LAND & WATER CONSERVATION

The City of Newcastle

Hunter Coast and Estuary Management Committee

Umwelt
Environmental Consultants

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Status of the Coastline

1.0 A FRAMEWORK FOR COASTLINE MANAGEMENT

1.1 THE COASTLINE MANAGEMENT PROCESS

In 1988 the NSW Government adopted the Coastline Hazard Policy (refer to Section 1 of the Reference Document for more detailed information into the NSW Coastline Management Framework). The primary objective of the policy is to reduce the impact of coastline hazards on owners of private and public land. The Coastline Management Manual (1990) was released with the Hazard Policy in order to provide local Councils with a better understanding of coastal processes, hazards and coastline management so that balanced, merit based decisions could be reached. The Manual sets down a management system that requires other planning factors, such as social, economic, recreational, aesthetic and ecological issues, be weighed along with coastline hazard considerations and beach amenity requirements, when making decisions regarding coastal development.

The steps involved in formulating a Coastline Management Plan are depicted in **Figure 1.1**. In broad terms they include:

1. Establishing a coastline management committee;

2. Identifying the type, nature and significance of the various coastal processes and hazards that affect the area of interest;

3. Undertaking a Coastline Management Study;

4. Preparing a Coastline Management Plan consisting of the best combination of options for dealing with the various social, economic, aesthetic, recreational, ecological and hazard issues and problems; and

5. Implementation of the Plan.

1.1.1 What is a Newcastle Coastline Management Study

The coastline of Newcastle evolved geologically over the last 250 million years. About 17,000 years ago, the Australian Aborigine inhabited the Newcastle coastline and began to influence the landscape. They utilised the coastline's sandy beaches and dunes, rock platforms and wetlands that existed, for food and shelter. Large middens of pipi shells still exist today on Stockton Bight. With European settlement in Newcastle 200 years ago, the Newcastle coastline began to further evolve around the development of its port. The development of the urban environment and coastal landscape has been artificially shaped by human settlement, resulting in the coastline you see now. Today the coastline still includes beaches, however, they are somewhat altered and have associated hazards. Recreation areas, parks, ocean baths, roads and houses also now occupy the coastline, and integrated management of the Newcastle Coastline into the future is required.

The first step towards integrated management of the Newcastle coastline is to define the type, nature and significance of coastline hazards of relevance to the coastline. This work was undertaken and is documented in the Newcastle Coastline Hazard Definition Study 2000 (WBM, 2000a). A Coastline Management Study is next undertaken to identify options relevant to the environmental planning and management of the Newcastle coastal area. The study is the outcome of the integration of environmental, social, cultural, and economic information about Newcastle's coastline and presents a range of strategic options for integrated and sustainable management of the coastline.

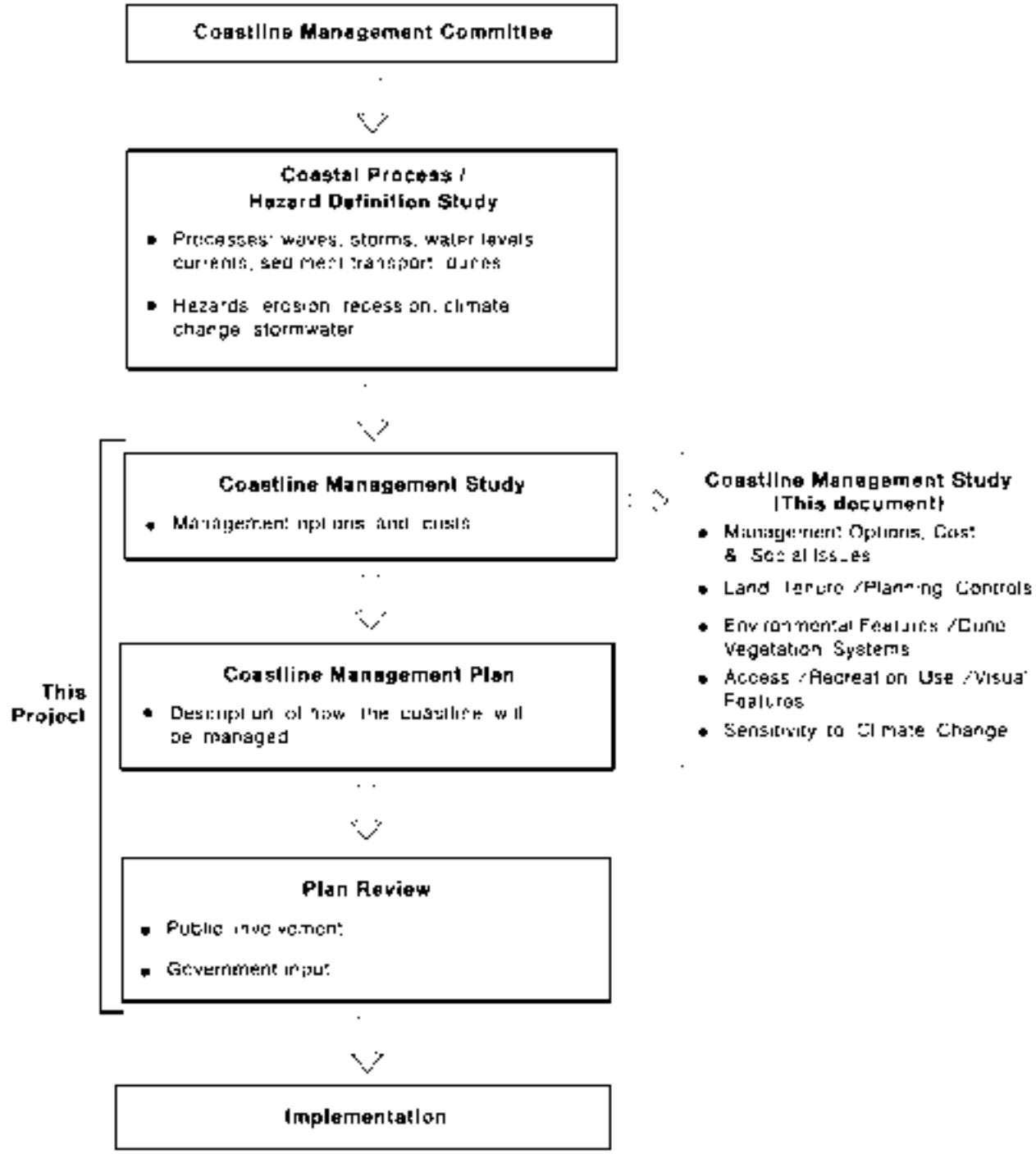

FIGURE 1.1
The Coastline Management Framework

Umwelt (Australia) Pty Limited
Source: (NSW Government, 1990)

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Having identified all issues of relevance to the Newcastle coastline and considered these issues, and then weighed up all management options, the findings of the Coastline Management Study are then formulated into the Coastline Management Plan. The Plan sets out how the coastline will be managed to achieve desired outcomes.

1.1.2 Definition of the Study Area

The Coastline Management Study area is bounded by the southern and northern extremities of the Newcastle Local Government Area (LGA) (refer to **Figure 1.2**). These extremities are Glenrock Lagoon in the south, and the southern boundary of the Rifle Range at Fern Bay in the north.

The seaward and landward extent of the study area is variable and includes both marine and terrestrial areas about the shoreline. This extent includes coastline areas as defined in the Coastline Hazard Policy (within the State Government's Coastline Management Manual) and the Revised NSW Coastal Policy (1997). As well as the coastline, the study area includes a series of small catchments, which drain to the coastline south of the Hunter River. These include the catchments of Glenrock Lagoon, Murdering Gully, and several heavily urbanised stormwater catchments in the Merewether, Bar Beach and inner Newcastle areas.

A key challenge with such a large and diverse study area is to maintain focus on the principal issues for sustainable management of the coastline. To facilitate focus on the key issues, we have introduced the concept of a C*ore Area* and a *Context Area* (or area of influence). These two zones within the overall study area are defined by the following criteria.

The *Core Area* includes the coastal hazard zone, as defined in the Coastline Hazard Definition Study (WBM, 2000a), and adjacent marine and terrestrial areas that are directly associated with the coastline, in terms of physical processes and socio-economic functions. It includes:

- drainage outlets that directly discharge across the beach to the ocean;
- the nearshore (water) zone and its water quality, where most recreation takes place;
- access tracks;
- parking areas;
- coastal amenities and facilities; and
- some residences and commercial activities.

The *Context Area* is a much larger area where activities interact with the management of the core area. For the present study, this includes the small coastal catchments and broader components of the Newcastle urban area. The Management Study and Plan take into account the features and activities of these areas, but address them in less detail than the Core Area.

The Newcastle coastline is illustrated in **Figures 1.3** to **1.5**, with key coastal features highlighted.

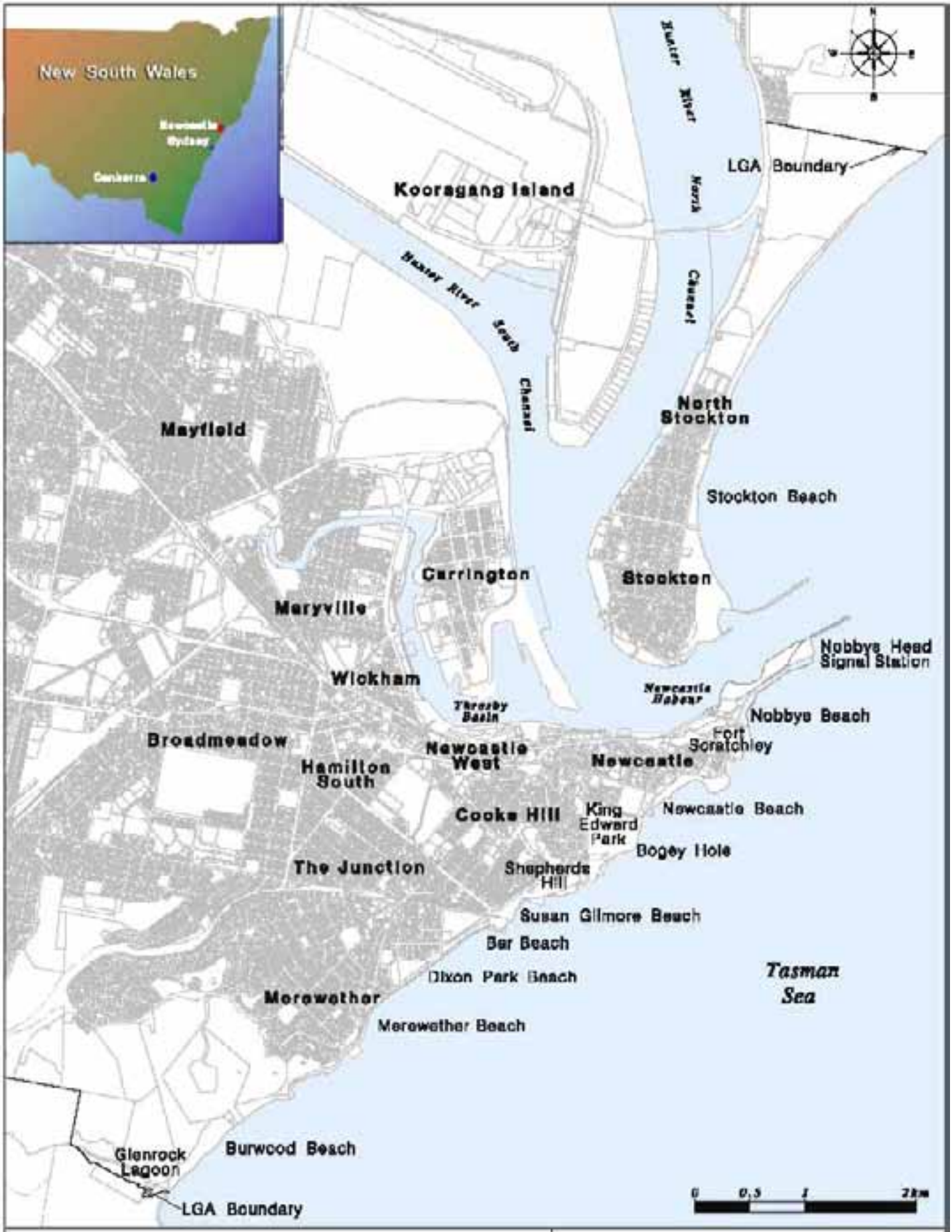

FIGURE 1.2
Locality Plan

Unwelt (Australia) Pty Limited

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0 0.25 0.5 1km

FIGURE 1.3
Stockton Beach Coastal Features

Umwelt (Australia) Pty Limited
Source: Coastal Surveillance Aerial Photo 1999

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0 0 0 1km

Umwelt (Australia) Pty Limited
Source: Coastal Surveillance Aerial Photo 1999

FIGURE 1.4
Nobbys Beach to Strzelecki Lookout Coastal Features

A4 Approx Scale 1:25 000 | Ref No.:R02_V2/1411_118.dgn

0 0.25 0.5 1km

Umwelt (Australia) Pty Limited
Source: Coastal Surveillance Aerial Photo 1999

FIGURE 1.5
Strzelecki Lookout to Glenrock Lagoon Coastal Features

A4 Approx. Scale: 1:20 000 | Ref No.:R02_V2/1411_120.dgn

1.1.2.1 Regional context

The Newcastle coastline has a number of features that distinguish it from other coastlines and from other environments. They combine the physical and ecological processes of the coastline, and the ways in which the local community has interpreted, managed and developed the coastline over time.

The distinguishing features of the Newcastle Coastline include:

- A great diversity of coastal environments, including pocket beaches, a small Intermittently Open and Closed Lagoon or Lake (ICOLL), the mouth of one of the largest river estuaries in NSW, high rocky cliffs, coastal bluffs, and the southern end of the largest coastal sandy barrier in NSW, Stockton Bight. This coastline is representative of the broadest range of coastline hazard and coastal management issues in NSW.

- The southern section of the Stockton Bight. The Stockton Bight coastal sand barrier system is dominated by multiple transgressive dune episodes. The morphology and structure of the coastal dune system that separates the coastline from the estuary of the Hunter River, has high scientific, ecological, and visual significance.

- It was formerly the home of the Awabakal and Worimi Aboriginal people, and remnant evidence of their activities is preserved, as is evidence of early interaction between European settlers and Aboriginal people. Much of the raw material that was used for artefacts found along Stockton Bight came from the cliffs within the Newcastle coastline. The study area has significance in terms of the regional pattern of Aboriginal occupation.

- It is one of the areas of longest European settlement in Australia, and its history includes early convict settlement, pioneering extractive and processing industries, the development of major maritime industries, national defence initiatives, and community recreational activities. These features alone would attribute the area high cultural significance that warrants extensive conservation efforts.

- It is highly valued by the local and regional community for recreational purposes, and has been so for more than 100 years. The Newcastle City beaches are accessible by public transport, making them a particularly important recreational resource for young people who live in suburbs that are remote from the coastline.

- The study area lies within the Greater Metropolitan Region. This area is covered by a range of planning policies that are designed to manage intensive population and development pressures in a broadly coastal environment.

- It lies within the second largest urban area in NSW. The coastline is valued by a regional population that extends well beyond the boundaries of the Newcastle local government area. During community consultation programs, Newcastle residents have identified the city's beaches as its most valuable asset.

- The regional economy of the Hunter has traditionally relied on heavy industry as the main driver of growth and employment. This is no longer the case. The city of Newcastle and regional businesses have worked hard in recent years to promote the natural and cultural values of the city, to overcome the dirty industrial image, and to foster new economic activity that builds on the aesthetic, recreational, heritage and natural values of the coastline. This planning context of recasting the regional image is highly significant in NSW.

1.1.3 Who is Involved: The Coastline Management Committee and other Key Stakeholders

1.1.3.1 Hunter Coast and Estuary Management Committee

In 1996 Newcastle City Council (NCC) convened the Hunter Coastal Management Committee to provide an effective framework on which to base investigations into the processes causing beach erosion at Stockton. The Committee initiated the Stockton Coastline Hazard Definition Study in 1997 as a first phase response to identifying and managing the coastal hazards that place infrastructure at Stockton at risk.

In 1997 the Committee also broadened its focus to include issues within the Hunter River estuary, resulting in the formation of the Hunter Coast and Estuary Management Committee. The Committee has flagged the need to ensure Council's Hunter Coastline Management Program includes the balanced consideration of coastline hazards, social, cultural, economic and environmental issues. The Committee requires the Program to produce a plan that will foster the long term viability of the coastal systems and maintain their values to the community.

NCC has established a vision for the city as being a model sustainable city of the 21st Century. Council sees the Coastline Management Plan and companion Estuary Management Plan as key programs to guide the City's strategic direction into the future.

The preparation of the Coastline Management Plan provides opportunities for Council and the community to create a partnership with the NSW Government to meet the objectives of the NSW Coastal Policy (1997), and provide a sustainable future for the NSW coast.

The preparation of the Coastline Management Study and Plan is supervised by the Committee. The Committee was established to provide broad representation of local and State Government authorities, coastal user groups and community conservation interests in planning for the sustainable use of the Newcastle coastline. The committee comprises the following groups:

- NCC Staff;
- Newcastle City Councillors;
- Regional Recreational Fishing Advisory Council;
- Premier's Department;
- Department of Land and Water Conservation;
- BHP Long Products Division;
- University of Newcastle Geosciences;
- Surf Industry Cluster;
- Commercial Fishermen's Co-operative Ltd;
- Environment Protection Authority;
- Hunter Catchment Management Trust;

- Department of Urban Affairs and Planning;
- Newcastle Port Corporation;
- Community Representatives;
- Port Stephens Council;
- The Waterways Authority of Newcastle;
- Hunter Water Corporation;
- Environmental Sustainability - Maitland City Council;
- Kooragang Wetlands Rehabilitation Project representative;
- Honeysuckle Development Corporation;
- National Parks and Wildlife Service;
- Newcastle District Anglers Association;
- NSW Fisheries; and
- Port Waratah Coal Services.

1.1.3.2 Community Input

Community input to the development of the Management Plan is fundamental in ensuring that the wide range of community views are taken into consideration and that ownership of actions detailed in the Plan is developed amongst community members.

The wider community had opportunities to attend a public workshops during the Management Study phase, as well as comment on the draft Coastline Management Study and Plan when they are publicly exhibited by NCC. All comments received by the community will be taken into consideration in finalising the Coastline Management Study and Plan.

Community Working Group

A major component in each stage of the consultation is a meeting of the Community Working Group. This group consists of key stakeholders and community groups, Councillors, Council staff and State agency officers (see Reference Document, Section 3, for full list of stakeholders). The group provides a 'sounding board' throughout the iterative Coastline Management Plan development process by identifying and prioritising issues, clarifying linkages, assessing impacts and suggested management options.

In February 2001, the first Community Working Group workshop was conducted. This workshop provided the Working Group with an opportunity to contribute to the development of the Coastline Management Study and Plan early in the planning process. At the workshop, community members were invited to discuss and comment on issues of concern to them, the significance of the coastline, and concepts and themes for the future of the coastline. A second Community Working Group workshop was held in July 2001 during the Management Study compilation, to finalise the issues and management options before the draft Management Study and Plan were put on public exhibition.

A Discussion Paper (see Reference Document, Section 4) was compiled to assist the Community Working Group members to participate in the Coastline Management planning process. The Paper introduced a wide range of issues associated with the Newcastle coastline and commenced the process of linking the Coastline Management Study and Plan with the Coastline Hazard Definition Study.

The outcomes of the workshops and technical studies establish a framework for the development and evaluation of a range of management options to address both strategic and local scale management issues.

A summary of the first Community Working Group workshop and issues raised is provided in **Section 7.3**.

1.1.3.3 Newcastle City Council

A further component of the coastline management process is the exchange of information between Council and Council's consultants compiling the Management Study and Plan. There are numerous sections of Council that have an interest or management responsibilities in the Newcastle coast, therefore, establishing a relationship with Council for the plan making and implementing process is necessary to ensure the development of a meaningful plan that can be realistically implemented.

To assist with this process, Council's consultants have met with Council's officers at an informal workshop to canvass the many issues associated with the Newcastle coastline. Also, during compilation of the Management Study, communication with Council officers has continued.

1.1.4 Objectives of this Project

The primary objective of the Newcastle Coastline Management Plan is to develop an integrated management planning framework that is effective for the Newcastle coastline and to ensure a sustainable balance between long term utilisation and conservation.

This will be achieved by investigating and assessing management options relating to coastline values, issues and hazards and developing strategic actions for the effective management of:

- coastal processes and hazards;
- social, economic, cultural, recreational, ecological, aesthetic and tourism values;
- public access;
- land tenure, use and management;
- human impact on the coast;
- the natural environment; and
- coastal ecology.

In addition, it is an objective to prepare a management plan that is in accordance with the State Government's Coastline Management Manual (NSW Government 1990), and will therefore facilitate local government access to joint funding programs. This manual is currently being revised.

The NSW Coastal Policy 1997 provides guidance about a range of objectives for the implementation of the principles of ESD in the coastal zone.

1.2 STATUTORY AND POLICY CONTEXT

There are numerous plans and policies relevant to planning and management of the Newcastle Coastline. These are discussed, where relevant, throughout the document.

1.2.1 NSW Coastal Policy 1997

The NSW Coastal Policy 1997 does not currently impose statutory obligations on the Newcastle LGA and other urban areas of the Greater Metropolitan Region (GMR). However, the Premier of NSW announced on 26 June 2001 an $11.7 million coastal package, which includes extending the Coastal Policy to include the GMR. As a result, the policy will be reviewed and updated in due course. Nevertheless, the policy provides an important framework within which regional and local policies can be formulated and applied. The policy also applies to the offshore component of the coastal zone for Newcastle, which extends 3 nautical miles seaward from the open coast high water mark.

1.2.2 Ecologically Sustainable Development

NCC has demonstrated a strong commitment to implementing the principles of Ecologically Sustainable Development (ESD) in its decision making and has provided regional leadership in this regard. Council is looking to the Coastline Management Plan as a fundamental part of its sustainable management strategy. This means that Council's objectives for the project extend beyond the generic objectives of the Coastline Management Manual.

The NSW Coastal Policy has, as its central focus, ESD of the NSW coastline. It is based on the following four principles of ESD:

- conservation of biodiversity and ecological integrity;
- inter-generational and social equity;
- the need in decision-making to value fully all the resources of the coastal zone; and
- A risk averse approach to decision-making, especially where location is critical or environmental impacts are uncertain but, potentially, significant (the precautionary principle).

To give expression to this vision for the coastal zone the Government has adopted the following nine goals, which represent a commitment to:

1) Protect, rehabilitate and improve the natural environment.
2) Recognise and accommodate the natural processes.
3) Protect and enhance its aesthetic qualities.
4) Protect and conserve its cultural heritage.
5) Provide for ecologically sustainable development and use of its resources.
6) Provide for ecologically sustainable human settlement.

7) Provide for appropriate public access and use.

8) Provide information for its effective management.

9) Provide for integrated planning and management.

The above goals represent the overriding principles for the implementation of the Newcastle Coastline Management Plan

2.0 THE COASTAL LANDSCAPE

Section 2 briefly describes the development of Newcastle's coastal landscape and describes the features of the landscape that require management into the future.

Newcastle's coastal landscape is the result of its geological formation combined with the history of human activity on the coastline's basic natural environment. Today, the Hunter River separates the Newcastle coastline into two distinct physiographic units:

1. to the north, a low-lying coastal plain bordered by a barrier beach system; and

2. to the south, elevated bedrock cliffs punctuated by pocket beaches.

The barrier beach systems was formed by sea level rise and subsequent onshore movement of sand. In contrast, the bedrock cliffs are the eroded and uplifted remnants of sedimentary layers deposited in the Sydney Basin about 250 million years ago. These rocks, known as the Newcastle Coal Measures, contain commercially valuable coal seams.

2.1 GEOLOGICAL EVOLUTION

2.1.1 Bedrock Cliffs

Newcastle's story begins in the Permian Period of geological time, some 250 million years ago. At this time, Australia was part of the Gondwana supercontinent and the Hunter region was close to the South Pole.

During the Permian, Newcastle's landscape looked very different from the way it looks today. Large rivers flowed southwards across a vast low-lying plain with extensive peat mires. The rivers originated in high, actively rising mountain ranges located north and northeast of Newcastle (Herbert, 1997). Peat-forming plants grew in extensive wetlands covering the plain and from time to time explosive volcanoes located east of the present coastline erupted, spreading volcanic ash over vast areas. Sand, gravel and mud were transported southwards by meandering river channels, infilling lakes and coastal lagoons. All these sediments accumulated in a subsiding area known as the Sydney Basin. Geologists estimate that the 400 metres thick sequence of Newcastle Coal Measures took about 3 million years to accumulate.

Peat mires of the Newcastle Coal Measures came to an end when the climate changed. Temperatures rose and rainfall decreased. Deposition of sediments continued, but without peat mires. Layer upon layer of sediments continued to accumulate, as the land slowly subsided to accommodate the load. Scientific study suggests that up to 4 kilometres of sediment once overlay the coal measures, which compacted sand into sandstone, gravel into conglomerate, mud into shale, volcanic ash into tuff, and peat into coal.

About 95 million years ago during break-up of the Gondwana supercontinent, stretching of the earth's crust caused a split or rift in the continent, roughly parallel to the present coast and forming the edge of the continental shelf as it is today. As the two sides of the rift spread apart, new sea-floor was formed, creating the Tasman Sea. Land on the eastern side of the rift drifted eastwards and subsided beneath the ocean to form a micro-continental submarine rise on which more recent volcanism formed Lord Howe Island.

Rifting caused the land west of the split to rise, so that the sedimentary pile of the Sydney Basin was uplifted. Weathering and erosion then began to strip off layers of rock. Over tens of millions of years, erosion removed many layers of sedimentary cover to eventually expose the rocks of the Newcastle Coal Measures.

Conglomerates and sandstones are more resistant to weathering and erosion than the finer grained shales, tuffs and coal seams. Consequently, hills and ridges are generally capped by conglomerate or sandstone while gentle slopes and valleys are underlain by softer shales, tuffs and coal seams. For example, resistant Merewether Conglomerate caps Shepherds Hill and the Merewether cliffs. This conglomerate also capped Nobbys Head before the top half of Nobbys was blasted off to provide rock for breakwater construction and a flat surface for the lighthouse (Kerr, 2000).

Newcastle's coastal cliffs have been created during thousands of years of marine erosion. Breaking waves pounding repeatedly at coastal hill slopes gradually cut cliffs at sea level. Vertical cracks, known as joints, occur naturally in the rocks and help the rocks to break up. Erosion also occurs along horizontal bedding planes – the original depositional layers in sediments. Over time waves cut a notch at sea level, undercutting the rocks above. Unsupported blocks of rock then collapse, resulting in cliff retreat. Persistent erosion and cliff retreat leads to development of wave-cut rock platforms at sea level. Eventually, the bases of cliffs are protected from wave erosion by wide rock platforms and fallen blocks, which exist today.

Beaches between cliffed headlands south of the Hunter River consist of thin sand deposits overlying bedrock. They occupy re-entrants formed by coastal valleys in elevated topography that is controlled by erosion resistant rocks in the Newcastle Coal Measures.

2.1.2 Coastal Plain

During the last 2 million years, recurring "ice ages" have caused numerous rises and falls in sea level. During ice ages, icecaps expand and glaciers advance, locking up vast amounts of water as ice. This causes sea level to fall by as much as 120 metres. During an interglacial period, when ice caps thaw and glaciers retreat, sea level rises. The alternating of ice ages causes sea level to rise and fall on about a 100,000 year cycle. However, there are small-scale fluctuations within this broad-scale cycle.

When sea level was lower than it is today, the Hunter River and its tributaries carved out a broad valley extending at right angles to the present day coastline. This palaeovalley extended from 35 kilometres inland (Maitland area) to half-way across the continental shelf, some 15 to 20 kilometres from the present coastline (Roy & Crawford 1980, Roy *et al*. 1995) (**Figure 2.1**). The main river channel passed through the centre of Stockton Bight. The valley has since been infilled with sediments deposited by the Hunter River delta. The episodic erosion and infilling of this valley were controlled by rising and falling sea levels.

The last thaw commenced about 17,000 years ago. At that time, sea level was about 120 metres below present sea level and approximately 25 kilometres east of the present shoreline. As sea level rose, wave action reworked the sediment and gradually pushed sand westwards towards the present coastline. At the same time, sediments were being deposited in the old Hunter River valley, gradually filling the valley as sea level rose. Sea level took about 10,000 years to rise to the present level where it has remained, with minor fluctuations, for the past 6,500 years.

At maximum sea level rise (6,500 years ago) sand barriers linked Nobbys Head and Birubi Point, creating an extensive coastal lagoon between the Hunter River and Port Stephens (**Figure 2.1**). Continued deposition by the Hunter River gradually infilled the coastal lagoon leaving Tilligerry Creek and Fullerton Cove as the last remnants of the former lagoon. Wave action in Stockton Bight continued to bring sand onshore, and some sand was blown off the beach to form mobile dunes. The barrier beach and dune system is known as the Outer Barrier (**Figure 2.1**). Another, older sand mass known as the Inner Barrier (or Tomago Sandbeds), formed by a similar process about 120,000 years ago, when sea level was approximately 5 metres higher than it is today.

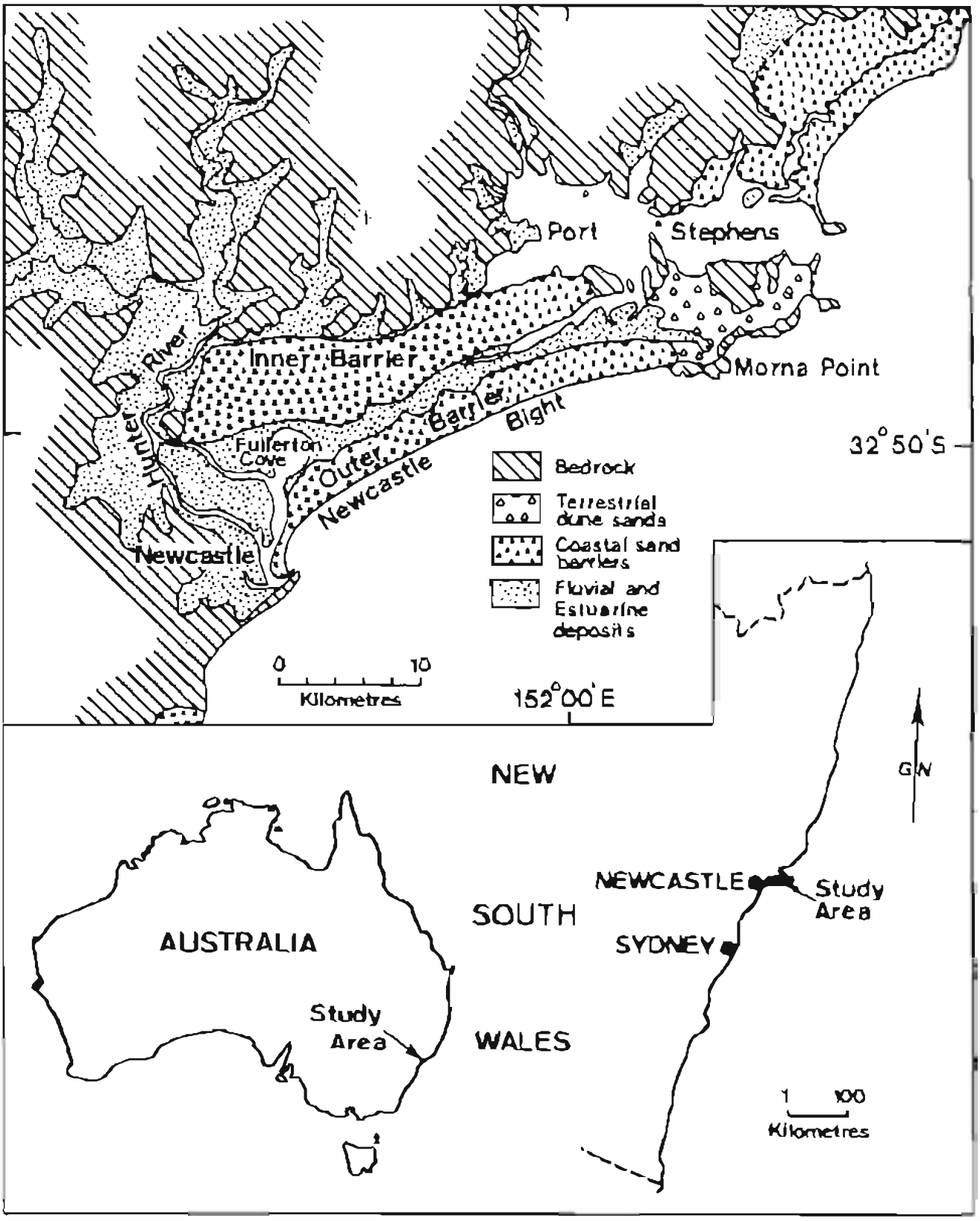

FIGURE 2.1
Locality Plan Depicting the Geological Sedimentary Features of the Newcastle Region

Umwelt (Australia) Pty Limited
Source: Roy & Crawford, 1980

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2.2 ABORIGINAL ARCHAEOLOGY

2.2.1 Occupation

Newcastle encompasses the territories of two 'tribes' – the Awabakal, and the Worimi (Tindale, 1974 in Kuskie & Kamminga 2000:59) (**Figure 2.2**, upper). The Awabakal were arguably the largest clan of a tribe in the Lake Macquarie region but because of Threlkeld's (an early missionary) well known studies in the area, Awabakal became the name which represented the entire tribe. Early government documents indicate this large tribe was composed of a number of clans – the Awabakal (Lake Macquarie and Newcastle region), the Five Islands clan, the Ash Island clan, the Kurungbong clan (Cooranbong), and the Pambalong clan (Swamps district and near Newcastle) (**Figure 2.3**, lower).

Threlkeld recorded many aspects of the lives of Aboriginal people, including ceremonies and spiritual beliefs, important places, implements, and the capture and collection of food:

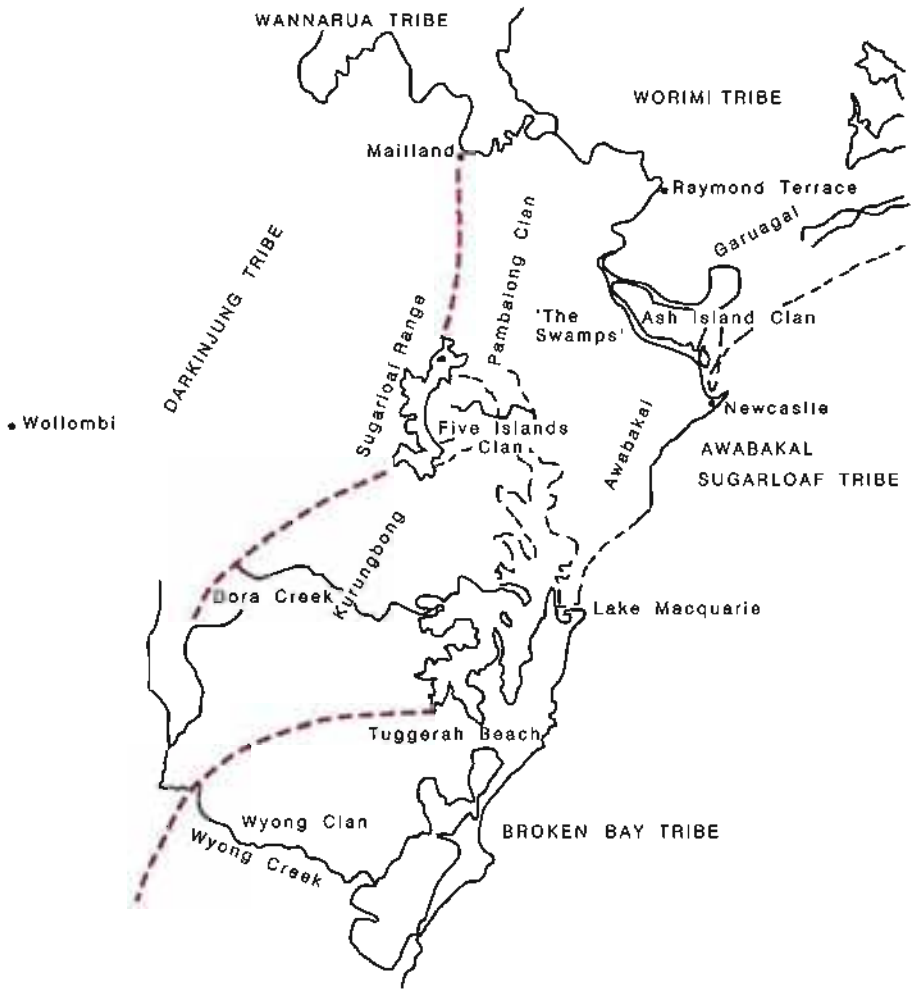
> *There is a sort of sacred place near Newcastle on the sea-beach, beneath a high cliff, named Yi-ran-na-li, where, it is said, that if any person speak, the stones will fall down upon them, from the high arched rocks above, the crumbling state of which is such as to render it extremely probable, that the mere concussion of air from the voice would cause the effect to take place. I was walking beneath the projecting rock and called loudly to McGill, who with other Aborigines, were with me, he instantly beckoned me to be silent, at which I wondered, a few small stones fell down from the crumbling overshadowing cliff at that moment, and they urged me on.* (Threlkeld, Gunson 1974:65)

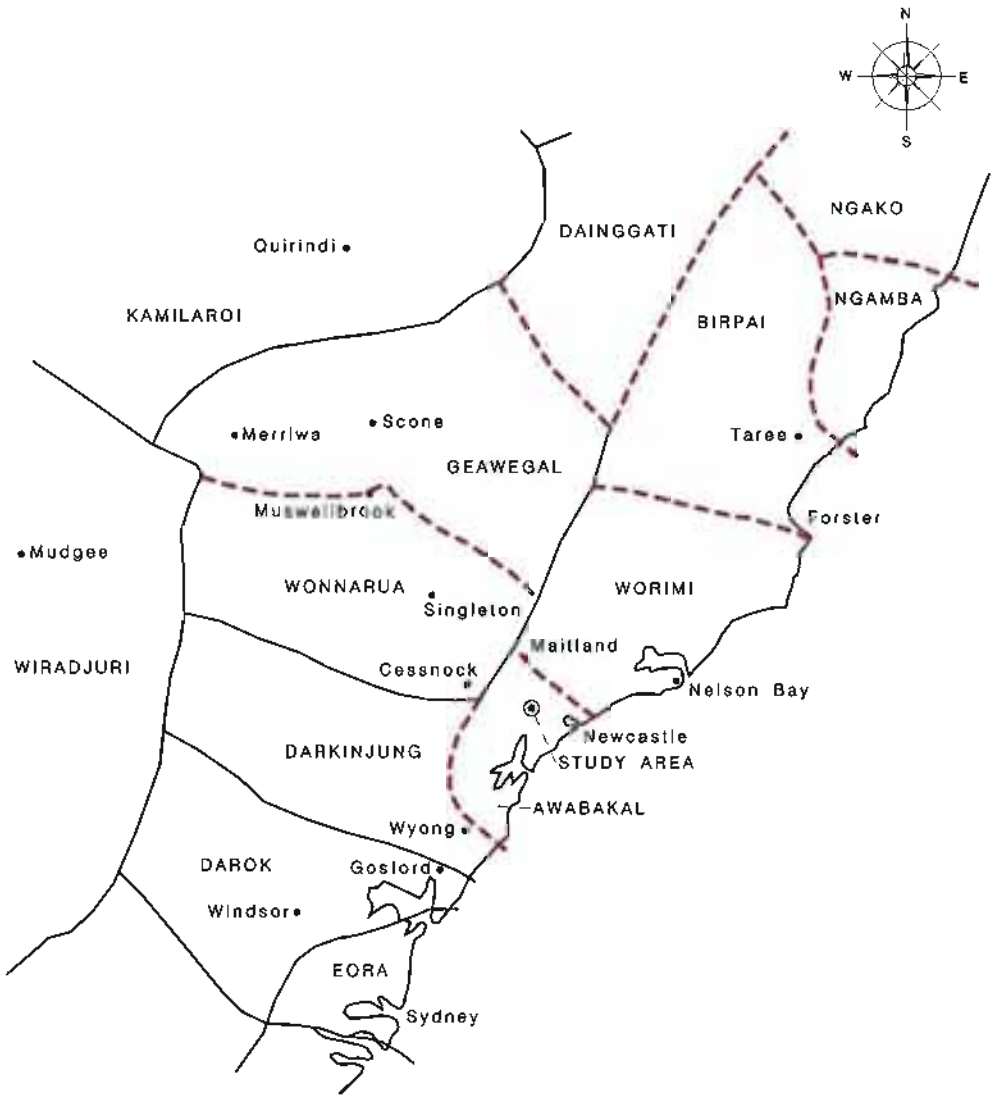
> *Cockles were the every day dish on the lake, not because they are the favourite food, but, because they can be at all seasons, most easily obtained. These are roasted and eaten, squeezing them first in the hand to press out the superfluous liquor contained within them, but they are a tough morsel. The mutton bird, at a certain season is highly esteemed, they are found on Nobbys Island, where you may tread upon their nests, which are in small holes, nearly buried in a snuff-like substance – soil, perhaps guano, covered with a particular sort of seaweed. A Whale, cast on shore, is quite a feast, and messengers are despatched to all the neighbouring tribes, who assemble and feast upon the monster of the deep so long as the treat lasts. Porpoises are never refused.* (Threlkeld, Gunson 1974:55)

Convict artist, Joseph Lycett portrayed his perception of the life of Aboriginal people in the eighteenth century in a number of paintings (see **Plates 1** and **2**). These paintings depict men and women fishing with spears, diving for crayfish, and cooking over fires on the beach. **Plate 1** shows Nobbys Head in the background.

The effect of European settlement was devastating to these groups. Their land was taken and the animal and plant resources in the region diminished. This brought misunderstanding and conflict and the majority of the groups died through either conflict with Europeans or disease.

There is a strong Aboriginal community today who have a great interest in and concern for the management and conservation of Aboriginal cultural heritage sites. These sites reflect and provide a link with their ancestors and a way of life that was destroyed by the arrival of Europeans. The Aboriginal community is represented by the Awabakal Aboriginal Land Council in the southern portion of the study area, and by the Worimi Aboriginal Land Council in the northern portion (north of the Hunter River mouth).





After Gunson 1974

KEY:

Tribal Boundary

Umwelt (Australia) Pty Limited
Source: NPWS

FIGURE 2.2
Cultural Groups Boundaries

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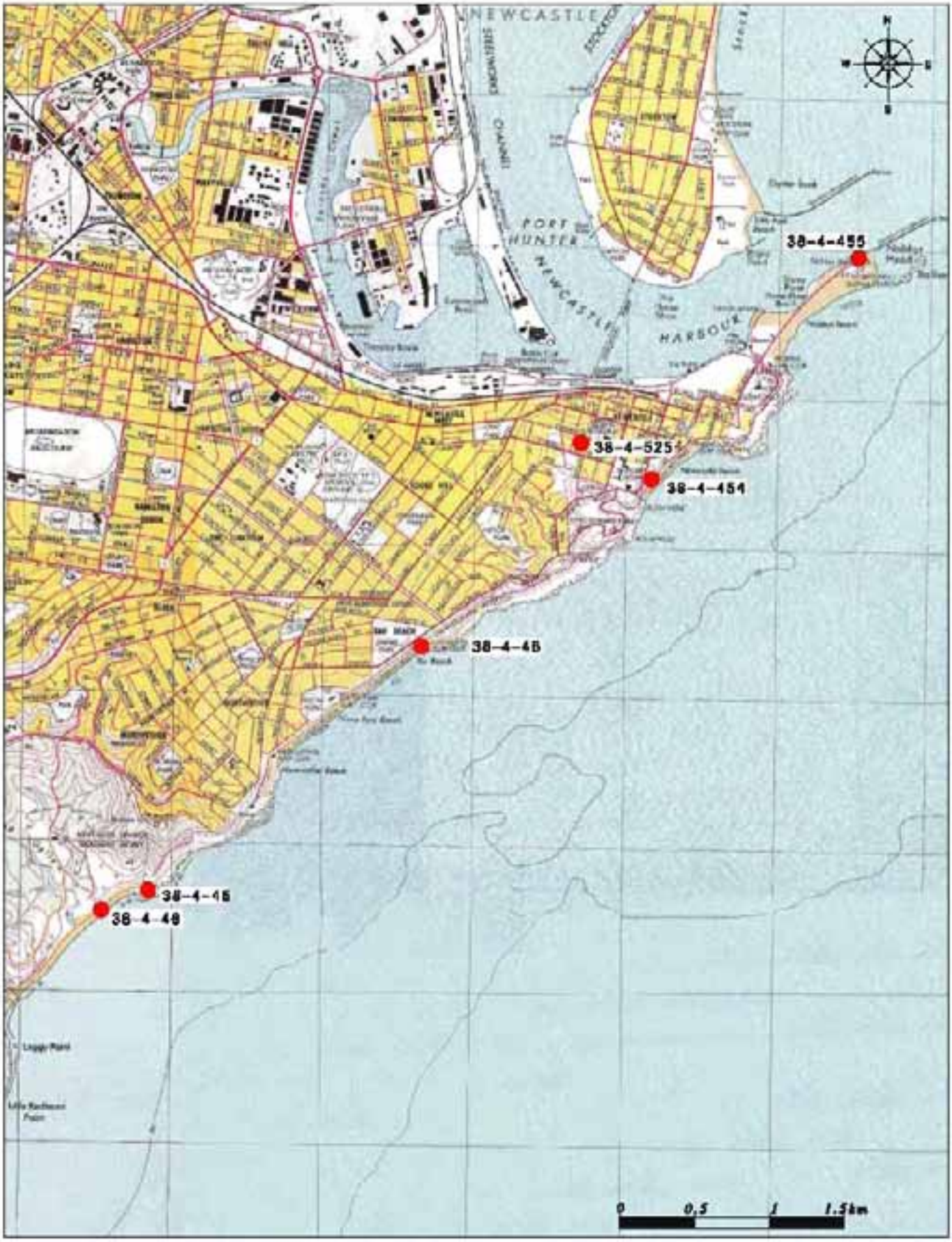


Legend

38-4-48 Previously Recorded Aboriginal Sites

Umwelt (Australia) Pty Limited
Source:Newcastle (9232-2-5) & Wallsend (9232-3-5) Topographic Maps

FIGURE 2.3
Previously Recorded Aboriginal Sites In the Vicinity of the Study Area

A4 Scale: 1:35 000 | Ref No.:R02_V2/1411_100.dgn

PLATE 1
Aborigines resting by camp fire, near the mouth of the Hunter River.
(Source: Turner & Blyton 1995:18, Courtesy of National Library of Australia)

PLATE 2
Aborigines spearing fish.
(Source: Turner & Blyton 1995:18, Courtesy of National Library of Australia)

2.2.2 Material Culture

Professor Len Dyall recorded numerous Aboriginal sites along the Newcastle coastline in the 1960-70s, however, the majority of these appear not to have been formally registered with the NSW National Parks and Wildlife Service but were reported in local journals such as *Hunter Natural History*. The bulk of Dyall's studies were undertaken over thirty years ago, and it is likely that many of the sites inspected have been buried, disturbed or possibly even destroyed by development in the intervening years.

Dyall noted that the majority of Aboriginal sites in the region were located adjacent to the ocean, estuaries, and on the shoreline of Lake Macquarie (Dyall 1971:155). Many of these sites were middens consisting of 'pipi from ocean beaches, turbans, winkles, rock oysters, and whelks from tidal reefs; and oysters, whelks, and cockles from tidal flats' (Dyall 1971:155). Such 'shell heaps' were utilised by early European settlers for lime in the construction of buildings and infrastructure. According to Dyall (1971:155), '(p)rior to the establishment of heavy industry in Newcastle, shell middens extended all the way from Port Waratah to Sandgate along the riverfront', although some of these may have been natural shell deposits.

