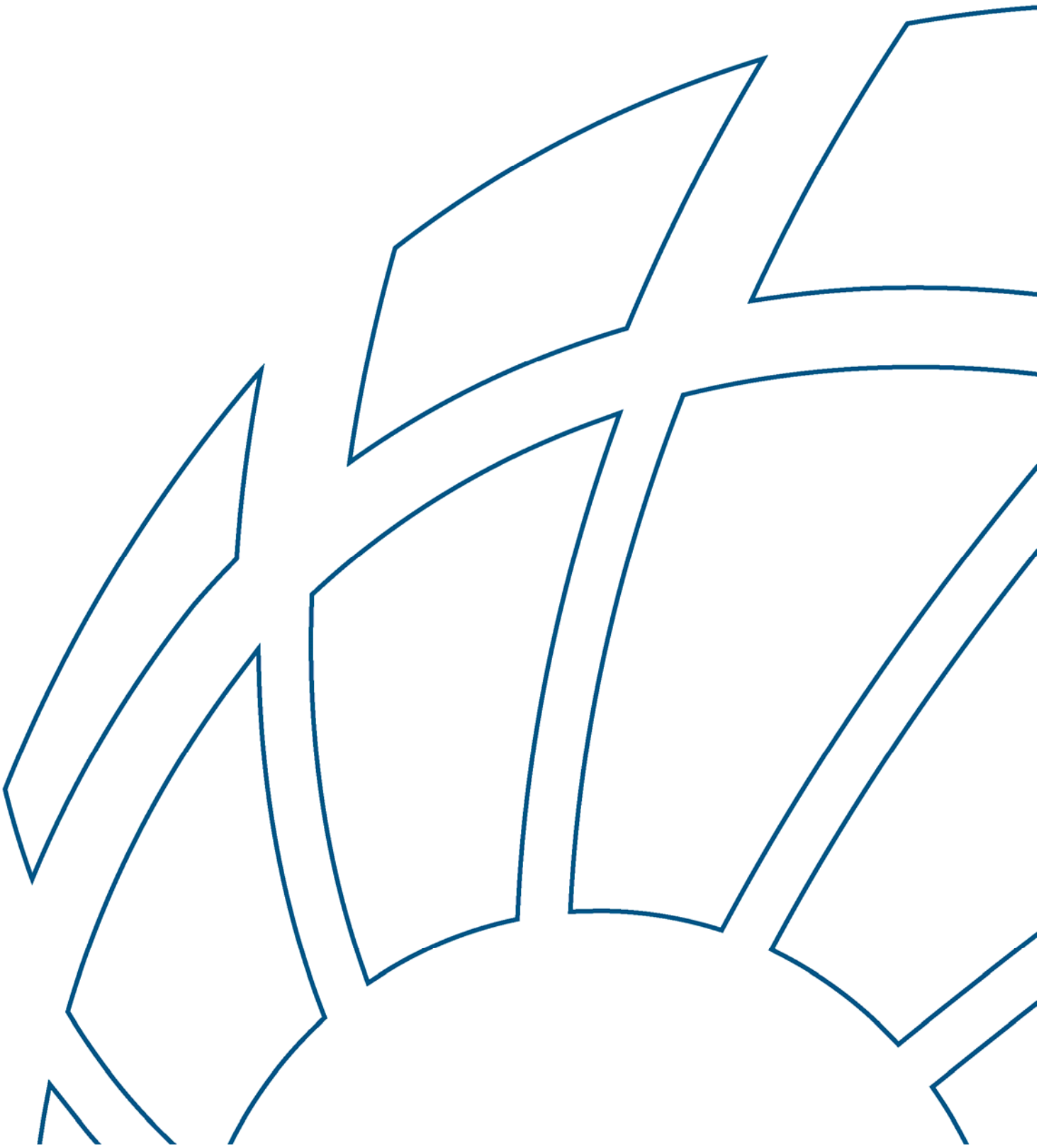
BMT WBM

Kingscliff Coastal Risk Management Study



Kingscliff Coastal Risk Management Study

Prepared for:	Tweed Shire Council
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

Offices

Brisbane
Denver
London
Mackay
Melbourne
Newcastle
Perth
Sydney
Vancouver

Document Control Sheet

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane Qld 4000
Australia
PO Box 203, Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

Document:	R.B21093.001.01.docx
Title:	Kingscliff Coastal Risk Management Study
Project Manager:	Philip Haines
Author:	Philip Haines , Joris Jörissen, Sophie Hipkin
Client:	Tweed Shire Council
Client Contact:	Jane Lofthouse
Client Reference:	

Synopsis: **This report documents the key coastal processes affecting the coastal zone of Kingscliff and provides a summary of options previously investigated for management of this coastal zone. It also provides the results of a multi-criteria assessment on short-listed options for the Kingscliff foreshore.**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	28/1/15	PEH		JJ	
1	3/3/15	PEH		JJ	
2	7/7/15	PEH		JJ	

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
Tweed Shire Council	PDF	PDF	PDF								
BMT WBM File	PDF	PDF	PDF								
BMT WBM Library	PDF	PDF	PDF								

Contents

List of Figures

List of Tables

1 Introduction

1.1 Background

The Kingscliff foreshore has a history of severe coastal erosion events and active shoreline management to protect and preserve land and assets affected by coastal erosion.

In 1999, Tweed Shire Council commenced development of a coastline management plan in accordance with the NSW Government's Coastline Management Manual (1990). The Tweed Coastline Hazard Definition Study was completed and adopted by Council in 2001 (WBM, 2001). This study identified the individual coastline hazards including short and long term erosion, shoreline recession oceanic inundation and coastal entrance instability. The Study defined the Immediate, 2050 and 2100 coastal erosion hazard areas within the Shire and identified various public and community assets at Kingscliff that were at risk from coastal erosion hazards. These assets included the Cudgen Headland Surf Life Saving Club (SLSC), Kingscliff Amenities Hall and Kingscliff Beach Holiday Park.

A number of studies were then undertaken to identify an appropriate risk management approach, and a Tweed Shire Coastline Management Plan developed (Umwelt, 2005b). The Tweed Shire Coastline Management Plan describes a protection strategy in the form of a 500m long rock seawall combined with beach nourishment as the primary management action for Kingscliff Beach. The Plan notes that, based on the costs calculated at the time, the capital cost of the seawall was comparable to the cost of planned retreat, but community feedback provided through public workshops and direct correspondence demonstrated a general preference for the protection option. This was caveated by the community on maintaining beach amenity as part of the protection option.

In December 2006, the Plan was amended during development of the Kingscliff Beach Foreshore Protection Works Environmental Impact Statement (WorleyParsons, 2008), which recommended the implementation of a modified set of works to achieve the adopted management strategy. The recommended protection works included:

- A vertical buried seawall of limited length protecting the Cudgen Headland SLSC only;
- Initial and ongoing nourishment generally in accordance with the Tweed Shire Coastline Management Plan; and
- Creation of a linear beach front reserve about 15m wide from the back dune to the proposed boundary of the redeveloped Kingscliff Beach Holiday Park.

Council commenced implementing the amended plan and constructed a buried vertically piled concrete seawall in front of the Cudgen Headland SLSC (completed August 2010).

During the period between 2009 and 2012, a number of severe erosion events were experienced at Kingscliff Beach, which resulted in a significant loss of foreshore land and impacted on public assets and infrastructure. During this period, Council assets were destroyed (Faulks Park access road and car park), relocated (cabins at Kingscliff Beach Holiday Park) or were at high risk of being affected (Kingscliff Beach Holiday Park amenities block). In response to the significant erosion, Council undertook a series of emergency foreshore protection works. This included constructing a low rock revetment along Faulks Park, constructing a 4m high geotextile sandbag wall along the Kingscliff

Beach Holiday Park and beach nourishment at the southern end of Kingscliff Beach using sand from Cudgen Creek.

Following the protracted erosion that commenced in 2009, the NSW Coastal Panel made a number of recommendations to the Minister for the Environment (NSW Government, 2011) including a revised Coastal Zone Management Plan be prepared for Kingscliff/Dreamtime Beach. The revised plan is to incorporate a short-term management strategy for the remaining unprotected sections of Kingscliff Beach; a plan for ongoing monitoring of beach erosion; an economic assessment of the relative costs and benefits of short and long-term options; and analysis and assessment of the technically feasible management options for the site (including groynes).

Council has been advancing the CZMP process and taking necessary steps that precede the CZMP update. The steps involved in the process of preparing the CZMP, including progress to date, are:

Completed steps:

- Development of feasible management options including those considered in the Tweed Shire Coastline Management Plan (Umwelt, 2005a);
- Investigations into seawall options and their characteristics (WRL, 2012);
- Investigations into a groyne field option (WRL, 2013);
- Preparation of a Draft EIS for sand extraction from the Tweed River and delivery by pipeline to Kingscliff Beach for the purposes of providing a source of sand for beach nourishment (KBR, 2012);
- Updated coastal hazards assessment adopted by Council in February 2014 (BMT WBM, 2013);
- Preparation of a Cost Benefit Assessment of seven management options (Griffith University, 2013); and
- Adoption by Council (21 November 2013) of proceeding with the two preferred options of a) terminal protection through seawall, sand nourishment and land use planning and b) planned retreat for management of coastal hazard risk at Kingscliff. The option of 'do nothing' is required to be considered as the 'business as usual' case for assessment purposes.

Current steps:

- Development of the Kingscliff Beach Foreshore – Coastal Risk Management Study
- Development of the Kingscliff - Dreamtime Beach Coastal Zone Management Plan.

1.2 Purpose of Report

This report has been prepared to fulfil the requirements of the Kingscliff Beach Foreshore Coastal Risk Management Study (CRMS).

