# Coromandel Peninsula

# Ecological Assessment of Natural Character

Prepared for Thames-Coromandel District Council

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focus

resource management group

# Coromandel Peninsula - Ecological Assessment of Natural Character

**Report prepared for:**

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# EXECUTIVE SUMMARY

This report was commissioned by the Thames-Coromandel District Council to identify and assess the ecological natural character values of the coastal environment and freshwater ecosystems within the Thames-Coromandel district.

Natural character is assessed in terms of both ecology (the viable functioning of natural processes) and experience (the attributes of "naturalness") (Environment Waikato, 2000). This project is designed to complement the earlier assessment of natural character from an experiential perspective, and thereby provide a comprehensive natural character assessment for the district. It also complements the Significant Natural Areas (SNA) project recently completed by Environment Waikato and Thames-Coromandel District Council.

Central and local government policy relevant to natural character is reviewed together with relevant literature and case law.

The ecological assessment of natural character involved identification of the following ecosystems within the district:

- sand dunes;
- gravel and boulder beaches;
- coastal wetlands;
- coastal forest;
- inland wetlands; and
- rivers.

The natural processes, features and ecological functioning that underpin the visual impression of natural character for each of these ecosystems is outlined. Human activities and influences that can modify the various ecosystems are also discussed.

The assessment of ecological natural character considers the intactness, functioning and resilience of the ecosystems and the levels of disturbance to natural features and processes.

Criteria are developed for each ecosystem to identify and map areas of high ecological natural character within the district. This assessment was undertaken as a desk-top exercise using existing information and data bases, and field inspections were then undertaken at a selection of sites to ground truth the assessment criteria. The mapping was standardised at a scale of 1:10,000 (unless otherwise stated) reflecting limitations of data and budget relevant to this study.

Recommendations are made that district policy be developed to:

- protect the indentified areas of high ecological natural character ; and
- restore critical ecosystems where they are degraded, to the extent that this is practical and appropriate.

# 1 INTRODUCTION

## 1.1 Project Brief

This report has been commissioned by the Thames-Coromandel District Council (TCDC) to identify and assess the ecological natural character values of the coastal environment and freshwater ecosystems within the Thames-Coromandel district.

The project is designed to complement the assessment of natural character from a landscape perspective undertaken by Brown (2008), and will integrate with this work to provide a comprehensive natural character assessment for the district.

It also complements the Significant Natural Areas (SNA) project recently completed by Environment Waikato and Thames-Coromandel District Council (Kessels et. al., in press) which assesses indigenous terrestrial (including duneland) and freshwater wetland natural areas.

## 1.2 Background

Under section 6(a) of the Resource Management Act (1991) the preservation of the natural character of the coastal environment, wetlands, and lakes and rivers and their margins is identified as matter of national importance.

Identification of areas of high natural character in the Thames-Coromandel district is an important step towards achieving this objective, including the development of relevant policy to guide future activities in the Thames-Coromandel district.

Natural character is assessed in terms of both ecology (the viable functioning of natural processes) and experience (the attributes of "naturalness") (Environment Waikato, 2000).

The TCDC commissioned a District Landscape Assessment which was finalised in 2008 (LA4, 2008). This was then peer reviewed and further refined by Brown (2008) to include consideration of natural character from a landscape/experiential perspective based on the following 'environmental indicators' of natural character (Ministry for the Environment, 2002):

- Abiotic factors
- Vegetation Cover & Patterns (partially)
- Land Uses / Activities
- Seascapes & Water Areas
- Vegetation Type
- Vegetation Cover & Patterns
- Natural Processes

In addition, the assessment by Brown (2008) had regard to more experiential values related to the perception of the likes of 'wildness', ' wilderness' and 'remoteness' derived from Policy

1.1.3 (a) (iii) in the New Zealand Coastal Policy Statement (Department of Conservation, 1994).

The Brown (2008) landscape assessment does not examine the ecological functioning of ecosystems except to broadly differentiate between native and exotic vegetation.

Brown (2008) classifies landscapes with significant or higher natural character values as 'Outstanding Natural Character Areas' or 'Significant – High Natural Character Areas'. He also identifies 'Amenity' landscapes. The terms "outstanding", "significant" and "amenity" are relevant to RMA sections 6(b), 6(c) and 7(c) respectively.

A review of Brown (2008) determined that the ecological aspects of natural character needed to be identified, and draft criteria for an ecological assessment were provided (Graeme & Dahm, 2008). Graeme & Dahm (2008) also recommended identifying priority areas for restoration of ecological natural character, which requires further work. This current report focuses on the ecological aspects of existing natural character only.

# 2 Natural Character Overview

This chapter reviews the following:

- central and territorial government legislation and policy relevant to natural character; and
- literature and case law relevant to ecological aspects of natural character.

## 2.1 Legislation & Policy

### 2.1.1 RESOURCE MANAGEMENT ACT

Section 6(a) of the Resource Management Act 1991 (RMA) identifies as a matter of national importance:

> *"The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development."*

The RMA does not define 'natural character' or the 'coastal environment', but these terms have been partially defined in existing case law (see section 2.2 below).

The RMA defines the terms 'wetland', 'lake' and 'river' as follows:

> ***Wetland:*** *includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.*
>
> ***Lake:*** *means a body of fresh water which is entirely or nearly surrounded by land, and for the purposes of Part X only means a lake whose bed has an area of 8 hectares or more.*
>
> ***River:*** *means a continually or intermittently flowing body of fresh water, and includes a stream; but does not include any artificial watercourse; and for the purposes of Part X only means a river or stream whose bed has an average width of 3 metres or more.*

### 2.1.2 HAURAKI GULF MARINE PARK ACT

The Hauraki Gulf Marine Park Act 2000 (HMPA) establishes overall objectives for the Gulf, its islands and catchments, aiming to achieve integrated management across land and sea. It provides stronger policy for the 'maintenance' of the soil, air, water, and ecosystems of the Gulf; as well as the 'protection, and where appropriate, enhancement' of the life-supporting

capacity and natural and physical resources of the Gulf environment than the RMA.

The HMPA defines the term 'coastal area' as follows:

> *Coastal area means those areas of land (other than islands) that contribute to the distinctive character of the coast, including, but not limited to,—*
>
> *(a) land providing access to coastal water; or*
>
> *(b) land containing an uninterrupted ecological sequence of habitats and vegetation; or*
>
> *(c) land with historic features related to the coast*

### 2.1.3 NATIONAL POLICY STATEMENTS

**New Zealand Coastal Policy Statement**

Chapter 1 of the New Zealand Coastal Policy Statement 1994 (NZCPS) outlines policies and national priorities for preserving the natural character of the coastal environment. These policies include the protection of:

- Significant indigenous vegetation and significant habitats of indigenous fauna (Policy 1.1.2)
- Essential or important elements including landscapes, seascapes and landforms (Policy 1.1.3)
- The integrity, functioning, and resilience of the coastal environment (Policy 1.1.4).

In addition, Policy 1.1.5 identifies as a national priority the restoration and rehabilitation of the natural character of the coastal environment where appropriate.

The NZCPS has been reviewed (Rosier, 2004) and the present draft document (Department of Conservation, 2008) proposes a range of additional polices and clarification regarding the preservation of natural character.

**National Policy Statement for Freshwater**

In terms of the freshwater environments identified in Section 6a, a draft National Policy Statement for Freshwater Management is currently before a Board of Inquiry. The present (July 2008) draft includes a range of objectives and policies to address matters of national significance relating to the sustainable management of Freshwater Resources. The draft includes requirements for the:

- identification and protection of Notable Values (including potential values) of any Outstanding Freshwater Resources; and
- enhancement or restoration of Notable Values of any Degraded Freshwater Resources.

'Notable Values' in relation to any Freshwater Resource include scientific, ecological and biodiversity values.

### 2.1.4 REGIONAL AND DISTRICT POLICY

The national legal and policy framework of natural character provides the basis for regional and district planning, within which further refinement of the concept is undertaken. For instance, section 3.5.4 of the Waikato Regional Policy Statement includes as an objective the "*preservation of the natural character of the coastal environment, including the physical and ecological processes which ensure its dynamic stability*".

The Thames-Coromandel District Plan identifies landscape and natural character as a Significant Resource Management Issue (Section 212) – including the objective "*to recognise, protect or, where appropriate, enhance the natural character of the District*." The jurisdiction of the District Plan is limited to the coastal environment above Mean High Water Spring (MHWS).

The TCDC Community Outcomes, statements of what the District wants to achieve now and in the future, include the desired outcome that "*Our communities recognise and value the natural environment"* including recognition and enhancement of natural ecosystems, the protection of catchments through good land management, and waterways kept clean and healthy.

## 2.2 Literature & Case Law

This section briefly reviews case law and existing practice in respect to natural character.

### 2.2.1 NATURAL CHARACTER

**Environment Waikato review**

Environment Waikato has undertaken a comprehensive review of the concept of 'natural character' (Environment Waikato, 2000), including relevant case law. The report concludes that the term 'natural character' is a complex, dynamic, and evolving concept.

The review notes that both case law and leading practitioners agree that natural character does not refer exclusively to New Zealand's indigenous natural environment. Rather, natural character is best assessed in terms of a spectrum, with 'pristine' at one end and 'culturally-dominated' at the other. The highest natural character value is accorded to pristine environments such as undisturbed landforms, but also natural processes and native fauna and flora. 'Natural character' in its broader interpretation also includes all other features produced by nature, whether it be exotic plants, farmland, or deer. The introduction of any man-made structures automatically detracts from natural character.

In a contribution to the early stage of the review, Lucas (1996) noted that natural character is assessed in terms of:

- ecology, the viable functioning of natural processes; and
- experience, the attributes of "naturalness".

Smale (1994), in Environment Waikato (2000) notes the significance of the ecological processes which underlie the visible manifestation of natural character; that while we tend to focus on appearances, the preservation of natural character must first be concerned with sustaining the processes that underlie the visual expression.

The review concludes (page 78):

> "*[Thus] the preservation of natural character requires the maintenance of:*
> *(1) The viable functioning of natural processes and systems (i.e. ecological attributes).*
> (2) *The visual attributes of 'naturalness'.* "

The review found that the Environment Court has also accepted that natural character goes beyond the purely visual to include ecological and biotic systems and the elements, patterns and processes of those systems; that implicit in s.6(a) is the preservation of ecosystems and ecological processes and the extent to which those are modified by any development.

Case law has found the components of natural character to include:

- Geology, landform and vegetation (Gill and others vs. Rotorua District Council and Another 1993);
- Natural elements, processes, and patterns (Brook Weatherwell-Johnson vs. Tasman District Council 1996);
- Ecosystems, including potential vegetation cover (Gill and others vs. Rotorua District Council and Another 1993; Minister of Works and Development vs. Marlborough Sounds Maritime Planning Authority 1986).

'Potential naturalness' in terms of successional processes is highlighted in the review as an important consideration in assessing natural character. Cases were also highlighted where preference was given to assessment of natural character that emphasised the importance of ecological resilience and restoration.

The review concluded that the primary components which underpin natural character in terms of Section 6(a) of the RMA are natural processes, natural elements and natural patterns.

These three components interrelate with one another to produce 'natural character' of varying degrees. They can be summarised as (adapted from Environment Waikato, 2000):

*Natural processes*
The preservation of natural character must first be concerned with sustaining the ecological processes which underlie the visual expression of an environment. These processes have both biological and physical components.

*Natural elements*
These are the product of ecological processes. They may or may not be expressed visually. In terms of the coastal environment, natural elements may include geology, landforms, vegetation cover, seabed, foreshore, etc.

*Natural patterns*
Natural patterns pick up on the natural expression or distribution of unmanufactured elements in an environment.

Rackham (1996) in Environment Waikato (2000) describes the interrelationship of natural processes, elements, and patterns as follows:

> *"Natural character reflects the disposition of natural elements in dominantly natural patterns. It is natural processes that have resulted in those patterns and elements, and it is the continuation of natural processes that will secure natural character in the future … (N)atural character, in the context of sustainability, is dependent on the presence of natural elements, arranged in natural patterns and underpinned by natural processes."*

**New Zealand Coastal Policy Statement**

A review of the NZCPS (Rosier, 2004) has provided the only other comprehensive review of natural character since Environment Waikato (2000).

The proposed NZCPS (Department of Conservation, 2008) aims to strengthen the management framework for natural character and recognises that landscapes, natural features, processes and indigenous biological diversity are all components which contribute to achieving the preservation of natural character. The proposed NZCPS emphasises that the focus of management approaches to natural character should be on protection and restoration.

**Natural character assessments**

Landscape assessments of natural character identify and rank the visual value of landforms, vegetation types and patterns, and land/seascapes in relation to the degree of development (land use and structures). A landscape assessment looks at the degree of the human built versus that 'of nature'. However, ecological assessments of natural character, such as this report, identify and assess the functioning ecosystem processes and features that underpin the visual impression of 'natural character'. The ecological focus is on the intactness, functioning and resilience of ecosystems and the levels of disturbance to the natural features and processes.