The sites are also located in the vicinity of other resources such as stone for tool making, and ochre which may have been used for ceremonial purposes, and for rock art. According to Dyall (1971:176) there are sources of chert in the form of small boulders located at Nobbys Head, Merewether, and Glenrock. He noted that evidence of the breaking up and utilisation of such boulders could still be seen and formed 'quarry sites'. Additionally, a 'crumbly red ferruginous sandstone' (a possible source of ochre) was recorded at Murdering Gully, and a yellow ochre source was recorded at Merewether Beach (Dyall 1971:156). Dyall notes that water could probably have been easily obtained by digging in the sand adjacent to swamps and lagoons.

Dyall (1971:156) recorded three sets of axe grinding grooves on Flaggy Creek and its tributaries. These grooves are the result of grinding edges onto axes and occur in sets of twelve or more in this area.

Stone implements recorded by Dyall (1971:158) include edge ground axes (sometimes used as hammers and anvils); geometric microliths and Bondi points; large stone tools 'recognised as chisels, scrapers, gravers, rasps, and spokeshaves needed to make wooden implements (boomerangs, clubs, spearthrowers, shields, food vessels, canoes, paddles, etc).

There are no recorded sites in the Stockton Bight portion of the study area, north of the Hunter River. This narrow peninsula, located between the ocean and the Hunter estuary has been substantially altered by extensive development and natural dune erosion processes. Residential and industrial development and reclamation along the harbour shoreline, are likely to have destroyed, or at least substantially disturbed, the archaeological record in this area.

2.2.3 Aboriginal Sites Recorded in the Study Area

The recorded sites within the study area are outlined in **Table 2.1** and plotted on a topographic map (**Figure 2.3**) to show the location of the sites across the landscape.

Sites include two open camp sites at Murdering Gully near Glenrock Lagoon; an open campsite at Dixon Park, Merewether; Yirannaii and Nobbys, natural mythological sites above Newcastle Beach and Nobbys headland; and an open campsite at the Catholic Education site in Church Street, Newcastle.

Table 2.1 - Aboriginal Sites Recorded within the Study Area

NPWS Site No.	Site name	Site type
38-4-45	Kahibah; Murdering Gully Beach	Open campsite
38-4-46	Kahibah; Murdering Gully Beach	Open campsite
38-4-48	Merewether; Dixon Park	Open campsite
38-4-454	Yirannaii	Natural mythological site
38-4-455	Nobbys	Natural mythological site
38-4-525	Catholic Education site	Open campsite

Source: NPWS Register of Aboriginal Sites

It is clear that the few recorded sites located on the Newcastle coastline are a small remnant of the evidence which is likely to have existed prior to the development which has occurred over the last two hundred years. In the southern portion of the study area, King Edward Park and the area south to Shepherds Hill has a small likelihood of containing archaeological material. In the northern portion of the study area, the area between Corroba Reserve and the Rifle Range is the most likely place to contain such material. The lack of intensive development and ground disturbance in these areas may warrant further investigation. Additionally, the name 'Corroba' Reserve indicates an Aboriginal cultural origin.

2.3 EUROPEAN HISTORY

2.3.1 Overview of Cultural Landscape

The Newcastle coastline is one of the richest and most diverse regional coastlines in the State, retaining uniquely blended evidence of the City's penal, colonial and maritime heritage. Newcastle is and has always been a maritime city since European settlement. A principal reason for its original establishment as a penal settlement was that 'the Coal River' (now Hunter River) was accessible by water but not by land and the initial escape attempts involved piracy, resulting in the naming of Pirate Point. Throughout the penal period, the decades of post-penal recession and the development from the mid-19th Century to its present place as the premier coal-port of the southern hemisphere, Newcastle has been dominated by its proximity to and dependence on the sea and maritime commerce.

Signal Hill's dominance of the harbour entrance made it a natural site for the location of Fort Scratchley, which was constructed to defend the town. Fort Scratchley reflects the long term military presence in the town from foundation. The military establishment was quartered above the coastline in the present Hunter Hospital precinct, where it overlooked the town and was not too far from the Gaols. The first of these was located where the Royal Newcastle Hospital North Wing is now located. This subsequently became the town's first hospital. The second was located on the northern aspect of Signal Hill. The soldier interest in hygienic recreation is reflected by the Bogey Hole and the Soldiers Baths. Fort Scratchley, Shepherds Hill military precinct and, on the north shore, Fort Wallace, are reminders of the military role.

While Newcastle's earliest European residents were mostly prisoners, they were also the first industrial workers, hewing coal, cutting timber and burning lime. Little evidence remains of the latter works, other than the absence of shell middens, which were used as a source of lime. The sites of the earliest tunnel mines have been identified in the coastal cliff-face as has the site of Australia's first shaft mine behind south Newcastle Beach and subsequent shafts above the coast near Ordnance Street. For a short time prisoners also produced salt on

the harbour foreshore and although this site is not identifiable, Blaxland's (later Woolley's) commercial salt plant is identified on early maps south of Flagstaff Hill.

The earliest developments in the town were clustered inside the southern harbour entrance. Flagstaff (later, Signal) Hill, on the mainland at the entrance, was used as a lookout post and to fly the flag for the settlement. In the earliest expression of Newcastle's concern for its maritime visitors a wood-fired beacon was maintained at Flagstaff Hill and navigation lights, the Bull Beacons, near Horseshoe Beach. Nobbys Island, then considerably higher than at present, was the earliest place of solitary confinement, separated from the mainland by a submerged reef over which the current ran, and sea broke. Nobbys and the Big Ben Reef accounted for many ships, the victims of poor navigation or unfortunate sets of wind and sea.

Major Barney's original solution to the difficult entrance conditions was to dynamite the rock that formed Nobbys Island, however his proposal was aborted after loud protests by the local population and wiser heads later replaced the Signal Hill beacon with the present lighthouse on Nobbys. In the meantime, the approach to the harbour was receiving attention. Prisoners commenced the construction of Macquarie Pier in c. 1818, building on the submerged reef. The rock wall eventually reached out to the Big Ben Reef, with rock quarried on Nobbys and at Waratah. A railway was constructed for transport along the breakwater.

Despite the warnings to shipping, Newcastle has a sad history of shipwreck. Research has indicated that 170 losses have occurred along the Newcastle stretch of coastline. These are detailed in the Reference Document. The approach from the north was dogged by the infamous 'Oyster Bank' off Stockton Beach, which was exacerbated by the changed pattern in the flood tide caused by the southern breakwater. The Oyster Bank claimed over two dozen ships in the 19th Century. Nine of these vessels were lost along the southern edge of the Bank in a 10-year period, commencing with the *Colonist* in 1894 and culminating with the *Adolphe* in 1904. Together with 11 mud punts, the wrecks were incorporated into the northern breakwater and commemorated as Shipwreck Walk. The northern breakwater was completed in 1912 with the express purpose of channelling river flow and ebb tide to scour sand from the bar and reduce the need for dredging in the harbour, which began in 1859. It is estimated that after 1859, an average of one million cubic metres of material (sand) per year was dredged from the harbour until 1979, when rock was also cut and dredged from the bottom.

The settlement was separated from the coastline by a belt of constantly drifting sand, which was immortalised early in the settlement's life by being dedicated as a public recreation reserve. Arcadia Park, the Obelisk Reserve, King Edward Park and Fletcher Park are tangible survivors of this reserve. There is now no surface evidence of cottages and workshops associated with the building of the northern breakwater and there is unlikely to be evidence of the transient's Depression settlement called Nobbys Camp.

Three elements dictated the nature of land management in the region: local coal mines and industries, rail corridors and the route of Lake Macquarie Road (the present line of Darby Street then Glebe Road). The nature of the ownership of land was significant in determining the location of development and its timing. Immediately south and west of the original town boundary, the Australian Agricultural Company (AA Company) grant extended south to a line now identified as Glebe Road. South of the AA Company grant, apart from the 35-acre (14.23 hectare) Glebe, the Merewether Estate (formerly Burwood Estate) consolidated the former private land holdings of James Mitchell and AW Scott and extended south to Glenrock Lagoon and to what has become the southern boundary of the City of Newcastle.

Macquarie Pier caused the build-up of sand on its southern face, resulting in the formation of Nobbys Beach. The coastline is marked by a string of beaches from Stockton to Burwood, but Newcastle Beach and the Merewether strip have been particularly concerned with the

love of salt-water bathing for which Newcastle is noted. The beaches also reflect the changes in social attitudes to sea and public bathing, when the southern part of Newcastle Beach was reserved for the ladies and the Gulf at Merewether south was reserved for naked men – the ladies did not venture onto the rock shelf. Picnickers ventured from the Merewether tram terminus to Burwood Beach along the Newcastle Coal and Copper Company's railway, but averted their eyes passing above the Gulf. The early involvement of Newcastle in sea-bathing was matched by an equally early participation in the Surf Lifesaving Movement. The Nobbys, Cooks Hill and Merewether Pavilions and Surf Life Saving Club buildings and the Cooks Hill Memorial appropriately record Newcastle's personal association with the seashore.

The mobile sand encountered by the earliest European settlers also dictated many of the formation processes of the cultural landscape along the coastline. The impact has been noted of the drift from the back of Newcastle Beach, in the dedication of a reserve for public recreation. Similarly the drift from the Merewether Beach precinct was noted on Parish Maps from the mid-19th Century. These drifts were responsible firstly for a reservation from development while still in the hands of the AA Company and the Merewether Estate and then in the resumption of the affected land to enable control measures to be undertaken. Empire Park and Dixon Park are reminders of control reservations. On the other hand, the community value attached to these long stretches of beach was reflected in the reservation of a 100-foot strip along the coastline in 1911, dedicated 1912.

Newcastle East, the CBD and The Hill have all retained substantial elements of their 19th Century historic character, contrasting with the immediate area behind Newcastle beach which is now dominated by tall hospital buildings and residential or motel buildings taking advantage of the attractions of the beachfront location. The extensive areas of reclamation carried out to accommodate the historic port and railway activity has now been developed as sweeping foreshore parklands integrated with early reminders of port activity in the retained warehouses, customs house and railway buildings, to create one of Newcastle's major open space areas which is of regional significance.

Most urban development in Cooks Hill and Merewether had occurred by the 1930s, although there was no continuous street system along the coastline. The growing dominance of travel by motor vehicle saw a continuous through traffic route developed to provide an alternative route to the Pacific Highway from southern suburbs to the Newcastle CBD. Later the Memorial Drive extension of the coastal route provided access to the eastern end of the CBD via Watt Street with a further extension via Shortland Esplanade to Nobbys Beach to complete the traffic system which is now a controlling feature of the coastline.

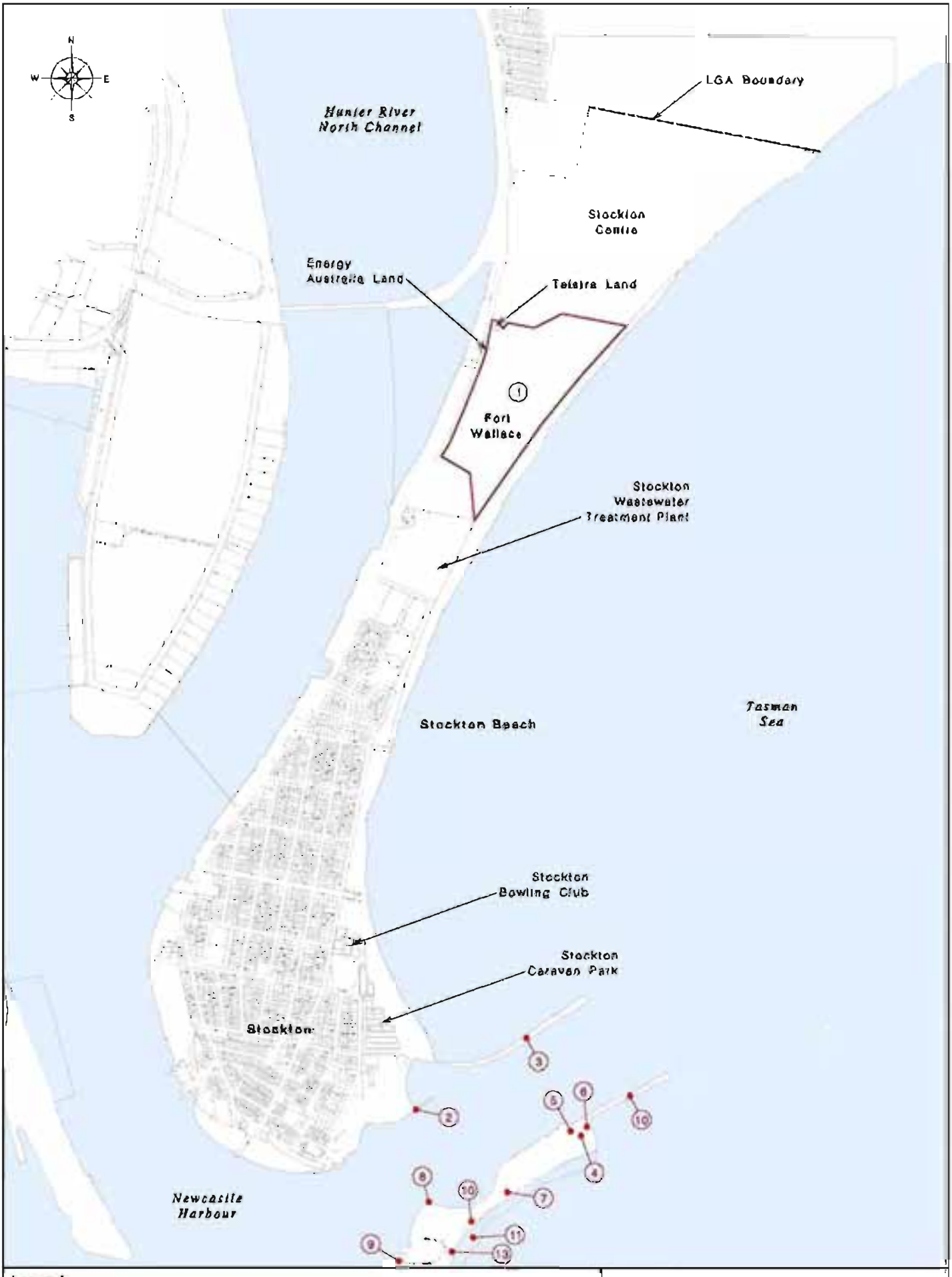
The pattern of development at Stockton is distinctly different from that of Newcastle, partly because of the terrain, and partly because of the substantial Crown land subdivisions. The area appears in a post-publication annotation on the 1893 Town Map as dedicated 23 April 1895, by which time the Government Town had been laid out. Extensive reclamation has created the broad foreshore open space reserves around the outside of the street system. North of Clyde Street, the Crown laid out its subdivisions on a regular rectangular grid oriented north-south and east-west setting well back, between 60 and 120 metres from the back of the beach. Subsequent beach erosion however, has removed much of this reserve north of the surf life saving club and has removed it entirely at the northern part of the historic Crown land subdivision. The later Crown land subdivision north of Flint Street, designed in accordance with garden suburb principles, also presented open space to the beach but a substantial part of this has been lost to beach erosion. Further to the north beach dunes remain although in a degraded condition, with public development for the sewerage treatment works, Fort Wallis and the hospital set well back from the frontal dunes.

To date, 49 land-based European heritage resources have been identified in proximity to the coastline of Newcastle City. These resources are summarised in **Table 2.2** and illustrated in

Figures 2.4 and **2.5**. **Table 2.2** also indicates if the resource is scheduled within the draft LEP 2000 as an Environmental Heritage Item. A detailed description of these items is provided in the Reference Document.

Table 2.2 - Land-based European Heritage Resources

Figure No / Site No	Resource	LEP 2000
2.5/34	Asylum Mine Shaft No 1	✗
2.5/33	Asylum Mine Shaft No 2	✗
2.5/38	Bogie Hole	✔
2.4/8	Bull Beacons	✗
2.5/37	Coal Pit/Shaft	✗
2.5/49	Coke Ovens	✔
2.5/29	Convict Coal Mine Adit	✗
2.5/43	Cooks Hill Lifesaving Memorial	✔
2.5/42	Cooks Hill SLSC	✔
2.4/13	Cottages below Fort Scratchley	✗
2.5/22	Early Cliff Face Coal Mine	✗
2.5/15	Engineering Works, Signal Hill	✗
2.5/18	Fort Scratchley	✔
2.4/1	Fort Wallace	✗
2.5/21	Gaol	✗
2.5/36	Government Mine Shaft	✗
2.5/39	King Edward Park	✔
2.5/31	Ladies Beach	✗
2.4/7	Macquarie Pier	✔
2.4/44	Merewether Beach Precinct (includes Dixon Park/Bar Beaches)	**Part**
2.5/47	Merewether Ocean Baths	✔
2.5/32	Military/Ordnance Precinct	✔
2.5/27	Newcastle Beach	✗
2.5/45	Newcastle Coal and Copper Company Railway	✔
2.5/48	Newcastle Coal and Copper Company Smelter, Coal Mine	✔
2.5/23	Newcastle Ocean Baths	✔
2.4/11	Nobbys Beach	✗
2.4/14	Nobbys Beach Pavilion	✔
2.4/12	Nobbys Camp	✗
2.4/5	Nobbys Head	✗
2.4/4	Nobbys Head	✗
2.4/10	Nobbys Head Railway	✗
2.4/6	Nobbys Head Tunnel	✗
2.5/35	Obelisk Precinct	✔
2.4/2	Pirate Point	✗
2.4/9	Plank Pathway to Signal Hill	✗
2.5/26	Royal Newcastle Hospital	✗



Legend

(8) Heritage Features depicted in table 2.2

FIGURE 2.4
Land Based Heritage Resources

Umwelt (Australia) Pty Limited
Source: Newcastle City Council

0 0.25 0.5 1 km

A3 Scale 1:15 000

Ref No.:R02_V2/1411_138.dgn

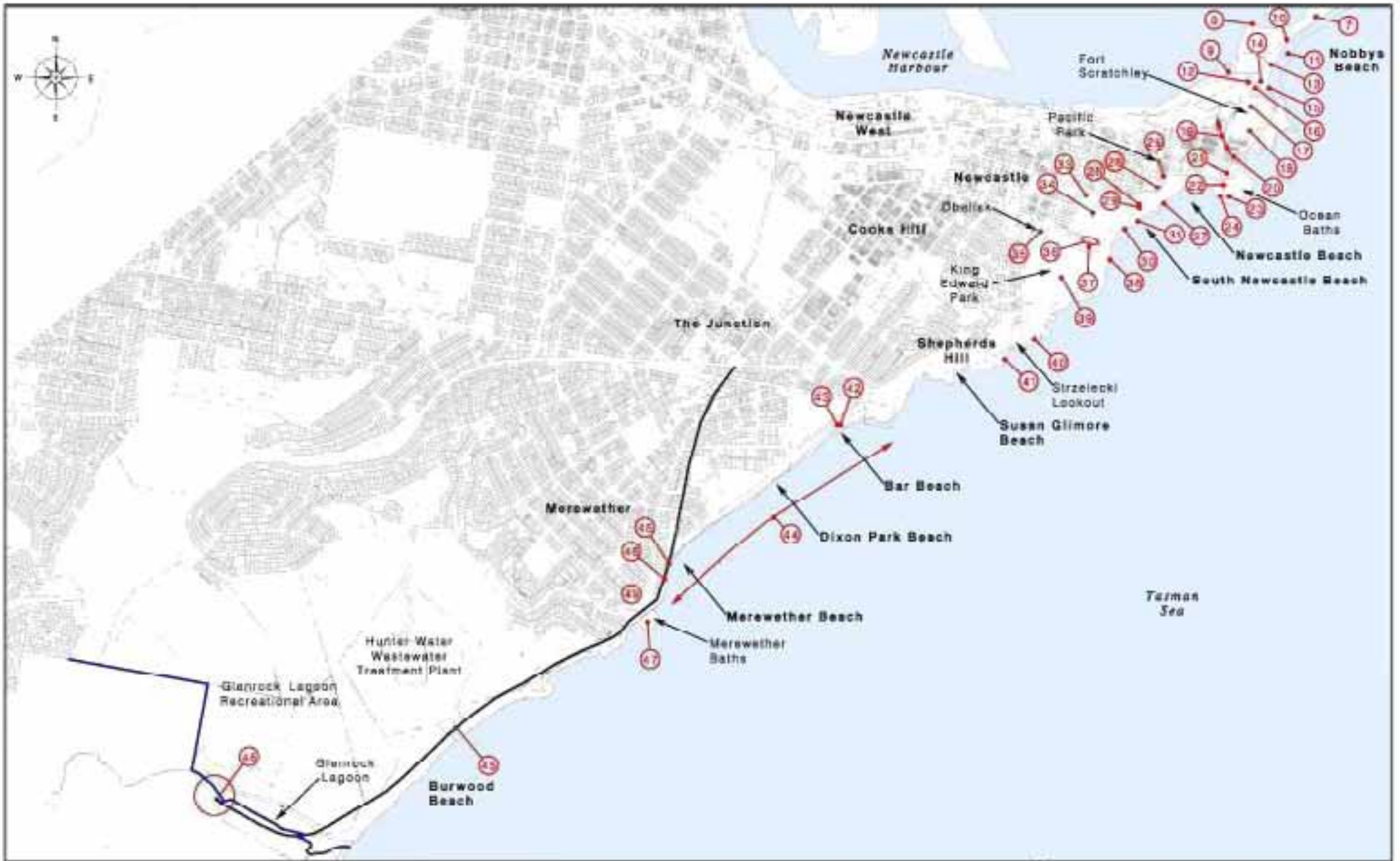

Newcastle Harbour
Fort Scratchley
Nobbys Beach
Newcastle West
Pacific Park
Newcastle
Obelisk
Cooke Hill
Ocean Baths
Newcastle Beach
South Newcastle Beach
King Edward Park
The Junction
Shepherds Hill
Strzelecki Lookout
Susan Gilmore Beach
Bar Beach
Dixon Park Beach
Merewether
Merewether Beach
Merewether Baths
Tasman Sea
Hunter Water Wastewater Treatment Plant
Glenrock Lagoon Recreational Area
Glenrock Lagoon
Burwood Beach
Legend
Heritage Features depicted in table 2.8
Disused Train Route
LGA Boundary
Unwalt (Australia) Pty Limited
Source: Newcastle City Council
0 0.25 0.5 1km
FIGURE 2.5
Land Based Heritage Resources
A3 Scale 1:20 000
Ref No.:R02_V2/1411_139.dgn

Table 2.2 - Land-based European Heritage Resources (cont)

Figure No / Site No	Resource	LEP 2000
2.5/25	Royal Newcastle Hospital, Nth Wing	✔
2.5/20	Salt Works	✘
2.5/40	Shepherds Hill Fortification Precinct	✔
2.5/41	Shepherds Hill Mine Entrance	✘
2.4/3	Shipwreck Walk	**Part**
2.5/28	Shortland Esplanade Building	✘
2.5/17	Signal Hill	✔
2.5/24	Soldiers Baths	✔
2.5/30	South Newcastle Beach Adit	✘
2.5/46	Surf House	✔
2.5/19	The Sandhills	✘
2.5/16	Water Reservoir below Signal Hill	✘

✔ *Scheduled within draft LEP 2000 as an Environmental Heritage Item*

✘ *Not scheduled within draft LEP 2000 as an Environmental Heritage Item*

3.0 COASTAL ECOLOGY

The development of Newcastle's coastal landscape (**Section 2.0**) has both contributed to and constrained the natural environment of Newcastle's coastline. **Section 3.0** outlines the ecological attributes of the coastline that exists today.

3.1 GENERAL COASTAL ECOLOGY

The vegetation of the Newcastle coastline consists of two broad units; coastal and terrestrial vegetation. Coastal vegetation is able to adapt and grow in exposed sites and poor sandy soils. It is important as it acts as a beach stabiliser, a protection barrier for vegetation/structures inland, it provides a habitat for native fauna and has substantial scenic and educational values. Where conditions are more favourable for plant growth, such as where protection is offered by landforms or surrounding coastal vegetation, less hardy terrestrial vegetation including eucalypt and wetland species are able to grow.

The ecological integrity of the Newcastle coastline is greatly reduced due to the increasing pressure on the coastline from urbanisation and the dominance of the introduced species Bitou Bush (*Crysanthemoides monilifera*). Bitou Bush has displaced natural vegetation communities and reduced the terrestrial fauna habitat of the Newcastle coastline. Bitou Bush also, through its growth form, results in modified dune erosion patterns further reducing the potential for native communities to re-establish.

Beach Spinifex (*Spinifex sericeus*) dominates the strandline zone in front of the foredune, in all Newcastle beaches, with American Sea Rocket (*Cakile edentula*) and American Pennywort (*Hydrocotyl bonariensis*) occurring in some areas. The foredune vegetation is dominated almost exclusively by Bitou Bush (*Crysanthemoides monilifera*), with *Acacia sophorae* occurring in regeneration areas at Stockton Beach and the Merewether Beach to Dixon Park stretch. Other species commonly found on the foredune included the sedge *Isolepis nodosa* and Beach Primrose (*Oenothera drummondii*) with the endemic species' *Banksia integrifolia, Casuarina equisitifolia, Leptospermum laevigatum, Westringia fruticosa* and *Lomandra longifolia* occurring in rehabilitated areas at Bar Beach.

Hind dune vegetation was lacking on all of the beaches due primarily to urban development and associated infrastructure. Hind dune vegetation at Stockton Bight included Coastal Tea Tree (*Leptospermum laevigatum*) and Coastal Banksia (*Banksia integrifolia*), with some *Acacia longifolia*.

Themeda australis grasslands were identified at Shepherds Hill (see **Figure 7.8** in **Section 7**), while sheltered areas displayed coastal shrubland associations dominated by *Acacia longifolia, Leptospermum levigatum and Lomandra longifolia*. *Themeda australis* grasslands are also found within the Glenrock State Recreation Area. This grassland community is considered significant as it has not been devastated by Bitou Bush invasion and is considered representative of headland associations existing prior to the introduction of Bitou Bush and other invasive species.

Terrestrial fauna habitat is limited in coastal areas due to the highly degraded nature of dune ecosystems. The coastline does, however, provide habitat for a wide range of coastal birds. Rocky platforms provide habitat for the threatened Sooty Oystercatcher (*Haematopus longirostris*) and the nearshore coastal zone provides foraging habitat for a wide range of fish-eating birds and waders, including threatened species.

The most obvious and well known species inhabiting the sandy beaches are the semi-terrestrial ghost crabs (*Ocypode sp*.) and the bait pipi (*Donax sp*.). There are no known significant sublittoral areas along the coastline.

Intertidal or littoral areas, are the narrow transitional zone between the terrestrial and the marine environments (that is, those areas located between the highest high and lowest low tide marks). Tidal movement, waves and spray, give rise to a gradual transition zone, creating a habitat that is neither fully marine nor fully terrestrial.

An assessment of intertidal species composition and abundance was undertaken as part of this study in order to assess the significance of Newcastle's intertidal areas. Three rock platforms were examined, representing a variety of platform and intertidal community types present along the Newcastle coastline.

The rock platforms assessed included:

Platform at north Susan Gilmore Beach

A relatively short rock platform, extending approximately 25 metres out from the bottom of a steep, unstable cliff/bluff. The platform itself consists of a high flat expanse of rock with no significant rock pools, cracks or crevices. A small boulderfield can be found at the extreme rear of the rock platform, under the adjacent cliffs, however it is located in the spray zone rather than in the area between low and high tide.

Platform at the Cowrie Hole

Nobbys Beach rock platform extends approximately 45 metres out from an artificial seawall. The rocky shore has a sheer drop (0.5-1 metre) into the sea at its seaward extent, causing water to collide with the rocks and rush around the platform, up onto the significantly lower sides and then pool in the low landward portion of the shore. The rock platform consists of shallow rock pools, cracks and crevices, with no boulderfields due to the construction of an artificial retaining wall.

Platform at and adjacent to Merewether Baths

Merewether rock platform extends out from a low cliff/bluff. It is a relatively flat, constant sloping shore extending approximately 40 metres down towards the ocean. The rock platform has some shallow rock pools, cracks and crevices, however lacks significant boulder fields.

Despite the different types of rocky shores encountered the general patterns and distribution of organisms in relation to height on the shore and associated wave energy remained the same across the platforms surveyed. One of the most obvious and abundant organisms inhabiting Newcastle's rocky shores is the Blue Periwinkle (*Nodilittorina unifasciata*). These small blue gastropods were scattered across otherwise bare rocks at the top of all the shores examined.

The mid level of the shores were dominated by gastropods, limpets and barnacles, with wave exposure and habitat diversity controlling the different patterns found from shore to shore. In areas sheltered from wave exposure limpets and gastropods were the most abundant species. The Black Periwinkle (*Neria atramentosa*), Striped Periwinkle (*Austrocochlea porcata*), Tent Periwinkle (*Benbicium nanum*) and limpet (*Cellana tramuserica*) were the most commonly encountered species. The encrusting algal species, *Cryptonemilaes sp*. and *Ralfsia sp*. were generally restricted to surfaces kept moist by pooling water. Rock pools provided optimal habitat for some foliose species, specifically *Codium fragile*, *Enteromorpha intestinalis*, *Hormosira banksii* and *Sargassum sp*.

In areas of higher wave exposure, the community structure changed from being dominated by gastropods to being dominated by barnacles. The Honeycomb Barnacle *Chamaesipho*

tasmanica inhabited areas influenced by wave action, however the volcano-shaped *Tesseropora rosea* dominated areas where the wave-action was stronger, often with *C. tasmanica* located at slightly higher levels on the shore. Dense encrustations of the tubeworm *Galeolaria caespitosa* covered the wave-exposed rocks below the barnacles. In more sheltered areas, the calcareous algae *Corallina officinalis* formed dense beds, dominating the area. Below the tubeworms, mixed amongst the algae, cunjevoi (*Pyura stolonifera*) were found, along with large grazing chitons, *Plaxiphora albida* and *Onithochiton quercinus*.

The low level of species richness and habitat complexity on the rocky shores of the Newcastle coastline do not meet with NSW Fisheries' broader objective of establishing Intertidal Protection Areas (IPAs), which were established in 1993, as a trial, to protect and preserve a sample of all intertidal communities along the NSW coastline.

However in May 2001, NSW Fisheries released a Consultation Paper regarding the selection process for candidate Aquatic Reserves for rocky shores and estuaries (Batemans Shelf and Hawkesbury Shelf bioregions), which includes the Newcastle coastline. Fifteen rocky shores in the above mentioned bioregions have been identified as candidate sites for possible declaration as aquatic reserves. The candidate rocky shore sites identified in the Sydney area are currently IPAs however none of these are located on the Newcastle coastline.

In order for the coastline to benefit from the formation of an Aquatic Reserve, these areas must be rich in diversity and/or capable of acting as reservoirs to repopulate other areas affected by disturbances such as trampling and harvesting. It is not considered that any of the generally homogenous intertidal communities present along the Newcastle coastline warrant the protection afforded by the establishment of an Aquatic Reserve. Further, due to their low habitat complexity, the number of ecological niches available is limited, and therefore species diversity is not likely to greatly increase from the formation of an Aquatic Reserve.

Nonetheless, the local community values these intertidal areas, particularly schools and the university who use the rock platforms for educational purposes.

3.2 ECOLOGICALLY SIGNIFICANT AREAS

Very few areas along the Newcastle coastline are ecologically significant having unique or rare habitat, biodiversity, natural condition or importance as a corridor to other significant areas. The importance of significant areas include:

- a large diversity of habitats within the area. The benefits of a diversity of habitats has been well documented and include the better functioning of the ecosystem;
- the representation of the remaining examples of particular habitats or corridors in the area; and
- the maintenance of the genetic integrity of local flora and fauna populations.

3.2.1 Glenrock State Recreation Area

Glenrock State Recreation Area (SRA), under the management of NSW National Parks and Wildlife Service, comprises the most significant area of remnant vegetation remaining in the NCC area with 500 hectares of the area contained within the City of Newcastle. The SRA is of high conservation significance due not only to its size, but also to the wide range of flora and fauna and threatened species habitat, and also its recreational and education value.

Dry sclerophyll forest associations, especially on the higher slopes and ridges dominate the Glenrock SRA. Headlands and low lying areas behind the dune system are dominated by heath vegetation associations while exposed locations at Merewether Heights contain a closed heath /scrub community which is considered to be unusual (NPWS, 1996). This community contains a mixture of heath, forest and rainforest species. Littoral rainforest communities also exist in the SRA occurring in sheltered gullies.

Two species listed as 'vulnerable' on the *Threatened Species Conservation Act, 1995* are known to occur within Glenrock SRA, *Tetratheca juncea* and the orchid *Diuris praecox* with *Thesium australe* considered likely to occur on the headlands within the reserve. All three species are considered to be inadequately protected within conservation reserves in the region. Several other species found within the SRA are considered to be significant in the local area. These species include the climbing orchid *Galeola cassythoides*; the understorey species *Hakea bakerana*; and the headland species *Rulingea hermannifolia*.

3.2.2 Glenrock Lagoon

Coastal lagoons form where creeks and rivers flowing to the sea are slowed by the flatter terrain of the beach. The water from the creeks and rivers, pools in the flat low-lying area behind the frontal dune. During storm events they break out across the foredune and during calm weather they are restricted again by sand movement inland.

Glenrock Lagoon, with Glenrock SRA, originates from Flaggy Creek and, compared to other lagoons on the coastline, has a substantial catchment size. The majority of the catchment is in reserves. The vegetation of the area is quite significant and includes a transition between closed heath/scrub to open forest with a rainforest understorey just upstream of the lagoon (National Parks & Wildlife Service, 1994). Soft Rush (*Juncus kraussii*) and Feather Grass (*Phragmites australis*) grow within the lagoon, with coastal vegetation grading into open and closed forest surrounding most of the lagoon. Some siltation and pollution, including overflows from sewerage pipes, is present in the lagoon.

3.2.3 Habitat Corridors

Significant flora and fauna habitat corridors are generally lacking along the Newcastle coastline with Glenrock SRA providing the only significant corridor linking Newcastle's coastal vegetation to areas of significant vegetation to the south through Lake Macquarie. A tentative corridor exists in the north of the Newcastle coastal zone with the fragmented coastal vegetation communities of northern Stockton providing a tenuous link to significant habitats in Stockton Bight, especially those proposed to be protected in the recently announced National Park and State Recreation Area.

Few east / west corridors are evident along the coast due to urban development. Tenuous links occur between vegetation communities at Shepherds Hill and degraded remnant vegetation at Nesca Park and from Glenrock SRA to public reserves in Merewether (Myamblah Crescent Reserve and Merewether golf course). Urban development prevents the strengthening of these east/west corridors.

4.0 AMENITY AND COMMUNITY USE

In addition to the development of the cultural landscape, the amenity of the coastline can influence the community's use of the coastline. Similarly, the amenity is influenced by many factors, such as land ownership, visual amenity (aesthetics), planning controls and accessibility. **Section 4.0** describes the current amenity and community usage of the Newcastle coastline.

4.1 LAND OWNERSHIP

The Newcastle coastline is unique in that the vast majority of coastal land is in public ownership (refer to **Figures 4.1** and **4.2**). The beaches are mainly Crown land under the control of the State or NCC, and therefore subject to the administration of the *Crown Lands Act, 1989*, as is all Crown Land.

The beach is Crown Land north of Flint Street (Stockton), with Hunter Water, the Department of Defence and Hunter Area Health owning large areas of adjacent land north to the LGA boundary.

Coastal lands on the southern Stockton peninsula are dominated by Crown Land under the care and control of Newcastle Council which incorporates Stockton Beach and the foreshore area including the Stockton Caravan Park and playing fields.

Newcastle Port Corporation owns and maintains the breakwaters at the entrance to Newcastle Port and Hunter River.. The car park and boat ramp at Horseshoe Beach are owned by the Waterways Authority and leased by NCC.

The section of coast stretching from Nobbys Beach to King Edward Park is almost exclusively Crown Land under the care and control of NCC. Exceptions include Crown Land containing the Obelisk, Newcastle Bowling Club and Nobbys Headland, which are leased by other parties, and the site of Fort Scratchley, which is leased from the Commonwealth Government. Council is currently negotiating with the Commonwealth in order to transfer Fort Scratchley to NCC's care and control (NCC, 2000 (Heritage Plan)).

The central section of the coastline stretching from Shepherds Hill to Merewether Beach incorporates Merewether, Dixon Park and Bar Beaches and the adjacent foreshore and associated parks. The beaches and foreshores are Crown Land or Crown Land under the care and control of NCC. The Shepherds Hill area and some parks such as Dixon Park are classified as Community Land under the ownership of Council with the trig station located at Shepherds Hill, adjacent to Memorial Drive, being Crown Land.

The southern portion of the Newcastle LGA is dominated by Glenrock SRA under the ownership of NPWS. This area also encompasses Burwood Waste Water Treatment Plant which is operated by Hunter Water Corporation.

4.2 LAND USE AND AESTHETICS

Aesthetic quality is a central concern of coastline management. It is an aspect that overlaps all other concerns for the NSW Coastal Policy as it depends largely on the attributes and condition of the natural and cultural environment and on natural processes. It also depends on public access which is adequate to allow enjoyment of the coastline but controlled within the limits of safety and the environmental capacity of the area. The way in which the coastline is used and maintained is also important, in particular the maintenance of clean beaches and clean water.

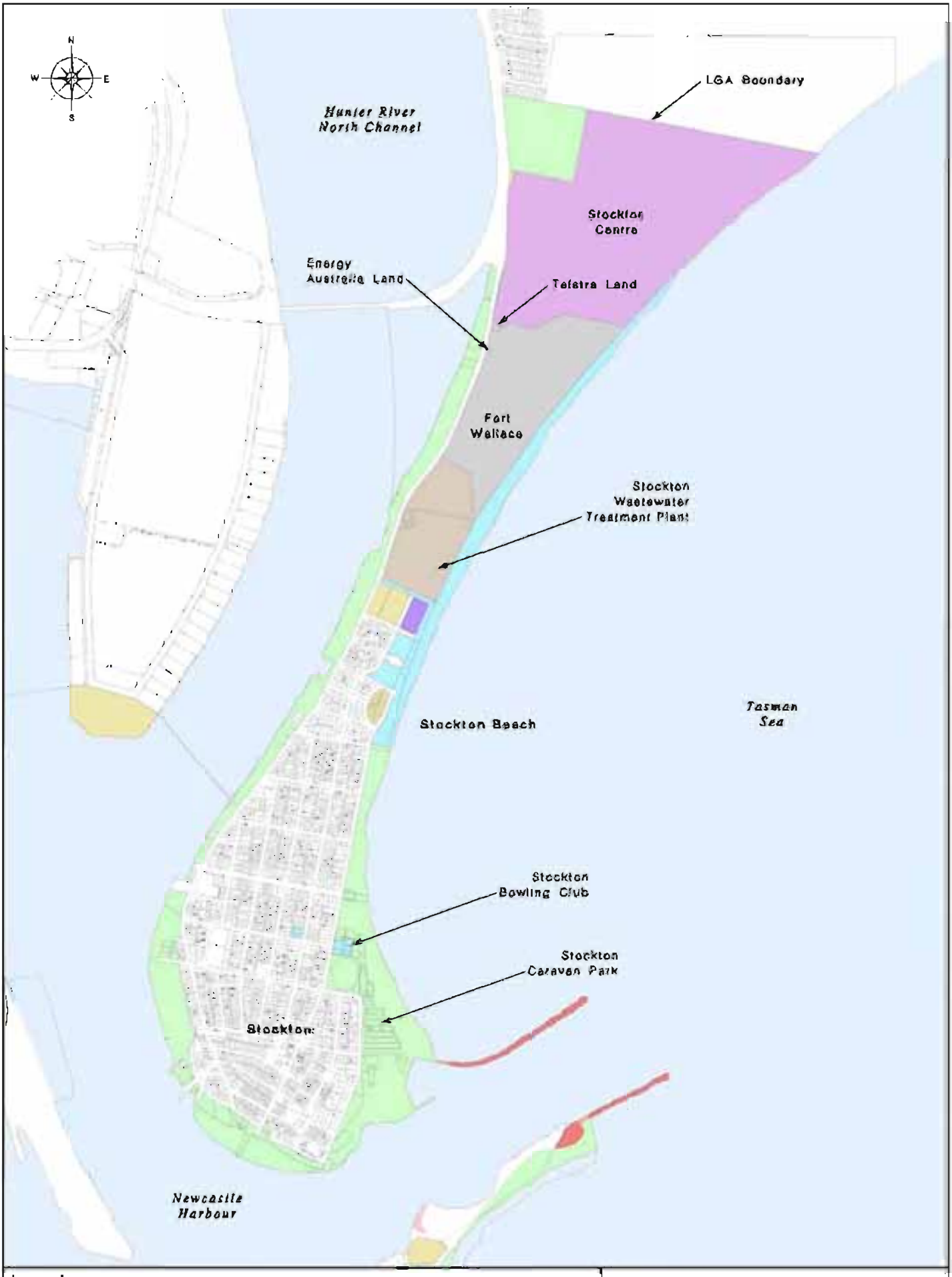


FIGURE 4.1
Land Ownership

A3 Scale 1:15 000

Ref No.:R02_V2/1411_142.dgn


Newcastle Harbour
Nobbys Beach
Newcastle West
Pacific Park
Port Waratah
Newcastle
Obelisk
Newcastle Beach
Ocean Baths
Cooks Hill
South Newcastle Beach
King Edward Park
Newcastle Bowling Club
The Junction
Shepherds Hill
Empire Park
Strzelecki Lookout
Bar Beach Bowling Club
Susan Gilmore Beach
Bar Beach
Dixon Park
Dixon Park Beach
Merewether
Jefferson Park
Merewether Beach
Tasman Sea
Merewether Baths
Hunter Water Wastewater Treatment Plant
Glenrock Lagoon Recreational Area
LGA Boundary
Glenrock Lagoon
Burwood Beach
Legend
Crown Land - Other
Department of Defence
Freehold Land
Hunter Area Health
Hunter Water
NPWS
Hunter Port Corp
NCC Leases
NCC Community Land
NCC Operational Land
NCC Crown Land Management of NCC
0 0.25 0.5 1km
Umwelt (Australia) Pty Limited
Source: Newcastle City Council
FIGURE 4.2
Land Ownership
A3 Scale 1:20 000
Ref No :R02_V2/1411_143.dgn

4.2.1 Aesthetic Attributes of the Newcastle Coastline

The broad impression of the cultural landscape that has developed along the Newcastle coastline is of a varied and attractive landscape, that is distinctively different north and south of the Hunter River mouth.

South of the Hunter, rugged cliffs and bluffs, with extensive rock platforms, and Nobbys breakwater frame the beaches. Urban development has been kept back from the immediate coastline by a continuous recreation reserve system which incorporates seawalls, beach promenades, surf pavilions and kiosks, and associated car parks along the beach front reserves. Ocean baths and amenity buildings have been developed on the rock platforms at Merewether and Newcastle. The Glenrock SRA at the southern boundary of the City secures the only extensive natural area within the LGA, south of the Hunter River.

North of the Hunter River, the broad sandy sweep of the Stockton Bight presents a low-lying landscape that is mainly differentiated by cultural features such as the breakwater, the seawall, the broad reclaimed recreational reserves along the river foreshore and the conspicuous edge defined by Stockton's urban area. Severe beach erosion has had a major aesthetic impact removing much of the usual attraction of the beach and associated reserves. The dunes at North Stockton are severely disturbed but have retained significant areas of hind dune vegetation and represent a major opportunity for rehabilitation to create a significant natural landscape element at the northern boundary of the City.

The surf pavilions are the major 'activity nodes'[1] within the coastline reserves. The pavilions show different design approaches that reflect the period they were constructed. The older pavilions at Nobbys and the former Merewether Surf House pavilion were designed as stylish and valued community buildings recognising the particular conditions of their sites. The more recent pavilions at Merewether, Dixon Park Beach and Stockton are less ambitious, utilitarian designed buildings, perhaps reflecting a reduced concern for the design of community buildings and scarce funding. The new pavilions at Bar Beach and Newcastle exhibit a different approach again. Protected by earlier seawalls and beach promenades, the pavilions are sited on the beach escarpment and have been designed to be inconspicuous from the street and to address the beach only and not to support activity at street level. These pavilions do not include provision for social activities, only for activities relating to beach use.

All of the surf pavilions along the Newcastle coastline were historically sited in foreshore parks. However, only Stockton now displays a good relationship to supporting parkland where landscaped, shady and sheltered picnic areas and a children's playground are a part of an attractive community park in a beach environment. The other Newcastle parks have been compromised by unsympathetically sited car parks and access roads, the sub-arterial road, the lack of a range of facilities and, in most places, the lack of landscaping.

Streets generally bound the coastline reserves. This is aesthetically significant as the view from the reserves is of building frontages rather than backs, and the coastline achieves maximum visual exposure from the public roads and the fronts of dwellings.

The urban edge is mostly formed by residential buildings of one or two storeys, but redevelopment is commonly for larger dwellings and units of three or three and a half storeys.

[1] 'activity nodes' is a term used throughout the document to describe locations along the coastline that regularly attract people and associated activities.

The progressive development of the road system has had a significant impact on the aesthetics of the coastline corridor. The sub-arterial road along Scenic Drive, Memorial Drive and Reserve Street, is an important route for access to the coastline and to the City Centre. However, its presence along the coastline has had adverse impacts on the pedestrian environment.

To describe the Newcastle coastline in more detail, it is necessary to describe it in smaller sections. Attributes of these sections are described in **Sections 4.2.1.1** to **4.2.1.7**.

4.2.1.1 Stockton North (Non-urban)

North Stockton is characterised by its development for public rather than urban purposes. The uses are of low intensity and set behind beach dunes on the ocean side which is screened by or softened by vegetation on the riverside. The remaining dunes are disturbed but have retained some natural vegetation especially on the rear face.

The river foreshore is mangrove lined and the approach to Stockton from the Stockton Bridge at Port Stephens along Fullerton Street is between the river foreshore reserves and the low intensity public uses. This approach provides an attractive entry to the town and an important aesthetic element. Major detractors are the telephone exchange and Fort Wallace, where buildings are visually intrusive and landscaping inadequate to reduce visual impact.

Rehabilitation of the dunes will improve the appearance of the area from the beach and enhancement of the vegetated corridor along Fullerton Street would represent significant aesthetic opportunities for North Stockton.

4.2.1.2 Stockton South (Urban)

The urbanised area of the Stockton Peninsula has a distinctive character arising from the adjacent ocean and Hunter River waterways, its flat topography and extensive reclaimed foreshore reserves. The relative isolation of the town also contributes to its character. The ferry service link with the City Centre is the only ferry service in Newcastle. Rawson Park has developed as the town park around the surf pavilion, Lynn Oval, the Caravan Park, kiosk bowling and tennis clubs, war memorial and Stockton Colliery Disaster memorial and plaque. A strong sense of the community involvement is present in the park, unlike other reserves along the Newcastle coastline which tend to display regional rather than local characteristics. Empire Park at Bar Beach with its bowling and tennis clubs and war memorial shows some similar local character, but the surf club and beach are isolated from the park by Memorial Drive and the park has none of the local "personality" of Rawson Park. The groves of Norfolk Island Pines and other vegetation are important to the character and aesthetic appeal of the park.

Hereford Street, distinguished in the town by its wide central median, is fittingly terminated by the war memorial with its grove of pines. The Caravan Park is the town's most significant tourist facility and an important element in the park. The park is well connected to the town's street system and business centre.

The entire ocean foreshore and most of the river foreshore reserve is addressed by streets rather than back fences.

The northern breakwater is a key aesthetic element and popular for its Shipwreck Walk and fishing. The ocean beach has been severely eroded north of the Caravan Park and protective seawalls have been provided in places. This beach erosion has had a significant impact on the aesthetic appeal of Stockton (see **Plates 3** and **4**).

Plate 3
Mitchell Street seawall at Stockton Beach looking south.
Part of the Newcastle skyline is in the background. *(Source: WBM Oceanics Australia)*

Plate 4
Stockton Beach (1998) looking north from the end of the Mitchell Street seawall past the North Stockton Day Care Centre. *(Source: WBM Oceanics Australia)*

The Ballast Grounds reserves and Griffith Park along the river frontage range from 60 to 200 metres in width and include the swimming pool, ferry wharf, boat ramps, moorings and service facilities, foreshore footpath/cycleway, community buildings, picnic and sports areas. The reserves are mainly mown grass with some landmark groves of fig trees. Norfolk Island Pines mark the original shoreline.