The purpose of this document is to provide a summary of the key coastal processes affecting the coastal zone of Kingscliff and identify and discuss all previous hazard management options considered for Kingscliff. This report describes the key aspects of each management option and provides a shortlist of potential management options, which are then assessed via a multi-criteria

assessment. A final recommendation for a preferred risk management strategy is provided for subsequent adoption in the Kingscliff – Dreamtime Beach Coastal Zone Management Plan.

1.3 Description of Study Area

Kingscliff Beach is located immediately north of Cudgen Headland and the Cudgen Creek training walls, forming the southern part of a 7 km long embayment with a continuous sandy beach which encompasses Kingscliff Beach and Dreamtime Beach.

The study area of the Foreshore Coastal Risk Management Study covers the coastal zone along Kingscliff Beach but focuses on the shoreline area between the Cudgen Headland SLSC and the Kingscliff Beach Bowls Club.

A number of shoreline protection works have been established within the study area, as shown on Figure 1-1, including:

- Two rock training walls at the Cudgen Creek river entrance (built in 1967) to alleviate flooding issues within Cudgen Lake and Cudgen Creek and to prevent meandering of the creek entrance along Kingscliff Beach;
- A rock seawall in front of the Kingscliff Bowls Club (initially built in 1967 and upgraded in 1995) to protect the club against erosion threats;
- A vertically piled concrete seawall in front of the Cudgen Headland SLSC (completed in August 2010);
- A low rock seawall along Faulks Park (completed in early 2011 as emergency protection works);
- A geotextile sand container wall to the immediate north and south of the piled concrete seawall (completed in October 2011 as emergency protection works); and
- A rock seawall along the Holiday Park, located immediately north of the geotextile sand container wall up to the Kingscliff Beach Bowls Club (built in December 2011 as emergency protection works).

LEGEND

Existing Foreshore Protection Works

Title:
Existing Foreshore Protection Works

Figure: 1-1

Rev: A

N

0 80 160m

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B21093_I_PEH Kingscliff\DRG\CCA_001_150303_Existing_Foreshore_Works.wor

2 Coastal Processes and Erosion Hazards

2.1 Introduction

An understanding of the coastal processes affecting the shoreline at Kingscliff is essential in making an informed decision on the most appropriate future management strategy. In general terms, the behaviour of the beaches within the Tweed Shire is characterised by:

- Wave-induced longshore transport of sand, with a strong net transport to the north;
- Onshore/offshore movements of sand associated with relatively short term storm-related erosion and subsequent rebuilding of the beach and foredune;
- Wind-induced transport of sand from the beach to the back-beach dune system; and
- At some locations, effects of creek entrance movements and/or movements of beach sand into and from lower tidal estuary areas under the influence of tidal and flood flows.

Any or all of these processes may be occurring at any time, depending on prevailing wave, wind and tide conditions. The resultant beach behaviour is one of constant change with substantial movements of the beach and foredune in the short to medium term (days/weeks/years) but only gradual progressive movements of the mean shoreline alignment in the longer term (decades/centuries).

A detailed assessment of the key coastal processes at Kingscliff, including the geological context and their influence on coastal hazards, is provided in the Tweed Shire Coastal Hazards Assessment report (BMT WBM 2013a).

2.2 Coastal Processes

Regionally, the Kingscliff to Dreamtime Beach embayment is part of a long coastal unit that experiences a continuous alongshore transport of sand extending from around the Clarence River in the south to Moreton Bay in the north. This coastal unit has a series of major controlling headlands past which the sand is moved by the prevailing waves.

Cudgen Headland has significant effect on sand transport and shoreline responses at Kingscliff, particularly in controlling the nature and rates of headland bypassing supply of sand into the embayment. The shoreline processes along the Kingscliff / Dreamtime Beach embayment are thus uniquely dependent on how the headland controls interact with the prevailing deep water wave climate.

The shoreline behaviour is thus sensitive to variability of the deep water wave conditions at both short (days to weeks) and longer term (months; years; decades) time-scales. Of particular relevance to Kingscliff, is the ‘sand slug’ effect around the headland in which the southern end of the beach is supplied through periodic sand pulses. These pulses manifest themselves as sand waves that eventually attach to the beach. Often a topographically controlled rip migrates in advance of these sand waves, which can cause localised beach erosion (Short, 1999).

Sand from South Kingscliff Beach will only travel around the headland when significant quantities of sand accumulate in a deposition area around the southern Cudgen Creek training wall and favourable wave conditions occur.

The deep water wave climate of the northern NSW coast comprises a highly variable wind wave climate superimposed on a persistent long period moderate to high energy south easterly swell. Two dominant types of storm wave generation, east coast low and tropical cyclone, determine the prevailing extreme wave climate.

Annual and medium term (decadal) variability in the wave climate is observed in the wave climate, at least in part associated with the El Niño Southern Oscillation (ENSO). Variability in wave height and direction that persists for years to decades may result in alternate cycles of erosion and accretion and potential rotation of the shoreline. This is related to variability in the alongshore sediment movement and the direction of intense storm waves. The data suggests an extended La Niña pattern prior to 1977 followed by predominantly El Niño through to about 2009. There have been several La Niña years both within that time and strongly so during 2010-12.

El Nino La Nina

Figure 2-1 Conceptual Response to ENSO Wave Climate at Kingscliff (From BMT WBM, 2013a)

Cyclone erosion events in the region have been recorded in surveys at the Gold Coast and are also indicated in the photogrammetry data for Tweed Shire, as analysed in (BMT WBM 2013a). Storm bite volumes up to 250m^3/m have been identified but are more typically around 150-200m^3/m. The larger volume losses may occur during multiple storm events or where there is significant alongshore net sand loss in addition to the removal of sand to nearshore (BMT WBM 2013a).

Superimposed on these short to medium term fluctuations, the shoreline is subject to ongoing shoreline recession. Recent research on a regional scale and the 2013 coastal hazard assessment show that there is a gradient in the net longshore sand transport rate from about 150,000-200,000m^3/yr at the Clarence River to about 550,000m^3/yr at the Gold Coast. Additionally, recent research shows that there is a net shoreward sand supply into the shore-face from the inner continental shelf of about 0.5-1.0m^3/m/yr, partially offsetting shoreline recession that would otherwise result from the alongshore transport gradient.

The long term shoreline recession rate within the Kingscliff/Dreamtime Beach embayment has been assessed in the coastal hazard assessment at about 0.15m/year at the southern end (Kingscliff) reducing to about 0.05m/year towards the northern end, with an uncertainty provision of about ±20% incorporated in the recession hazard distances.

2.3 Coastal Hazards

The Kingscliff coastline is affected by a range of coastal hazards that will become potentially more acute or extensive in the future with climate change induced sea level rise. The key coastal hazards include:

- The erosion hazard, including components of immediate storm erosion, shoreline variability and future shoreline recession;
- Coastal inundation associated with wave run-up and overtopping of the dune barrier; and
- Dune zones of reduced foundation capacity.

These hazards have been assessed and mapped as part of the Tweed Shire Coastal Hazards Study (BMT WBM, 2013a). The definition of coastal hazards inherently involves uncertainty relating to not only how prevailing oceanic conditions will manifest in the future and how reliably their effects on the shoreline can be determined, but also the considerable unknown factors involved and limitations in the available measured data.

As such, the approach adopted was to provide a band of feasible erosion extents, defined on hazard maps by lines representing the 'best estimate', 'minimum' and 'maximum' likely limits for the immediate, 2050 and 2100 planning periods. The 'maximum' and 'minimum' extents of the erosion hazard represent the range within which the erosion hazard is most likely to apply, as allowance for uncertainty inherent in the data interpretation and modelling, as well as other factors that are difficult to quantify reliably.

2.3.1 Coastal Erosion Hazards

During severe storms or a series of storms in succession, increased wave heights and elevated water levels results in wave attack of the beach berm and foredune region. Storm events generate high rates of transport of sand both:

- Offshore, with sand eroded from the beach face and transported to the nearshore seabed to form a sand bar roughly parallel to the shoreline; and
- Alongshore (i.e., along the beach) either upcoast or downcoast depending on wave direction, with gradients in the transport rates leading to erosion or accretion.

The result is erosion on the beach face and dune that may pose a hazard to back beach land and assets. The short term storm related cross shore sand transport and longshore drift occur simultaneously, the latter commonly leading to a significant shoreline erosion component immediately downdrift of headlands in cases where the sand supply into the beach compartment is less than the transport away to the north. Their effects are additive, although the beach itself (above mean sea level) will be observed to erode predominantly during storm events.

The beaches along the Kingscliff embayment experience considerable fluctuation associated with storm erosion and variability due to changes in the prevailing wave conditions, as evidenced by the significant erosion experienced at Kingscliff in recent years (Refer to Figure 2-2). As well, there is a general regional trend of long term shoreline recession on which short to medium term variability is superimposed.

Thus, the 'immediate' erosion hazard extent represents the zone that could be affected by erosion in the immediate near future (e.g. over the next few years) in the event of one or more major erosion events, while the 2050 and 2100 extents incorporate a landward shift in the immediate hazard line in response to the long-term shoreline recession, including the effects of sea level rise.

Figure 2-3 presents the coastal erosion hazard extents mapping for Kingscliff. It should be noted that these erosion hazard lines are based on the Kingscliff seawalls not being in place and that there is a zone of reduced foundation capacity that extends landward of these erosion hazard lines.

Amongst other factors, the width of the zone of reduced foundation capacity behind the hazard lines is dependent upon the angle of repose of the dune sand and the height of the dune above mean sea level and would typically be about 8 to 12m along Kingscliff Beach.

2.3.2 Coastal Inundation Hazards

Where the crest height of a cliff, shoreline structure or dune is less than the wave run-up level, waves will overtop the shoreline and may cause inundation of the land behind. Consequently, this may present a hazard if the rate of overtopping can cause a significant impact to people or assets behind it.