Landscape assessments of natural character focus on existing landscape values without determining what might happen to those landscapes in the future. However, an ecological assessment includes the 'potential naturalness' of natural character, in terms of its ecological resilience, successional processes and restoration potential.

### 2.2.2 COASTAL ENVIRONMENT

The RMA does not define the term 'coastal environment'. The NZCPS however does provide the following definition:

> *"… an environment in which the coast is a significant part or element. The coastal environment will vary from place to place depending upon the extent to which it affects or is (directly) affected by coastal processes and the management issue concerned. It includes at least three distinct, but interrelated parts:*
>
> - *the coastal marine area*
> - *the active coastal zone; and*

- *the land backdrop.*

*The coastal environment includes at least the coastal marine area, the water, plants, animals, and the atmosphere above it; and all tidal waters and the foreshore whether above or below mean high water springs, dunes, beaches, areas of coastal vegetation and coastal associated animals, areas subject to coastal erosion or flooding, salt marshes, sea cliffs, and coastal wetlands, including estuaries, and in the absence of such features (particularly in urban areas where the natural shoreline had been modified), all of the land that extends 40 metres inland of mean high water springs".*

Also, the HMPA defines the term 'coastal area' as follows:

*Coastal area means those areas of land (other than islands) that contribute to the distinctive character of the coast, including, but not limited to,—*

*(a) land providing access to coastal water; or*
*(b) land containing an uninterrupted ecological sequence of habitats and vegetation; or*
*(c) land with historic features related to the coast*

The Environment Court has generated a substantial amount of case law regarding the 'coastal environment'. The following excerpts provide guidance to how it should be defined:

- "*What constitutes the coastal environment will vary from place to place and according to the position from which a place is viewed. Where there are hills behind the coast, it will generally extend up to the dominant ridge behind the coast. But where the land behind the coast is generally flat, there may be great difficulty in defining the coastal environment.*" (*Northland Regional Planning Authority v Whangarei County (1977) A4828 (TCPAB**)).***
- "(T)*he coastal environment is just that, an environment. It is not a zone which might readily be identified by lines on a map. In defining that environment there will frequently be grey areas and blurred edges*" In the circumstances, it was determined that the coastal environment included the river basin together with the sand hills and escarpments. It ceased at the escarpment ridgeline and did not extend across the elevated terrace land. (Kaupokonui Beach Soc Inc v South Taranaki DC EnvC W030/08).
- "*It is also obvious that the area at the mouth of the river is part of the coastal environment. The coastal environment is generally accepted as extending to the crest of the nearest skyline." (*Wilkinson vs Huranui 2000 EnvC C50/00)
- The coastal environment was held to be "*An environment that is a complex, diverse, and a fragile ecological and environmental system, which included inland lakes, dunes, and a wetland area that were all contiguous with, or close to, the actual coastline*." (*Coutanche v Rodney DC W94/93 (PT ))*

Guidelines for determining the landward boundary of the coastal environment are contained in Policy 7.4.1 of the Auckland Regional Policy Statement which identifies areas and features that shall be taken into consideration. These include (selected):

"*(i) Any vegetation or habitat adjacent to, or connected with, the coastal marine area (CMA) which derives its intrinsic character from a coastal location or which contributes to the natural character of the coastal environment;*

*(ii) Any landform adjacent to the coastal marine area which is presently being formed or modified by processes of coastal erosion or deposition;*

*(v) Identified areas of Significant Natural Heritage and Outstanding and Regionally Significant Landscape Areas which are adjacent to the coastal marine area;*

*(viii) Any land adjacent to the coast where activities may take place which have a direct physical connection with, or impact on, the coastal marine area;"*

The 'coastal environment' can also be broadly defined based on bioclimatic conditions and landforms affected by coastal processes. Bioclimatic zones are commonly used to refer to the broad distribution of vegetation zones along both altitudinal and coastal-inland gradients where a particular climatic regime dictates the character of the natural ecosystem (Leathwick et. al., 1995).

Environment Waikato have used bioclimatic criteria to broadly define the coastal environment as the area <300m above sea level and/or <1km from the coast. These boundaries are based on major climatic influences that drive vegetation pattern – primarily temperature and moisture balance (which roughly correspond with altitude). This area delineates the environments which are typified by frequent windblown salt and a marked reduction in the severity of frost (Leathwick et. al., 1995). The Landward Boundary of Coastal Environment (as depicted in maps for the draft Regional Policy Statement) is derived from Bioclimatic Zones and Coastal Environment Landscape features (Williams, pers com.)

The Protected Natural Areas Programme (PNAP) report for the Coromandel (Humphries & Tyler, 1990) uses pohutukawa as the indicator species for the coastal bioclimatic zone. This species is generally regarded as extending a canopy up to 1km inland, although individual pohutukawa can be found further inland. The PNAP report also includes a Semi-Coastal zone indicated by the presence of puriri; which overlaps with the coastal zone but can extend further inland.

Brown (2008) defined the 'coastal environment' for the Thames-Coromandel District based on a variety of factors including landscape and the 'first ridge' principle. In most areas this delineation of the coastal environment adequately encompassed the coastal ecosystems identified in this study. There were however places where coastal ecosystems extended further inland (e.g. some coastal forests and dunes, and coastal wetlands).

The Thames-Coromandel District Plan also identifies a 'Coastal Zone' for planning purposes, which applies to areas of land in which the coast is a significant part or element. The width of this Coastal Zone varies around the District, and generally includes the land between the coast and the first ridgeline inland and other land where the coast is a significant part, even though it might not be visible from the coast or a public road (Thames-Coromandel District Council, 2007).

Due to the variable nature of natural and physical coastal influences, determining a district-wide 'coastal environment zone' will inevitably involve some degree of subjective judgment. The Environment Waikato Coastal Bioclimatic Zone generally encompassed all of the coastal ecosystems mapped for this report. In places however, the landward boundary of this coastal environment extended too far inland. In general, a coastal bioclimatic zone defined as being below 200m altitude and less than 1 km inland is considered adequate on exposed areas of both the eastern and western coastlines, with the inland distance reducing to < 500m in sheltered areas (e.g. around estuaries).

# 3 Ecosystems Relevant to Natural Character

This chapter reviews the ecosystems relevant to natural character within the Thames-Coromandel district, and in particular:

- natural system description and functioning; and
- levels of ecosystem modification.

As discussed in Section 2.2.1, an ecological assessment of natural character identifies the functioning ecosystem processes and features that underpin the visual impression of 'natural character'. The focus is on the intactness, functioning and resilience of ecosystems and the levels of disturbance to natural features and natural processes. This chapter therefore provides the foundation for developing criteria to identify areas of high natural character – considered in Chapter 4.

The assessment of natural character from an ecological perspective requires the landscape to be divided into functioning units. A dynamic complex of plant, animal and microorganism communities and their physical environment, interacting as a functional unit can be defined at various levels as an 'ecosystem' (United Nations, 1997, Cardinale et. al, 2006).

The broad ecosystem categories identified for natural character assessment within the coastal environment and waterways of the Thames-Coromandel district are (from Graeme & Dahm, 2009):

- sand dunes;
- gravel and boulder beaches;
- coastal wetlands;
- coastal forest;
- inland wetlands; and
- rivers.

Each of these ecosystems has unique features although they are also often strongly linked with other ecosystems (e.g. dunes with coastal wetlands; freshwater wetlands with rivers). There are no identified lakes within the Thames-Coromandel district which fit the description of the RMA.

There are a number of historically rare ecosystems (i.e. ecosystems having a total extent less than 0.5% of New Zealand's total area) within the broad ecosystem categories adopted within this report. These are terrestrial and wetland ecosystems that were rare before human colonisation of New Zealand and which often have highly specialised and diverse flora and fauna characterised by endemic and nationally rare species (Williams et. al., 2007).

In addition, much of the Thames-Coromandel district coast is composed of cliffs and rocky shorelines. Cliffs which are composed of acidic and basic volcanic rock are identified as historically rare ecosystems at a national level (Williams et. al., 2007) and are common on the Thames-Coromandel coast. There are also isolated rocky coastal features which can have outstanding natural values including blowholes, coastal caves and rock stacks. For instance,

coastal rock stacks, a historically rare ecosystem at a national level are relatively common on both the east and west coasts of Thames-Coromandel district. Some of these have been botanically mapped (Esler, 1978). Cliff and rocky coastlines generally have high natural character from an ecological (physical and biological) perspective except where fronted by development (e.g. roads; reclamations) and/or seawalls (e.g. parts of the Thames Coast). The physical features are however generally static (unlike dunes or shingle beaches) and relevant physical coastal processes (e.g. wave erosion at toe; weathering) are typically slow. They are also generally protected from human activities by inaccessibility and unlikely to be threatened by future activities (e.g. future roads or reclamations). Areas of rocky coastline which have high natural character value from a visual perspective have already been mapped by Brown (2008). Therefore, we have not included rocky coastlines as a separate ecosystem and have only included these areas where they fall within coastal forest ecosystems.

The mapping of ecosystems with high ecological natural character has an ecosystem and catchment focus rather than the smaller remnant-scale focus of the SNA project. An ecosystem with high natural character may or may not have SNA sites within it, but the significance of the ecosystem/catchment area functioning as a whole forms the basis of the ecological natural character assessment. The ongoing health and functioning of a specific SNA is likely to be dependent on the maintenance or enhancement of the wider ecosystem that influences the movement of individuals and energy within the SNA (see Palmer, 2009).

## 3.1 Dunes

### 3.1.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

Coastal sand dunes (Figure 1) occur extensively along the eastern Coromandel Peninsula coastline but are very rare along the more sheltered western Coromandel coast where only one site now remains at Otautu Bay. This broad ecosystem type includes various sub-ecosystems which have been identified as historically rare – including active sand dunes, dune deflation hollows, stable sand dunes and dune slack wetlands (Williams et. al., 2007). Dunes are also specifically prioritised as a national priority for protection, as they are now uncommon due to human activities (DoC & MfE, 2007).

Physically, the dunelands of the Thames-Coromandel district coastline are ‘shore parallel dunes’ which originate along the landward edge of the beach due to the deposition and trapping of windblown sand within vegetation. The most seaward or frontal dune is an integral part of the active beach system exchanging sand with the beach to seaward. The dunes further landward are often referred to as backdunes or (more technically) relict foredunes. These dunes formed along earlier more landward coastlines and have been stranded as the shoreline advanced.

Frontal dunes are subject to periods of storm erosion and subsequent recovery (as illustrated in Figure 2), which creates a dynamic shoreline. During major storms sand moves offshore to form a bar, and following storms the bar gradually returns to the shoreline and the beach recovers. Native sand binding species, particularly spinifex and pingao, grow down the eroded dune face and trap windblown sand – gradually repairing the eroded dune. The native sand binding plant species on the seaward dune face are critical to the process of dune recovery

**Figure 1: Coastal dune system (Otama) showing the spinifex vegetated frontal dune and regenerating native forest in the backdune.**

following storms and the prevention of wind erosion. The cyclic process of beach and dune erosion and recovery illustrated in Figure 2 are central to the natural dynamics and values of Thames-Coromandel district beaches.

The most significant shoreline fluctuations on eastern Thames-Coromandel district beaches are typically associated with multi-decadal (commonly 30-50 year) cycles, probably related to climate cycles (Dahm & Munro, 2002; Dahm & Gibberd, in prep.). These multi-decadal cycles are often characterised by lengthy periods of several years (sometimes 1-2 decades) during which duneline erosion or recovery can cumulate.

There are several Thames-Coromandel district beaches which have had a significant seaward advance since beach development commenced 7000-7500 years ago, and are now backed by wide coastal plains composed of coastal dunelands (e.g. Whitianga, Whangamata, Pauanui, Opoutere, Cooks and Kennedy Bay beaches). Other beaches which did not advance significantly tend to be backed by single dunes. These single dunes are large and wide at some sites (e.g. Tairua and Otama beaches), and very limited (often just a veneer of sand over older materials) at other sites (e.g. Hahei and Opito beaches).

Net shoreline advance of Thames-Coromandel district beaches has now ceased, with most beaches currently in a dynamic equilibrium (i.e. simply fluctuating backwards and forwards over periods of decades to centuries) (Dahm and Munro, 2002). The sediment reserves in dunes landward of the beaches are therefore finite. These sand reserves provide for long-term resilience of the beach in the event of any future trend for shoreline retreat, as may occur with projected climate change.