The urban edge is made up mainly of single storey dwellings but there are an increasing number of new and renovated two storey dwellings. Some prominent two-storey hotels and commercial buildings and a large aged person's housing development also front the foreshore reserves.

Perhaps the most significant aesthetic attribute at Stockton is the outstanding views of the ocean, the river, the port, shipping and the Newcastle skyline, which are available from the reserves, the bounding streets and buildings, and also along streets within the urban area.

A major conceptual landscape plan has been prepared for the peninsula - *Land Use and Development Study for Stockton Foreshore*, (Suters Architects Snell, March 1993.) This is a comprehensive study for the whole of Stockton involving community consultation, a detailed description and assessment of the peninsula, a landscape concept plan and recommendations for implementation.

Stockton Beach reserves have largely disappeared through erosion leaving the Caravan Park, surf pavilion, bowling club and associated car park at the edge of the beach and under threat from further erosion. A seawall protects part of Mitchell Street and fronting dwellings (see **Plate 3**). Temporary protection works have also been carried out at the surf club.

Beach erosion is a major concern for Stockton and has greatly reduced the aesthetic appeal of the ocean foreshore, particularly through the exposure of rubbish and fill. Proposals for combating beach erosion have been investigated over a number of years and have been reviewed during this study. A beach nourishment program is being considered. Aesthetically in the context of Stockton, this is likely to be preferable to "hard" engineering approaches such as extension of the seawall. Any works should be integrated with works to improve the pedestrian environment along Mitchell Street, including an extension of the footpath/cycleway.

4.2.1.3 Nobbys Beach

Nobbys Beach has been created by the construction of the southern breakwater (see **Plate 5**). Earlier, the current shoreline was shallow water with rock outcrops. The beach has formed against the breakwater. The Foreshore (the reserve system on the southern side of Newcastle Harbour, extending from Nobbys Beach to the Honeysuckle Development in the west) has been created by reclamation for the port. The area is outstanding for its visual qualities. Nobbys Headland is described in the Heritage Places Plan of Management (POM) as …"one of the most distinctive physical icons of the Lower Hunter and a potent symbol of the history of the Port of Newcastle…".

Fort Scratchley provides the backdrop to the beach. Urban development, including heritage buildings, provides the backdrop to The Foreshore. From the breakwater and Nobbys Head there are outstanding views to the Fort, Newcastle East, the City Centre and the port (see **Plate 6**).

The Nobbys surf pavilion, designed in the Spanish Mission style, is a single storey building at street level set on a flat grassed sand terrace raised above the beach by a seawall. The whole building complex is backed by the ramparts of Fort Scratchley. Designed by architect Frank Scorer in 1934 as a unified group of buildings, and recognised as a heritage item, the pavilion, its ancillary structures and setting, represent an aesthetically pleasing facility. A

Plate 5
Nobbys Beach and Head (1998). The northern breakwall can be seen in the top left and behind that is Stockton Bight. *(Source: WBM Oceanics Australia)*

Plate 6
The end of the southern breakwall looking west, back to Nobbys Beach and the city. *(Source: Newcastle City Council)*

Landscape Masterplan is being implemented for The Foreshore, and this is an attractive area with the landscaping maturing.

Nobbys Beach has an attractive surf pavilion and grassy setting, but car parks and busy roads separate this area from the adjoining parks so that there is no park integrated with the beach to provide, a landscaped picnic area and children's playground. The parking areas also compromise the approach to the popular Macquarie Walk to Nobbys Headland.

4.2.1.4 Newcastle Beach

Newcastle Beach, with its backdrop of tall buildings and predominantly paved surfaces, has a strong urban character unlike other Newcastle beaches (see **Plate 7**). Here the historic character has been largely replaced by a new urban character. This presents an area of intensive urban development and of strong visual character, at the edge of the City Centre, dominated by the tall buildings of the Royal Newcastle Hospital and residential units and motels on the beachfront. As recently as June 2001, another beachfront residential tower (the York) has been approved by Council in front of the Royal Newcastle Hospital's former north wing.

The area is potentially attractive for tourist development and the Hospital site may represent Newcastle's most important opportunity for major tourist developments. The present planning controls accept the loss of the earlier low-rise character and set limits on building heights similar to the existing buildings confirming the new character. The cliffs and taller buildings overshadow the beach and open space.

The re-alignment of Shortland Esplanade and the construction of a pedestrian tunnel between Pacific Park and the surf pavilion has removed the former Shortland Park as a usable area and created an aesthetically unappealing environment, dominated by vehicular traffic and offering only limited activities. There is no active street frontage on the sand or to the water. The pavilion is similar to the Bar Beach pavilion in its design approach addressing only the beach, and not the street or parks The former refreshment shops and hotel which provided a link to Hunter Street have been lost. The design of Shortland Esplanade is unattractive for pedestrians with narrow footpaths little seating and no landscaping, shade or shelter. There are none of the streetside refreshment establishments that might be expected at an urban beach beside a major business centre.

The design of Shortland Esplanade has created a barrier for access to the Ocean Baths and car parking has intruded on the associated picnic area. There is space here for a small park and children's playground. The parking area has not been formalised and is inefficient.

4.2.1.5 Shepherds Hill, King Edward Park

The Shepherds Hill - King Edward Park area (see **Plate 8**) is distinctively different from the beaches to the south, rising 40 metres to 60 metres from rock platforms, cliffs extend around behind Susan Gilmour Beach which has a secluded character as it is set about 30-40 metres below the cliffed shoreline from Shepherds Hill to King Edward Park. The beach has a dramatic setting and high aesthetic quality.

The Newcastle Bowling Club occupies the prominent headland which forms the northern boundary to King Edward Park opposite the James Fletcher Hospital. The building detracts from the appearance of the Park.

Like Empire Park at Bar Beach, King Edward Park extends back as a triangle with its base at the coast and its apex in the urban area. The unusual angled northern boundary of Empire Park and the southern boundary of King Edward Park, mark the boundary of the original AA Company land grant. King Edward Park is distinguished by a deep gully extending inland

Plate 7
Newcastle Beach looking west over CBD and harbour in the background. Note one of Newcastle's many rock platforms in the foreground. *(Source: Newcastle City Council)*

Plate 8
Newcastle Beach looking south to King Edward Park and the Obelisk in top right.
(Source: WBM Oceanics Australia)

from the foreshore. The Park has been designed around the protection offered in the gully where a rotunda, picnic area and formal flower garden have been developed. The reserves extend inland for a maximum distance of about 600 metres including Arcadia Park and the Obelisk, which lie outside King Edward Park and adjoin it at its northwestern corner. The Obelisk provides panoramic views and is a landmark structure visible from much of inner Newcastle and Stockton. The inland boundaries of the reserves are at an elevation of about 60 m AHD. The southern boundary of King Edward Park is formed by the heritage dwellings along The Terrace. The northern boundary is along Ordnance Street backed by residential buildings and by the boundary wall of the James Fletcher Hospital.

Strzelecki Lookout at the northern end of the Shepherds Hill unit, is a significant lookout with an elevation of about 60 m AHD. It provides views to the ocean but also inland to the Hunter River estuary and a large part of the City. There is an unattractive communications building on the reserve. A small group of houses approach the cliff top fronting Cliff Road, and these back onto the reserve. The Shepherds Hill military complex comprising the gunner's cottage, the 1890s disappearing gun emplacement and WWII observation buildings occupy the highest part of the Shepherds Hill landscape unit and form the south eastern boundary to King Edward Park. There are panoramic views from the observation buildings.

The reserve width between the cliff top and Memorial Drive is from about 60-100 metres. A mixture of detached dwelling houses and units along Memorial Drive forms a continuous edge to the coastline corridor. The urban area falls away from the cliffs and the coastline reserve extends inland to link with Nesca Park north of the Fenton Avenue intersection with Memorial Drive.

4.2.1.6 Bar Beach to Merewether Beach

This stretch of beach extends between the headland at the northern end of Bar Beach and the headland south of Merewether Beach (see **Plate 9**). It includes Bar Beach, Dixon Park and Merewether Beach. The beaches are backed by steep escarpments approximately 10 metres in elevation with a minor headland separating Dixon Park from Empire Park. The land rises back from the beach at Merewether and Dixon Park into the residential areas but is flat at Bar Beach. The headland at Merewether has an elevation of about 40 metres at the coastline and the northern headland at Bar Beach has an elevation of 20 metres rising up to about 60 metres at Shepherds Hill which forms the northern boundary to the unit. Residential development extends over the headlands.

Susan Gilmore Beach, protected by its steep access, remains an attractive natural beach.

At Bar Beach (see **Plate 10**), Empire Park has been severed from the beach by the busy Memorial Drive. Car parking and traffic movement dominates the beach area. Empire Park has been developed with an oval, and amenities building, tennis courts and clubhouse, skate rink and bat ball court and the Bar Beach Bowling and Sports Club. The club building addresses Kilgour Avenue and presents its rear service and parking area to the beach. A large car park on the headland north of the beach is conspicuous and unattractive.

At Dixon Park a potentially attractive park has been isolated from the beachfront by car parking and the park has a playground but little landscaping, shade or shelter (see **Plate 11**).

Merewether Baths, Merewether Surf House and the Merewether SLSC (see **Plate 11**) are linked by upper and lower promenade and form a distinctive group identified in Council's Heritage Places POM. Merewether Surf House, designed in the Art Deco style by architects Pitt and Merewether, and constructed in 1936, is regarded as a heritage building of local and regional significance in the POM and LEP. The building has been sited on the steep beach escarpment, the two upper storeys address the street and the lower storey addresses the beach

Plate 9
Susan Gilmore Beach to Merewether looking south. Note Empire Park at the right.

Plate 10
Bar Beach (1998) looking north, to Shepherds Hill

Plate 11
Dixon Park and Merewether Beaches (1998) looking south.
(Source: WBM Oceanics Australia)

Plate 12
Burwood Beach (1998) looking south.
(Source: WBM Oceanics Australia)

from the upper promenade. A traditional shade structure near the old pavilion straddles the lower beach promenade.

The present surf club building at Merewether Beach has a café operating from its kiosk. Fast food is available from a shop some 300 metres from the beach on Ridge Street. The Beaches Hotel, a restaurant and some offices form a small commercial area at the Ridge Street intersection. The intersection has left in/left out only access to the coastline sub-arterial Frederick Street. There are bus stops at the intersection. The major road is difficult to cross and a pedestrian tunnel provides access under Frederick Street between the beach and the residential area and bus stops. The public reserve is steep and is broken up by roads and parking and there is no attractive supporting parkland.

The coastline public reserves corridor is about 100 metres wide at Merewether Beach, narrowing at the northern end where Johns Parade is aligned along the bluff top. The reserve widens to encompass Dixon Park providing an average depth of about 140 metres from the beach escarpment, narrows again at Ocean Street which is aligned along the bluff top and finally widens again to an average width of about 200 metres at Empire Park.

Within the reserves, baths are set in the rock platform at Merewether Beach and there are surf clubs at all three beaches and the former pavilion (Merewether Surf House) remains. These are landmark buildings and form nodes of activity ('activity nodes').

Streets define the coastline corridor with mainly residential buildings facing the reserves. The streets bound the reserves at all points and the view from the streets and from the residential buildings is across the reserves to the ocean. The buildings form the visual backdrop to the reserve. They are mainly one and two storeys in height, with occasional three storey buildings, and two three-storey unit buildings over parking at the northern end of Ocean Street on the headland between Dixon Park and Empire Park. These have a setback of some 20 metres from the bluff tops and are conspicuous and out of character with their surroundings.

As for Merewether Beach, the height of buildings is generally low, however a number of more recent redevelopments of smaller domestic buildings have produced buildings up to the maximum nine metres allowed by the development controls. It is likely that the taller buildings will eventually replace all the single storey dwellings.

Landmark buildings are the surf pavilions, the Beach Hotel and recent residential flat buildings at the northern end of the area, fronting Memorial Parade, and Parkway Avenue. Planning controls set guidelines for limiting the scale of buildings by limiting heights and the length of a wall without some articulation. More specific guidelines could be prepared to describe a future designed character for the corridor edge as it is likely that more property allotments will be amalgamated and larger scale residential units proposed.

There is very little vegetation in the reserves other than Bitou Bush, mown grass and vegetation established as a result of dune rehabilitation efforts. Dwellings addressing the edge of the reserve across the streets have few examples of well-developed front gardens, and except for some successful planting around the tennis courts and amenities building in Empire Park, there is no significant street tree planting at any place within the unit. The lack of vegetation affords no screening or softening of the urban edge bounding the coastline corridor which presents as a harsh and unrelieved skyline from the beach and the reserves.

The war memorial erected by Cooks Hill SLSC at Bar Beach Avenue in 1918 has been isolated from Empire Park by the construction of Memorial Drive.

Parkway Avenue, with its broad grassed median reaches the coastline at the parking area immediately north of Bar Beach in an unattractive termination to this major "garden suburb"

inspired link between Hamilton garden suburb and the beach. The median planting of Norfolk Island Pines does not extend to the beach.

Dunes have been partially rehabilitated along the length of the beach but there is no planting adequate to provide shade, protection from wind or visual relief, or to soften the appearance of the urban edge.

4.2.1.7 Burwood Beach

The Burwood Beach area (see **Plate 12**) is bounded by Burwood Beach, Glenrock Lagoon (the City boundary) and by the ridgeline to the west and north. The ridgeline is at an elevation of about 80 m AHD and is followed by the Pacific Highway, Scenic Drive and residential buildings along the northern part and onto the headland at Merewether. The area is generally natural bushland within the Glenrock SRA the centre occupied by the Newcastle Sewerage Treatment Works immediately north of Murdering Gully. Lookout points are available in Hickson Street at the northern boundary of the area. The area is distinctive on the Newcastle coastline as a substantially natural area. Participants at the Community Working Group Workshop One indicated that the area is appreciated aesthetically for its naturalness and desired improvements related to rehabilitation of vegetation, stormwater outlets and water quality.

4.3 LAND USE PLANNING INSTRUMENTS AND POLICY

Existing and proposed land use planning instruments and policies applicable to the Newcastle coastline include the Local Environmental Plan (LEP) and relevant Plans of Management. **Figures 4.3** and **4.4** show the existing land use zones under Newcastle Local Environmental Plan 1987 (NLEP 1987), as they apply to the coastline. A detailed discussion of the existing and proposed LEP and policies for the Newcastle coastline are discussed in detail in the Reference Document. In summary, the key points are:

- While NLEP 1987 and the draft Newcastle Local Environmental Plan 2000 (NLEP 2000) provide for a single open space and recreation zone along most of the coastline corridor, there is no unified set of guidelines for the kinds of development and uses, or desirable character of development in the zone.

- The draft NLEP 2000 provides for a significant relaxation of controls on uses permissible within the 6a zone and would rely heavily on Plans of Management to guide land use decisions. No detailed Plans of Management are in place but these would be essential to be able to operate under draft NLEP 2000. The 6a zone under NLEP 1987 and draft NLEP 2000 includes Crown lands and Council Community Land and Plans of Management would need to be prepared in accordance with the *Local Government Act 1993* (LG Act) or the *Crown Lands Act 1989* (CL Act), which have different requirements. To develop a consistent approach for public reserves along the coastline, it is important that a unified set of Plans of Management be produced, preferably under both the LG Act and the CL Act to avoid the problems associated with arbitrary tenure boundaries.

- The Plans of Management cover only public reserves and not adjoining roadways or Crown land that is not reserved, for example, where special leases apply at bowling clubs. It is therefore important to prepare development control plans over both public reserves and other land zoned 6a and adjoining streets or other forms of public land. The DCPs would provide a co-ordinating document and could adopt the Plans of Management.

Umwelt (Australia) Pty Limited
Source: Newcastle City Council

FIGURE 4.3
LEP Zoning

A3 Scale 1:15 000

Ref No.:R02_V2/1411_140.dgn


Newcastle Harbour
Nobbys Beach
Newcastle West
Pacific Park
Fort Scratchley
Newcastle
Obelisk
Newcastle Beach
Ocean Baths
Cooks Hill
South Newcastle Beach
King Edward Park
Newcastle Bowling Club
The Junction
Shepherds Hill
Empire Park
Bar Beach Bowling Club
Susan Gilmore Beach
Strzelecki Lookout
Bar Beach
Dixon Park
Dixon Park Beach
Merewether
Jefferson Park
Merewether Beach
Tasman Sea
Hunter Water Wastewater Treatment Plant
Merewether Baths
Glenrock Lagoon Recreational Area
LGA Boundary
Glenrock Lagoon
Burwood Beach
Legend
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Umwelt (Australia) Pty Limited
Source: Newcastle City Council
0 0.25 0.5 1km
FIGURE 4.4
LEP Zoning
A3 Scale 1:20 000
Ref No :R02_V2/1411_141.dgn

- Community expectations are changing and the pursuit of economic expansion through tourism is introducing demands for more development and new types of development along the coastline. Similarly, there are no specific guidelines recognising the special sensitivity of the coastline corridor to new development at its interface with the urban edge. Newcastle is fortunate to have a continuous open space strip separating the shoreline from urban development. With some notable exceptions this strip is of adequate width to secure the amenity of the shoreline.

- Land use zones at North Stockton reflect the long-standing public uses but do not anticipate the possibility of future redevelopment of these sites, which provide the only opportunities for large scale "greenfield" sites on the Newcastle coastline.

- The Newcastle Landscape Structure Plan (NLSP) identifies the need for establishing large-scale theme trees[2] along the coastline to define the boundary between the land and the ocean. Other landscape treatment is needed to provide wind protection, visual interest and to define various use areas.

- The NLSP calls for the preparation of detailed master plans and management plans along the coastline and establishes guidelines or principles for the landscape treatment of urban beaches, dune systems and cliffs and headlands, which have not yet been developed.

4.4 ACCESS

A continuous through traffic route links the Pacific Highway via Scenic Drive and local streets in Merewether to Darby Street and the mid-point of the CBD. Similarly, Memorial Drive links to Scenic Drive and provides access to the eastern end of the CBD via Watt Street with a further extension via Shortland Esplanade to Nobbys Beach to complete a traffic system that is now a controlling feature of the coastline.

The arterial road represented by the coastal link along Scenic Drive, Memorial Drive and Reserve Street, is an important route for access between the southern and eastern suburbs and the City Centre. However, its presence along the coastline has adverse impacts on the accessibility of the coastline from the urban area. This is reflected both as a physical barrier created but also the adverse aesthetic effects which stem from an environment designed for through traffic and conflicting with the needs of recreational users of the coastline. This is a conflict which needs to be resolved by traffic management, such as traffic calming at vulnerable locations, also by appropriate design measures to improve the aesthetics in areas of conflict to provide for a more pedestrian oriented environment as opposed to a vehicle oriented environment.

The coastline link is diverted around Dixon Park, Merewether and King Edward Park but elsewhere it has progressively reduced the width of coastline reserves with road widening and realignment to meet increasing traffic. The barrier created by the roads and increasing traffic has reduced ease of access to the coastline and has had a significant aesthetic impact in places. The alignment of roads along beaches is a common pattern in coastline development and a common response now is to increase the capacity of alternative routes and to take measures to calm traffic, provide adequate pedestrian crossings, including controlled intersections and urban design measures to improve the environment for pedestrians.

[2] 'theme tree' would most likely be a single species of tree used along the coastline, to act as a form of natural landmark.

Stockton Beach remains accessible from almost the entire length of urban development, which is where the majority of people need to access the beach for recreation. Access to the northern section of the beach is only gained from the southern beach as public access is not permitted though the Stockton Centre, Fort Wallace and the Wastewater Treatment Plant.

4.5 GENERAL RECREATION DEMAND

Newcastle's coastline is an important tourist and recreational resource. This area encompasses both marine and terrestrial areas surrounding the shoreline. These areas are intensively used for recreational purposes by a variety of groups and individuals.

Recreational uses include land and water based activities such as swimming, recreational and professional surfing, windsurfing, bodyboarding, sailing, diving and snorkelling, recreational and commercial fishing operations, hang gliding, bird watching, commercial tour operations, personal water craft (PWC), skate boarding and roller blading. A range of passive recreational uses of the foreshore include picnicking, kite flying, walking, bicycling, and walking dogs. In the harbour area, a range of major events are held annually including the Maritime Festival, Mattara Festival and New Years celebrations that also depend on the aesthetic value of the coastline.

Particular aspects of the local and regional recreation and tourism industry have the potential to provide significant benefit to the community. These include:

- the recreational and professional surfing industry which are attracted by the beaches and waves;
- Surfest held at Newcastle Beach;
- promotion of King Edward Park and The Foreshore for wedding ceremonies and/or photography opportunities; and
- general promotion/marketing of the coastline, its attributes and benefits.

Some of the issues considered in the review of the interactions of the recreation and tourism industry with natural and cultural resources, and natural hazards of the coastline include examining environmental problems such as erosion, water quality, sea shell removal, litter and habitat disturbance. Other issues include the impacts of overcrowding, particularly in sensitive areas; users conflicts between the various recreating/tourism groups, particularly between users of the water; and the safety and management of users.

4.5.1 Non-participant Observations

As part of the Coastline Management Study, a non-participant observational research study was conducted of open space and recreational settings within the study area. The research involved observations of recreational behaviour along the entire Newcastle coastline except for Stockton. Stockton was excluded from the observations, as a student from the University of Newcastle was concurrently conducting on-site surveys at this location, involving a recreation component. Part of the context area of Burwood Beach, Glenrock State Recreation Area was also excluded as visitor use data was previously prepared by NPWS (1997) and Manidis Roberts Consultants (1990).

The observational study was designed to assess the following:

- the main uses and users of each open space and recreation setting within the coastline;

- the current level of use of informal recreation areas where no admission fee is charged, such as the beaches, urban parks and tourist sites; and

- any issues/conflicts/problems surrounding usage, such as spatial use of the site, atypical behaviour, pollution, safety and access.

The research involved the use of a Non-Participant Observation Method. A summary of the recreation activities and an explanation of the Non-Participant Observation Method is contained in the Reference Document. A summary of the non-participant observations is as follows:

Stockton Beach (Urban) Area

A Newcastle University Honours student prepared a community survey in late 2000 that involved a recreational component, which was therefore used to examine recreational activity in Stockton. The survey identified a high beach attendance rate within the Stockton community, with 75% of the 122 respondents attending the beach on a daily or weekly basis. Recreational activity was primarily passive with 86% of respondents listing walking, and 64% listing relaxing as the most common recreational activity undertaken within the Stockton management unit, in order of preference. Swimming and surfing were also popular recreational pursuits with 59% and 34% of respondents participating respectively. Participation in these recreational activities is undertaken along the entirety of Stockton Beach.

Fort Scratchley

Non-participant observations of Fort Scratchley were not included as part of the study. Alternatively, visitor books were examined comprising the period of April 2000 to February 2001 and personal communications were held with volunteer staffing.

It is estimated that locals accounted for 75% of visitors to Fort Scratchley, with the remaining 25% comprising intrastate, interstate and overseas visitors. Visitation is at its highest level whenever the 'Firing of the Big Guns' events are held. Generally the big guns are fired on Australia Day, during Fort Scratchley's Anniversary in June, on the October long weekend when Mattara is held, and for special events such as the running of the Olympic Torch. Fort Scratchley has recently received more grant funding to restore the remaining big guns and to replace the modern electrical lighting throughout the tunnels with replica lanterns.

Nobbys Beach Area

Walking for pleasure was the highest-ranking recreational activity at Nobbys Beach, with walking along the breakwater a common activity. Dog walking and swimming was also common, with the leash free dog zone at Horseshoe Beach attracting many dog owners. However, surfing and body boarding is always a popular pursuit at Nobbys. There was 1089 people observed during the survey.

Newcastle Beach Area

Swimming is the principal recreational activity, with the Newcastle Ocean Baths attracting many swimmers. Walking for pleasure, surfing and body-boarding also accounted for high proportions of users. The skate ramp located at South Newcastle Beach attracted a high proportion of youth. Newcastle Beach attracts a large number of people with 1752 people observed during the survey.

Shepherds Hill Area

The principal recreation use in this area is picnicking and barbecuing, which coincides with Council's management practises to have parks function as meeting places. The other major recreational use was in admiring the views afforded by the cliffs and bluffs in this section of the coastline. The focal point is King Edward Park, where the majority of the picnics and barbecues were observed, with both formal and informal gardens, shade and playground facilities that combine to provide a functional picnic area. A total of 430 people were observed in King Edward Park and its surrounds during the survey.

Merewether/Dixon Park/Bar Beach/Susan Gilmore Beach Area

The principle recreation use within this area is swimming, especially as the area includes the Merewether Baths. Sunbathing, surfing, body boarding and walking for pleasure also accounted for significant proportions of beach users. This area was observed to have the greatest number of people involved in recreational activities, with 2620 people observed during the survey. This result concurs with a summary of beach participation rates in 1999/2000 which showed that the Merewether-Dixon Park-Bar Beach stretch had the highest attendance during the 1999/2000 season.

Burwood Beach Area

The non-participant observations indicate that the principal recreational uses are surfing and body boarding, and walking for pleasure. General recreational demand is low with only 82 people observed in the Burwood Beach area.

4.5.2 Existing Studies into Recreation Demand

A significant number of relevant documents and publications have been examined to provide an overview of open space and recreation in the Newcastle LGA. These include numerous policies and plans developed by NCC that provide the framework for the planning and management of facilities such as playgrounds, sportslands and neighbourhood parks. It should be noted, however, that the majority of recreation reports virtually ignored the Newcastle coastline.

A summary of the main findings of the review includes the following:

Open Space and Recreation Settings

There are two categories of open space and recreation settings: those which are natural such as beaches, bushland and foreshore areas; and those which are man-made areas such as ovals, parks, playgrounds and sports facilities. Respondents to workshops and community surveys conducted by Hassell (1996), as part of the Newcastle Open Space Plan, considered natural features as significant assets to open space in Newcastle. The Newcastle/Lake Macquarie Open Space Study (1987) found that Newcastle has a comprehensive range of parks, pools and complexes which are both accessible and useable. However, no specialist facilities to encourage and enable participation in activities at an advanced level exist.

Interestingly, the 1987 survey (NCC/LMCC) indicated people have a preference for recreating at beaches (29%), foreshore parks (19%), and sports facilities (19%).

Clouston (1993) found that given the size of the population and area of the LGA, there is an under supply of specialist facilities like heated pools, to enable all year round training. The dispersal of these facilities is irregular and focused primarily around the city centre and inner suburbs. The situation is further complicated by the geographic location of Stockton, across

the Hunter River. Given these factors, access to many facilities may be difficult, depending on where you live within Newcastle. However, some of these facilities may not be appropriate near a beach.

Community Values of Open Space

A community survey conducted by the Hunter Valley Research Foundation (HVRF) in 1999 concluded respondents generally agree the following are of a good standard - the quality of the harbour and beaches, the amount and availability of quality open space; and the standard of living. However, since the survey was conducted, the general level of satisfaction had declined with some Council services and facilities, such as the range of recreation opportunities decreasing, the deterioration of the overall attractiveness/ maintenance of the coastline area, and the decline in good quality parks and recreation areas.

A study by Clouston (1993) found visual aspects of facilities was important in attracting both casual and team/organised users to recreational facilities. Existing facilities were considered to be in disrepair and visually unappealing, consequently resulting in under-utilisation. It is perceived that Council places a higher level of emphasis on organised sports as opposed to informal activity, reflected in the high number of formal oval and field recreation spaces in Newcastle (HVRF 1991). Respondents to the 1987 Open Space Study placed more importance on unstructured use of parks and reserves than on organised sport (NCC and LMCC 1987).

Reports by the Australia Institute and NCC 2000, Hassell 1996, HVRF 1991, HVRF 1999 and NCC 1996, indicate the most significant aspects of open space and desirable indicators of quality of life in Newcastle valued by the community are:

- environmental value (clean beaches and monitoring of pollution to ensure visual aesthetics and, water and air quality);
- accessibility to the site and facilities;
- aesthetic quality (quietness, cleanliness and tree planting);
- opportunities for informal recreation linkages and connections;
- resources and asset value, including an increase of natural habitat in the reserve system; and
- the potential and opportunities for tourism activities, such as organised sport.

Design of Open Space and Recreation Settings

Respondents to the Hassell (1996) community survey indicate a need for capital improvements rather than on-going maintenance of areas. For example, respondents felt the existing open space does not hold sufficient shade in the form of trees or picnic shelters, such as the poorly shaded areas of Empire Park and Bar Beach. Foreshore areas could be better utilised with the addition of cycleways and pathways such as the recently initiated Bathers Way Walk; amenities, specifically toilets, are lacking and, where provided, are in poor condition; access to beaches and parks for the aged and people living with disabilities requires upgrading.

Council Management

Respondents to the Hassell (1996) community survey were generally dissatisfied with the lack of clear direction that Council has shown regarding the managing of open space and

recreation in Newcastle. Respondents to the 1987 Open Space Study (NCC/LMCC) and 1993 Clouston survey felt Council's management of facilities is handled in a reactive manner rather than an overall planned approach. Respondents were also opposed to user pay systems, primarily for reasons of equity and also in view of Council's perceived poor record of managing facilities in a reactive manner rather than a planned approach. Council's current standard of maintaining facilities is seen as continually declining, in line with a reduction in staffing and funding. There was a strong view that community representatives must be involved in the decision-making process concerning the management of open space and recreation. The community requires improved communication channels with Council and the establishment of a Council-community liaison process (Clouston 1993, HVRF 1999).

Participation

According to the 1987 Open Space Study (NCC/LMCC) the most popular activities participated in were passive outdoor activities like picnics and barbecues (83%), swimming/sunbathing at the beach (65%), driving for pleasure (61%) and walking (57%). The more recent community survey conducted by Hassell (1996) indicates that the most popular activities are organised sport (27%) – tennis, golf, netball, bowls; and informal recreation such as walking (17%) and visiting the beach (11%). A significant drop was noted in picnics and barbecues (6%), and driving for pleasure (3%).

It was found that Novocastrians spend their recreation time in essentially the same way as the national population, including:

- The majority participate in informal recreation and recreation at home. Informal recreation such as walking for pleasure accounts for 17%, the greatest response for any activity. Females preferred walking, while males preferred visiting beaches and surfing (Hassell 1996). These choices may have been limited as participation in activities such as sunbathing and swimming were not asked.

- A level of participation in organised sport of 27%, which corresponds with the national participation rate of 27.8% (Australian Bureau of Statistics 1995). The leading sports were Tennis (22%), Golf (10%), Netball (8%) and Outdoor Bowls (7%).

- Participation in court based sports like netball and tennis, and aquatic recreational activities like the use of personal watercraft is increasing.

Further to these findings, the National Recreation Participation Survey conducted by the Department of Arts, Sport, the Environment, Tourism and Territories estimates about "a quarter (or 25%) of the adult population visit the beach at least once in a typical summer week" (Lynch and Veal 1996, p. 274). In comparison, "about 17% of the adult population visit a park or playing field in the course of a summer week" (Lynch and Veal 1996, p. 277).

Unmet Needs

According to the Hunter Valley Research Foundation Community Survey (1999), the community of Newcastle identified the same issues as still requiring attention, as had previously been identified in the 1997 and 1998 surveys. In short there is the need for additional cycleways; to address the issue of the inadequacy of facilities and services for the aged and youth; and designing public areas that are safe to use.

The Newcastle Open Space Plan (Hassell 1996) concluded the quality of Newcastle's open space is perceived as high by users, however the high quality facilities are generally of a particular type, like sportsgrounds, or specific areas, such as Blackbutt Reserve, reflecting the level of service provided by the Council in maintaining these facilities. There is a greater

need for the provision of additional facilities of equivalent standard throughout the city and, as previously concluded, a move towards capital improvements as opposed to maintenance.

The Open Space Plan (Hassell 1996) identified the following issues:

- Low discretionary income and significant unemployment levels may place restrictions on participation in organised sport, such as joining fees, membership fees, uniforms and travel.

- Unemployed/youth:
  - existing youth centres should open longer;
  - lack of play equipment; and
  - poor/no lighting at skateboarding facilities.

- Indigenous people:
  - lack of information provided by NCC about decisions; and
  - lack of access to grounds and facilities due to sole use by sporting clubs and groups.

- People living with disabilities:
  - lack of access to many open space and recreation settings is the primary concern;
  - lack of playground equipment for children living with disabilities;
  - provision of areas for disabled persons animals;
  - lack of information specifically for disabled persons;
  - provision of a sensory garden;
  - inadequate design spaces to allow for wheelchair and scooter access; and
  - poor/unsafe road crossing and pavement camber.

- Non-English speaking backgrounds:
  - the size and location of some facilities/areas create problems due to their inability to cater for extended family groups ranging in number and age;
  - lack of public transport; and
  - cost of participation.

4.6 BEACH USAGE

4.6.1 Beach Visitation Levels

Coopers and Lybrand (1997) estimate there are over one million residents and visitors to Newcastle who attend the beaches each year. Newcastle residents see the maintenance of the beaches and beach facilities as one of the most important services provided by NCC. NCC is responsible for providing the majority of facilities and services on Newcastle beaches, however some services like the management of kiosks and beach patrols are provided by private operators and Surf Life Saving Clubs.

The beach user profile indicates that the largest user group is adults, comprising 60% of all beach users (see **Table 4.1**). Adults have been shown during non-participant observations to utilise the coastal strip for a variety of passive and active recreational activities including walking for pleasure, swimming and surfing. Adults have also been shown to use the beach for informal and formal dining and socialising at restaurants and cafes, such as the Beach Hotel and Swells Café in Merewether. Coopers and Lybrand (1997) show that usage by youth is generally restricted to weekends and school holidays. Non-participant observations indicate however, that youth also utilise the beach and recreational areas within the coastal

strip during weekdays, especially in areas such as the Ocean Baths and the skate ramps at South Newcastle Beach and Empire Park, both before and after school and for structured school sport activities.

Table 4.1 - Beach User Profile

Segment	Size	Growth	Profile
Youth	23%	Growing	Use beaches during the school holidays and weekends. Access by public transport, skateboard, driving and walking. Unstructured sport such as surfing and socialising.
Adults	60%	NA	Not available
Families	13%	Growing	Unorganised recreation, family outings, weekends, school holidays. Morning and afternoon usage.
Aged	4%	Growing	Strolling and swimming, morning an afternoon
Surf Life Saving Clubs	0.1%	Declining	Structured land and water based activities

Source – Coopers and Lybrand 1997

4.6.2 Swimming and Surfing

Obtaining accurate figures on the level of participation of the community in surfing activities is difficult with research indicating that 13% of the Hunter population surveyed were surfers. This research was limited however, as individuals over the age of 20 were not surveyed, and as Surfing Australia (1997) indicate, 37% of surfers are under the age of 18. As a consequence, the accuracy of this figure may be limited. On the basis of surfboard sales there are well over 10000 surfboard riders in the Hunter with 1000 individuals registered as members of the sixteen official surfing clubs in the Hunter. The Hunter region holds 13 major surfing contests each year, including the internationally recognised Surfest competition held in March, which attracts many of the worlds best surfers. Local surfing clubs also hold regular surfing contests, generating approximately 200 local contests each year.

4.6.2.1 Patrolled Beaches

The Beaches Service Level Review (NCC 2000c), and the Surfing Industry Feasibility Study (University of Newcastle, 1998) indicate that Council provides lifeguard services to protect the safety of beach users and to enforce the appropriate regulations under the *Local Government Act 1993*. Lifeguard services are provided at the beaches in **Table 4.2** within the NCC area. An opportunity exists for Life Savers to take a more active role in beach management.

Table 4.2 - Estimated Beach Attendance (1997)

Patrolled Beach	Estimated Attendance
Stockton Beach	25000
Nobbys Beach	690840
Newcastle Beach	294570
Bar Beach	128625
Dixon Park Beach	55560
Merewether Beach	50550

Source: Coopers and Lybrand (1997)

The Surf Life Saving Clubs supplement the beach inspector patrols employed by NCC per year. The NCC Recreation Strategy (1997) estimated that patrols at Nobbys, Newcastle, Bar, Dixon Park and Merewether were worth $14,000, however, it is uncertain how this figure was estimated and figures provided by the Surf Life Saving Associations estimate this worth to be $174,080 (University of Newcastle 1998). There is a discrepancy in the value placed on the service provided by the SLSC, which may need to be addressed by Council if surf life savers are to have a greater role in beach management in the future.

Beach attendance records (see **Table 4.2**) indicate that the most frequently used beaches are Nobbys Beach and Newcastle Beach, which is a reflection on public transport access to these beaches. These beaches are a short walk from Newcastle train station and many of the bus routes servicing the outer suburbs of Newcastle and Lake Macquarie terminate in Scott Street, a short walk from both beaches. Peak beach visitation is generally found to be on weekends during the summer months which is when public transport services are limited. This creates congestion in Nobbys car park and along the streets surrounding Newcastle Beach, as seen during non-participant observation surveys.

Further to the above records, the lifeguard service compiles data regarding attendance, rescue numbers and beach conditions for each patrol season. A summary of the information provided by NCC for the 1998/99 and 1999/2000 patrol seasons is provided in **Table 4.3**.

Table 4.3 indicates the following:

- When taking into consideration the 1998/99 attendance records of the unpatrolled areas of these beaches ('rest of beach'), Nobbys Beach has the overall highest attendance record, followed by Newcastle Beach and Bar Beach, with Stockton again recording the lowest attendance record. These findings correspond with those indicated in **Table 4.2**.

- For 1999/2000 the results are the same.

- Newcastle Beach recorded the highest number of rescues, followed by Nobbys Beach, Bar Beach and Stockton Beach, with Dixon Park Beach and Merewether Beach having comparatively low rescue figures for the 1998/99 and 1999/2000 patrol season.

- Merewether Beach had the most dangerous surf conditions during the patrol seasons with Dangerous Surf signs displayed regularly. However, Newcastle Beach, Bar Beach and Dixon Park Beach are infrequently closed due to dangerous conditions. The lowest frequency of dangerous surf conditions and closed beaches occurred at Stockton Beach during the patrol season.

Newcastle's beaches received a high rating on the ABSAMP[3] beach safety rating for the provision of safe beaches to the public. The Beaches Service Level Review (2000c) by NCC indicates that NCC is one of the few major councils in New South Wales with an excellent record of no lives lost at their patrolled beaches for a period of approximately 24 years.

4.6.2.2 Unpatrolled Beaches

Unpatrolled beaches in Newcastle include Burwood, Susan Gilmore, South Newcastle and Horseshoe Beaches. Information was obtained from Council, NPWS and general observations. A brief review of the usage characteristics of the each of the beaches is as follows.

[3] Australian Beach Safety and Management Program.

Table 4.3 - Lifeguard Service Records of Patrolled Beaches

	Nobbys		Newcastle		Bar Beach		Dixon Park		Merewether		Stockton		TOTAL	
	1998/ 1999	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**	**1998/ 1999**	**1999/ 2000**
Surf Conditions:														
Safe	271	292	128	184	235	251	160	163	107	102	207	232	**1108**	**1224**
Dangerous	24	27	51	9	65	38	57	31	84	94	21	5	**302**	**204**
Closed	33	14	49	39	34	44	28	39	37	30	2	3	**183**	**169**
Attendance:														
Patrolled Area	120050	132409	144892	118915	143974	126277	41445	43250	42297	34419	32019	35572	**524677**	**490842**
Rest of Beach	449795	466960	255720	245625	223499	217030	80350	95784	191395	192025	29961	35504	**1230720**	**1252928**
Total	*569845*	*599369*	*400612*	*364540*	*367473*	*343307*	*121795*	*139034*	*233692*	*226444*	*61980*	*71076*	***1755397***	***1743770***
Preventative Actions	12941	7820	6431	6009	3659	2917	2746	2053	4199	2982	640	917	**30616**	**22698**
Ordinance Infringements	55	268	1	5	58	4	29	87	70	2	2	5	**215**	**371**
Rescues	51	64	192	144	60	43	23	6	51	4	50	33	**427**	**294**
First Aid	1134	1141	1157	1071	958	1250	937	750	956	1104	365	396	**5507**	**5712**

Source: NCC 2000c

Little Park Beach

Little Park Beach is on the southern side of the northern breakwater, within Newcastle Harbour, and is used mainly walking, sitting and swimming activities.

Horseshoe Beach

Horseshoe Beach is on the northern side of the southern breakwater, within Newcastle Harbour, and is the only designated beach area for leash free roaming and swimming for dogs within the LGA. The principle recreational use of the beach is therefore dog walking and swimming activities and also fishing, picnicking and admiring the views of the harbour and Stockton.

South Newcastle Beach

South Newcastle Beach is located at the southern end of the patrolled Newcastle Beach and features a skate ramp on the promenade. The principle recreational use of the area involves skating and related activities such as roller blading, as well as surfing. Some passive recreational activities also occur including walking for pleasure and sunbathing. The skate ramp attracts a high proportion of young people to the locality.

Deviant behaviour has been identified as an issue at South Newcastle with graffiti commonly occurring, especially in the vicinity of the skate ramp, and a high proportion of litter often exists. However, the skating facility is highly used by youth of various ages, and is one of three such facilities on the coastline.

Susan Gilmore Beach

Susan Gilmore Beach is primarily used for surfing, with swimming and sunbathing other common recreational pursuits at the beach.

Burwood Beach

Burwood Beach is managed by NPWS and has very few facilities. Access is by foot only.

Recreational activities that occur at the beach include sightseeing/viewing scenery, sunbathing, swimming, surfing, dog walking, walking for pleasure, hang gliding particularly above the slope north of Burwood Beach. Recreational opportunities at Burwood Beach can also be integrated with other activities in Glenrock State Recreation Area such as picnicking, sightseeing and walking for pleasure.

NPWS (1997) indicates the need for some form of control to ensure that hang gliding activities do not cause erosion on the slope north of Burwood Beach or instability of the dunes. Vehicular access to Burwood Beach for purposes of emergency is being sought through the Glenrock War Memorial Scout Training Camp and Burwood Beach Wastewater Treatment Works.

The recreational value of Glenrock SRA is derived from the variety of natural landscapes and the remoteness from the urban landscape. NPWS, as managers, regard recreational uses which rely on the naturalness and high landscape value, as appropriate forms of recreational activity to be undertaken within the Area. Recreational facility development should be limited to providing for beach access, walking, viewing scenery, picnicking, the study of nature and historic sites and similar activities. In this way it is considered the SRA will provide an alternative to more urban recreational activities (NPWS, 1997).

4.7 PASSIVE RECREATION

Passive recreational activities are the most common recreational pursuits along the Newcastle coastline and include picnics, walking for pleasure, sunbathing and cycling.
The Newcastle area has the highest level of bicycle use per capita of any urban area in NSW, with 150000 bicycles in working order, compared to 151000 cars (NCC, 1997). Cycling in Newcastle is undertaken for commuting, fitness and training, racing and triathlon competition, shopping and recreation. The Newcastle and Lake Macquarie Bike Plan shows that 41% of recreational cyclists cycle between 1-4 times per week, with a vast majority of cyclists (81%) preferring to ride on roads with 28.4 % opting for marked on road cycle lanes and 22.5% preferring off road cycle paths. This illustrates the popularity of on and off road cycle paths and need to promote and provide cycling areas to cater for the popularity of the activity.

Picnics are common recreational pursuits within the Newcastle coastal zone with 8% of people identified in the non-participant observation study conducted for this study engaged in picnicking activities. The vast majority of picnickers (36%) were observed in the Shepherds Hill area, with usage concentrated in King Edward Park. The open space areas within the coastal zone are generally disconnected from the beach precincts and contain only limited picnicking, shade and barbecue facilities.

Recreational walking is a common passive recreational activity. Walking for pleasure accounted for 15% of the people observed recreating in the coastal zone during the non-participant observation survey, with 27% of people observed in the Burwood Beach area and 25% of users at Nobbys Beach area. Recreational walking is undertaken by people off all ages and fitness levels which contributes to its popularity as a recreational activity.

Walking tracks and routes that exist include:

- *Great North Walk* - 250 kilometre walking track from Sydney to Newcastle which crosses a diverse range of natural landscapes (Department of Land and Water Conservation publish a 'Discovery Kit' including six maps and notes). No permit is required to walk the track, it has good access, is not a wilderness walk, and can be walked during any season (July to November is best).

- *Bathers Way* - NCC has recently initiated the first stage of a coastal walk from Glenrock SRA to Nobbys Breakwater, taking visitors for a natural and cultural heritage walk along the Newcastle coastline and providing opportunities for a diverse range of educational and recreational experiences. It provides links to other walks such as the Great North Walk, Newcastle East Heritage Walk, and Lake Macquarie Coastline Walk.

Sunbathing is another common passive recreational activity undertaken on all of the city beaches and in many of the open space areas. Sunbathing accounted for 12% of overall recreation use within the management area, comprising as much as 20% in the Merewether Beach to Bar Beach stretch of coastline, with no observations within the Shepherds Hill area. Sunbathing peaks in the warmer summer months, especially on the weekends, when visitation to the beaches is at its peak.

A popular passive pursuit not often recorded is 'sitting and looking' at the beach and its environs. Facilities along the coastline do not promote this, as access and shade for people, particularly with disabilities or the elderly, is severely lacking.

4.8 CLIFF AND BLUFF USAGE

The predominant recreational usage of cliffs and bluffs within the Newcastle coastline area observed within the non-participant observation study was hang gliding, particularly above the slope north of Burwood Beach, Strzelecki Lookout, over King Edward Park and from the slopes of Dixon Park. However, while hang gliders take off from the cliffs and bluffs, their landing sites include the northern corner of Empire Park, Dixon Park and an exposed patch within Glenrock SRA. The lack of formalised areas for hang gliders to take off (Strzelecki Lookout) and land (Empire Park and Dixon Park) needs to be addressed to avoid potential conflict in land use and for the safety of coastline users. Hang gliding in the Glenrock SRA does not create the same conflict, however, there is an issue of soil erosion associated with the take off site within the SRA.

A high proportion of people were observed at Strzelecki Lookout, King Edward Park, and Bar Beach car park, admiring the view from the vantage points on the cliffs and bluffs. Many of the people were observed in cars, with a high proportion of couples observed. Hang gliders were also observed to attract a high proportion of spectators.

The cliff sections of the coastal strip, especially between the Bogey Hole and Susan Gilmore Beach are frequently used by rock fishers and recreational walkers (WBM, 2000a). Defined walkways that utilise Newcastle's cliffs and bluffs include the Bathers Way, Great North Walk and the Newcastle East Heritage Walk.

4.9 FISHING

Recreational fishing is conducted along diverse areas of the coastline from beaches, to rocks, cliffs and bluff areas. There are no areas closed to recreational fishing along the coastline and the standard bag and size limits as set by NSW Fisheries are applicable. Recreational fishing was observed during the non-participant observation survey, and is known to occur along Stockton Beach and along the rock platforms, especially in the Bogey Hole to Susan Gilmore Beach stretch of the coast. The survey of Australian Beaches undertaken by the Surfrider Foundation (1996) indicates that recreational fishing is greater on non-urban beaches than on urban beaches.

Commercial fishing activities are undertaken in areas adjacent to the Newcastle coastline, with the most conspicuous being the Stockton Bight, north of Stockton Beach. There are a number of commercial fishing licenses in Newcastle, however, there were no commercial fishing activities recorded during the non-participant observation survey.

4.10 DOG WALKING AND HORSE RIDING

Horse riding is a popular recreational activity in Glenrock SRA and along Stockton Beach. Horse riding in Glenrock has lead to the proliferation of many informal tracks and erosion. As horse riders currently use the beach and dune areas, the NPWS aim to establish a series of designated horse riding trails in order to reduce erosion, contain vegetation destruction and control weeds (NPWS, 1997).

Horse riding in the Stockton Bight area is predominantly undertaken along the beach and dunes with a number of tour operators offering horse riding activities. These tours are based in the Port Stephens local government area, however there is opportunity for the tours to be undertaken in the Newcastle LGA.