BMT WBM (2013a) assessed the potential for wave runup and dune overtopping at Kingscliff Beach. The assessment was undertaken for high tide conditions, considering a 100 year ARI still water level and 100 year ARI incident significant wave height. Because of the variability of wave heights, the wave overtopping assessment was based on the 2% run-up levels ($R_{u2\%}$).

The design run-up level for natural beaches/dunes was found to be varying from approximately 4.1mAHD at the Surf Club to approximately 4.5mAHD, indicating that:

- No potential for overtopping north of the Bowls Club where dune heights are in excess of 6mAHD;
- The dune crest levels along the Kingscliff Holiday Park are typically at 4.0 to 4.5mAHD and are approximately at the design run-up limit, with some minor overtopping feasible in the lower parts;
- Generally sufficient dune heights along the Surf Club area to prevent overtopping; and
- A clear potential for overtopping adjacent to Faulks Park where dune levels are generally at 3.5mAHD.

It is likely that Kingscliff will experience enhanced wave run-up and overtopping in the future, as sea level rises.

It is important to note that the design wave run-up levels were based on the assumption that the shoreline comprises a natural beach/dune system. Where waves impact on shoreline protection structures (in particular vertical or steeply sloping surface such as seawalls), substantially higher wave run-up levels can be experienced. Therefore, wave overtopping is typically a key consideration in the design of such protection structures.

Figure 2-2 Kingscliff Foreshore Recent History

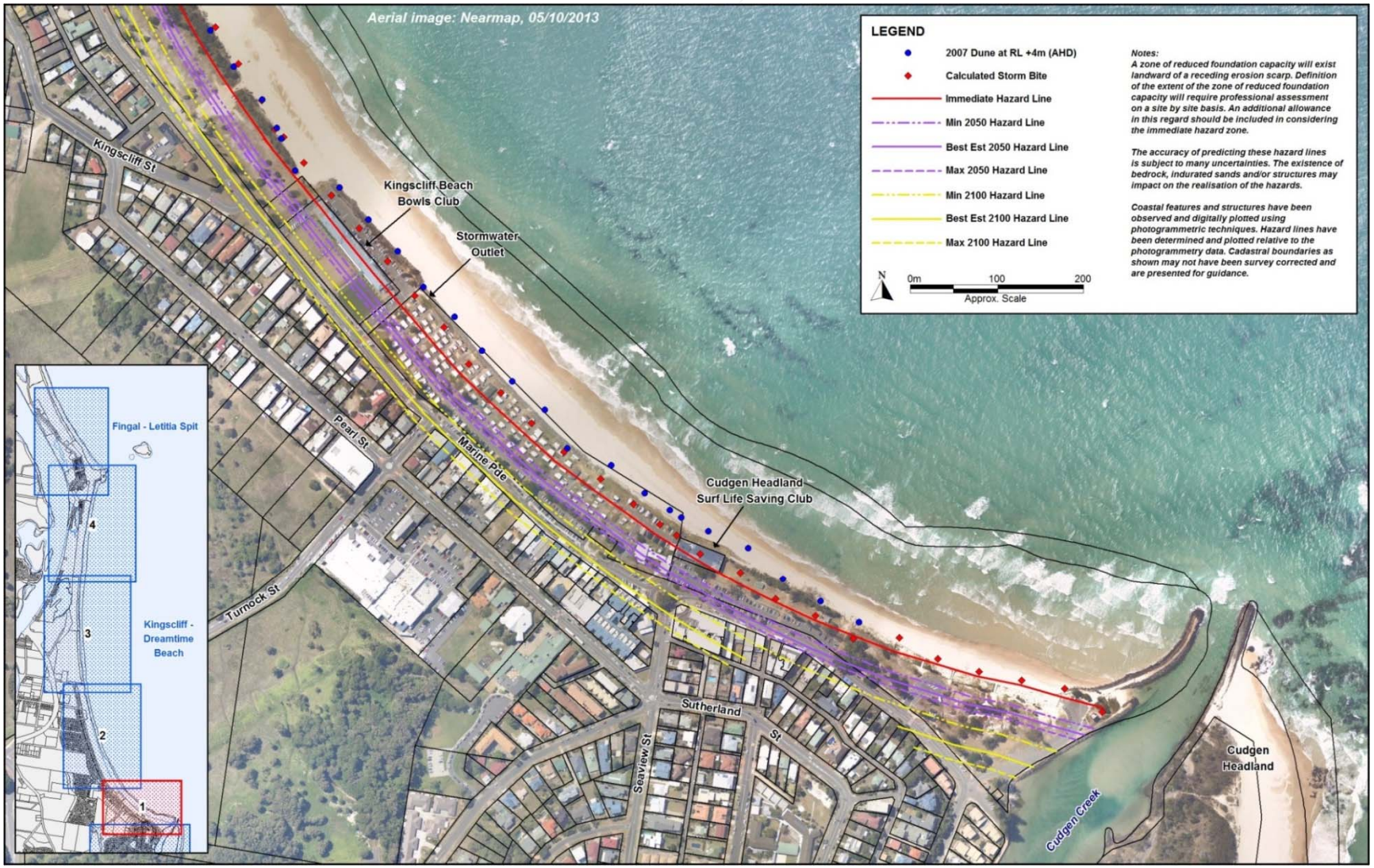


Figure 2-3 Erosion Hazard Zones: Kingscliff

3 Beach Management Options for Consideration

3.1 Key Objectives

The main coastal management issue at Kingscliff is determining a suitable strategy for dealing with assets that are or may become subject to erosion threats. The Kingscliff Beach Holiday Park, Cudgen Headland SLSC building, the Kingscliff Bowls Club and various foreshore park facilities in Faulks Park are located within the immediate erosion hazards zone. The Kingscliff Amenities Hall, Marine Parade and numerous properties along the parade lie within the projected erosion hazards zones.

Many of the assets within the erosion prone areas are key tourist facilities and important to the local economy of Kingscliff. It is also recognised that the beach itself is a central focus of the local and tourist amenity of the town and must be preserved in the long term.

As such, the key objectives for management of Kingscliff Beach are:

- To preserve the beach as a recreational asset, with appropriate access and land management provisions; and
- To continue to provide public facilities in a cost effective manner that support the local economy of Kingscliff and have appropriate risk levels.

3.2 Generic Option Considerations

A range of generic erosion management options are available for consideration, which may be classified in terms of their consistency with natural coastal and environmental processes and the natural character and values of the coastline as follows:

"Soft" Options: Options which restore and/or preserve the natural character, behaviour and values of the coastal system. These will ensure the sustainable existence and natural character of the sandy beaches and dunes such that future erosion, both during short term storms and over the longer term, can be accommodated in a coastal buffer zone without threat to development requiring engineering works.

Soft options may include works such as beach nourishment with sand or planning solutions that require all future development to be outside the zone of potential erosion (buffer zone), including:

- Regulatory controls on building in undeveloped areas;
- Opportunistic removal or relocation of public assets; and
- Works aimed at restoration of the beach/dune system seaward of the development to provide an adequate buffer width to accommodate erosion.

"Hard" Options: Options that involve construction of works either to form a barrier to natural coastal erosion to protect development (seawalls) or to alter the natural processes to change the way in which the beach behaves (groynes and breakwaters).

Combinations of options or "hybrid" management approaches are often the most suitable where existing development lies within the erosion prone area. For example, works options such as terminal protection (seawalls) are sometimes combined with partial set-back of development, or may be

augmented with ongoing beach nourishment to offset associated deleterious environmental and recreational amenity impacts. In addition, most options need to be supplemented with relevant amendments to local planning controls.

Thus, engineering works options for the shoreline may include 'soft' or 'hard' solutions, or a combination of both. The most common feasible works options for overcoming shoreline erosion problems include the following and are discussed in more detail below:

- Beach nourishment with sand to restore the beach and dune system;
- Seawalls to protect coastal infrastructure;
- Groynes to capture and control the longshore movements of sand; and
- Offshore breakwaters or submerged reefs to modify wave processes which cause erosion of the beach.

Such works options are generally costly, and the 'hard' structural options typically may have adverse side effects on the beach system. Ongoing maintenance requirements must be considered in both the design and financing. Experience indicates that careful design in full cognisance of the prevailing coastal and ocean processes and the short and longer term effects is essential for success and cost-effectiveness of such works.

For example, it is known that seawalls constructed on retreating shorelines may give protection to land based assets, but will eventually cause loss of the adjacent beach. There is a need to ensure that the foundations of the seawall are sufficiently deep for stability to cater for the loss of the beach, typically requiring deeper foundations the more seaward the seawall is located. Similarly, beach nourishment must be designed and implemented to provide for the cross-shore and longshore movements of sand affecting the area for long term effectiveness in providing property protection while maintaining the recreational amenity of sandy beach systems.

3.2.1 Decision Matrix

It is convenient to consider beach protection options in the broad terms of the matrix illustrated in Table 3-1. This matrix, in effect, represents a decision tool based on criteria relating to:

- 'Natural' versus 'Altered' character; and
- 'Non-works' (planning) versus 'Works' options.

Table 3-1 Matrix of Beach System Management Options

	Preserve Natural Beach System Character	Accept Change to Natural Beach System Character
Non-Works Options (planning, management and regulation)	Development free buffer zones via planning or land use regulation; Resumptions of erosion prone development; Relocation or set-back of assets; Land use and building guidelines and controls; Management including dune care activities.	Accept development on vulnerable erosion prone land, but prevent any protection works (allow loss of buildings and facilities as erosion occurs).
Works Options	Beach nourishment with sand to restore the beach and dune system; Submerged reefs for shore protection.	Seawalls to protect assets; Groynes to control the longshore movements of sand; Offshore breakwaters to modify beach shape and sand transport.

