenough
T10	Existing drainage sump near southern boundary to be redesigned as a compensating basin low-key passive recreation area with linkage to the existing parking area. Some native vegetation should be retained in the area, perhaps and east-west strip on the southern half of the reserve.	H-M	Shire of Greenough
Vegetation & Habitat			
T11	Dead and large shrubs along the existing DUP near Watterson Road could be hand-pruned or slashed to improve appearance and remove overhanging branches.	L	Shire of Greenough
T12	Provision of landscaped areas and facilities should be concentrated in existing cleared or degraded areas and developed as pockets rather than along the entire foreshore area to maximise retention of native bushland and fauna habitat and minimise possible degradation through the encroachment of grass and weeds.	H	Shire of Greenough
Beaches & Coastal Dunes			
T13	Repair and extend stormwater outlet and restore dune and revegetate.	H-M	Shire of Greenough

SOUTHGATE Sheets 18, 19, 20, 21 and 22

Management Priority: Conservation/Recreation

Description

Foreshore Area:

Local Government: Shire of Greenough
Area covered: Between about 80m south of southern end of Glendinning Road to 400 north of the Greenough River mouth
Width: Undefined
Setback (30 yrs): Recommended 60-140m
Includes: VCL

Areas adjacent include:

- Undeveloped large blowout and partly vegetated land.

Physical Characteristics:

- Sandy beaches interspersed with areas of inshore reef.
- Dunes reaching up to around 10mAHD.
- Dunes in southern portion reasonably well vegetated but with obvious areas of disturbance.
- Includes large mobile sand sheet.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Only in foredunes north of blowout	Very Good	
ArOaSl	Secondary dune north of blowout	Very Good	Boxthorn
MhAr	Inland area near Tarcoola	Very Good	
ArOaSc	Stabilised dunes within and west of blowou	Very Good	
OaScTd	Small sections in blowout	Very Good	

Fauna habitat:

- *Melaleuca huegelii/Acacia rostellifera* Scrub (MhAr) at the northern end of Southgate is the only area within the foreshore that supports this vegetation. The tall, dense structure of the vegetation may provide habitat for a different range of fauna than the lower, more open vegetation elsewhere in the foreshore.
- Much of the northern area is denuded of vegetation and supports little habitat.

Recreation:

Main Uses/Activities	*Existing Facilities*
Recreational fishing	ORV access point
Recreational boating	
ORV access and/or use	
Sandboarding	

Key features:

- Northern portion consists of large mostly denuded blowout.
- Permitted ORV use area.
- Limited access to the area.

Key Issues:

- Has been some effort to rehabilitate portions of the dunes and continued ORV use may conflict with this.
- Northern end of Southgate popular in summer for recreational fishing and informal boat launching.
- Boat launching is difficult during adverse weather conditions.

Management

Current/Proposed:

- Coastal management strategy and revegetation program has previously been prepared as part of proposed future urban development of the area.
- A protected district boat launching facility has been proposed at this location in a study commissioned by the Shire of Greenough.

Recommendations:

Access	Priority	Management Responsibility
SG1 Maintain current access for recreational fishing and informal boat launching.	H-M	Shire of Greenough
SG2 Install signage at strategic locations such as entrance tracks or where multiple tracks are forming requesting ORV users to use existing tracks and avoid damage vegetation and revegetating areas.	M	Shire of Greenough
Facilities		
SG3 Actively monitor community needs and pursue installation of protected district boat launching facilities as proposed in the previous feasibility study.	M	Shire of Greenough
Vegetation & Habitat		
SG4 Consider maintaining bushland linkage between foreshore and inland areas by ensuring development of this area aims to protect the linkage, and reserving the area.	M-L	Developer of Adjacent Land and Shire of Greenough
SG5 Undertake revegetation of denuded and degraded sections prior to or in conjunction with development of the adjacent land.	L	Shire of Greenough
SG6 Retain stand of *Melaleuca huegelii* within Foreshore Reserve or Public Open Space adjacent to Foreshore Reserve	L	Developer of Adjacent Land and Shire of Greenough

Future Considerations:

If a protected district boat launching area is constructed then access and facilities in this area would need to be greatly improved. Development of this facility would markedly increase the recreational potential and demand at this location. A detailed concept plan for the area should be developed as part of any plans to construct the district boat launching facilities to identify parking, DUPs, pedestrian access and complementary facilities such as picnic areas and toilets.

Residential development of the adjacent land should involve preparation of detailed foreshore management plans outlining the location of facilities and access to manage potential impacts on the foreshore area as a result of increased demand and recreational potential.

GREENOUGH/CAPE BURNEY Sheet 22

Management Priority: Conservation /Recreation

Description

Foreshore Area:

Local Government: Shire of Greenough
Area covered: Between 400 north to the Greenough River mouth
Width: Undefined
Setback (30 yrs): Recommended 60m
Includes: Reserve 20995

Areas adjacent include:

- Greenough River.
- Undeveloped, mostly vegetated land.

Physical Characteristics:

- Sandy beach with some areas of inshore rocky platforms.
- Dunes rising to around 5mAHD that are susceptible to wind erosion and destabilisation.

Biological Environment:

Vegetation	*Site Specific Comments*	*Condition*	*Major Weeds*
TdSl	Some *Atriplex isatidea* present Some dunes undergoing rehabilitation	Very Good	
ArOaSc		Good to Very Good	Boxthorn Walkaway Burr

Fauna habitat:

- Relatively dense habitat to about 2m high on protected side of dunes.
- Coastal area connects with nearby riverine habitats.
- Currently connects with habitat inland of the foreshore area.

Recreation:

Main Uses/Activities	*Existing Facilities*
Swimming	Constructed parking
Surfing	Formal pedestrian access
Recreational fishing	Toilets
Walking	Shelters
Dog exercising	Lookout
ORV access and/or use [incl. quad bikes]	

Key features:

- Popular surfing and swimming beach.
- Adjacent river and river foreshore is popular for recreational activities.
- Tourists and visitors commonly visit the area.
- Bushland provides connection to inland areas and river foreshore.

Key Issues:

- Security issues at existing parking area.
- Large car parking area is unappealing and unlikely to encourage visitors to stay within the foreshore area.

Management

Current/Proposed:

- Access provided by formalised carparks and designated access tracks.
- Greenough/Cape Burney Progress Association's emphasis is for facilities and improvements along the river foreshore and coastal area south of the river.
- A washdown shower is planned within the car parking area.

Recommendations:

Facilities	Priority	Management Responsibility
GR1 Redesign car park to improve amenity and provide additional facilities. Car park could include shade trees, and grassed or mulched areas with picnic tables and possible BBQs within the area defined by concrete blocks.	H-M	Shire of Greenough
GR2 Install washdown shower near beach access path.	H-M	Shire of Greenough
Vegetation & Habitat		
GR3 Maintain bushland linkage between foreshore and inland areas and river by ensuring any development aims to protect the linkage, and reserving the area.	M	Developer of Adjacent Land and Shire of Greenough

7. IMPLEMENTATION

7.1 Overview

Implementation of the recommendations and management measures outlined in this plan will involve a considerable amount of work and expenditure over many years. Implementation of the management measures outlined in this plan is the responsibility of the relevant local authority although it is intended some assistance will be provided through external sources of funding and by involvement of the community.

It is anticipated that this plan will be implemented in the following ways:

- The City of Geraldton and Shire of Greenough formally endorsing the Final Plan.
- The Steering Committee or similar overseeing implementation of the recommendations contained within the Final Plan.
- A program of implementation being established each year by the Steering Committee based on the priorities outlined in the Final Plan and/or agreed revised priorities.
- External funding to be sought to assist implementation of the recommendations.
- Formal review of the Final Plan undertaken by the Steering Committee every 5 years.

7.2 Priorities

Overall, assessment of the coastal foreshore area within the Geraldton-Greenough study area identified several management issues as the main priorities for implementation of strategies or actions.

The highest priority issues relate to:

- Weed management including effective and ongoing weed control as well as prevention of weed establishment and opportunities for invasion.
- Appropriate tenure and protection of land and vegetation within the coastal foreshore area.
- Sand replenishment works within coastal areas experiencing significant periodic or long-term erosion.
- Identified lack of protected boat launching facilities within the region and the expected increase in demand for facilities in the future.

- Coordination of works that have the potential, or are likely, to impact on the coastal foreshore environment or access to the foreshore area such as the Southern Transport Corridor project.

Several Coastal Sectors were also identified as priority areas for management works to be implemented. The Coastal Sectors considered to be of highest priority are:

- Sunset - in relation to the long-term trend of erosion that is threatening adjacent facilities and development, and need to reinstate truncated access.

- Back Beach – this is a regional beach area that would benefit substantially from improvements in the amenity of the area and provision of additional or improved facilities.

- Chapman River Mouth – should be afforded improved protection, and works should be undertaken to enhance the vegetation and habitat and recognise the site's significance.

- Point Moore – should be afforded improved protection of vegetation and habitat and its significance as a reasonably large area of coastal vegetation and habitat in the region be identified and promoted.

Priorities for implementation of specific management recommendations within each of the Coastal Sectors is identified in Section 6 of this report.

7.3 Resource Allocation & Coordinated Management

The local authorities need to ensure funds dedicated to coastal foreshore areas are allocated as part of Council budgets to allow for capital works and routine and general maintenance for measures such as repairs to paths and carparks, and ongoing weed control and revegetation.

City of Geraldton and Shire of Greenough may wish to consider developing a position for a dedicated officer that is shared between the local authorities on a part-time basis to coordinate coastal foreshore management in the region. This person would be the main point of contact for community members to discuss issues and suggestions, prioritise and proposed works that the local authorities should budget for and undertake, and work within the local authorities to ensure coordinated coastal foreshore management. The appointed officer could also be responsible for other environmental issues throughout the local authorities' boundaries. If a shared officer is not consider appropriate then communication between a nominated officer within each of two local authorities should be encouraged. Nominated officer/s would oversee and co-ordinate implementation of management measures and works within the coastal foreshore areas and be responsible for allocation of budgets for foreshore works.

The Steering Committee for this project should continue or a similar coastal planning and management liaison group should be formed to provide a forum for public discussion and input of coastal management issues. This group would provide input to the local authorities and assist with the planning and implementation of coastal

foreshore works. The group could involve coastal sporting groups, community action groups, ratepayer groups, Aboriginal community representatives, and representatives from the local authorities. The system would encourage greater community involvement in the planning and management of decision-making processes and facilitate implementation and maintenance of coastal works by community based groups.

The local authorities should establish a system whereby community members and local groups can report issues or propose suggestions that will be considered and dealt with and responded to promptly. Comments in relation to the foreshore area should be dealt with by a nominated officer or a single department (eg. planning) so that works can be efficiently coordinated. Efficient response to community comments will assist maintaining community interest in the foreshore areas and may promote community involvement with management by way of 'friends of' and 'coastcare' groups.

7.4 Possible External Sources of Funding & Resources

Grants and other sources of funding are available from a number of government departments, organisations and industry. Sponsorship from local businesses for specific projects can also be a useful source of funding or of goods and services in response for appropriate recognition. Furthermore, implementation of many tasks could be assisted by volunteer labour, work experience teams or community members, thereby reducing the overall cost of the project.

Some of the currently available schemes or programs that may be able to provide assistance with matters relating to management of the coastal foreshore include the following:

Envirofund
Envirofund is a Commonwealth Government initiative to assist communities to undertake local projects aimed at conserving biodiversity and sustainable resource use. Envirofund incorporates funding for Coastcare along with others such as Bushcare, Landcare and Rivercare. Funding applications can range from a few hundred dollars up to $30,000. The grants are administered by the Natural Heritage Trust and more information can be obtained from their web site at www.nht.gov.au/envirofund.

Coastwest
Coastwest is a Western Australian program administered by the Department for Planning and Infrastructure that assists groups to conduct a range of coastal management works and raise awareness about the issues in their local areas. It provides funding opportunities for community groups planning to undertake coastal management activities. Up to $1 million is available for allocation to projects throughout WA each year.

Gordon Reid Foundation
The Gordon Reid Foundation for Conservation Grants is a Lotteries Commission fund aimed at assisting community groups to conserve natural habitats and biodiversity. There are two grant categories, Minor Grants of up to $5,000 and Major Grants for over $5,000, available to local government authorities and non-profit community groups.

Greening WA
Greening WA Inc works with the community to protect and restore native vegetation, particularly on degraded farmland, wetlands and natural bushland. More information can be obtained from www.greeningaustralia-wa.org.

Community Cultural Development Grants
This grant program replaces the Community Environment Art and Design (CEAD) which was a funding program linked to the Australia Council for Arts. The Community Cultural Development Board supports community driven projects that the community manages, develops creative ideas and creates the artwork. More information can be obtained from www.ozco.gov.au/ccd/index.htm.

Community Conservation Grants
These grants are allocated annually by the Minister for the Environment and are designed to assist communities and individuals to undertake projects involving flora, fauna, conservation and/or land rehabilitation to benefit nature conservation. Grant amounts range from $5,000 to $50,000 and are usually advertised in newspapers around August to October.

Country Pathways
Funding is available to local authorities from the Country Pathways Grant Scheme for the shared paths for up to 50% of the construction costs to a maximum total of $50,000. The program aims to improve cycling facilities in regional parts of the state. For more information visit www.dpi.wa.gov.au/regional/cycling_regional.

Recreational Boating Facilities Scheme
This is an initiative to improve the quality and quantity of recreational boating facilities throughout the state. Application can be made for upgrading or establishment of new facilities. Funds are available only to local authorities for facilities available to the general public of up to $250,000 at a time with equal contribution from the local government. Examples of appropriate infrastructure include boat launching ramps, boat washdown facilities, moorings, fish cleaning tables and marine safety signage. For more information refer to www.dpi.wa.gov.au/imarine/coastal_fac/rbfs.

Commonwealth Regional Solutions Program
The Commonwealth Department of Transport and Regional Services funds a Regional Solutions Program that offers grants of between $1,000 and $500,000 for regional development initiatives. Eligible projects include community planning, local project implementation, community adjustment initiatives, regionally based enterprise or infrastructure projects and employment of community–based development officers.

Corporate Sponsorship
Significant contributions could be sought from the local businesses within the Geraldton-Greenough region to assist with the implementation of management measures. Sponsorship could involve cash contributions, supply of products and materials such as timber or limestone, or through the provision of services such as printing, engineering or carpentry. Works or programs undertaken could acknowledge contributions on signage, foreshore facilities or furniture or in interpretive leaflets.

Conservation Volunteers
Implementation of various management measures can be assisted by volunteer labour and work experience particularly for some activities that may involve more technical aspects. Volunteer labour groups such as Conservation Volunteers Australia could assist with implementation of specific tasks. Green Skills Inc is a community-operated organisation that offers work experience to those interested in conservation work and provides casual employment for experienced persons through its Ecojobs program.

Commonwealth government programs such as Work for the Dole also offer a source of labour that may be suitable for certain tasks. Green Reserve is a work experience initiative that forms part of the Work for the Dole scheme and is funded by the Commonwealth Government and managed by Conservation Volunteers Australia.

More information and contact details for these groups can be obtained from the following websites:

www.conservationvolunteers.com.au
www.greenskills.green.net.au
www.greenreserve.com.au

Labour to assist with projects can also come from students involved in courses related to conservation and land management. Students attending the local TAFE in Geraldton in relevant courses could be come involved in a range of activities including weed control, revegetation, stabilisation, and construction of controlled access and facilities depending on the course.

Wila Gutharra CDEP
The involvement of Aboriginal people in coastal development projects could be possible through the Wila Gutharra Community Development Employment Program (CDEP).

Department of Justice
Prisoners on work release from local prisons is a potential source of labour for coastal programs.

7.5 Community Involvement & Education

General Community

Community involvement in the management of the coastal foreshore area should be promoted and encouraged. Community involvement (ie local residents and interest groups) is desirable to ensure that the local community has a sense of ownership in the coastal foreshore that will afford a greater level of protection against the threat of damage by fire, vandals etc.

In addition, promoting an understanding of the sensitivity of the coastal environment and habitats amongst local residents and the community will assist in reducing the impacts of less visible threats. This includes issues such as inappropriate use of the area

such as uncontrolled access, rubbish and garden waste dumping, and predation of wildlife and disturbance by cats and dogs.

The development of a sense of ownership can be achieved by involving the local community in both the implementation of works and in future planning for the area. For example:

- Assisting in seed collection, planting and weed removal activities undertaken by the local authorities or community groups.
- Developing programs in association with local schools for seed collecting, planting etc.
- Seeking the input of local residents as part of the process of implementation and review of the Management Plan.
- Providing forums or avenues for community members to make comments and suggest ideas, such as the liaison groups and identifying nominated local government officers as a point of contact.
- Education of the community of the values, issues and impacts on the coastal foreshore and promotion of local community groups currently working to protect the foreshore through newspaper or newsletter articles and other forms of media.
- Developing innovative signage and interpretive material.
- Naming walk trails or picnic areas.
- Creating sculpture or artworks for use within the coastal reserve areas.
- Developing and joining local 'Coastcare' and/or 'Friends of' groups.

It is important to ensure that the efforts of the local community towards management of the coastal foreshore are recognised. This can be achieved by installing signage which identifies existing and future management work undertaken by a local community group, and/or by the local authorities holding events or special days to recognise efforts, encourage greater participation and exchange of ideas and experience.

As well as recognition of efforts to manage the foreshore area, community participation needs to be suitably supported by the local authorities to maintain enthusiasm and involvement. Local authorities need to ensure responses to community issues or ideas is provided in a timely manner and that at all times the community's input and efforts is valued.

Schools Program

Management of the coastal foreshore area should incorporate opportunity for raising awareness of coastal management issues within the local school community.

Consideration could be given to the development of competitions focussed around coastal issues for involvement of school children. Such a competition could have two separate programs: one for the primary schools and one for the secondary schools. The primary schools program could involve an art competition with several age categories, while the secondary school program could involve a literature competition such as short story, essay or poem and/or art, sculpture, poster or photographic competition. Several different themes could be developed including coastal flora and fauna, beach life and celebrating our coast. Judges for the competition could include Steering Committee members, councillors, local personalities, art teachers, local artists or authors such as Tim Winton. Prizes for the winning entries may include publication in the local papers, displays in the library or shopping centres during the advertising period and/or local events such as the Sunshine Festival, use within the foreshore areas such as signage, and/or local sponsorship prizes.

The success of any schools focussed program however, often relies on the cooperation and enthusiasm of the schools, teachers and parents. Discussion with representatives of the Geraldton Schools Community to gauge the likely level of support and interest in such competition indicated that there was little support for a one off competition. It was generally thought that children did not gain a lot from one-off competitions, which often were not directly linked to the curricula framework.

Teachers were however, keen to incorporate coastal planning/management issues into the curricula framework, and would be happy to work with the Geraldton community to this end. It was thought that, to be effective, a schools program should ideally be a term length learning experience tied to the learning strategies for the whole school (ie the four phases of childhood development, early childhood, mid development, secondary).

The incorporation of such a program into schools in the Geraldton region would require the preparation of a resource package for teachers that is tied back to curricula outcomes. The development of a suitable resource package would involve identifying key people in the community, consulting with local schools (primary and secondary) as to their specific needs and developing suitable material. Opportunities for linkages with other programs, such as local Aboriginal studies, would also be identified. Under the current outcomes based curricula, children are required to produce a product at the end of each term to show they are learning. Awareness of coastal issues within the broader community could be enhanced by the display of the educational product, with suitable community recognition (for example, in the local newspaper).

Development of schools program for the region should be pursued by the local authorities together with the Steering Committee and Coastcare Facilitator. Once developed, there is also potential to expand a coastal management schools program into other natural resource management issues such as landcare, wetland or river care and weed management within the Geraldton region.

7.6 Review

As part of the preparation of the detailed work scheduled and budget allocation the recommendations and priorities contained in this plan should be reviewed by the

Steering Committee or liaison group to ensure the works and priorities continue to reflect community desires and expectations.