The original vegetation of eastern Coromandel Peninsula dunes is assumed to have included a succession from pioneer sand binding species (largely spinifex and pingao) on the seaward dune face through to coastal and/or lowland podocarp forest in back dune areas (Dahm, 2001). A number of the plant species in this zone are unique to coastal dunes having adapted to live in this harsh environment. There are also a range of native animals that occur largely or exclusively within dune environments including the katipo spider, copper butterfly and the shiny black sand scarab, one of New Zealand's largest beetles. A range of native sea birds also utilise beach and dune environments including the New Zealand dotterel, little blue penguin and variable oystercatchers.

### 3.1.2 ECOSYSTEM MODIFICATION

The ecological natural character of coastal dunes around the Thames-Coromandel district coastline has been widely and extensively modified by human activities, affecting both dune landforms and vegetation (Environment Waikato, 1999; Dahm, 2001). The modification of dune vegetation has included total removal of original dune forests, extensive disruption and loss of other native dune vegetation, and the introduction of a wide range of competing exotic plant species. Within the Waikato Region, 98% of coastal sand dune vegetation has been lost since 1840 with the remaining 2% extensively modified (HGF, 2004). A number of dune plant species are now listed as nationally threatened including pingao, sand pimelea, sand tussock, and sand spurge.

The human-induced disruption of stabilising dune vegetation (e.g. by stock grazing, vegetation clearance, earthworks and sand mining) has led to significant modification of dune landforms by wind erosion. Serious wind erosion was common from the 1800's to the mid 1900's when large areas of blow-outs and migrating sand sheets were evident (Dahm 2001; Dahm & Munro, 2002).

Dune vegetation and landforms have also been extensively modified by a wide range of human activities accompanying widespread subdivision and development over the last 30-50 years. These impacts include extensive leveling of relict and frontal dunes, replacement of native vegetation with exotics accompanying widespread "gardening" of frontal dunes, and damage to sensitive dune vegetation on the seaward dune face due to poorly managed beach access (Environment Waikato, 1999; Dahm, 2001; Dahm et al., 2005). Beach sediment reserves have also been reduced by sand extraction at some beaches – most notably Kuaotunu West (aka Grays) Beach. Seawalls have also been placed at some sites, preventing or restricting the process of natural dune erosion and recovery – most notably at Buffalo and Cooks Beach's.

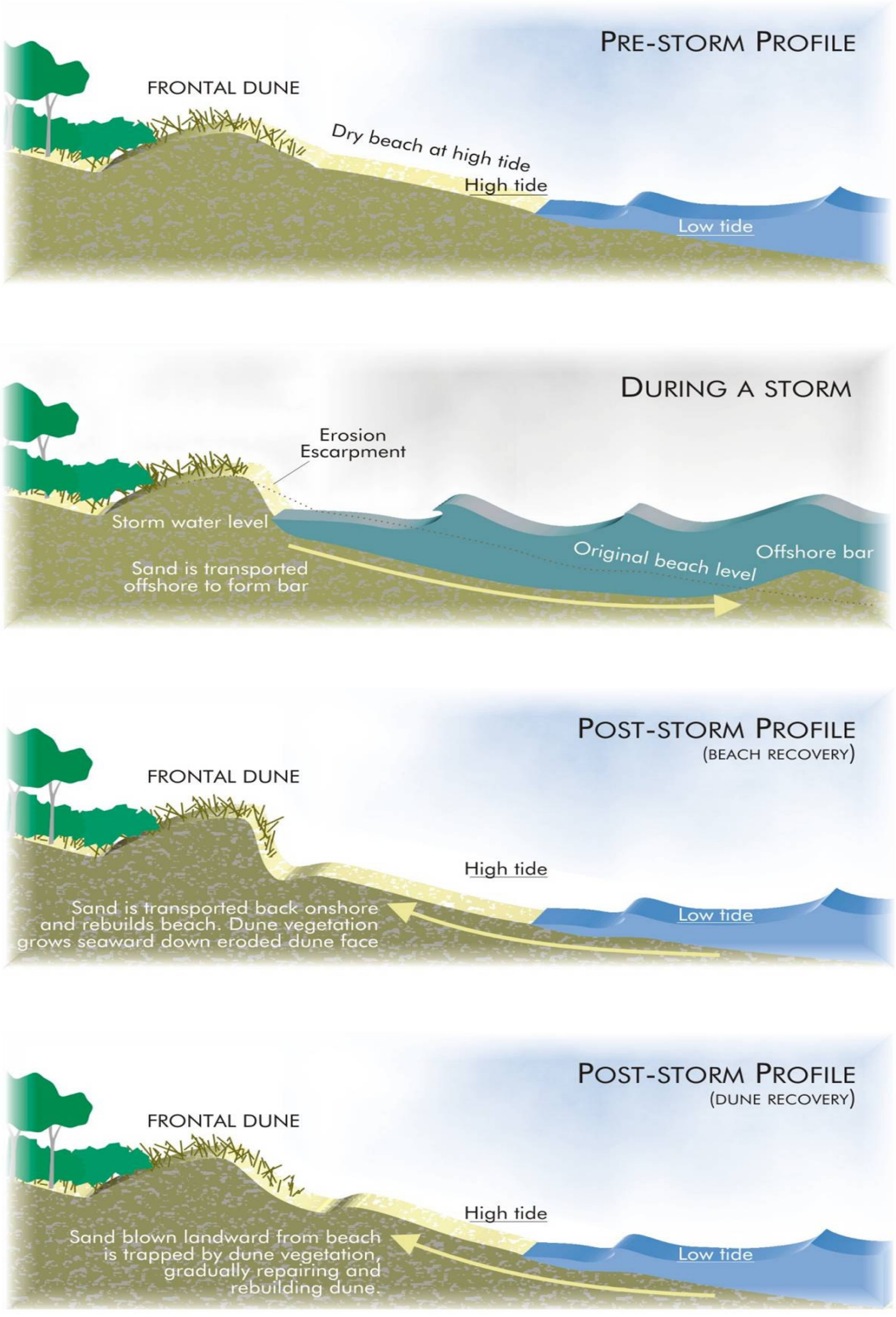


**Figure 2: Dune erosion and repair**

## 3.2 Gravel & boulder beaches

### 3.2.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

Gravel and boulder beach ecosystems (Figure 3 and Figure 4) within the Thames-Coromandel district are typically limited to relatively narrow beaches along the coastline.

Within the district this broad coastal ecosystem type includes the following sub-ecosystems: mixed sand and gravel beaches (most common type), gravel beaches and boulder beaches. Mixed sand and gravel beaches are common on the western coast of the Coromandel, particularly around the western margin of Mount Moehau and along the Thames Coast.

The ecosystem as broadly defined in this report includes two specific ecosystems which have been identified nationally as historically rare – being stony beach ridges and 'shingle' (mixed sand and gravel) beaches (Williams et. al., 2007). These ecosystems are also specifically prioritised as a national priority for protection (DoC & MfE, 2007).

In terms of physical coastal processes and features, chenier beaches could also be classified as mixed sand and gravel beaches. However, these systems are limited to estuaries within the

**Figure 3: Gravel beach system with back-beach storm ridges**

**Figure 4: Boulder beach at base of Mount Moehau**

district and have therefore been included within the broad coastal wetland ecosystem as defined in this report. The chenier ridges of the Thames-Coromandel district are typically mixed sand and shell and therefore fall within the category of shell barrier beaches, which have also been identified as historically rare ecosystems (Williams et. al., 2007).

Gravel and boulder beaches are formed from wave sorting and redistribution of sediments deposited by streams discharging to the coast, with some contribution also from cliff erosion. Sediments deposited seaward of the stream entrances during floods are subsequently reworked by waves, with sands and fine gravels moved onshore to form the mixed sand and gravel beaches.[1]

The sediment size range on the beaches is variable and depends largely on sediment sources and wave energy. Sands and fine gravels tend to characterise beaches in lower energy areas and those removed from sediment sources. Larger materials including boulders can occur in higher energy areas and beaches close to sediment sources – such as the beaches on the west coast around the base of Mount Moehau (Figure 4). Sorting of sediment sizes across the beach is a common characteristic of mixed sand and gravel beaches – with the coarsest materials typically concentrated in storm ridges above high tide.

The morphology of mixed sand and gravel beaches differs markedly from sandy beach systems. In the Thames-Coromandel district (especially the west coast) the beaches are

[1] This ecosystem type does not include beaches with a thin sand, gravel or boulder layer over a bedrock base.

typically narrow systems compressed against steep land. The seaward toe of the beaches typically occurs above low tide, whereas the seaward edge of sandy beach systems can extend to 6-8 m below low tide. The beaches are also steep with slope increasing as beach sediments coarsen and the percentage of sand decreases. The steep, narrow nature of the beaches results in wave breaking occurring close to the shoreline. Waves tend to break by plunging on the beach face, so the beaches lack the wide surf zones which characterise sandy beaches of the eastern Coromandel. Wave energy is therefore dissipated over a narrow beach width and sediment movement is dominated by swash processes. Significant wave run-up and overtopping can occur during periods of extreme waves. The permeable nature of the beaches means that wave run-up tends to concentrate coarser material in berms above high tide – since wave up-wash generally exceeds backwash.

A typical beach profile includes an intertidal platform seaward of the beach (often rock-lagged), an intertidal beach face, and a beach berm elevated above high tide often backed by one or more storm ridges. The beaches typically have a lower berm formed by common wave conditions with one or more higher storm ridges further landward formed during periods of more extreme wave run-up. The elevation of the storm ridges reflects the maximum elevation of land building in a particular storm event. The storm ridges can remain inactive for considerable periods between storms, particularly on the west coast of Thames-Coromandel where high-energy storm swell is infrequent (Dahm & Gibberd, 2009). Therefore, these higher storm ridges are often vegetated.

The gravel beach systems of the Coromandel typically have limited back beach sediment reserves – often giving way landward to coastal cliffs, wetlands/lagoons or alluvial plains. This indicates low rates of net sediment supply. However, river entrance deltas composed of successive gravel ridges do occur in some areas along the Thames Coast (Dahm & Gibberd, 2009).

Natural vegetation communities on gravel beach systems are likely to have included sand convolvulus and pohuehue on the highest storm ridge landward of the beaches. This pioneer vegetation gives way landward to hardy coastal shrubs and coastal forest in more stable areas. Native animals which utilise gravel and boulder beach ecosystems include the egg laying and shore skinks, New Zealand dotterel, and variable oystercatcher.

### 3.2.2 ECOSYSTEM MODIFICATION

The ecological natural character of Thames-Coromandel gravel beaches has been extensively modified by a variety of human activities including encroachment of development, seawalls, gravel extraction, and change of vegetation cover.

In many areas, back-beach storm ridges have been leveled to form roads or residential development; in some places this development and accompanying seawalls encroach onto the high tide beach and further seaward. Areas that have been leveled have frequently been raised with fill. The encroachment has buried many storm ridges and sometimes even high tide beach areas. The encroachment essentially truncates many gravel beach systems leaving insufficient space for storm ridges to develop. The encroachment and associated seawalls also prevent natural shoreline adjustment to natural forces.

Historically, a significant volume of gravel extraction has also occurred at many sites (e.g. Waikawau on the west coast; beaches around the west Moehau coastline) impacting on the

ability of the beach to draw on already-limited sediment reserves. Gravel extraction from streams feeding to the coasts has also reduced sediment supply to the beaches.

There has also been significant loss and truncation of natural vegetation sequences and extensive invasion of exotic species in the storm ridge vegetation zone.

Overall, most existing gravel beach systems are truncated on their landward margins and natural beaches with unmodified backshore areas are now extremely rare.

## 3.3 Coastal Wetlands

### 3.3.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

Coastal wetland ecosystems include estuarine wetlands (Figure 5) and any contiguous freshwater wetlands. These wetlands occur extensively around the margins of Thames-Coromandel estuaries and estuarine embayments (e.g. Graeme 2008). There are also a large number (>100) of smaller wetlands within the estuarine areas of streams and rivers. The coastal wetland ecosystems as mapped extend above and below MHWS thereby crossing jurisdictional boundaries. The sub-ecosystems of estuarine wetlands, lagoons and damp sand plains are among the historically rare wetland types identified nationally (Williams et. al., 2007). Wetlands in general are also a national priority for protection, as they are now uncommon due to the effects of human activities (DoC & MfE, 2007).

The coastal wetlands of the Thames-Coromandel district encompass a range of environments and vegetation communities including freshwater wetlands, riparian margins, saltmarsh

(including rush/sedgeland, saltmarsh ribbonwood and sea meadow), mangroves, seagrass, open intertidal flats and tidal channels. Estuarine wetlands have many highly specialised plants and animals unique to this environment, and therefore they contribute a distinctive element to the natural character of the coastal environment. Mangroves occur only in northern New Zealand, and as such provide more local character. Estuarine vegetation communities are spatially arranged according to variations in bed elevation, tidal inundation, salt concentration, wave exposure and other factors. The coastal wetlands within the district provide feeding, breeding, spawning and nursery habitat for a range of bird and fish species.