To be consistent with coastal management policy guidelines and the priorities generally adopted by the community in areas where beach amenity and ecological integrity is important, the options in the column headed 'Preserve Natural Beach System Character' would normally have highest ranking in any assessment criteria. Consideration may also be given to other low cost temporary works options and hybrid options that combine the beneficial characteristics and offset deleterious characteristics of specific individual options.

The likelihood of success (or the risk of failure) is a key consideration in the selection of possible solution options. The options adopted involving expenditure of public funds should preferably be tried and proven techniques for dealing with beach erosion problems. There are a number of other (generally lower cost) options that are commonly put forward, covering a wide range of operational modes and with various claims of success. Most of these options typically have limited theoretical backing, have limited potential for providing significant long term benefits and/or have generally not been proven as an effective means of beach stabilisation. Such options would be ranked as low feasibility of success and would not be recommended.

3.2.2 Retreat Options

The intent of retreat options is to progressively remove the development under threat and allow the beach and dune to behave in the natural manner, thus restoring and retaining the natural character and amenity of the beach as the shoreline recedes. The planned retreat option acknowledges that erosion is an ongoing phenomenon and seeks to address the issue by opportunistic removal of threatened facilities rather than trying to protect them. Retreat would allow a quantity of sand currently retained in the foreshore to become engaged in the active beach zone, thus accommodating natural beach movements.

Where retreat of developed erosion prone land is adopted, there is often a need for alternative land on which the development may be relocated. This could be immediately landward of the erosion

hazard zone, retaining the 'beach front' position, or completely removed from the beach/dune environment away from future threat.

3.2.3 Protections Options

Options to hold the present coastal alignment generally fall into the following sub categories:

- Beach nourishment to rebuild the beach with sand imported from outside the active beach system to make up the deficit, either alone or with other control structures to improve the longevity and give added protection;
- Beach relocation through the redistribution of the existing sand on the beach; and
- Structural measures such as seawalls, groynes or offshore breakwaters/reefs to either directly protect assets or trap sand to rebuild the beach in front.

These protection options are discussed in detail below.

3.2.3.1 Beach Nourishment

Beach nourishment refers to the direct placement of sand imported from outside the active beach system onto the beach by pumping or by conventional earthmoving techniques. The primary intent of beach nourishment is to increase the volume of sand in the active beach system. With sufficient sand, recreational beach amenity can be maintained and provide protection to the development by building an adequate buffer zone width to accommodate natural beach fluctuations.

The quantity of sand required will be dependent on the design philosophy with respect to the level of initial and ongoing protection, the prevailing coastal processes and the use of structures to enhance the longevity of the works. Sufficient sand should ideally be provided to be able to accommodate short term (storm) erosion and a period of long term recession associated with longshore sediment transport differentials and sea level rise.

Beach nourishment is not considered a permanent long-term solution to beach erosion where there is an ongoing progressive net loss of sand and/or there will be future sea level rise, such as at Kingscliff, but rather, is an option that 'buys time' while planning is done for more permanent solutions and aspects of uncertainty in future shoreline change are confirmed (e.g. through on-going monitoring of recession and storm responses).

Should nourishment be implemented, provision should be made for the nourished sand to extend across the full beach profile to include depleted nearshore areas as well as the upper beach profile, the total quantity of sand being determined accordingly. If the sand is placed only on the upper visible portion of the beach, cross-shore redistribution will quickly occur to establish an equilibrium beach profile giving the impression that the sand is 'lost' and the nourishment campaign is a failure. In such a case, the sand is, in fact, not 'lost' but remains in the active system providing an overall net gain commensurate with the quantity placed after cross-shore distribution.

Dune construction and stabilisation works to prevent sand loss due to wind erosion usually needs to form part of any substantial beach nourishment scheme aimed at restoring the beach and dune system. In that case, it would incorporate design provisions to prevent dune overtopping and oceanic inundation as well as to accommodate the effects of climate change including sea level rise. Where

the aim of the nourishment is to re-establish a beach in front of an existing seawall without provision of a dune, the need for stabilisation works such as establishment of native dune vegetation would depend on the potential for wind erosion resulting from the works.

While beach nourishment may affect the ecological values of the beach and nearshore areas, it needs to be recognised that the nourishment sand would be placed in the active zone where the natural environment is one of substantial fluctuations and disturbances to which the ecological communities adapt naturally. The nourishment would effectively rebuild the beach. As such, while there may be some short term ecological impacts due to beach nourishment, in the longer term the environment will generally adapt and recolonise to behave as a natural beach system.

One of the inherent advantages of beach nourishment is that it maintains the natural character and recreational amenity of a beach while also providing protection to coastal assets. As such, where the beach is severely depleted of sand, it provides many intangible benefits to the general community, as well as a direct economic benefit to those businesses that rely on tourism and the presence of a usable beach.

A disadvantage of beach nourishment with respect to protection of development is that the nourished beach will continue to erode if the natural shoreline recession is progressive and significant redistribution of sand can be experienced, particularly in areas with substantial longshore transport. Ongoing maintenance nourishment is often required to maintain the beach, which may be seen by some as a temporary solution and a waste of resources.

Furthermore, identification and access to sources of suitable nourishment sand is often a key issue, as is the ongoing cost to maintain this protection and amenity. Unlike the adjacent Gold Coast area, sourcing of sand from offshore reserves is not favoured by government. Other sources, including dredging of the Tweed River, have therefore been considered for nourishment of Kingscliff Beach. Transport of sand to the beach is generally most cost-effectively achieved by dredging procedures. The use of trucks to import large volumes of sand is usually slow and costly, with adverse impacts on the local community and road infrastructure.

3.2.3.2 Sand Relocation

Sand relocation refers to moving sand within the beach system. Sand relocation differs from beach nourishment as no additional sand is added to system, rather the sand is simply redistributed within the beach system to help maintain beach amenity or strengthen the dune at a section of shoreline susceptible to storm erosion.

There are two types of sand relocation works, depending on the nature of the redistribution, namely beach recycling and beach re-profiling.

Beach recycling involves the collection of material from a downdrift location and transporting it to an updrift end of a beach on a regular basis. Recycling may be undertaken using land or seaborne transport depending on access, tidal range, beach levels and quantity to be relocated.

Beach re-profiling, or “beach scraping”, generally involves relocating sand from the lower part of the beach to the upper beach and dune system using mechanical equipment (refer Figure 3-1). The action is assumed to mimic natural beach recovery processes, albeit at an increased rate. TSC currently undertakes beach scraping at Kingscliff as part of ongoing beach maintenance.

Beach scraping can be used successfully to restore beach amenity, widen the upper beach and rebuild dunes. On developed shorelines these actions will temporarily improve the protection of adjacent assets by increasing the upper beach width using sand from the lower beach which may be partially infilled with sand moved alongshore by wave processes. Such works are relatively inexpensive, can be implemented quickly and are often undertaken in response to a significant beach erosion event. The main short coming of beach scraping as an erosion control measure is that it does not increase the overall beach system volume of sand, needs to be repeated frequently and will only offer limited and short term shoreline protection.

Beach relocation works are often undertaken in conjunction with active dune building and stabilisation through revegetation. Additional recovery/stabilisation can be achieved through the use of accretion fencing that acts to trap windblown sand during onshore wind conditions.

Figure 3-1 Beach Re-profiling using Mechanical Equipment (Souce: Carley et al., 2010)

3.2.4 Structural Protection Options

Structural options provide protection to assets against erosion either directly through the construction of a physical barrier separating the erodible material immediately behind the structure from wave and current forces (i.e. terminal protection) or by rebuilding of the beach through the construction of groynes. They are options that could be considered in the event that sufficient beach nourishment sand is not available and/or retreat options are not viable. However, there are always some adverse impacts of such an approach where no additional sand is provided, as outlined below.

Such structures would typically be of flexible rubble mound design with rock being sourced and trucked to the site from quarries in the region. While they may be effective in protecting property or providing a localized wider beach, they are generally accompanied by associated costs related to adverse impacts on the adjacent beaches. This cost is typically made up of direct costs associated with lost income from the tourist industry and other intangible costs associated with the natural coastal amenity, beach access, loss of recreational beach area and degradation of ecological values.

3.2.4.1 Seawalls

Seawalls or rock revetments are commonly built along the back of the beach with the intent of providing terminal protection against shoreline erosion. Seawalls are robust structures constructed along the shoreline which provide a physical barrier separating the erodible material immediately behind the structure from wave and current forces acting on the beach itself. They are typically constructed of loosely placed rock or as concrete (vertical or stepped) modular units.

Where possible, seawalls should be continuous to prevent end effects and/or discontinuities that could threaten the overall integrity of the wall. They also have to be suitably founded for stability against scour at the toe of the structure, particularly on a receding shoreline. Haphazardly placed rock and/or the use of inappropriate materials intended to provide shoreline erosion protection can have the opposite affect by accelerating the erosion problem.

Positioning a seawall on a natural beach requires consideration of both the cross-shore location and the longshore alignment of the structure. These need to be considered from both structural and coastal process viewpoints (i.e. the effect of hydrodynamics and coastal processes on structural integrity and the effect of the structure on beach processes). The cross-shore positioning of a seawall influences the interaction of the natural beach system and seawall structure. To minimise disrupting littoral transport processes, seawalls are ideally positioned as far landward as possible.

On a receding shoreline, the beach profile migrates progressively further landward relative to the seawall over time. This leads to a gradual decrease in the quantity of sand within the beach system, with:

- Lowering and eventual loss of the beach in front of the wall (refer to Figure 3-2); and
- Exacerbation of the erosion on the downdrift end of the wall where the losses are transferred and concentrated (refer to Figure 3-3).

Scour and lowering of the beach in front of the wall ultimately exposes it to higher wave attack and can lead to slumping and the need for increased maintenance. Such maintenance is typically in the form of topping up of the wall with additional rock. However, where the seawall is not adequately designed or constructed, complete reconstruction may be needed.