A more thorough audit of the implementation progress and review of the recommendations and priorities should be undertaken at least every five years by the Steering Committee and/or local authorities. Review of the recommendations and progress is essential in ensuring that the desires of the local community are being addressed and ensure significant changes in the region, development proposals or experiences after finalisation of the plan can be taken into account.

8. SUMMARY OF RECOMMENDATIONS

DRUMMOND COVE

Access		Priority	Management Responsibility	Indicative Cost
DC1	Restrict ORV access along the beach from the car park on Seacrest Way by placing rocks across the beach and provide alternative access further south within Drummond Point. Need to continue access for informal boat launching from this area until facilities are fully upgraded to the north to meet community needs.	H	Shire of Greenough	Boulders sourced from local council quarry
DC2	Progressively upgrade paths and fencing to match standard of the facilities at the end of Waterfront Close.	M-L	Shire of Greenough	Fencing - $16.50/m (ringlock) DUP - 30m @ $50/m - $1,500
Facilities				
DC3	Regularly maintain and upgrade existing boat launching ramp.	H	Shire of Greenough	Ongoing maintenance Upgrade costs dependent on standard required
DC4	Limited facilities such as BBQs and picnic areas could be catered for in the cleared reserves immediately east of Whitehill Road as the demand for facilities increases.	M-L	Shire of Greenough	Concept plan should be developed initially - $5,000 BBQ - $7,000 for standard two plate electric, brick. Tables/Seating - $1,000 each on concrete slab.
DC5	Actively monitor community needs and pursue installation of protected district boat launching facilities as proposed in the previous feasibility study and then close the existing ramp and informal launching areas.	H	Shire of Greenough	-
DC6	Develop foreshore area for recreational purposes upon removal of lease cottages west of Whitehill Road	M	Shire of Greenough	Concept plan to be prepared initially - $5,000
DC7	Lease Cottages to be removed	M	Shire of Greenough	
Vegetation & Habitat				
DC8	Undertake weed control and rehabilitation of isolated degraded areas near parking areas and facilities.	H-M	Shire of Greenough	Approx. 1000m^2 @ $2.50/$m^2$ - $2,500
DC9	Control illegal dumping of garden and household refuse.	H	Shire of Greenough	-
DC10	The northern portion of adjacent portion of Reserve 43315 should be retained in its natural state to maintain linkage with vegetation in Foreshore Reserve & to compliment adjacent areas of POS and community facilities.	H	Shire of Greenough	-

DRUMMOND POINT

Access		Priority	Management Responsibility	Indicative Cost
GL1	Construct formal access paths to the beach from the developing residential area using existing ORV tracks wherever possible.	H	Shire of Greenough	Approx. 70m of paths (limestone) @ $10/m - $700
GL2	Construct a small car parking area near the southern limit of the residential area currently being developed.	H	Shire of Greenough	Approx. 500m^2 (limestone) @ $7/$m^2$ - $3,500
GL3	Provide an improved access track, with added material such as limestone where necessary, to the Point surfing area for vehicles along existing tracks within the foreshore, extending from the carpark to be created near the developing residential area.	H-M	Shire of Greenough	Approx. 750m length of track (limestone) @ $10/m - $7,500
GL4	Tracks and exits points onto the beach should be rationalised with those considered unnecessary for access to the Point or sections of the coast being blocked using barriers such as logs, boulders or bollards and signage, and then revegetated.	H-M	Shire of Greenough	Boulders sourced from local council quarry Revegetation of old tracks - approx 2,500m^2 @ $2.50/$m^2$ - $6,250
GL5	Install DUP along boundary of Foreshore Reserve and development that connects with the DUP along Seahaven View	M	Shire of Greenough	Approx 1.2km @ $50/m (concrete) - $60,000
Vegetation & Habitat				
GL6	Undertake revegetation works around the parking area at the Point to discourage random ORV and pedestrian access within the foreshore area.	M	Shire of Greenough	Approx. 1000m^2 @$2.50/$m^2$ - $2,500
GL7	Development of the nearby areas within Drummond Point coastal sector should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	M-L	Developer of Adjoining Land and Shire of Greenough	-
GL8	Control illegal dumping of garden and household refuse	H	Shire of Greenough	-
GL9	Coastal Rubbish, wood collection and fires associated with camping	H	Shire of Greenough	

GLENFIELD

Access	Priority	Management Responsibility	Indicative Cost
GL1 Install signage requesting ORV users to use existing tracks and avoid damage to the dunes and vegetation.	H	Shire of Greenough	3 signs @ $80 + $30 installation - $330
GL2 *Vegetation & Habitat*			
GL3 Remove African Boxthorn	H	Shire of Greenough	Labour costs plus chemicals
GL4 Control illegal dumping of garden and household refuse	H	Shire of Greenough	-
GL5 Development of the nearby areas within Drummond Point coastal sector should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	L	Developer of Adjoining Land and Shire of Greenough	-

SUNSET NORTH

Access	Priority	Management Responsibility	Indicative Cost
SN1 Install signage requesting ORV users to use existing tracks and avoid damage to the dunes and vegetation.	H-M	City of Geraldton	2 signs @ $80 + $30 installation - $220
SN2 Close and rehabilitate tracks close to existing residential areas.	M-L	City of Geraldton	Boulders sourced from local council quarry Revegetation of old tracks nearest to development - approx 2,500m^2 @ $2.50/$m^2$ - $6,250
Vegetation & Habitat			
SN3 Progressively revegetate foredunes extending from the Sunset sector to improve stabilisation.	M-L	City of Geraldton	Extensive areas require stabilisation at $2.50/$m^2$
SN4 Development of the adjacent area should consider retention of sections of bushland inland of the foreshore area to maintain existing vegetation and fauna linkage.	L	Developer of Adjacent Land and City of Geraldton	-

SUNSET

Access		Priority	Management Responsibility	Indicative Cost
S1	Assess safety and make changes to dune and pathways between the river mouth and north of Triton Place. Access paths through the dunes should be restored and lowered to ensure better access, particularly at Bosley Street, should erosion and cliffing of the frontal dunes occur.	H	City of Geraldton	In conjunction with sand replenishment work.
S2	All access paths should be sufficiently wide for access for windsurfers with low removable bollards installed to prohibit vehicle access but enable access for maintenance vehicles.	H	City of Geraldton	In conjunction with sand replenishment work.
S3	Provide improved access along the foreshore by defining and upgrading a dual use path connecting from the Chapman River and running from Swan Drive to Triton Place in front of the caravan park and through the drainage reserve.	H-M	City of Geraldton	In conjunction with sand replenishment work. Approx. 850m concrete DUP @ $50/m - $42,500
S4	Block ORV access from Triton Place parking area and adjoining degraded area, along tracks entering from adjoining northern foreshore sector and from Swan Drive.	H-M	City of Geraldton	Boulders sourced from local council quarry
Facilities				
S5	Install extra shade and grassed areas to assemble windsurfing equipment particularly near Bosley Street car park and in front of the caravan park as part of the works to restore access.	H-M	City of Geraldton	In conjunction with sand replenishment work Approx. 800m^2 grass @ $7/$m^2$ - $5,600 Two shade shelters @ $5,000 - $10,000
S6	Enhance the drainage reserve between Bosley Street and Triton Place through planting and landscaping with facilities such as shade, seating and BBQs to create an attractive area for relaxation and picnics that is sheltered from dominant southerly/south-westerly winds.	M	City of Geraldton	Concept plan to be prepared - $5,000
S7	Parking and access area off Swan Drive near Chapman River could be modified by relocating parking further back from the river and beach, providing greater areas of turf for laying out windsurfing equipment and relaxing, improving shade by building structures or planting trees, developing picnic areas within Reserve 27322 and maximising viewing opportunities over the river.	M-L	City of Geraldton	Approx. 2,000m^2 of lawn @ $7/ m^2 - $14,000 Two shade shelters @ $5,000 - $10,000 Concept plan for Reserve 27322 - $5,000
S8	Potential for a small interpretive area for Aboriginal culture	M-L	City of Geraldton	Part of Concept Plan (see above S7)

Access		Priority	Management Responsibility	Indicative Cost
	by establishing local plants traditionally used as a food or medicinal resource close to a current tourist destination and access to the Chapman River area in Reserve 27322 should be considered.			
S9	Formalise the existing carpark at Triton Place to discourage undesirable behaviour.	M	City of Geraldton	$30,000
Coastal Stability				
S10	Develop management plan for erosion control of dune. Plan should include a long-term monitoring program of the dunes to assess erosion and determine appropriate management measures such as the deposition of sand and when works needs to be implemented.	H	City of Geraldton	$10,000 for plan.
Vegetation & Habitat				
S11	Ensure revegetation using local species is undertaken following completion of the works to deposit sand and modify dunes to restore access.	H	City of Geraldton	-
S12	Rehabilitate degraded area north of Triton Place and east of the parking area.	L	City of Geraldton	Revegetate approx. 3,000m^2 @ $2.50/$m^2$ - $7,500
S13	Control Boxthorn in Reserve 41198 north of Triton Place.	M	City of Geraldton	
Tenure				
S14	Amend the City of Geraldton Town Planning Scheme to ensure the entire foreshore area is appropriately reserved. This may include resuming land north of Triton Place and east of existing carpark.	H-M	City of Geraldton	-

CHAPMAN RIVER MOUTH

Access		Priority	Management Responsibility	Indicative Cost
CR1	Maintain and improve existing walk trails from the Kempton Street car parking area to the southern bank of the river.	H-M	City of Geraldton	500m @ $10/m (limestone) - $5,000
CR2	Block ORV access in front of Nazareth House to the foreshore from the car parking areas using rocks, bollards or logs to prevent disturbance of wildlife.	H	City of Geraldton	Boulders or old power poles to be sourced by council at no cost

Access	Priority	Management Responsibility	Indicative Cost
CR3 *Facilities*			
CR4 Install interpretive signage at the northern end of the car parking area regarding access and minimising impacts such as disturbance of wildlife and vegetation.	M	City of Geraldton	One sign @ $80 + $30 installation - $110
CR5 Install interpretive signage regarding values of the river and the Chapman River Regional Park at the beginning of the walk trails.	M	City of Geraldton	Approx. $500/ interpretive sign
Vegetation & Habitat			
CR8 Continue weed control and revegetation work to restore local occurring native species in areas to the south and east of the river.	H	City of Geraldton	Approx. 20,000 m^2 @ $2.50 m^2 - $50,000
Coastal Stability			
CR9 Maintain or improve crude seawall in front of residences to provide added security of property.	M	Adjacent Landowners	Landowners cost of sourcing suitable material for stabilisation
Tenure			
CR10 Consider purchasing properties west of Kempton Street when and if these properties are up for sale and reserve land for foreshore protection.	L	Adjacent Landowners and City of Geraldton	Market Value

BLUFF POINT

Vegetation & Habitat	Priority	Management Responsibility	Indicative Cost
BP1 Continue to undertake regular weed control and revegetation works.	H	City of Geraldton	Support to local community group - $2,500/yr for weeding and rehabilitation

RUNDLE PARK/ST GEORGES

Access	Priority	Management Responsibility	Indicative Cost
RP1 Consider modifying car park to create direct access from parkland to beach for pedestrians or install traffic calming measures such as raised, paved area for safer pedestrian crossing.	M-L	City of Geraldton	Subject to engineering design

BERESFORD/CHAMPION BAY

Access	Priority	Management Responsibility	Indicative Cost
B1 Pursue installation of DUP through freehold property to provide direct connection from Beresford to Rundle Park/St George's.	H	City of Geraldton and Landowner	100m @ $50/m (concrete) - $5,000
Facilities			
B2 Elevated, degraded site opposite Mabel Street could be modified to create a lookout and resting site off the DUP.	M-L	City of Geraldton	Approx. $5,000
B3 Prior to, or in conjunction with, removal of the railway line prepare a landscape plan for the foreshore area to enhance the visual amenity and increase use of this area by landscaping and installing additional facilities such as discrete grassed areas, shade and feature trees and parking.	L	City of Geraldton	$5,000 for preparation of a plan
Vegetation & Habitat			
B4 Progressively revegetate areas between the beach and DUP with suitable low coastal species.	M-L	City of Geraldton	Area requiring revegetation to be determined
Coastal Stability			
B5 Regularly replenish coastal sand to maintain foreshore and beach	H	City of Geraldton	Volume of sand and long term source of sand will determine cost
Tenure			
B6 Railway land should become part of the coastal foreshore reserve once the rail line has been removed.	M-L	City of Geraldton	-

MARINA

Access	Priority	Management Responsibility	Indicative Cost
BCM1 Reinstate access paths following sand replenishment.	H-M	City of Geraldton	20m @ $50/m - $1,000
BCM2 Consider creating direct vehicle access off Chapman Road to the parking area following removal of the railway line.	L	City of Geraldton	Subject to engineering design

Access	Priority	Management Responsibility	Indicative Cost
Facilities			
BCM3 Prior to, or in conjunction with, removal of the railway line prepare a landscape plan for the foreshore area to enhance the visual amenity and increase use of this area by landscaping and installing additional facilities such as discrete grassed areas, shade and feature trees, parking and ablutions.	L	City of Geraldton	$5,000 for plan
Vegetation & Habitat			
BCM4 Brush or revegetate the sand replenishment areas to stabilise sediment in conjunction with reinstating access paths.	H	City of Geraldton	Approx. 1,000m^2 @ $2.50/ m^2 - $2,500
Coastal Stability			
BCM5 Regularly replenish coastal sand in southern section to maintain foreshore and beach as part of the GPA sand bypassing.	H-M	City of Geraldton	Volume of sand and long term source of sand will determine cost
Tenure			
BCM6 Railway land should become part of the coastal foreshore reserve once the rail line has been removed.	M-L	City of Geraldton and Westrail	-

PAGES

Access	Priority	Management Responsibility	Indicative Cost
P1 Block ORV access at western end near the existing groyne by placing rocks or bollards across the current access point.	M	City of Geraldton	Boulders to be sourced from council quarry
P2 Liaise with relevant parties in relation to the STC to ensure easy access to this beach and safety for users are maintained or improved.	H	City of Geraldton	-
Facilities			
P3 Provide improved shade through tree planting and/or installation of shade structures within parkland areas adjacent to car parking area to maximise use of the area for picnics and family groups	H	City of Gerldton	20 trees @ $100/tree - $2,000 2 shade shelters @ $5,000 - $10,000
P4 Upgrade unsealed access as a sealed access way.	M	SCT Authority	

Access		Priority	Management Responsibility	Indicative Cost
	Internal alignment / may need re-design of access way			
Vegetation & Habitat				
P5	Undertake weed control and rehabilitation of degraded areas within the eastern foreshore area.	M-L	City of Geraldton	Approx 1ha @ $2.50/ m^2 - $25,000
Beach & Coastal Dunes				
P6	Liaise with Geraldton Port Authority regarding extraction of beach sand and assess impacts on the beach during and after activities.	H	City of Geraldton and Geraldton Port Authority	-

POINT MOORE

Access		Priority	Management Responsibility	Indicative Cost
PM1	Maintain access for ORVs to the beach but undertake works to improve access such as adding crushed limestone to minimise widening of tracks and damage to adjacent vegetation.	H-M	City of Geraldton	
PM2	Install speed limit signs at ORV access points	H	City of Geraldton	2 signs @ $110 - $220
PM3	Install fencing along either side of vehicle access and informal car parking areas to define tracks and parking and minimise damage to adjacent vegetation.	M	City of Geraldton	500m @ $16.50/m (ringlock) - $8,250
PM4	Close tracks through the foreshore area to vehicles by placing rocks or bollards across the tracks and maintain as walking trails, undertaking improvements such as the addition of crushed limestone where needed.	H-M	City of Geraldton	Boulders sourced from local council quarry
PM5	Liaise with relevant parties in relation to the STC to ensure easy access to this area is maintained.	H	City of Geraldton	-
Vegetation & Habitat				
PM6	Undertake weed control to improve condition of foreshore	H	City of Geraldton	Labour + chemicals
PM7	Use sand trapping fences to primarily encourage foredune formation and regeneration of coastal species and to control ORV and pedestrian access.	M	City of Geraldton	Cost of approx. 100m sand trapping fence
Facilities				
PM8	Erect signage indicating ORV access points and tracks.	M	City of Geraldton	2 signs @ $110 - $220

Access		Priority	Management Responsibility	Indicative Cost
PM9	Interpretive signage could be installed along walk trails and access points outlining some of the natural characteristics of the area and local flora and fauna to raise public awareness.	M-L	City of Geraldton	2 signs @ $500/interpretive sign - $1,000

GREYS

Access		Priority	Management Responsibility	Indicative Cost
G1	Prohibit access for ORV within the foreshore to limit damage to vegetation and destabilisation of the dunes by blocking tracks with bollards and/or brush and erecting signage.	M	City of Geraldton	Boulders sourced from local council quarry
G2	Rationalise and provide better-defined pedestrian access by blocking some tracks with brush and rehabilitating, and fencing others and realigning to avoid wind scouring wherever possible.	M	City of Geraldton	
G3	Improve steep sloping access from existing parking area opposite Point Street.	H-M	City of Geraldton	Cost of mini excavator for ½ day.
G4	Restore and improve truncated and scoured paths in western section.	H-M	City of Geraldton	Cost of mini excavator for ½ day plus possible chain log ramp at two locations
G5	Control access from western parking area by installing fencing to define parking and erecting directional signage.	H-M	City of Geraldton	120m fencing @ $16.50 - $1980 2 signs @ $110 - $220
G6	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton	-
Facilities				
G7	Close carpark at end of Point Street and relocate further west in accordance with STC plans	H	STC Authority	
Vegetation & Habitat				
G8	Rehabilitate cleared area of primary dune by applying brush and possibly planting and dispersing seed.	M	City of Geraldton & STC Constructions	Approx. 1500 m^2 @ $2.50 - $3,750
G9	Closely monitor works associated with the STC to ensure minimum loss of native vegetation and protection of the small wetland area and dunes.	H	City of Geraldton	-

SEPARATION POINT

Access		Priority	Management Responsibility	Indicative Cost
SP1	Prohibit access for ORV within the foreshore to the north to limit damage to vegetation and destabilisation of the dunes by blocking tracks with bollards and/or brush and erecting signage and maintain as walking trails.	M	City of Geraldton	Material to be sourced by council at no cost Signage – one sign @ $110 - $220
SP2	Construct direct, controlled beach access from the memorial at the lookout.	L	City of Geraldton	Approx 50m of track @ $10/m (limestone) - $500 plus cost of clearing if necessary
SP3	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton	-
SP4	Provide improved delineated access from Beachlands locality to the foreshore as part of the STC works.	H-M	City of Geraldton	Approx 110m upgraded to limestone @ $10/m - $1100
Facilities				
SP5	Enhance lookout with improved shelter/shade, marked parking bays and landscaping.	M-L	City of Geraldton	Lookout - $5,000 Shade shelter - $5,000 Marked parking bays - ? Landscaping - $2,500
SP6	Erect additional interpretive signage perhaps identifying local features that can be readily seen or locations of specific reefs or wrecks.	L	City of Geraldton	Directional sign - $500 - $2,000 depending on design
Vegetation & Habitat				
SP7	Maintain connectivity to adjoining coastal sectors and adjacent reserves.	M	City of Geraldton	-

MAHOMETS

Access		Priority	Management Responsibility	Indicative Cost
M1	Improve car parking areas by providing easier access off the road and defining the area using bollards or fencing.	M-L	City of Geraldton	60m fencing @ $16.50/m (ringlock) - $1000
M2	Close small informal carpark in central part of Mahomets	M	City of Geraldton	Boulders to be sourced from local council quarry
M3	Upgrade carpark to east of carpark to be closed	M	City of Geraldton	500 m^2 @ $25/ m^2 (asphalt) - $1,250
M4	Rationalise access to the beach by closing some informal paths and identifying dedicated access points.	M	City of Geraldton	Material to block tracks to be sourced by council
M5	Liaise with relevant parties in relation to the STC to ensure access to this area is maintained.	H	City of Geraldton	-
M6	Prohibit ORV access from parking area off Hadda Way by blocking tracks with bollards and/or brush and erecting signage.	M-L	City of Geraldton	Material to be sourced by council Sign - $110
Vegetation & Habitat				
M7	Maintain connectivity to adjacent vegetated reserves.	H	City of Geraldton	-
M8	Rehabilitate degraded areas and closed tracks through brush application and possible planting or seed dispersal	M	City of Geraldton	Area of rehabilitation to be determined after closed tracks identified.