Estuarine wetland habitats are extremely productive ecosystems, providing significant sources of energy and organic matter to the wider estuarine environment. For instance, above-ground biomass of mangroves of 130 tonnes per hectare has been measured, with annual productivity typically ranging from 0.61 to 8.1 tonnes per hectare (Morrisey et. al., 2007). Much of the organic material in estuarine wetlands is however invisible and consists of fast growing bacteria, unicellular algae and animals. For instance, mud flats can produce four times more plant material per hectare than the best New Zealand pastures (NIWA, 2001). Plants are grazed and filtered by invertebrates like snails, cockles and oysters. These are then eaten by juvenile and other small fish which may be hunted by larger fish like snapper, kingfish, rays and sharks. This highly productive environment also supports large flocks of migratory waders and

**Figure 5: Saltmarsh and mangrove communities around the margin of Tairua Harbour**

a range of other bird species, many of which are threatened species such as Australasian bittern, banded rail, North Island fernbird, spotless crake, New Zealand dotterel, brown teal and reef heron.

Freshwater fish (e.g. eel and Galaxiid species) migrate through estuaries at least twice in their life cycles. Often freshwater habitats close to the coast and at lower elevations are more commonly used than those further inland (Sorrell & Gerbeaux in Harding et al, 2004). Estuary and stream bank vegetation flooded by spring tides provides important spawning habitat for one of the two main whitebait species - inanga.

Estuaries are natural sediment sinks and gradually infill over time, although investigations of Thames-Coromandel district estuaries indicate that natural rates of infilling prior to human settlement were very low (Hume & Dahm, 1992; Swales & Hume, 1995). Thames-Coromandel estuaries tend to be primarily composed of sandy sediments, with muddy sediments in sheltered areas.

Coastal wetlands provide important buffers between the land and sea by helping to filter sediments, nutrients and other pollutants draining from the land. Wetland vegetation can also provide natural protection to land, absorbing wave energy and so reducing erosion and inundation of adjacent coastal land.

Coastal wetlands provide a wide range of direct and indirect services to the economy of the Waikato Region including storm and flood protection, nutrient recycling and water quality

protection, spawning and nursery areas and wildlife habitat (Patterson & Cole, 1998). These ecosystem services are often taken for granted, but are very difficult and expensive to artificially replicate once they are removed. Collectively, the financial value of ecosystem services is very significant for the Waikato Region. For instance, the ecosystem services provided by estuarine wetlands of the Waikato Region were valued in 1998 at $46,400 per hectare per year – having the highest value of all the ecosystems investigated, including agricultural land (Patterson & Cole, 1998). These estuarine ecosystems comprise only 0.4% of the area of the total region (including the CMA) but made up nearly 10% of the total value of ecosystem services assessed.

### 3.3.2 ECOSYSTEM MODIFICATION

The ecological natural character of coastal wetlands in the district has been adversely impacted over time by a wide range of human activities including drainage, bunding/stop-banking, infilling/reclamation, stock access, plant and animal pests, riparian vegetation clearance, sediment-laden runoff, and subdivision and development around the landward margins. In the longer-term, sea level rise and other effects of projected climate change may also adversely affect these wetlands (Graeme & Dahm, 2007).

Drainage, bunding and stop-banking can alter hydrological connections and the saline influence resulting in significant degradation or total loss of the affected wetland areas. Similarly culverts and causeways can alter hydrological connections. Any hydrological impacts on coastal wetlands can often be permanent, and have far-reaching ecological effects that may not be anticipated.

Infilling and reclamation results in complete loss of wetland areas and is often very difficult and costly to reverse. This is an issue not only for existing wetlands, but also former wetland areas that have been modified (e.g. drained for agriculture) that could potentially be restored to wetlands in the future.

Stock and feral animal pests (e.g. goats and pigs) can have a severe impact on vegetation and soil and water quality through pugging, grazing, defecation, weed introduction and erosion. Animal pests can also pose a significant threat to native wildlife, particularly birds which nest in wetlands. Stock damage has also encouraged the establishment of Southern Saltmarsh mosquito infestations, a recent issue in the Thames-Coromandel district. In general, stock damage is reversible but can take some time after stock are removed.

Plant pests are also a significant threat as they can out-compete and displace native vegetation and benthic animal communities resulting in a loss of biodiversity and changes in hydrological functioning. A particularly significant plant pest in Thames-Coromandel district estuaries is saltwater paspalum which is widespread (Graeme & Kendal, 2001) and spreading rapidly (Graeme, 2007). Other common estuarine weeds in the district's estuaries include spartina and tall fescue (see also Section 4.5 for freshwater wetland weeds).

Certain catchment land activities have also significantly changed the character of coastal wetlands. For instance, investigations indicate that sedimentation rates in Thames-Coromandel district estuaries have accelerated by 10-20 times over the 100-150 years since European settlement (Hume & Dahm, 1992; Swales & Hume, 1995). This increased sedimentation has contributed to the expansion of mangrove communities in some harbours

(Morrisey et. al., 2007).

Increased subdivision and housing development around the landward margins of coastal wetlands can have a multitude of adverse effects on the wetlands. These include coastal structures (e.g. seawalls), stormwater outlets, loss of riparian vegetation and disruption to natural vegetation sequences, increased wildlife (e.g. bird) disturbance, domestic predators (e.g. cats and dogs), and modification of important natural coastal formations (e.g. beaches and cheniers).

Climate change also has the potentially to significantly impact Coromandel Peninsula estuaries. For instance, projected sea level rise will significantly modify existing estuarine wetland communities (e.g. saltmarsh replaced by mangroves) and result in the loss of marginal communities if they are unable to migrate landward (Graeme & Dahm, 2007).

## 3.4 Coastal Forest

### 3.4.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

Coastal forest ecosystems (Figure 6) extend a variable distance inland from the coastline to where lowland forest becomes dominant. Estimates indicate that only 12.5% of the original coastal forest within the Coromandel Ecological Region remains, of which only 6.8% is protected (Harding, 1997). The various land environments that make up coastal forest are also a national priority for protection as less than 20% of these original land environments now remain (DoC & MfE, 2007).

Coastal forest is characterised by plants which are adapted to windblown salt and have a reduced tolerance to frost. It also typically has a low canopy (no higher than 20m) with dense crowns (Dawson & Lucus, 1996). The two main primary coastal forest sub-ecosystem types identified in the Thames-Coromandel district (adapted from vegetation types in Humphreys & Tyler, 1990) are:

1. 'Pohutukawa rock treeland' which grows on coastal cliffs and is characterised by a canopy of large spreading pohutukawa over a sparse understory and groundcover of flax, ngaio, taupata, kawakawa, rangiora, karo, *Astelia banksii* and shining spleenwort.
2. 'Pohutukawa-broadleaved species forest' which has varying proportions of pohutukawa and puriri in the canopy. Other canopy and subcanopy species include kohekohe, pigeonwood, mahoe, mapou, nikau, taraire, kowhai, wharangi, whau, houpara and karaka.

There can be a transition zone of semi-coastal forest between coastal and lowland forest in which frost-intolerant broadleaves such as puriri, kohekohe, nikau and karaka are more predominant in the canopy Humphreys & Tyler (1990). Inland ridges can truncate the influence of salt-laden winds, and mark an immediate change from coastal to lowland forest communities.

Humphreys & Tyler (1990) note that coastal forests in the Coromandel Ecological Region are

**Figure 6: Remnant and regenerating coastal forest near Port Jackson**

generally highly fragmented and disturbed, with little primary forest cover remaining, making it difficult to establish its original extent. For the purposes of this report the definition of the inland boundary of the coastal forest is the lesser of:

- An elevation of 200m; or
- 1 km inland from the coast and 500m behind estuaries[2].

This definition generally incorporates the "first ridge" principle. Field observations indicate that pohutukawa does not generally extend in any significant density beyond 200m altitude (see also discussion in Section 2.2.2).

There are a number of threatened plant species found in the Thames-Coromandel district for which coastal forest and rocky coastal edges are important habitat. Threatened plants found in coastal situations include thick-leaved tree daisy (*Olearia pachyphylla*), *Picris burbidgei, Pimelea tomentosa*, fireweed (*Senecio scaberulus*), and mawhai (*Sicyos australis*/*S*. aff. *australis*). Threatened animals that utilise coastal forest as habitat include Duvaucel's gecko, North Island kaka and North Island brown kiwi.

[2] The 'coastal environment' is mapped relative to the landward edge of the identified coastal wetland ecosystems.

Coastal forest (like all forests) helps regulate climate, absorb water, nutrients, and carbon dioxide, produce oxygen and stablise land. Coastal forest also provides habitat for a wide range of native flora and fauna including common and threatened species.

### 3.4.2 ECOSYSTEM MODIFICATION

The ecological natural character of coastal forests has been highly modified in the Thames-Coromandel district. The major impact has been from large-scale forest removal to the extent that little original coastal forest now remains. In addition, remaining areas have and continue to be impacted by ongoing vegetation clearance, browsing, weed competition and wildlife predation.

Vegetation clearance can involve the removal of mature or secondary coastal forest. Clearance of mature forest is now rare but there is ongoing removal of regenerating forests, particularly for the establishment of exotic plantation forests or for pasture. The subdivision of coastal land also introduces new housing into coastal forest with associated potential adverse effects.

Browsing by stock, goats, pigs, deer and possums (as well as rats eating fallen seeds) can have serious negative impacts on long-term forest health. As well as the competitive and predatory pressure on native wildlife, there are compositional changes in the forest as the most palatable plant species are targeted, but most significantly a loss of regeneration and ultimately canopy collapse.

Invasive weeds can prevent the regeneration of native trees by outcompeting native seedlings and dominating understory and canopy vegetation. Some species that have been found in the district (e.g. climbing spindleberry) can smother and collapse existing canopy. Forest fragments close to human habitation (Timmins & Williams, 1991) or fragmented by browsing or vegetation clearance are very susceptible to invasion by introduced weeds.

Coastal forest fauna is seriously impacted by predation where introduced animals such as possums, cats, rodents, and mustelids are not controlled. Uncontrolled dogs pose a significant threat to ground-based wildlife also.

## 3.5 Inland Wetlands

### 3.5.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

Inland wetlands (Figure 7) are permanent or temporary freshwater wetlands that support plants and animals specially adapted to wet conditions. Wetlands are often features of a stream system – occupying low-lying areas adjacent to stream channels and abandoned stream channels. The RMA (1991) definition for a wetland:

*"includes permanently or intermittently wet areas, shallow water, and land water margins*

*that support a natural ecosystem of plants and animals that are adapted to wet conditions"*.

Wetland ecosystems are divided into 8 different sub-classes dependant on their substrate, water regime and the consequent factors of nutrient status and pH level (Johnson & Gerbeaux, 2004; Hunt, 2007). Inland wetland types which occur in the Thames-Coromandel district include swamps, marshes, seepages, ephemeral wetlands and fens. Several of the wetland sub-ecosystems identified are historically rare (Williams et. al., 2007).

Wetlands are identified as a national priority for protection as they are now relatively uncommon due to human activities (DoC & MfE, 2007). The Environment Court has also highlighted that wetlands are a valuable and rapidly diminishing resource; and that a relatively insignificant and small-scale wetland can still be of national importance under s 6(a) (MfE, 2009).

Wetlands provide valuable 'ecosystem services' - including storm protection, flood control, habitat, nutrient recycling and waste treatment (Environment Waikato, 2008b). Collectively, the economic value of these services is significant for the Waikato Region. For instance, the various ecosystem services provided by freshwater wetlands of the Waikato Region were valued in 1998 at $39,800 per hectare per year – almost 40 times the value per hectare of agricultural and horticultural land (Patterson and Cole, 1998).

Wetlands support a diverse range of plants and animals, including many threatened species that rely on wetlands for survival. Birds that utilise wetlands include waterfowl (such as the threatened species' brown teal and grey duck) and also marsh birds (such as the threatened species' Australasian bittern, spotted crake and marsh crake). Fish species associated with wetlands in the Thames-Coromandel district include the short-finned eel and inanga (both important fishery species) and threatened species such as giant kokopu and long-finned eel.

Wetlands are important storage areas for floodwaters, slowing the flow of water off the land, soaking up excess floodwater, and then slowly releasing it to maintain summer water flows. Wetlands also help trap sediment, nutrients and other harmful substances from land runoff helping maintain water quality in stream and estuarine ecosystems. Bacteria living in wetland soils absorb and break down nitrogen from farm run-off and leachate, also improving water quality.

Riparian vegetation is an integral part of wetland ecosystems forming an important buffer between wetlands and adjacent land uses. Removal of this vegetation can significantly reduce wildlife habitat, bank stability, water quality and biodiversity values in general.