Figure 3-2 Seawalls on Eroding Shorelines Cause Loss of Usable Beach

Figure 3-3 End Effects at Geotextile Sand Container Wall at Kingscliff Beach Holiday Park (from NSW Government, 2011)

3.2.4.2 Groynes and Artificial Headlands

Groynes and artificial headlands are impermeable structures constructed approximately perpendicular to the shoreline and extend across the beach and the nearshore surf zone. Their function is to trap sand moving along the shoreline under longshore transport processes to build up and stabilise the alignment of the beach on the updrift side. By necessity they affect sand supply to the shoreline on the downdrift side, causing erosion there until such time as sand bypassing around the groyne occurs, restoring longshore sand transport to the downdrift side.

The intent of groynes and artificial headlands is to provide a buffer of sand on their updrift side that can accommodate the effects of a storm or fluctuation in sand supply, while maintaining a recreational beach. The shoreline alignment will also change providing greater stability and reduced long term erosion immediately updrift of the structure. The extent of accretion and length of shoreline affected is dependent on the length of the structure as well as the characteristics of the longshore transport processes. Generally, the longer the groyne, the more sand it will trap over a longer distance with decreasing influence away from the structure.

However, there is a physical limit to the length of shoreline affected and therefore a number of structures may be needed if substantial benefit or protection is required over a long stretch of shoreline. In such a case, there is a balance between the length and spacing of groynes that needs to be optimised as part of a detailed design process.

An artificial headland is a groyne type structure that has a substantial shore-parallel width at its head in comparison to a conventional narrow groyne. It is believed that this width alters the mechanisms of sand transport past the end of the structure and may allow a wider/longer beach to be retained on the updrift side for the same protrusion offshore. This could have the benefit of minimising the need for, or maximising the spacing of, additional structures to provide protection for a long stretch of coastline. However, such headland type structures would be larger and more expensive to construct.

Groynes or artificial headlands can thus be used to rebuild a beach and stabilise the shoreline against ongoing recession on the updrift side. However, in the absence of other works such as beach nourishment, this comes at the cost of exacerbated erosion on the downdrift side to where the erosion trend is transferred.

Another important consideration associated with these structures is their potential visual intrusion to the vista of a long sweeping beach and interruption to direct access along the beach.

3.3 Management Options Previously Investigated for Kingscliff

TSC has been working actively to understand and manage the impacts of coastal hazards within its local government area. Specifically, a Coastal Hazard Definition Study was undertaken in 2001 (WBM Oceanics, 2001), a Coastline Management Study was completed in 2005 (Umwelt, 2005a) and a Coastline Management Plan was developed in 2005 (Umwelt, 2005b). More recently, the Coastal Hazard Definition Study was updated (BMT WBM, 2013a) and a number of option analysis studies were undertaken (Worley Parsons, 2008, WRL, 2012, 2013, KBR, 2012).

This section provides a summary of the options previously considered within the Tweed Shire Coastline Management Plan (CMP) and supporting studies, as well as studies and assessments completed subsequently.

3.3.1 Coastline Management Plan (2005)

The 2005 CMP and supporting studies considered the following five shortlisted management options for Kingscliff:

- Do Nothing option;
- Terminal protection with beach nourishment option;
- Construction of a groyne at the Bowls Club with beach nourishment option;
- Construction of a groyne at Murphys Road with beach nourishment option; and
- Planned Retreat option.

3.3.1.1 Option 1: Do Nothing

The 'Do Nothing' option involves Council taking no strategic action to manage the risks associated with existing and future coastal hazards. This option does not represent the status quo, as present management efforts, including beach scraping works and the management and maintenance of existing shoreline protection structures (both the emergency works as well as the permanent structures) would be ceased.

If nothing is done to manage the adverse impacts of coastal processes, the beach is likely to deteriorate further as the erosion process continues. This would almost certainly result in further shoreline recession and would progressively put more assets under threat of erosion.

The lack of maintenance would result in progressive deterioration of existing shoreline protection structures and a reduction in their structural capacity. In the short to medium term, the Cudgen Headland SLSC building, the Kingscliff Bowls Club, the Holiday Park, the Kingscliff Amenities Hall and several foreshore park facilities (e.g. toilet blocks and picnic shelters) would be at risk of being damaged or destroyed by coastal processes. The deterioration of protection infrastructure would have a detrimental impact on beach amenity and lead to unpredictable erosion of the foreshore.

Although there are no direct capital costs under the 'Do Nothing' option, there may be substantial costs involved. The costs of this option relate mostly to the dollar value of assets and foreshore land lost to coastal processes (when this occurs) and the impacts of the option on the local economy, which are likely to be substantial. Tourism is a particularly important industry for Kingscliff, and the beach is one of the main tourist attractions to the area.

3.3.1.2 Option 2: Terminal protection with beach nourishment

The terminal protection with beach nourishment option was adopted as Council's preferred management strategy at the time of completion of the CMP in 2005.

This option involves the construction of a 500m long rock wall extending from the Cudgen Headland SLSC to the existing rock wall in front of the Bowls Club (Refer to Figure 3-4). The CMP recommended that the rock wall was placed as far landward as possible. Community support for this option was provided on the provision that beach amenity was maintained and that there were no adverse impacts.

Following adoption of the CMP by Council in 2005, Worley Parsons was commissioned to prepare an Environmental Impact Statement (EIS) for implementation of the seawall strategy (Worley Parsons, 2008). The EIS made recommendations regarding the length, material and design of the seawall and recommended the following works:

- A vertical buried seawall of approx. 100m long protecting the Cudgen Headland SLSC only;
- Initial and ongoing nourishment generally in accordance with the Tweed Shire Coastline Management Plan (i.e. an initial nourishment volume of 250,000 plus 5,000 m^3 per year ongoing); and
- Creation of a linear beach front reserve about 15m wide from the back dune to the proposed boundary of the redeveloped Kingscliff Beach Holiday Park.

Council commenced implementing the amended plan and completed the construction of the buried seawall (a secant piled vertical concrete wall) in front of the Cudgen Headland SLSC in August 2010 as the first step of the long term management strategy.

Shortly after completion, severe erosion was experienced near the Surf Club and the wall became exposed. To date, the piled concrete wall has successfully protected the surf club against erosion. However, strong vibrations are experienced from time to time due to wave impacts during high water levels and significant wave events. This raises concerns about the capacity of the wall to provide appropriate protection during severe erosion events.

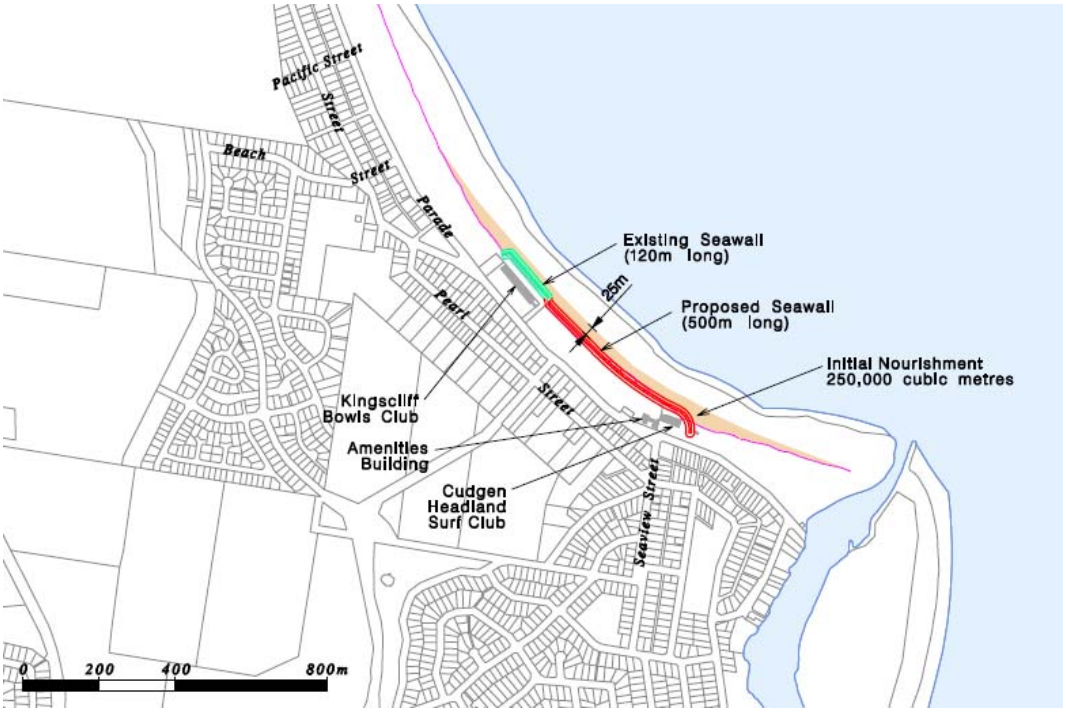


Figure 3-4 Terminal Protection with Beach Nourishment Option as Proposed in Umwelt (2005a)

3.3.1.3 Option 3: Groyne at Bowls Club with beach nourishment

In the CMP, this option is described as the construction of a large (250m long) groyne at the northern end of the Bowls Club in combination with beach nourishment (Refer to Figure 3-5). The groyne would be built approximately perpendicular to the shoreline with the intended purpose to trap sand that moves along the beach (littoral drift), thereby controlling the width of the beach on its southern end. The groyne construction was to be accompanied by an initial beach nourishment volume of approximately 1 million m^3 of which 700,000m^3 was to be placed on the beach to the south of the groyne and 300,000m^3 to the north. It was envisaged that the groyne would be constructed from quarry rock.

Umwelt (2005a) estimated that the capital cost for the groyne would be approximately $1.6M with an annual maintenance allowance of $30,000. The capital cost of nourishment was estimated to be $15.0M with a maintenance budget of $30,000 per annum.