NCC (1999) has designated Horseshoe Beach as the only beach where dogs are permitted, which includes leash free roaming and swimming. The only other leash free park area along the coastline is in King Edward Park. Activities observed involving dogs at Horseshoe Beach are often in conflict with people fishing, using hire equipment, and launching surf vessels. Dog walking on other non-designated beaches and surrounding areas, however, is popular for many people and the beaches used for this purpose include all of the beaches within the LGA, with the greatest numbers observed at Nobbys Beach, probably due to its proximity to Horseshoe Beach. Problems associated with recreational dog walking include litter and health risks from droppings, nuisance and conflict with other users, and potential safety issues in high usage areas/times. This problem was particularly evident in the park at Horseshoe Beach where dog faeces bins were overflowing.

4.11 VEHICLE USAGE

Recreational vehicle usage is prohibited on Newcastle's beaches. Four wheel driving is common on the mobile dunes of Stockton Bight, which lay within the Port Stephens LGA, with access to the southern area of Stockton Beach restricted through the use of fencing. The fencing does not however, prevent the access of vehicles from Port Stephens into Newcastle and vice versa. Low level vehicle usage of the beach occurs in the northern extremities of Stockton Beach.

5.0 SOCIAL AND ECONOMIC SETTING

The Newcastle coastline represents a "quality corridor", important socially and economically for the City and the region. It provides a much-valued setting for residential development, visitor accommodation, outdoor recreation, staging of events, sight-seeing that includes views of ocean and coastline, visits to heritage items and places and, for staging recreational and cultural events. The coastline's attributes are enjoyed by the Newcastle local community and also draw visitors to the city.

The coastline and associated open spaces provide an outstanding scenic setting for Newcastle's historic city centre. With an extraordinary cluster of heritage items of national significance, cultural, entertainment and shopping facilities, all set in a compact area, measuring 1 kilometre by 2 kilometres and surrounded on three sides by water, the City Centre presents an identifiable venue offering a wide range of activities for the community and visitors alike, all at the focus of the local and regional transport system.

Rejuvenation of the inner city is drawing residents back into Newcastle's historic centre, attracted by its exceptional 19th and early 20th century character, regional and urban facilities and a choice of residential environments. This rejuvenation as a living area has been galvanised by the Honeysuckle Better Cities Renewal Project around the surplus port lands and is now extending to the expansion of visitor accommodation with a number of hotels and serviced apartment developments completed or under way.

The coastline corridor also provides an outstanding setting and recreational area for the many inner residential areas of Newcastle.

After decades of population decline, Newcastle is now growing with rejuvenation of the city centre and redevelopment in the inner suburbs, as well as at the urban fringe. The city's population was estimated at 140,995 in June 2000 (DUAP) and the forecast population at 2021 is 145,200 (DUAP 1994).

The Newcastle coastline is important, not only to Newcastle residents but also to residents of the region. The Lower Hunter sub-regional population was estimated as 483,290 in 2000 (ABS estimate 2000) and forecast at 523,900 for 2021.

The population of Newcastle is increasing and ageing. There is a much higher proportion of disabled people compared with the State average, and unemployment is higher and incomes lower than the State average. The coastline appears to attract a disproportionate number of people from the young to middle age groups of the population to its beaches, reserves and facilities. Current proposals such as the Bathers Way should broaden the appeal of the coastline, to include a greater number of older people. The introduction of the coastline sub-arterial road has facilitated vehicular access to the coastline, but has also attracted through traffic travelling to the city centre. In some places this traffic has been accommodated at the expense of pedestrian amenity.

Pressure for use of the coastline will increase in response to population growth, increased per capita demand for leisure and, in particular, with increased consciousness of the importance of exercise for health. However, it is the response to improved facilities, environmental improvements and promotion that is likely to contribute most to increased use of the coastline corridor. This will come both from the local and regional communities and from visitors. Pressures created by improved facilities and promotion are likely to far outweigh any increase in demand for use of the coastal corridor arising from population growth or changing population characteristics.

The *Bathers Way Assessment of Tourism Potential* (Dain Simpson Associates, December 2000) provides tourism input into the planning and design of the Bathers Way Coastline Walk. The report refers to estimated domestic and international overnight visits for Newcastle LGA of 723,000 for 1996/97 (Tourism NSW LGA Visitation Estimates 1996/97 - data series discontinued). For 1999, the report presented combined Hunter and Central Coast Region domestic overnight visits of about 3.875 million; international overnight visits of 104,000 and 10.8 million day trips (Bureau of Tourism Research Regional Profiles, 1999). The report commented on the large market base that this visitation represented for Newcastle and that tourism operators advised that visitation to Newcastle had grown substantially since 1996/97, both in the domestic and international markets.

As a regional centre, the city centre attracts large numbers of youth and young adults, especially on Friday and Saturday nights. Some of the activity generated occurs in the coastline corridor, especially at the Foreshore Park, Nobbys Beach and Newcastle Beach. These activities are significant socially and economically but can conflict with residential amenity.

The coastline is a venue for events that are valued both for community development, as entertainment for the local and regional community, and for developing industries, especially the tourism and the surfing industries.

A Surfing Feasibility Study (University of Newcastle, 1998) calculated that the surfing industry in the Hunter Region directly contributes over $36.5 million and over 400 jobs annually to the region. However, despite this, the study also claimed that the surfing industry supporting this economic activity has received little attention or recognition as a contributor to the economic and social development of the region.

Tourist accommodation in Newcastle has been mainly limited to hotel and motel type accommodation, with a few bed and breakfast establishments emerging in recent times. Accommodation in serviced apartments has been limited with most multi-unit developments being occupied by permanent residents. However, as Newcastle has been developing as a tourist destination, the city centre has seen an increase in hotel/motel accommodation and most recently in serviced apartments. Mixed use development having several levels of residential units above commercial establishments is now common in the city centre, which is also common along Sydney's urban beaches, replacing conventional residential development. This kind of development provides increased residential choice as well as tourist accommodation and small scale commercial development to support coastline recreational activity.

Tourist accommodation vies for attractive coastline sites with accommodation for permanent residents. In response to market factors, the most favoured sites have tended to attract residential accommodation rather than tourist accommodation. The development of serviced apartments can offset this barrier to tourism development by providing for a flexible form of accommodation which can house mixtures of permanent residents and short stay residents in prime coastal locations.

Apart from the city centre, the only area of commercial development at the urban/coastline interface is at Merewether Beach, where a small local centre has developed around the Beach Hotel and at Stockton where the commercial zoning extends to the reserve and where a shop and two hotels adjoin the reserves. The Beach hotel had its origins in the early mining community and was at the terminus of an historic tramline. This settlement had not developed in the same way as similar situations in Sydney where tram termini at beaches such as Bondi, Coogee, Bronte and Manly developed substantial local shopping centres. Of these, perhaps, Bronte which is the most comparable where the small shopping centre and the present bus terminus at the beach, has been entirely taken over by food outlets. Bronte

combines these facilities with ocean baths and associated swimming, beach and surf pavilion, with an extensive parkland to form an outstanding beachside recreational area which is attractive, not only for its beach and surf activities, but also for its food outlets, picnicking and general recreational use of the park. Newcastle's beaches are not at the focus of commercial centres with the attendant opportunities for a greater mix of activities to take advantage of the beach location in the way that is common in Sydney.

Residential redevelopment adjacent to the coastline corridor has an impact on the level and kinds of use of the coastline reserves and on its appearance. In the vicinity of Newcastle Beach, high rise residential and tourist development dominates the environment and further major projects are proposed. Redevelopment of the hospital site has been foreshadowed and this represents perhaps the most important medium term opportunity for tourist development on the Newcastle coastline.

Most of the urban/coastline interface in Newcastle is occupied by detached dwelling houses of one or two storeys on small allotments. Site amalgamation to provide suitable sites for medium density development has not been common in the immediate coastline frontages that have been occupied by relatively few households. The dwellings tend to be owner occupied or permanently occupied with little accommodation for visitors outside the city centre. Even in the city centre, permanent residential accommodation tends to occupy the majority of sites most attractive for visitor accommodation.

6.0 COASTAL PROCESSES AND HAZARDS

Coastal processes give rise to a variety of coastline hazards that can damage or destroy coastal developments and coastline amenity. **Section 6.0** briefly describes those processes relevant to the Newcastle coastline, and the development subjected to coastline hazards.

6.1 BEACHES AND DUNES

6.1.1 The Beach Erosion and Accretion Cycle

Often the beach is perceived to be the sandy area between the waterline and the dunes. It actually includes the beach berm, where sand-binding grasses may exist, and any incipient foredune formations. Typically, however, the overall beach system extends from several kilometres offshore, in water depths of around 20 metres (Nielsen, 1994), to the back-beach dune or barrier region, which may extend up to several hundred metres inland (**Figure 6.1**). When examining the coastal processes of a beach system it is often necessary to consider this wider definition.

The beach comprises unconsolidated sands that can be mobilised under certain meteorological conditions. The dynamic nature of beaches is often witnessed during storms when waves remove sand from the beach face and the beach berm and transport it, by a combination of longshore and rip currents, beyond the breaker zone to deeper water where it is deposited as sand bars (**Figure 6.2**). As offshore sand bars build up, waves break further offshore until, eventually, sufficient wave energy is dissipated in the surf zone to prevent any further beach erosion. For severe storms, however, there may not be enough sand on the beach berm to build up the offshore bars to the extent required to protect the beach. In this case, the erosion continues into the frontal dune, and a steep erosion escarpment is formed. This erosion process may take place over several days or up to a few weeks.

The amount of sand eroded from the beach during a severe storm will depend on many factors including the state of the beach when the storm begins, the storm intensity (wave height, period and duration), direction of wave approach, the tide levels during the storm and the occurrence of rips.

Studies to quantify storm erosion processes for the Newcastle City beaches have been completed by WBM Oceanics Australia (1998). From those studies it was concluded that severe storms in the Newcastle area could remove from the beach berms and dunes, above mean sea level, up to 200 m^3 of sand per metre length of each beach.

6.1.2 Longer Term Beach Changes and Recession

Following storms, ocean swell moves the sand from the offshore bars onto the beach face where onshore winds move it back onto the frontal dune. This beach-building phase, typically may span many months to several years. Following build-up of the beach berm and incipient foredunes, and re-growth of sand-trapping grasses, it can appear that the beach has fully recovered and beach erosion has been offset by beach building.

However, in some instances, not all of the sand removed from the berm and dunes is replaced during the beach-building phase. Once the sand has been transported offshore into the surf zone, it may be moved alongshore under the action of waves and currents and out of the beach compartment. Some of the sand transported directly offshore during storms may become trapped in offshore reef systems thereby preventing its return to the beach. Other direct losses of material from the beach may include inland transport of sand under the action of onshore winds; this mechanism being called aeolian sand transport. Evidence of such action occurs at Stockton Beach and Stockton Bight. Over the longer term, should the

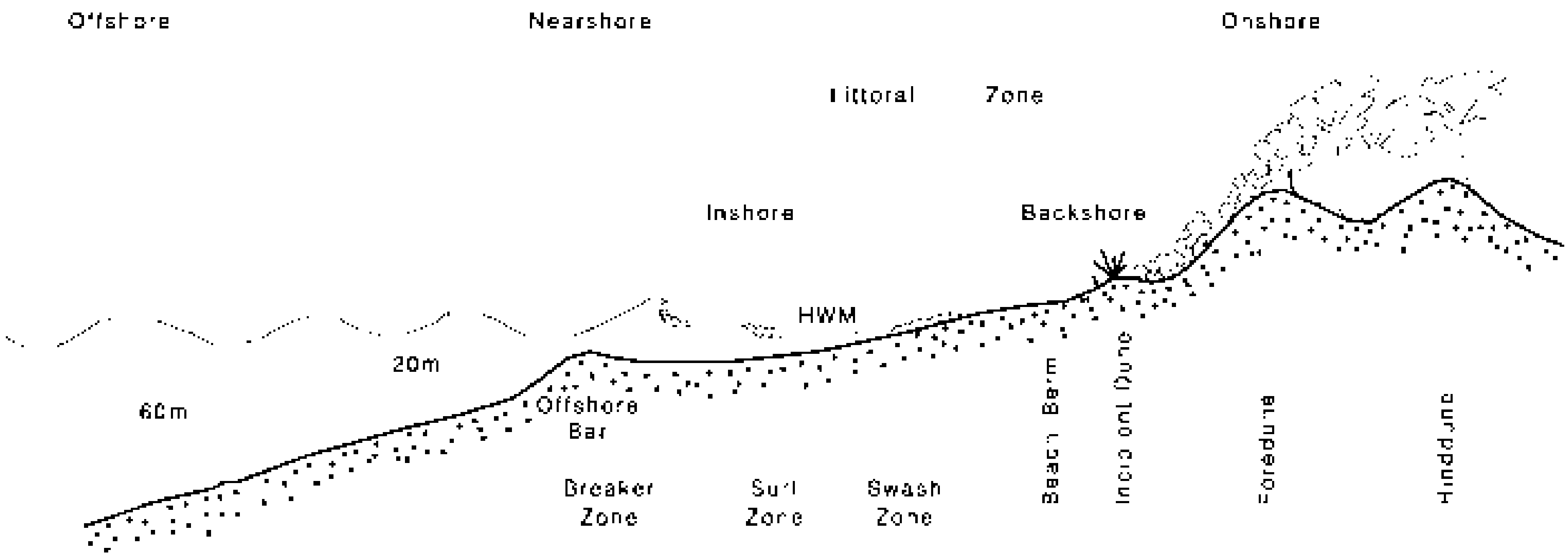


FIGURE 6.1
Coastal Zone Definition Terminology

Not to Scale

Umwelt (Australia) Pty Limited
Source: SMEC

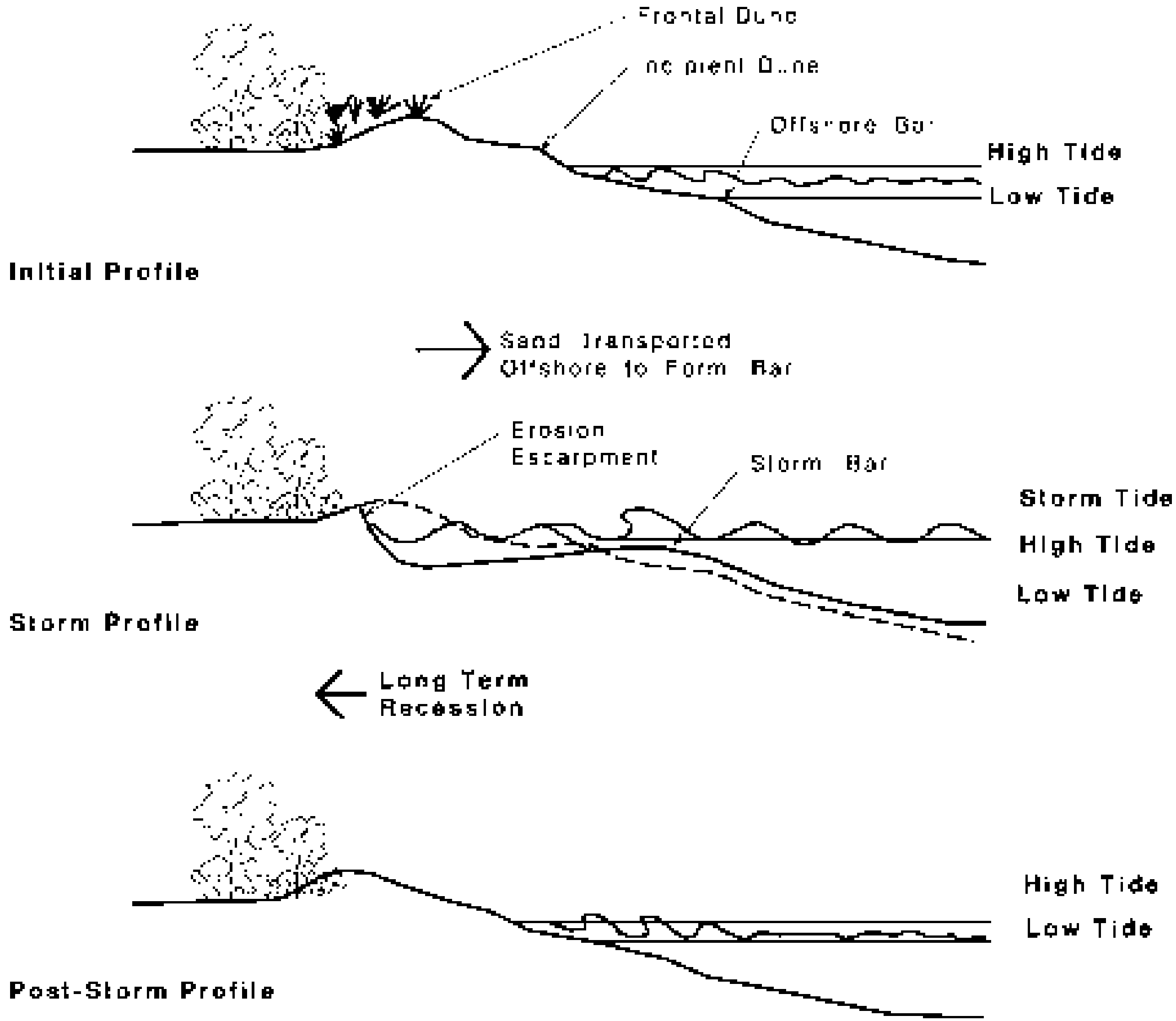


FIGURE 6.2
Storm Erosion/Accretion Cycle
(No Permanent Sand Loss)

A4 Not to Scale	Ref No. [illegible]

Umwelt (Australia) Pty Limited
Source: NSW Government, 1988

amount of sand taken out of the compartment by alongshore processes exceed that moved into the compartment from adjacent beaches or other sources, then there will be a direct and permanent loss of sand from the beach and a deficit in the sediment budget for the beach (**Figure 6.3**). This will result in an increasing potential for dune erosion during storms and long term beach recession (**Figure 6.4**).

Another factor that may affect long term trends on beaches is rising sea level. Recently it has been postulated that there may be a long term trend of rising sea level as a result of an enhanced *Greenhouse Effect.* This effect is due to the thermal expansion of ocean waters resulting from an increase in average world temperatures, melting of the south polar ice cap and retreat of glaciers. Rising sea level will result in landward movement of the shoreline (beach recession) with increased potential for dune erosion on developed beaches where the dune line is being protected against erosion. There could be increased storminess as world weather patterns change and subsequent further erosion of unconsolidated beach sands.

The most recent report of the Intergovernmental Panel on Climate Change (IPCC, 2001) indicated that, while temperatures may have risen in the atmosphere (+0.05° to 0.10°C per decade since 1979), the data show that global average surface temperature has increased by +0.05° to 0.15°C per decade since 1979, with warming occurring primarily over the tropical and sub-tropical regions.

However, the data on sea level rise is somewhat equivocal. While IPCC (2001) stated that global average sea level rose between 0.1 m and 0.2 m last century (average 1 mm /yr to 2 mm/yr), measured long term trends in mean sea level (MSL) from Australian stations are less that those determined for most other locations (Cox and Horton, 1999). More recently, as measured over the 5 years to 1995, there has been a steep falling trend in MSL at Port Pierie (~24mm/yr), Port Adelaide (~28 mm/yr), Fort Denison (~27 mm/yr) and Fremantle (~35 mm/yr). The MSL at Fort Denison in 1993 was about the lowest since the mid 1940s and around the same as that recorded in the 1890s (Cox and Horton, 1999). The reason for this recent large rate of fall in Australian sea levels is not known, but a correlation with *El Nino* conditions through the Southern Oscillation Index has been suggested (Cox and Horton, 1999)

Nevertheless, that there may be a long term trend of rising sea level is a projection of IPCC (2001), which advises a range of sea level change from +0.09 m to +0.88 m between 1990 and 2100. The current mid range scenario (most likely) IPCC sea level rise projections for 2050 and 2100 are 0.2 m to 0.5 m (+4 mm/yr to +5 mm/yr receptively).

Recently, researchers have identified long term cycles in weather patterns that are thought to influence beach conditions. In the Southern Hemisphere, the El Nino Southern Oscillation (ENSO) has been recognised for many years and appears to signify periods for which drought and flooding may be expected. The Southern Oscillation Index (SOI) has a periodicity of, typically, 6 to 18 months (**Figure 6.5**).

From some 24 years of subaerial beach survey data, Short *et al*. (2000) identified long term cycles of beach rotation at Narrabeen-Collaroy varying from 1 year to 8 years, with typical periods of 3 to 5 years. Beach rotation refers to alternating phases of erosion and accretion. These cycles were thought to be related to the SOI. Ranasinghe *et al.* (in prep.) investigated the relationship between the SOI and wave climate and, subsequently, beach rotation. The objectives of the study were to:

- establish a quantitative link between beach rotation and the SOI;
- investigate the effect of SOI phase shifts on wave climate; and
- to examine the relationship between variations in wave climate and beach rotation.

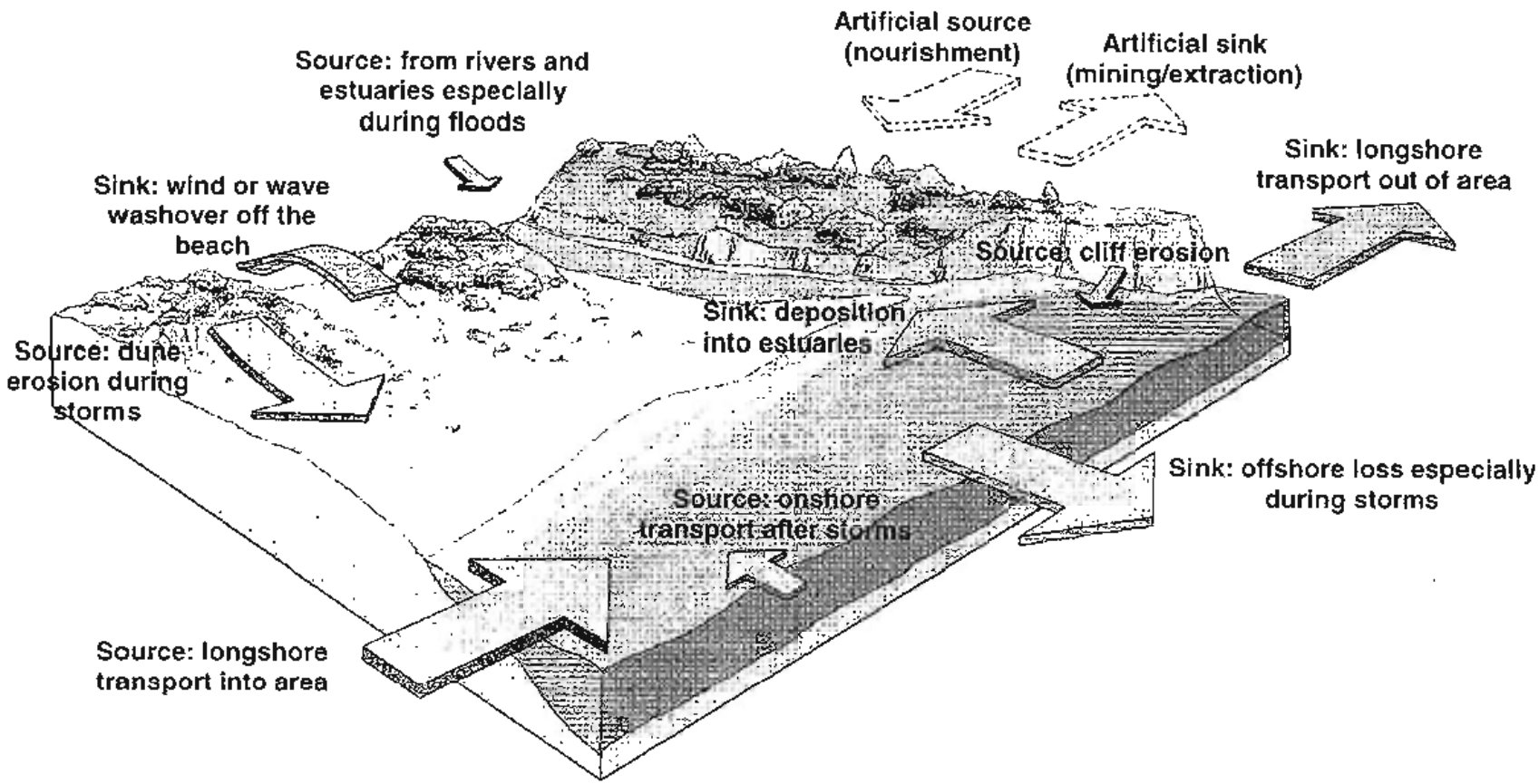


FIGURE 6.3
Typical Sediment Budget Diagram showing Possible Sources and Losses of Sand for a Beach

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Umwelt (Australia) Pty Limited
Source: NSW Government, 1990

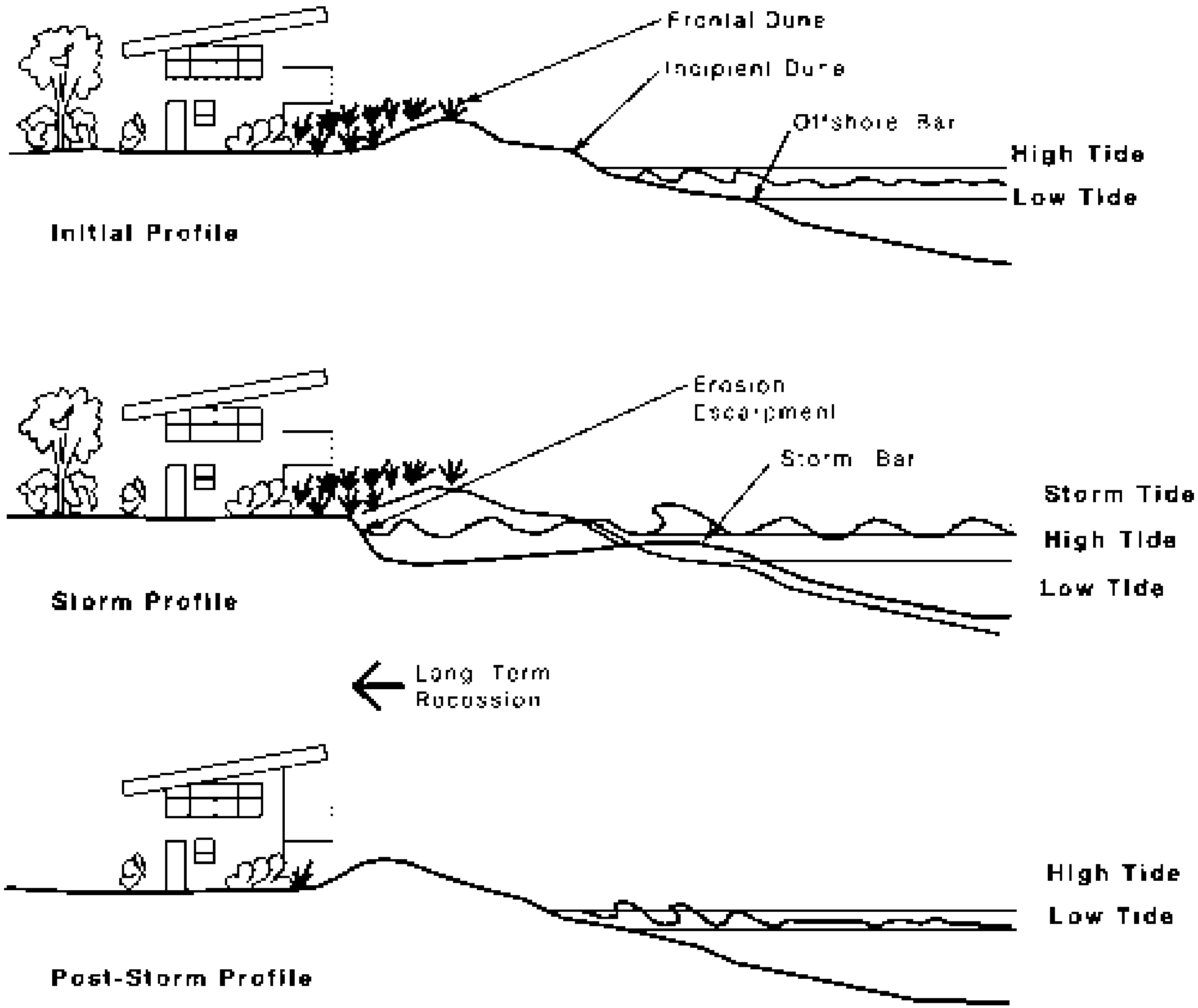
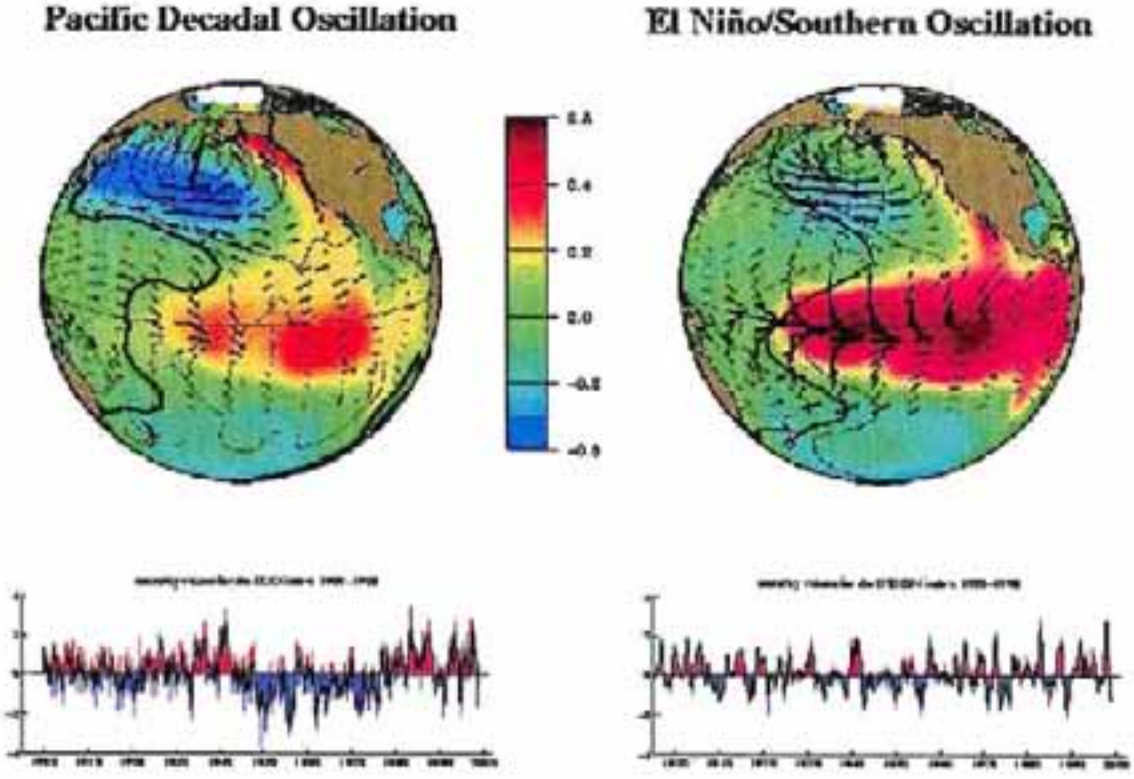


FIGURE 6.4
Long Term Beach Recession (Profile Displaced Landward due to Permanent Sand Loss)

A4 Not to Scale

Umwelt (Australia) Pty Limited
Source: NSW Government, 1986



Legend

SST – Sea Surface Temperature
SLP – Sea Level Pressure
Stress – Surface Wind Stress

Unweit (Australia) Pty Limited
Source: BMRC

FIGURE 6.5
Top:Typ. Warm Phases and Time Series of PDO & ENSO Indices Bottom:Sea Surface Temperatures,Sea Level Pressure and Surfaces Windstress for Warm Phase Indices

A4 Not to Scale | Ref No.:H02_V2/1411_045.cdr

The data used for the study included:

- monthly beach profile data obtained by Short at Narrabeen Beach, Sydney from 1976 to 2000;
- directional wave data (hindcasted and measured) off the Sydney coast as obtained by the Manly Hydraulics Laboratory of the DPWS; and
- SOI data.

Ranasinghe *et al.* (in prep.) concluded that an increase in high-energy wave events with a more southerly incidence during *La Nina* periods may result in accretion of the southern ends and erosion of the northern ends of this type of beach. In this regard, the impact of sea breeze may be relevant also. Conversely, they concluded that the more easterly and less frequent high-energy wave events during *El Nino* periods might result in erosion of the southern ends and accretion of the northern ends of these beaches. The results also indicated that shoreline changes at the southern ends of these beaches might lag behind the changes in SOI by up to 1.5 years while those at the northern ends may respond to SOI fluctuations within three months.

6.1.2.1 Longer Term Beach Changes and Recession in Newcastle

The erosion studies on Stockton Beach done by WBM (1998) and DLWC (1995) did not quantify any coastal processes that result in the erosion or fluctuation of Stockton Beach. The two studies were contradictory in their interpretation of historical shoreline changes and their prognosis for future trends at Stockton Beach. DLWC presents the view that Stockton Beach experiences large fluctuations but no long term recessionary trend of the shoreline is evident (Moratti, 1997). In contrast, WBM (1998) has assumed that recent trends in shoreline recession would prevail for 50 years, albeit at reducing rates.

The WBM (1998) prognosis of continuing long term erosion at Stockton Beach is consistent with the study by Manly Hydraulics Laboratory (PWD, 1977), which identified major aeolian processes as causing long term recession of Newcastle Bight shoreline. However, aeolian forces are relevant to sections of Stockton Bight that are north of Stockton Beach. However, the PWD (1977) study also identified very large shoreline fluctuations at Stockton, which it was suggested may be attributable to major floods on the Hunter River. That assessment, however, was masked by the influence of breakwater constructions at the Hunter River entrance. Although it was recognised that those breakwater constructions have had a major influence on the shoreline configuration at Stockton, it has not been concluded, either by PWD (1977) or by WBM (1998), that the impacts of breakwater construction are completed.

The geological record indicates the major influence that the Hunter River has had on marine sedimentation in Newcastle Bight. The River is considered to be a continuing major influence on the coastal zone. As with major oceanic storms, major floods inject huge amounts of energy and nowadays, to a lesser extent, material into the littoral zone. Engineering works at the River entrance have changed the way those inputs are distributed. Works that have the potential to impact on coastal alignments and sediment supply in the littoral zone include construction of entrance training walls and channel and harbour dredging.

The construction of the Hunter River entrance breakwaters has had a major influence on adjacent coastal alignments. This is reflected in historical records (see **Section 2.3**). That influence is continuing today in a number of ways. Firstly, the breakwaters have interfered significantly with nearshore wave transformation processes, causing the development of a

major curvature in the coastal alignment at the southern end of Stockton Beach. This is expressed in a progradation of the shoreline along the breakwater with concomitant recession of the beach line further to the north. Secondly, and probably more importantly as found elsewhere on the NSW coast (see Nielsen & Gordon, 1980), the breakwater construction would have improved the hydraulic conveyance characteristics of the inlet considerably. This would have led to a marked change in tidal discharge with a concomitant reduction in the extent and level of shoals associated with the river entrance. This would have allowed greater amounts of wave energy to impact on the Stockton foreshore as well as changing the angle of incidence of nearshore waves and result in changes to rates and net amounts of sediment transport and, hence, coastal alignments. Further, a deepening of the entrance, whether by breakwater construction or dredging, would lead to a reduced capacity for sand supply by longshore transport across the entrance bar and onto the beach at Stockton.

Other impacts of dredging include the creation of sinks for marine sand. Artificial deepening of the navigation channels and harbour berths and disposal of that material outside the littoral zone has the potential to create a sediment sink which may be infilled with marine sand. Given that the beach sand wedge is likely to extend to water depths in excess of 20 metres, any channel cut through this active zone has the potential for infilling from adjacent littoral zones. Infilling may be at the expense of the adjacent littoral zone, with drawdown of sediment from adjacent areas including the offshore littoral zone at Stockton. Harbour deepening may also intercept any supply of marine sand reworked by the River during major floods.

A review of available historical hydrographic survey data has indicated significant long term changes occurring at the Hunter River entrance for over a century. These changes have included a progressive lowering of the seabed in the nearshore zone of Stockton Beach. While no detailed coastal process studies have been undertaken to examine these changes, the data have been interpreted based on experience gleaned from studies of other similar estuary entrances.

It has been postulated that the major cause of change to the nearshore and foreshore zone of Stockton Beach can be related to changes made to the configuration of the Hunter River estuary entrance as a result of breakwater construction and the deepening of the entrance channel. Breakwater construction has altered irrevocably the configuration of nearshore shoals offshore of Stockton Beach. This has not only resulted in increasing the level of wave-energy reaching the shore, but also in changing the magnitudes and/or directions of wave-induced littoral currents. These changes have induced foreshore re-alignment, increased beach fluctuations and have resulted in foreshore erosion. Further, the breakwater construction has interrupted the passage of littoral drift to Stockton Beach from the south, which may lead to foreshore erosion. Deepening of the entrance channel has caused a draw down of the adjacent nearshore seabed areas, resulting in foreshore erosion at Stockton Beach.

The photogrammetric study (DLWC, 1995) identified a major accretionary stage of Stockton Beach between 1950 and 1965, which has been followed since by progressive accelerated erosion. Various explanations for this trend shown in the surveys of the subaerial beach sand volumes have been proffered, including major flooding of the Hunter River (Public Works Department, 1977) and medium-term decadal oscillations in wave climate. However, no evidence for these explanations has been proffered. An explanation for this short term accretionary trend observed in the photogrammetry data may lie in the anecdotal evidence of Professor Ron Boyd (Dept. of Geology, Uni. of Newcastle), a long term resident of Stockton Beach since early childhood, who has recalled massive sand nourishment of the beach occurring during the entrance dredging operations being undertaken in the 1960s.

The acceleration in the potential erosivity of the Stockton foreshore, as indicated by numerical modelling (refer to “Shifting Sands at Stockton Beach” report within the Reference Document), has been reflected in the historical shoreline change analysis

presented in DLWC (1995). While the severity of the 1974 "*Sygna*" storm may yet to be repeated, DLWC (1995) has attributed what appears to be a recent acceleration in beach erosion throughout the 1990s to the occurrence of severe storms during that period. As indicated by the SBEACH modelling, should the observed trend in change to the nearshore morphology continue, progressively greater erosion of the beach can be expected with even regular storm activity.

The current trend of foreshore recession experienced at Stockton Beach is likely to be progressive rather than cyclic. Further, the erosivity of the foreshore at Stockton is likely to increase with time, thereby resulting in an ever-increasing risk to development located there. Clearly, a considerable amount of further investigative work will be required before a full understanding emerges of the processes that are causing sand transport, beach erosion and longer-term shoreline changes at Stockton Beach.

6.1.3 Coastal Process Hazards

The coastal process hazards can be delineated by lines on a map defining the zones of land under threat. Typically, these include areas of dune erosion and inundation. Because coastlines, often, are changing with time, the threat of coastal erosion hazard is likely to vary with time. For this reason, the hazard lines are prepared for the current situation and estimates for the future are based on trends derived from a coastline hazard definition study. Such a study has been completed for the Newcastle City coastline by WBM Oceanics Australia (1998). In the following, the delineation of coastal process hazards is summarised from that study.

WBM Oceanics Australia (1998) did not present any hazard definition lines for the southern beaches. The basis for this was that the storm erosion demand would erode the sand back to the rock basement levels, which would result in the removal of the sand from these beaches while not causing any back beach recession scarp.

The lack of development on Burwood Beach obviated the construction of hazard lines there (WBM, 1998). For Burwood Beach, WBM (1998) presented the various components and resulting hazard line distances, in **Table 6.1**.

Table 6.1 - Burwood Beach Erosion Hazard Line Definition

Component	Immediate	50 year
	2000	**2050**
Short Term (m)	40	40
Long Term (m)	5	5
Greenhouse (m)	0	8
Total (m)	45	53
Adopt (m)	**45**	**55**

For Stockton Beach, WBM (1998) constructed an immediate (2000) erosion hazard zone for storm scour (**Table 6.2**). The width of this zone varied from 0 metres at the breakwater to 5 metres at the southern end of the seawall. North of the seawall it was set to 10 metres. South of the seawall to the Surf Club, the seaward boundary of this zone was defined by a continuous smooth line located 5 metres landward of the 1952/99 erosion escarpments, increasing to 15 metres at the breakwater. North of the seawall, it varied from 5 metres at the seawall to 15 metres at the sewerage ponds.

Table 6.2 - Stockton Beach Erosion Hazard Band Definition Relative to 1999 Erosion Scarp

North of Seawall (At Sewage Ponds)	Immediate (2000)		50 Year (2050)		
	Min	Max	Min	Best	Max
Reference Line	10	10	10	10	10
Short Term (m)	5	15	5	10	15
Long Term (m)	0	0	0	29	48
Greenhouse (m)	0	0	8	8	8
TOTAL (m)	15	25	23	57	81
ADOPTED (m)	**15**	**25**	**25**	**55**	**80**

North of Seawall (Child Care Centre)	Immediate (2000)		50 Year (2050)		
	Min	Max	Min	Best	Max
Reference Line	0	0	0	0	0
Short Term (m)	5	15	5	10	15
Long Term (m)	0	0	0	29	48
Greenhouse (m)	0	0	8	8	8
TOTAL (m)	5	15	13	47	71
ADOPTED (m)	**5**	**15**	**15**	**45**	**70**

South of Seawall	Immediate (2000)		50 Year (2050)		
	Min	Max	Min	Best	Max
Reference Line	0	0	0	0	0
Short Term (m)	5	10	5	7.5	10
Long Term (m)	0	0	0	10	19
Greenhouse (m)	0	0	8	8	8
TOTAL (m)	5	10	13	25.5	37
ADOPTED (m)	**5**	**10**	**15**	**25**	**35**

At Surf Club	Immediate (2000)		50 Year (2050)		
	Min	Max	Min	Best	Max
Reference Line	0	0	0	0	0
Short Term (m)	5	10	5	7.5	10
Long Term (m)	0	0	0	0	10
Greenhouse (m)	0	0	8	8	8
TOTAL (m)	5	10	13	15.5	28
ADOPTED (m)	**5**	**10**	**15**	**15**	**30**

Table 6.2 - Stockton Beach Erosion Hazard Band Definition Relative to 1999 Erosion Scarp (cont)

At Breakwater	Immediate (2000)		50 Year (2050)		
	Min	Max	Min	Best	Max
Reference Line*	10	10	10	10	10
Short Term (m)	5	5**	5	5	5**
Long Term (m)	0	0	0	0	0
Greenhouse (m)	0	0	8	8	8
TOTAL (m)	15	15	23	23	23
ADOPTED (m)	**15**	**15**	**25**	**25**	**25**

* *Follows approximately the re-constructed dune crest centre line.*

** *There is evidence of additional erosion by secondary effects immediately adjacent to the breakwater probably due to wave reflections. Monitoring of this area during storms is required to ensure prompt remedial action in the event of imminent dune breakthrough.*

WBM (1998) presented a prognosis for ongoing erosion at Stockton Beach, which included an allowance for recession, associated with a sea level rise attributable to the *Greenhouse Effect*. Accordingly, WBM (1998) constructed a 2050 erosion hazard zone with width that varied from 0 metres at the breakwater to 20 metres at the southern end of the seawall and which was set to 55 metres north of the seawall. South of the seawall to the Surf Club, the seaward boundary of this zone was defined by a continuous smooth line located 15 metres landward of the 1952/99 erosion escarpments, increasing to 25 metres at the breakwater. North of the seawall, it varied from 15 metres at the seawall to 25 metres at the sewerage ponds.

The prognosis for future erosion proffered by WBM (1998) is unlikely to have taken account of the accelerating increase in the potential for storm erosion at Stockton Beach. While WBM (1998) recognised that "the erosion rate over recent years has been much higher than average" it advised that "there is a reasonable chance that the present general trend of erosion may reduce or reverse at some future time".

The future hazard assessment made in WBM (1998) was predicated on the assumptions that:

- *"the adopted trend of shoreline retreat will continue unchanged for the next 20 years;*
- *shoreline retreat will then progress at a rate of 50% for the following 30 years (to 50 years), reducing to zero thereafter; and*
- *a transition zone exists south of the Mitchell Street seawall with shoreline retreat rates reducing both along the beach (towards the south) and in time as outlined above".*

The prognosis now, as ascertained from the analysis and interpretation of the long term changes in the seabed morphology and numerical beach erosion modelling (refer to "Shifting Sands at Stockton Beach" report within the Reference Document), is not consistent with that presented in the Newcastle Coastline Hazard Definition Study (WBM, 1998). It can be expected that the recent higher-than-average erosion rates are likely to increase at an accelerating rate under large wave activity and the threat to development at Stockton Beach will increase with time. The level of risk, however, has yet to be quantified. Nevertheless, it can be assumed that the hazard definition presented in WBM (1998) is likely to be a significant underestimate of what, realistically, may occur.

For the southern developed beaches (except for Burwood Beach), the long term limit of erosion was defined by the bedrock outcrops or constructed seawalls.

6.1.4 Risks Resulting from Foreshore Erosion and Recession

6.1.4.1 General

Progressive foreshore recession and storm erosion, ultimately, may result in a threat to development on unconsolidated foreshores. The risk to development will vary depending upon its situation and proximity to the beach.

The definition of hazard risk levels on coastal foreshores has been adopted from Nielsen *et al.* (1992). The application of the stability assessment is presented schematically in **Figure 6.6**. A number of zones are delineated; a *Zone of Wave Impact*, a *Zone of Slope Adjustment*, a *Zone of Reduced Foundation Capacity* and a *Stable Foundation Zone*.

The *Zone of Wave Impact* delineates an area where any structure or its foundations would suffer wave attack during a severe storm. It is that part of the beach that is seaward of the dune erosion escarpment.

A *Zone of Slope Adjustment* encompasses that portion of the seaward face of the dune that would slump to the natural angle of repose of the dune sand following removal by wave erosion of the design storm erosion demand. That presents the steepest stable dune profile under the conditions specified.

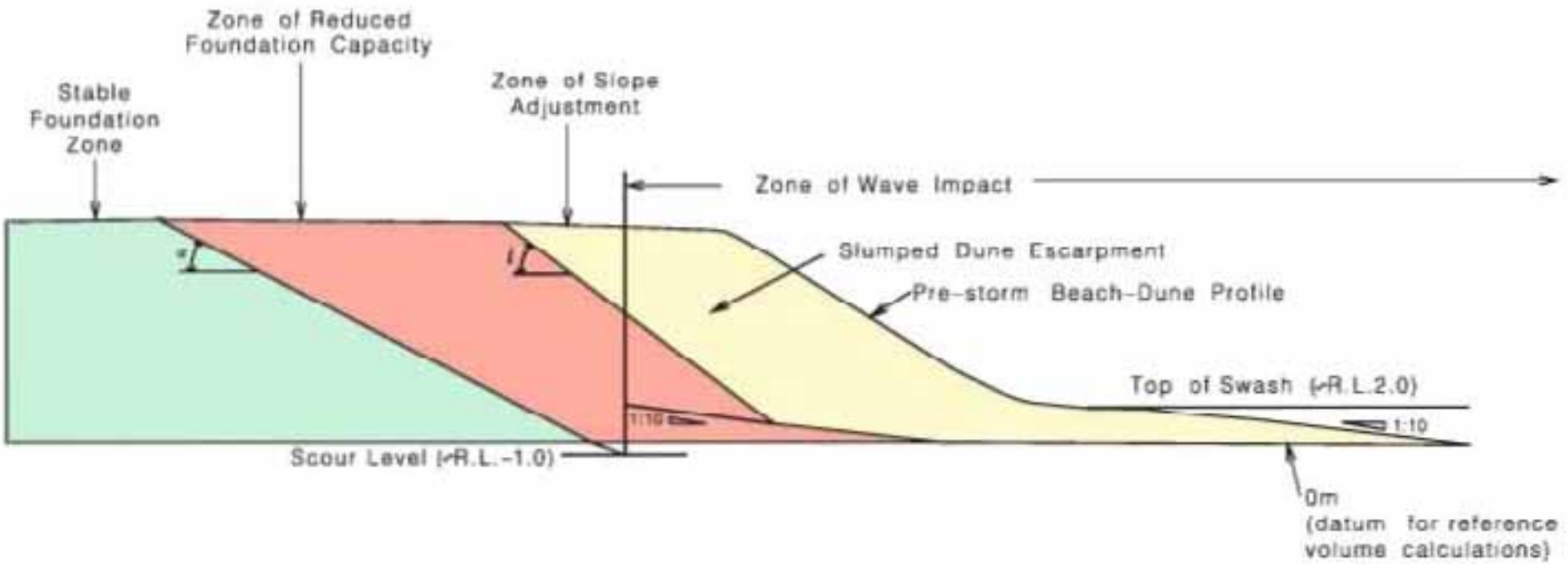
WBM (1998) defined a hazard band that circumscribed a level of uncertainty that WBM had assessed for the definition of the storm erosion hazard. The landward boundaries of the "Beach Erosion Hazard Bands", as defined in the Newcastle Coastline Hazard Definition Study (WBM, 1998), were taken to define the landward limit of the *Zone of Slope Adjustment*.