### 3.5.2 ECOSYSTEM MODIFICATION

The ecological natural character of wetlands in the Thames-Coromandel district has been significantly impacted by human activities which have reduced the extent of wetland area and degraded the remaining wetlands. Wetlands once covered large areas of New Zealand, but they are now among the rarest and most at-risk ecosystems (Environment Waikato, 2008a). Drainage, cultivation and infilling has caused the loss of ~98% of the original wetlands in the Coromandel biogeographic unit (Ausseil et. al., 2008). Many of the remaining wetlands have also been degraded by stock access, weed invasion, land runoff (nutrient enrichment and sedimentation), changes to hydrological regimes (e.g. damming, draining), catchment works

and barriers to freshwater fish migration.

Plant pests threaten native biodiversity in freshwater wetlands. The most significant freshwater wetland weeds in the Thames-Coromandel district wetlands include grey willow, crack willow, reed sweet grass, Mercer grass and pampas.

Animal pests can also damage native wetland ecosystems by grazing, rooting (i.e. pigs) and trampling. Predation can also significantly impact native wetland fauna. For instance, wetland birds, lizards and insects are predated by mustelids, rats and cats. Introduced animals can also compete with as well as predate native fish fauna (e.g. gambusia (DoC, 2008)). Migratory freshwater fish species are particularly threatened by over-fishing and loss of their wetland habitat.

**Figure 7: Small remnant freshwater wetland on valley floor**

## 3.6 Rivers

### 3.6.1 NATURAL SYSTEM DESCRIPTION AND FUNCTIONING

The RMA defines a 'river' as "*a continually or intermittently flowing body of fresh water, and includes a stream; but does not include any artificial watercourse …".*

Rivers (Figure 8) are open ecosystems which are largely dependent on a continuing supply of energy, materials, nutrients and organisms (such as insects) from outside of the waterbody

itself. The importance of terrestrial inputs to the natural functioning of running-water ecosystems and the significance of links between aquatic and terrestrial food webs mean that river ecology must be viewed in the context of its catchment (Winterbourn, 2004). As rivers are generally one-way systems, the ecological health upstream influences the freshwater community health downstream. Protection of the natural freshwater fluvial processes and water quality will also enhance the coastal environment and its water quality.

The flow regimes of New Zealand rivers are determined primarily by the amount of rainfall, catchment geology, soils and topography, catchment area and shape (Gupta, 2007; Harding et al, 2004). In the Thames-Coromandel district the high and steep topography, shallow soils, vegetation cover and intense rainfall events give rise to steep rocky streams with high flood runoff and low mean flows. These characteristics and sediment transport influence river morphology and the biological communities living within streams (Winterbourn, 2004). The frequency and severity of flood events and the associated transport of sediment in rivers directly affect aquatic life through disturbance, and is important in shaping their habitat (including channel morphology and substrate) (Wilding, 2007). Other factors influencing community structure are biotic factors such as food availability and interactions among species.

The concept of river health incorporates both ecological and human aspects. Meyer (1997) describes a healthy river as “an ecosystem that is sustainable and resilient, maintaining its ecological structure and function over time while continuing to meet societal needs and expectations." Therefore, a healthy river system is able to support the range of organisms that have adapted to live there, performs the ecological functions that would be expected, and has the ability to bounce back after disturbance. A healthy river will also supply the goods and services that are valued by people (e.g., GOODS - clean water for drinking, water supply for irrigation/industry, environment for recreation and spiritual renewal; SERVICES - cleansing and detoxifying water, producing fish, providing aesthetic pleasure, maintaining water supply, storing and regenerating essential elements). These values can be intrinsic (e.g. species have a right to exist) or instrumental (e.g., tourism value of trout fishery).

An assessment using various invertebrate measures and habitat quality scores indicated that ecosystem condition of Thames-Coromandel district streams were generally well above or above average for the Waikato region (Collier & Kelly, 2006).

The condition of catchment and riparian vegetation has a critical influence on the health and quality of stream ecosystems – influencing water velocities, habitats, nutrient dynamics, bank stability, water clarity, water temperature and quantity, and ultimately the abundance and diversity of aquatic life (e.g. Reeves et. al., 2004; Boothroyd et. al., 2004; Meleason & Hall, 2005). Riparian vegetation forms an important buffer between waterbodies and adjacent land uses. The riparian zone is highly variable in width, depending on the hydrological regime, and its influence on the river ecosystem (e.g. providing shade, organic matter input, habitat for stream invertebrates, birds and fish) (Reeves et al, 2004; Eikaas et al., 2005; Collier & Smith, 1998).

Regional prediction models predict high average native fish species richness in coastal and lowland areas of small catchments around the Coromandel Peninsula (Leathwick & Julian, 2009). Fish diversity decreases with distance inland as natural topography and man-made structures hinder fish movement. Long-finned eel, koaro and banded kokopu are however good climbers and can penetrate well inland (McDowall, 2000). Nearly half of our native

freshwater fish are diadromous (i.e. they migrate to and from the sea). Many galaxiid species spawn during elevated stream flows and their eggs develop out of water amongst stream bank litter and gravels and therefore rely on heavy riparian plant cover to prevent them from dehydrating (McIntosh & McDowall, 2004).

Threatened animal species associated with rivers and their margins in the Thames-Coromandel district include (threatened species status in brackets):

> giant kokopu (Gradual decline), longfin eel (Gradual decline), lamprey (Sparse), short-jaw kokopu (Sparse), koura (Gradual decline), freshwater mussel (Gradual decline), and Hochstetters frog (Sparse).

Many threatened forest species also utilise river margins and beds such as the North Island brown kiwi (Serious decline).

**Figure 8: A Coromandel river with forested riparian margins**

### 3.6.2 ECOSYSTEM MODIFICATION

The ecological natural character of rivers and streams can be impacted by loss of native vegetation cover, development of impervious cover through roading and urbanisation, the presence of dams, culverts and other impacts on fish passage, both point and diffuse source terrestrial nutrient inputs, point discharges from mines and industrial sites, water takes, and introduced fish species.

As rivers flow downstream, the health of headwaters affects the entire stream reach. Clearance of catchment and riparian vegetation, especially in headwaters, leads to elevated sedimentation, unstable stream banks, heated and sunlit waters and loss of habitat for native 'forest' fish and invertebrate species. In assessing river networks, Leathwick & Julian (2008) take account of the greater effects of degradation of headwater catchments on lower reaches, than the degradation of downstream reaches on headwater streams.

Water quality is generally poorest in rivers and streams in urban and farmed catchments. This reflects the impact of non-point-sources of pollution (sediment, nutrients, bacteria, pesticides) in these catchments (MfE, 2007 pg 261). Many of our native fish and aquatic invertebrate species are sensitive to the effects of loss of shade, and elevated sedimentation and nitrification (Winterbourn, 2004; McIntosh & McDowall, 2004).

Nationally, over-allocation of water resources is severely impacting habitat quality for our native fish and invertebrate populations (MfE, 2007 pg 264). At present this is a limited influence on Thames-Coromandel district streams but there are a number of large water takes in the district which may be having a localised effect (James & Dewson, 2008).

Despite regional differences, the loss of indigenous forest and its replacement by pasture tends to have a homogenising effect on stream invertebrate faunas (Winterbourn, 2004). Regional prediction models predict the highest species richness for stream macro-invertebrates is along the western side of the Coromandel Peninsula north of Thames (Leathwick & Julian, 2009).

Parkyn et. al (2003) found that riparian buffer widths appear to be closely related to stream health. The permanency of the riparian buffer is important. While exotic forestry provides shade, woody inputs and bank/catchment stability for the later period of the growing cycle, these values are generally lost following logging. Quinn et al. (2004) concluded that logging disturbance can degrade stream invertebrate community structure and biodiversity values severely unless wide and continuous buffers of undisturbed riparian forest are retained. They also found that continuous buffers provided more protection than patch buffers.

Man-made stream barriers such as dams, culverts, fords, weirs and diversion structures can restrict fish passage if they are not built correctly. Such barriers have the greatest impact on our native diadromous (migrating) fish populations, and in lowland areas where natural restrictions would not generally occur (cf. the high incidence of natural restrictions such as waterfalls inland along the Coromandel range). Fish passage is an issue of high priority in the Thames-Coromandel district given the diverse and abundant fish populations, proximity to the sea and the available upstream habitat of largely undeveloped land (Kelly & Collier, 2006). Unnatural barriers to fish migration are generally only of concern in lowland areas due to the natural steep waterfalled nature of the Coromandel range. As Kelly & Collier (2006) point out the presence of a coastal ring road with steep upstream catchments has the potential to limit the movement of fish into freshwater environments only metres from the sea.

Flood control works can also affect the natural character of rivers. Flood control works are particularly common along the western coast of the Coromandel Peninsula. These works are generally in the lower coastal reaches of rivers and can adversely affect floodplain functioning and remove spawning habitat for fish.

Exotic fish are not a widespread problem with only gambusia and trout present in isolated

areas around the Coromandel. Exotic fish can compete for resources and predate on native fish, restricting their populations (DoC, 2008; Townsend & Crowl, 1991). Some exotic species, such as trout, can also exert strong control over algal and invertebrate community structure and ecosystem function (Townsend, 2003).

# 4 Natural Character Assessment & Mapping

This chapter outlines the approach used to assess and map areas of high natural character from an ecological perspective.

The assessment criteria developed for each ecosystem is briefly outlined. These criteria focus on those natural features and processes critical to the integrity, functioning and resilience of each ecosystem. The assessment has sought to use objective criteria but there are limitations imposed by the quality of available information for each ecosystem and the assessment does involve a level of considered judgment.

The mapping process and data used for each ecosystem type is outlined below. The mapping of areas of high natural character was standardised at a scale of 1:10,000 (unless otherwise stated) reflecting limitations of data and budget relevant to this study. All mapping was undertaken using Mercator projection (NZTM) and the Geodetic datum (NZGD 2000). Field verification was undertaken at selected sites to check the areas mapped.

## 4.1 Dunes

### 4.1.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of dune ecosystems are dune landforms, dune vegetation and the natural coastal processes of dune building, erosion and repair.

Natural dune landforms that are not influenced by anthropogenic activities are now exceedingly rare (Nordstrom, 1990, 1994). Subdivision and development has extensively leveled both relict backdunes and, in places, the frontal dunes. Most dunes on the eastern Coromandel Peninsula have also experienced periods of severe wind erosion accompanying vegetation loss and disturbance associated with past human activities. This wind erosion has significantly modified many dune systems, particularly the more seaward dune systems. The only remaining areas with unmodified dune morphology tend to be small areas of remnant relict back-dunes and these are extremely rare. Most of these unmodified relict dune areas do not have natural dune vegetation (generally being covered in grass).

Dune vegetation has also been extensively modified, with no mature succession from pioneer sand grasses through to lowland coastal forest remaining on any Thames-Coromandel district dune systems. The only dune system in the district with any significant area of coastal forest occurs at Otama Beach where the forest is in the early stages of regeneration (e.g. shrubs and small trees) – although small patches of regenerating forest can be found at a number of other back-dune sites. At many sites even the frontal dune vegetation (i.e. the spinifex dominated seaward face and the low groundcover zone immediately landward) is also extensively modified.

The natural process of dune erosion and recovery still occurs at most sites except those sites with seawalls (e.g. Buffalo Beach) or which lack appropriate native sand-trapping vegetation

(e.g. spinifex and pingao) on the seaward dune face (this vegetation being critical to the natural process of dune building and repair).

In view of the highly modified nature of remaining dune systems and the national priority to protect and restore these ecosystems, areas of high natural character are defined as:

- dunes with appropriate native dune sand-trapping vegetation on the seaward dune face);
- any additional areas of regenerating native dune vegetation (e.g. backdune vegetation), even areas that have exotic plants present.

Dune systems fronted by seawalls have been excluded since these structures prevent periodic storm erosion critical to natural sand exchange between the beach and dune system.

### 4.1.2 DATA USED FOR MAPPING

The areas of high natural character were identified and mapped for dunes using:

- 2007 aerial photography;
- 1:250,000 geological mapping;
- local knowledge of dune systems including work undertaken by the Environment Waikato Beachcare programme.

The seaward edge of the beach system evident in the available photography was adopted as the seaward edge of mapped units – although in reality the seaward edge of active beach systems generally lies some distance offshore (e.g. depths of 5-7m for most of the eastern Coromandel Peninsula beaches).

The identified areas of high natural character were mapped within the NC_DUNES dataset.

## 4.2 Gravel & boulder beaches

### 4.2.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of gravel and boulder beach ecosystems include beach landforms, natural vegetation sequences and the coastal processes of sediment supply, alongshore transport and storm ridge building.

Natural gravel beach landforms and vegetation have been significantly influenced by anthropogenic activities around the Coromandel Peninsula coast; in particular, truncation of the beach systems by encroachment of roads, seawalls and other human development. In places, sediment supply has also been impacted though in most areas the supply of material from streams and alongshore has not yet been interrupted.