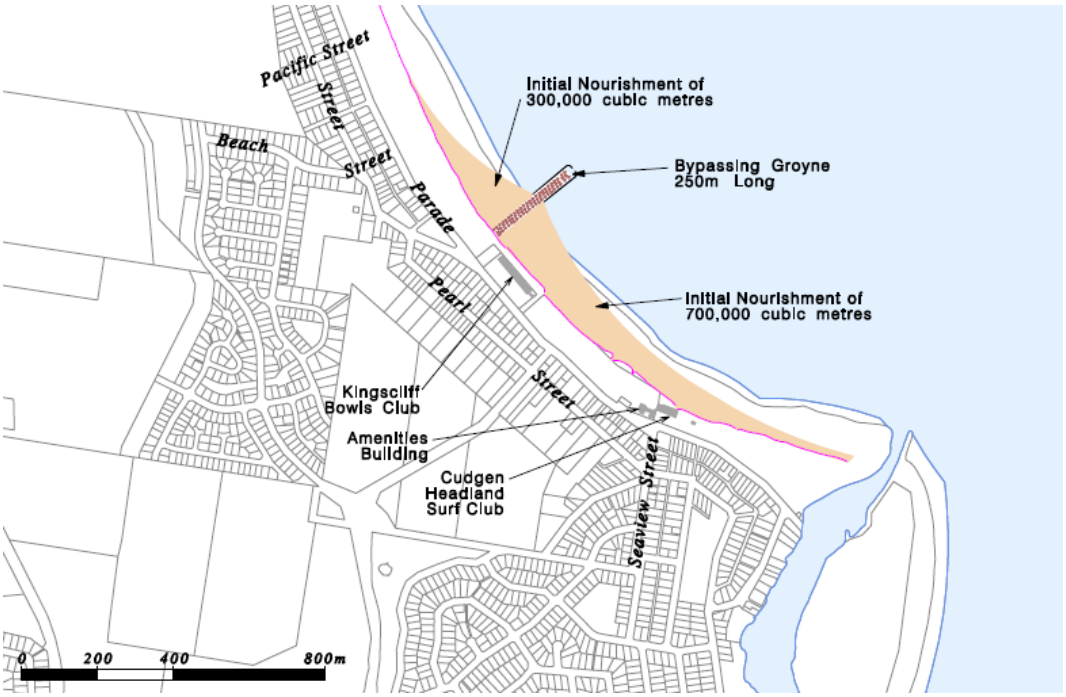


Figure 3-5 Groyne at Bowls Club with Beach Nourishment Option as Proposed in Umwelt (2005a)

3.3.1.4 Option 4: Groyne at Murphys Road with beach nourishment

In the CMP, this option is described as the construction of a 350m long groyne at Murphy Road, approximately 1.8 km north of the Bowls Club in combination with beach nourishment (refer to Figure 3-6). The construction of this groyne was to be accompanied by an initial beach nourishment volume of approximately 2.2 million m^3 of which approximately 1.8 million m^3 was to be placed on the beach to the south of the groyne and 400,000m^3 to the north.

Umwelt (2005a) estimated that the capital cost for the groyne would be approximately $3.8M with an annual maintenance allowance of $80,000. The capital cost of nourishment was estimated to be $33.0M with a maintenance budget of $90,000 per annum.

This option is not considered viable due to lack of a sufficient quantity of sand for the initial nourishment of this option.

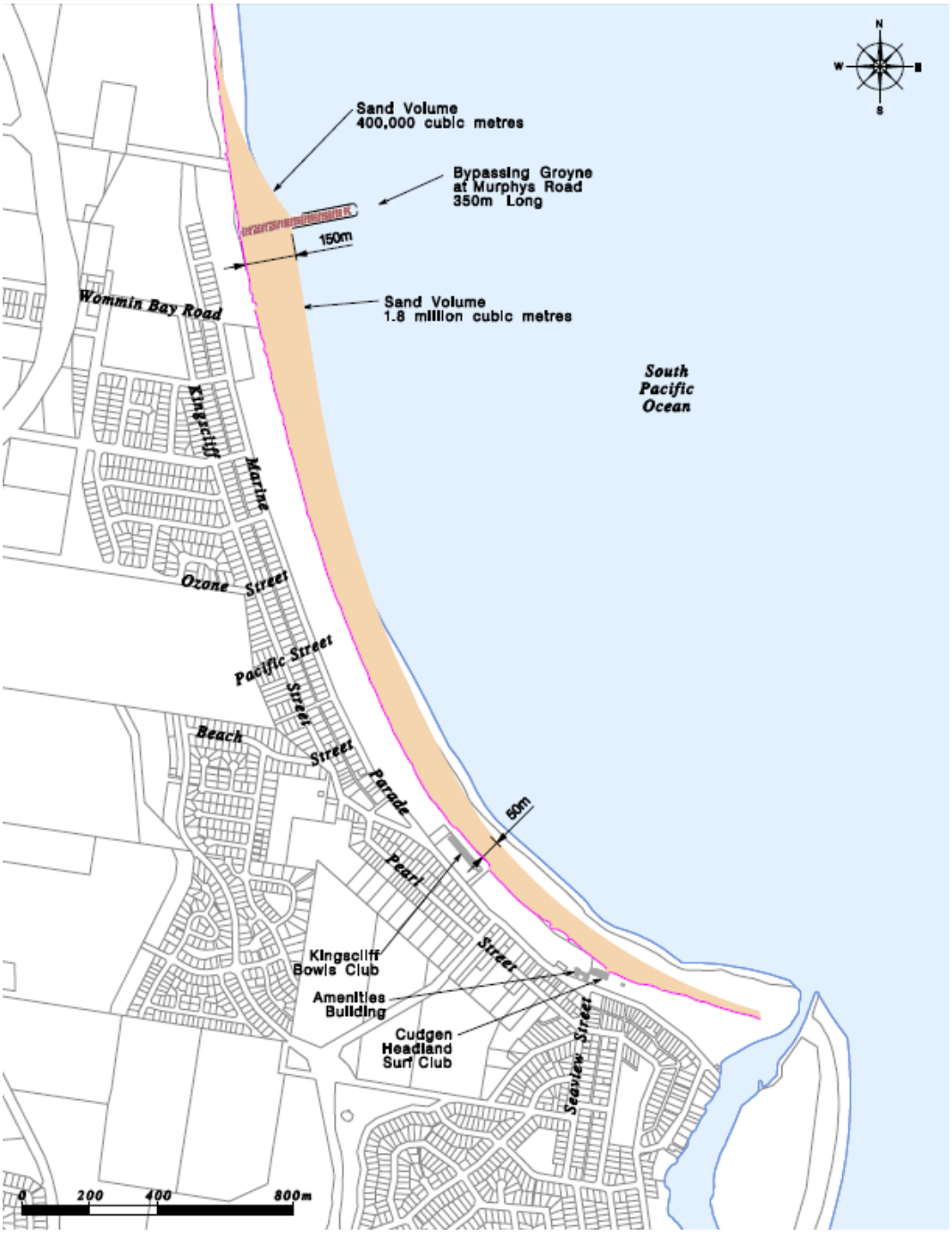


Figure 3-6 Groyne at Murphys Road with Beach Nourishment Option as Proposed in Umwelt (2005a)

3.3.1.5 Option 5: Planned Retreat

In the CMP, this option is described as the removal and/or relocation of all structures under threat in the immediate hazard zone, up to the 50 year hazard line over time, which included the Holiday Park, Cudgen Headland SLSC building, parkland toilet blocks and picnic shelters and the Kingscliff Amenities Hall in the longer term. The planned retreat option specifically excluded the Kingscliff Bowls Club building and its associated bowling greens and, car parks, because these assets benefit from the existing rock wall, which had been upgraded to an appropriate engineering standard.

As part of the CMP development, the viability of partial retreat of the Holiday Park (i.e. retreat from the immediate coast hazard zone) was examined (Umwelt, 2005a). It was concluded that "*due to there being a critical size below which the park would not remain viable as a business entity, it proved not to be viable.*"

Umwelt (2005a) estimated that the capital costs for the planned retreat option that provides for relocation of the Holiday Park to Cudgen Headland, the relocation of the Amenities Hall, the Surf Club building and other infrastructure, would be approximately $9.9M. The capital cost for the planned retreat option that includes removal (and no relocation) of the Holiday Park was estimated in the order of $4.9M.

Maintenance cost for the planned retreat option was estimated by Umwelt to be in the order of $100,000 per annum. This includes costs associated with maintenance of the existing seawall, including either nourishment or beach scraping, and maintenance of the parkland.