BACKS BEACH

Access		Priority	Management Responsibility	Indicative Cost
BB1	Identify dedicated access to the beach for surf life saving and maintenance ORVs that is suitable and accessible year round. Consider using movable log and chain at the exit point to prevent becoming bogged.	H	City of Geraldton	-
BB2	Prohibit general ORV access to the beach by using bollards or fencing.	M	City of Geraldton	?
Facilities				
BB3	Improve visual appearance and appeal by modifying parking areas to include verges and islands planted with trees to provide shade.	H	City of Geraldton	$5,000 for concept plan
BB4	Plant shade trees and/or provide additional shelters within existing grassed areas, possibly providing windbreaks at the same time.	H	City of Geraldton	As determined by concept plan

Access		Priority	Management Responsibility	Indicative Cost
BB5	Upgrade and improve toilet/shower facilities and regular maintain in good condition.	H	City of Geraldton	As determined by concept plan
BB6	Pursue redevelopment and improvement of the surf life saving club facilities.	H	City of Geraldton and Geraldton Surf Club	As determined by concept plan or separate plan funded by surf club
BB7	Upgrade and possibly expand the southern car parking area to create a more formal and attractive area that will be used by greater number of visitors to increase potential surveillance and reduce security issues.	H-M	City of Geraldton	Carpark – approx. 1,000 m^2 @ \$25/ m^2 (asphalt) - \$25,000 Lawned area – approx. 500 m^2 @ \$7/ m^2 - \$3,500
Beach & Coastal Dunes				
BB8	Stormwater outlet needs improvement (extension) and scoured area needs to be reinstated with suitable sand and the area revegetated.	H-M	City of Geraldton	Extension of pipe – subject to engineering design Rehabilitation – approx. 500 m^2 @ \$2.50/ m^2 - \$1,250

TARCOOLA NORTH

Access		Priority	Management Responsibility	Indicative Cost
TN1	Prohibit ORV access to the beach by installing bollards or fencing and/or applying brush material.	M	City of Geraldton	Material to be sourced by council
Facilities				
TN2	Consider installing toilets along this section	M	City of Geraldton	Subject to design
Vegetation & Habitat				
TN3	Stabilise and revegetate, through brush application and possible planting and seed dispersal, exposed areas within the dunes and near the beach.	M-L	City of Geraldton	Several small sections, total area to be determined but not exceeding 1,000 m^2 @ \$2.50/ m^2 - \$2,500

TARCOOLA

Access		Priority	Management Responsibility	Indicative Cost
T1	DUP along Glendinning Road should be upgraded and widened to encourage greater usage.	H-M	Shire of Greenough	Approx 2.2km – total upgrade to concrete path of suitable width @ $50/m - $110,000
T2	DUP should be installed connecting Glendinning road path to Willcock Drive and delineating the boundary of the foreshore area and lots with suitable grade separation between houses and DUP.	H	Shire of Greenough	350m @ 50/m (concrete) - $17,500
T3	Install a walk trail between lot boundaries and foreshore area between Lockyer and Watterson Road and provide defined beach access paths along this section.	H-M	Shire of Greenough	??
T4	Access path to beach near Glendinning Park should be relatively level and maintained in good condition.	M	Shire of Greenough	-
T5	Consider installing traffic calming features such as raised paved areas or potential road closure (based on vehicle and pedestrian numbers) to allow improved pedestrian movement between Glendinning Park and the foreshore.	M	Shire of Greenough	Subject to engineering design
Facilities				
T6	Degraded area near northern parking area should be landscaped to provide small parkland or be revegetated.	M-L	Shire of Greenough	Approx. 500 m^2 @ $2.50/ m^2 (revegetated)- $1,250 or 500 m^2 @ $7/ m^2 (grassed) - $3,500
T7	Cleared area opposite Glenndinning Park should be enhanced through additional landscaping and provision of facilities such as seating and shelters.	M	Shire of Greenough	Shelter - $5,000 Landscaping - $3,000
T8	Large existing cleared area near Sander Street and parking area near Buchanan Place could be redesigned and enhanced by additional tree planting, and provision of extra facilities such as seating and shade, and possibly picnic tabes and BBQs.	M-L	Shire of Greenough	BBQ - $7,000 for standard two plate electric, brick. Tables/Seating - $1,000 each on concrete slab. Trees – 50 @ $100 (semi-mature) - $5,000
T9	Southern parking area and degraded area should be redeveloped to provide improved facilities such as grassed areas, shelters, toilets and better beach access, and an attractive passive recreation area.	H-M	Shire of Greenough	$2,500 for concept plan
T10	Existing drainage sump near southern boundary to be redesigned as a compensating basin low-key passive recreation area with linkage to the existing parking area. Some native vegetation should be retained in the area,	H-M	Shire of Greenough	

Access	Priority	Management Responsibility	Indicative Cost
perhaps and east-west strip on the southern half of the reserve.			
Vegetation & Habitat			
T11 Dead and large shrubs along the existing DUP near Watterson Road could be hand-pruned or slashed to improve appearance and remove overhanging branches.	L	Shire of Greenough	Council labour cost
T12 Provision of landscaped areas and facilities should be concentrated in existing cleared or degraded areas and developed as pockets rather than along the entire foreshore area to maximise retention of native bushland and fauna habitat and minimise possible degradation through the encroachment of grass and weeds.	H	Shire of Greenough	-
Beaches & Coastal Dunes			
T13 Repair and extend stormwater outlet and restore dune and revegetate.	H-M	Shire of Greenough	Pipe cost subject to engineering design Revegetation – approx. 500 m^2 @ \$2.50/ m^2- \$1,250

SOUTHGATE

Access	Priority	Management Responsibility	Indicative Cost
SG1 Maintain current access for recreational fishing and informal boat launching.	H-M	Shire of Greenough	-
SG2 Install signage at strategic locations such as entrance tracks or where multiple tracks are forming requesting ORV users to use existing tracks and avoid damage vegetation and revegetating areas.	M	Shire of Greenough	2 sings @ \$110 - \$220
Facilities			
SG3 Actively monitor community needs and pursue installation of protected district boat launching facilities as proposed in the previous feasibility study.	M	Shire of Greenough	-
Vegetation & Habitat			
SG4 Consider maintaining bushland linkage between foreshore and inland areas by ensuring development of this area aims to protect the linkage, and reserving the area.	M-L	Developer of Adjacent Land and Shire of Greenough	-

Access	Priority	Management Responsibility	Indicative Cost
SG5 Undertake revegetation of denuded and degraded sections prior to or in conjunction with development of the adjacent land.	L	Shire of Greenough	Extensive areas to be revegetated
SG6 Retain stand of *Melaleuca huegelii* within Foreshore Reserve or Public Open Space adjacent to Foreshore Reserve	L	Developer of Adjacent Land and Shire of Greenough	-

GREENOUGH/CAPE BURNEY

Facilities	Priority	Management Responsibility	Indicative Cost
GR1 Redesign car park to improve amenity and provide additional facilities. Car park could include shade trees, and grassed or mulched areas with picnic tables and possible BBQs within the area defined by concrete blocks.	H-M	Shire of Greenough	Concept plan required - $4,000
GR2 Install washdown shower near beach access path.	H-M	Shire of Greenough	Cost dependent on availability of piped water
Vegetation & Habitat			
GR3 Maintain bushland linkage between foreshore and inland areas and river by ensuring any development aims to protect the linkage, and reserving the area.	M	Developer of Adjacent Land and Shire of Greenough	-

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FIGURES

CGE-2003-001/23_48f1.dgn DATUM: AMG DRAWN BY: EDS/GLM 27-05-04 CHECKED BY: PvdM 27-05-04 PRINTED: Wed 16 Feb 05

kilometres

0 0.5 1 1.5 2 2.5

SCALE 1 : 60 000

Legend

Study Area Boundary

Tarcoola / Southgate Sector Boundary

Shire Boundary

Drummond Cove

Drummond Cove / Drummond Point

Drummond Point / Glenfield

Glenfield / Sunset North

Glenfield

Sunset North / Sunset

Sunset Beach / Sunset

Chapman River Mouth

Chapman River Mouth / Bluff Point

Bluff Point / Bluff Point

Bluff Point / St Georges/Rundle Park

St Georges/Rundle Park / St Georges/Rundle Park

Beresford

Beresford / Marina

Beresford

LIMIT OF STUDY

LIMIT OF STUDY / Pages Point Moore

Pages Point Moore

GERALDTON

Greys Point Moore

Greys / Separation Point

Separation Point / Mahomets

Mahomets / Back Beach

Back Beach / Tarcoola North

Tarcoola North / Tarcoola

Tarcoola Beach

Wandina

Narngulu

Tarcoola / Southgate

Southgate / Greenough

Greenough / LIMIT OF STUDY

Greenough River

Woorree

River

Chapman

CITY OF GERALDTON

SHIRE OF GREENOUGH

INDIAN OCEAN

ATA Environmental
environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

COASTAL FORESHORE AREA AND SECTORS

FIGURE 1

CGE-2003-001/23_48f2.dgn DATUM: AMG DRAWN BY: EDS/GLM 27-05-04 CHECKED BY: PvdM 27-05-04 PRINTED: Wed 16 Feb 05

kilometres

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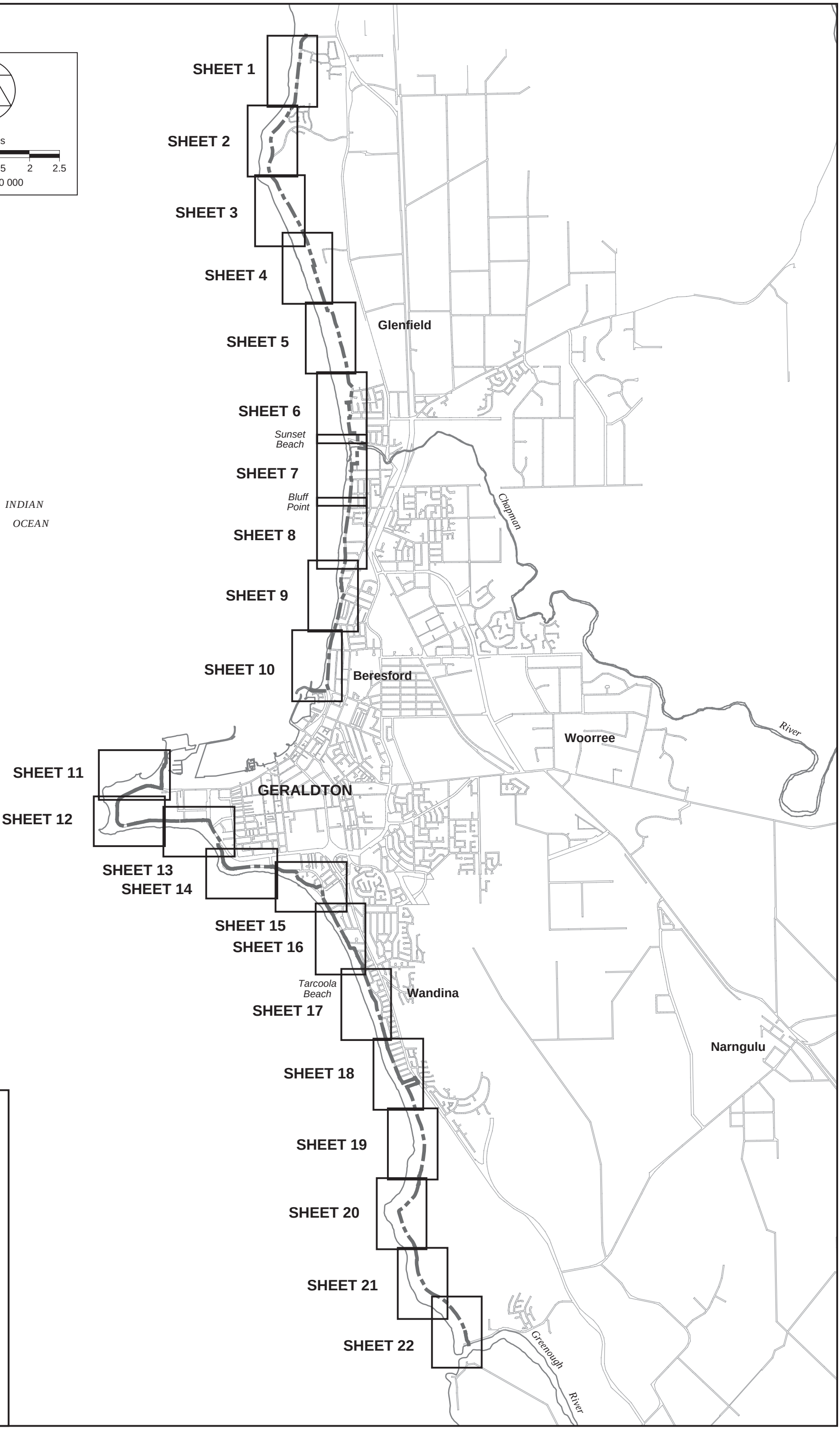
SCALE 1 : 60 000



GERALDTON - GREENOUGH COASTAL STRATEGY & FORESHORE MANAGEMENT PLAN

SHEET INDEX FOR FIGURES 3 & 4

FIGURE 2

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LEGEND

OaSl — Vegetation Type Boundary

Limit of Survey

Track/Path

Glenfield / Sunset North — Study Sector Boundary

Cadastral Road Boundary

Cadastral Lot Boundary

Shire/City Boundary

Topographic Contour (mAHD)

1m Interval with 5m Index for Geraldton

5m Interval for Greenough

VEGETATION LEGEND

TdSl *Tetragonia decumbens* /*Spinifex longifolius* Low Open Heathland/Grassland

OaSl *Olearia axillaris* Shrubland over *Spinifex longifolius* Grassland

Nb *Nitraria billardierei* Closed Heath

OaScTd *Olearia axillaris* Shrubland over *Scaevola crassifolia* /*Tetragonia decumbens* Low Open Heath

AiTd *Atriplex isatidea* Open Heath over *Tetragonia decumbens* Low Open Heath

AiOaTdSl *Atriplex isatidea* /*Olearia axillaris* Open Heath over *Tetragonia decumbens* /*Spinifex longifolius* Low Open Heath/Grassland

NbOaMiSl *Nitraria billardierei* /*Olearia axillaris* /*Myoporum insulare* Open Heath over *Spinifex longifolius* Grassland

NbSlTd *Nitraria billardierei* Open Heath over *Spinifex longifolius* /*Tetragonia decumbens* Grassland/Low Open Heath

ArOaSl *Acacia rostellifera* /*Olearia axillaris* Open Heath over *Spinifex longifolius* Grassland

ArOaSc *Acacia rostellifera* /*Olearia axillaris* Open Heath over *Scaevola crassifolia* Low Open Heath

Ar *Acacia rostellifera* Open to Closed Heath

ArAiTd *Acacia rostellifera* /*Atriplex isatidea* Open Heath over *Tetragonia decumbens* Low Open Heath

Sv *Sporobolus virginicus* Grassland

MhAr *Melaleuca huegelii* /*Acacia rostellifera* Closed Scrub

Co *Casuarina obesa* Woodland

Ac *Atriplex cinerea* Low Closed Heath

t Tamarisk (*Tamarix aphylla*) Trees

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS LEGEND

FIGURE 3

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metres

0 25 50 75 100

SCALE 1 : 3 000

Drummond Cove

TdSl
OaSl
ArOaSl
Nb
OaSl
ArOaSl
TdSl
ArOaSl
OaSl
TdSl
ArOaSl
TdSl

Reserve 44791
Reserve 40591
Reserve 44792
Reserve 44787
Reserve 24738
Reserve 24738
Reserve 42313
Reserve 43315

Waterfront Close
WHITEHILL ROAD
SEACREST WAY

Cleared
Existing Residential
Native Vegetation
Existing Residential
Existing Residential
Seagrass Wrack
Inshore reef/rock

-5
-10
-15
-20

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 1

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Reserve 43315

Reserve 43360

TdSl

ArOaSl

Existing Residential

Reserve 43315

07

10

10

5

Cleared

5

Native Vegetation

5

Drummond Cove

Drummond Point

OaSl

ArOaSc

Reserve 43360

ArOaSc

OaSl

ArOaSc

OaSl

Inshore reef/rock

Inshore reef/rock

Inshore reef/rock

metres

0 25 50 75 100

SCALE 1 : 3 000

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GERALDTON - GREENOUGH COASTAL STRATEGY

& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 2

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metres
0 25 50 75 100
SCALE 1 : 3 000

Native Vegetation

Native Vegetation

NbSlTd

ArOaSc

ArOaSl

ArOaSc

AiTd

NbSlTd

NbSlTd

ArOaSc

TdSl

AiTd

AiTd

Drummond Point

Glenfield

ATA Environmental
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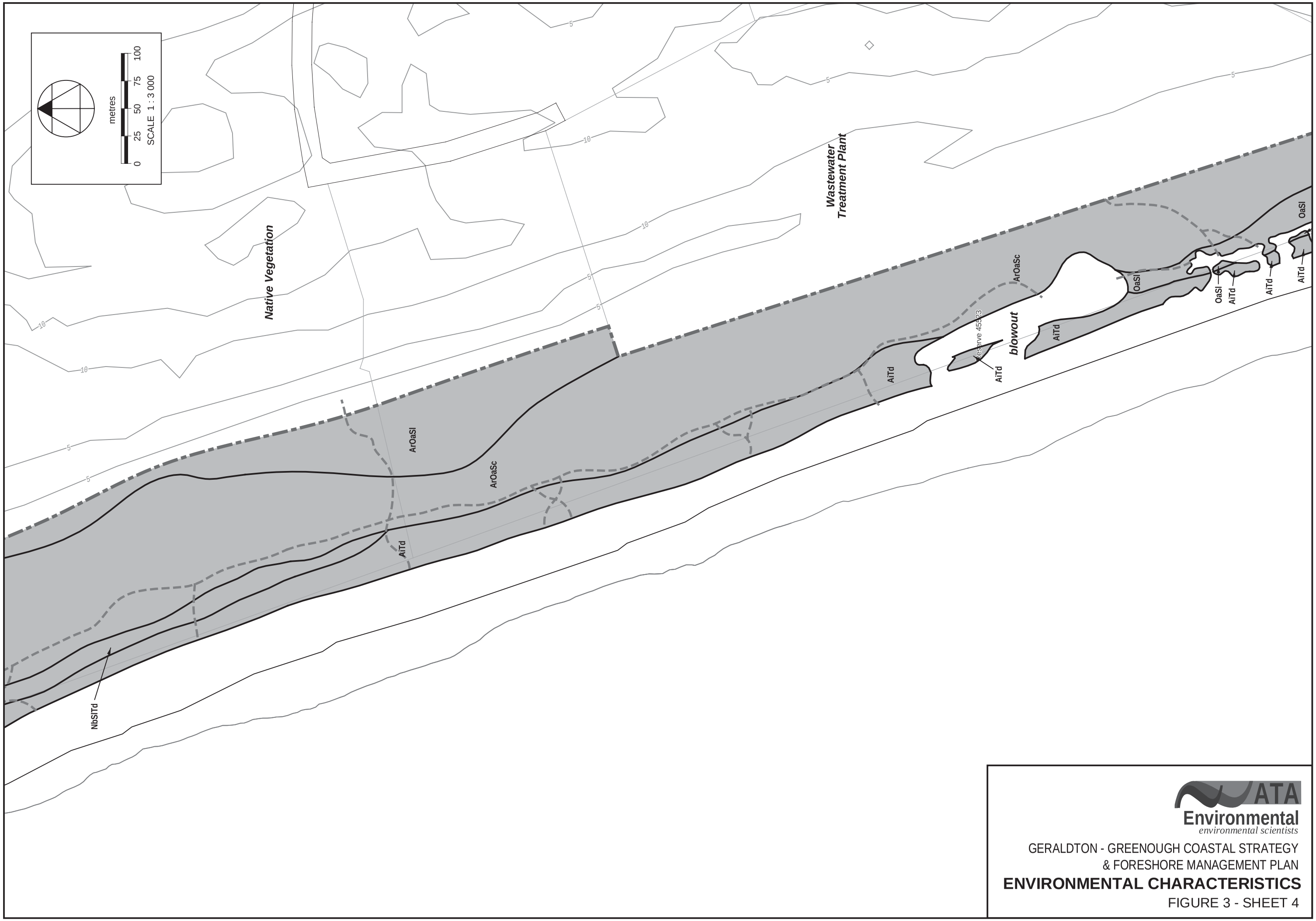
GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 3