A *Zone of Reduced Foundation Capacity* for building foundations takes account of the reduced bearing capacity of the dune sand adjacent to the erosion escarpment. It was considered that structural loads should be transmitted only to soil foundations outside the zone within which the Factor of Safety was less than 1.5 during extreme scour conditions at the face of the dune. This allows for the design assumption that the soil may develop its full bearing capacity.

Typical geotechnical properties for normally consolidated dune sands are provided in **Figure 6.6**. Typical beach scour levels are around –1 m AHD (Nielsen *et al.*, 1992). The reduced levels of the back beach areas at Stockton Beach are around 5 m AHD for areas north of the surf club reducing to 4 m AHD at the Caravan Park (DLWC, 1995). For these parameters, the width of the *Zone of Reduced Foundation Capacity* has been determined as 13 metres for areas north of the surf club, reducing to 9 m at the Caravan Park.

Structures not piled and located within the *Zone of Slope Adjustment* and seaward may be subject to foundation failure (soil slip and subsequent undermining) associated with a severe storm erosion event. Foundations for structures within the *Zone of Slope Adjustment* should comprise piles embedded to a sufficient depth within the *Stable Foundation Zone* to develop within that zone adequate capacity to support the vertical loads applied by the structure and differential horizontal soil pressures on the piles from the soil above the wedge failure plane (Nielsen *et al*., 1992).

For the same conditions, landward of the *Zone of Slope Adjustment* structures not adequately piled would be founded in a zone that could be considered to have an inadequate factor of safety (*Zone of Reduced Foundation Capacity*). Foundations for structures within this zone



Angle of response of dune sand: $i \sim \phi \neq 34^{\circ}$

Safe angle of response of dune sand: $\alpha = \tan^{-1}\{(\tan\phi)/1.5\} \neq 24^{\circ}$

All levels to AHD

FIGURE 6.6
Stability Zones for Dune Erosion Delineating the Degrees of Risk to Foreshore Development

A4 Not to Scale | Ref No: R02_W2/1411_047.dgn

Cowell (Australia) Pty Limited
Source: After Nielsen et al., 1992

should comprise piers embedded to a sufficient depth within the *Stable Foundation Zone* to develop within that zone the capacity to support the vertical loads applied.

6.1.4.2 Hazard Risks at Stockton Beach

The coastal hazards, as described above, have been applied to delineate the hazard risks at Stockton Beach, which is the only precinct of the study area exposed to such risks. Zones of beach erosion risk for conditions based on WBM (1998) are presented in **Figures 6.7** and **6.8**. South of the seawall, it would appear that there is a high risk to some 170 metres of Mitchell Street and there is a high risk to much of Dalby Oval. Further south, the surf club facilities, both new and old pavilions including the car park, are under direct threat as are the cabins of the caravan park, notwithstanding the healthy dune that has been re-established there. Further, much of the foreshore reserve is at high risk of being lost to erosion.

At present there is no development under direct threat of storm erosion north of the seawall, except for the most-seaward pond of the Wastewater Treatment Plant. The day care centre is located within, but on the boundary of, the *Stable Foundation Zone* for current conditions.

Zones of beach erosion risk for the year 2050 based on WBM (1998) are presented in **Figure 6.9** and **6.10**. South of the seawall, numerous beachfront properties in the block between Pembroke Street and Hereford Street are affected by the erosion hazard. Mitchell Street extending past and including the War Memorial would be at high risk under the WBM (1998) scenario of future erosion. This 2050 zone of high risk extends southward to include the surf club facilities and encroaches onto significant areas of the Caravan Park.

North of the Stockton seawall (**Figure 6.10**), the hazard risk zones affect the Day Care Centre directly with affectation to numerous properties on the western side of Barrie Crescent and Eames Avenue. The erosion risk has extended father into the second pond of the Wastewater Treatment Plant.

However, in light of the recent investigations discussed in **Sections 6.1.2.1** and **6.1.3** (Shifting Sands at Stockton Beach), the hazard risk at Stockton Beach is likely to be exacerbated. As a result, the hazard risk will need to be further assessed as part of additional studies into the stability of Stockton Beach.

6.2 EXISTING COASTLINE INFRASTRUCTURE

6.2.1 Composition of Coastline

The Newcastle coastline comprises approximately:

- 4.9 kilometres on unprotected beach of which approximately 3.2 kilometres of Stockton Beach is badly eroded and requires urgent attention (as discussed in **Section 6.1**).

- 3.3 kilometres of cliff line and associated rock platforms. Sections of the cliff line are unstable and present hazards to road users and pedestrians (discussed further in **Section 6.4**). Approximately 450 metres of the toe of the cliff line is protected by a seawall.

- 3.5 kilometres of seawall or rock seawall or sandbag wall that protects infrastructure including surf clubs; roadways, pathways and parking areas; picnic areas, roller skating areas and residences (discussed in this section).

- 2.2 kilometres of breakwater (discussed in this section).

FIGURE 6.7
Immediate (2000) Zones of Beach Erosion Risk Stockton Beach (South)

A4 Scale: 1:5000 | Ref No.:R02_V2/1411_049.dgn

FIGURE 6.8

Immediate (2000) Zones of Beach Erosion Risk Stockton Beach (North)

A4 Scale 1:5000 | Ref No :R02_V1/1411_058.dgn

Legend

- Zone of Wave Impact & Slope Adjustment
- Zone of Reduced Foundation Capacity
- Stable Foundation Zone

Umwelt (Australia) Pty Limited
Source: SMEC

FIGURE 6.9
50 Years (2050) Zones of Beach Erosion Risk Stockton Beach (South)

A4 Scale: 1:5 000 | Ref No::R02_V2/1411_055.dgn

FIGURE 6.10
50 Years (2050) Zones of Beach Erosion Risk Stockton Beach (North)

A4 Scale: 1:5 000 | Ref No.: R02_V2/1411_056.dgn

Some of the infrastructure is of historic significance. Since settlement of Newcastle, considerable money and resources has been expended on the development and maintenance of coastline infrastructure and on the protection of adjoining properties. In many instances this infrastructure is showing signs of fatigue and disrepair despite evidence of ongoing maintenance (WBM, 2000a).

Structures present in the immediate coastal zone include seawalls, surf clubs and pavilions, ocean baths and residences. Seawall structures have been constructed along developed areas of the Newcastle coastline to limit landward erosion, protect structures such as surf clubs and pavilions and to provide roadway access. Recreational activities have resulted in the construction of ocean baths as well as surf club and associated structures (WBM, 2000a).

The seawalls in the Newcastle area are predominantly rigid and impermeable structures. Newcastle Beach, Bar Beach and Merewether Beach have various vertical concrete block and sandstone wall revetments. Many of these structures are old, show advanced stages of deterioration and require maintenance. In contrast to the situation at Stockton Beach, none of the other seawalls appears to be having any adverse impacts on the beach amenities. They are vertical or near vertical in profile (gradients of 1H in 10V or greater) and mostly founded on rock (WBM 1998).

6.2.2 Emergency Response and Interim Action

The management and maintenance of existing infrastructure is a major part of the coastal management program for Council. Prior to the commencement of the Coastline Management Study and Plan, a draft *Newcastle Coastline Emergency Response and Interim Action Plan* (ERIAP) was prepared by WBM Oceanics Australia (WBM, 2000). This provided an interim action framework that addressed the higher risk issues identified in the *Newcastle Coastline Hazard Definition Study* (WBM, 1998). However, the ERIAP addressed the management and maintenance issues of Newcastle's coastline infrastructure, to better guide Council in its decision making regarding those coastal risks, for the short and long term.

The ERIAP collated the key findings and recommendations of the *Newcastle Coastline Hazard Definition Study* into the following broad categories:

1. General considerations and investigation and review, regulation of works and activities.

2. Emergency Response issues.

3. Interim Actions.

However, at the time of drafting this Coastline Management Study, the ERIAP and Coastline Management Study and Plan are being progressed simultaneously. As a result, NCC decided to further develop the implementation framework for the components of the emergency response and interim actions of the draft ERIAP by redistributing them into three existing programs, as follows:

1. The Emergency Response issues and actions in the ERIAP will be further developed and transferred into the Newcastle Disaster Management Plan (DISPLAN) framework.

2. The Interim Action component of the ERIAP, as identified, principally addresses structural aspects of coastal infrastructure including built and natural assets. Many of these issues are currently addressed as components of Council's Major Asset Presentation Program (MAPP).

   The MAPP is an on-going asset management program that will ensure that Council's coastal asset management responsibilities are resourced and actioned according to priority.

3. The other components of the ERIAP, such as the general considerations, actions relating to assets not under the control of Council (e.g. Stockton Wastewater Treatment Plant), general principles of coastal management, recommended investigation and review processes, and other potential issues with the ERIAP are to be considered by the Coastline Management Study and Plan.

In light of the above, only a brief account of the status of Newcastle's coastline protective structures and other infrastructure is provided in **Sections 6.2.3**, **6.2.4** and **6.2.5**. A more detailed examination of the structures remains in the *Newcastle Coastline Hazard Definition Study* (1998). Furthermore, only the relevant management issues and options regarding existing coastline infrastructure, not those now dealt with by the DISPLAN and MAPP, are summarised in **Sections 7.0** and **8.0**.

6.2.3 Coastline Protective Structures

Stockton Beach

Two seawalls have been constructed at Stockton Beach. A rock wall extends along Mitchell Street between Pembroke Street and Stone Street (refer to **Plate 3** in **Section 4.2**) while a sandbag wall has been constructed seaward of the Stockton Surf Life Saving Club.

A rock seawall was constructed along part of the beach at Stockton in 1989 to protect some 600 metres length of Mitchell Street north from Pembroke Street. The structure was designed by NSW Public Works, Coast & Rivers Branch for NCC. Sections of the seawall appear now to be far steeper than as shown in the design drawings and parts of the structure have subsided. It would appear now that some maintenance work for the seawall is required.

The Stockton seawall has prevented erosion of this section of Mitchell Street north from Pembroke Street. However, the rock revetment has been outflanked on both its northern and southern flanks. At present, to the north of the seawall, the dune in front of the Day Care Centre has receded well beyond the alignment of the seawall. It would be valid to conclude that the presence of the seawall has exacerbated erosion in front of the Centre. However, had it not been for the seawall, it would appear that sections of Mitchell Street are likely to have been damaged severely from erosion.

To the south of the revetment, Mitchell Street is, progressively, coming under direct threat of storm erosion. At present, a 75 m length of Mitchell Street warrants protection.

The revetment itself has subsided significantly at various locations. The damage that has been observed is far greater than that which could have been expected under a normal maintenance program.

A seawall made of geotextile bags was installed in 1996 around the Stockton surf club as a temporary measure to protect the building from storm erosion. While successful in protecting the building to date, it would appear that this structure also exacerbates erosion of the adjacent beach. This protection will come under significant threat during future storms. The revetment is becoming outflanked as recession proceeds on either side of the structure. The geotextile sandbags have only a limited capacity to withstand wave attack. While they will afford a modicum of protection during severe storms, they will not provide adequate protection to the building against an extreme storm event.

Nobbys to Ocean Baths

From Nobbys Beach to Ocean Baths the seawall (up to 3 metres in height) is mostly founded on the sandstone rock platform. The wall comprises mostly an older mass concrete structure with sandstone aggregate with some newer sections. Examination of historical photos by WBM (1998) indicated that the seawall was constructed along the rock platform and backfilled to form Shortland Esplanade with the base of the original cliff along the western edge of the roadway.

The seawall (apart from Chainage 45 metres to 80 metres) is maintaining its structural integrity (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

Ocean Baths to South Newcastle

The coastline from Newcastle Ocean Baths to South Newcastle is protected by a number of seawall structures, ranging from old sandstone block walls to high concrete gravity walls and new stepped profile concrete walls.

Where Shortland Esplanade narrows through to King Edward Park, a substantial seawall structure has been constructed for support of the roadway. The wall ranges from about five metres to nine metres in height, is vertical in profile and founded on rock (WBM, 2000a).

The seawall structures from Newcastle Ocean Baths to South Newcastle are highly variable in composition and integrity with localised repair and replacement of wall sections having been undertaken as required. The current maintenance practices mainly consist of repair as needed when sections of a wall deteriorate or storm damage occurs.

The seawalls are maintaining their structural integrity (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

Bar Beach

The seawall at Bar Beach extends from the base of the cliff below the car park through to the southern end of the surf club. At the northern end of the new pavilion, a sandstone block wall up to 2.5 metres in height occurs above a picnic area (WBM, 2000a).

The seawalls are maintaining their structural integrity (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

Dixon Park

A rock rubble seawall buried in the back of the beach at Dixon Park is lining a clayey bluff and is protecting the surf club buildings and car park. Most of the time the structure is buried in sand and has a vegetative cover. This, unlike the existing wall at Stockton, makes it unobtrusive.

The seawall is maintaining its structural integrity (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

Merewether Beach

Rigid seawall structures at Merewether Beach extend from the baths through to the northern end of the surf club on John Parade. The structures comprise:

- sandstone block walls with blocks set in a mortar bed;
- sections of old mass concrete with sandstone rock aggregate; and
- new stepped mass concrete wall in front of Merewether Surf Club.

The seawalls are maintaining their structural integrity (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

6.2.4 Ocean Pools and Structures

The ocean bath structures have been constructed on the sandstone rock platforms within the wave zone. The concrete structures are frequently over topped by waves during storm events and at high tide. The baths have a high level of public utilisation and are considered by large sections of the Newcastle public as landmark structures (WBM, 2000a). The pools and structures include:

- Newcastle Ocean Baths;
- Bogey Hole Baths;
- Ladies' Baths, Merewether; and
- Merewether Baths.

No significant deterioration or structural inadequacy was noted in a walk over survey of the bath structures. The outer concrete walls show only limited corrosion and are founded directly on the sandstone rock surface in tight contact with little or no erosion evident at the concrete / rock interface. Ongoing settlement and wash out of loose sandy backfill material from beneath pool deck areas is resulting in some cracking of concrete pavements and the need for maintenance (WBM, 2000a).

The ocean pools and structures are all structurally sound (WBM, 2000a), however, a number of maintenance issues exist that will be addressed as part of Council's MAPP.

6.2.5 Surf Clubs and Buildings

Buildings within the immediate coastal zone comprise surf clubs and related structures with only limited residential structures present.

The only structures under threat at present from storm damage or loss of foundation support through erosion are the structures at Stockton such as the surf club which are founded on deep sand profiles. The remaining surf club structures are protected by seawalls and rock platforms with most founded down onto rock (see **Table 6.3**). The integrity of the seawall structures is integral to the long term protection of these structures from storm damage.

Due to the harsh nature of the immediate coastal environment, construction materials are subject to extreme corrosion levels requiring a high degree of maintenance and appropriate material selection in design.

Table 6.3 - Surf Club Structures

Surf Club	Seawall Protection	Foundations	Location
Stockton	Sandbag wall	High level in sand	Foredune
Nobbys	Old rigid wall	Rock?	On beach, rock platform
Newcastle	New stepped rigid wall	Rock	On beach, rock platform
Bar Beach	Old and new rigid walls	Rock	On beach, rock platform
Dixon Park	None	Clay?	Footslopes of low hill
Merewether	Old and new rigid walls and rock wall	Rock?	Foredune on rock platform

Stockton Day Care Centre, Surf Club and Caravan Park

The above structures are founded on high level pad or slab footings bearing directly onto the sand. Available geotechnical information suggests that the subsurface profile at these sites comprises 10 metres to 20 metres of medium dense to dense sand over clay with rock at a depth of about 30 metres to 40 metres (WBM, 2000a).

The management and maintenance of these structures requires further works to either the existing seawalls and/or other actions. A number of maintenance issues exist that will be addressed as part of Council's MAPP and **Sections 7.0** and **8.0** of this Study.

Newcastle Port Corporation Buildings (State Government), Nobbys

The lighthouse and signal station structures on Nobbys Headland are founded on rock and residual clay soils. The risk posed to the buildings associated with cliff line erosion and instability is very low considering a current erosion rate of about 15 mm per year. The closest structure is about 2.5 metres from the cliff crest and comprises an old storeroom. A brick fence at the south eastern corner of headland is starting to become undercut by cliff erosion and will require remedial works in the short term (WBM, 2000a).

Any maintenance issues regarding the buildings are the responsibility of the Newcastle Port Corporation.

Nobbys Surf Club

Nobbys Surf Club is located at the toe of the north eastern end of Fort Scratchley with rock slopes rising to the rear of the club and Shortland Esplanade with the club protected by a concrete seawall. Filling of the rock platform and construction of seawalls formed the area along Shortland Esplanade. This was preceded by the construction of the seawall to Nobbys Headland, which resulted in sand deposition in the area of the surf club. The extent to which the surf club is founded over fill materials or sand deposits is unknown, however the performance of the structure suggests that foundations have most likely been taken to rock (WBM, 2000a).

The integrity of the Surf Club is enhanced by maintenance of the existing seawall, which will be addressed as part of Council's MAPP.

Newcastle Surf Club

Redevelopment of Newcastle Surf Club and pavilion has involved taking all foundations to rock and the construction of a stepped concrete seawall (WBM, 2000a).

The integrity of the Surf Club is enhanced by maintenance of the existing seawalls, which will be addressed as part of Council's MAPP.

Bar Beach Surf Club and Pavilion

The older Bar Beach Surf Club structure and the newer beach pavilion and tower are founded on rock using a combination of pad, pier and buttress footings. Site investigation for the new pavilion encountered rock at a level of about 3 to 4 m AHD (WBM, 2000a).

The older surf club structure is situated directly on the beach with the eastern facing wall supported by a continuous footing that acts as a seawall. The integrity of the Surf Club and pavilion rely on the maintenance of the existing seawall, which will be addressed as part of Council's MAPP.

Dixon Park Surf Club

Dixon Park Surf Club is situated on gentle slopes at the base of a low hillside area that rises to the north west behind the fore dunes. The buildings appear to be supported on high level footings that occur in clayey residual soils with possibly some sandy soils at the southern end of the structure. The building is located about 20 metres behind the foredunes at an elevation of about RL 14 metres.

The integrity of the Surf Club is enhanced by maintenance of the existing rock seawall, which will be addressed as part of Council's MAPP.

Merewether Surf Club, Surf House and Pavilion

Merewether Surf Club is located at the northern end of the rock platform on a low sand hill situated at the rear of the beach. It is unknown whether the club is founded on high level footings in the sand or on piers taken through the sand to rock which is likely to occur at a depth of about 3 metres to 5 metres (WBM, 2000a).

The club structure was threatened by severe sand erosion during the 1974 storm event. Remedial works subsequently undertaken included construction of a rock wall in front of and to the north of the club and a concrete retaining wall in front of the club (WBM, 2000a).

The derelict surf house structure is situated on a terraced bank that rises from the rock platform to the bath access road. The structure is likely to be founded on residual soil or rock with rock likely to be encountered at shallow depth across the bank in front of the structure (WBM, 2000a).

An open beach pavilion structure has recently been constructed along the promenade directly above the lower seawall, which is about 1.5 metres in height and constructed of sandstone blocks. The structure is founded on concrete pads bearing directly onto the corners of the seawall.

The integrity of the Surf Club, Surf House and Pavilion rely on maintenance of the existing seawall, which will be addressed as part of Council's MAPP.

6.2.6 Stormwater Outlets and Water Quality

6.2.6.1 Stormwater Outlets

Extensive modification of Newcastle's coastal catchments through urbanisation has led to the replacement of natural drainage systems with concrete drains. These drains transport and deposit sediments, rubbish, heavy metals, oil, bacteria, nutrients and other chemicals into our coastal waters. The stormwater system for Newcastle has evolved with the development of Newcastle since the first drains were constructed in 1888, and as a result, the infrastructure is relatively fixed in its current locations.

The NCC Stormwater Management Plan (2000) identified twelve major stormwater drainage outlets in the coastal zone discharging directly onto adjacent beaches and headlands. Several other stormwater discharge locations associated with small local catchments were identified in the study area, discharging over cliff faces and rock platforms. The twelve major discharge points (**Figure 6.11**) are situated at the following beaches:

- Merewether Beach (2).
- Dixon Park Beach (1).
- Bar Beach (2).
- Susan Gilmore Beach (1).
- South Newcastle Beach (1).
- Newcastle Beach (1).
- Cowrie Hole (1).
- Nobbys Beach (1).
- Stockton Beach (2).

The coastal stormwater discharges can form ponds when the beach is in a depositional phase with a high beach berm preventing water from flowing into the ocean. The quality of the stormwater runoff in terms of bacterial and virus counts is still not determined and has been identified as part of Council's data gap (Newcastle City Council 2000). However, parents often see these ponds as a safe alternative for their children to swim in, and as a result, put their children in danger of contracting water borne diseases if contaminated stormwater is an issue.

Water quality sampling has been undertaken by Hunter Water in the Coastal Zone. Numerous data collection days by Streamwatch volunteers has also occurred. Preliminary results of the Streamwatch project indicate that the levels of phosphorus are routinely high in the city, while Council and Hunter Water did analysis and confirmed the impact of faecal contamination in stormwater flows that reach the beach.

Council has undertaken water quality testing at the saltwater baths for many years and results over the previous year indicate 100% compliance level against faecal coliform standards.

Despite the relatively small size of the catchments situated along the coastal zone, stormwater discharges during periods of high rainfall have caused erosion and scouring of receiving beaches, decreasing amenity and the quality of coastal waters, while posing a threat to community safety through the potential collapse of eroded banks. The Stormwater Management Plan also identified the lack of water quality information in regard to pathogens in urban stormwater, an issue which raises implications for public health and safety.

Newcastle City Council is presently implementing part of its Stormwater Management Plan, through the "Where the Source meets the Sea Project", for which it has received grant funding from EPA Stormwater Trust. The project includes the installation of drainage pit screens to keep litter (including cigarette butts) out of stormwater drains and therefore out of the ocean. Litter is collected by street sweeper on a daily basis. These devises are being installed in Fort Drive, Shortland Esplanade and some carpark areas at Nobbys. Some pits also contain absorbent material to collect oils and grease from the roads.

Legend

- 1 Stormwater Outlet Locations
- Stormwater Outlet Catchment

Umwelt (Australia) Pty Limited
Source: NCC Stormwater Management Plan (2000)

FIGURE 6.11
Catchments – Major Stormwater Outlets

A4 Scale 45: 000 | Ref No.:R02_V2/1411_103.dgn

In addition, drainage that previously outletted directly onto Nobbys Beach has been redirected, via pit screens to a sandfilter device in the park behind Horseshoe Beach. A sediment trap collects sand and silt sized particles prior to water entering the sandfilter which uses 'bioremediation' to break down oils and grease, heavy metals, nutrients and bacteria that may be present in the stormwater. A gravel trench is attached to the end of the sandfilter to facilitate infiltration and act as a bypass during large rainfall events.

All devices are being trialed and may be installed at other locations throughout the city. A community education program is an also an integral part of the project, and includes surveys, community art, a Dunecare group, workshops.

6.2.6.2 General Water Quality

Sewage outfalls and stormwater runoff introduce an artificial source of nutrients into the marine environment. Previous studies have found that the increase in nutrients can cause a change in the species composition of macroalgae on rocky shores. Species with high tolerance limits and opportunistic species (e.g. *ulva*) tend to dominate the affected shores, quickly recolonising areas where other species die back. The removal of the nutrient source does not always result in the affected habitat returning to its natural state due to a lack of available space for the previous inhabitant species to recolonise.

Burwood Beach and Stockton wastewater treatment plants currently discharge effluent to the ocean, although the Stockton facility is due for decommissioning in 2002. Burwood discharges secondary treated effluent through deep-water outfall, while Stockton discharges secondary treated effluent through a near-shore outfall. According to the Newcastle Council's State of Environment Report 1998/99, during strong southerly storm events, effluent from Burwood tends to move onshore toward Merewether Beach area, thus reducing the water quality of the beach.

Water quality is regularly monitored for recreational usage by Hunter Water and the Environmental Protection Authority (EPA) under its 'Beachwatch' program. The Beachwatch program was established in 1989, and the Hunter region was added to the program in 1996. It involves routinely monitoring and reporting bacterial levels, in order to determine water quality at key recreational sites such as beaches. Beachwatch uses two types of indicator organisms, faecal coliforms and enterococci, to measure recreational water quality, as recommended by the National Health and Medical Research Council (NHMRC) and the Australian and New Zealand Environment and Conservation Council (ANZECC).

According to the Beachwatch Annual Report (2000), the Hunter Region beaches continue to be the cleanest group of beaches monitored as part of the Sydney, Hunter and Illawarra Beachwatch program. All Newcastle ocean beaches recorded 100% compliance with water quality criteria for the NHMRC primary bacterial indicator faecal coliforms, and for the secondary indicator, enterococci, for the entire summer 1999-2000 season. This compares favourably with the previous summer (1998-1999) when two Newcastle Beaches, Merewether and Burwood south, recorded compliance with enterococci criteria of 92% and 96%, respectively.

Newcastle and Merewether Baths are also tested every Wednesday for faecal coliform bacteria and assessed against aesthetics quality criteria. Results over the previous year indicate 100% compliance against recommended health standards (Newcastle City Council 2000).

During heavy rainfall and flood events the discharge of silt and pollution from the Hunter River does impact upon the water quality of the beaches near to the mouth of the river, in particular, Stockton Beach. While there is little that can be done once this has reached Newcastle's beaches, improved catchment management practices in the catchment of the Hunter River can assist in addressing this issue.

6.3 CLIFF AND BLUFF STABILITY

The coastal cliffs of the Newcastle area occur in a dynamic coastal environment where exposure to the harsh marine conditions results in erosion and cliff regression. The propensity for rock and soil materials to erode is related to their physical properties and structure. As rock breaks down under the influence of mechanical and physical weathering it becomes more susceptible to erosion under the action of running water and wind. The erosion potential of soils is significantly reduced by the presence of vegetation and significantly increased by concentration of surface water flow (WBM, 2000).

The concentration of stormwater run-off discharge along some cliff areas has resulted in localised erosion (King Edward Park, Susan Gilmore Beach access track and Hickson Street).

Long term erosion and cliff line regression is the cumulative result of both ongoing breakdown and erosion of the soils and rock together with small scale temporal instability events such a rock falls and slides. The hazard from long term erosion is in relation to the progressive loss of utilisable property and support for structures following cliff line regression (WBM, 2000).

Evidence of past instability in the form of rock fall debris can be observed at the base of each of the coastal cliff sections (WBM, 2000). Areas where specific cases of cliff instability have been noted and documented include:

- Fort Scratchley where rotational sliding of fill and clay soils at the crest of the slope above Fort Drive has occurred and some minor regrading works undertaken.

- Shortland Esplanade between Nobbys and Ocean Baths where rock bolting was undertaken to reduce the risk of rock falls onto the roadway.

- Shortland Esplanade at South Newcastle Beach where preliminary works (drainage, barrier fencing) has been undertaken to minimise the risk and impact of rock falls. Slope processes and stability issues have been assessed along this section of the cliff by consultants SMEC (1991 and 1996) and RCA (1998) and slope stabilisation and improvement works outlined.

- Dixon Park at the end of Kilgour Avenue where a rock fall of sandstone blocks onto the beach occurred in June 1997 and the toe of the cliff was fenced off.

- Merewether Beach where loose blocks and rock falls in the cliff below Hickson Street were documented in 1981 by

- engineering staff and remedial options assessed.

A summary of the cliff and bluff instability hazards from WBM (1998) are as follows:

Nobbys Headland

Cliff instability associated with rock block falls.

Nobbys to Newcastle Ocean Baths

Areas of potential instability occur in the section to the east of Nobbys Surf Club where a steeply battered fill embankment occurs along Fort Drive. Some localised minor slumping may occur following rainfall events.

Localised small scale slumping has occurred in the past in fill and residual soils below Fort Drive and the presence of steep slopes in soil strength materials indicates that there is a risk of further small scale localised instability at this location.

Shortland Esplanade (South Newcastle Beach/King Edward Park)

Periodic rock falls along Shortland Esplanade have been occurring since the road was constructed, and the risk of further rock and debris falls occurring onto the roadway is assessed to be high to very high.

The risk of rock and debris falls occurring during rainfall events is considered to be very high and, as such, constitutes a potential threat to public safety. During non-rainfall periods, the risk is reduced to some degree but still constitutes a potential threat to public safety.

Bogey Hole to Susan Gilmore Beach

There is a high risk of rock falls associated with the natural slope erosion and degradation processes that are occurring on the cliff. The area is mainly used by rock fishers or recreational walkers and is not an area of high public utilisation, however, most rock fishers would be are aware of the potential for rock falls and although the risk of falls is high, the risk of an adverse consequence is low.

Scenic Lookout to Shepherds Hill

The rock is undergoing active erosion. A coastal walking path previously tracked along the ridge.

Bar Beach

At the northern end of Bar Beach, active erosion of the cliff scarp above the beach and access ramp is occurring. There is a high risk of soil and rock debris falling onto the beach or access ramp in an area of high public utilisation. A small retaining wall at the crest of the slope is being undercut by erosion.

Dixon Park, Kilgour Avenue

There is a risk of further rock falls occurring through erosion.

Merewether to Burwood Beach

The risk of rock and debris falls occurring along the base of the cliff is assessed to be high to very high, and include:

- the area below Hickson Street;
- the area to the south of the baths; and
- to the south of this area as the cliff swings to the southwest towards Hickson Street.

7.0 MANAGEMENT ISSUES

Identification of the values and significance of the coastline assists in determining appropriate management options. **Section 7.0** outlines the values attributed to the Newcastle coastline, the opportunities and constraints, and the main issues associated with the management of the Newcastle coastline. These have been identified from the status of the coastline in **Sections 1.0** to **6.0**, as well as results from the community Working Group Workshop, the consideration of Council and regional policies, and discussions held with relevant Council and State agency staff.

7.1 COASTLINE VALUES AND SIGNIFICANCE

7.1.1 Community Values

How the community values its coastline is documented in numerous Council reports and studies. For example, a recent analysis of Newcastle's community values, the "Indicators of a Sustainable Community" (NCC and the Australian Institute, 2000), stated that clean beaches are rated by the community as one of Newcastle's most important values. Further, the "beach" has been rated as one of the most valuable attributes of the city by the Newcastle community in a number of surveys.

The community's values have been researched and compiled throughout the course of the Management Study and incorporated in **Sections 7.1.1** to **7.1.4**.

A summary of the key values raised at the first workshop of the Community Working Group is detailed below:

- If there is an emergent theme for management over the next five years, it is one of protecting the natural values of the coastline.
- Education and awareness, including the knowledge of "how to" is an ongoing process.
- The critical role of stormwater pollution in determining cleanliness and amenity of beaches was highlighted.
- Recognition of cultural and natural heritage values of the coastline was high, tempered at times with concerns about safety.
- Long term visions included 'appropriate' development and redevelopment of key coastal sites such as the Merewether Surf House and the Newcastle Bowling Club. Transparency in the process of decision-making and implementation for these sites was highlighted.
- Balancing access and community facilities.
- A conflict exists between parochial nature of various suburbs and overall management approaches. The management plan should be developed to foster stewardship, building on the parochialism. Consequently, there is a need to apply a ranking or weight of the issues in each area.

7.1.2 Natural and Cultural Significance

There are a number of features of the Newcastle coastline that contribute to high natural or cultural significance to parts of this coastline. These include:

- The northern section of the Newcastle coastline forms part of the Newcastle Bight. The Newcastle Bight coastal sand barrier system is dominated by multiple transgressive dune episodes. The morphology and structure of the coastal dune system, that separates the estuary from the ocean, has high scientific, ecological, and visual significance.

- Glenrock Lagoon is a coastal lagoon system that is dominated by freshwater conditions for much of the time and forms part of Glenrock SRA. The outlet is predominantly closed with sand and only discharges following significant rainfall. Glenrock lagoon is the only Intermittently Closed or Open Lagoon or Lake (ICOLL) on the Newcastle coast.

- The lack of natural habitat elsewhere on the Newcastle coastline highlights the significance of Glenrock SRA.

- The water quality of Newcastle beaches is generally very good and is consistent with protection of aquatic ecosystems, primary contact recreation (swimming and surfing) and consumption of fish. Newcastle beaches are amongst the cleanest urbanised beaches in NSW, and highly valued for their cleanliness.

- The coastline of Newcastle LGA occupies a unique position in the coastal heritage of NSW. In brief, this stretch of coastline represents a rich heritage, amongst the richest and most diverse regional stretches of coastline in the State, in relation to the European settlement of NSW.

- The coastline and landscape as a whole is important to the Aboriginal community for cultural reasons. The coastline was an area rich in natural resources which were used by their ancestors and continue to be used. Other places such as Nobbys Headland represent mythological sites, explaining the creation of the landscape and the people in it. Sites such as stone artefact scatters and middens provide direct evidence of the lifestyle of Aboriginal people prior to European settlement and are a symbolic link with the past for indigenous people today.

7.1.3 Amenity and Community Use

Many parts of the Newcastle coastline are highly valued for their visual amenity, which is derived from clean water, rugged outcrops, sandy shorelines and areas of natural bushland. For example, several locations on the coast, including residential areas, offer extensive views of the length of the Newcastle coastline.

The amenity of the coastline, as raised in **Section 7.1.1**, is rated as having high value to the community. One of the key aspects raised was the desire to have clean beaches. The coastline is also valued highly as an area for recreation and general community use by both residents of the region and visitors.

7.1.4 Socio and Economic

The socio-economic values of the coastline can be summarised as follows:

- There is a desire to promote a positive image of the City of Newcastle as a “clean and green” city by respecting, protecting and complementing its natural and cultural heritage, its identity and sense of place. The coastline corridor represents an ideal opportunity to express this value.

- The provision of economic well-being of the community, in particular through the creation of jobs, in a social and environmentally responsible manner. The coastline represents an opportunity to contribute to local employment through its rehabilitation

and enhancement, which is anticipated to attract visitors from outside the city, both in its function as a regional centre and as a primary tourist development area attracting visitors from beyond the region and overseas. The tourist industry is labour intensive and there are opportunities to create many jobs through the potential of the coastline corridor in its own right to attract visitors, and in combination with other attractions, particularly in the city centre. Beyond that, the coastline represents perhaps the most important recreational opportunity in the city for its own residents and, therefore, makes a vital contribution to the attraction of Newcastle as a place to live and work. In turn, this is of central importance to expansion of the Newcastle economy and the creation of jobs. Also, the rehabilitation, enhancement and management of the coastline corridor in itself, represents a generator of employment.

- A central social value is the improvement of the quality of life and well-being of the people of Newcastle and as a major recreational venue, the coastline corridor has the potential to make an important contribution to this value.

- In the interests of pursuing a sustainable pattern of urban development, the attraction of the coastline to residents provides an opportunity for increased residential densities adjacent to the coastline corridor and to accommodate more intensive use of the corridor itself, which already is perhaps the most intensively used recreational area in the City.

- This value includes the view that a high level of access to the coast is required for all people and responds to the value that the coastline, as a spatially fixed resource, must accommodate high levels of use without suffering an unacceptable loss of amenity through the intrusion of private motor vehicles on pedestrian areas. Central to this view is the idea that the coastline should provide a safe, attractive, friendly and efficient pedestrian environment.

- One of the most powerful values of relevance to the coastline corridor is the desire to conserve and manage the City's natural resources for present and future generations. Although significant parts of the coastline corridor have been urbanised, the Burwood Beach Management Unit is one of the most important natural areas in the City. There are many other areas, particularly on the cliff and bluff tops, where rehabilitation of natural vegetation will enrich the quality and variety of natural areas within the corridor, both for their intrinsic worth and for the greater enjoyment of residents and visitors using the coastline. The large public landholdings along the North Stockton coastline represent a major opportunity for the rehabilitation of natural systems and for their linking with the proposed national park, regional park and state recreation area recently identified by the NSW Government in the adjoining Port Stephens Local Government Area.

- Encouragement of community participation in the future development and management of the coastline corridor is a central value for the community. This is to ensure better decision making and outcomes in accordance with community wishes and to secure a sense of commitment to the rehabilitation, conservation, and use of the coastline corridor in a sustainable way.

7.2 OPPORTUNITIES AND CONSTRAINTS

The development of the built environment has been strongly influenced by the opportunities and constraints presented by the natural characteristics of the coastline, but also by the early location decisions, and the alignment and extent of early administrative and land ownership boundaries. Also, large-scale works needed to improve the harbour including large areas of land fill and the construction of breakwaters and training walls, substantially changed the physical environment. There have been large areas of land reclamation in the estuary both at

the location of the original settlement on the southern bank of the river mouth and at Stockton. The construction of training walls has led to the build up of beaches at Nobbys and contributed to beach erosion along the Stockton beachfront.

Section 7.2 is a summary of the opportunities and constraints that have become evident from investigation of the status of the coastline in **Sections 1.0** to **6.0**, as well as results from the Community Working Group Workshops and the consideration of Council and regional policies.

7.2.1 Natural and Cultural

Development along the coast has altered the dune environment to varying degrees. Housing, intensive recreation and waste disposal have taken their toll on dune plants, resulting in land degradation along with wind erosion, coastal recession and destruction of coastal flora and fauna. However, in its present stage of development, opportunities exist for the maintenance and conservation of many of the natural features that help to define the Newcastle coastline.

Natural and planned revegetation programs can repair damage of dune vegetation, enabling pioneer species to recolonise unstable areas. The immediate coastline of Newcastle is almost entirely within public ownership, enabling Council to co-ordinate replanting and stabilisation efforts in an attempt to halt receding dunes and offer protection to existing infrastructure. A consequence of this action however, if not planned sympathetically, may be the loss of water views from coastal residences, businesses and public viewing locations. This action has the potential to cause conflict between different stakeholders and the need for conservation, due to a lack of defined user rights, decreased aesthetic value and possible depreciation in property values.

Dune areas require active management and this requirement will increase as recreational use of beaches becomes more intensive. It is essential that damage be reduced to a minimum in order to protect native plant communities. This can be achieved through establishment of formalised pedestrian access to beaches via fenced walkways, preventing dune instability and directing people away from sensitive areas.

The level of human activity on intertidal rocky shores will only increase with the growth of population. The main impacts caused by humans are through accidental trampling and collection of species, particularly for bait and food. Due to the complexity of interactions among species (both competitive and predatory processes) the removal of a single species, through targeted collection, e.g. by fishers for bait, has the potential to disrupt the entire community structure of an area, resulting in long term consequences to the integrity of the remaining population.

The recent release of a draft New South Wales Strategic Plan for Bitou Bush (*Chrysanthemoides monilifers ssp. rotunda*) (15 February 2001) by NPWS provides the impetus for action, providing the necessary background information, vision and strategies for achieving a reduction in the introduction, spread and associated impacts caused by Bitou Bush on biodiversity. An opportunity exists for the control and reduction of Bitou Bush in the Newcastle coastline area. This opportunity, however, is dependent on the long term commitment of volunteers to aid in the removal of Bitou Bush, replanting of native species and long term maintenance of regenerating areas. The seeds of a Bitou Bush are capable of lying dormant in the soil for a period of up to 10 years. Therefore, in order for successful long term eradication of the species, maintenance of the area must continue for at least this long.

The dunes at Stockton North are severely disturbed, detracting from their potential to provide a significant natural aesthetic element of the Newcastle coastline in their current form. The Special Use zones, under draft LEP 2000, along the corridor are likely to provide important opportunities for future tourist development and special consideration of the siting,

height and design of any development is needed for the opportunity to create an attractive natural beach setting.

Although the Aboriginal archaeological record today is a fragment of the original evidence, the recorded sites and the Newcastle coastline landscape are of importance to the local Aboriginal community and provide an opportunity to further the general public's understanding of Aboriginal culture and history in the area.

It is unlikely that any of the recorded sites along the Newcastle coastline are of scientific significance and are able to contribute to relevant archaeological research questions. A large number of archaeological sites are likely to have been destroyed as the intensive development of the Newcastle coastline has proceeded over 200 years. The surviving evidence of traditional Aboriginal occupation is just a fragment of that which originally existed. The stone artefact scatters and middens recorded by Dyall in 1971 had been affected by natural erosive processes and development activities. All of these sites are likely to have been substantially disturbed or destroyed by the continued intensive development and use of the area in the intervening thirty years. Additionally, the context of all these sites has largely been destroyed by the surrounding urban development. The Aboriginal sites and the landscape as a whole are therefore of symbolic and social value rather than of value from a scientific point of view.

Development activities which continue to threaten remaining archaeological sites (both known and unknown) include:

- Tourism and leisure related activities, including walking tracks and other such facilities.
- Residential development on headlands and other bedrock landscapes, and on sand.
- Installation and maintenance of infrastructure, e.g. roads, sewage.
- Maintenance and rehabilitation works along the coastline, including coastal protection work.

Natural processes also form a threat to coastal Aboriginal sites. Such processes include:

- Beach erosion.
- Dune erosion.
- Rock fall (Nobbys Head).

Beach and dune erosion are probably most relevant to the relatively undisturbed areas in the northern portion of the study area between Corroba Reserve and the Rifle Range.

The historical European heritage of the coastline provides both major opportunities and significant constraints. There are numerous heritage resources scheduled for inclusion in the draft LEP 2000 as environmental heritage items which provides an opportunity for their conservation for future generations. However there are several heritage items along the coastline that have not been included. This would be a constraint to the management of such resources.

7.2.2 Amenity and Community Use

The vast majority of the immediate Newcastle coastline is in public or public authority ownership and is zoned for open space and recreation or special uses. It presents an

outstanding opportunity for a comprehensive approach to coastline management, in response to increasing pressures for the use of a fixed resource.

Protection and enhancement of the coastal ecology along Newcastle's coastline is also vital to the continued growth of the tourism industry and recreational opportunities currently provided. Therefore a balance between urbanisation and the highly valued aesthetic beauty must be sought. This aesthetic beauty is derived from clean water, rugged cliffs and bluffs, sandy shorelines and areas of natural bushland.

A summary of the key opportunities is as follows:

- To provide an accessible coastal recreation zone for the Newcastle and Hunter community, with the provision of greater levels and greater accessibility of public transport, traffic 'slow' zones and efficient parking.

- Continued improvement and maintenance of facilities in open space settings within the coastal zone.

- To provide a range of recreational facilities, including picnic tables and barbecues, seats (especially in areas providing scenic vistas) and playgrounds for an integrated informal recreation setting.

- To improve the amenity of the coastal zone which is significant in the 'wanting' of informal and passive recreation activities through structure plantings in the main precincts, especially including the heavily concreted Merewether Beach, Dixon Park Beach, Bar Beach and Newcastle Beach, and Newcastle Ocean Baths;

- To create more accessible and safe vantage points, particularly for people living with disabilities and the elderly, along the coastline through the provision of viewing areas and interpretative signage;

- Provision of designated hang gliding and landing areas; and

- The involvement of local streamwatch groups in the water quality testing of urban stormwater discharges on Newcastle beaches, and the provision of government funding, e.g. Natural Heritage Trust grants, for community groups to purchase the necessary equipment.

- The Fullerton Street corridor is a distinctive and potentially attractive approach to Stockton. Eventually the Special Use zones along the corridor are likely to provide important opportunities for future tourist development which could diminish the attraction of the corridor.

- The large areas of publicly owned land at the northern end of the Stockton peninsula present future potential for development should these lands become available. These lands include the soon to be decommissioned wastewater treatment plant. At this stage, there are no plans for the site once decommissioned. However, an area will need to be maintained for use as a pump station. Therefore, the treatment ponds will not be needed by Hunter Water Corporation, but will need to be maintained or rehabilitated taking into account the associated coastal hazards.

The range of opportunities, however, has a number of constraints. These constraints include:

- traffic areas proposed to be 'slowed' include major arterial roads into Newcastle city;

- salt laden winds, especially along the city's beaches, limit the potential for vegetation establishment;

- the safety risk associated with walkways and cycleways along the cliff tops which are known to be unstable in many areas;

- the emphasis on vehicle usage as opposed to pedestrian and public transport usage;

- the legislative constraints associated with the establishment of commercial activities within the open space zones;

- Bitou Bush infestation of the coastline restricting the natural heath and dune vegetation from establishing and flourishing;

- poor road system and access to significant vantage and recreation points, including unclear designated parking areas and a lack of turning facilities leading to congestion;

- the available public land for use in the "end of pipe" treatment of stormwater in the beach catchments is extremely limited; and

- cost of asset presentation and maintenance.

7.2.3 Social and Economic

The Newcastle coastline currently presents a range of opportunities and constraints with regard to development of the social and economic environment of Newcastle. A summary of those includes the following:

- At present the public can enjoy unrestricted access to most parts of the coastline corridor. Except for the extreme northern part of the Stockton peninsula, there is a continuous strip of land in public ownership available for public recreation. There are a limited number of Crown leases for surf club premises, for the Bar Beach Bowling Club in Empire Park, for the tennis club at the Obelisk, for the Newcastle Bowling Club beside King Edward Park, and for the signal station at Nobbys Head. The exclusive use of areas within the coastline corridor for commercial tourist purposes, either permanently or from time to time, can help to develop particular tourist markets such as the conference market. An opportunity exists to seek a balance between developing tourist markets in the interests of Newcastle's economy as a whole, and maintaining access to the public in general to enjoy the coastline corridor, particularly where the current policy allows only uses that support the use of the reserves for recreation purposes, while particular tourist markets could benefit from activities of a commercial nature that rely on the coastal reserves only as a picturesque setting, a special place.

- Unlike many of Sydney's beaches, there are few situations where commercial activities extend down to the urban/coastline interface. It is common in Sydney for commercial centres to adjoin the beachside reserves and these are dominated by cafes, restaurants, outdoor eating, take away food and so on. The Beach Hotel at Merewether is the only example of this kind of opportunity in Newcastle apart from restaurants in two motels at Newcastle Beach. It is likely that some eateries, designed to serve users of the coastline, will be sought within the public reserves, such as Merewether Surf House.

- Associated is the need for eateries along the coastline to meet the needs of different groups. At present, the only food and drink services within the coastline reserves are available at the surf club kiosks. The Newcastle Bowling Club and the Bar Beach Bowling and Sports Club have Crown Special Leases and have been withdrawn from the King Edward Park Reserve and the Empire Park Recreation Reserves respectively.

- Elsewhere the provision of eating facilities within public reserves has commonly involved establishments providing not only a restaurant or café service, but also take away services for the use of reserve users. This practice helps to satisfy the idea that a choice of food services are catered for at such establishments rather than exclusive uses permanently occupying the reserves but not ancillary in function to the reserves.

- Often leases for Council's Community Lands are to the maximum of 21 years to justify the necessary improvements. Crown Special Leases can be for up to 40 years and involve withdrawing land from a public reserve over the area to which the special lease applies. In a situation where the demands for use of the coastline corridor are changing and expanding, especially with the satisfaction of rapidly changing tourist demands, long term leases can inhibit flexible management of public land.

- While there are increased expectations for greater pedestrian amenity, comfort and safety, the introduction of the major traffic route through the coastline corridor has reduced these qualities. This is a common problem in beachfront areas where road alignments have left only a narrow recreation reserve between the beach and the road. This is particularly evident at Newcastle Beach, Nobbys Beach and Bar Beach. Car parking areas have created similar problems in reducing the amenity of pedestrian areas and displacing opportunities for pedestrians to enjoy the coastline. At the same time, parking is essential for providing access to the coastline. An appropriate balance is needed between the requirements of through traffic, vehicular access and parking for coastline users and at the same time, maintaining the amenity of the coastline attractions.