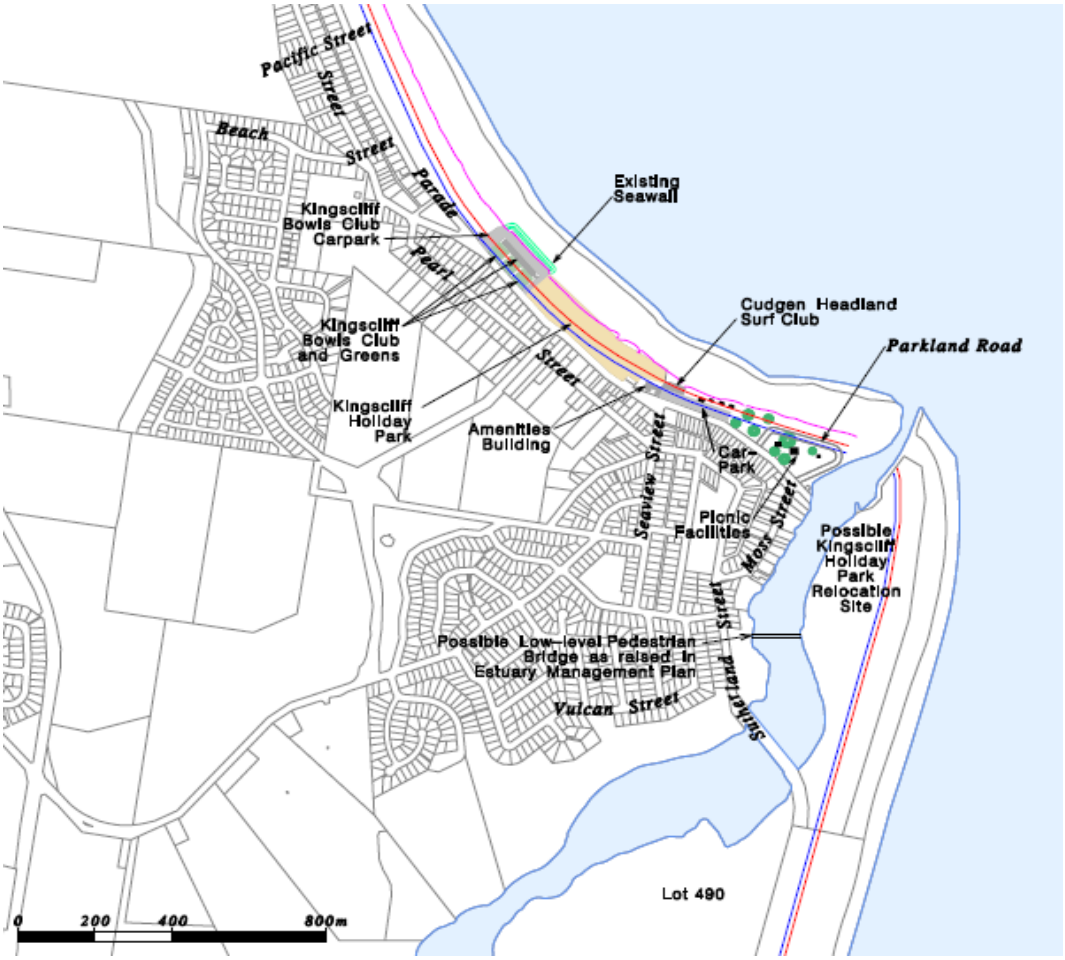


Figure 3-7 Planned Retreat Option as Proposed in Umwelt (2005a)

3.3.2 Alternative Terminal Seawall Designs

Following the erosion episodes between 2009 and 2012, WRL carried out a study that examined a range of options for implementing a long term seawall along the Holiday Park between the Surf Club and the Bowls Club (WRL, 2012).

The study considered two design scenarios for the seawall. In the first scenario Council would commit to ongoing monitoring and beach nourishment to maintain beach amenity. In the second scenario, beach amenity was allowed to be compromised and complete protection of development was provided only by a seawall.

The WRL study found that if beach amenity is to be maintained, any seawall construction that seeks to protect the Holiday Park without further reducing its size must be accompanied by beach nourishment. WRL determined that an initial sand volume of approximately 570,000 to 700,000 m^3 (depending on the adopted seawall design), followed by an ongoing beach nourishment volume requirement of about 3,900m^3 per year, would be required to maintain beach amenity and preserve public access to the beach.

The report notes that the estimates for ongoing nourishment volume do not include any allowance for mitigation of alongshore dispersion losses of nourishment sand. Alongshore spreading losses

following major beach nourishment work at Kingscliff are expected to be substantial (BMT WBM, 2013b), and consequently ongoing nourishment requirements are likely to be significantly underestimated. BMT WBM recommends that the alongshore losses be assessed to provide a better estimate of the maintenance requirements of any terminal protection option that includes major beach nourishment.

The initial capital cost estimate varied depending on the adopted armour material (rock, sand-filled geotextile containers or concrete elements), design philosophy and commitment to beach nourishment for amenity purposes. Cost estimates from the WRL study are summarised in Table 3-2.

The table shows that the initial capital costs for a rock wall foreshore protection strategy without commitment to beach nourishment for amenity purposes are estimated to be approx. $5.8M. If Council commits to beach nourishment for amenity purposes, large scale beach nourishment would be required and the total capital cost for implementation of a rock seawall protection strategy would increase to approximately $22.4M ($5.8M for the rock wall and $16.6M for the initial beach nourishment).

The WRL study indicates that concrete seawall options (including implementation of a stepped wall) would cost less than implementation of the rock wall option, should Council commit to ongoing beach nourishment for amenity purposes. This is due to the smaller beach nourishment volume requirements for these concrete options, compared to the rock wall option.

Table 3-2 Cost Estimates for Selected Terminal Protection Options (from WRL, 2012)

Option	Description	Capital Cost	Ongoing Maintenance Costs[1]	Beach amenity maintained ? (i.e. acceptable beach width?)
Rock seawall with beach nourishment	Sloping greywacke revetment with wave return wall, plus beach nourishment along entire beach (initial volume ~700,000m^3), plus ongoing maintenance)	$22.4M	$0.23M p.a.[2]	Yes
Rock seawall without beach nourishment	Sloping greywacke revetment with wave return wall	$5.8M	$0.09M p.a.	No
Concrete (Seabee) seawall without beach nourishment	Steep sloping revetment of concrete armour units with wave return wall, plus beach nourishment along entire beach (initial volume ~570,000m^3, plus ongoing maintenance)	$19.7M	$0.21M p.a.2	Yes
Stepped concrete seawall without beach nourishment	Sloping revetment of concrete armour units with wave return wall	$7.5M	$0.04M	No
Stepped concrete seawall with beach nourishment	Stepped monolithic seawall with wave return wall, plus beach nourishment along entire beach (initial volume ~600,000m^3, plus ongoing maintenance)	$21.3M	$0.20 p.a.[2]	Yes
Stepped concrete seawall without beach nourishment	Stepped monolithic seawall with wave return wall	$8.8M	$0.02 p.a.	No

Notes:

1. excludes maintenance costs of existing shoreline protection structures

2. Ongoing nourishment requirements based on estimates by WRL (2012), which do not include any allowance for mitigation of alongshore spreading losses of nourishment sand

3.3.3 Beach Nourishment Alone Option

As part of the alternative terminal seawall design study, WRL also investigated the "Beach Nourishment Alone" option for Kingscliff Beach (WRL, 2012).

The study estimated that an initial nourishment volume of approx. 810,000m^3 (placed along a shoreline section of approx. 1,100m) would prevent erosion from extending landward of the existing foreshore protection alignment.

KBR (2012) indicates that Tweed River could be a source of beach nourishment sand and highlights a 660,000m^3 reserve of suitable sand in the lower Tweed River. The KBR report assumes the sand would be dredged from the river using a Cutter Suction Dredger and pumped to Kingscliff via a temporary pipeline at a rate of approximately 550m^3 per hour. WRL (2012) indicates that a number of alternative (terrestrial) sources exist, which can supply the remaining volume for the initial beach nourishment (approx. 150,000m^3).

Preliminary modelling by BMT WBM (2013b) demonstrated that such large scale beach nourishment operation would be subject to substantial alongshore dispersion following the nourishment. The

results from the modelling (reproduced in Figure 3-8) indicate that without maintenance nourishment works or use of control structures, approx. 50% of the initial nourishment volume would have been lost from the nourished section along Kingscliff Beach and be transported to the beach further north within 8 years.

Based on this modelling, it is estimated that without use of control structures an ongoing maintenance volume in the order of 250,000m^3 of sand every 3 to 4 years may be required at Kingscliff to maintain a reasonable buffer in front of the existing foreshore protection alignment. The most cost effective source sand for maintenance nourishment is likely to be the recycling of sand. Such sand recycling operation would relocate sand that is transported northwards under longshore sand transport processes from Dreamtime Beach to Kingscliff Beach. These regular maintenance nourishment works would be supplemented with ad-hoc beach scraping and beach importation works as necessary.

The WRL (2012) estimates that the capital cost for initial beach nourishment of approximately 810,000m^3 would be about $21.9M.

In addition, there will be an ongoing cost associated with maintenance nourishment works.

The cost for ongoing maintenance nourishment, based on interpretation of preliminary modelling results by BMT WBM (2013b) and assuming that most ongoing nourishment sand can be sourced by recycling from Dreamtime Beach, is estimated to be in the order of $600,000 to $800,000 per annum.