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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 4

CGE-2003-001/23_48f3b.dgn DATUM: AMG DRAWN BY: EDS//GLM 27-05-04 CHECKED BY: PvdM 27-05-04 PRINTED: Wed 16 Feb 05

metres
0 25 50 75 100
SCALE 1 : 3 000

SHIRE OF GREENOUGH
CITY OF GERALDTON

Native Vegetation
Native Vegetation
Wastewater Treatment Plant
blowout
blowout
blowout
blowout
ArOaSc
ArOaSl
AiTd
OaSl
Reserve 41198
Glenfield
Sunset North

ATA Environmental
environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 5

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 6

metres

0 25 50 75 100

SCALE 1 : 3 000

Sunset
Chapman River Mouth

Chapman River Mouth
Bluff Point

CHAMPION

BAY

ArAiTd
Reserve 27322
Cleared
Reserve 27321
BALER
SWAN
Ac
Ar
Co
Chapman
River
Reserve 41198
Sand Bar
Nazareth House
TdSl
CROWTHERTON
Large mounds of seagrass wrack
Existing Residential
FULLER
Nb
ArOaSl
OaSl
STREET
HUNGERFORD
KEMPTON
MALCOLM
CATHERINE
Seagrass Wrack

GERALDTON - GREENOUGH COASTAL STRATEGY & FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 7

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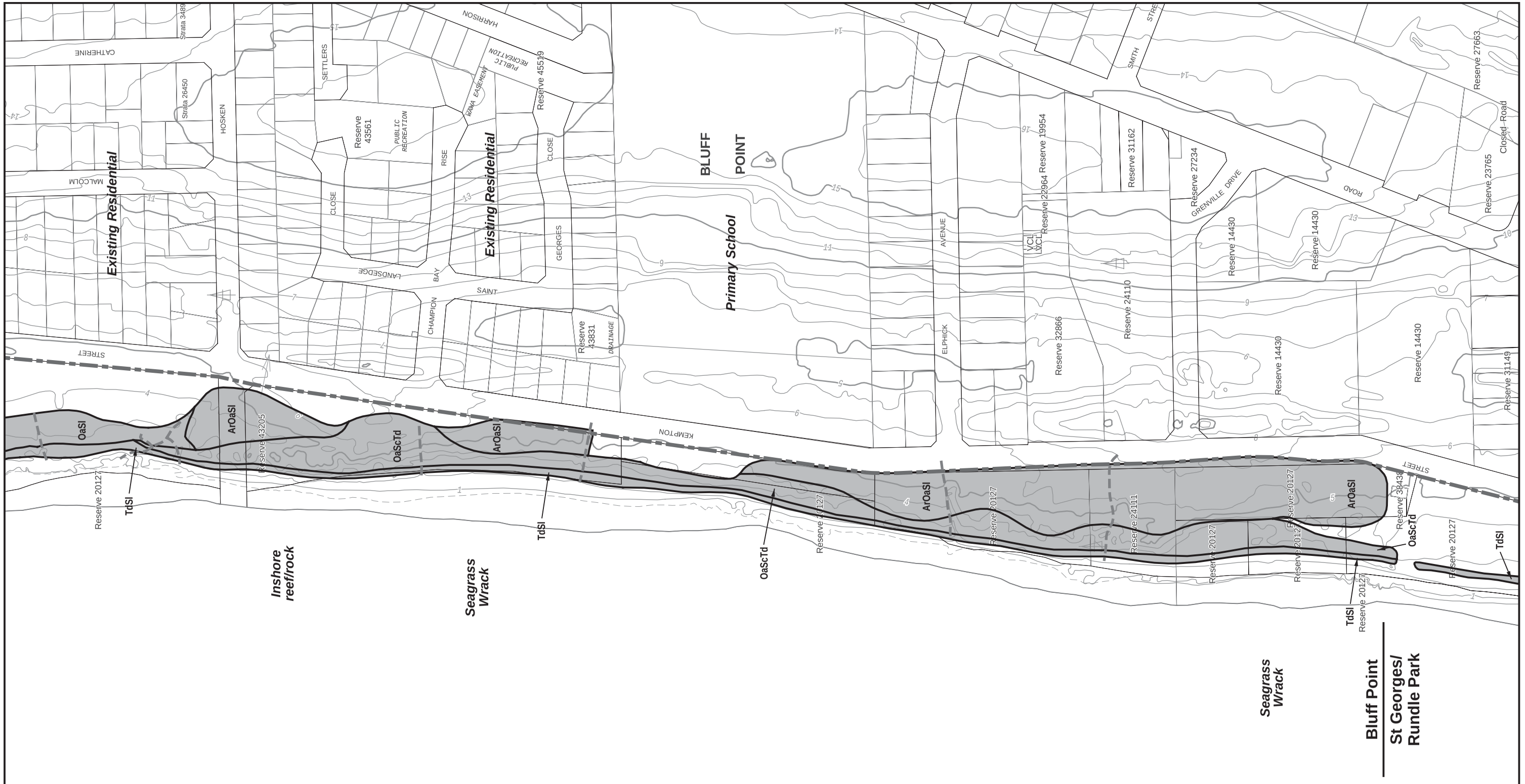

metres
0 25 50 75 100
SCALE 1 : 3 000

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 8

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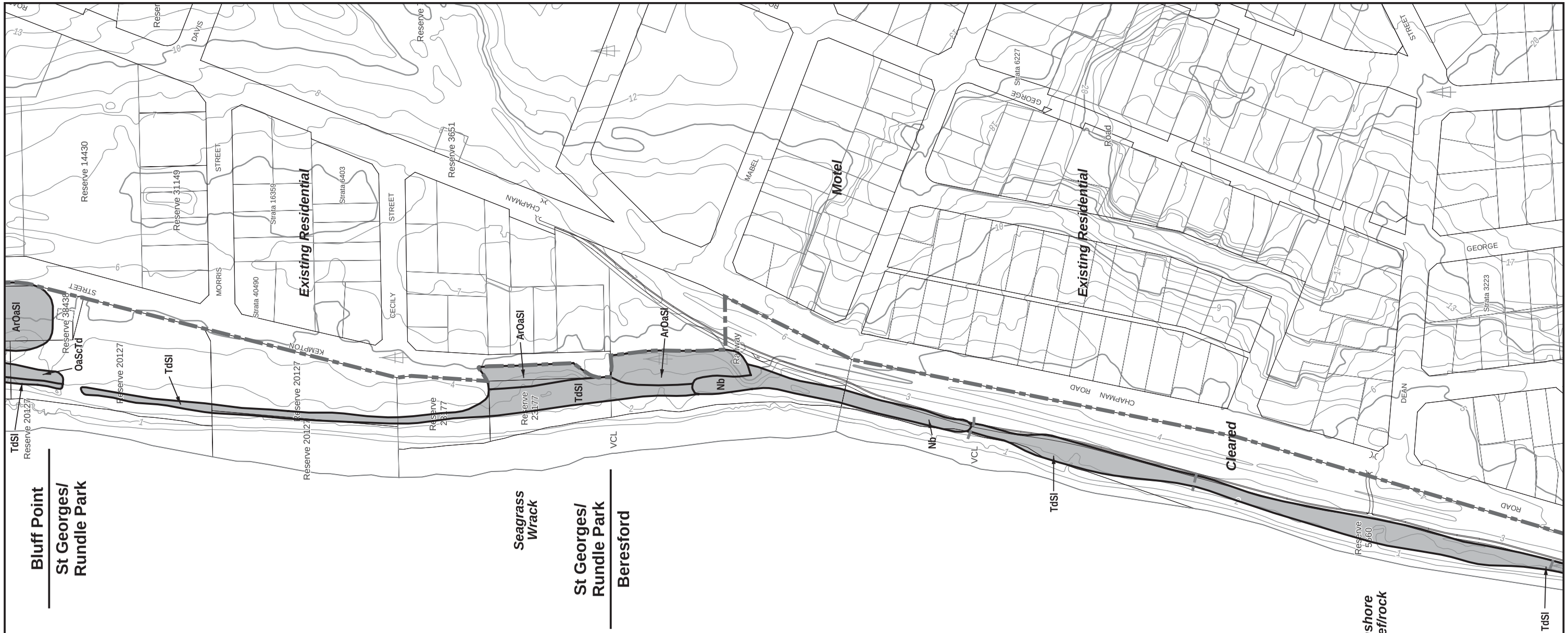
Bluff Point

St Georges/ Rundle Park

St Georges/ Rundle Park

Beresford



metres
0 25 50 75 100
SCALE 1 : 3 000

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GERALDTON - GREENOUGH COASTAL STRATEGY
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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 9

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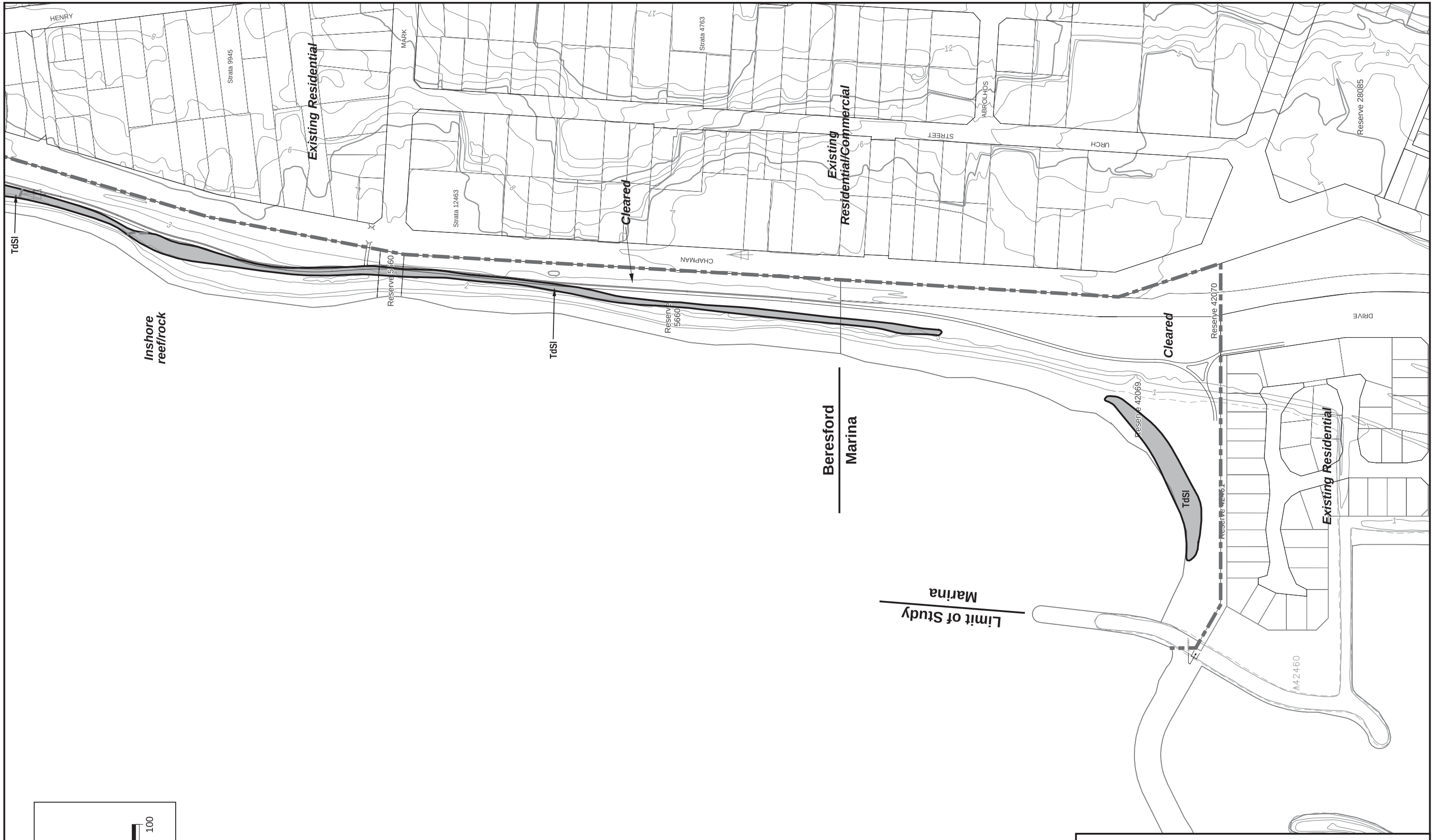

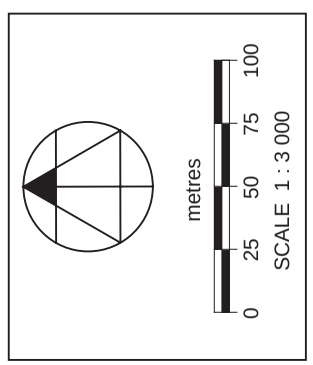

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& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 10

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metres

0 25 50 75 100

SCALE 1 : 3 000

Limit of Study
Pages

Pages
Point Moore

Nb
NbOaMiSl
OaScTd
OaSl

Seagrass
Wrack

Cleared

Caravan Park

Geraldton
Port/Industrial

Reserve 20606
Reserve 29729
Reserve 35256
Reserve 29173

WILLCOCK DRIVE

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 11

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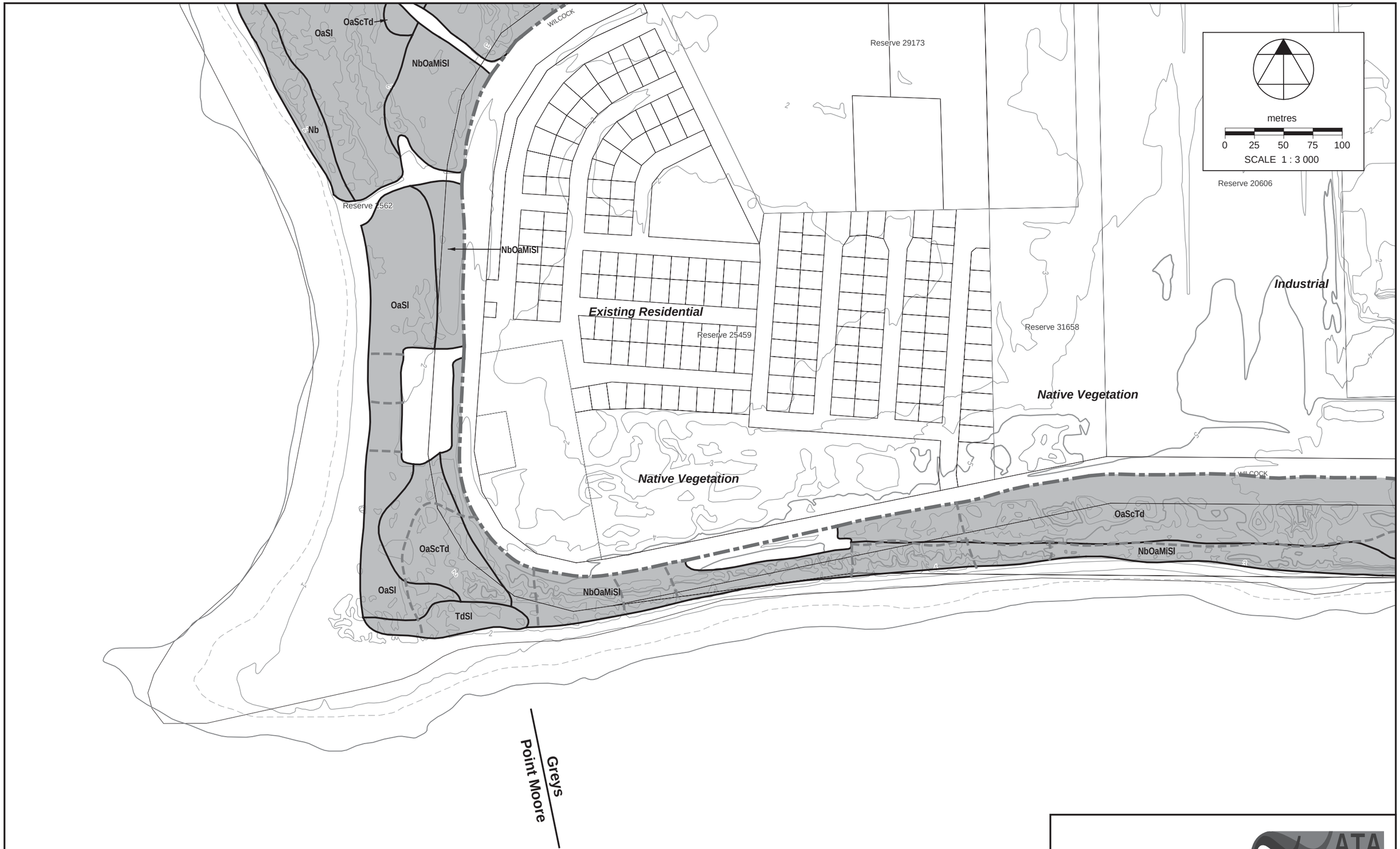

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 12

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CGE-2003-001/23_48f3b.dgn DATUM: AMG DRAWN BY: EDS/GLM 27-05-04 CHECKED BY: PvdM 27-05-04

Reserve 36805

HAIGH ST

POINT STREET

DRIVE

Industrial

Industrial

Industrial

3116

3116

3116

Reserve 21773

Closed Road

metres

0 25 50 75 100

SCALE 1 : 3 000

OaScTd

Reserve 2562

Sv

t

OaScTd

NbOaMiSl

AiOaTdSl

TdSl

Reserve 2562

ArOaSc

Nb

Reserve 27529

VCL

VCL

VCL

Reserve 42569

Reserve 33635

Reserve 32733

CROWTHER

Reserve 35989

Reserve 33799

Reserve 33799

Reserve 38325

Native Vegetation

Reserve 45207

VCL

Reserve 45140

Reserve 36091

FOOTWAY

Reserve 27530

VCL

TdSl

Nb

Greys Separation Point

Former Caravan Park

BEACHLA

Reserve 24

ATA Environmental
environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 13

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DATUM: AMG

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Greys Separation Point

TdSl

Nb

NbOaMiSl

AiOaTdSl

Former Caravan Park

Former Caravan Park

Native Vegetation

Reserve 24819

Reserve 25667

Reserve 27530

Reserve 27529

Reserve 20195

Reserve 20195

1635

VCL

VCL

MALEY ST

ELIOT

PORTWAY

WILCOCK DRIVE

metres

0 25 50 75 100

SCALE 1 : 3 000

Mahomets Separation Point

PORT GREY

ATA Environmental
environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 14

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DATUM: AMG

CGE-2003-001/23_48f3b.dgn

Native Vegetation

Existing Residential

MAHOMETS

WILLCOCK DRIVE

Tourist Accommodation

Mahomets Back Beach

Cleared

FLATS

Back Beach Tarcoola North

Existing Residential

t

NbOaMiSl

ArOaSl

AiOaTdSl

TdSl

Nb

AiTd

Ar

Reserve 20195

Reserve 20193

Reserve 31671

Reserve 30063

Reserve 30043

Reserve 34450

Reserve 41778

Reserve 34451

Reserve 34452

Reserve 40479

Strata 10239

Strata 18304

Strata 17581

Strata 17582

Strata 33339

Strata 6029

Strata 11883

Strata 5495

Strata 18774

Strata 25325

Strata 22397

Strata 18775

Strata 19461

Strata 24023

Strata 15882

Strata 20015

Strata 7111

Strata 7110

Strata 7686

Strata 9538

Strata 20186

Strata 15571

Strata 23870

Strata 25685

Strata 14745

Strata 4534

Strata 15306

metres

0 25 50 75 100

SCALE 1 : 3 000

ATA Environmental

environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY

& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 15

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metres
0 25 50 75 100
SCALE 1 : 3 000