- Tourist accommodation at the coastline urban area interface has been generally limited to Newcastle Beach, with residential uses occupying the remainder of the coastline edge. The retention or creation of opportunities for tourist accommodation at favoured coastline sites is a common problem in NSW and may be particularly important for Newcastle, where expansion of the tourist industry is seen as an important part of expanding the local economy based on the coastline as a natural and heritage attraction.

- The attraction of large numbers of visitors to the coastline corridor fulfils an important regional role for the city centre and the vitality generated by the night life and the special event program are important to the development of the tourism industry. The coastline corridor is an important venue for some of these activities. However, these activities, especially noisy activities carried on late at night, can be disturbing for local residents.

- Facilities such as marinas, on the harbour side, could provide important opportunities for attracting visitors to the Stockton peninsula.

- The lack of landscaping for shade and shelter is an important limitation to attracting a wider range of users to the coastline corridor adversely affecting the quality of the reserves and the image of the coastline.
- The coastline corridor is a unique, identifiable place within which a number of projects are underway or proposed, involving large expenditures by the Council and government agencies. These include maintenance of existing seawalls, beach erosion and dune management works and park and other open space improvements. Other projects are the Bathers Way coastline walk, and the preparation and implementation of development controls. It is important that the co-ordination of the planning design and implementation of these projects and subsequent development and upkeep in response to a common set of objectives and priorities.

7.3 SUMMARY OF COASTLINE MANAGEMENT ISSUES

The following issues have been identified through investigations of this Study, including the Community Working Group Workshops and the consideration of Council policies that have been developed in consultation with the community. **Figures 7.1** to **7.10** illustrate the key issues for management along the Newcastle coastline.

Community Working Group Issues

Key issues raised by the Community Working Group at the workshops are summarised in **Table 7.1**.

Table 7.1 - Issues from Community Working Group Workshops

Beach Area	Priority Issues Nominated	Additional Issues	Priority Linkages
Stockton	• Beach erosion • Coastal properties at risk from coastal processes • Safety • Tourism development	• Access overall • Breakwater • Tourism • Redevelopment opportunities • Research is required • Establish workable emergency management plan to protect community assets	Safety
Nobbys/ Newcastle	• Commercial development • Parking/traffic • Stormwater (Chosen for safety amenity, access & convenience)	Newcastle • Skyline • Entrance to beach via tunnel • Litter • Replace degraded assets such as rusted fences • Hire beach equipment Nobbys • Sand Drift (Macquarie Walk) • Lack of public access to Lighthouse • Disabled access • Lack of boating facility at Horseshoe • Improve companion animal management	Ocean processes
Shepherds Hill	• Natural heritage & protection of remnant vegetation • Cultural heritage • Traffic & visitor management in a fragile environment of natural and cultural significance	• Natural heritage (themeda, bitou/weed problem • Cultural sites – need for restoration and conservation • Current land management practices • Erosion of gully near Bogey Hole • Traffic Management • Bathers Way project linkage to this study • Significance to indigenous communities? • Balance access with users and natural values • Prefer low key redevelopment of Bowling Club and Cottage	

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.1
Newcastle / Port Stephens Boundary Management Issues

A4 Scale: 1:6000	Ref No.:HB2_V2/1411_062.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.2
Stockton Beach (North of Stockton Town) Management Issues

A4 Scale: 1:6000	Ref No.:H02_V2/1411_092.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.3
Stockton Beach (North of Seawall) Management Issues

A4 Scale: 1:6000	Ref No.:R02_V2/1411_091.dgn

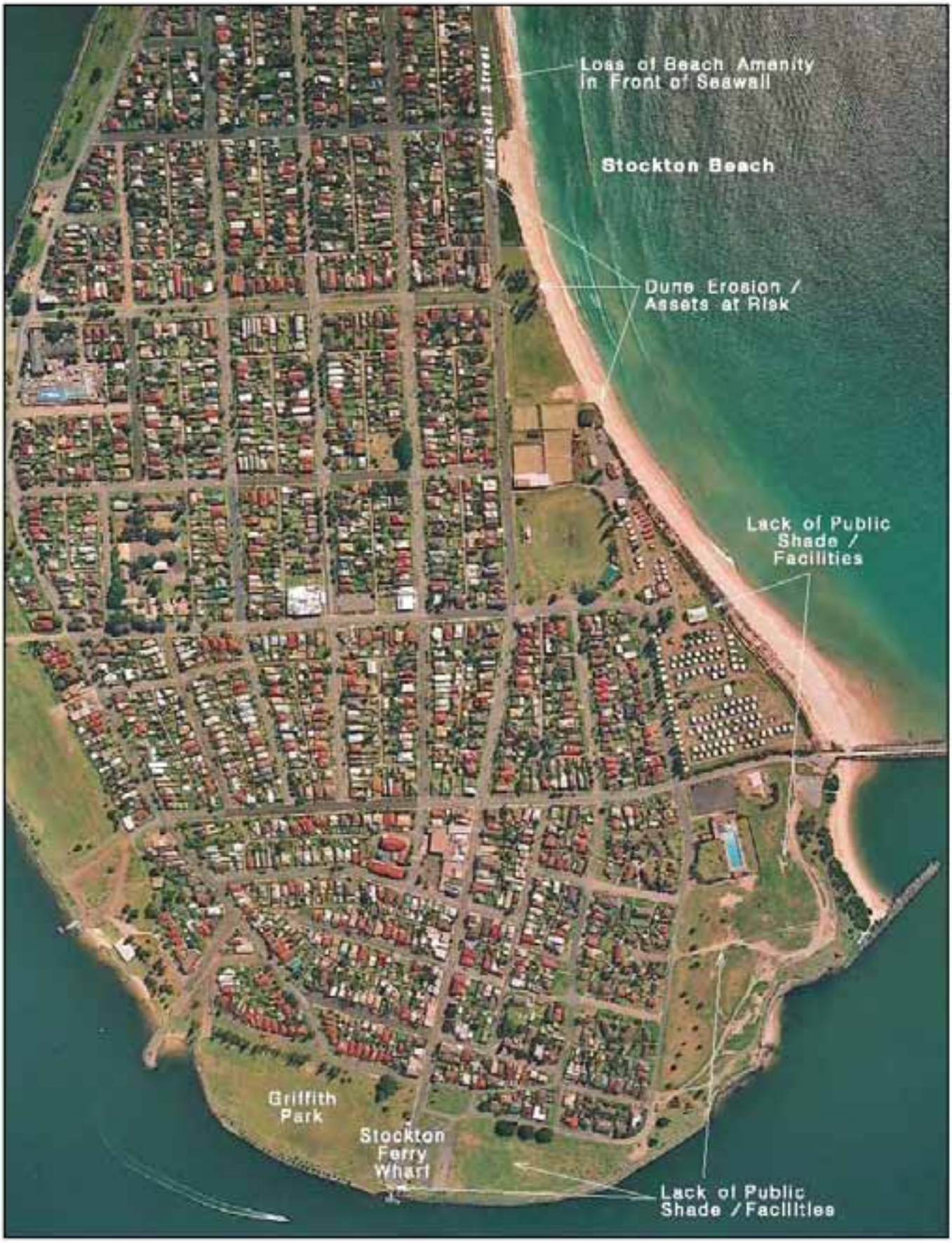


FIGURE 7.4
Stockton Beach (South of Seawall)
Management Issues

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

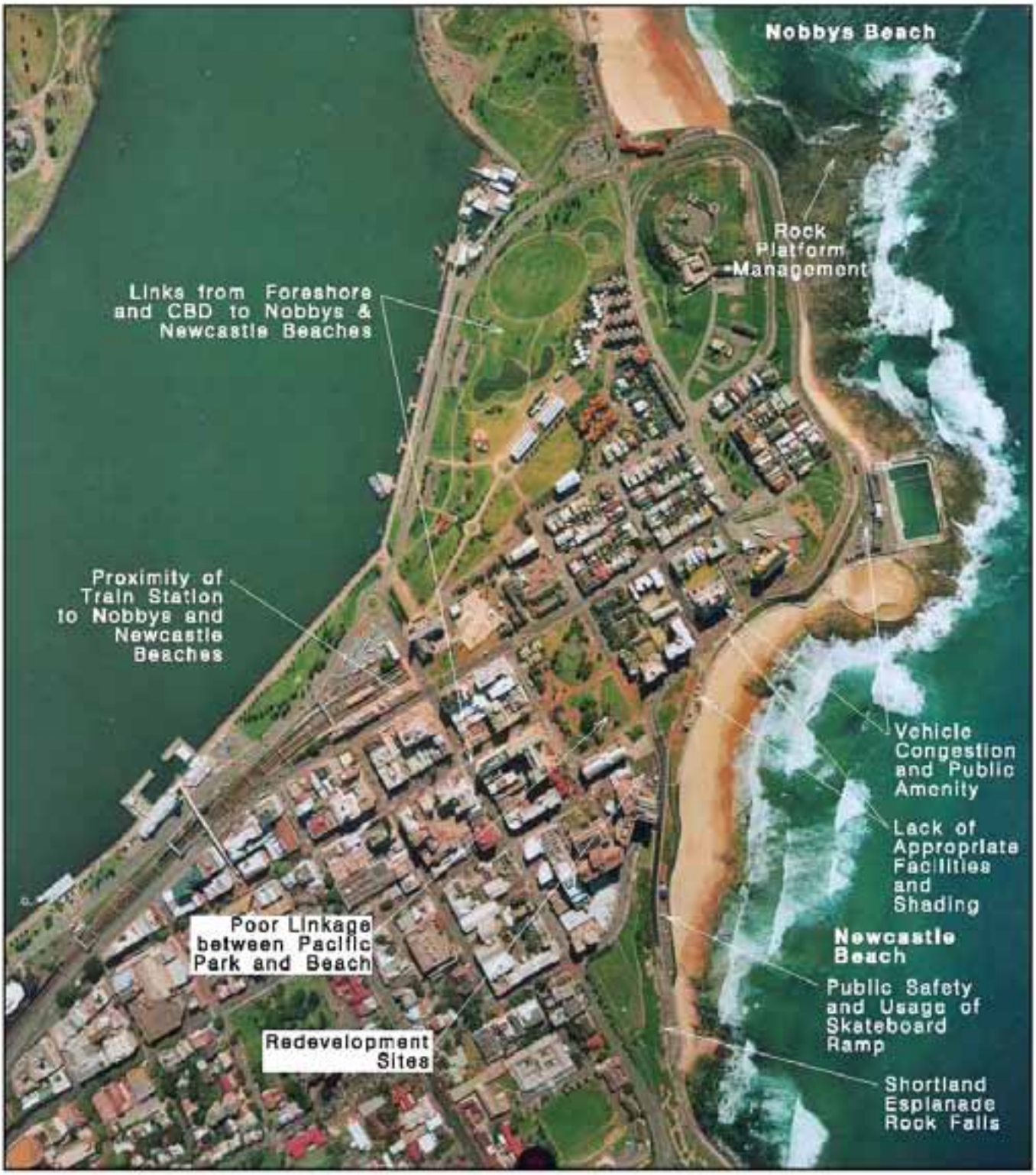
A4 Scale: 1:6000 | Ref No.:R02_V2/1411_076.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.5
Nobbys Beach
Management Issues

A4 Scale: 1:6000	Ref No.:R02_V2/1411_076.dgn



0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.6
Newcastle Beach Management Issues

A4 Scale: 1:6000	Ref No.:R02_V2/1411_088.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.7
Shepherds Hill
Management Issues

A4 Scale: 1:6000 | Ref No.:R02_V2/1411_087.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.8
Bar Beach / Susan Gilmore Beach Management Unit – Coastal Features

A4 Scale: 1:6000	Ref No.:802_V2/1411_072.dgn

0 75 150 300m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.9
Merewether / Dixon Park Beaches
Management Issues

A4 Scale: 1:6000 | Ref No.:R02_V2/1411_065.dgn

0 100 250 500m

Umwelt (Australia) Pty Limited
Photo Source: Coastal Surveillance Aerial Photo 1999

FIGURE 7.10
Burwood Beach
Management Issues

A4 Scale: 1:10 000 | Ref No.:H02_V2/1411_064.cdr

Table 7.1 - Issues from Community Working Group Workshops (cont)

Beach Area	Priority Issues Nominated	Additional Issues	Priority Linkages
Merewether/ Dixon Park/ Bar Beach	• Stormwater management • Dune control/erosion & vegetation management • Recreational amenities (cohesive look) • Dixon Park parkland development	• Dixon Park development • Maintenance & improvement of Bathers Way • Revegetate dunes • Consider hang gliders' needs • Suggestions re: Dixon Park Beach car park and viewing platforms • Surf club re-use options	Stormwater accessibility
Burwood Beach	• Dune erosion & weed infestation • Beach access • STP offshore outfall	• Feral Animals • Collaborate with NPWS, HWC, Scouts and Awabakal Land Council re: management of area • Improve stormwater management • Recognise hang gliding launch site	Dune erosion

7.3.1 Whole of Coastline

Many management issues have been found to be relevant to the entire Newcastle coastline, or a significant length of the coastline, rather than individual beaches or group of beaches. For this reason they have been designated as "whole of coastline" issues and listed here in **Section 7.3.1**. Those issues relevant only to individual beaches, or a group of beaches, are therefore listed under the relevant individual beaches in the following **Sections 7.3.2** to **7.3.7**. Many of the whole of coastline issues are to be addressed at a more strategic level, to provide unity in the management of the entire coastline. The whole of coastline issues include:

- Coastline infrastructure and structure maintenance.

- The management of the rock platforms along the coastline, from Nobbys to Burwood Beach, particularly regarding human impacts such as food and bait gathering.

- The unauthorised use of companion animals such as dogs on all beaches, in particular Nobbys Beach.
- Sustainable use, promotion and management of tourism opportunities.

- Equity of access to the coastline involving both the maintenance of public access to all parts of the coastline and the idea of physical access to the coastline itself.

  An important part of this issue is the need to provide for public safety along the coastline therefore accepting the need to restrict or control access to dangerous areas, particularly along the unstable bluffs and cliff tops.

- The increasing demands for "life style" recreation which commonly involves the enjoyment of food and drink in coastline locations, especially in restaurants and cafes where outdoor eating is a significant emergent demand.

- An associated issue is the need for eateries along the coastline to meet the needs of different groups. At present, the only food and drink services within the immediate coastline reserves are available at the surf club kiosks.

- A related issue is the length of the period of any lease issued to provide facilities.

- New development/redevelopment and its obstruction of lookout vistas and views.

- Stormwater impacts on beach amenity due to scour and water quality, particularly of ponded stormwater on the beach.

- Increased expectations for greater pedestrian amenity, comfort and safety, is hindered by the major traffic route through the coastline corridor.

- Ensuring that there is adequate scope for tourist accommodation in the urban areas immediately adjoining the beach. However, especially noisy activities carried on late at night, can be disturbing for local residents and the resolution of such conflicts require special management measures.

- The lack of signage along the coastline – comprising directional, site and interpretative To address this, as part of the Bathers Way, Council has planned to introduce tourism information bays and banners at key gateway locations; and a City-wide signage program;

  Importantly, an associated issue is the co-ordination of the planning design and implementation of projects involving large expenditures by the Council and government agencies such as the Bathers Way coastline walk, and subsequent development and upkeep in response to a common set of objectives and priorities.

- The importance of place and identity and the need for a range and choice of settings of different character.

- The rehabilitation of degraded environments to secure the coastline cultural landscape as a high quality corridor and perhaps the City's most significant aesthetic experience.

  Weed infestation, in particular Bitou Bush, exists along the entire coastline and includes the dunal systems and cliffs and bluffs. The potential for rehabilitation of entire lengths of dunes exists at all locations.

- The height, bulk, scale, setback and siting of new development should ensure that beaches and recreation reserves are not overshadowed, and should consider the aesthetic impact on the public reserves.
- The aesthetic quality of the coastal public reserves, or the coastline as a whole, is diminished by the general lack of vegetation and the lack of shade, shelter and softening and screening of development along the urban edge of the reserves.

  However, the preservation of views to the coastline from private property is one of the most highly valued aspects of coastline living. Vegetation can obstruct views of the coastline from streets, the reserves and from private property and the impact on loss of views should be an important consideration for any landscaping proposals.

- An Aboriginal cultural heritage management study and plan has not been prepared for the Newcastle coastline area and consequently the archaeological resources in the area are not well understood or managed.

- The Aboriginal cultural heritage along the Newcastle coastline is of symbolic and social value rather than of scientific value. The remaining physical evidence of traditional Aboriginal occupation is a small fragment of the original evidence.

- The Aboriginal community, represented by the Worimi and Awabakal Local Aboriginal Land Councils, has a concern and interest in the conservation and management of the remaining Aboriginal sites and in the coastline landscape as a whole.

- Aboriginal cultural heritage issues need to be integrated into planning, management, and interpretation of the Newcastle coastline, even though there is a lack of physical evidence. The Aboriginal community should be involved and consulted throughout the process.

7.3.2 Stockton Beach

The management issues are:

- Erosion of the foreshore along the urban precinct of Stockton and the threat to coastal properties and facilities at risk due to coastal processes, particularly at either end of the existing seawall and adjacent to the Surf Club and Childcare Centre.

  Associated with this issue is the maintenance of the existing rock seawall and the loss of amenity as a result of the loss of usable beach area seaward of the wall.

- Sand encroachment in the northern extremity of Newcastle LGA due to the westward dune migration.

- Compatible coastline management with Port Stephens Council, which includes the management of 4WD usage at north Stockton.

- The Fullerton Street corridor is a distinctive and potentially attractive approach to Stockton.

- The Stockton peninsula presents some significant opportunities for future development of the local economy through the pursuit of tourist activities.

- At Stockton there are opportunities for strengthening the relationship between the reserves and commercial activities. The draft LEP 2000 provides for an extensive frontage of 2(b) zoning to the reserves.

7.3.3 Nobbys Beach

The management issues are:

- The risk of rockfall at Nobbys Head and along Shortland Esplanade between Nobbys and Newcastle Ocean Baths.

- The leash-free dog use at Horseshoe Beach and the unauthorised extension of this practice onto Nobbys Beach.

- Links to CBD and harbour foreshore – opportunities for commercial development.

- The siting and appearance of car park spaces and associated vehicular access is intrusive and has reduced aesthetic quality and amenity at Nobbys Beach. Associated with this is the vehicle congestion and public safety near the roundabout.

- Sand drift onto southern breakwater behind the dunes and seaward of Nobbys Headland.

- The maintenance of views from the lookout area of Fort Scratchley may be threatened by future development.

7.3.4 Newcastle Beach

The management issues are:

- Car parking congestion and traffic management on Shortland Esplanade. The coastal arterial road is visually and physically intrusive because of its alignment and design and detracts from the amenity of recreational places.

- The siting and appearance of car park spaces and associated vehicular access within is intrusive and has reduced aesthetic quality and amenity at Newcastle Ocean Baths.

- Wave overtopping and inundation of the lower promenade areas and sections of Shortland Esplanade, particularly near the Cowrie Hole, which may cause risk and damage.

- Cliff erosion and rock fall onto Shortland Esplanade at South Newcastle Beach.

- Integration of adjacent public space with Newcastle Beach such as Pacific Park and Fletcher Park, and the promenade area (Shortland Park).

  The link to CBD and harbour foreshore, especially via Pacific Park, is an associated issue.

- Existing development is visually intrusive at the Royal Newcastle Hospital site. This is an area where future redevelopment is likely and where special care with design is necessary to protect and enhance aesthetic quality.

- Commercial development opportunities of the Newcastle Beach precinct.

- The maintenance of views from the lookout area of Fletcher Park may be threatened by future development.

- Sand blown up and onto the promenade and road.

- Usage of skate ramp facility and public safety.

7.3.5 Shepherds Hill Area

The management issues are:

- Extreme wind exposure and the lack of protective structures/vegetation.

- Unstable soil structure in cliffs and associated rock fall, especially along The Esplanade, which has potential to impact the annual Hill Climb event (Mattara Festival).

- Fragmented trails and access along area and within King Edward Park.

- Erosion from runoff down cliff face.

- Parking confined to lookout and is limited at Bogey Hole.

- Commercial opportunities at sites, such as the Newcastle Bowling Club and Shepherds Hill Cottage.

- Existing development is visually intrusive on headlands at Cliff Street, The Hill and at Newcastle Bowling Club on Ordnance Street. These are areas where future redevelopment is likely and where special care with design is necessary to protect and enhance aesthetic quality.

- The maintenance of views from the lookout areas of Shepherds Hill, which include Strzelecki Lookout and the Cottage may be threatened by future development.

- Pedestrian links within the park system, especially to the Obelisk.

- Hang gliding access and safety at Strzelecki Lookout.

- Protection of remnant Themeda grassland.

- Bitou Bush eradication.

7.3.6 Merewether, Dixon Park and Bar Beach

- Stormwater impacts on cliff stability and the viability of cliff top access infrastructure at Susan Gilmore Beach and associated rock falls from the cliff of Susan Gilmore/Bar Beach.

- Susan Gilmore is an unpatrolled beach, however public access is encouraged via the cliff top car park.

- Hard steep surfaces of the foreshore at Bar Beach exacerbate runoff, hinder access and detract visually.

- The coastal arterial road (Memorial Drive) at Bar Beach is visually and physically intrusive because of its alignment and design and detracts from the amenity of recreational places. Access between the beach and Empire Park can be particularly dangerous at times.

- The siting and appearance of car park spaces and associated vehicular access is intrusive and has reduced aesthetic quality and amenity at Bar Beach, in particular the main car park above Susan Gilmore Beach, and at the Merewether Baths and Beach. Vehicular access to Merewether baths is particularly confusing and congested.

- Parkway Avenue is one of the most important links between Newcastle's residential areas and the coastline and is a major design feature with its wide landscaped central median. Landscaping of the median and the design of the arrival point at the Bar beach car park is aesthetically disappointing and does not recognise the significance of this nodal point.

- The intersection at Parkway Avenue/Memorial Drive/ Bar Beach Avenue is dangerous for pedestrians and parking.

- The maintenance of mown areas between Memorial Drive and the sand dunes south of the Surf Life Saving Club is encroaching into dunal vegetation areas

- Risks from rock fall along the cliff section at Dixon Park - Kilgour Avenue.

- Visual amenity improvement of Dixon Park is needed through vegetation planting, and is exposed to strong salt-laden winds.

- Dixon Park requires addition landscaping, park furniture, play equipment and shade areas.

- Hang gliding at Dixon Park lacks a formally designated area/facilities.

- Existing development is visually intrusive on headlands at Lloyd Street Merewether and the northern end of Ocean Street Dixon Park. These are areas where future redevelopment is likely and where special care with design is necessary to protect and enhance aesthetic quality.

- Commercial opportunities at the Merewether Baths precinct, which include the Surf House.

- Surf House is in poor state of repair, however provides a significant opportunity for restoration and subsequent adaptive use as a restaurant or similar.

- Public transport to/from Merewether commercial centre is inadequate.

- Public shade is poor along Merewether promenade, and not equitable for all users.

7.3.7 Burwood Beach

The management issues are:

- Compatible coastline management with Lake Macquarie City Council and National Parks and Wildlife Service, at Burwood Beach, particularly regarding the naturally significant Glenrock SRA.

- Hand gliding location lacks a formalised area and could potentially result in erosion of the area.

- Rock falls from high cliffs south of Merewether Baths.

- Glenrock Lagoon water quality.

- Wastewater Treatment Plant outfall offshore.

PART 1B

Management Options and Impacts

8.0 MANAGEMENT OPTIONS

8.1 DECISION-MAKING FRAMEWORK FOR DEVELOPING MANAGEMENT OPTIONS

To address the management issues raised in **Section 7.0** a range of management options are explored in **Section 8.0**. For a general discussion of the various options commonly available to deal with coastal hazards and threats, refer to Section 7 of the Reference Document, Coastal Hazard Management Options.

Establishing a transparent decision making framework that implements the principles of ESD in a systematic and understandable way is a major challenge not only for management of a coastline, but for planning and management of development in general. However, because of the high level of usage and development pressure on coastal environments, often within an inherited land use planning framework, the decision making process is complex, interlinked and frequently controversial.

At the operational level, a range of criteria can be considered for making decisions about the sustainable management of the coastline. These include:

- capital and maintenance costs;
- social, economic and environmental costs and benefits;
- potential to achieve funding for the proposed works/activities;
- ability to implement and likely timeframe for implementation; and
- community preferences identified through the consultation program.

An important objective for a good decision making framework is effective monitoring and reporting of agreed performance indicators. This information can then be used to refine the decision making framework, and to refine specific management actions over time, so that the benefits to the community and the environment are maximised.

8.2 WHOLE OF COASTLINE

8.2.1 Stormwater Management

The available public land for use in the "end of pipe" treatment of stormwater at all locations is extremely limited. Further, only the catchment draining to the stormwater outlet off John Parade (see **Figure 6.11**) is considered large enough to warrant treatment with a gross pollutant trap (GPT). GPTs can be designed to extract litter and oils from stormwater before they reach the beach and are relatively expensive.

An option for Council is to implement a stormwater outlet maintenance schedule that involves the regular surveillance of beach stormwater outlets after major rainfall events. This could be incorporated into existing beach cleaning and maintenance practices, to reduce the cost to Council. Should adverse erosion occur, such as deep scour of the beach dune, as a result of rainfall, mechanical manipulation of the sand to remove the scarp formed would return beach amenity. This would also remove the potential for stormwater which may contain potentially harmful bacteria, to pond.

The main options for ongoing management of stormwater outlets available are:

- remedial action to combat erosion of beaches from stormwater discharges especially after periods of extended rainfall;
- install more public bins along the foreshore and in public areas such as parks etc in an attempt to minimise the amount of litter washed into the stormwater drains;
- install a Gross Pollutant Trap at the Merewether Beach stormwater outfall No. 2;
- improve the performance of the existing stormwater system;
- increase the accountability of people who fail to install sediment traps around developments, lack appropriate bunding in commercial facilities to cater for any oil spill etc leading to the potential pollution of our waterways; and
- develop community awareness of the impact of catchment activities on the quality of stormwater.

8.2.2 Natural Environment

Weed infestation is similar along the entire coastline, which includes the cliffs, bluffs and dune areas, and is mainly Bitou Bush. Therefore, weed infestation and revegetation of natural areas is addressed as a whole of coastline issue.

Similarly, the rock platforms along the coastline are similar in species composition and geographic form, and are also addressed as a whole of coastline issue.

8.2.3 Amenity and Community Use

The Open Space Plan for Newcastle (Hassell, 1996), which was reviewed in **Section 4.0**, identified numerous management strategies. The following are still relevant to the whole of the coastline today:

- Council needs to offer a range of low cost informal recreation opportunities which have a lower level of service by the Council than more formal facilities.
- Unemployed/youth:
  - consult youth centres concerning longer operating hours;
  - provide additional play equipment; and
  - provide lighting around skateboarding facilities to enable safe use.
- People Living with Disabilities:
  - provide adequate access to open space and recreation settings;
  - provide appropriately designed spaces to allow for wheelchair and scooter access;
  - provide playground equipment suitable for children living with disabilities;
  - provide access for disabled persons' animals;
  - provide information specifically for disabled persons; and
  - provide safe road crossings.
- Equity for people living with disabilities and those of a non-English speaking background; greater provision of facilities for female sports participants; distribution of sporting facilities among sports groups; activities for older persons; and costs associated with use of facilities.

- There is the potential to increase the use of existing areas by providing additional facilities, and through the upgrading and maintaining of those that already exist. This will increase their flexibility and allow greater range and level of use by the community.

Activity Nodes within the Coastline Reserves

In the absence of commercial facilities convenient to the coastline, there is an option to encourage small scale commercial development within mixed use buildings adjoining the coastline reserves at Stockton, Newcastle Beach, Bar Beach and Merewether and also to include appropriate facilities within the coastline reserves. For example:

- Provide for development of comprehensive recreational service areas at activity nodes, such as surf pavilions and ocean baths, within the coastline corridor to support recreational use including the Bathers Way.

- Include low key eateries at nodes as an expansion or redevelopment of existing kiosks. Eateries should preferably have outdoor seating overlooking the water and should recognise the need for different types of establishments such as take-away snacks and drinks and table service cafes. Merewether Surf House is an example of a location that could be used for such a facility.

- Facilities at activity nodes should include quality facilities such as beach promenades and seating, rest parks, picnic/barbecue areas, children's playgrounds, parking, equipment hire, public phones/taxi phones, and toilets.

- The activity nodes can provide services for footpath/cycleway users at reasonable intervals and can be appropriate places to start or finish walks, especially for visitors.

Vehicular Traffic and Pedestrian Amenity

- Provide for traffic calming and improved pedestrian amenity and access to the coastline at the following locations:
  - Merewether Local Centre (Ridge/Frederick Street).
  - Bar Beach (Memorial Drive at Bowling Club, Surf Club, Parkway Avenue).
  - Newcastle Beach.
  - Nobbys Beach.
  - Stockton (Mitchell Street, at ocean foreshore).

- The measures needed depend on particular circumstances but in principle, should consider:
  - Footpath extensions or carriageway landscaping to narrow carriageways at pedestrian crossing points, to define parking bays, to provide opportunities for landscaping close to the traffic lanes.
  - Speed control devices.
  - Special carriageway surface treatments at activity nodes.
  - Verge landscaping, landscaping in footpath extensions or in carriageways.
  - Roundabouts and traffic signals.

Car Parking

- As part of landscaping master planning, provide for redesign of parking at Merewether Baths/Surf House, Dixon Park Beach, Bar Beach, King Edward Park, Newcastle Beach and Ocean Baths, Nobbys to provide for less intrusive parking to and improve links between, parklands and the foreshore at activity nodes.

- Proposals could include more efficient layouts with marking of spaces, landscaping for shade and visual amenity, disabled parking and short and medium term parking at activity nodes.

Land Use Planning

- Plans of Management for reserves could be prepared to satisfy the requirements of both the CL Act and the LG Act to provide for continuity of land use planning and management over the various tenancies of the coastline reserves. The Coastline Management Plan can provide a strategic plan for the preparation of plans of management under the CL Act and LG Act.

- A single development control plan which identifies the coastline corridor as a specific unit can adopt Plans of Management and include provisions for areas other than Crown reserves and community lands such as Crown Special Lease areas, streets and private land at immediate urban interface, to provide a comprehensive coverage for coastline management and planning.

- The Coastline Management Plan can identify sites where tourist development and accommodation is preferred and establish controls and incentives to discourage the use of those sites for other purposes.

  Such sites could include:
  - Royal Newcastle Hospital site where DCP 57 requires future development is to be in accordance with a Master Plan.
  - Possible expansion of Stockton Caravan Park as an important and unique tourist accommodation facility on the Newcastle Coastline.
  - Potential sites for boating related development including marinas along the Stockton River foreshore.
  - Areas at the urban coastline edge where mixed use development could be encouraged to provide for accommodation suitable for visitors over commercial facilities required by visitors.
  - The Special Use zones at North Stockton where tourist development and dune conservation could be preferred to residential development. Guidelines should be established for any development in relation to securing the dunes in public ownership, building setbacks, height, and type of uses, views from beach and Fullerton Street to any development.

Design Guidelines for the Coastline Corridor

Design guidelines should be incorporated in a DCP (the Urban Code).

- Prepare a comprehensive set of design guidelines for the coastline corridor to reflect its significance as a recreation area of high aesthetic quality including:
  - Principles for the whole corridor.
  - Principles for sub units.
  - Detailed land use and master plans according to priorities.

- Adopt standards to ensure no overshadowing of beaches and reserves by buildings, for example, adopt the NSW Government Coastal Policy Guideline of no overshadowing before 3.00 pm mid winter and 6.30 pm summer daylight saving time.

- DCP to include detailed guidelines for the type, location, scale of uses appropriate within the public reserves, Crown Special Lease areas and Special Uses 5(a) zones should these become available for redevelopment.

- Include guidelines for the future desired character of the corridor and sub units and guidelines for the design of facilities to achieve the desired character.

- Include guidelines for the preservation of views from existing lookouts where these may be threatened by development carried out in accordance with present controls (i.e. Strzelecki Lookout, the Obelisk).

- Include controls for the scale, height, setback, colour, design quality of new development or redevelopment on headlands.

8.2.4 Cultural Heritage

Management Strategies for Aboriginal Heritage

Following are a number of options to deal with the Aboriginal heritage issues:

- Management of cultural heritage within the area should concentrate on wider cultural heritage values and interpretation rather than on the protection of specific archaeological sites. Such values tend to survive in relatively undisturbed areas or natural contexts. Examples of such areas include King Edward Park and south to Shepherds Hill, and the area between Corroba Reserve and the Rifle Range in the northern portion of the study area.

- Cultural heritage interpretative/educational material (in the form of interpretative signs, for example) could illustrate the lifestyle and history of Aboriginal people and how the landscape was used and has evolved up to the present. Information provided could be based on Aboriginal cultural views of the landscape, and their association with the coastline. The Awabakal and Worimi Aboriginal Land Councils should be consulted and have a major input into the material provided.

  Such interpretative signs may be able to be incorporated into the Bathers Way Coastal Walk plans. Shepherds Hill Reserve, with its wide views of the coastline and remnant native vegetation would appear to be an appropriate location for such a sign or series of signs.

- Previously recorded Aboriginal sites within the study area could be relocated and their condition and significance assessed thoroughly in consultation with the Aboriginal community. Additionally, relatively undisturbed areas within the study area, if any, could be investigated for Aboriginal archaeological sites.

  The Lake Macquarie Coastline Management Study concluded that a detailed assessment of Aboriginal archaeology was required in the area prior to preparing management options and recommendations. This work is currently being undertaken as part of an Aboriginal Sites Management Study for the Lake Macquarie LGA. A detailed management plan could be compiled for the Aboriginal cultural heritage values along the Newcastle coastline. This management plan would include:

  - Detailed descriptions of individual Aboriginal sites and their significance
  - The identification of previously undisturbed landscapes, and/or archaeologically sensitive areas, if any, within the study area.
  - Research into local history records regarding ethnographic accounts of Aboriginal people and/or sites at the time of early European settlement.
  - Procedures which ensure that all development in archaeologically sensitive areas is preceded by an archaeological survey

- Procedures which ensure that cultural heritage values within the study area are actively conserved and managed, including an awareness that natural landscapes are likely to have associated cultural values which need to be conserved and managed appropriately.
- Recommendations regarding appropriate educational/interpretative material Aboriginal cultural sites and/or cultural landscapes along the Newcastle coastline.

Management Strategies for European Heritage

It is not proposed to make recommendations relevant to individual heritage items and sites but rather to propose strategies that will result in appropriate conservation and/or management outcomes in respect of each item.

In this regard, attention is directed to:

- the provisions of the NSW *Heritage Act 1977* and in particular to:

- the provisions of the Commonwealth *Historic Shipwrecks Act 1976*, which automatically protects all shipwrecks that are over 75 years of age located in waters adjacent to the NSW coast. Shipwrecks of lesser age can also be protected if they are considered to be significant.

Options for management of European heritage include:

1. Further studies of the resources of European heritage associated with the Newcastle coastline so that:

    i. an appropriate curtilage or precinct can be defined for each European heritage item;
    ii. a qualified evaluation can be made of the heritage significance of each item, where that has not yet been done;
    iii. where the evaluation of significance warrants this action, that a conservation management plan should be prepared and implemented for a European heritage resource;
    iv. to the extent that a resource may not be so recorded, that the heritage resources tabulated in the Reference Document be added to the inventory of heritage resources scheduled under the Local Environment Plan of Newcastle Council.

2. In the event that any activity is undertaken, planned or foreshadowed that could have the effect of disturbing, damaging or destroying the fabric, visual amenity or curtilage or precinct of any heritage resource tabulated in the Reference Document, the party responsible for any such activity should be required:

    i. to complete a detailed archaeological study of the proposed site and an analysis of the heritage impact of such proposal. Such a study should include:

        (a) study of the historical context of the study area;
        (b) study of the archaeological and physical context;
        (c) consideration of the fabric of the study area and its components;
        (d) synthesis of the archaeological material with its historical context;
        (e) the assessment of the significance of the archaeological material;
        (f) analysis of the potential impact of the proposed development;
        (g) recommendations for the appropriate management of the resource; and/or

ii. to demonstrate compliance or intended compliance with the requirements of all relevant NSW and Commonwealth legislation relating to the protection and/or conservation and/or management of non-indigenous heritage.

8.2.5 Existing Coastline Infrastructure South of Hunter

Council has care and maintenance responsibilities for numerous structures and infrastructure present in the immediate coastal zone including seawalls, surf clubs and pavilions, ocean baths, roads and car parks (**Section 6.2**). As discussed in **Section 6.2**, their maintenance is now largely being incorporated into Council's Major Asset Presentation Program (MAPP). However, it is important that an indication of the costs associated with such maintenance is scheduled in the Coastline Management Study and Plan, to assist Council in prioritising its maintenance, or replacement, of existing structures in light of the capital and maintenance costs that may be associated with new works recommended within the Coastline Management Plan.

Table 8.1 is a schedule of likely costs associated with the replacement of such structures, south of the Hunter River, while **Table 8.2** is a schedule of estimated maintenance costs for the next five and 30 year periods. The structures presented in the following tables are those south of the Hunter River. Structures present in the Stockton coastal zone are subject to detailed discussion in **Section 8.5**, due to the severity of the risk of failure to those structures.

As can be seen from **Table 8.1**, on present day values infrastructure within the immediate coastal zone south of the Hunter River, is estimated to be worth approximately $16 million with an additional $19.5 million worth of facilities being reliant on protection from coastal processes.

Estimated annual maintenance cost is approximately $560,000 for infrastructure within the immediate coastal zone and an additional $690,000 for facilities reliant on protection.

On this basis it is estimated that approximately $1.25 million (3.5%) will need to be expended annually in maintaining the $35.5 million worth of infrastructure and facilities south of the Hunter River.

From **Table 8.2**, assuming a discount rate of 7%, it is estimated that annual maintenance costs for the immediate coastal zone and facilities reliant on protection will increase to approximately $6.1 million/year over the next 20 years. As detailed in **Table 8.1**, the estimated replacement cost of the infrastructure and protected facilities in 20 years' time is approximately $101.5 million.

Table 8.1 - Existing Infrastructure Replacement Costs

Asset Description	Present Day Cost to Replace ($)[4]	5 Year Cost to Replace*	20 Year Cost to Replace*
Immediate Coastal Zone			
Nobbys Beach/Shortland Esplanade Seawall	670,000	939,710	2,592,689
Newcastle Ocean Baths	5,900,000	8,275,055	22,831,138
Newcastle Beach Seawall	730,000	1,023,863	2,824,870
South Newcastle Beach Seawall	218,000	305,756	843,591
Bogey Hole Baths (Access)	3,400	4,769	13,157
Bar Beach Seawall	90,000	126,230	348,272
Merewether/Dixon Park Rock Seawall	4,000,000	5,610,207	15,478,738
North of Merewether Beach Seawall	321,000	450,219	1,242,169
Ladies' Baths Merewether	5,000	7,013	19,348
Merewether Baths	4,100,000	5,750,462	15,865,706
Total	**$16,037,400**	**$22,493,283**	**$26,075,880**
Facilities Reliant on Protection			
Nobby Surf Club	1,125,000	1,577,871	4,353,395
Nobbys Surf Club Equipment Shed	130,000	182,332	503,059
Nobby Surf Club northern Car Park - 1400 m^2	57,022	79,976	220,657
Nobby Shade Structure	46,800	65,639	181,101
Nobbys Shade Structure Car Park - 750 m^2	30,547	42,844	118,207
Shortland Esplanade (Nobbys to Ocean Baths- 500 metres)	305,475	428,444	1,182,092
Newcastle Beach Shade Structure	41,040	57,561	158,812
Newcastle Surf Life Saving Club	5,670,000	7,952,468	21,941,111
Shortland Esplanade (South Newcastle Beach- 350 metres)	213,832	299,910	827,462
Bar Beach Pavilion	2,805,000	3,934,158	10,854,465
Bar Beach Pavilion Car Park - 750m^2	30,547	42,844	118,207
Bar Beach South Car Park - 1250m^2	50,912	71,407	197,013
Cooks Hill Surf Life Saving Club	450,000	631,148	1,741,358
Memorial Drive (Bar Beach) - 400 metres	277,380	389,040	1,073,373
Dixon Park Surf Life Saving Club	2,647,500	3,713,256	10,244,990
Dixon Park Kiosk	73,440	103,003	284,190
Dixon Park Shade Structure	71,200	99,862	275,522
Dixon Park Car Park - 4900m^2	199,577	279,917	772,300
John Parade – 300 metres	183,285	257,067	709,255
Merewether Surf Life Saving Club	1,512,000	2,120,658	5,850,963
Merewether Surf House	2,016,000	2,827,544	7,801,284
Merewether Beach Shade Structure	1,512,000	2,120,658	5,850,963
Merewether Baths Car Park - 2000 m^2	81460	114,252	315,224
Total	**$19,530,017**	**$27,391,859**	**$75,575,003**

** assumed 7% discount rate*

[4] Based on cost estimates provided by Newcastle City Council

Table 8.2 - Estimated Annual Infrastructure Maintenance Costs

Asset Description	Maintenance[5] ($/year)*	5 Year ($/year)	20 Year ($/year)
Immediate Coastal Zone			
Nobbys Beach/Shortland Esplanade Seawall	23,345	32,743	90,338
Newcastle Ocean Baths	206,077	289,034	797,453
Newcastle Beach Seawall	25,830	36,228	99,954
South Newcastle Beach Seawall	7,623	10,692	29,499
Bogey Hole Baths (Access)	144	202	557
Bar Beach Seawall	3,150	4,418	12,190
Merewether/Dixon Park Rock Seawall	140,000	196,357	541,756
North of Merewether Beach Seawall	11,246	15,773	43,518
Ladies Baths Merewether	215	302	832
Merewether Baths	144,900	203,230	560,717
Total	**562,530**	**788,977**	**2,176,814**
Facilities Reliant on Protection			
Nobby Surf Club	39,375	55,225	152,369
Nobbys Surf Club Equipment Shed	5,000	7,013	19,348
Nobby Surf Club northern Car Park - 1400m^2	2,500	3,506	9,674
Nobby Shade Structure	2,012	2,822	7,786
Nobbys Shade Structure Car Park - 750m^2	1,200	1,683	4,644
Shortland Esplanade (Nobbys to Ocean Baths-500 metres)	12,000.	16,831	46,436
Newcastle Beach Shade Structure	1,765	2,476	6,830
Newcastle Surf Life Saving Club	198,450	278,336	767,939
Shortland Esplanade (South Nctle Beach-350 metres)	7,200	10,098	27,862
Bar Beach Pavilion	98,175	137,696	379,906
Bar Beach Pavilion Car Park - 750m^2	1,200	1,683	4,644
Bar Beach South Car Park - 1250m^2	2,000	2,805	7,739
Cooks Hill Surf Life Saving Club	15,750	22,090	60,948
Memorial Drive (Bar Beach) - 400 metres	9,500	13,324	36,762
Dixon Park Surf Life Saving Club	92,667	129,970	358,592
Dixon Park Kiosk	3,158	4,429	12,220
Dixon Park Shade Structure	3,062	4,295	11,849
Dixon Park Car Park - 4900m^2	10,000	14,026	38,697
John Parade - 300 metres	6,800	9,537	26,314
Merewether Surf Life Saving Club	52,920	74,223	204,784
Merewether Surf House	70,560	98,964	273,045
Merewether Beach Shade Structure	52,920	74,223	204,784
Merewether Baths Car Park - 2000m^2	3,000	4,208	11,609
Total	**691,214**	**969,463**	**2,674,781**

** assumed 7% discount rate*

[5] Based on cost estimates provided by Newcastle City Council

8.2.6 Coastline Infrastructure at Stockton

As discussed in **Section 6.1** erosion has been evident of Stockton Beach for a number of decades with the severity of the erosion fluctuating depending on prevailing wave climate conditions. Prior to this study being undertaken, a number of reports describing the erosion of Stockton Beach and its possible implications have been prepared. These include:

- Stockton Beach Remedial Action Plan (WBM 1996);
- Stockton Beach Coastline Hazard Study (DLWC 1995);
- Newcastle Coastline Hazard Definition Study (WBM 2000); and
- Newcastle Coastline Emergency Response And Interim Action Plan (WBM 2000).