In view of the highly modified nature of gravel beach systems and the national priority to protect and restore these ecosystems, areas of high natural character are defined as:

- All gravel beach areas with at least a natural high tide beach;

- Any natural back beach areas with well defined major storm ridges ;
- Any remnant back-beach native vegetation sequences on beach gravels.

Adjacent beaches of high natural character which are dynamically linked by sediment exchange have generally been mapped as one unit even where separated by small rocky promontories. Therefore, the mapped units do occasionally include small beach lengths without high tide beaches.

Cliff areas and streams without beaches have not been mapped even though these may be an important source of sediment supply to beach systems further alongshore.

### 4.2.2 DATA USED FOR MAPPING

The areas of high natural character were identified and mapped using:

- 2007 aerial photography;
- local knowledge.

The seaward edge of the beach system evident in the available photography was adopted as the seaward edge of mapped units – though the active beach system may well extend into subtidal areas in some places. Intertidal flats immediately offshore were generally included in stream delta complexes (e.g. Waikawau on the Thames Coast). In some locations where it was difficult to discern whether or not the beach is backed by a storm ridge (and where field access and inspection was not practical within the constraints of this study), we generally mapped the landward boundary only 2-4 m into the land behind.

As noted earlier, chenier landforms located within estuarine wetland ecosystems have not been separately mapped as beaches.

The identified areas of high natural character were mapped within the NC_GRAVEL_ BOULDER_BEACHES dataset.

## 4.3 Coastal Wetlands

### 4.3.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of coastal wetland ecosystems are hydrological regime and connectivity, native vegetation and biota (including riparian margins), and sediments.

Coastal wetlands have been significantly impacted by land use (including encroachment and land runoff) and by weed and animal pests. Most, if not all, estuarine wetlands within Thames-Coromandel district have been subject to accelerated sedimentation. There has also been widespread loss and degradation of riparian margins and upper intertidal areas as a result of drainage, bunding, reclamation and other activities associated with encroachment of land uses into wetland areas.

Notwithstanding these negative impacts, remaining wetland areas retain significant ecological values and functioning. In view of the highly modified nature of coastal wetlands, the critical values of these ecosystems and the national priority to protect and restore them, areas of high natural character are defined as:

- All areas of estuarine wetland subject to tidal inundation, excluding areas which are actively drained and are currently grazed grassland;
- All freshwater wetlands contiguous with estuarine wetlands, excluding areas which are actively drained and are currently grazed grassland;
- All areas of mature or regenerating riparian vegetation surrounding the above areas (to a maximum width of 50m).

### 4.3.2 DATA USED FOR MAPPING

The areas of high natural character were identified and mapped using:

- 2007 aerial photography;
- estuarine vegetation mapping and associated reports available for specific harbours (Graeme 1997-2009) ;
- local knowledge.

Mean High Water Spring (MHWS) boundaries which form the seaward extent of District Council control were not determined. Instead the seaward edge of coastal wetland systems are defined by the harbour entrance (e.g. for tidal estuaries), stream mouths, or embayment entrances (e.g. Colville bay). In places the landward boundary was difficult to define accurately. Where uncertainty exists we have adopted a precautionary approach to wetland inclusion and mapped the most apparent landward boundary. In the case of estuarine wetlands, the landward boundary could potentially be mapped with improved accuracy once detailed bed level information (e.g. LiDAR data) is available.

The identified areas of high natural character were mapped within the NC_COASTAL_WETLAND dataset.

## 4.4 Coastal Forest

### 4.4.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of coastal forest ecosystems are succession and regeneration, seed dispersal, weeds and animal pests. Existing coastal forest remnants include those in early stages of succession as well as mature forests.

The extent of coastal forests have been severely reduced and the remnants degraded by land clearance and other human activities. Remaining forests are also often highly fragmented and therefore more susceptible to weed invasion, stock damage, wind throw, changes in microclimate (e.g. light exposure, soil and air temperature), and loss of biodiversity (Davies-Colley et al., 2000; Brockerhoff et. al., 2005; Timmins & Williams, 1991; East & Williams, 1984). In addition, animal browsing can significantly impact on successional processes, understorey regeneration and canopy health. Native forest fauna are negatively impacted by these effects

on their habitat, and also the competition and predation from various animal pests.

Despite these impacts, coastal forest remnants retain significant ecological values. The natural processes of seed dispersal, succession and regeneration also continue even in degraded ecosystems and can be enhanced by appropriate management of plant and animal pests and by fencing stock out.

Coastal forest ecosystems with high natural character are defined as:

- All areas of regenerating or mature native coastal forest greater than 0.5ha and within the defined 'coastal environment' (see Section 2.2.2).

The maturity of the forest is not a significant factor in the assessment of ecological natural character. Any area of forest in which the natural processes of seed dispersal, succession and regeneration are occurring is considered to be functioning naturally and to have the potential to evolve to a climax state. The maintenance of natural processes and ecological functioning are the critical factors in ecological natural character – particularly as the composition of the natural climax state may well shift in response to climate change.

Browsing and foraging of introduced animals, and the competition from pest plants can significantly degrade the health and regenerating ability and therefore the ecological natural character of coastal forests. Detailed information is not presently available on these influences for each individual site mapped. However, given the size of the areas mapped, we believe high levels of ecological natural character remain. Addressing any adverse effects from weed or animal pests will further increase the natural character values of the sites.

### 4.4.2 DATA USED FOR MAPPING

The coastal forest assessment was based on shapefiles of forest and scrub areas determined to be significant in the Significant Natural Areas (SNA) project (Kessels et. al, in press) that lay within the 'coastal environment'. The SNA project used a minimum area of 0.5ha for mapping SNA's. Additional coastal forest areas were also identified which met the high natural character definition above. Databases used were:

- Significant Natural Areas forest and scrub layers (2009);
- Coastal Environment line;
- Biodiversity Vegetation (BIOVEG 2007) TCDC layer.

The identified areas of high natural character were mapped within the NC_COASTAL_FOREST dataset.

## 4.5 Inland Wetlands

### 4.5.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of inland wetland ecosystems are the hydrological regime and the native vegetation and biota.

Inland wetlands in the Thames-Coromandel district have been extensively drained and infilled, though the full extent of historic loss in the district is difficult to quantify. Remnant wetlands have also been degraded by stock grazing, land runoff and weed invasion. Remnant wetlands also frequently lack an adequate buffer of riparian vegetation.

In view of the significant historic losses of inland wetland ecosystems, the highly modified nature of remaining inland wetlands and the national priority to protect and restore these ecosystems, areas of high ecological natural character are defined as:

- All remaining freshwater wetlands > 0.5ha and the associated riparian vegetation (to a maximum width of 50m).

### 4.5.2 DATA USED FOR MAPPING

Inland wetlands with high natural character were identified and mapped using shapefiles of freshwater areas determined to be significant in the Significant Natural Areas (SNA) project (Kessels et. al, in press). The SNA project used a minimum area of 0.5ha for mapping SNA's. Additional inland wetland areas were also identified which met the high natural character definition above. Information used included:

- Significant Natural Areas wetland layers (2009)
- Biodiversity Vegetation (BIOVEG 2007) TCDC layer.

The Waikato Regional Plan significance criterion identifies all wetlands as significant. The SNA project only mapped those wetlands which were over 0.5ha in size, therefore missing the large number of smaller wetlands within the Thames-Coromandel district which also qualify as being areas of high ecological natural character. However, it was beyond the scope of this study to attempt to map these additional smaller wetland areas. Nonetheless, wetland areas less than 0.5 ha should also be included by any policy relevant to inland wetlands.

The identified areas of high natural character were mapped within the NC_INLAND_WETLAND dataset.

### 4.5.3 ASSOCIATED WORK

As part of the Waters of National Importance (WONI) project, research is being undertaken to set priorities for protecting inland wetlands throughout New Zealand that will protect their full range of biodiversity values (Ausseil et. al., 2008). This assessment will allow DoC and other agencies to identify management priorities to protect as full a range of biodiversity as possible.

## 4.6 Rivers

### 4.6.1 ASSESSMENT CRITERIA

Important factors in assessing the integrity, functioning and resilience of river ecosystems are the extent of native riparian and catchment vegetation, hydrological regime, sediment runoff, and aquatic biota.

The ecological natural character of rivers in the Thames-Coromandel district is generally high as indicated by instream studies (e.g. Collier & Kelly, 2006; Environment Waikato, 2009; Beard,

2008). The most significant negative impacts on rivers are the loss of catchment and riparian vegetation with associated accelerated flood and sediment runoff, localised sources of contaminants (e.g. nutrients from farms; seepage from historic mines) and barriers to fish passage.

Headwaters are identified as particularly important to the health of a river network as they are generally one-way systems. Energy in the form of organic detritus and soil nutrients, pollutants and cool (or heated) water all flow downstream.

Research has identified that catchment and riparian vegetation play a significant role in the ecological natural character of rivers. Freshwater invertebrate monitoring results suggest that declines in ecological condition (measured by macroinvertebrate community health) are probably greatest in small lowland rivers that have higher proportions of their upstream catchment developed (Collier & Kelly, 2006). This is also supported by Death & Collier (in press) who found that Waikato catchments with >80% indigenous vegetation cover were associated with macroinvertebrate communities characteristic of non-degraded conditions. This linkage suggests the variables most likely to be influenced at a catchment scale (i.e. water temperature, nutrient levels and sedimentation) are likely to be controlling water and habitat quality and thus macroinvertebrate communities in these streams. Leathwick & Julian (2009) use this >80% catchment cover limit to determine whether or not an individual catchment unit is adequately protected.

As research suggests that having 80-90% of indigenous vegetation cover in a catchment is generally adequate to protect river values, we have taken a conservative approach and define a river reach with high natural character as:

- a river reach that has ≥90% indigenous vegetation cover in its catchment.

This ensures that the non-indigenous area of up to 10% has a relatively small impact on natural character, especially when it could occur in parts of the catchment with relatively greater negative impacts on a river such as the headwater or riparian margin.

Many river reaches downstream of identified high natural character watersheds may also have high water and habitat values. However, where riparian and catchment cover is absent, the processes that maintain ecological values and water quality at a high level are disrupted and there is potential for high natural character values to be degraded. In addition, once a break in catchment vegetation occurs, there is increased probability that forest areas further downstream are under pressure (e.g. the forested area is within a farm and stock have access to the forested understory and waterways).

While areas are identified as having high natural character this does not mean that there are no adverse effects occurring within them. Potential adverse effects that have not been specifically assessed here include:

- barriers to fish passage - some river watersheds that have been identified as having high natural character may have a major barrier to fish passage, meaning that the upstream river ecosystem may not be accessible to certain native fish.

- grazing by stock, goats, pigs, possums, and competition by weeds – these pressures degrade indigenous vegetation health and contributes to increased erosion. This

downstream effect of mammalian grazing on indigenous vegetation is recognised by the Peninsula Project which aims to reduce erosion and flooding.

- housing and roading - there were some river watersheds mapped as having high natural character where roads were close to watercourses and/or there is extensive urban development in the catchment (e.g. Tuateawa). We have assumed that existing management control mechanisms for water and erosion (e.g. covenants, septic disposal design standards, culvert design standards) will minimise any adverse effects on rivers or ensure effects are only ever temporary and of short duration. Therefore we have given precedence to the extent of indigenous vegetation in a catchment over any potential effects from roading or housing.

The legal protection status of catchment vegetation is an important aspect of managing natural character over time, but this is a point-in-time assessment therefore protection status has not been included.

All of these potential effects would be important to consider when assessing the prioritisation for restoration of high natural character in rivers.

### 4.6.2 DATA USED FOR MAPPING

The river reaches with high natural character were identified and mapped using the following data sets:

- 2007 aerial photography;
- Biodiversity Vegetation (BIOVEG 2007) TCDC indigenous vegetation layers (Herbaceous Freshwater Vegetation, Indigenous Forest, Manuka and/or Kanuka, Broadleaved Indigenous Hardwoods, Fernland);
- Land Cover Database 2 (LCDB2) River and River Gravels layer;
- Stream locations based on the NIWA River Environment Classification dataset;
- Watershed boundaries based on the NIWA River Environment Classification dataset[3];
- 20m contours.

Rivers were assessed based on their watershed sub-catchments at the scale set by the NIWA dataset, which is a recognised national river dataset. Each watershed was firstly assessed to determine if it had greater than or equal to 90% indigenous vegetation cover within itself and in combination with any watersheds upstream. Watersheds with <90% indigenous vegetation cover but immediately downstream of watersheds with ≥ 90%indigenous vegetation cover were then individually assessed to identify a point within the watershed upstream of which there was ≥ 90% indigenous vegetation cover. Those full and partial watershed areas meeting this criterion were then highlighted to represent high natural character of the river. All

[3] This dataset excludes some coastal catchments that were smaller than the mapped scale but included first order streams. These streams however lie within the 'Coastal Environment' and will be mapped under 'Coastal Forest'.

watersheds mapped as having high natural character had to have a contiguous connection to a headwater with greater than or equal to 90% indigenous vegetation cover.