Tarcoola North
Tarcoola

Back Beach
Tarcoola North

Seagrass Wrack

Existing Residential

Motel

Cleared

CITY OF GERALDTON
SHIRE OF GREENOUGH

GLENDINNING ROAD

WILLCOCK DRIVE

Reserve 29265
Reserve 33147
Reserve 30043
Reserve 42292
Reserve 34973
Reserve 39733
Strata 7297
Strata 26234
Strata 26618
Strata 34282
Strata 5294
Strata 33565
Strata 3272
Strata 32

TdSl
AiTd
Ar
ArDaSl

ATA Environmental
environmental scientists

GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 16

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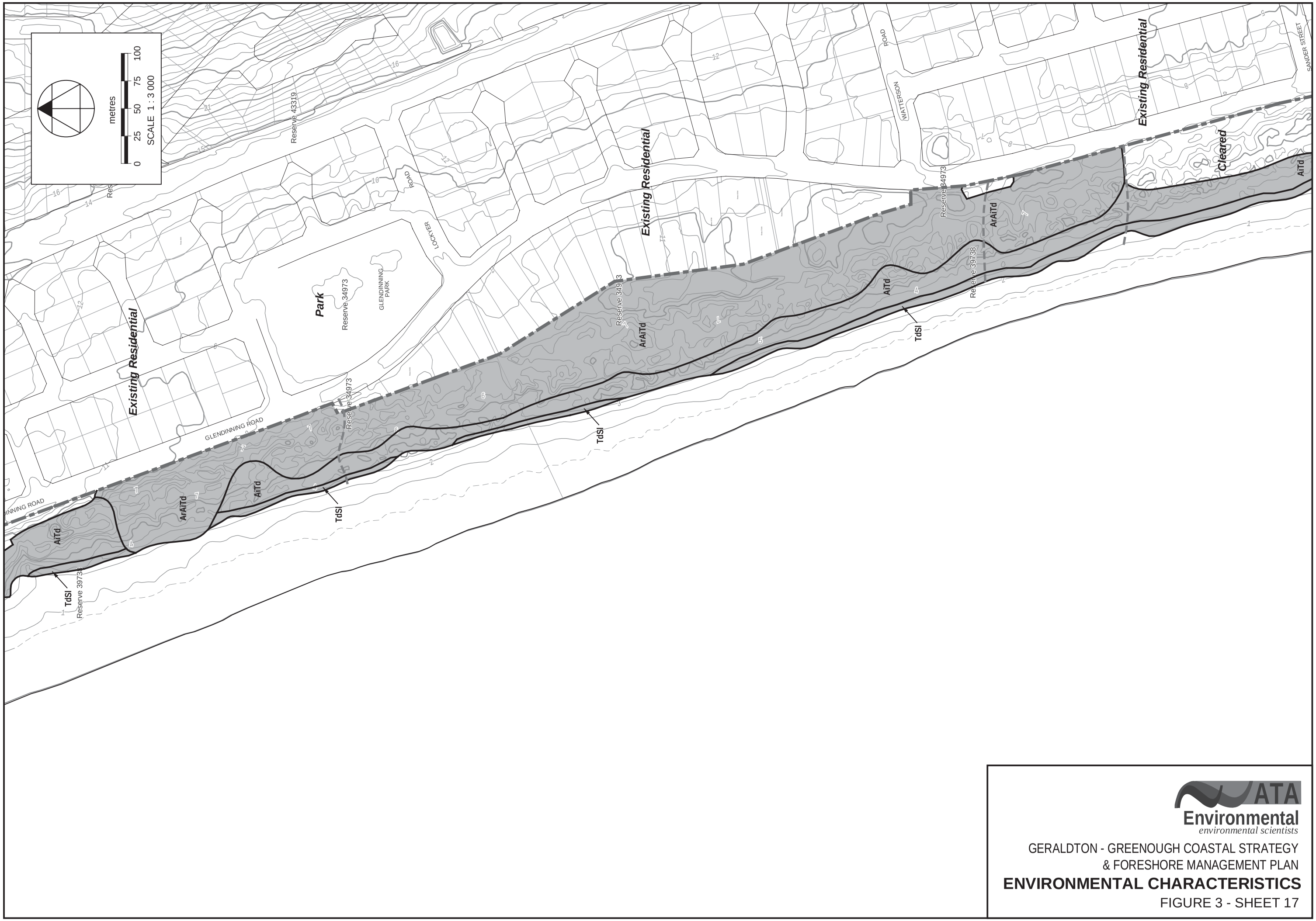

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 17

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metres
0 25 50 75 100
SCALE 1 : 3 000

Reserve 35357
Reserve 43307
Reserve 35488
Reserve 39738

Existing Residential

Cleared

Native Vegetation

sump

ArOaSl
MhAr
AiTd
ArAiTd
TdSl
NbSlTd

SANDER STREET
BUCHANAN PLACE

Tarcoola
Southgate

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 18

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0 25 50 75 100
metres
SCALE 1 : 3 000

Native Vegetation

blowout

blowout

blowout

ArOaSl

TdSl

Seagrass Wrack

ArOaSc

ArOaSc

ArOaSc

ArOaSc

OaScTd

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FIGURE 3 - SHEET 19

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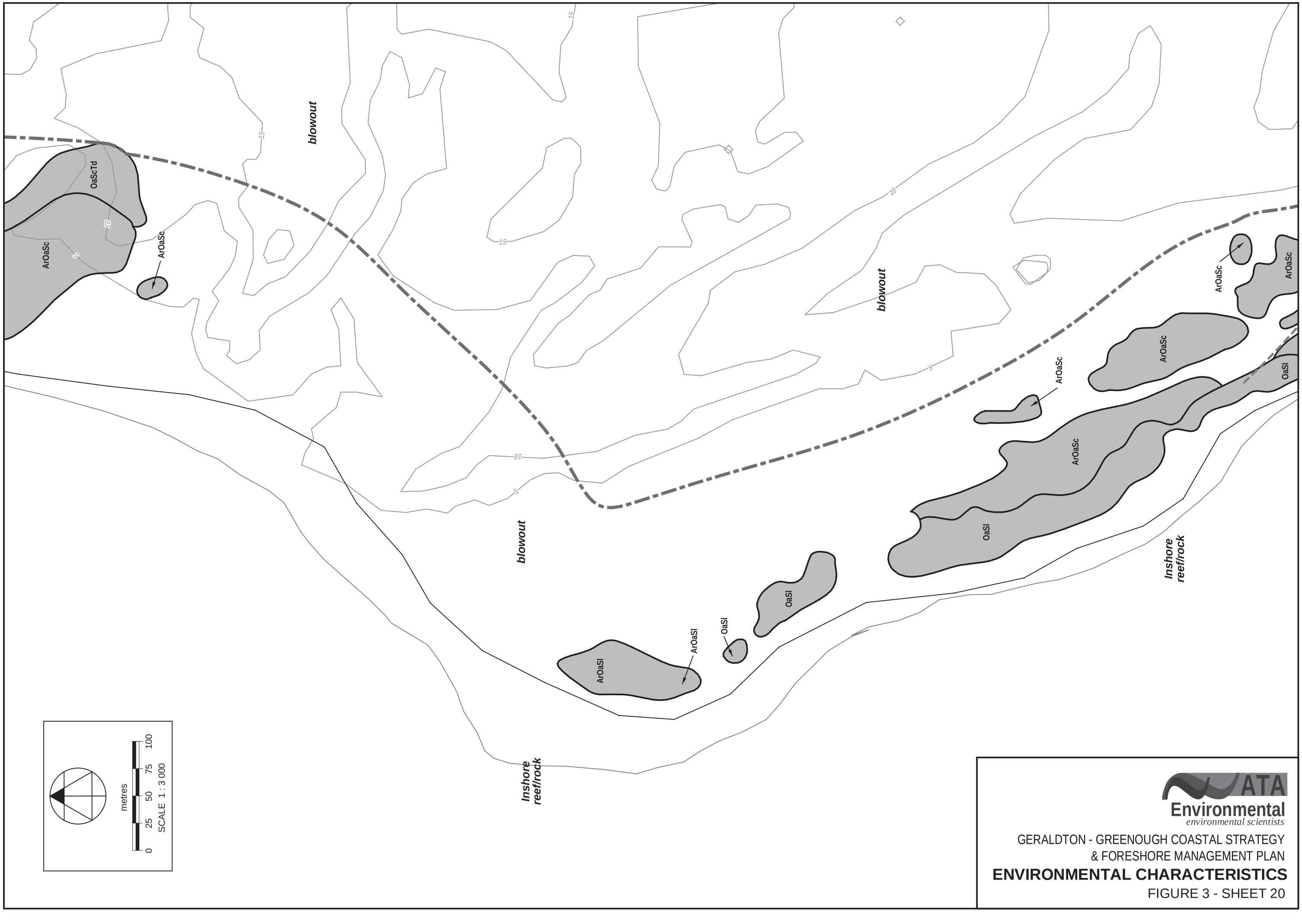

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 20

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metres
0 25 50 75 100
SCALE 1 : 3 000

Native Vegetation

blowout

Inshore reef/rock

ArOaSc

OaSl

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 21

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metres
0 25 50 75 100
SCALE 1 : 3 000

Native Vegetation

Greenough River

Reserve 28653

Reserve 24420

Reserve 20995

Reserve 20995

ArOaSc

TdSl

blowout

Inshore reef/rock

Sand Bar

Greenough Limit of Study

Southgate Greenough

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 22

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DRAWN BY: EDS 21-05-04

DATUM: N/A

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LEGEND

- Vegetated Area
- Limit of Survey
- Glenfield / Sunset North — Study Sector Boundary
- Cadastral Road Boundary
- Cadastral Lot Boundary
- Shire/City Boundary
- Proposed Geraldton Southern Transport Corriodor Reserve

Topographic Contour (mAHD)

- 5 — 2 — 1m Interval with 5m Index for Geraldton
- 5 — 5m Interval for Greenough

FMP LEGEND

- Track
- Beach Access
- Close Track and Rehabilitate
- Dual Use Path
- Proposed Dual Use Path
- Off Road Vehicle Access
- Boat Ramp
- Rehabilitate
- Lawn/Parkland
- Wildlife Linkage
- Parking
- Toilets
- Viewing Area/Lookout
- Block ORV access
- Signage

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MANAGEMENT MEASURES LEGEND

FIGURE 4

metres
0 25 50 75 100
SCALE 1 : 3 000

Drummond Cove

Rehabilitate
(DC8)

Cleared
Future Residential

Reserve 44791

Parkland

Install additional
access path
(DC2)

Provide picnic facilities to
complement existing facilities or
district boat ramp if constructed
(DC4)

Pursue construction of district
boat launching facilities
(DC5)

Waterfront Close

Previously Proposed
Protected Boat Ramp

Reserve 40581

Parkland

Existing
Residential

Reserve 44792

Rehabilitate
(DC8)

Maintain vegetated
linkage
(DC10)

Reserve 44787

Sporting Facilities
Play Equipment
Picnic Facilities
BBQ's
(DC4)

Native
Vegetation

Community
Hall

Regularly maintain upgrade
launching ramp
(DC3)

Block ORV
access

WHITEHILL ROAD

Native Vegetation
(to be developed
for residential use)

Develop Foreshore area for recreational
purposes upon removal of lease
cottages west of Whitehill Road
(DC6)

Existing
Residential
(to become
freehold)

Reserve 24738

Native Vegetation
(to be developed
for residential use)

Lease Cottages to be removed
(DC7)

Reserve 24738

Reserve 42813

SEACREST WAY

Existing
Residential

Block ORV
access
(DC1)

Reserve 43315

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GERALDTON - GREENOUGH COASTAL STRATEGY
& FORESHORE MANAGEMENT PLAN

MANAGEMENT MEASURES

FIGURE 4 - SHEET 1

metres
0 25 50 75 100
SCALE 1 : 3 000

Reserve 43315
Reserve 43360
Reserve 43315
Reserve 43360

Block ORV access (DC1)

Drummond Cove
Drummond Point

Create access path (DP1)

Concentrate POS and Facilities

Maintain vegetated linkage (DP6)

Close and rehabilitate tracks not required as beach access paths (DP4)

Install DUP that connects with DUP along Seahaven View

Formalise access paths using existing tracks where possible (DP4)

Install small off street parking area (DP2)

Improve track to allow reliable ORV access to Drummond Point (DP3)

Block ORV access (DP4)

Consider maintaining vegetated linkage (DP6)

Undertake revegetation around parking area to discourage informal tracks (DP5)

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 2

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Drummond Point

Glenfield

Install signage regarding ORV use and impacts (GL1)

Undertake revegetation planting around parking area to discourage informal tracks (DP5)

Native Vegetation

metres

0 25 50 75 100

SCALE 1 : 3 000

Consider retaining sections of bushland as wildlife linkage (GL4)

Native Vegetation

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 3

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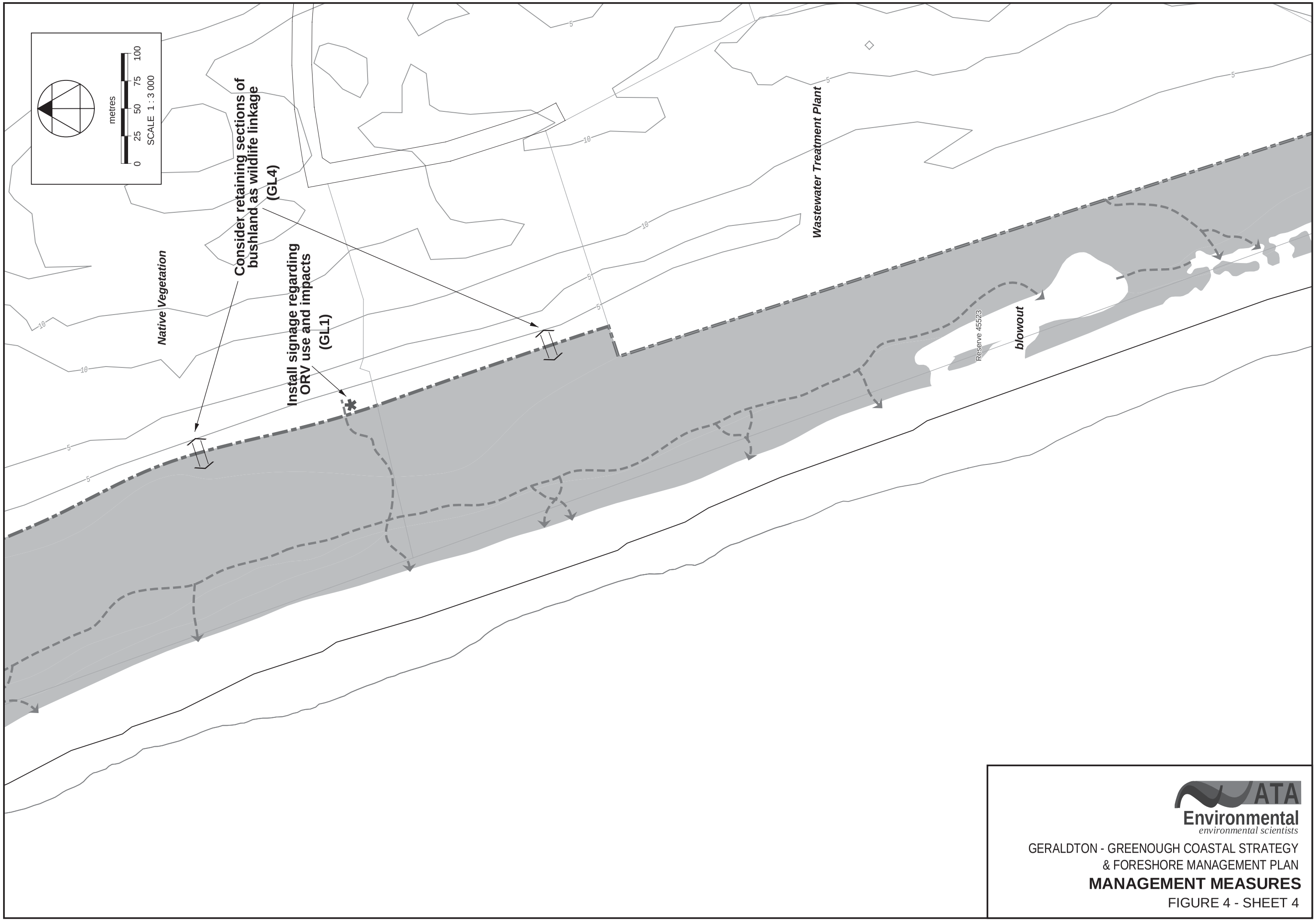

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 4

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metres

0 25 50 75 100

SCALE 1 : 3 000

Glenfield

Sunset North

blowout

blowout

blowout

Reserve 41198

blowout

Consider retaining sections of bushland as wildlife linkage (SN4)

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 5

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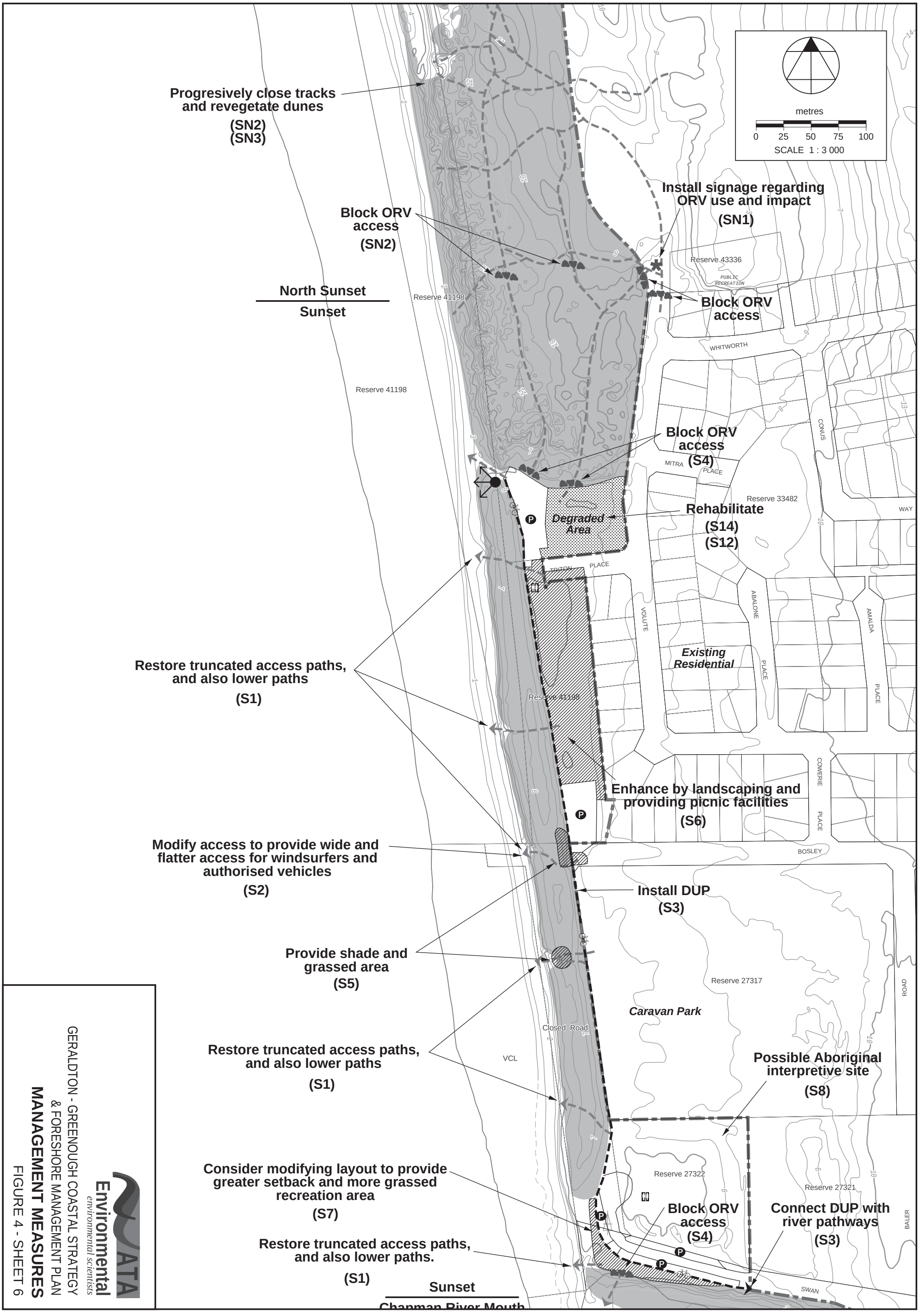

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 6

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metres

0 25 50 75 100

SCALE 1 : 3 000

Consider modifying layout to provide greater setback and more grassed recreation area

(S7)

Restore truncated access paths, and also lower paths.