These reports identified a number of actions to be undertaken to assist in reducing the impact of erosion on Stockton and to further the understanding of the erosion processes to enable appropriate mitigation measures to be implemented. Some of these works have been subsequently undertaken as identified in **Table 8.3** and others remain to be undertaken**.**

Table 8.3 – Previously Recommended Works for Stockton Beach

Task/Provision	Estimated Cost ($)	Status
Immediate Works and Contingency Plan (WBM 1996)		
Dune Reconstruction:		
Caravan Park	$300,000	Completed but subject to further erosion and requires additional work
Elsewhere	$20,000	Completed but subject to further erosion and requires additional work
Maintenance Works:		
Relocate threatened minor facilities	$5,000	Completed
Remove tank traps	$2,000	Completed
Undertake end works at seawall	$60,000	Not Done
Erect Fencing along dune	$12,000	Partially Done
Contingency Plan		
Sandbag protection to surf club	$70,000	Undertaken
Sandbag protection to old pavilion	$70,000	Not Done
Sandbag protection to Dalby Oval	$120,000	Not Done

Table 8.3 – Previously Recommended Works for Stockton Beach (cont)

Task/Provision	Estimated Cost ($)	Status
Regulation of Works and Activities (WBM 1996) • Immediate Works and Contingency Plan can be varied in consultation with government agencies and community • No structures be erected or sand and dune vegetation interfered with in the coastal hazard zone and nearshore zone. • Formalise zoning on Crown and Council owned land within the erosion hazard zone to prevent construction of works other than for sound coastal management. • No subdivision of lots allowed in the coastal hazard zone.		
Investigation and Review Program (WBM 1996)		
Erosion Hazard Investigation	$50,000	Partially undertaken needs to be revised as a result of work undertaken as part of this study (see Shifting Sands report in Reference Documents)
Sand Nourishment Investigation	$15,000	Not Done
Beach Monitoring Program	$50,000	Partly undertaken by DLWC and Newcastle University
Offshore Reef Study	$30,000	Funded by Stockton community and Newcastle Port Corporation and partially undertaken by Dr Kerry Black

WBM (2000) provided estimates for beach erosion of the next 50 year period and delineated potential hazard zones associated with the estimated beach erosion. Using this information, a range of management options for the Stockton beach were identified and costed as part of this study. These options are detailed in the Reference Document and included:

- Sand nourishment (650,000 m^3) at an estimated capital cost of approximately $5.7 million with an annual maintenance cost of approximately $0.23 million per year (based on a sand nourishment volume of 200,000 m^3 over a 10 year period);
- Seawall with sand nourishment (250,000 m^3) with ongoing sand nourishment of 200,000 m^3 over 10 years at a capital cost of $10.7 million with an ongoing maintenance cost of $0.16 million;
- Sand nourishment (650,000 m^3) with terminal groyne/headland at a capital cost of $15.8 million with an annual maintenance cost of $0.15 million (see indicative **Figure 8.1** and **8.2**);
- 870 metre extension of the existing seawall at a capital cost of approximately $8.0 million with an annual maintenance cost of $0.04 million (see indicative **Figure 8.3** and **8.4**);
- One large artificial submerged nearshore reef (1,650,000 m^3) at a capital cost of approximately $14.2 million with and ongoing maintenance cost of $0.26 million (see indicative **Figure 8.5**);

Legend

Increased Beach and Dune

FIGURE 8.1
Terminal Groyne / Headland with Sand Nourishment Stockton Beach

Umwelt (Australia) Pty Limited
Source: SMEC

A4 Scale: 1:12 500

Ref No.:R02_V2/1411_067.dgn

Legend

Increased Beach and Dune

Note: All Groynes are Approx. 250m In Length

Umwelt (Australia) Pty Limited
Source: SMEC

FIGURE 8.2
Bypassing Groyne Field with Sand Nourishment Stockton Beach

A4 Scale: 1:12 500

Ref No.: R02_V2/1411_098.dgn

Legend

Revetment Structures

FIGURE 8.3
Revetment Structures
Stockton Beach

Umwelt (Australia) Pty Limited
Source: SMEC

A4 Scale: 1:12 500

Ref No.: R02_V2/1411_068.dgn

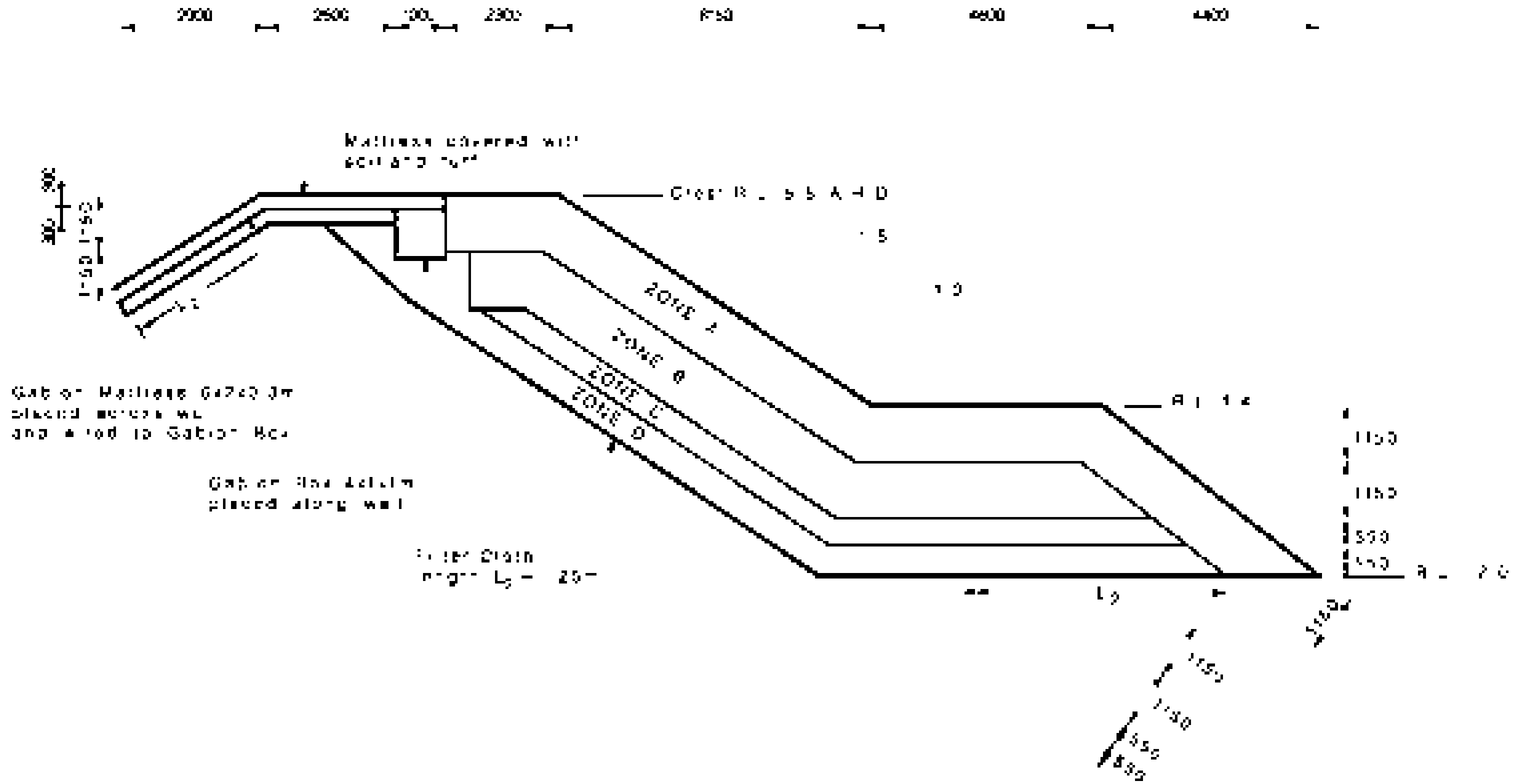


FIGURE 8.4
Design Cross section of
Stockton Seawall

Not to Scale

Umwelt (Australia) Pty Limited
Source: SMEC Newcastle Coastal Zone Management Plan

Legend

Increased Beach and Dune

FIGURE 8.5
Conceptual Design of Artificial Submerged Reef

Umwelt (Australia) Pty Limited
Source: SMEC

A4 Scale: 1:12 500

Ref No.:R02_V2/1411_087.dgn

- Two smaller artificial submerged nearshore reefs (950,000 m^3) at a capital cost of $11.4 million with an ongoing maintenance cost of $0.26 million (see **Figure 8.6**);

- Planned retreat which may result in the loss over the next 50 year period of approximately $215 million in real estate and infrastructure along and adjacent to Stockton Beach as detailed in **Table 8.4** (see indicative **Figures 8.7** and **8.8**). Voluntary purchase may from part of the Planned Retreat option or couple with other options however, realistically only small numbers of properties may be able to be acquired over a number of years due to constraints on available funding;

Each of these options were based on the assumption that erosion off Stockton Beach is cyclic not progressive and that the beach processes, even though they fluctuated, were basically in equilibrium.

Subsequent to this work, additional analysis (Umwelt 2001) was undertaken of available hydrosurvey information which dates back to 1816. Analysis of this survey data indicates that a significant volume of sand has moved off Stockton Beach resulting in the sea bed adjacent to the beach lowering by 4 to 7 metres since the mid 1860's. Lowering of the sea bed has resulted in an estimated 4 million m^3 of sand being lost from the beach and adjoining sea bed since 1921. This equates to an average rate of erosion/sand loss of approximately 50,000 m^3/year for that period. Available data indicates that between 1988 and 2000 the rate of erosion/sand loss from Stockton Beach increased to approximately 170,000 m^3/year. This analysis demonstrates that the erosion off Stockton Beach is ongoing and not a cyclic fluctuation in response to variations in prevailing wave conditions as was previously thought. What is not known at this time is where the sand is going and what is causing the observed ongoing erosion.

As a result of the observed changes to the sea bed profile, wave transformation analysis indicates that the erosivity or erosional energy of significant storms, such as that experience in 1974, would be approximately double that of the same storm in the 1950's. This increased erosional energy will tend to further exacerbate the erosion of Stockton Beach.

As a consequence of the observed changes (i.e. lowering) of the sea bed to profile it is considered that previous erosion and hazard line predictions (WBM 2000a) are an under estimate of the likely magnitude of erosion, resulting in the extent of the hazard zones being landward of those previously predicted.

It is apparent from the above discussion that a more detailed understanding of the coastal processes at Stockton Beach is required before appropriate mitigation works can be designed and implemented. It would be possible to undertake beach nourishment, extend the seawall or build a submerged or offshore reef at this time with these works costing in the order of $5 to $10 million as discussed above. The observed erosion rates, particularly between 1988 and 2000, indicate that there is a high probability that the longevity of any such works may be very short.

To address erosion issues at Stockton Beach the following is proposed to:

1. **DISPLAN** - Fully develop and detail Emergency Response Procedures for Stockton Beach as outlined in Newcastle Coastline Emergency Response And Interim Action Plan (WBM 2000) as part of Council's DISPLAN. This is being undertaken concurrently with this study and is planned for release in 2002.

   A contingency plan to protect community and private assets is currently in place and includes the use of emergency sand bagging under the control of the local State Emergency Service (SES). Their closest office is located at Tighes Hill

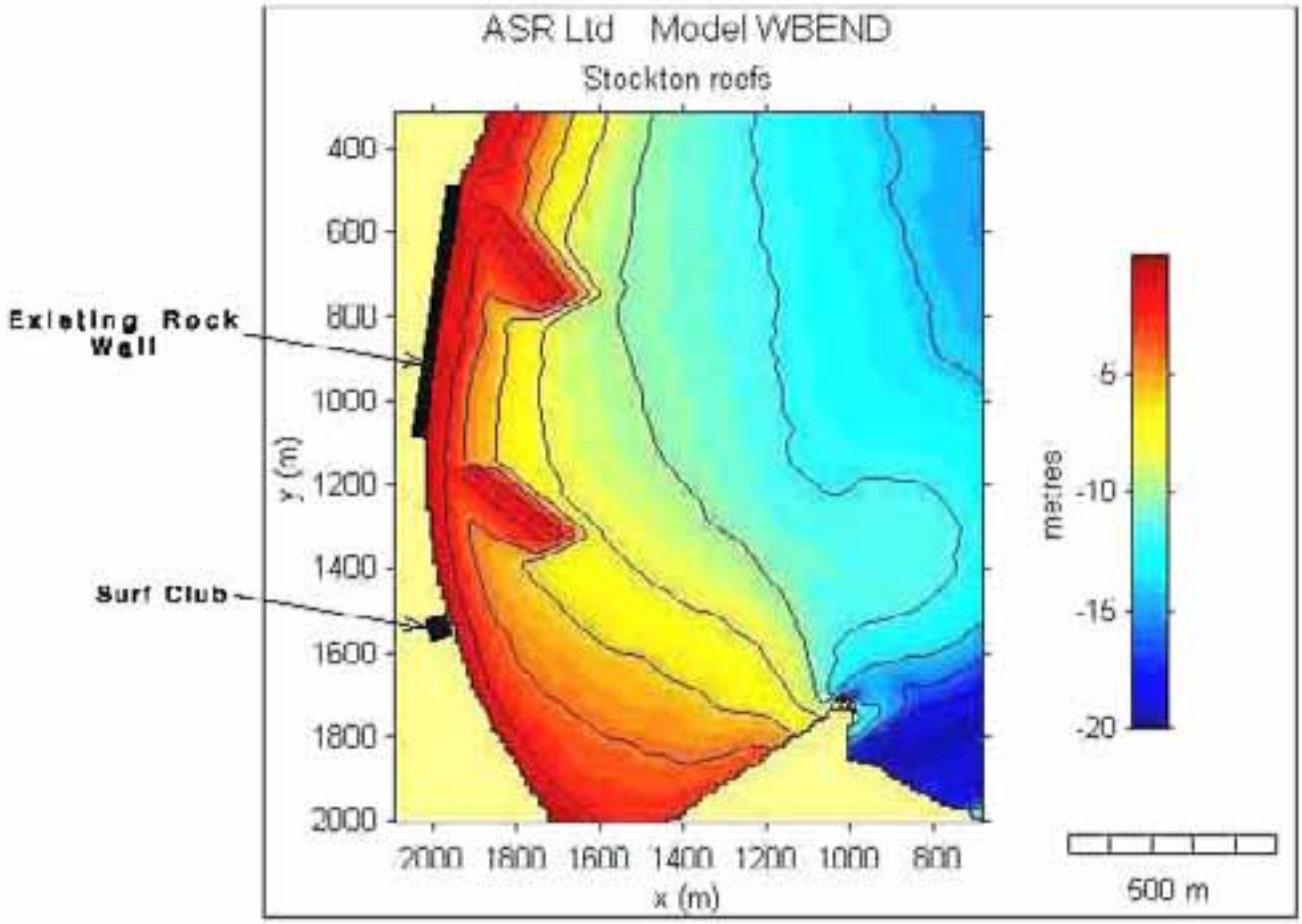
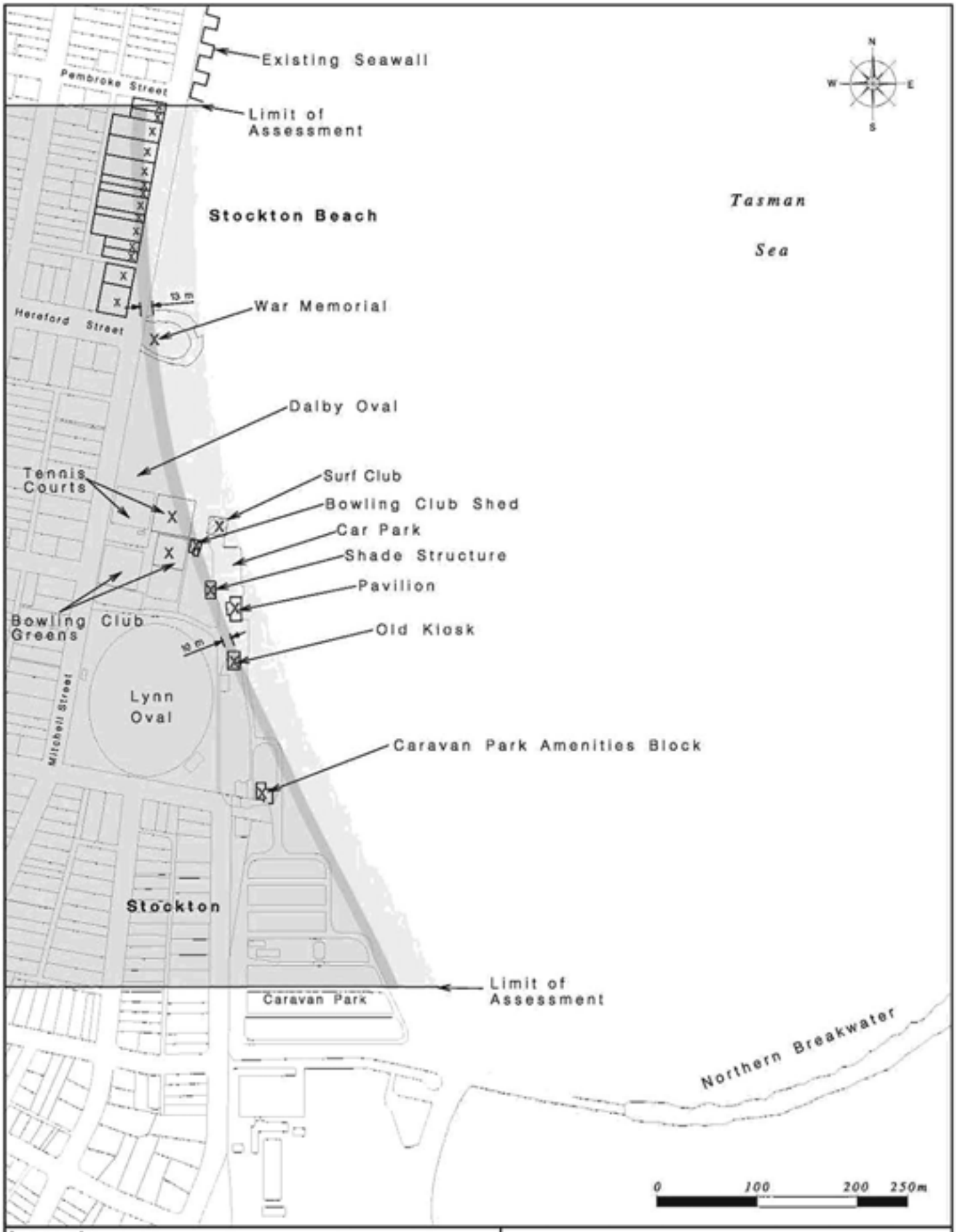


FIGURE 8.6
Conceptual Design of Two Artificial Submerged Reefs

Not to Scale	Ref No..R02_V2/1411_094.dgn

UMwelt (Australia) Pty Limited
Source: ASR Limited



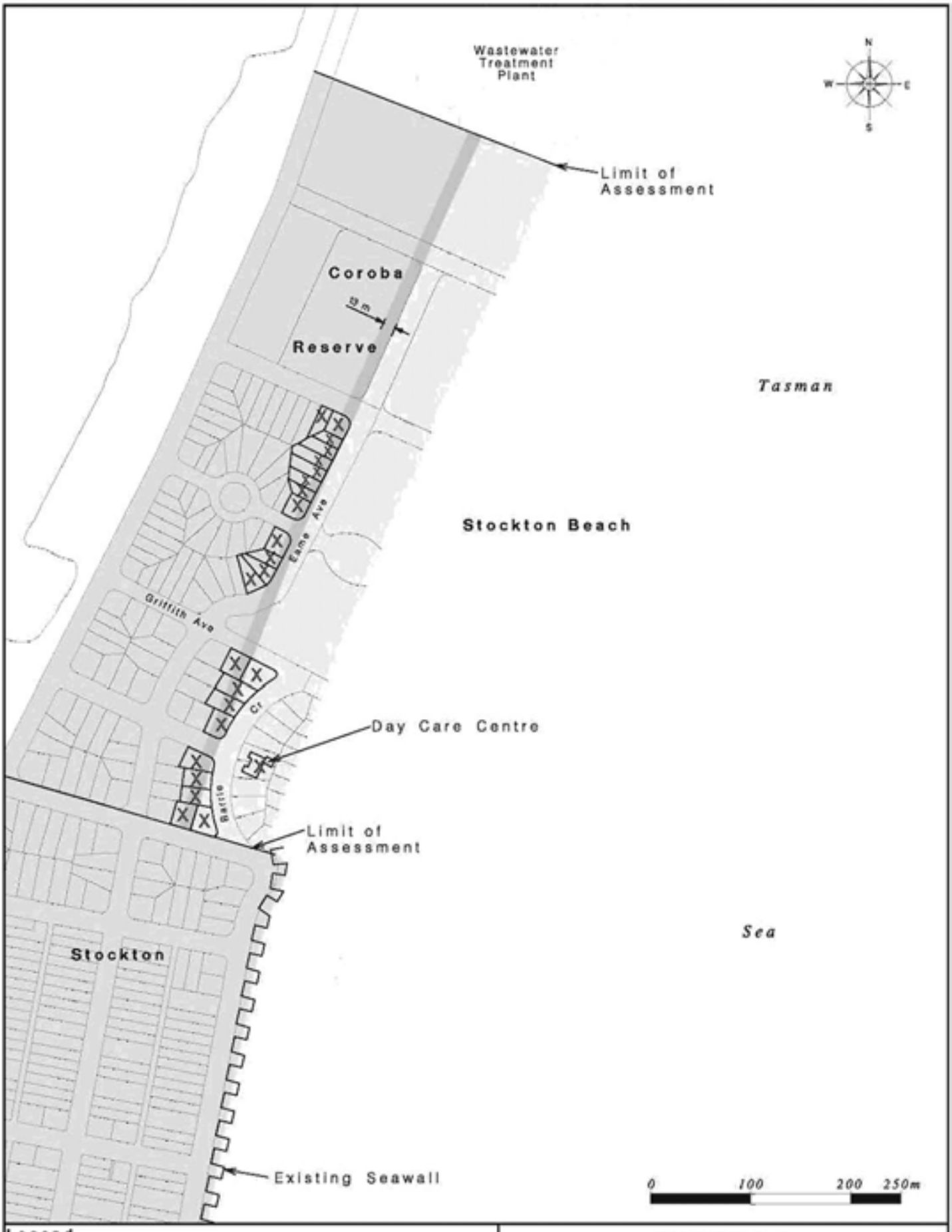
Legend

- Zone of Wave Impact & Slope Adjustment
- Zone of Reduced Foundation Capacity
- Stable Foundation Zone
- X Buildings & Infrastructure under Threat within 50 Years

Umwelt (Australia) Pty Limited
Source: SMEC

FIGURE 8.7
Planned Retreat Option Based on 50 Years (2050) Zones of Beach Erosion Risk Stockton Beach (South)

A4 Scale: 1:5 000 | Ref No.:R02_V2/1411_101.dgn



Legend

- Zone of Wave Impact & Slope Adjustment
- Zone of Reduced Foundation Capacity
- Stable Foundation Zone
- X Buildings & Infrastructure under Threat within 50 years

Umwelt (Australia) Pty Limited
Source: SMEC

FIGURE 8.8
Planned Retreat Option based on 50 Years (2050) Zones of Beach Erosion Risk Stockton Beach (North)

A4 Scale: 1:5 000 | Ref No.:R02_V2/1411_102.dgn

(mobile phone 0417 401 270). The service has 1000 bags stored on site in preparation for a storm event.

In addition, the Tighes Hill SES has a sand bagging machine that can fill and produce a sand bag every 10 seconds. A second sand bagging machine is available at the Maitland branch of the SES which could be transported to Stockton Beach within one hour.

2. **Works Recommended for Immediate Action -** In lieu of implementing major works to address long term erosion processes at Stockton Beach, on the basis that major works could not be recommended without a detailed coastal process understanding having been developed, it is proposed that the following works are implemented to supplement the interim measures already adopted by Council:

   - Large sand bag protection works to be installed as an extension of the rock revetment south of Pembroke Street to protect some 75 metres of Mitchell Street.

   - Additional large sand bags be installed to prevent the sand bag revetment at the surf club from being outflanked.

   - Sand be placed at the root of the Northern breakwater to obviate a break through at this location and resultant oceanic inundation of the Caravan Park.

3. **Detailed Process Analysis and Consideration of Long Term Management Options** - Undertake detailed analysis of the coastal processes impacting on Stockton Beach to identify the cause of the observed long term erosion, the pathway of sand movement from the beach system and appropriate structures/systems that can be implemented to address the erosion of the beach. This work will include tracer studies, further hydrographic survey, development of detailed wave transformation models and detailed design of feasible structures/systems.

Preliminary analysis indicates that any works on Stockton Beach are likely to cost in excess of $10 million and are likely to require significant ongoing maintenance and financial commitment.

Table 8.4 – Assets and Infrastructure

Asset Description	Capital ($)*	Tenure
Planned Retreat (Property Acquisition) - Seawall Retention		
Residential Lots (37 @ 450 k)	16,650,000	Private
Day Care Centre	200,000	Crown – NCC Control
Stockton Surf Club	2,175,000	Crown – NCC Control
Stockton Pavilion	840,000	Crown – NCC Control
SLSC Car Park (2500m2)	101,825	Crown – NCC Control
Shade Structure (near SLSC)	50,000	Crown – NCC Control
Bowling Club Shed (Brick)	30,000	Crown – Leased to Club
Bowling Club Green (x1)	80,000	Crown – Leased to Club
Tennis Courts (x3)	210,000	Crown – NCC Control
Bed & Breakfast (Old Kiosk)	150,000	Crown – NCC Control
Area of Caravan Park Sites	160,000	Crown – NCC Control
Caravan Park Amenities Block	50,000	Crown – NCC Control
Dalby Oval	165,000	Crown – NCC Control
Road Surface (1200m)	733,140	NCC
Relocate Coroba Park oval west	10,000	Crown – NCC Control

Table 8.4 – Assets and Infrastructure (cont)

Asset Description	Capital ($)*	Tenure
Relocate War Memorial	20,000	Crown – NCC Control
Repair existing seawall	1,000,000	Crown – NCC Control
Construction of new seawall returns	1,000,000	DLWC/NCC
Wastewater Treatment Plant	N/A - To be Decommissioned in 2002	
Remove Structures	5,000,000	
TOTAL	**28,624,965**	
Planned Retreat (Property Acquisition) - Seawall Removal		
Residential Lots (83@450k)	37,350,000	Private
Road Surface (1900m)	1,160,805	NCC
Remove Structures	6,000,000	
Assets from Seawall Retention Option	4,241,825	See above
TOTAL	**48,752,630**	

**present day value*

8.2.7 Whole of Coastline Management Options

Of the many issues raised in **Section 7.0**, a high proportion are relevant to the entire coastline, or a significant length of the coastline, rather than individual beaches or areas. For this reason, they have been grouped as 'whole of coastline' issues (**Section 7.3.1**), and their relevant management options explored in **Table 8.5**.

Table 8.5 - Whole of the Coastline Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Maintenance of existing coastline structures and infrastructure	Implement Council's DISPLAN in relation to coastal hazards, as taken from the ERIAP.	High	As req'd $230,000+	N/A	To fulfil Council's 'Duty of Care' in relation to public safety.	Competing priorities with other non-coastal emergencies.	Med
	Implement Council's MAPP in relation to coastal hazards for immediate coastal zone structures ongoing and in accordance with Coastline Management Plan priorities.	Ongoing	As req'd $16M/$70M (cost to replace)	$500,000/ $2.5M	To fulfil Council's 'Duty of Care' in relation to public safety. Provides for the aesthetic and recreational amenity of the coastline.	High costs associated with the maintenance of infrastructure.	High
	Implement Council's MAPP in relation to coastal hazards for infrastructure reliant on protection and in accordance with Coastline Management Plan priorities.	Ongoing	As req'd $19.5M/ $85.5M	$700,000/ $3M	To fulfil Council's 'Duty of Care' in relation to public safety. Provides for the aesthetic and recreational amenity of the coastline.	High costs associated with the maintenance of infrastructure.	High
Natural Environment							
Management of rock platforms from Nobbys to Burwood Beach	Install international standard educational signage at each rock platform entrance point – regarding the ecology and collection of intertidal species.	High	$10,000	$2,000	Education of rock platform users to protect diversity of species. Provides protection of intertidal organisms on rock platforms. Cost effective.	Signs can be ignored.	Med

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Enforce policing of NSW Fisheries bag limits for taking of individual species	High	N/A	N/A	Provides protection of intertidal organisms on rock platforms.	Enforcement is NSW Fisheries' responsibility.	Med
	Apply to be part of the 'Project Aware on the rocks' training program for Newcastle LGA.	Med	$500	N/A	Provides training for local volunteers in the management of rock platforms. Cost effective.		High
	Continue to support regional Coastcare facilitator.	High	N/A	$2,500 and in-kind support	Provides a cost-effective resource for the improvement of the natural coastal environment. Provides training and support to community groups. Relieves the burden on Council to resource such a position, as it is funded mainly by State/Federal Government.	Coastcare facilitators are currently non-permanent positions. State/Federal funding may cease.	High
	Assist Coastcare in promotion of their rock platform/ intertidal areas educational program, via Council media.	Med	$2,000 to $4,000	$2,000 to $4,000	Assists in educating a wider audience with in the community		High
Weed infestation, particularly Bitou Bush, and potential rehabilitation/re-establishment of dune vegetation	Undertake Dune Revegetation and Weed Maintenance Management Plan for entire coastline which includes cliffs and bluffs.	High	$25,000	N/A	Co-ordinated approach to the major weed problem rather than ad-hoc approach. Weed maintenance and dune revegetation in one plan. Bitou bush is almost impossible to eradicate so a weed maintenance plan is important. Control wind blown sand.	Funds to undertake plan could be spent on revegetation works.	Med
	Assist with the establishment of Landcare/ Dunecare/ Coastcare group(s) for entire coastline or individual beach areas	Ongoing		$1,000-$3,000 per group	Establish community ownership of the beach and improve ecological integrity. Increase visual and recreational amenity.	Such groups require continual support.	High

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Continue to support regional Coastcare facilitator.	High	N/A	$2,500 and in-kind support	Provides a resource to the improvement of the natural coastal environment. Provides training and support to community groups. Relieves the burden on Council to resource such a position.	Coastcare facilitators are currently non-permanent. Such groups require continual support.	High
	Undertake manual dune rehabilitation through establishing native vegetation, removal of Bitou Bush infestations and repair and maintenance of fencing	High and Ongoing	$15,000 to $20,000 per hectare	As req'd $3,000 to $5,000 per hectare	Restore ecological integrity of coastline vegetation. Work should link to Newcastle Biodiversity Strategy Improve visual amenity of coastline. Provides habitat for native fauna. Control wind blown sand	Labour intensive	High
The unauthorised use of companion animals such as dogs on all beaches	Install new, and upgrade existing, signs regarding use of companion animals on beaches, in relation to new Companion Animal Act.	High	$500 per sign	<$500 per sign	Community is aware of the issue. Public pressure for appropriate use will increase.	Signs can be ignored.	Med
	Council's ranger service telephone number be placed on signs and other locations.	Low	$500 per sign	<$500 per sign	Any community member can take action.	Signs can be ignored.	Med
	Empower Council lifeguards with the authority to fine offenders.	Med	N/A	$1,000-$3,000 for training.	This resource currently exists and is a cost-effective approach.	Lack of acceptance by community and lifesavers to have increased powers.	Low
	Public Awareness Campaign	Low	$5,000	$5,000	Community is aware of the issue. Public pressure for appropriate use will increase.		High
	Investigate extra dog use beaches other than Horseshoe Beach	Low	$2,000	$1,000	May reduce unauthorised use on beaches.	Beaches are not appropriate areas for companion animals, particularly regarding human health and amenity	Low

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Amenity							
The aesthetic quality of the coastal public reserves, and the coastline as a whole, is diminished particularly by general lack of vegetation, shade and shelter.	Review and implement Newcastle Landscape Structure Plan (NLSP) to confirm strategic principles and priorities for landscaping the coastline corridor.	High	$5,000 to $10,000	N/A	Uniform and co-ordinated approach to coastline aesthetic quality. Potential economic benefits from beautified coastline.	Time delay in finalisation of NLSP.	High
	Continue preparation of master plans for the coastline corridor, reserves and adjoining streets in accordance with NLSP to provide shade, shelter and visual amenity.	High	N/A	As req'd	Uniform and co-ordinated approach to coastline aesthetic quality. Potential economic benefits from beautified coastline.	Time delay in finalisation of NLSP.	High
	Remove redundant infrastructure, fences, signage, etc. and replace with consistent design infrastructure.	High	$		Reduced long term maintenance costs. Increased amenity of coastline.	Labour intensive.	High
	View preservation from public and private lands should be investigated on part of each master plan.	High	$10,000	N/A	Uniform and co-ordinated approach to coastline aesthetic quality. Potential economic benefits from beautified coastline.	Time delay in finalisation of NLSP.	Med
	Explore themes for whole of coastline and individual areas to provide identity i.e. species of medium to large trees to identify activity nodes.	Low	$5,000 to $10,000	$1,000 to $2,000	Attract visitors to the main facilities of the coastline. Uniform and co-ordinated approach to coastline aesthetic quality. Potential economic benefits from beautified coastline.		High
New development and its obstruction of lookouts	Prepare a DCP or LEP to ensure views from lookouts remain unhindered	Low	$10,000	N/A	More enforceable controls on inappropriate development		Med
Stormwater impacts on beach amenity due to scour and water quality, particularly of ponded stormwater.	Implement stormwater outlet maintenance program for the coastline, particularly after heavy rain events, to reshape dunes and remove ponding	High, Ongoing	N/A	$1,000-$3,000 per outlet	Can be incorporated into current beach maintenance program. Improved beach amenity. Removal of public health risk.	Labour intensive practice.	High

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Erect signs after rainfall events if ponding occurs to warn public of public health risk	High, Ongoing	$1,000 per sign	<$1,000 per sign.	Community awareness of public health risk. Possible fulfilment of Councils 'Duty of Care'	Hazard still exists	Med
	Install more bins on foreshore to aid in rubbish removal	Low	$ design	$ design	Reduced litter reaching the beach area.	Detract visually.	Med
	Install GPT with oil separator within John Parade Merewether outlet (outlet No.2), under John Parade footpath	Low	$50,000-$80,000	$5,000	Removal of litter and oil from stormwater that reaches beach. Only catchment that may warrant such a device	High capital costs. High maintenance costs.	Med
	Increase the accountability of people who fail to install sediment traps at new developments in a coastal catchment.	High, Ongoing	N/A	N/A	Less pollutants reaching the beach environment.		Med
	Develop community awareness of the impact of catchment activities on the quality of stormwater as part of LGA catchment management program.	High	$design	$5,000 to $10,000	Cost effective if part of LGA program. Increased awareness in community.	Cultural apathy in relation to stormwater education.	Med

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Socio-Economic							
Co-ordination of the planning, design and implementation of coastal projects, particularly those involving expenditure, by Council and government agencies, and subsequent development and upkeep	Employment of Coastal Management Officer at NCC, within City Strategy – Environmental Assets Team	Med	N/A	$80,000 to $110,000	A consistent and integrated approach to coastal management can be co-ordinated from one section of Council. The Officer can co-ordinate implementation of the Management Plan. Assist (or co-ordinate) in regional management of Hunter coastline. One point of contact between Council and the community / State agencies regarding coastal management. Perhaps include estuary management into all of the above. Co-ordinate the Hunter Coast and Estuary Management Committee.	Cost of employing another staff member. The role may be able to be fulfilled by a current staff member.	High
	All proposals and Development Applications with the potential to impact on the coastline be referred to the Hunter Coast and Estuary Management Committee for comment.	Ongoing High	N/A	N/A	Consistent application of the principles within the NSW Coastal Policy and the Newcastle Coastline Management Plan.	Delay in approval process.	Med
Equity of access to the coastline	Extend present public transport services to provide for bus and taxi services to the activity nodes to support tourist one-way trips along the Bathers Way.	Med	$design	N/A	Allows members, the community and tourists, without vehicles, to access the majority of the coastline. These services will also support ESD principles for coastline users in general.	Depends partly on the NSW Government for public transport.	Med

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide footpath/cycleways as a continuous link between activity nodes within the foreshore reserves.	Low	$120 linear metre	$5,000	The Bathers Way and the Stockton coastline footpath/ cycleway would link Newcastle with Lake Macquarie to the south and Port Stephens to the north.		High
	Complete the section between Nobbys and Bar Beach Pavilion, for the Bathers Way, where there are gaps and inadequate routes, as the highest priority.	High	$design	$design	Provides continual access along coastline.	Potentially high capital costs.	High
	Landscape to provide footpath/cycleways, shade, shelter and visual amenity including softening or screening of urban development where it is close to the route.	High	$design	$design	Improves amenity for users of path. Improves equity by increasing the ability for people to use the path. Greater acceptability of residents in close proximity.	Potential high capital costs.	High
The length of the period of any lease issued to provide facilities	Prepare guidelines for the management and operation of facilities within the public reserves and Special Lease areas including appropriate leasing and licensing arrangements.	Med	$5,000 to $10,000	$1,000 to $2,000	Increased range of commercial opportunities, therefore services being provided to the community.	Guidelines need to be very flexible to cater for changing demands.	Med
	Maintain flexibility of control over uses in the coastline reserves by allowing only short to medium term leases.	High	N/A	N/A	Some uses may be season dependent. Community expectations and trends can change rapidly.	Some commercial enterprises require long term leases for financial security.	Med
	Ensure flexibility to meet changing needs for services and activities within the coastline corridor to take precedence over income earning considerations.	High	N/A	N/A	Some uses may be season dependent. Community expectations and trends can change rapidly.	Some commercial enterprises require long term leases for financial security.	Med

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Develop guidelines for temporary use of public reserves for a range of events in support of community activity and development of the tourist industry including short term exclusive use of suitable areas to facilitate private events.	Med	$5,000		Assists in organising of major events such as Surfest.		Med
The height, bulk, scale, setback and siting of new development should ensure that beaches and recreation reserves are not overshadowed, and should consider the aesthetic impact on the public reserves.	Prepare a Coastline DCP to include: • Prepare a comprehensive set of guidelines for the coastline corridor to reflect its significance as a recreation area of high aesthetic quality including: - principles for the whole coastline; - principles for sub-units; and - detailed land use and master plans according to priority. • Adopt standards to ensure no overshadowing of beaches and reserves by buildings, for example, adopt the NSW Government Coastal Policy Guideline of no overshadowing before 3.00pm mid winter and 6.30pm summer daylight saving time.	High	$50,000	N/A	Increases and maintain public amenity of beach areas. Provides for consistent management approach of coastline.	Limits height and location of buildings adjacent to beaches.	

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	• DCP to include detailed guidelines for the type, location, and scale of uses appropriate within the public reserves, Crown Special Lease areas and Special Uses 5(a) zones should these become available for redevelopment. • Include guidelines for the future desired character of the corridor and sub units and guidelines for the design of facilities to achieve the desired character. • Include guidelines for the preservation of views from existing lookouts where these may be threatened by development carried out in accordance with present controls – Strzelecki Lookout, the Obelisk. • Include controls for the scale, height, setback, colour, and design quality of new development or redevelopment on headlands.						
Cultural Heritage							
Management of aboriginal cultural heritage of the coastline	A detailed management plan be compiled for the Aboriginal cultural heritage values along the coastline.	Med	$20,000	N/A	Management of aboriginal cultural heritage is on wider cultural heritage values and interpretation rather than on the protection of specific sites.		Med

Table 8.5 - Whole of the Coastline Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Produce interpretive /educational material, such as interpretive signs, to illustrate their lifestyle and history and how the landscape was used.	Med	$20,000	$2,000	Informs the community and visitors of Aboriginal cultural heritage. Cost effective. Can be incorporated into the current Bathers Way project.		High
	Previously recorded sites within the coastline be relocated and their condition and significance assessed.	Low	$design	N/A	Informs the community and visitors of Aboriginal cultural heritage. Can be incorporated into the current Bathers Way project.		Med
Management of European cultural heritage of the coastline	The resources of European heritage associated with the Newcastle City coastline be further studied	High	$25,000 (not including a Consultation Management plan if needed)	$ Design	Provides definition of the resource. Provides for proper comprehension of the heritage values of the resource (individually and collectively) Improves Council's ability to: • manage the values of the resource, and • communicate the values of the resource Satisfies statutory requirements.		High
	In the event that any activity is undertaken, planned or foreshadowed that could have the effect of disturbing, damaging or destroying the fabric, visual amenity or curtilage or precinct of any heritage resource referred to in **Section 2.3** the party responsible should be required (in accordance with **Section 8.2.4**): • to complete a detailed archaeological study, and • to demonstrate compliance or intended compliance with the requirements of all relevant NSW and Commonwealth legislation.	High Ongoing	Site dependant	N/A	Provides definition of the resource. Provides for proper comprehension of the heritage values of the resource (individually and collectively) Improves Council's ability to: • manage the values of the resource, and • communicate the values of the resource Satisfies statutory requirements.		High

8.3 SPECIFIC BEACH AREAS MANAGEMENT OPTIONS

Of the many issues raised in **Section 7.0**, a high proportion are relevant to the entire coastline, or a significant length of the coastline, rather than individual beaches or areas. For this reason, they have been addressed as 'whole of coastline' issues in **Section 8.2**. However, if a 'whole of coastline' issue has a unique quality or high priority in a particular area, it is also addressed in the relevant management options table. The management options tables for the Newcastle Coastline are:

- Stockton Beach (**Table 8.6**).
- Nobbys Beach (**Table 8.7**).
- Newcastle Beach (**Table 8.8**).
- Shepherds Hill area (**Table 8.9**).
- Merewether Beach / Dixon Park / Bar Beach (**Table 8.10**).
- Burwood Beach (**Table 8.11**).

8.3.1 Stockton Beach management Options

The range of possible options to address identified management issues for Stockton Beach are presented in **Table 8.6**.

Table 8.6 - Stockton Beach Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Erosion of the sand dune system and the associated development at risk from coastal processes.	As part of any beach protective works provide for footpath / cycleway within public reserve along Mitchell St	High	$design	$design	Promenade facilities are retained and/or enhanced.		High
Damage to fencing at toe of dune in seaward of caravan park	Reinstate fencing and access #	Low	$10,000		Public amenity is returned and maintained.	Works may need to be repeated following storm event/s.	High
	Fertilise and supplementary planting as needed #	Low	$5,000		Public amenity is returned and maintained.	Works may need to be repeated following storm event/s.	High
Management of Dune Revegetation	See **"Whole of Coastline"**						

Table 8.6 - Stockton Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Amenity							
The aesthetic quality of the coastal public reserves, and the coastline as a whole, is diminished by general lack of vegetation, shade and shelter.	Provide adequate shade structures, picnic and barbecue areas and implement tree planting at Griffith Park, Pitt Street Reserve and Rawson Park.	Med	$design	$design	Improve visual and recreational amenity.	Increases number of facilities requiring maintenance.	High
Pedestrian amenity and access to the coastline	Provide traffic calming devices along the Mitchell St beach frontage	Med	$design	$design	Improves pedestrian safety and amenity.		Med
	Angle parking front to kerb and footpath extensions for landscape islands to define parking bays on both sides of street and to facilitate pedestrian crossings	Med	$design	$design	Improves pedestrian safety. Increases visual amenity.		Med
	Provide for large tree landscaping at locations such as road intersections with seating and picnic facilities, with trees positioned to maintain views for residents	Med	$design	$design	Improves pedestrian safety. Increases visual amenity. Improves the equity of access to the beach and its foreshore/promenade.	Some minor loss of views of the ocean.	Med
Compatible coastline management with Port Stephens	Install and maintain signage re: 4WD access	Med	$500 per sign	<$500 per sign	Community is aware of the issue of 4WD access	Signage can be ignored.	Med
	Physically restrict access points from Newcastle LGA on the beach	Med	$2,000 per access point	<$2,000 per access point	Community is aware of the issue of 4WD access		Med
	Provide formal beach access north of WWTP	Med	N/A	$1,000 per access point	Stockton could service some of the trade associated with 4WD beach goers	Damage to dune areas	Med

Table 8.6 - Stockton Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Socio-Economic							
Opportunities for future development of the local economy through the pursuit of tourist activities	Provide for low key refreshment facilities at Stockton Ferry Wharf.	Med	$20,000	$2,000 to $4,000	Establish an attractive arrival/departure point. Support coastline footpath/cycleway. Facility can be leased. Provides income for use on other initiatives.	Due to relative isolation, vandalism may be an issue	High
	Provide a directory of facilities available in Stockton and surf pavilion area at Stockton Ferry Wharf. (eventually, a restaurant may be appropriate at the wharf)	Med	$5,000	$1,000	Establish an attractive arrival/departure point. Support coastline footpath/cycleway. Facility can be leased. Directory could form part of refreshment facilities.	Due to relative isolation, vandalism may be an issue	High
	In a coastline DCP for new development (See **Table 8.3**) include a section specifically to address the Fullerton Street corridor/Stockton North redevelopment.	Low	$10,000	N/A	Forward planning approach to avoid ad hoc decision-making.	DCP needs to be dynamic to cater for changing community values.	Med
	Support the development of small scale commercial uses within mixed use buildings at the edge of the reserves in the proposed 2(b) zoning under draft LEP 2000.	Ongoing	As req'd. $design	$design	Greater services and facilities to coastline users and visitors.		Med
	Wider promotion of the Stockton Caravan Park as Newcastle's only such coastal facility.	Ongoing	$design	$design	Increase tourism to Newcastle. Economic benefits to Stockton and Newcastle.	Increase pressure on facilities and infrastructure. Sometimes full.	Med
	Ensure a Decommissioning Plan for Stockton. WWTP identifies sustainable future opportunities for the site	High	To be determined	To be determined	Future uses are compatible.		High

8.3.2 Nobbys Beach Management Options

The range of possible options to address identified management issues for Nobbys Beach are presented in **Table 8.7**.