The identified areas of high natural character were mapped within the NC_RIVER dataset.

### 4.6.3 ASSOCIATED WORK

As part of the Waters of National Importance (WONI) project, research is being undertaken to set priorities for protecting rivers throughout New Zealand that will protect their full range of biodiversity values (Leathwick & Julian, 2008; Leathwick & Julian, 2008). This assessment will allow DoC and other agencies to identify management priorities to protect as full a range of biodiversity as possible. Leathwick & Julian (2009) have analysed the Waikato Region using the WONI criteria. This data will be used in the identification of Significant Natural Areas of river systems within the Waikato Region.

Guidelines have also recently been developed for the integration of natural character and landscape considerations in water allocation decisions (Boffa Miskell, 2009).

An Envirolink funded project is looking at national guidelines for water body values criteria. As part of this project, Marlborough District Council is funding the development of the natural character criteria for rivers and these criteria should be finalised in 2009 - 2010.

We therefore recommend that the criteria developed for rivers in this report be reviewed in relation to other recently developed criteria once they are available.

# 5 Policy Implications

The key focus for district policy to enable protection of the ecological natural character of ecosystems within the Thames Coromandel District includes:

- protection of identified areas of high natural character ; and
- restoration (to the extent practical and appropriate) of critical[4] ecosystems where they are degraded.

The following sections briefly discuss these actions.

## 5.1 Protection of areas of high ecological natural character

It is necessary to develop district policy to ensure that remaining areas of high ecological natural character are protected from further degradation (as required by S.6 RMA and s.8 HGMPA). District policy should target the key threats to areas of high ecological natural character (see discussion of ecosystem modification in Chapter 3).

The significant threats to **dunes and gravel beach** areas that are identified as having high ecological natural character include structures such as seawalls and stormwater outlets, encroachment by human development, weeds, and disturbance of vegetation.

The significant threats to **coastal and inland wetlands** that are identified as having high ecological natural character include encroachment of adjacent human activity (e.g. drainage, infilling, bunding, stock access), weeds and wildlife predation.

The primary threat to remaining **river and coastal forest** areas with high natural character is clearance of catchment and riparian vegetation. Weeds and wildlife predation are also a threat to coastal forest ecosystems.

A policy package of rules and incentives will be required to manage these threats to ensure no further loss of areas of high natural character within the Thames-Coromandel district. For instance, use of incentive provisions to encourage formal protection of these areas. In addition, many landowners place a high value on protection of environmental values and therefore the provision of information to landowners is likely to play a key role in protection of these areas. In many cases areas of high natural character on private land remain due to the proactive actions of past and present landowners.

The Ministry for the Environment and Department of Conservation have identified four 'National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land' (DoC & MfE, 2007). These priorities will help identify those critical areas of existing high natural character which require the most urgent attention:

[4] Critical = those ecosystems that fall within the national priorities for protection (DoC & MfE, 2007) or are identified as local priorities by council.

National Priority 1: Indigenous vegetation associated with land environments, (defined by Land Environments of New Zealand at Level IV), that have 20 percent or less remaining in indigenous cover.

National Priority 2: Indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.

National Priority 3: Indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2. Ecosystems relevant to the Thames-Coromandel district include coastal systems, such as coastal turf and coastal rock stacks.

National Priority 4: Habitats of acutely and chronically threatened indigenous species. While this is not an ecosystem-focused priority, threatened species are often linked with threatened ecosystems (≈ habitat). Habitat protection is essential for the ongoing protection of threatened species.

## 5.2 Restoration of critical ecosystems

National and territorial plans contain policies that require natural character to be restored and rehabilitated where appropriate. The RMA requires that 'particular regard' be had to restoration of degraded sites (s. 7(c), (f) and (g)), and restoration is a general focus of the management objectives of the HGMPA. The NZCPS (1994) has policy promoting the restoration of natural character as a national priority. The associated commentary states:

*"In preparing a plan, it may be appropriate to identify areas which on their own are compromised, but within a wider context of the coastal environment, contribute to the natural character. The implementation of methods to remedy or mitigate localised adverse effects could allow for restoration of the natural character as a consequence. This could involve the foreshadowing of conditions which would be attached to resource consents to achieve the restoration or rehabilitation, or the identification of finite term consents which would not be renewed."*

This project has identified that there could be further enhancement of values within areas which have been identified as having high ecological natural character (e.g. weed and pest control, ensuring fish passage, removing stock).

There is also considerable potential for restoration of high natural character value outside of the areas identified in this report, particularly ecosystems identified as National Priorities (DoC & MfE, 2007) which are currently in a degraded condition. Further investigation of restoration opportunities within the Thames-Coromandel district would be useful to realise the potential for appropriate policy and incentive provisions,

The frontal **dune** areas identified as having high ecological natural character are largely in public ownership and restoration can be addressed through existing programmes such as the Beachcare programme supported by both TCDC and EW. There are however extensive back-dune areas that are within private property. In addition, restoration of the full width frontal

dune will in many cases require dune restoration on private land because of the close proximity of existing development to the sea. It may be possible to encourage restoration of these areas also through the Beachcare programme and, where appropriate, conditions accompanying resource consent approvals.

The majority of **gravel beaches** lie within public land and the primary opportunities for restoration include removal of unnecessary seawalls and related structures, retreat of encroaching development to create back-beach space, and restoration of natural vegetation sequences including weed control. It is important that reserve management and long-term infrastructure plans (e.g. roading) recognise the need to maintain and restore these active ecosystems. Where seawalls are required in the interim, emphasis should be given to the location and design of these structures to minimise encroachment. In addition these structures should ideally be accompanied by long-term strategies that will eventually eliminate the need for the seawall. When private land is developed it is important that sufficient width of reserve is provided where practical to encompass the full beach system including active and relict storm ridges.

There is potential to restore large areas of **coastal wetlands** that have been historically lost or degraded. Given the significant values of these ecosystems, particularly estuarine wetlands, this is recommended as a high restoration priority. The vast majority of this potential is within private land, therefore any policy needs to include rules to prevent permanent loss of this potential (e.g. through infilling) and incentives to encourage restoration. Restoration should where practicable include allowance for wetland expansion in response to projected sea level rise. Relevant landowners should also be encouraged to adopt appropriate riparian management practices around existing wetlands. There is also some potential for restoration of **inland wetlands**. This includes weed control and appropriate fencing of existing wetlands as well as restoration of hydrological regimes and natural vegetation where wetlands have been degraded or lost. Once again this largely involves private land and therefore appropriate incentive provisions are likely to be required.

There is considerable potential for restoration of **coastal forest** with the priority being stock-fencing and appropriate weed and animal pest control within existing remnants. In the longer term restoration activities could also include linking neighbouring remnants to create wildlife corridors and larger forest areas.

Restoration priorities for **river systems** should focus on existing catchments with areas of high ecological natural character. It is now recognised that restoration effort needs to be coordinated at the watershed scale to maximise environmental benefits (Palmer, 2009). It is beneficial to concentrate restoration efforts on river systems that already have forested headwaters. These forested headwaters will influence the downstream habitat characteristic such as temperature, nutrient and sediment levels that alter water quality (Harding et. al., 2006). River catchments assessed as having high ecological natural character but that have an identified fish barrier (e.g. Kelly & Collier, 2006, and farm and forestry stream surveys) should be prioritised for restoration of fish passage. Also, small headwater areas and riparian margins without indigenous vegetation that are within identified areas of high natural character should be prioritised for restoration.

Where continuing land use activities preclude native reforestation of river catchments, the focus should be on riparian vegetation restoration. Parkyn et. al (2003) found that riparian buffer widths appear to be closely related to stream health. The permanency of the riparian

buffer is important. Quinn et al. (2004) concluded that logging disturbance can degrade stream invertebrate community structure and biodiversity values severely unless wide and continuous buffers of undisturbed riparian forest are retained. They also found that continuous buffers provided more protection than patch buffers.

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# APPENDIX A: National Legislation

## Resource Management Act 1991

### s.6 Matters of national importance

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:

(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:

Other matters of national importance include:

(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development.

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

### s.7 Other matters

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to:

(a) Kaitiakitanga;

(b) the efficient use and development of natural and physical resources;

(c) the maintenance and enhancement of amenity values;

(d) intrinsic values of ecosystems;

(e) recognition and protection of the heritage values of sites, buildings, places, or areas;

(f) maintenance and enhancement of the quality of the environment;

(g) any finite characteristics of natural and physical resources; and

(h) the protection of the habitat of trout and salmon.

## Hauraki Marine Park Act 2000

The Hauraki Gulf Marine Park Act establishes overall objectives for the Gulf, its islands and catchments, aiming to achieve integrated management across land and sea. This ensures the effects of urban and rural land use are given proper attention and the life supporting capacity of the Gulf is protected (ARC, 2009).

The Act provides integrated management of the Gulf across 21 other statutes by requiring that all persons carrying out functions for the Gulf under those Acts must have particular regard to sections 7 and 8 of the HGMPA. There are also more specific requirements relating to sections

7 and 8 in terms of the Resource Management Act, Conservation Act and Fisheries Act (ARC, 2009).

Section 7 of the HGMPA recognises the national significance of the Hauraki Gulf including:

- The interrelationship between the Hauraki Gulf, its islands, and catchments and the ability of that interrelationship to sustain the life-supporting capacity of the environment of the Hauraki Gulf and its islands are matters of national significance.
- The life-supporting capacity of the environment of the Gulf and its islands includes the capacity:
  - to provide for the historic, traditional, cultural, and spiritual relationship of the tangata whenua of the Gulf with the Gulf and its islands and; the social, economic, recreational, and cultural well-being of people and communities:
  - to use the resources of the Gulf by the people and communities of the Gulf and New Zealand for economic activities and recreation
  - to maintain the soil, air, water, and ecosystems of the Gulf.

Section 8 of the HGMPA establishes that the objectives of the management of the Gulf, is islands and catchments are:

**a.** the **protection** and, where appropriate, the **enhancement** of the life-supporting capacity of the environment of the Hauraki Gulf, its islands, and catchments;

b. the **protection** and, where **appropriate**, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments;

c. the **protection** and, where appropriate, the **enhancement** of those natural, historic, and physical resources (including kaimoana) of the Hauraki Gulf, its islands, and catchments with which tangata whenua have an historic, traditional, cultural, and spiritual relationship;

d. the **protection** of the cultural and historic associations of people and communities in and around the Hauraki Gulf with its natural, historic, and physical resources;

e. the **maintenance** and, where appropriate, the **enhancement** of the contribution of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments to the social and economic well-being of the people and communities of the Hauraki Gulf and New Zealand;

f. the **maintenance** and, where appropriate, the **enhancement** of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments, which contribute to the recreation and enjoyment of the Hauraki Gulf for the people and communities of the Hauraki Gulf and New Zealand.

## NZ Coastal Policy Statement 1994

Chapter 1 - National Priorities For The Preservation Of The Natural Character Of The Coastal Environment Including Protection From Inappropriate Subdivision, Use And Development

**Policy 1.1.1**

It is a national priority to preserve the natural character of the coastal environment by:

(a) encouraging appropriate subdivision, use or development in areas where the

natural character has already been compromised and avoiding sprawling or sporadic subdivision, use or development in the coastal environment;

(b) taking into account the potential effects of subdivision, use, or development on the values relating to the natural character of the coastal environment, both within and outside the immediate location; and

(c) avoiding cumulative adverse effects of subdivision, use and development in the coastal environment.

**Policy 1.1.2**

It is a national priority for the preservation of the natural character of the coastal environment to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna in that environment by:

(a) avoiding any actual or potential adverse effects of activities on the following areas or habitats:

(i) areas and habitats important to the continued survival of any indigenous species; and

(ii) areas containing nationally vulnerable species or nationally outstanding examples of indigenous community types;

(b) avoiding or remedying any actual or potential adverse effects of activities on the following areas:

(i) outstanding or rare indigenous community types within an ecological region or ecological district;

(ii) habitat important to regionally endangered or nationally rare species and ecological corridors connecting such areas; and

(iii) areas important to migratory species, and to vulnerable stages of common indigenous species, in particular wetlands and estuaries;

(c) protecting ecosystems which are unique to the coastal environment and vulnerable to modification including estuaries, coastal wetlands, mangroves and dunes and their margins; and

(d) recognising that any other areas of predominantly indigenous vegetation or habitats of significant indigenous fauna should be disturbed only to the extent reasonably necessary to carry out approved activities.

**Policy 1.1.3**

It is a national priority to protect the following features, which in themselves or in combination, are essential or important elements of the natural character of the coastal environment:

(a) landscapes, seascapes and landforms, including:

(i) significant representative examples of each landform which provide the

variety in each region;

(ii) visually or scientifically significant geological features; and

(iii) the collective characteristics which give the coastal environment its natural character including wild and scenic areas;

(b) characteristics of special spiritual, historical or cultural significance to Maori identified in accordance with tikanga Maori; and

(c) significant places or areas of historic or cultural significance.