(S1)

Sunset

Chapman River Mouth

Block ORV access

(S4)

Connect DUP with river pathways

(S3)

Continue weed control and revegetation

(CR5)

Maintain and improve walk trail

(CR1)

Install signage regarding disturbance of wildlife from dogs

(CR3)

Block ORV access

(CR2)

Install interpretive signage about river and park

(CR4)

Consider purchasing properties if up for sale

(CR8)

Chapman River Mouth

Bluff Point

CHAMPION

BAY

Maintain and improve crude seawall

Continue weed control and revegetation

(BP1)

Reserve 27322

Reserve 27321

Reserve 41198

Reserve 20127

Existing Residential

SWAN

CHAPMAN RIVER

CROWTHERTON

FULLER

HUNGERFORD

KEMPTON STREET

MALCOLM STREET

CATHERINE STREET

BALER

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 7

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metres

0 25 50 75 100

SCALE 1 : 3 000

Continue weed control and revegetation (BP1)

Monument

Boat launching ramp

Bluff Point

St Georges/ Rundle Park

BLUFF POINT

Reserve 20127 STREET MALCOLM CATHERINE HOSKEN Strata 26450 Strata 3489 Reserve 43205 SETTLERS CLOSE Reserve 43561 PUBLIC RECREATION LANDSEDGE CHAMPION BAY RISE SAINT WAWA EASEMENT HARRISON Reserve 45519 GEORGES CLOSE Reserve 43831 DRAINAGE KEMPTON Reserve 20127 ELPHICK AVENUE Reserve 20127 Reserve 32866 Reserve 22964 Reserve 19954 Reserve 24110 Reserve 31162 SMITH STREET Reserve 24111 Reserve 20127 Reserve 27234 GRENVILLE DRIVE Reserve 14430 Reserve 20127 Reserve 20127 Reserve 14430 Reserve 14430 ROAD Reserve 20127 Reserve 38438 STREET Reserve 14430 Reserve 20127 Reserve 27663 Reserve 23765 Closed Road Reserve 31149

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GERALDTON - GREENOUGH COASTAL STRATEGY & FORESHORE MANAGEMENT PLAN

MANAGEMENT MEASURES

FIGURE 4 - SHEET 8

metres

0 25 50 75 100

SCALE 1 : 3 000

Bluff Point

St Georges/ Rundle Park

Boat launching ramp

Consider modifying carpark layout or installing traffic calming measures (RP1)

St Georges/ Rundle Park

Beresford

Pursue installation of DUP (B1)

Possible lookout (B2)

Improve amenity by landscaping and installing additional facilities when railway is removed (B3)

Land should be transferred to local authority after railway is removed (B5)

Reserve 20127
Reserve 38438
Reserve 14430
Reserve 31149
Reserve 20127
Reserve 20127
Reserve 20127
Strata 40490
Strata 16359
Strata 6403
Reserve 23177
Reserve 23177
Reserve 3651
Reserve 5660
Strata 6227
Strata 3223
MORRIS STREET
DAVIS
CECILY STREET
CHAPMAN ROAD
GEORGE STREET
DEAN STREET
MABEL
ROAD
VCL
VCL
railway
line
Road
Existing Residential
Existing Residential

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GERALDTON - GREENOUGH COASTAL STRATEGY & FORESHORE MANAGEMENT PLAN

MANAGEMENT MEASURES

FIGURE 4 - SHEET 9

metres

0 25 50 75 100

SCALE 1 : 3 000

Improve amenity by landscaping and installing additional facilities when railway is removed (B3)

Future groyne (aproved by City of Geraldton)

Progressively revegetate with low coastal species (B4)

Beresford Marina

Limit of Study Marina

Regularly replenish sand to maintain foreshore and beach (BCM5)

Reinstate access as part of sand replenishment (BCM1)

Brush or revegetate sand replenishment areas (BCM4)

Improve amenity by landscaping and installing additional facilities when railway is removed (BCM3)

authorised vehicle access

Consider creating vehicle access off Chapman Rd after removal of railway (BCM2)

Existing commercial/residential

HENRY

Strata 9945

Reserve 5660

MARK

Strata 12463

Reserve 5660

CHAPMAN

Strata 4763

Reserve 42069

Reserve 42461

Reserve 42070

railway line

Reserve 28085

DRIVE

STREET

URCH

M42460

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 10

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metres

0 25 50 75 100

SCALE 1 : 3 000

Limit of Study
Pages

Pages
Point Moore

Periodically remove
seagrass from beach

Undertake weed control
and rehabilitation
(P5)

Close and
rehabilitate tracks
(PM4)

Play
equipment

Maintain track as
a walking trail

Block ORV
access
(P1)

Install speed
limit signs
(PM2)

Undertake
weed control
(PM6)

Install interpretive
signage
(PM9)

Block ORV
access
(PM4)

Upgrade
unsealed access
(P4)

Provide improved shade by
planting trees or erecting shelters
(P3)

Define parking areas and
ORV access with fencing and
improve access where necessary (PM3)

Sealed

Unsealed

WILLCOCK

DRIVE

Reserve 29729

Reserve 20606

Reserve 35256

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 11

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Define parking areas and ORV access with fencing and improve access where necessary (PM3)

Install speed limit signs (PM2)

Undertake weed control (PM6)

Reserve 2562

Reserve 25459

Reserve 31658

Reserve 20606

WILCOCK

metres

0 25 50 75 100

SCALE 1 : 3 000

Install interpretive signage (PM9)

Sea Rescue

Maintain vegetated linkage

Control access from parking area through fencing and signage (G5)

Install Sand Trapping Fences (PM7)

Block ORV access (G1)

Restore and improve truncated or scoured access (G4)

Relocate Point Street car park further west (G7)

Greys Point Moore

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& FORESHORE MANAGEMENT PLAN

MANAGEMENT MEASURES

FIGURE 4 - SHEET 12

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Reserve 36805

HAIGH ST

POINT STREET

DRIVE

3116

Closed Road

3116

Reserve 21773

3116

metres

0 25 50 75 100

SCALE 1 : 3 000

Protect wetland (G9)

Southern transport corridor proposed across this section

Reserve 2562

Reserve 2569

VCL

Reserve 32733

CROWTHER

Reserve 33635

Reserve 35989

Improve steep sloping access track (G3)

Reserve 2562

Reserve 33799

Rehabilitate (G8)

BEACHLA

Reserve 38325

Reserve 33799

VCL

VCL

Reserve 27529

Block ORV access (SP1)

Reserve 45207

VCL

FOREWAY

Reserve 45140

Reserve 36091

Reserve 27530

Greys Separation Point

Block 4WD access on beach to north

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 13

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Greys Separation Point

Block 4WD access on beach to north (SP5)

Ensure beach access maintained (SP3)

Construct improved access from lookout (SP2)

Enhance lookout by landscaping and providing shade/shelters and more interpretive signage

(SP5)

(SP6)

Former caravan park

Reserve 27530

Reserve 27529

Reserve 24819

Reserve 25667

Reserve 20195

VCL

1635

ELIOT

PORTWAY

WILCOCK

DRIVE

MALEY ST

Proposed Marine Training Facility site

Formalise access to foreshore (SP4)

Maintain vegetated linkage (M7)

Close Parking

Upgrade Parking

Define parking and improve access to parking

(M1)

Rationalise access tracks in consideration of STC works and rehabilitate closed tracks

(M4)

(M8)

metres

0 25 50 75 100

SCALE 1 : 3 000

Mahomets Separation Point

PORT GREY

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 14

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Future Caravan Park

Maintain vegetated linkage (M7)

MAHOMETS

WILLCOCK DRIVE

HADDAD WAY

Improve and define parking area

Block ORV access (M6)

Reserve 20195

Mahomets Back Beach

Provide more shade trees and shelters (BB4)

Modify to include planted islands (BB3)

Upgrade toilets (BB5)

Pursue upgrade of facilities (BB6)

FLATS

Prevent 4WD entry to beach (BB2)

Identify dedicated authorised ORV access and regularly maintain or improve (BB1)

Upgrade car park (BB7)

Possible car park extension or lawn/parkland

Extend drain outlet and repair dune (BB8)

Back Beach Tarcoola North

Reserve 34450

Reserve 41778

Reserve 34451

Reserve 34452

Reserve 40479

Reserve 34671

Reserve 30063

SLSC

Strata 20186

Strata 15571

Strata 7111

Strata 7110

Strata 7686

Strata 9538

Strata 14745

Strata 10239

Strata 18304

Strata 17581

Strata 17582

Strata 33339

Strata 6029

Strata 11883

Strata 23870

Strata 25685

Strata 5495

Strata 25325

Strata 22397

Strata 18775

Strata 19461

Strata 24023

Strata 18774

Strata 15882

Strata 20015

Strata 4534

Strata 15306

metres

0 25 50 75 100

SCALE 1 : 3 000

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 15

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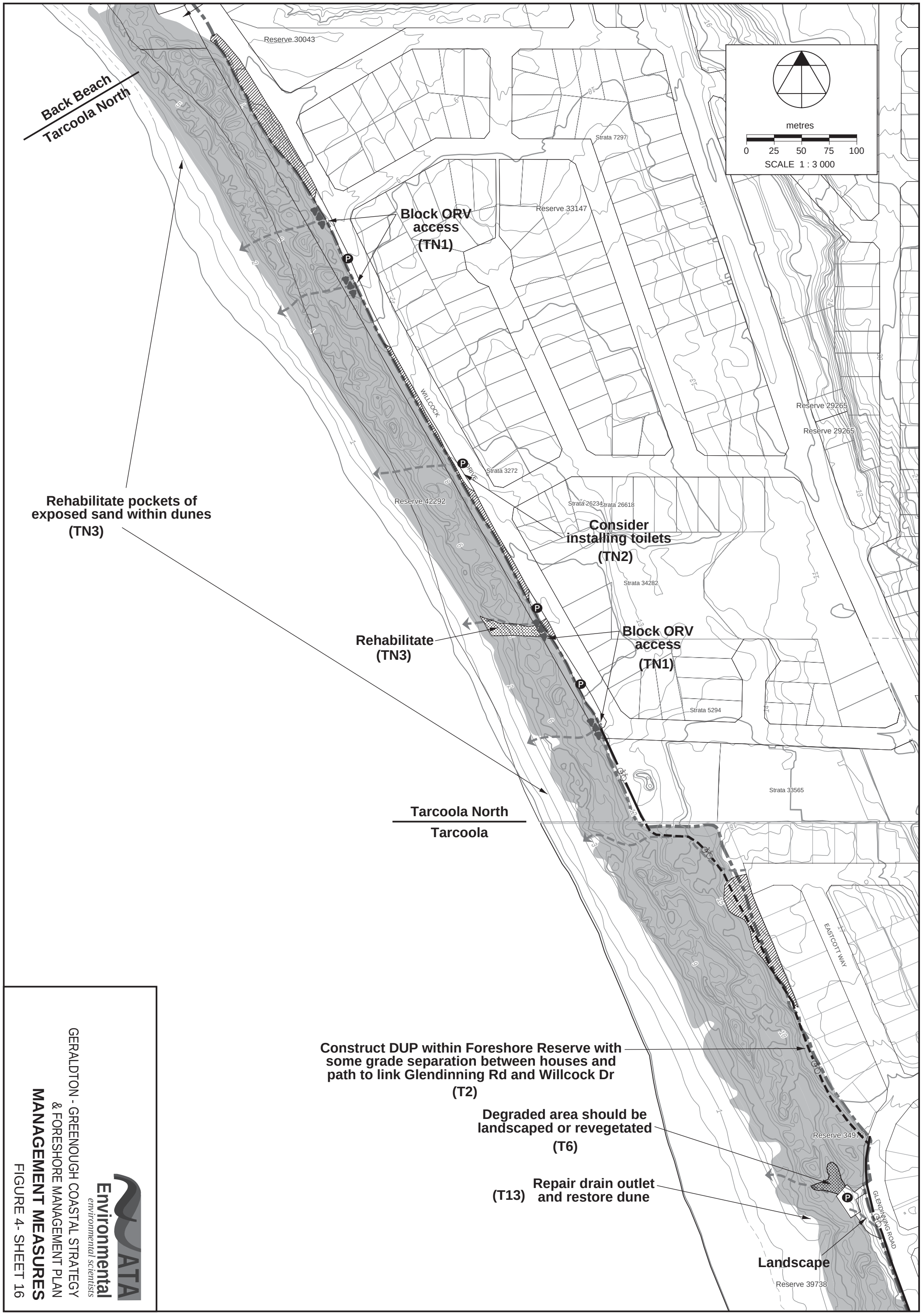

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MANAGEMENT MEASURES

FIGURE 4- SHEET 16

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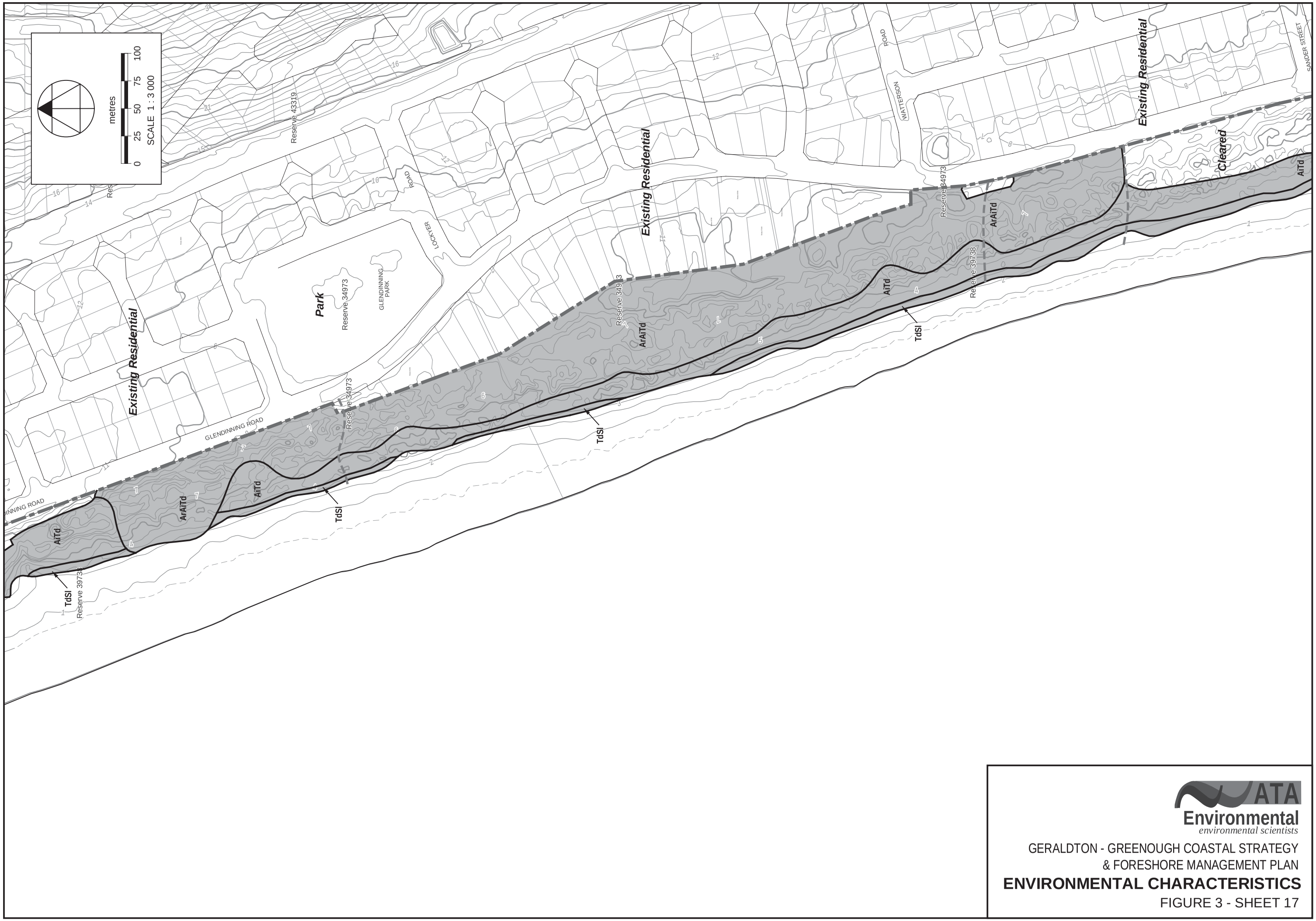

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 17

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metres
0 25 50 75 100
SCALE 1 : 3 000

Reserve 35357
Reserve 43307
Reserve 35488
Reserve 39738

Existing Residential

Cleared

Native Vegetation

sump

ArOaSl
MhAr
AiTd
ArAiTd
TdSl
NbSlTd

SANDER STREET
BUCHANAN PLACE

Tarcoola
Southgate

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& FORESHORE MANAGEMENT PLAN

ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 18

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0 25 50 75 100
metres
SCALE 1 : 3 000

Native Vegetation

blowout

blowout

blowout

ArOaSl

TdSl

Seagrass Wrack

ArOaSc

ArOaSc

ArOaSc

ArOaSc

OaScTd

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ENVIRONMENTAL CHARACTERISTICS

FIGURE 3 - SHEET 19

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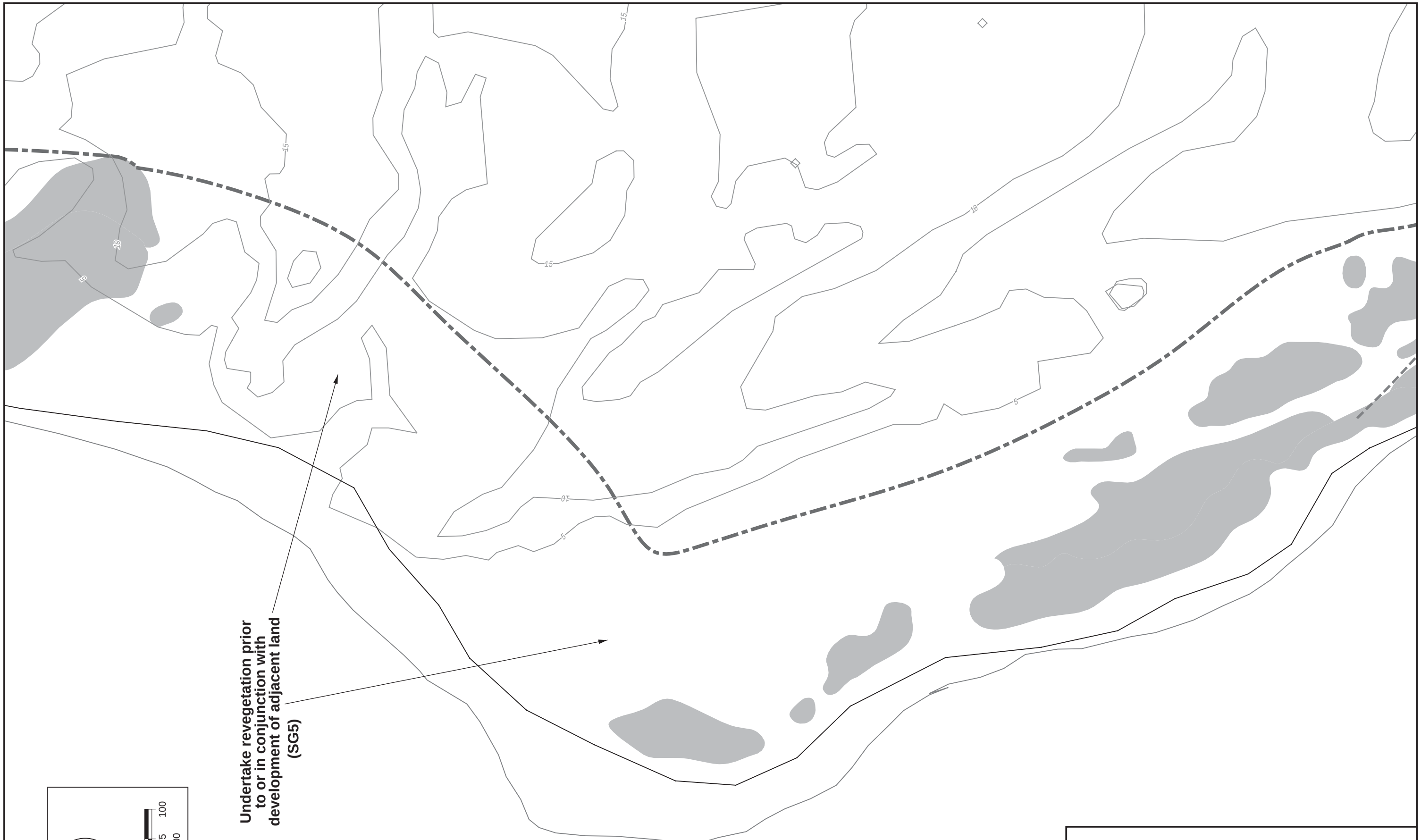

metres
0 25 50 75 100
SCALE 1 : 3 000

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 20

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metres
0 25 50 75 100
SCALE 1 : 3 000