Table 8.7 - Nobbys Beach Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Coast	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Sand drift (wind blown sand) on to southern breakwater #	Undertake dune rehabilitation through establishing native vegetation, removal Bitou Bush infestations #	Med	$15000-$20000 per hectare	As req'd $1,000 to $3,000 per hectare	Will reduce sand drift.	Continual maintenance of vegetation is required if sand drift is to be overcome.	Med
	Install dune fencing to restrict public access	Med	$3,000	$1,000 to $3,000	Assists in vegetation stabilisation.	High maintenance costs. Reduces public amenity. Detracts visually	Low
	Clear sand as necessary and place on beach #	Ongoing	N/A	$5,000	Access to lighthouse and breakwater is maintained	Ad hoc costs to Port Corporation	High
Rock falls from high cliffs in high use area of Nobbys Headland #	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard. Council's 'Duty of Care' may be fulfilled. Cost effective.	Hazard still exists.	Med
	Provide fencing to prevent access #	Med	$2,500	<$2,500	Community awareness of hazard. Council's 'Duty of Care' fulfilled.	Hazard still exists. Detracts visually. High maintenance.	Low

Table 8.7 - Nobbys Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Coast	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Areas of instability of cliff face above Shortland Esplanade between Nobbys and Newcastle Ocean Baths	Erect warning signage.	High	$3,000	<$3,000	Community awareness of hazard. Council's 'Duty of Care' fulfilled.	Hazard still exists. High maintenance.	Low
	Implement appropriate slope stabilisation and improvement strategies which includes public consultation.	Med	$design	$design	Pedestrian and vehicle access remains.	Potentially high capital costs	Med
Natural Environment							
Management of Rock Platforms	See **"Whole of Coastline"**						
Management of Water Quality	See **"Whole of Coastline"**						
Management of Dune Revegetation	See **"Whole of Coastline"**						
Amenity							
The aesthetic quality of the coastal public reserves, and the coastline as a whole, is diminished by general lack of vegetation, shade and shelter.	Provide picnic and barbecue facilities within foreshore park of Horseshoe Beach	High	$1200 per site		Improves visual and recreational amenity. Improves the equity of access.	Increases number of facilities requiring maintenance.	High
The siting and appearance of the car park spaces and vehicle access is intrusive, particularly the congestion and public safety near the roundabout.	Provide for traffic calming devices.	Med	$design	$design	Improve pedestrian environment. Increases public safety	Traffic will be slowed during peak use times.	High
	Carriageway landscaping to narrow carriageway at pedestrian crossing points.	Med	$design	$design	Improve pedestrian environment. Increases public safety	Traffic will be slowed during peak use times.	High
	Widening of footpaths between the Newcastle and Nobbys Surf Pavilions	Med	$ per m^2	$ per m^2	Improves pedestrian amenity. Improves equity of access between the beach and park.		High

Table 8.7 - Nobbys Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Coast	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
The leash free dog use at Horseshoe Beach and the extension of this practice at Nobbys	Relocate "dog poo bins" from current location to a more inconspicuous location with in dog exercise area	Med	<$1,000	N/A	Improves visual and recreational amenity of beach area		High
	See **"Whole of Coastline"**						
	Reduce dog exercise area in size.	High	N/A	N/A	Improves visual and recreational amenity of beach area	Opposition from users of exercise area	Med
Socio-Economic							
Links to CBD and The (harbour) Foreshore	Provide for traffic calming devices	High	$design	$design	Improves pedestrian amenity		High
	Extend Bathers Way concept to include Nobbys Beach	Med	$design	$design	Improves pedestrian amenity. Improves visitor awareness.		High

8.3.3 Newcastle Beach Management Options

The range of possible options to address identified management issues for Newcastle Beach are presented in **Table 8.8**

Table 8.8 - Newcastle Beach Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Rock falls in high public use area of Shortland Esplanade, South Newcastle Beach #	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard. Cost effective.	Hazard still exists. Council's 'Duty of Care' may not be fulfilled.	High
	Implement slope stabilisation and improvement strategies #	High	$ design	$ design	Pedestrian and vehicular access remains.	High maintenance / inspection costs	High
	Close vehicular access and maintain narrowed pedestrian access	Med	$ design	$ design	Pedestrian access remains	Vehicular access is lost. Some car park spaces lost and public safety at risk.	Med
	Close public access completely	Med	$10,000		Public safety ensured	Vehicular access is lost. Some car park spaces lost and public safety at risk.	Low
Inundation of the lower sections of Shortland Esplanade	Close Shortland Esplanade during periods of inundation and assess any damage to infrastructure	Ongoing	$3,000	N/A	Public safety ensured	Damage may still occur to infrastructure. Temporary closure of public access	High
	Investigate preventative works for future, such as "wave return" on top of existing seawall	Low	$60,000		Reduce the need for temporary closures and damage to infrastructure	Reduced amenity	Med

Table 8.8 - Newcastle Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Natural Environment							
Management of Rock Platforms	See **"Whole of Coastline"**						
Management of Water Quality	See **"Whole of Coastline"**						
Management of Dune Revegetation	See **"Whole of Coastline"**						
Amenity							
The siting and appearance of car park spaces and vehicle access is intrusive and reduced public amenity at Newcastle Baths	Redesign area at the Ocean Baths to regulate parking and restore the former picnic area	Med	$design	$design	Restoration of the former picnic area. Improves public amenity.	May reduce number of car park spaces	High
	Provide a children's playground	Med	$15,000	$2,000	Restoration of the former picnic area. Improves recreational amenity.	Most likely to reduce the number of car park spaces	High
	Reduce the dominance of hard surfaces	Med	Re-grassing areas from $20 per m2		Addition of grassed sections and plantings. Improved public amenity. Lessens stormwater run off.		High
Car parking congestion and traffic management in Shortland Esplanade	Provide for traffic calming of Shortland Esplanade	High	$design	$design	Improves pedestrian amenity. Reduces the dominance of cars along foreshore.	May congest area if not designed appropriately.	High
	Replace pedestrian underpass with a signal controlled intersection and restoration of Shortland Park	Low	$100,000+		Improves pedestrian amenity. Improves equity of access between the beach and park	High capital cost.	Med
Integration of adjacent public space with Newcastle Beach, such as Pacific Park, Fletcher Park and promenade area (Shortland Park)	Provide for traffic calming of Shortland Esplanade	Low	$100,000+		Improves pedestrian amenity. Improves equity of access between the beach and park.	High capital cost.	High
	Replace pedestrian underpass with a signal controlled intersection and restoration of Shortland Park	Low	$100,000+		Improves pedestrian amenity. Improves equity of access between the beach and park.	High capital cost.	Med

Table 8.8 - Newcastle Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide terraced areas north of the Pavilion to provide a broader pedestrian area suitable for outdoor eating facilities	Low	$design	$design	Improves pedestrian amenity. Improves equity of access between the beach and park. Reduces stormwater run off.		Med
	Redesign Pacific Park area to allow smoother transition for pedestrians between Hunter St and the beach	Low	$design	$design	Improves pedestrian amenity and link between the beach and park		Med
	Provide additional parking at Newcastle Beach with redevelopment of the Hospital site	High	$design	$design	Improves pedestrian amenity.	Potentially long time frame before available.	High
	Provide public parking behind a commercial street frontage to Shortland Esplanade, where available	Med	$design	$design	Improves pedestrian amenity.	Potentially long time frame before available.	High
Public shading facilities are lacking at Newcastle beach foreshore area	Provide for sheltered seating in pedestrian areas allowing for views to the beach and Shortland Esplanade	High	$3,000	$500	Improves pedestrian amenity and equity of access to coastline.	May suffer vandalism.	High
	Provide for landscaping in Shortland Park and pedestrian areas to provide shade and further picnic facilities at Newcastle Beach	High	$1200 per site		Improves pedestrian amenity. Reduces stormwater run off.	Slight loss of previously unspoilt views from street level.	Med-High
Socio-Economic							
Existing development is visually intrusive at the Royal Newcastle Hospital site.	Include guidelines for redevelopment within a Coastline DCP – see **"Whole of Coastline"**	High	N/A	N/A	See **"Whole of Coastline"**	See **"Whole of Coastline"**	High
The siting and appearance of car park spaces and vehicle access is intrusive and reduces public amenity at Newcastle Baths	Consider establishment of low-key café at the Ocean Baths Pavilion	Med	$design	$design	Improved amenity of users. Economic benefits.		High

Table 8.8 - Newcastle Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Integration of adjacent public space with Newcastle Beach, such as Pacific Park, Fletcher Park and promenade area (Shortland Park)	Redesign Pacific Park to allow provision of facilities to allow activities such as markets, exhibitions and food stalls along the route	Low	$design	$design	Economic benefits to local economy. Increase recreational opportunities for beach users.	Adequate parking in the short term.	Med
Commercial development opportunities of the Newcastle Beach precinct	Support commercial development of the street frontages along Newcastle Beach when considering redevelopment proposals, especially the hospital site, in between the beachfront hotels and the street frontage	Ongoing	N/A	N/A	Provide more facilities for beachgoers and visitors. Economic benefits to local community.	Long term option	Med

8.3.4 Shepherds Hill Area Management Options

The range of possible options to address identified management issues for the Shepherds Hill Area are presented in **Table 8.9**

Table 8.9 - Shepherds Hill Area Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Loose footing and continued erosion along crest of cliff at Memorial Dr and The Terrace #	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard in relation to steep pathway and wet footing conditions. Cost effective.	Hazard still exists. Council's 'Duty of Care' may not be fulfilled unless access is restricted.	High
	Restrict access by fencing #	Low	$2,000 to $5,000	<$2,000	Reduces public risk. Council's 'Duty of Care' fulfilled.	Reduced visual amenity. High maintenance costs. Hazard still exists.	Low
	Permanently close dangerous existing section between Susan Gilmore Beach and Strzelecki Point #	Low	$5,000	$2,500	Reduces public risk. Council's 'Duty of Care' fulfilled.	Alternative route required	Med
	Investigate alternative route/boardwalk options in high risk area #	High **See Amenity**	$20,000	$3,000	Improves safety	Maintenance costs may prove to be higher.	Med
Unstable cliff environment and potential hazardous area for cliff top viewing in the vicinity of the Bathers Way.	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard. Fulfilment of Council's 'Duty of Care'. Cost effective.	Hazard still exists.	High

Table 8.9 - Shepherds Hill Area Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide formalised pathways/fencing/to control access #	Med	$140,000 ***	$3,000	Community awareness of hazard. Public safety improves.	High maintenance responsibilities.	Low-Med
	Geotechnical investigation to assess risk and risk mitigation measures #	Med	$35,500	N/A	Hazard may be ameliorated in the long term.	Time associated with completing the investigation. Potential maintenance costs.	Med
Rock falls from cliff section above Bogey Hole baths #	Erect warning signage with international standard warning diagram #	High	$500	<$500	Community awareness of hazard. Cost effective.	Hazard still exists. Council's 'Duty of Care' may not be fulfilled.	High
Natural Environment							
Protection of remnant vegetation Shepherds Hill cliff and bluff areas*	Replant area with indigenous heath species and remove Bitou Bush infestations.	Med	$15000 - $20000 per hectare	$ per ha.	Revegetation with native species will increase the ecological integrity of the system.	Needs to be undertaken	Med
	Stop the mowing of native *Themeda australis* grassland communities	High	N/A	N/A	Improves ecological integrity of headland areas. Cost saving to Council	Community may take time to adjust to lack of moving practice.	Med
	Assist to maintain Landcare group to undertake revegetation and maintenance works and invite community involvement.	Med		$3,000	See **"Whole of Coastline"**		
Management of Rock Platforms	See **"Whole of Coastline"**						
Management of Dune Revegetation	See **"Whole of Coastline"**						Med
Amenity							
Fragmented trails and access along area especially within King Edward Park	Create a pedestrian link to Nesca Park from Memorial Drive	Low	$15,000	$2,000	Improve safety and provides greater equity in access.	Steep slope to negotiate in constructing link.	Med
	Create a formal path or boardwalk from Bar Beach to Strzelecki Lookout	Med	$130,000	$3,000 to $5,000	Improves safety. Provides for greater equity in access to coastline.	Direct views of the coastline may be lost in places.	Med

Table 8.9 - Shepherds Hill Area Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Create a viewing platform at Strzelecki Lookout in conjunction with hang glider take-off area.	Low	$10,000	$1,000 to $2,000	Improves visitor safety and enhance visitor experience.		Med
	Upgrade paths throughout the Park	High	From $15 per m2	$2,000	Increases safety. Increases equity in access through the Park.		High
The maintenance of views from Strzelecki Lookout and the cottage may be threatened by future development	Ensure protection of views with Coastline DCP	High	N/A	N/A	Views from lookout are retained.	May restrict some private development opportunities.	Med
	Investigate means to reduce visual intrusion of communications facilities at lookout.	Low	$5,000		Improves amenity of the lookout area and enhances the visitors experience.	May be costly.	High
	Line marking to formalise parking activity and circulation at lookout	High	$2,000	$1,000	Improves equity of access to a popular lookout.	Labour intensive maintenance.	Med
	Develop design guidelines to ensure any redevelopment of adjoining private property does not intrude on amenity of reserve	High	$5,000 (check)	N/A	Current view remains uninhibited or improves.	Guidelines may be difficult to enforce.	High
Socio-Economic							
Commercial opportunities at sites within the Shepherds Hill area	Renew special lease for Club when lease expires and allow for refurbishment of club buildings and maintain present bowling club use.	Med	$5,000	Club's expense	Community recreational facility remains open.	Club may need substantial upgrading.	Med
	Issue a new Special Lease for a new function in the Club building. Must be low key	Med	$5,000	Dependent on function.	New function should enhance use of the area.	Works may be required to the existing building.	Med
	Do not renew lease for a Bowling Club and return land to King Edward Park reserve.	Med	$100,000	N/A	Increases open space area of the park. Enhances views from the Obelisk.	Cost of demolition. Loss of community facility.	Med

Table 8.9 - Shepherds Hill Area Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Do not renew lease in the Club building and provide for a visitor facility for King Edward Park, which may include: Restaurant, café, kiosk, souvenirs gallery, toilets and/or interpretation centre, provide parking to support greater pedestrian use of the Rotunda/picnic area and for events in the park.	Med	$design	$design	Increases amenity for users of coastline and park. Economic benefits gained could be used to embellish park.	Building may need substantial upgrading	High
	Develop a low-key refreshment facility, operating in support of the Bathers Way incorporated in part of the Shepherds Hill cottage	Low	$design	$design	Increases recreational opportunities in King Edward Park.	The cottage may first need renovations.	Med
	Remove existing treated log fencing and barriers and replace with more appropriate fencing to reveal rather than obscure the heritage of the site	Med	$10,000	$2,000	Improves visual amenity of the cottage and one of the gateways to the Park. Treated log fencing could be reused elsewhere.		High

8.3.5 Merewether / Dixon Park / Bar Beach Management Options

The range of possible options to address identified management issues for the Merewether / Dixon Park / Bar Beach Area are presented in **Table 8.10**.

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Stormwater impacts on cliff stability and poor drainage at cliff access point of Susan Gilmore Beach #	Investigate stormwater discharge management options #	Medium	$2,000		Removal of drainage hazard.	Council's 'Duty of Care' may not be fulfilled due to access remaining open.	Med
	Erect warning signage with international standard warning diagram #	High	$500	<$500	Community awareness of hazard in relation to steep pathway and wet footing conditions. Cost effective.	Hazard still exists. Council's 'Duty of Care' may not be fulfilled.	High
	Permanently close access to Susan Gilmore Beach from cliff access point and install warning sign at entrance point from Bar Beach	High	$500	<$500	Community awareness of hazard. People are not encouraged to an unpatrolled beach and into hazardous rock fall area. Fulfilment of Council's 'Duty of Care'. Cost effective. Removal of Ongoing cliff access maintenance costs.	Loss of access point to the beach.	Med

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Active erosion of cliff scarp above area of high public use at the northern end of Bar Beach #	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard of natural rock falls. Fulfilment of Council's 'Duty of Care'. Cost effective.	Hazard still exists. Visual impact of sign.	High
	Geotechnical investigation to assess risk and risk mitigation measures #	High	$2,500	N/A	Hazard may be ameliorated in the long term.	Time associated with completing the investigation.	Med
Risk of rock falls along cliff section at Dixon Park – Kilgour Ave #	Erect warning signage with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard of natural rock falls. Immediate fulfilment of Council's 'Duty of Care'. Cost effective.	Hazard still exists.	High
	Restrict access by fencing #	Low	$2,000	<$2,000	Severely reduces public risk.	Reduced visual amenity. Very high maintenance costs. Hazard still exists.	Low
	Geotechnical investigation to assess risk and risk mitigation measures #	Med	$2,000	N/A	Hazard may be ameliorated in the long term	Time associated with completing the investigation. High cost assessment.	Med
Rock falls from high cliffs in areas of high public use south of Merewether Baths #	Erect signage warning of hazard with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard of natural rock falls. Immediate fulfilment of Council's 'Duty of Care'. Cost effective.	Hazard still exists.	High
Natural Environment							
The maintenance of mown areas between Memorial Drive and dune vegetation south of the Life Saving Club encroaches into native regeneration areas.	Revise mowing maintenance. Maintenance practices to be less encroaching, in conjunction with Dune Maintenance Management Plan (see **"Whole of Coastline"**.	High	N/A	Associated with dune management	Improves ecological integrity of dune. Mowing maintenance costs will be reduced.	Lessen areas of usable open space.	Med
Management of Rock Platforms	See **"Whole of Coastline"**						

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Natural Environment							
Management of Dune Revegetation	See **"Whole of Coastline"**						
Amenity							
The intersection of Parkway Ave/Memorial Dr/Bar Beach Ave is dangerous for pedestrians, traffic and parking	Provide short term measures to improve traffic control at the intersection	High	$50,000	$	Improves public safety and amenity of coastline users		High
	Provide long term measures to redesign the intersection to provide for a fitting termination of Parkway Ave at the coastline	Med	$300,000	$5,000	Improves visual amenity of area.	High capital costs	High
Hard steep surfaces of the foreshore at Bar Beach exacerbate runoff, hinder access and detract visually	Replace all unnecessary hard surfaces within the Beach precinct and replace with grassed areas	High	$20 per m^2 for planting	$2,000	Improves visual amenity and provide areas for passive recreation and picnicking.	Grassed areas will require higher maintenance than hard surfaces	High
Memorial Drive is visually and physically intrusive because of it design , and access between Bar Beach and Empire Park is dangerous *	Remove parking along Memorial Drive and establish trees within existing parking spaces	Med	$25,000	$5,000	Assists in creating a link between Memorial Dr and Empire Park. Parking is prevalent in car parks at either end of Bar Beach	Loss of close-to-beach parking.	Med
	Provide for traffic calming of Memorial Dr at the Bowling Club	High	$20,000	$5,000	Provides linkage between Empire Park and Bar Beach. Improved pedestrian access	Slows traffic on a high volume roadway.	High
	Provide for traffic calming of Memorial Dr at Surf Club	High	$20,000	$5,000	Provides linkage between Empire Park and Bar Beach. Improved pedestrian access	Slows traffic on a high volume roadway.	High

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide for traffic calming at Parkway Ave	High	$20,000	$5,000	Improved pedestrian access. Provides linkage between Empire Park and Bar Beach.	Slows traffic on a high volume roadway.	High
The aesthetic quality of the coastal public reserves, and the coastline as a whole, is diminished by general lack of vegetation, shade and shelter.	Planting of suitable trees growing indigenous species on grassed embankments and open spaces along beach promenade. (in consultation with the hang glider industry)	High	$5 per m^2		Improves visual amenity of precinct and assist in maintaining ecological integrity of the coastline.	Some views from residents may be interrupted.	High
	Install picnic facilities and shade structures at the northern corner of Empire Park in conjunction with a hang glider landing area.	High	$10,000 to $20,000	$2,000	Improved amenity and facilities at an under-utilised area, so close to Bar Beach Pavilion	Facilities must be low-key to cater for hang glider landings	High
	Provide shade facilities at Dixon Park using trees and shade structures.	High	$10,000	$2,000	Improves recreational opportunities. Reduces impact of salt-laden winds.	May interfere with hang glider landings.	High
	Install further picnic facilities wind breaks at Dixon Park *	High	$25,000	$2,000	Improves public and visual amenity and recreational opportunities.	May interfere with hang glider landings.	High
	Relocate or greatly reduce Dixon Park car park and enlarge Dixon Park Surf Club car park.	Low	$100,000	$3,000	Enhances linkage between beach and park. Reduces stormwater run off.	Possible reduction of parking at foreshore.	Med
	Develop shade through the provision of trees and structures in Jefferson Park including picnic facilities	High	$25,000	$5,000	Improves amenity. Visual and recreational. Reduces impact of salt laden winds.	Need high level maintenance in early stages of growth.	High
	Plant native tree species in car parks	High	$5 per m^2		Delineates car spaces. Provides shade. Improves amenity.	Need high level maintenance in early stages of growth	High

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide adequate lighting at the Merewether Baths	High	$2000 per unit	<$2,000	Improves safety, especially at night.	May disturb residences in the vicinity.	High
	Link the Beach Hotel with the Surf House via a pathway through Jefferson Park, including picnic tables in park design	High	Pathway from $15 per m^2; Shade structures, seating and picnic facilities $25000		Linking coastal open space areas with surrounding areas of economic activity to maximise recreational amenity and public use	May create public nuisance by linking the Hotel with the beach.	High
	Provide terraced areas with shade and siting structures along promenade at Merewether Bath precinct.	Low	$30,000	$5,000	Greatly improves equity of access and public amenity.	High capital cost.	High
Equity of access	Provide disabled access to Merewether baths **	High	$3,000	<$1,000	Improves equity of access to Baths precinct		High
	Address weekend and public holiday public transport access to beaches to Merewether, Dixon Park and Bar Beach **	High	$design		Improves visitation at poorly accessed beaches will alleviate some overcrowding issues in the peak user periods at other beaches	Public transport is controlled by State Government.	Med
	Continue lifeguard patrols after normal hours during daylight savings period, at the discretion of the lifeguards				Improves safety. Improves equity of access by providing patrolled beaches after work hours Mon-Fri.		
	Provide public telephone				Improves safety.	Associated costs.	
The siting and appearance of car park spaces and vehicle access is intrusive and reduced public amenity at Merewether Beach and Baths	Reduce the dominance of hard surfaces		Re-grassing areas from $20 per m^2		Addition of grassed sections and plantings. Improves public amenity. Reduces stormwater run off.		High
	Resurface car parks in Jefferson Park with a porous paving system	Low	$design	$design	Increases green volume and decrease surface water runoff.		High
	Framework plantings	High	$5 per m^2		Clearly define parking space and pedestrian space.		High

Table 8.10 - Merewether / Dixon Park / Bar Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide for traffic calming of John Parade and Merewether Baths car park access	Med	$20,000	$5,000	Improves pedestrian environment		High
	Create one-way traffic flow along John Parade and extend pedestrian walkway, including a cycleway, and street plantings	Med	$150 per m^2 to widen existing pathway		Reduces conflict between pedestrian and vehicular users of the coastal zone		
Socio-Economic							
Commercial opportunities at Merewether Activity Node	Restore Surf House as a centre providing a range of facilities under separate tenancies, if necessary, to include a café, interpretative centre or restaurant	Med	$1 million	$design	Social benefits to community. Baths precinct amenity improvement. Financial return to Council and community. Improved safety	High restoration costs.	High
	Support compatible commercial development of the Merewether local centre in the vicinity of the Frederick St / Ridge St intersection	Low	$design	$design	Provides greater range services to coastline users.		High
	Remove Surf House completely and rehabilitate site as open space with low-key commercial venture and public facilities.	Med	$200,000		Removes derelict building that may have exceeded life expectancy. Opens other opportunities for the land it occupies. Reduced public expenditure.	Surf House has cultural value and provides opportunities for enhancement of amenity of the coastline. Is a heritage listed item.	Med

8.3.6 Burwood Beach Management Options

The range of possible options to address identified management issues for Burwood Beach are presented in **Table 8.11**

Table 8.11 - Burwood Beach Management Options

Legend to Management Options Tables:

C / A	Community Acceptance
M	Million
*	Compatible with Bathers Way concept documentation
**	Compatible with Heritage Places Plan of Management
#	Compatible with ERIAP
ERIAP	Emergency Response and Interim Action Plan discussed in **Section 6.2.2**
DCP	Development Control Plan
DISPLAN	Newcastle (Council's) Disaster Management Plan

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
Management of Coastal Hazards							
Rock falls from high cliffs in areas of high public use south of Merewether Baths #	Erect signage warning of hazard with international standard warning diagram #	High	$1,000	<$1,000	Community awareness of hazard of natural rock falls. Immediate fulfilment of Council's 'Duty of Care'. Cost effective.	Hazard still exists	High
	Consider options raised by NPWS Risk Management Report, currently being prepared on this issue for the Glenrock SRA.	Med	N/A	N/A	NPWS is currently reviewing hazards and possible options to remove hazards through physical works.	May be costly	Med
Natural Environment							
Remnant vegetation management at Burwood Beach	Assist with establishment Dunecare / Coastcare group to undertake restoration of dune vegetation compatible with SRA vegetation communities	Med	$design	$design	Area under the control of NPWS	Area under the control of NPWS and Council has traditionally had little involvement. NPWS traditionally has little money for implementation of such actions.	Med

Table 8.11 - Burwood Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Close existing unneeded beach and dune access tracks	High	$3,000	$1,000	Improves ecological integrity of the reserve.	Area under the control of NPWS and Council has traditionally had little involvement. Difficult to actually close tracks when users are used to having them there.	Med
Compatible coastline management with LMCC, HWC and NPWS for Burwood Beach and SRA	Initiate joint committee/working group between LMCC, NCC, HWC and NPWS, particularly in regard to catchment management issues	Ongoing	N/A	$5,000	Committee can address catchment impacts of lagoon water quality. Greater funding potential. NPWS would support.	Area under the control of NPWS and Council has traditionally had little involvement.	Med
	Financially assist landcare group to undertake restoration of Glenrock SRA	Ongoing		$3,000	Removal of weeds will increase the flora and fauna potential of the SRA NPWS would support	Area under the control of NPWS and Council has traditionally had little involvement.	Med
Glenrock lagoon water quality	Implement water quality monitoring survey over numerous seasons and conditions to determine health of lagoon	Med			Reduce public health risk.	Area under the control of NPWS and Council has traditionally had little involvement.	High
	Investigate possible water treatment /detention devices which could be installed near manholes to treat and/or contain overflows	Low				May be costly.	Med
	Erect signs when water quality unsatisfactory for human use	High	$3,000	<$1,000	Increased public understanding of water quality issues	Area under the control of NPWS and Council has traditionally had little involvement.	Low
	Inform the public (especially main users of Glenrock Lagoon like the Scouts Association) that discharges have occurred.	High			Demonstrates due diligence. Reduces public health risk.	May be costly.	High
Burwood Wastewater Treatment outfall	Continue to monitor beaches under the EPA Beachwatch program and inform public of results	Ongoing			Public is informed of the health of Newcastle beaches.		High

Table 8.11 - Burwood Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Erect signage at those beaches likely to be affected on days the public is at risk from sewage outfall	Ongoing	$2,000	<$2,000	Cost effective. Public is informed of the health of Newcastle beaches.	Time lag between becoming aware of the risk and erecting signs from a liability perspective.	Low
Management of Rock Platforms	See **"Whole of Coastline"**						
Management of Dune Revegetation	See **"Whole of Coastline"**						
Amenity							
Hang gliding location lacks a formalised area within the SRA	Provide designated hang gliding area on existing site.	Low	$10,000	$2,000	Reduces potential for erosion of slopes and consolidates activity in one location. Gives ownership of the area to the hang gliders; may encourage protection of the area's natural values.		Med
	Provide line marking to delineate car parking spaces	Med	$2,000	<$2,000	Reduce congestion of area. Provide designated areas for vehicles and pedestrians	Small area available.	Med
	Provide for public phone for hang glider safety.	Low	$design	$design	Assist in providing emergency first aid to hang gliders Improve public safety.	May be cost prohibitive.	Med
Compatible coastline management with LMCC, HWC and NPWS for Burwood Beach and SRA	Investigate the provision of a viewing platform and interpretative signage, in conjunction with NPWS, at Hickson St lookout	Med	$10,000 - $15,000	$2,000 to $4,000	Reduces potential for erosion of slopes and consolidates activity in one location.	Small area available for such a facility.	High
	Link the Great Northern Walk and LMCC Coastal Walk with proposed Bathers Way walk through maintaining access routes and signage	Low	$3,000	$3,000	Provides beach access from surrounding streets. Provides linkage with other "coastal walks" NPWS currently applying for funding to link these walks.	Area is under the control of NPWS and Council has traditionally had little involvement.	Med

Table 8.11 - Burwood Beach Management Options (cont)

Issue	Option	Priority	Indicative Capital Cost	Maintenance Cost (pa)	Advantage	Disadvantage	C / A
	Provide appropriate signage at entry and exit of Burwood Beach and Glenrock SRA	Med			Provides beach access from surrounding streets. Provides linkage with other "coastal walks"	Area is under the control of NPWS and Council has traditionally had little involvement.	Med
	Maintain and enforce feral animal and companion animal management strategies to assist with protection of endangered or vulnerable flora and fauna, through joint patrols of the area (NCC and NPWS).	Low	$design	$design	Improve ecological integrity of the reserve.	Area is under the control of NPWS and Council has traditionally had little involvement.	
Socio-Economic							
Compatible coastline management with LMCC and NPWS for Burwood Beach and SRA	Initiate joint committee/working group between LMCC, NCC, NPWS, HWC, Scout Association and Awabakal Local Aboriginal Land Council.	Ongoing			Greater funding potential for management of SRA.		Med
Cultural Heritage							
Educating community of cultural heritage	Interpretative signage at viewing platform - produced in conjunction with Awabakal Land Council						

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10.0 GLOSSARY OF TERMS

Accretion	The accumulation of (beach) sediment, deposited by natural fluid flow processes.
Active margin	A margin consisting of a continental shelf, a continental slope, and an oceanic trench.
Aeolian deposits	Wind-deposited sediments, such as sand dunes.
Alongshore	Parallel to and near the shoreline; same as longshore.
Alluvial deposits	Detrital material which is transported by a river and deposited – usually temporarily – at points along the floodplain of a river. Commonly composed of sands and gravels.
Astronomical tide	The tidal levels and character which would result from gravitational effects, e.g. of the Earth, Sun and Moon, without any atmospheric influences.
Backshore	(1) The upper part of the active beach above the normal reach of the tides (high water), but affected by large waves occurring during a high. (2) The accretion or erosion zone, located landward of ordinary high tide, which is normally wetted only by storm tides.
Bar	An offshore ridge or mound of sand, gravel, or other unconsolidated material which is submerged (at least at high tide), especially at the mouth of a river or estuary, or lying parallel to, and a short distance from, the beach.
Barrier	A continuous offshore ridge built by shore drift. The barrier follows the line of breakers instead of the shoreline.
Barrier Island	An elongate offshore bar rising above the high-tide level and extending generally parallel to the coast. May consist of multiple ridges.
Barrier spit	Similar to a barrier island only connected to the mainland.
Bathymetry	The measurement of depths of water in oceans, seas and lakes; also the information derived from such measurements.
Bay	A recess or inlet in the shore of a sea or lake between two capes or headlands, not as large as a gulf but larger than a cove. See also *bight*, *embayment*.
Beach	The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation. The seaward limit of a beach – unless otherwise specified – is the mean low water line. A beach includes foreshore and backshore.
Beach crest	The point representing the limit of high tide storm wave run-up.
Beach erosion	The carrying away of beach materials by wave action, tidal currents, littoral currents or wind.
Beach face	The section of the beach normally exposed to the action of wave uprush. The foreshore of the beach.
Beach head	The cliff, dune or sea wall looming the landward limit of the active beach.
Beach nourishment	The process of replenishing a beach by artificial means; e.g., by the deposition of dredged materials, also called beach replenishment or beach feeding.
Beach profile	A cross-section taken perpendicular to a given beach contour; the profile may include the face of a dune or sea wall, extend over the backshore, across the foreshore, and seaward underwater into the nearshore zone.
Beach scarp	(1) An almost perpendicular slope along the beach foreshore; an erosional feature due to wave action, it may vary in height from a few centimetres to several metres, depending on wave action and the nature and composition of the beach. See *escarpment*. (2) A steep slope produced by wave erosion.
Beach width	The horizontal dimension of the beach measured normal to the shoreline.
Bed	The bottom of a watercourse, or any body of water.
Bench mark	A mark affixed to a permanent object in tidal observations, or in a survey, to furnish a datum level.

Benefits	The economic value of a scheme, usually measured in terms of the cost of damages avoided by the scheme, or the valuation of perceived amenity or environmental improvements.
Berm	On a beach: a nearly horizontal plateau on the beach face or backshore, formed by the deposition of beach material by wave action or by means of a mechanical plant as part of a beach recharge scheme.
Berm crest	The seaward limit of the berm, or the minimum depth of a submerged berm; also called berm edge.
Bight	A slight indentation in a coast forming an open bay, usually crescent shaped.
Blowout	A depression on the land surface caused by wind erosion.
Bluff	A high, steep bank or cliff.
Breaker zone	The zone within which waves approaching the coastline commence breaking, typically in water depths of between 5 m and 10 m.
Breaking depth	The still-water depth at the point where the wave breaks.
Breakwater	Offshore structure aligned parallel to the shore, sometimes shore-connected, that provides protection from waves.
Buffer area	A parcel or strip of land that is designed and designated to permanently remain vegetated in an undisturbed and natural condition to protect an adjacent aquatic or wetland site from upland impacts, to provide habitat for wildlife and to afford limited public access.
Bypassing, sand	Hydraulic or mechanical movement of sand from the accreting updrift side to the eroding downdrift side of an inlet or harbour entrance. The hydraulic movement may include natural movement as well as movement caused by man.
Chart datum	The plane or level to which soundings, tidal levels or water depths are referenced, usually low water datum.
Cliff	A high steep face of rock.
Climate change	Refers to any long term trend in mean sea level, wave height, wind speed, drift rate etc.
Coast	A strip of land of indefinite length and width (may be tens of kilometres) that extends from the seashore inland to the first major change in terrain features.
Coastal currents	Those currents which flow roughly parallel to the shore and constitute a relatively uniform drift in the deeper water adjacent to the surf zone. These currents may be tidal currents, transient, wind-driven currents, or currents associated with the distribution of mass in local waters.
Coastal defence	General term used to encompass both coast protection against erosion and sea defence against flooding.
Coastal management	The development of a strategic, long term and sustainable land use policy, sometimes also called shoreline management.
Coastal plain	The plain composed of horizontal or gently sloping strata of clastic material fronting the coast and generally representing a strip of recently emerged sea bottom that has emerged from the sea in recent geologic times. Also formed by aggradation.
Coastal processes	Collective term covering the action of natural forces on the shoreline, and the nearshore seabed.
Coastal zone	The land-sea-air interface zone around continents and islands extending from the landward edge of a barrier beach or shoreline of coastal bay to the outer extent of the continental shelf.
Coastline	The line where terrestrial processes give way to marine processes, tidal currents, wind waves, etc.
Conservation	The protection of an area, or particular element within an area, accepting the dynamic nature of the environment and therefore allowing change.
Continental shelf	The zone bordering a continent extending from the line of permanent immersion to the depth, usually about 100 m to 200 m, where there is a marked or rather steep descent toward the great depths.

Continental slope	The declivity from the offshore border of the continental shelf to oceanic depths. It is characterised by a marked increase in slope.
Current	Ocean currents can be classified in a number of different ways. Some important types include the following: - Periodic - due to the effect of the tides; such currents may be rotating rather than having a simple back and forth motion. The currents accompanying tides are known as tidal currents - Temporary - due to seasonal winds - Permanent or ocean - constitute a part of the general ocean circulation. The term drift current is often applied to a slow broad movement of the oceanic water - Nearshore - caused principally by waves breaking along a shore. Also, coastal currents such as California and Davidson currents that run parallel to the coast.
Cusp	One of a series of short ridges on the foreshore separated by crescent-shaped troughs spaced at more or less regular intervals. Between these cusps are hollows. The cusps are spaced at somewhat uniform distances along beaches. They represent a combination of constructive and destructive processes.
Datum	Any position or element in relation to which others are determined, as datum point, datum line, datum plane.
Debris line	A line near the limit of storm wave uprush marking the landward limit of debris deposits.
Deep water	In regard to waves, where depth is greater than one-half the wave length. Deep-water conditions are said to exist when the surf waves are not affected by conditions on the bottom.
Degradation	The geologic process by means of which various parts of the surface of the earth are worn away and their general level lowered, by the action of wind and water.
Delta	(1) An alluvial deposit, usually triangular, at the mouth of a river or stream. It is normally built up only where there is no tidal or current action capable of removing the sediment as fast as it is deposited and hence the delta builds forward from the coastline. (2) A wave delta is a deposit made by large waves which run over the top of a spit or bar beach and down the landward side.
Design storm	Coastal protection structures will often be designed to withstand wave attack by the extreme design storm. The severity of the storm (i.e. return period) is chosen in view of the acceptable level of risk of damage or failure. A design storm consists of a design wave condition, a design water level and a duration.
Design wave	In the design of harbours, harbour works, etc., the type or types of waves selected as having the characteristics against which protection is desired.
Detached breakwater	A breakwater without any constructed connection to the shore.
Diffraction	The phenomenon occurring when water waves are propagated into a sheltered region formed by a breakwater or similar barrier that interrupts a portion of the otherwise regular train of waves, resulting in the multi-directional spreading of the waves.
Downdrift	The direction of predominant movement of littoral materials.
Dredging	Excavation or displacement of the bottom or shoreline of a water body. Dredging can be accomplished with mechanical or hydraulic machines. Most dredging is done to maintain channel depths or berths for navigational purposes; other dredging is for shellfish harvesting or for cleanup of polluted sediments.
Drift sector	A particular reach of marine shore in which littoral drift may occur without significant interruption, and which contains any and all natural sources of such drift, and also any accretion shoreforms accreted by such drift.
Dunes	Accumulations of windblown sand on the backshore, usually in the form of small hills or ridges, stabilised by vegetation or control structures.

Dynamic equilibrium	Short term morphological changes that do not affect the morphology over a long period.
Ebb tide	A non-technical term used for falling tide or ebb current. The portion of the tidal cycle between high water and the following low water.
Ecosystem	The living organisms and the non-living environment interacting in a given area.
Elevation	The distance of a point above a specified surface of constant potential; the distance is measured along the direction of gravity between the point and the surface.
Embayed	Formed into a bay or bays; as an embayed shore.
Embayment	(1) An indentation in a shoreline forming an open bay. (2) The formation of a bay.
Emergent coast	A coast in which land formerly under water has recently been placed above sea level, either by uplift of the land or by a drop in sea level.
Endemic	Native to a specific geographic area.
Entrance	The entrance to a navigable bay, harbour or channel, inlet or mouth separating the ocean from an inland water body.
Erosion	(1) Wearing away of the land by natural forces. On a beach, the carrying away of beach material by wave action, tidal currents or by deflation. (2) The wearing away of land by the action of natural forces.
Escarpment	A more or less continuous line of cliffs or steep slopes facing in one general direction which are caused by erosion or faulting, also called scarp.
Estuary	(1) A semi-enclosed coastal body of water which has a free connection with the open sea. The seawater is usually measurably diluted with freshwater. (2) The part of the river that is affected by tides. (3) The zone or area of water in which freshwater and saltwater mingle and water is usually brackish due to daily mixing and layering of fresh and salt water.
Event	An occurrence meeting specified conditions, e.g. damage, a threshold wave height or a threshold water level.
Fault	A fracture in rock along which there has been an observable amount of displacement. Faults are rarely single planar units; normally they occur as parallel to sub-parallel sets of planes along which movement has taken place to a greater or lesser extent. Such sets are called fault or fracture zones.
Fauna	The entire group of animals found in an area.
Feeder beach	An artificially widened beach serving to nourish downdrift beaches by natural littoral currents or other forces.
Fetch	The length of unobstructed open sea surface across which the wind can generate waves (generating area).
Flood tide	A non-technical term used for rising tide or flood current. In technical language flood refers to current. The portion of the tidal cycle between low water and the following high water.
Flora	The entire group of plants found in an area.
Foreshore	In general terms, the beach between mean higher high water and mean lower low water.
Gabion	Structures composed of masses of rocks, rubble or masonry held tightly together usually by wire mesh so as to form blocks or walls. Sometimes used on heavy erosion areas to retard wave action or as a foundation for breakwaters or jetties.
Geology	The science concerned with the origin, history and structure of the Earth as recorded in rocks; together with the forces and processes now operating to modify rocks.
Geomorphology	That branch of physical geography which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.

Groyne	A shore-protection structure (built usually to trap littoral drift or retard erosion of the shore). It is narrow in width (measured parallel to the shore) and its length may vary from tens to hundreds of metres (extending from a point landward of the shoreline out into the water). Groynes may be classified as permeable (with openings through them) or impermeable (a solid or nearly solid structure).
Habitat	The place where an organism lives.
High water (HW)	Maximum height reached by a rising tide. The height may be solely due to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions. Non-technically, also called the high tide.
Hydrography	The description and study of seas, lakes, rivers and other waters.
Inshore	(1) The region where waves are transformed by interaction with the seabed. (2) In beach terminology, the zone of variable width extending from the low water line through the breaker zone.
Inshore current	Any current inside the surf zone.
Intertidal	The zone between the high and low water marks.
Lagoon	A shallow body of water, as a pond or lake, which usually has a shallow restricted inlet from the sea.
Leeward	The direction toward which the prevailing wind is blowing; the direction toward which waves are travelling.
Littoral	(1) Of, or pertaining to, a shore, especially a seashore. (2) Living on, or occurring on, the shore.
Littoral currents	A current running parallel to the beach and generally caused by waves striking the shore at an angle.
Littoral drift	The mud, sand, or gravel material moved parallel to the shoreline in the nearshore zone by waves and currents.
Littoral transport	The movement of littoral drift in the littoral zone by waves and currents. Includes movement parallel (long shore drift) and sometimes also perpendicular (cross-shore transport) to the shore.
Longshore	Parallel and close to the coastline.
Longshore drift	Movement of sediments approximately parallel to the coastline.
Longshore transport rate	Rate of transport of sedimentary material parallel to the shore. Usually expressed in cubic metres (yards) per year. Commonly used as synonymous with littoral transport rate.
Low water (LW)	The minimum height reached by each falling tide. Non-technically, also called low tide.
Managed retreat (or planned retreat)	The deliberate setting back of the existing line of defence in order to obtain engineering and/or environmental advantages.
Mean high water (MHW)	The average elevation of all high waters recorded at a particular point or station over a considerable period of time, usually 19 years. For shorter periods of observation, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19-year value. All high water heights are included in the average where the type of tide is either semidiurnal or mixed. Only the higher high water heights are included in the average where the type of tide is diurnal. So determined, mean high water in the latter case is the same as mean higher high water.
Mean high water springs (MHWS)	The average height of the high water occurring at the time of spring tides.
Mean low water (MLW)	The average height of the low waters over a 19-year period. For shorter periods of observation, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19-year value.
Mean low water springs (MLWS)	The average height of the low waters occurring at the time of the spring tides.

Mean sea level	The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings (see *sea level datums*).
Morphology	River/estuary/lake/seabed form and its change with time.
Nautical mile	Also known as geographical mile, its length is 1852 meters (6076.115 feet), approximately 1.15 times as long as the statute mile of 5280 feet.
Nearshore	In beach terminology an indefinite zone extending seaward from the shoreline well beyond the breaker zone.
Nearshore circulation	The ocean circulation pattern composed of the nearshore currents and the coastal currents.
Nearshore current	The current system caused by wave action in and near the breaker zone, and which consists of four parts: the shoreward mass transport of water; longshore currents; rip currents; and the longshore movement of the expanding heads of rip currents.
Neck	The narrow strip of land that connects a peninsula with the mainland, or connects two ridges.
Nourishment	The process of replenishing a beach. It may be brought about naturally, by longshore transport, or artificially by the deposition of dredged materials.
Ocean current	A non-tidal current constituting a part of the general oceanic circulation.
Oceanography	That science treating of the oceans, their forms, physical features and phenomena.
Offshore	In beach terminology, the comparatively flat zone of variable width, extending from the shoreface to the edge of the continental shelf. It is continually submerged.
Offshore breakwater	A breakwater built towards the seaward limit of the littoral zone, parallel (or nearly parallel) to the shore.
Offshore currents	(1) Currents outside the surf zone. (2) Any current flowing away from the shore.
Offshore wind	A wind blowing seaward from the land in the coastal area.
Onshore wind	A wind blowing landward from the sea.
Outfall	A structure extending into a body of water for the purpose of discharging sewage, storm runoff or cooling water.
Outflanking	erosion behind or around the inner end of a Groyne or bulkhead, usually causing failure of the structure.
Overfalls	Breaking waves caused by a conflict of currents, or by the wind moving against the current.
Overtopping	Water carried over the top of a coastal defence due to wave run-up or surge action exceeding the crest height.
Palaeovalley	A valley developed during a past epoch when climate conditions and seal levels were different from the present.
Peninsula	An elongated portion of land nearly surrounded by water and connected to a larger body of land, usually by a neck or an isthmus.
Permanent current	A current that runs continuously independent of the tides and temporary cause. Permanent currents include the fresh water discharge of a river and the currents that form the general circulatory systems of the ocean.
Permian	The last period of the Palaeozoic era of geological time, extending from 280 million years to 250 million years before present.
Photogrammetry	The science of deducing the physical dimensions of objects from measurements on images (usually photographs) of the objects.
Physiographic	Describing or pertaining to the natural surface of the land.
Pleistocene	An epoch of the Quaternary Period characterised by several glacial ages.
Pocket beach	A beach, usually small, between two headlands.
Preservation	Static protection of an area or element, attempting to perpetuate the existence of a given 'state'.

Profile, beach	See *beach profile*
Quaternary	(1) The youngest geologic period; includes the present time. (2) The latest period of time in the stratigraphic column, 0 – 2 million years, represented by local accumulations of glacial (Pleistocene) and post-glacial (Holocene) deposits which continue, without change of fauna, from the top of the Pliocene (Tertiary). The quaternary appears to be an artificial division of time to separate pre-human from post-human sedimentation. As thus defined, the quaternary is increasing in duration as man's ancestry becomes longer.
Recession	A net landward movement of the shoreline over a specified time.
Reef	A ridge of rock or other material lying just below the surface of the sea.
Reef breakwater	Rubble mound of single-sized stones with a crest at or below sea level which is allowed to be (re)shaped by the waves.
Re-entrant	An angle directed inwards; may refer to coastal indentations.
Reflected wave	That part of an incident wave that is returned (reflected) seaward when a wave impinges on a beach, seawall or other reflecting surface.
Reflection	The process by which the energy of the wave is returned seaward.
Refraction	The process by which the direction of a wave moving in shallow water at an angle to the bottom contours is changed. The part of the wave moving shoreward in shallower water travels more slowly than that portion in deeper water, causing the wave to turn or bend to become parallel to the contours.
Return period	Average period of time between occurrences of a given event.
Revetment	A facing of stone, concrete, etc., to protect an embankment, or shore structure, against erosion by wave action or currents.
Riparian	Pertaining to the banks of a body of water.
Rip current	A strong surface current of short duration flowing seaward from the shore. It usually appears as a visible band of agitated water and is the return movement of water piled up on the shore by incoming waves and wind. A rip current consists of three parts: the feeder current flowing parallel to the shore inside the breakers; the neck, where the feeder currents converge and flow through the breakers in a narrow band or "rip"; and the head, where the current widens and slackens outside the breaker line.
Rips	Agitation of water caused by the meeting of currents or by rapid current setting over an irregular bottom.
Risk analysis	Assessment of the total risk due to all possible environmental inputs and all possible mechanisms.
Run-up	the rush of water up a structure or beach on the breaking of a wave. The amount of run-up is the vertical height above stillwater level that the rush of water reaches.
Salient	Coastal formation of beach material developed by wave refraction and diffraction and longshore drift comprising of a bulge in the coastline towards an offshore island or breakwater, but not connected to it as in the case of a tombolo. See also *cusp*.
Sand	An unconsolidated (geologically) mixture of inorganic soil (that may include disintegrated shells and coral) consisting of small but easily distinguishable grains ranging in size from about 0.062 mm to 2.0 mm.
Sand dune	A dune formed of sand.
Sand spit	A narrow sand embankment, created by an excess of deposition at its seaward terminus, with its distal end (the end away from the point of origin) terminating in open water.
Scarp	See *escarpment*.
Scour protection	Protection against erosion of the seabed in front of the toe.
Sea defences	Works to prevent or alleviate flooding by the sea.
Sea level rise	The long term trend in mean sea level.

Seawall	A structure separating land and water areas primarily to prevent erosion and other damage by wave action.
Sediment	Loose, fragments of rocks, minerals or organic material which are transported from their source for varying distances and deposited by air, wind, ice and water. Other sediments are precipitated from the overlying water or form chemically, in place. Sediment includes all the unconsolidated materials on the sea floor.
Setback	A required open space, specified in shoreline master programs, measured horizontally upland from an perpendicular to the ordinary high water mark.
Shoal	(1) (noun) A detached area of any material except rock or coral. The depths over it are a danger to surface navigation. Similar continental or insular shelf features of greater depths are usually termed banks. (2) (verb) To become shallow gradually.
Shore	That strip of ground bordering any body of water which is alternately exposed, or covered by tides and/or waves. A shore of unconsolidated material is usually called a beach.
Shoreface	The narrow zone seaward from the low tide shoreline permanently covered by water, over which the beach sands and gravels actively oscillate with changing wave conditions.
Shoreline	The intersection of a specified plane of water with the shore.
Significant wave	A statistical term relating to the one-third highest waves of a given wave group and defined by the average of their heights and periods.
Significant wave height	Average height of the highest one-third of the waves for a stated interval of time.
Silt	Sediment particles with a grain size between 0.004 mm and 0.062 mm, i.e. coarser than clay particles but finer than sand.
Soft defences	Usually refers to beaches (natural or designed) but may also relate to energy-absorbing beach-control structures, including those constructed of rock, where these are used to control or redirect coastal processes rather than opposing or preventing them.
Spit	A long narrow accumulation of sand or shingle, lying generally in line with the coast, with one end attached to the land the other projecting into the sea or across the mouth of an estuary.
Spring tide	A tide that occurs at or near the time of new or full moon, and which rises highest and falls lowest from the mean sea level (MSL).
Storm surge	A rise or piling-up of water against shore, produced by strong winds blowing onshore. A storm surge is most severe when it occurs in conjunction with a high tide.
Sub-aerial beach	That part of the beach which is uncovered by water (e.g. at low tide sometimes referred to as drying beach).
Submergent coast	A coast in which formerly dry land has been recently drowned either by land subsidence or a rise in seal level.
Surf zone	The nearshore zone along which the waves become breakers as they approach the shore.
Survey, hydrographic	A survey that has as its principal purpose the determination of geometric and dynamic characteristics of bodies of water.
Survey, photogrammetric	A survey in which monuments are placed at points that have been determined photogrammetrically.
Survey, topographic	A survey which has, for its major purpose, the determination of the configuration (relief) of the surface of the land and the location of natural and artificial objects thereon.
Swell	Waves that have travelled a long distance from their generating area and have been sorted out by travel into long waves of the same approximate period.
Tidally driven circulation	The movement of fresh water and seawater that are mixed by the sloshing back and forth of the estuary in response to ocean tides.

Tidal wave	(1) A wave, in the oceans and seas, produced by tides and tidal currents. (2) Non-technical term in popular usage for an unusually high and destructive water level along a shore. It usually refers to storm surge or tsunami.
Tide	The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting upon the rotating earth. Although the accompanying horizontal movement of the water resulting from the same cause is also sometimes called the tide, it is preferable to designate the latter as tidal current, reserving the name tide for the vertical movement.
Tombolo	(1) Coastal formation of beach material developed by refraction, diffraction and longshore drift to form a 'neck' connecting a coast to an offshore island or breakwater (see also *salient*). (2) A causeway-like accretion spit that connects an offshore rock or island to the main shore, or to another island.
Topographic map	A map on which elevations are shown by means of contour lines.
Topography	The form of the features of the actual surface of the Earth in a particular region considered collectively.
Training wall	A wall or jetty to direct current flow.
Transgression, marine	The invasion of a large area of land by the sea in a relatively short space of time (geologically speaking). Although the observable result of a marine transgression may suggest an almost 'instantaneous' process, it is probable that the time taken is in reality to be measured in millions of years. The plane of marine transgression is a plane of unconformity. The reverse of a transgression is a regression.
Tsunami	A large, high-velocity wave generated by displacement of the sea floor (such as sudden faulting, landsliding, or volcanic activity); also called seismic sea wave. Commonly misnamed tidal wave.
Undercutting	erosion of material at the foot of a cliff or bank, e.g., a sea cliff, or river bank on the outside of a meander. Ultimately, the overhang collapses, and the process is repeated.
Uprush	The rush of water up the foreshore following the breaking of a wave, also called swash or runup.
Valley	An elongated depression, usually with an outlet, between bluffs or between ranges of hills or mountains.
Water, navigable	The waters which are or can be used as water highways for commerce.
Wave	(1) An oscillatory movement in a body of water manifested by an alternate rise and fall of the surface. (2) A disturbance of the surface of a liquid body, as the ocean, in the form of a ridge, swell or hump.
Wave climate	Average condition of the waves at a place, over a period of years, as shown by height, period, direction, etc.
Wave-cut platform	A horizontal bench of rock formed beneath the surf zone as a coast retreats because of wave erosion.
Wave generation	Growth of wave energy by wind.
Wave propagation	The transmission of waves through water.
Wave set-up	Elevation of the still-water level due to breaking waves.
Wetlands	Lands whose saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities that live in the soil and on its surface (e.g. Mangrove forests).
Wind current	A current created by the action of the wind. From theoretical considerations, currents produced by winds in the open sea will set to the right of the direction towards which the wind is blowing if in the Northern Hemisphere and to the left of this direction if in the Southern Hemisphere.