**Policy 1.1.4**

It is a national priority for the preservation of natural character of the coastal environment to protect the integrity, functioning, and resilience of the coastal environment in terms of:

(a) the dynamic processes and features arising from the natural movement of sediments, water and air;

(b) natural movement of biota;

(c) natural substrate composition;

(d) natural water and air quality;

(e) natural bio diversity, productivity and biotic patterns; and

(f) intrinsic values of ecosystems.

**Policy 1.1.5**

It is a national priority to restore and rehabilitate the natural character of the coastal environment where appropriate.

## Proposed New Zealand Coastal Policy Statement 2008

### Objective 3

The natural character of the coastal environment is **preserved**, through the **protection** or **restoration** of natural landscapes, features, processes and indigenous biological diversity.

Policy 30 Integrity and functioning

To **preserve** the natural character of the coastal environment, it is a national priority to protect its integrity and functioning by **maintaining**:

(a) the resilience and productivity of indigenous ecosystems;

(b) natural landscape and landform;

(c) the dynamic processes and features that arise from the natural movement of sediments, water and air;

(d) natural biotic patterns and movements;

(e) water and air quality; and

(f) natural substrate composition.

The implementation of Objective 3 requires the protection of the integrity and functioning of natural character by maintaining those values that contribute to natural character. To give effect to this approach these values need to be further identified and it is appropriate for policies to provide guidance on the components that collectively contribute to the integrity

and functioning of natural character.

In recognition of the increasing subdivision, use, and development pressures that are affecting natural character, it is also appropriate to reinforce the national importance of the protection of the integrity and functioning of natural character as derived from s6(a) and s58(a) of the RMA. This management approach also protects the collective contribution that these components make to natural character.

Policy 31 Indigenous biological diversity

To preserve the natural character of the coastal environment, it is a national priority to **protect** indigenous biological diversity in that environment, including by:

(a) **avoiding** adverse effects of activities on:

(i) areas containing indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;

(ii) areas containing taxa that are listed as threatened by the International Union for Conservation of Nature and Natural Resources;

(iii) indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare;

(iv) habitats of populations of indigenous species that are at the limit of their natural range, or are naturally rare; and

(v) areas containing regionally or nationally significant examples of indigenous community types; and

(b) **avoiding** significant adverse effects, and otherwise **avoiding, remedying or mitigating** adverse effects of activities on:

(vi) areas of predominantly indigenous vegetation in the coastal environment;

(vii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;

(viii) indigenous ecosystems and habitats that are unique to the coastal environment and particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, rocky reef systems, eelgrass and saltmarsh;

(ix) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes;

(x) habitats, including areas and routes, important to migratory species; and

(xi) ecological corridors and buffer zones that are important for linking or maintaining areas identified under this policy.

Policy 32 Outstanding natural features and landscapes

To preserve the natural character of the coastal environment, it is a national priority to **protect** outstanding natural features and landscapes, by ensuring that any adverse effects of subdivision, use, and development on them are no more than minor. Outstanding natural features and landscapes should be identified with regard to:

(a) the natural science factors, including geological, topographical, ecological and dynamic components; …

(d) transient values, including occasional presence of wildlife or values at certain

times of the day or year;…

Policy 34 Natural areas and features

In preserving the natural character of the coastal environment, it is a national priority to **protect** natural areas and features that are:

(a) of historic importance;

(b) of special value to tangata whenua;

(d) of special scientific importance; and

(d) wild or scenic.

Policy 35 Restoration of natural character

It is a national priority to **restore** the natural character of the coastal environment, in appropriate circumstances, including by:

(a) restoring indigenous habitats and ecosystems where these have been significantly adversely affected and life-supporting capacity is compromised;

(b) creating or enhancing habitat for threatened indigenous species;

(c) encouraging regeneration of indigenous species, and using local genetic stock, where practicable, when restoring habitat;

(d) reducing or eliminating discharges of contaminants that are causing significant adverse effects, particularly cumulative effects;

(e) requiring, where practicable, restoration conditions on resource consents for the continuation of activities that have compromised natural character;

(f) restoring dunes and other natural coastal features or processes;

(g) protecting and restoring riparian margins; and

(h) removing redundant structures and materials that lack heritage or amenity value.

The effective implementation of Objective 3 requires that restoration of the coastal environment is undertaken. Restoration is appropriate to address impacts from existing (and past) activities and restoration will assist in managing the effects on natural character of proposed activities. However complete restoration of the natural character of the coastal environment is not practicable. It is therefore appropriate to provide policy guidance on the particular circumstances in which restoration efforts are a priority. This includes circumstances where:

- Indigenous habitats, dunes, natural features, or water quality have been significantly affected
- Habitat for threatened indigenous species and riparian margins could be created or restored;
- Regeneration can be promoted using local genetic stock
- Structures have become redundant; and
- Resource consent applications for existing activities provide an opportunity to consider restoration through consent conditions.

The use of local genetic stock when undertaking restoration of indigenous vegetation is important for the protection and restoration of indigenous biological diversity.

Policy 36 Assessment and protection of natural character

Local authorities shall assess the natural character of the coastal environment of the region or district and provide for its preservation, including by provisions in policy statements and plans that address the national priorities in Policies 30 to 35.

It is considered that Policy 36 (in conjunction with the other natural character policies of this chapter) is the most appropriate means of achieving Objective 3 because the policy is:

- Effective in requiring that natural character must be assessed;
- Effective in enabling proactive planning for the protection of natural character;
- Effective in enabling a region or district to build on the national priorities;
- Efficient as it generates greater benefits than costs.

# APPENDIX B: Regional Legislation

## Waikato Regional Policy Statement

### 3 Significant Resource Management Issues, Objectives, Policies and Methods

**3.4 Water**

3.4.8 Wetlands

Issue:

Wetlands are an important resource within the Region. Human activities in and around wetlands have the potential to further adversely affect their natural character.

Objective:

An increase in the quantity and quality of the Region's wetlands.

Policy One: Significant Wetlands

Ensure that the natural character of significant wetlands are protected.

**3.5 Coast**

3.5.4 Natural Character and Coastal Processes

Issue:

Inappropriate subdivision, use and development within the coastal environment results in loss of natural character.

Objective:

Preservation of the natural character of the coastal environment[1], including the physical and ecological processes which ensure its dynamic stability.

Policy One: Protection of Significant Areas[2]

Through a consultative process, identify and protect significant areas, features, processes, and the range and diversity of species and their habitats in the coastal environment, including:

- natural character of the coastal environment
- outstanding landforms and landscapes
- significant indigenous vegetation and significant habitats of indigenous fauna
- areas of importance to tangata whenua.

Policy Two: Recognition of Natural Processes

Ensure that the subdivision, use and/or development of the coastal environment are undertaken in a way, or at a rate which recognises and provides for the unique processes operating in this environment.

## Waikato Regional Plan

3 Water Module

**3.1 Water Resources**

3.1.2 Objective

The management of water bodies in a way which ensures:

l. the natural character of the coastal environment, wetlands and lakes and rivers and their margins (including caves), is preserved and protected from inappropriate use and development

The Plan's jurisdiction in the 'coastal environment' encompasses land and water on the landward side of mean high water spring. Although the inland boundary of the 'coastal environment' will vary, it is generally understood to be where the coast is no longer a significant element. The Regional Coastal Plan has jurisdiction of the 'coastal environment' below mean high water spring.

## Waikato Regional Coastal Plan

3 Natural Character, Habitat and Coastal Processes

**3.1 Preservation of Natural Character**

Objective:

Preservation of the natural character of the coastal environment by:

Protecting it from inappropriate subdivision, use and development; and

Restoring it where appropriate.

**3.2 Significant Vegetation and Habitat**

Objective:

Areas of significant indigenous vegetation and significant habitat of indigenous fauna protected.

Principal Reasons for Adopting:

Human use of the CMA and coastal environment has tended to create cumulative changes which have adversely changed vegetation, habitats and landforms. Policies 1.1.2 and 1.1.3 of the NZCPS set out aspects which contribute to the preservation of the natural character of the coastal environment. Sensitive management of these features is required to ensure natural character is preserved.

**3.4 Protection of Coastal Processes**

Objective:

The integrity, functioning and resilience of coastal processes protected from the adverse effects of use and development.

Principal Reasons for Adopting:

The coastal environment is dynamic and processes such as dune formation, longshore drift of gravels, shells and sands, and wind and wave erosion influence the shape as well as the appearance of the coast. These physical processes also affect the natural movement of biota. Any proposal for use or development in the CMA must, therefore, take account of the effects of coastal processes and the dynamic nature of the coast.

# APPENDIX C: District Legislation

## Thames-Coromandel District Plan

### Section 2 - Significant Resource Management Issues

**212 Landscape and Natural Character**

212.3 Objectives

.2 To recognise, protect or, where appropriate, enhance the natural character of the District.

212.4 Policies

.1 To ensure the outstanding natural features and landscapes of the District are protected from inappropriate subdivision, use and development, particularly where significant landscape change may result. (The key landscape elements for the District identified on Maps and in the Background to the Issue comprise the outstanding natural features and landscapes of the District).

.2 To protect outstanding landscape values within the coastal environment and to encourage and provide for appropriate development, which will remedy or mitigate the adverse effects of past land uses and enhance the natural character and amenity values of the coastal environment.

.3 To promote the restoration and enhancement of existing degraded landscapes and ecosystems.

# APPENDIX D: Policy definitions

## RMA

**Intrinsic values:** In relation to ecosystems, those aspects of ecosystems and their constituent parts which have value in their own right, including:

> Their biological and genetic diversity
> The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience.

**River:** means a continually or intermittently flowing body of fresh water, and includes a stream; but does not include any artificial watercourse; and for the purposes of Part X only means a river or stream whose bed has an average width of 3 metres or more:

**Wetland:** Includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.

## Waikato Regional Policy Statement

**Biodiversity** means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

**Coastal environment:** An environment in which the coast is a significant element or part, and includes the coastal marine area.

**Ecological sequence** means a series of two or more connected ecosystem or vegetation types that retain natural transition zones along an environmental gradient. Ecological sequences that are not common in the Waikato Region include, but are not restricted to, native dune vegetation through to coastal scrub or forest, lake margins or geothermal systems to native forest, coastal to alpine vegetation. Such sequences should be largely intact (e.g. perhaps bisected by roads but not by large tracts of nonnative land cover), such that they can be traversed by the majority of indigenous species that are reliant on such sequences for the completion of part or all of their lifecycles (either by deliberate movement or dispersal of propagules such as seed or pollen). An exceptional, representative sequence will be one of the best examples of its type, taking into account its intactness, composition, and ecological processes.

**Ecological sustainability** means a site's ability to continue to exist as an area of indigenous vegetation or habitat for indigenous fauna when taking into account its size, shape, buffering from external effects, connection to other natural areas, and likely threats. It may change naturally into a different habitat but will remain essentially as indigenous species and of natural character.

**Ecosystem** means a dynamic complex of plant, animal and micro-organism communities and their non-living environment, interacting as a functional unit.

**Natural character** means the qualities of the coastal environment that together give the coast of New Zealand recognisable character. These qualities may be ecological, physical, spiritual, cultural or aesthetic in nature, whether modified or managed or not.

**Natural and physical resources** includes land, water, air, soil, minerals, and energy, all forms of plants and animals (whether native to New Zealand or introduced), and all structures.

**Preservation** in relation to a resource, means the maintenance, so far as is practicable, of its intrinsic values.

**Protection,** in relation to a resource means its maintenance so far as is practicable, in its current state; but includes:

a. its restoration to a former state
b. its augmentation, enhancement or expansion.

**Riparian margin** means a strip of land, usually of varying width, adjacent to a waterway and which contributes, or may contribute, to the maintenance and enhancement of the natural functioning, quality and character of the waterway and its margins.

**River*** means a continually or intermittently flowing body of fresh water, and includes a stream; but does not include any artificial watercourse.

## Waikato Regional Coastal Plan

**Natural Character:** The natural qualities of the coastal environment of New Zealand. Such qualities may include natural elements of ecological, physical, spiritual, cultural or aesthetic value. Both modified and managed environs have a degree of natural character by virtue of the presence of natural elements.

## Thames-Coromandel District Plan

**Natural Character** has the same meaning as in Section 6(a) RMA. This definition is evolving and linked to decisions of the Environment Court.

**Wetland** is a collective term for permanently or temporarily wet areas, shallow water and land water margins. Wetlands may be fresh, brackish or saline, and are characterised in their natural state by plants and animals that are adapted to living in wet conditions.

**Note** TCDC has no jurisdiction of wetlands below Mean High Water Springs (MHWS). Environment Waikato has controls over the draining of wetlands, whether they are below MHWS or not.