Consider retaining sections of bushland as wildlife linkage (SG4)

Install signage regarding ORV use and impacts (SG2)

Undertake revegetation prior to or in conjunction with development of adjacent land (SG5)

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MANAGEMENT MEASURES

FIGURE 4 - SHEET 21

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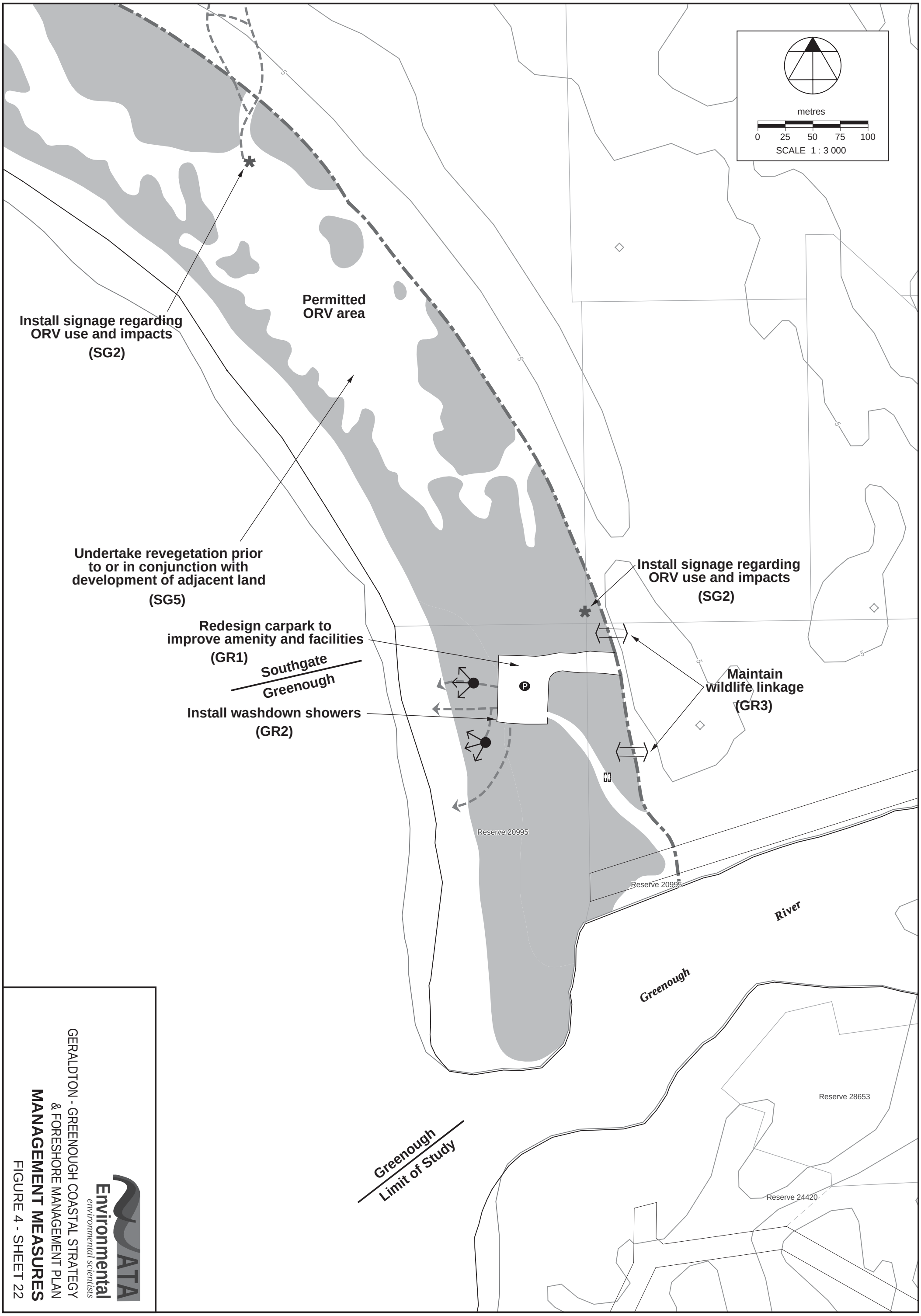

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& FORESHORE MANAGEMENT PLAN

MANAGEMENT MEASURES

FIGURE 4 - SHEET 22

PLATES

PLATE 1 ⇒
Acacia rostellifera/Olearia axillaris Open Heath over *Scaevola crassifolia* Low Open Heath [ArOaSc] at Drummond Point

⇐ PLATE 2
Olearia axillaris Shrubland over *Spinifex longifolius* Grassland [OaSl] at Drummond Point

PLATE 3 ⇒
Atriplex isatidea Open Heath over *Tetragonia decumbens* Low Open Heath [AiTd] at Back Beach

⇐ PLATE 4
Tetragonia decumbens/Spinifex longifolius Low Open Heathland/Grassland [TdSl] at Beresford

PLATE 5 ⇒
Nitraria billardierei/Olearia axillaris/ Myoporum insulare Open Heath over *Spinifex longifolius* Grassland [NbOaMiSl] at Greys

⇐ PLATE 6
Acacia rostellifera/Olearia axillaris Open Heath over *Spinifex longifolius* Grassland [ArOaSl] at Southgate

PLATE 7 ⇒
Melaleuca huegelii/Acacia rostellifera Closed Scrub [MhAr] at Southgate

⇐ PLATE 8
Sporobolus virginicus Grassland [Sv] at Greys

ATA Environmental
environmental scientists

APPENDICES

APPENDIX 1

VEGETATION CONDITION RATING

APPENDIX 1
VEGETATION CONDITION RATING

Vegetation Condition Rating Scale (Government of WA, 2000)
Pristine Pristine or nearly so, no obvious signs of disturbance
Excellent Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species
Very Good Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

APPENDIX 2

LOCAL NATIVE AND INTRODUCED PLANT SPECIES

APPENDIX 2
LOCAL NATIVE AND INTRODUCED PLANT SPECIES

Local Native Species	**Common Name**	**TdSl**	**OaSl**	**Nb**	**OaScTd**	**AiTd**	**AiOaTdS**	**NbOaMi**	**NbSlTd**	**ArOaSl**	**ArOaSc**	**Ar**	**ArAiTd**	**Sv**	**MhAr**	**Co**	**Ac**
Acacia rostellifera	Coast Wattle				□					□	□	□	□		□		
Acanthocarpus preissii	Prickle Lily	□	□							□		□					
Alyxia buxifolia	Sea Box/Dysentry Bush															□	
Angianthus cunninghamii		□															
Atriplex cinerea	Grey Saltbush	□	□	□	□	□	□	□						□		□	□
Atriplex isatidea	Coast Saltbush					□	□						□				
Bolboshoenus caldwellii	Marsh Club-rush																□
Cakile maritima	Sea Rocket	□	□	□													
Calandrinia liniflora											□						
Carpobrotus virescens	Pigface								□		□						
Cassytha sp	Dodder									□							
Casuarina obesa	Swamp Sheoak															□	
Clematis microphylla	Old Man's Beard									□							
Exocarpus sparteus	Broom Ballart									□							
Halosarcia halocnemoides	Shrubby Samphire																□
Isolepis nodosa	Knotted Club-rush													□			□
Juncus kraussii	Sea Rush																□
Logania sp.																	□
Melaleuca huegelii	Chenille Honeypot														□		
Myoporum insulare	Blueberry Tree/Boobiala		□	□		□		□		□	□			□			
Nitraria billardierei	Nitre Bush/Wild Grape			□		□		□	□	□							
Olearia axillaris	Coastal Daisy		□		□	□	□	□	□	□	□						
Rhagodia baccata	Seaberry Saltbush					□				□	□	□					
Santalum acuminatum	Sweet Quandong									□							
Scaevola crassifolia	Thick Leaved Fan Flower		□		□	□					□						
Senecio lautus	Coastal Groundsel										□						
Spinifex longifolius	Long Leaved Spinifex	□	□			□	□	□	□	□	□						
Sporobolus virginicus	Marine Couch													□		□	□
Tetragonia decumbens	Sea Spinach	□	□	□	□	□	□	□	□		□		□				
Threlkeldia diffusa	Wallaby Salt Bush	□	□			□	□					□		□			
Thryptomene sp										□							
Vulpia bromoides		□									□						
Zygophyllum fruticulosum										□							

Introduced Species	Common Name	TdSl	OaSl	Nb	OaScTd	AiTd	AiOaTdS	NbOaMi	NbSlTd	ArOaSl	ArOaSc	Ar	ArAiTd	Sv	MhAr	Co	Ac
Agave americana	Century Plant	□				□				□							
Anagallis arvensis	Pimpernel													□			
Arctotheca calendula	Cape Weed			□		□		□			□						
Avena fatua	Wild Oats	□		□		□		□		□							□
Brassica tournefortii	Wild Turnip									□							
Bromus diandrus	Great Brome	□															
Carpobrotus edulis	Pigface		□														
Cenchrus ciliaris	Buffel Grass									□							
Cynodon dactylon	Couch Grass	□			□	□						□	□				
Echium plantagineum	Paterson's Curse																□
Emex australis	Doublegee											□					
Euphorbia peplus	Petty Spurge																□
Euphorbia terracina	Geraldton Carnation Weed	□								□	□	□					□
Helianthus annuus	Sunflower					□				□							
Hyphochoeris glabra	Flat Weed							□						□			
Lolium perenne	Ryegrass	□															
Lycium ferocissimum	African Boxthorn		□			□	□	□		□	□	□	□			□	
Mesembryanthemum crystallinum	Ice Plant	□				□						□	□				
Oxalis pes-caprae	Soursob										□	□					
Poa annua	Winter Grass	□			□	□				□		□	□			□	
Reichardia tingitana	False Sowthistle						□				□		□				□
Rumex crispus	Curled Dock									□							
Salsola kali	Soft Roly-poly		□			□	□										
Sonchus oleraceus	Sow Thistle	□											□				
Tamarix aphylla	Tamarisk	□			□		□			□							
Trifolium spp	Clover	□						□									

APPENDIX 3

VERTEBRATE FAUNA

APPENDIX 3
VERTEBRATE FAUNA

The following list of vertebrate fauna recorded in coastal areas of the Geraldton-Greenough region is based on the following sources:

Study Area
Observations made during the August 2002 site inspection for this project combined with previous observations made by the project team members within the Geraldton-Greenough coastal foreshore study area.

Chapman River Wildlife Corridor Project
Observations made at the mouth of the Chapman River and immediately adjoining beach and riverine areas.

Source: John Braid, Project Officer, pers. comm., August 2002.

Greenough Coastal Management Plan
Records from the Greenough area outlined in the Draft Greenough Coastal Management Plan.

Source: Clayton, D.M. & Elliott, J.C. (1985) *Draft Coastal Management Plan, Shire of Greenough*. Department of Conservation and Environment. Bulletin 189, May 1985.

Oakajee Industrial Estate

Observations made during an assessment of the Oakajee Industrial Estate located 5-10km north of the Geraldton-Greenough study area.

Source: Dames & Moore (1993) *Flora and Fauna Assessment Oakajee Proposed Industrial Site*. Prepared for LandCorp.

Key:

✓	Recorded within the Geraldton-Greenough coastal foreshore area
*	Previous personal observations of the study team
□	Identified as likely to occur

Geraldton-Greenough Coastal Strategy and Management Plan
Herpetofauna

Scientific Name	Common Name	Study Area	Chapman River Wildlife Corridor Project	Greenough Coastal Management Plan	Oakajee Industrial Estate
AMPHIBIANS					
MYOBATRACHIDAE					
Arenophryne rotunda	Sandhill Frog				
Heleioporus albopunctatus	Spotted Burrowing Frog			✓	
Heleioporus eyeri	Moaning Frog			✓	
Limnodynastes dorsalis	Western Banjo Frog/Pobblebonk				
Neobatrachus sp.				✓	
REPTILES					
GEKKONIDAE					
Diplodactylus alboguttatus	White-spotted Ground Gecko				
Diplodactylus granariensis	Wheatbelt Stone Gecko				
Diplodactylus michaelseni					
Diplodactylus ornatus				✓	
Gehyra variegata	Variegated Dtella			✓	
Heteronotia binoei	Binoe's Prickly Gecko			✓	
Nephrurus levis					
Strophurus spinigerus	South-western Spiny-tailed Gecko			✓	
Phyllurus milii				✓	
PYGOPODIDAE					
Aprasia repens	South-western Sandplain Worm Lizard				
Aprasia smithi					
Delma butleri					
Delma fraseri	Fraser's Legless Lizard				
Delma grayii	Gray's Legless Lizard				
Lialis burtonis	Burton's Legless Lizard			✓	
Pygopus lepidopodus	Common Scaly Foot				
Pygopus nigriceps					
AGAMIDAE					
Amphibolurus maculatus maculatus				✓	
Amphibolurus minor minor				✓	
Ctenophorus inermis					
Ctenophorus maculatus					
Ctenophorus reticulatis					
Lophognathus longirostris				✓	
Moloch horridus					
Pogona minor	Western Bearded Dragon	✓*			
Tympanocryptis adelaidensis	Western Heath Dragon				
Tympanocryptis butleri					
VARANIDAE					
Varanus gouldii	Gould's Monitor				
SCINCIDAE					
Cryptoblepharus carnabyi					
Cryptoblepharus plagiocephalus	Snake-eyed, Fence or Sun Skink				✓
Ctenotus australis				✓	
Ctenotus fallens	West Coast Ctenotus			✓	
Ctenotus pantherinus					✓
Ctenotus schomburgkii					
Cyclodomorphus celatus	Western Slender Bluetongue				

Eremiascincus richardsonii	Broad-banded Sandswimmer				
Egernia kingii				✓	
Lerista connivens					
Lerista distinguenda				✓	
Lerista elegans	West coast Four-toed Lerista				
Lerista humphriesi					
Lerista kendricki					
Lerista lineopunctulata	West Coast Line-spotted Lerista			✓	
Lerista macropisthopus					
Lerista muelleri					
Lerista planiventralis					
Lerista praepedita	Western Worm Lerista				
Menetia greyii	Common Dwarf Skink				
Menetia surda					
Morethia butleri					
Morethia lineoocellata	Western Pale-flecked Morethia			✓	
Morethia obscura	Southern Pale-flecked Morethia				
Tiliqua occipitalis	Western Bluetongue	✓*		✓	
Tiliqua rugosa	Bobtail	✓*		✓	✓
TYPHLOPIDAE					
Ramphotyphlops australis	Southern Blind Snake				
Ramphotyphlops hamatus				✓	
Ramphotyphlops leptosoma					
Ramphotyphlops waitii	Beaked Blind Snake			✓	
BOIDAE					
Antaresia stimsoni	Stimson's Python				
Aspidites ramsayi	Ramsay's Python				
Morelia spilota	Southern Carpet Python				
ELAPIDAE					
Demansia psammophis	Reticulated Whip Snake			✓	
Neelaps bimaculatus	Black-naped Snake				
Pseudechis australis	Mulga Snake				
Pseudonaja nuchalis	Gwardar, Western Brown Snake			✓	
Pseudonaja modesta	Ringed Brown Snake				
Rhinoplocephalus monachus	Monk Snake				
Simoselaps fasciolatus	Narrow-banded Snake				
Simoselaps littoralis	West Coast Banded Snake			✓	
Simoselaps semifasciatus	Southern Half-girdled Snake			✓	

Scientific Name	Common Name	Study Area	Chapman River Wildlife Corridor Project	Greenough Coastal Management Plan	Oakajee Industrial Estate
BIRDS					
CASUARIIDAE					
Dromaius novaehollandiae	Emu				✓
PHASIANIDAE					
Coturnix pectoralis	Stubble Quail				
ANATIDAE					
Cygnus atratus	Black Swan		✓		
Tadorna tadornoides	Australian Shelduck		✓		
Chenonetta jubata	Australian Wood Duck				
Anas superciliosa	Pacific Black Duck	✓	✓		
Anas rhynchotis	Australasian Shoveler				
Anas gracilis	Grey Teal	✓			
Aythya australis	Hardhead		✓		
PODICIPEDIAE					
Tachybaptus novaehollandiae	Australasian Grebe	✓	✓		
Poliocephalus poliocephalus	Hoary-headed Grebe		✓		
ANHINGIDAE					
Anhinga melanogaster	Darter		✓		
PHALACROCORACIDAE					
Phalacrocorax melanoleucos	Little Pied Cormorant				
Phalacrocorax varius	Pied Cormorant	✓	✓		
Phalacrocorax sulcirostris	Little Black Cormorant		✓		
Phalacrocorax carbo	Great Cormorant		✓		
PELECANIDAE					
Pelecanus conspicillatus	Australian Pelican	✓	✓		
ARDEIDAE					
Egretta novaehollandiae	White-faced Heron	✓	✓		✓
Egretta sacra	Eastern Reef Egret	✓			
Ardea pacifica	White-necked Heron		✓		
Ardea alba	Great Egret	✓*	✓		
Ardea cinerea	Grey Heron		✓		
THRESKIORNITHIDAE					
Threskiornis molucca	Australian White Ibis				
Platalea regia	Royal Spoonbill				
ACCIPITRIDAE					
Pandion haliaetus	Osprey	✓	✓		
Elanus axillaris	Black-shouldered Kite	✓*			✓
Lophoictinia isura	Square-tailed Kite				
Haliastur sphenurus	Whistling Kite		✓		
Circus assimilis	Spotted Harrier				
Accipiter fasciatus	Brown Goshawk				

Accipiter cirrhocephalus	Collared Sparrowhawk				
Aquila audax	Wedge-tailed Eagle				
Hieraaetus morphnoides	Little Eagle				
FALCONIDAE					
Falco berigora	Brown Falcon				
Falco longipennis	Australian Hobby		✓		
Falco peregrinus	Peregrine Falcon				
Falco cenchroides	Nankeen Kestrel	✓	✓		✓
RALLIDAE					
Fulica atra	Eurasian Coot	✓	✓		
OTIDIDAE					
Ardeotis australis	Australian Bustard				✓
TURNICIDAE					
Turnix velox	Little Button-quail				
RECURVIROSTRIDAE					
Himantopus himantopus	Black-winged Stilt		✓		
CHARADRIIDAE					
Charadrius ruficapillus	Red-capped Plover	✓			
Elseyornis melanops	Black-fronted Dotterel	✓	✓		
Vanellus tricolor	Banded Lapwing				
LARIDAE					
Larus pacificus	Pacific Gull	✓			
Larus noveahollandiae	Silver Gull	✓	✓		
Sterna caspia	Caspian Tern	✓*			
Sterna bergii	Crested Tern	✓	✓		
Sterna hirundo	Common Tern		✓		
COLUMBIDAE					
Columba livia	Rock Dove	✓			
Streptopelia senegalensis	Laughing Turtle-Dove	✓			✓
Streptopelia chinensis	Spotted Turtle-Dove				
Phaps chalcoptera	Common Bronzewing				✓
	Brush Bronzewing				✓
Ocyphaps lophotes	Crested Pigeon				
CACATUIDAE					
Calyptorhynchus latirostris	Short-billed Black Cockatoo				
Cacatua roseicapilla	Galah				
Cacatua tenuirostris	Long-billed Corella				
Cacatua pastinator	Western Corella				
Cacatua sanguinea	Little Corella				
PSITTACIDAE					
Trichoglossus haematodus	Rainbow Lorikeet				
Glossopsitta porphyrocephala	Purple-crowned Lorikeet				
Polytelis anthopeplus	Regent Parrot				
Platycercus icterotis	Western Rosella				
Barnardius zonarius	Australian Ringneck				✓
Purpureicephalus spurius	Red-capped Parrot				
Neophema elegans	Elegant Parrot				

Neophema petrophila	Rock Parrot				
CUCULIDAE					
Cuculus pallidus	Pallid Cuckoo				
Chrysococcyx osculans	Black-eared Cuckoo				
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo				
STRIGIDAE					
Ninox novaeseelandiae	Southern Boobook				
TYTONIDAE					
Tyto alba	Barn Owl				
PODARGIDAE					
Podargus strigoides	Tawny Frogmouth				
APODIDAE					
Apus pacificus	Fork-tailed Swift				
HALCYONIDAE					
Todiramphus pyrrhopygia	Red-backed Kingfisher				
Todiramphus sanctus	Sacred Kingfisher	✓*			
MEROPIDAE					
Merops ornatus	Rainbow Bee-eater				
MALURIDAE					
Malurus splendens	Splendid Fairy-wren				
Malurus lamberti	Variegated Wren				
Malurus leucopterus	White-winged Wren	✓			✓
PARDALOTIDAE					
Pardalotus striatus	Striated Pardalote				
Sericornis frontalis	White-browed Scrubwren	✓		✓	
Calamanthus fuliginosus	Striated Fieldwren			✓	
Pyrrholaemus brunneus	Redthroat				
Smicrornis brevirostris	Weebill				✓
Gerygone fusca	Western Gerygone				
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	✓			
MELIPHAGIDAE					
Acanthagenys rufogularis	Spiny-cheeked Honeyeater				
Manorina flavigula	Yellow-throated miner				✓
Lichenostomus virescens	Singing Honeyeater	✓	✓		✓
Lichenostomus ornatus	Yellow-plumed Honeyeater				✓
Lichenostomus penicillatus	White-plumed Honeyeater	✓*	✓		✓
Lichmera indistincta	Brown Honeyeater				✓
Phylidonyris nigra	White-cheeked Honeyeater				✓
Phylidonyris melanops	Tawny-crowned Honeyeater				
Certhionyx niger	Black Honeyeater				
Epthianura albifrons	White-fronted Chat				
PETROICIDAE					
Petroica goodenovii	Red-capped Robin				
Melanodryas cucullata	Hooded Robin				
PACHYCEPHALIDAE					
Oreoica gutturalis	Crested Bellbird				

Pachycephala rufiventris	Rufous Whistler				
DICRURIDAE					
Grallina cyanoleuca	Magpie-Lark	✓	✓		✓
Rhipidura fuliginosa	Grey Fantail				
Rhipidura leucophrys	Willie Wagtail	✓	✓		✓
CAMPEPHAGIDAE					
Coracina novaehollandiae	Black-faced Cuckoo-Shrike	✓			✓
Lalage sueurii	White-winged Triller				
ARTAMIDAE					
Artamus personatus	Masked Woodswallow				
Artamus cinereus	Black-faced Woodswallow				✓
Strepera versicolor	Grey Currawong	✓			
CRACTICIDAE					
Cracticus torquatus	Grey Butcherbird	✓			✓
Cracticus nigrogularis	Pied Butcherbird				✓
Gymnorhina tibicen	Australian Magpie				
CORVIDAE					
Corvus coronoides	Australian Raven	✓	✓		
Corvus bennetti	Little Crow				
MOTACILLIDAE					
Anthus novaeseelandiae	Richard's Pipit				
PASSERIDAE					
Taeniopygia guttata	Zebra Finch				
DICAEIDAE					
Dicaeum hirundinaceum	Mistletoebird				✓
HIRUNDINIDAE					
Cheramoeca leucosternus	White-backed swallow				
Hirundo neoxena	Welcome Swallow	✓	✓		
Hirundo nigricans	Tree Martin				✓
Hirundo ariel	Fairy Martin				
SYLVIIDAE					
Cincloramphus cruralis	Brown Songlark				
ZOSTEROPIDAE					
Zosterops lateralis	Silvereye	✓			

Geraldton-Greenough Coastal Strategy and Management Plan
Mammals

Scientific Name	Common Name	Study Area	Chapman River Wildlife Corridor Project	Greenough Coastal Management Plan	Oakajee Industrial Estate
MAMMALS					
TACHYGLOSSIDAE					
Tachyglossus aculeatus	Short-beaked Echidna	✓*		✓	✓
DASYURIDAE					
Sminthopsis crassicaudata	Fat-tailed Dunnart			✓	
Sminthopsis dolichura	Little Long-tailed Dunnart				
Sminthopsis granulipes	White-tailed Dunnart			✠	
Sminthopsis griseoventer				✠	
Sminthopsis hirtipes	Hairy-footed Dunnart				
TARSIPEDIDAE					
Tarsipes rostratus	Honey Possum			✠	
MACROPODIDAE					
Macropus fuliginosus	Western Grey Kangaroo			✓	✓
Macropus irma	Western Brush Wallaby			✠	
Macropus robustus	Euro			✓	
MOLOSSIDAE					
Nyctinomus australis	White-striped Freetail-bat			✠	
VESPERTILIONIDAE					
Nyctophilus geoffroyi	Lesser Long-eared Bat			✠	
Nyctophilus timoriensis	Greater Long-eared Bat				
Chalinolobus gouldii	Gould's Wattled Bat			✠	
Chalinolobus morio	Chocolate Wattled Bat			✠	
Scoptorepens balstoni	Inland Broad-nosed Bat				
Eptesicus pumilus	Little Bat			✠	
MURIDAE					
Notomys mitchelli	Mitchell's Hopping-mouse			✠	
Pseudomys albocinereus	Ash-grey Mouse			✠	
Mus musculus	House Mouse			✓	✓
Rattus rattus	Black Rat			✓	
Rattus fuscipes	Southern Bush Rat			✠	
OTARIIDAE					
Neophoca cinerea	Australian Sea Lion	✓		✠	
CANIDAE					
Vulpes vulpes	Fox			✓	✓
FELIDAE					
Felis catus	Cat			✓	✓
LEPORIDAE					
Oryctolagus cuniculus	Rabbit	✓		✓	✓

APPENDIX 4

STAKEHOLDER CONSULTATION

APPENDIX 4
ORGANISATIONS AND INDIVIDUALS CONTACTED TO OBTAIN INPUT

Title	Name	Position	Organisation
Mr	Shane Hill MLA	Member for Geraldton	
Mr	Peter Mack		
		The Secretary	Active Community Environmentalists
Mr	Murray Criddle MLC		Agricultural Region
Ms	Jenna Brooker	Community Member	Batavia Coast Coastal Planning Group
Mr	Greg Burrows	Community Member	Batavia Coast Coastal Planning Group
Mr	Trevor Beaver		Batavia Coast Dive Club
Mr	Michael Cheah		Central West College of TAFE
Mr	Wayne Collyer	General Manager	Central West College of TAFE
Mr	Terry Brennan		Champion Bay Angling Club
Mr	Steve Cope	Executive Manager Planning and Development	City of Geraldton
Cr	Jean Edwards	Councillor	City of Geraldton
Cr	Rob Jeffries	Chief Executive Officer	City of Geraldton
Cr	Sue Lennard		City of Geraldton
Mr	Phil Melling	Manager Development Services	City of Geraldton
Mrs	Vickie Petersen	The Mayor	City of Geraldton
Cr	Paul Robb	Councillor	City of Geraldton
Mr	Kim Trotter		City of Geraldton
Mr	Tony McCann	Regional Manager, Marine	Department for Planning and Infrastructure
Ms	Vivienne Panizza	Senior Policy Officer - Coastal	Department for Planning and Infrastructure
Ms	Jane Passarelli	Strategic Planning	Department for Planning and Infrastructure
Mr	Stephen Petersen	Regional Planning Services Manager Midwest	Department for Planning and Infrastructure
Mr	John Allen	Regional Manager Northern Agricultural Region	Department of Agriculture
Ms	Nancye Gannaway		Department of Agriculture
Mr	Kelly Gillen	Regional Manager Midwest	Department of Conservation and Land Management
Ms	Sue Hancock		Department of Conservation and Land Management
Mr	Deon Utber	Bushcare Facilitator	Department of Conservation and Land Management
Ms	Renee Hodges	Environmental Officer	Department of Environmental Protection
Mr	Russell Dyson	Regional Manager	Department of Fisheries
Mr	Simon Forrest	Local Area Coordinator - Murchison/Gascoyne	Department of Indigenous Affairs
		The Secretary	Drummond Cove Progress Association
Ms	Victoria Casey		Friends of Bluff Point Foreshore
Ms	Leonie Noble		Friends of the Abrolhos
Mr	Charlie Brooks		Geraldton 4 Wheel Drive Club
Mr	Graham Maunder		Geraldton Angling Club
Mr	Leon Norris		Geraldton Boardriders (Inc)
			Geraldton Fisherman's Cooperative
Mr	Peter Duplex	Port Engineer	Geraldton Port Authority
Mr	John Durant	General Manager	Geraldton Port Authority
Mr	Robert Mosel		Geraldton Professional Fishermen's Association

Title	Name	Position	Organisation
Ms	Julie Firth	President	Geraldton Regional Herbarium
		The Secretary	Geraldton Surf Lifesaving Club
		The Secretary	Geraldton Windsurfing Club
Mr	Andre Garnaut	Bushcare Support Officer	Greening Australia
Ms	Dianne Hamilton	The Secretary	Greenough LCDC
Ms	Ann Franks		Greenough Rivermouth Progress Association
		The Manager	Landrow Developments
Mr	Tim Langford		Main Roads Western Australia
		The Secretary	Mid West Chamber of Commerce and Industry
Mr	Graeme Baesjou	Director	Mid West Development Commission
Ms	Jackie Healy		Midwest Development Commission
Mr	Mick Aitken		Mission Employment
Mr	Maurice Battilana	Chief Executive Officer	Shire of Chapman Valley
Cr	Anne Bell	Councillor	Shire of Chapman Valley
Mr	Ian Darcy	Principal Planner	Shire of Chapman Valley
Mr	John Braid	Chapman River Wildlife Corridor Project Officer	Shire of Greenough
Mr	Simon Lancaster	Manager Planning & Development	Shire of Greenough
Cr	John Ley	Councillor	Shire of Greenough
Mr	Clarrie Matsen	Councillor	Shire of Greenough
Mr	Bill Perry	Chief Executive Officer	Shire of Greenough
Mr	Tony Turner	Director Planning and Development	Shire of Greenough
Hon	Kim Chance MLC	Minister for Agriculture, Forestry and Fisheries	Shop 10/11 Geraldton Shopping Centre
Mr	Phil Wise		Sunset Beach Coast Care
Mr	Laurie Robinson	Team Leader	Voluntary Fisheries Liaison Officers, Department of Fisheries
Ms	Bronte Grant		Water and Rivers Commission
Mr	Mike Johnson	Ribbons of Blue Coordinator	Water and Rivers Commission
Mr	Ron Shephard	Regional Manager	Water and Rivers Commission / Department of Environmental Protection
Ms	Robyn Westlake		Woorree Wildflower Nursery
Ms	Raina Savage	Legal Officer	Yamatji Land & Sea Council
Mr	Geoff Barrett		
Mr	TG Brady		
Mr	Link Harris		
Mr	Max Jones		
Mr	John Laverack		
Mr	Ian Lovegrove		
Mr & Mrs	Robynne & Phil Richards		
Mr	Derek Smith	Geraldton Fishermen's Cooperative Ltd	

LIST OF STAKEHOLDERS THAT PROVIDED INPUT

Name	Organisation	Comments	Meeting/ Discussion
Ross McKay	-	✓	
John Laverack	-	✓	
Peter & Fran Mack	-	✓	
Ian Lovegrove	-		✓
John Braid	Chapman River Wildlife Corridor Project		✓
Paul Findlater	Department of Agriculture	✓	
Sue Hancock	Department of Conservation & Land Management - Midwest Region		✓
Bronte Grant	Department of Environmental Protection & Water & Rivers Commission	✓	
Laurie Robinson	Department of Fisheries	✓	
Deanne Fitzgerald	Department of Indigenous Affairs	✓	
Jacqueline Ferguson	Drummond Cove Progress Association	✓	
Jenna Brooker	Friends of Bluff Point	✓	✓
Sam	Geraldton Boardriders		✓
Charles Brooks	Geraldton Four Wheel Drive Club	✓	
Steve Clarke	Geraldton Windsurf Club	✓	
Tom Burgess & Frank Hill	Greenough/Cape Burney Progress Association		✓
Graeme Basejou	Mid West Development Commission		✓
Michael Aitkin	Mission Employment	✓	
	Naaguja Native Title Claim Working Group		✓
Murray Criddle MLC	National Party of WA	✓	
Kevin Flynn	Sunset Beach Coast Care	✓	
Eric Suarez	Sunset Beach Coast Care	✓	
Phil Wise	Sunset Beach Coast Care	✓	✓
Greg Burrows	TAFE	✓	✓
Cr Margaret Rowe	Tarcoola Progress Association		✓

APPENDIX 5

CONTROL METHODS FOR SELECTED WEED SPECIES

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CONTROL METHODS FOR SELECTED WEED SPECIES

Weed Species	Rating	Lifeform	Comments	Control Methods		
				Method	Notes	Timing
African Boxthorn (*Lycium ferocissimum*)	High	Perennial	Seeds viable after excreted by birds & animals. Seed germination occurs at any time of the year, and with early root growth being rapid this ensures that the young plants are competitive with other plants.	1,2,3	Eradicate by mechanical means and/or chemical herbicide application. Pull over or upwards using rope/chain and machinery. Cut main branches using a chain saw and apply herbicide to the exposed stump and broken stems and roots. Grazon DS Herbicide. Rate: 500mL/100L of water. Knapsack rate: 50mL/10L of water. Apply when less than 2m tall with good leaf cover and soil moisture. Roundup Herbicide. Knapsack/Handgun Rate: 7-10mL/1L. Low volume Roundup: water (1:29 or 1:19). Lower rate to be used for younger bushes, larger bushes require higher rate. Touchdown Herbicide. Hand spray Rate: 1L/100L. Spray foliage thoroughly. Velpar L Herbicide. Rate: 1mL per spot (bushes up to 1m tall), 4mL per spot (bushes up to 3m tall). Access. Paint stumps and broken roots with 200ml in 10L of diesel. Spray individual bushes and 5m radius with 100ml Grazon + 25ml Pulse in 10L water in late spring. Retreat regrowth and seedlings annually. Replant native species 2 years after last spray.	Plants don't flower until they are at least 2 years old. Flowers October-November.
Annual Winter Grass (*Poa annua*)	Mild; Minor weed	Annual	Widespread. In highly disturbed areas. Produces copious amounts of seed.	MHSW	Most selective grass herbicides do not control it, however, Assure is known to control it at 9L per ha. However, this should only be tried on experimental basis as the high concentration of solvent may damage native plants. Can use	

Weed Species	Rating	Lifeform	Comments	Control Methods		
				Method	Notes	Timing
					Glyphosate where there are no native plants. Should be controlled in nearby lawns, use Kerb/Poakil.	
Buffel Grass (*Cenchrus ciliaris*)	High	Perennial	Dispersal by wind, floods, fire and possibly domestic stock.		No control measures recorded.	Flowers February-October
Cape Weed (*Arctotheca calendula*)	Moderate; Minor weed	Annual	Widespread. Mainly in disturbed areas where extra water/nutrients encourage lush growth. Generally only worth controlling in these areas.	1,2,3,4	Glyphosate/Roundup knapsack 100mL in 15L water or stronger solution on large plants. Lontrel 1 in 100 has been used successfully by Mains Roads Dept. over 1 year old direct seeded woody seedlings and mature bush. Do not use over sensitive plants such as orchids. Seek further advice before using. 300ml/ha Lontrel or 5ml + 25ml wetting agent in 10L water.	Apply Glyphosate when plants are young or budding.
Century Plant (*Agave americana*)	Unrated; Minor weed	Perennial	Spreads from adjacent plantings or rubbish dumping.	1,2	Generally best to pull out eg chain and tractor, or dig out. Wear protective clothing/ goggles as sap irritates skin. Wash sap off straight away. Difficult to control using herbicides. Try spearing centre of the plant with a crowbar and pour in neat Glyphosate.	Apply herbicide when plant is actively growing.
Couch (*Cynodon dactylon*)	Moderate; Major weed	Perennial	Winter wet flats, creek- lines, woodland. Competes with native species. Mainly in highly disturbed areas.	3,4	Fusilade 4L per ha or similar herbicides eg Sertin, Targa. Glyphosate can be used if you can avoid non target species. Several applications may be necessary.	When actively growing - late spring or autumn. Best after fire spraying young growth
Geraldton Carnation Weed (*Euphorbia terracina*)	High; Major weed	Biennial	Mainly in highly disturbed areas. Usually a short lived perennial. Dispersed by fruit bursting open and scattering seeds, water	1,2,3,4	Spray seed 200,10-15mL in 10L water + 0.25% wetter, in early winter.	Flowers August-October

Weed Species	Rating	Lifeform	Comments	Control Methods		
				Method	Notes	Timing
			movement along streams and channels and in mud adhering to animals.			
Ice Plant (*Mesembryanthemum crystallinum*)	Moderate; Minor weed	Biennial	Usually in disturbed sites in beach sand. Only control where there is no danger of wind erosion. Annual or biennial may be difficult to control because of its fleshy leaves/stems. Changes soil pH may limit other species.	MHSW	No specific information for herbicide control. Suggest painting or spot spraying with Glyphosate/Roundup.	
Perennial Rye Grass (*Lolium prenne*)	Low; Minor weed	Perennial	Widespread. Common in disturbed areas. Some of the selective grass herbicides are far better than others in controlling Annual Ryegrass, it may also be the case for this species.	1,2,3,4	No specific information on herbicide control. Suggest Sertin, Targa and similar herbicide at 4L per ha.	Apply before flowering
Pigface or Hottentot Fig (*Carpobrotus edulis*)	Moderate; Nuisance weed	Perennial	Usually in bare or disturbed areas. Competes with native plants.	1	No specific information on control using herbicides. Pull up and destroy. Very difficult to control with herbicides	
Wild Oat (*Avena fatua*)	Moderate	Annual	Widespread. Mainly in highly disturbed areas. Competes with natives. Fire hazard	3,4	Generally easy to control. Grass selective herbicide preferred Use mix of 5ml Targa or Fusilade 212 or 2ml Verdict 520 + 100ml spray oil in 10L of water. Control of all grass species use 100ml Glyphosate in 10L water, spray until just wet whileactively growing.	Spray in winter before flowering. Particular attention in spring when plants produce seed quickly.

Method of Control:
1 Handweeding, pulling, digging
2 Herbicide wipe, stem injection, cut stump
3 Spot spraying
4 Blanket spraying