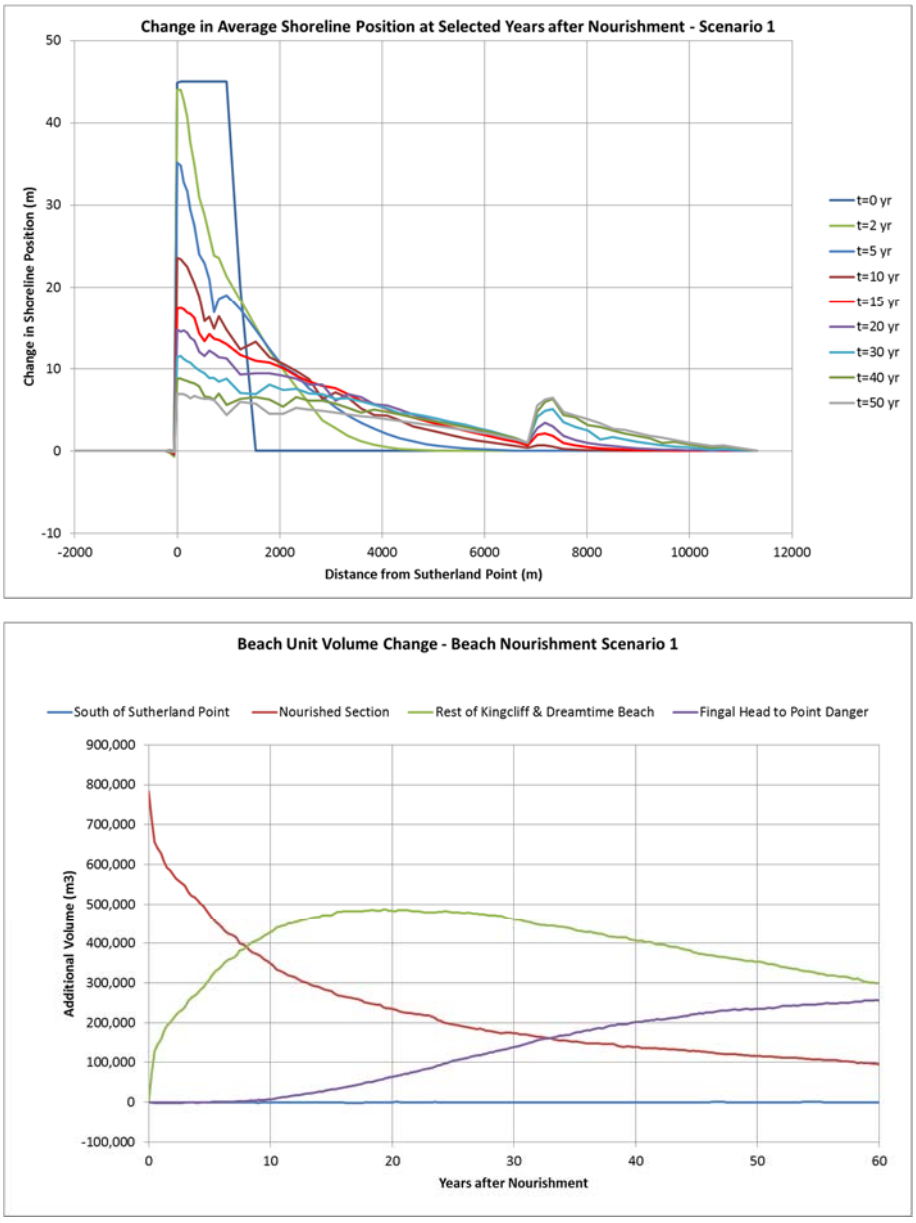


Figure 3-8 Modelled shoreline behaviour (top) and volume changes following a large scale beach nourishment campaign at Kingscliff (from BMT WBM, 2013b)

3.3.4 Groyne Field Concept Design

Following advice from the NSW Coastal Panel, Council commissioned WRL to prepare two different concept designs for a long term groyne field at Kingscliff (WRL, 2013). The first groyne field concept design assumed erosion protection would be provided by large scale beach nourishment in conjunction with the groynes. The second design assumed erosion protection would be provided by a terminal seawall along the Holiday Park in conjunction with the groynes. The study proposed a groyne field of two structures (one at the northern end of the KBBC rock revetment, 230m long in design 1 and 176m long in design 2, and one at the entrance road to Kingscliff Beach Holiday Park at the southern end of the park, 195m long in design 1 and 145m long in design 2,), constructed using a combination of rock and concrete Hanbars (with the concrete Hanbars at the seaward end).

The capital cost for construction of the groynes was estimated to be approx. $15.3M for the option with large scale nourishment and $12.5M for the option of combining the groyne field with a seawall. The study does not provide specific cost estimates for the associated beach nourishment or seawall, nor for the likely ongoing costs of these options.

Based on the cost estimates from previous studies (Umwelt, 2005a, WRL, 2012), BMT WBM estimates that the capital cost for the initial nourishment to be approximately $27.6M and approximately $5.8M for the seawall (assuming a rock wall as described in WRL, 2012).

3.3.5 Summary of Options Previously Considered

After review of previous option investigations and assessment of the present local conditions, eight possible options were identified to manage current and future coastal hazard risks at Kingscliff Beach. The key aspects of these long term management options considered for Kingscliff are summarised in Table 3-3.

Capital and maintenance cost estimates were derived from previous studies, as detailed in the sections above.

Table 3-3 Summary of Management Options Previously Considered for Kingscliff Beach

Option	Description	Advantages	Disadvantages	Capital / Ongoing Maintenance Cost (2014$)	Comments
Do Nothing	Undertake no strategic action to manage coastal hazard risks	• No direct expenditure	• High risk to existing development • Loss of beach amenity (strewn debris, degraded beach access etc.) • Safety issues for beach and foreshore users • Likely to be perceived by community as abandonment	N/A / $0.2M p.a.	• Does not address risks • Unlikely to be acceptable by community
Planned Retreat (with retention of Bowls Club)	Planned retreat as per option 5 in CMP, but without relocation of Cudgen Headland SLSC	• Restores natural beach • Maintains beach amenity • New and improved Holiday Park is provided	• Dependency on suitable relocation site for Holiday Park • Uncertainty of timeframes for required actions • Does not provide a long term solution (Marine Parade and associates buildings become under threat in longer term ~50 years) • Potentially strong opposition from community	$10.2M / $0.13M p.a.	• Costing based on immediate relocation of key assets, including SLSC and assumes relocation of Holiday Park to Cudgen Headland site • Maintenance costs reduce when retreat is completed
Beach Nourishment Alone	Initial nourishment volume of approx. ~810,000m^3, plus 39,000m^3 every 10 years (MHL, 2009). As noted previously, this is considered to be significantly under-estimated.	• Enhances beach amenity (increased beach width) • Increases beach buffer and therefore increases land and infrastructure protection • Slows long-term shoreline recession	• High capital and maintenance cost • Uncertainty regarding the future sand sourcing for maintenance nourishment • Uncertainty regarding the reliability as an effective erosion defence method • Impacts during works (disruption of traffic and recreational use of beach)	$21.9M / $0.2M p.a.	• Option may be unfeasible due to sand sourcing issues • Ongoing maintenance cost may be larger
Rock seawall with	Sloping greywacke revetment along Holiday Park with beach nourishment along	• Provides certain protection to key assets	• High capital and maintenance cost	$22.4M / $0.2M p.a.	• Option may be unfeasible due to sand sourcing issues

Beach Management Options for Consideration

Option	Description	Advantages	Disadvantages	Capital / Ongoing Maintenance Cost (2014$)	Comments
beach nourishment	entire beach (initial volume ~700,000m^3), plus 39,000m^3 every 10 years (MHL, 2009). As noted previously, this maintenance volume is considered to be significantly under-estimated.	• Maintains beach amenity during most periods • Provides long term solution for Marine Parade	• Uncertainty regarding the future sand sourcing for maintenance nourishment • Visual impacts of seawall on Holiday Park (crest height higher than foreshore land) • Loss of beach during severe storms • Loss of beach access following severe storms		• Ongoing maintenance cost may be larger
Rock seawall without beach nourishment	Sloping greywacke revetment along Holiday Park	• Provides certain protection to key assets in short to medium term • Lower cost	• Loss of beach amenity and access (progressive narrowing / loss of beach) • May cause accelerated erosion downdrift of seawall	$5.8M / $0.05M p.a.	
Stepped concrete seawall with beach nourishment	Stepped monolithic seawall along Holiday Park with beach nourishment along entire beach (initial volume ~600,000m^3, plus 39,000m^3 every 10 years (MHL, 2009). As noted previously, this maintenance volume is considered to be significantly under-estimated).	• Provides certain protection to key assets • Maintains beach amenity during most periods • Provides long term solution for Marine Parade • Smaller footprint compared to rock wall • Improved beach access compared to rock wall	• High capital and maintenance cost • Uncertainty regarding the future sand sourcing for maintenance nourishment • Visual impacts of seawall on Holiday Park (crest height higher than foreshore land) • Loss of beach during severe storms • Less adaptable than rock wall	$21.3M / $0.2M p.a.	• Option may be unfeasible due to sand sourcing issues • Ongoing maintenance cost may be larger
Stepped concrete seawall without beach nourishment	Stepped monolithic seawall along Holiday Park	• Provides certain protection to key assets in short to medium term • Smaller footprint compared to rock wall • Improved beach access compared to rock wall	• Loss of beach amenity and access (progressive narrowing / loss of beach) • May cause accelerated erosion downdrift of seawall • Less adaptable than rock wall	$8.8M / $0.05M p.a.	

Beach Management Options for Consideration

Option	Description	Advantages	Disadvantages	Capital / Ongoing Maintenance Cost (2014$)	Comments
Groyne field with beach nourishment	Two groynes with beach nourishment along entire beach (initial volume ~1,000,000m^3, plus 39,000m^3 every 10 years (MHL, 2009). As noted previously, this maintenance volume is considered to be significantly under-estimated)	• Enhances beach amenity (increased beach width) • Increases beach buffer and therefore increases land and infrastructure protection • Slows long-term shoreline recession	• High cost • Less certain protection than a seawall • Visual amenity of beach impacted • May cause accelerated shoreline fluctuation downdrift of groyne field	$43.0M / $0.2M p.a.	Certainty for protection of foreshore assets still requires construction of terminal seawall

3.4 Options for Further Consideration in Kingscliff Beach CRMS

Based on Council's preliminary evaluation of previously investigated options and assessment of the coastal processes and associated hazards, Council has selected three core management options for further consideration in the Kingscliff Beach Foreshore Coastal Risk Management Study (with two variants of one option), namely:

- Option 1: Do nothing;
- Option 2a: Planned retreat –*with retention* of the Cudgen Headland SLSC and Kingscliff Beach Bowls Club buildings;
- Option 2b: Planned retreat – *without retention* of the Cudgen Headland SLSC and Kingscliff Beach Bowls Club buildings; and
- Option 3: Terminal protection through seawall, sand nourishment and land use planning.

These four options, as described further below, are the subject of further assessment against a range of success criteria, which are detailed in the following chapter.

3.4.1 Option 1: Do nothing

Key points describing this option are as follows:

- No further works or expenditure;
- No beach nourishment;
- Existing facilities 'managed to fail' with removal once impacted and no replacement in the future;
- Temporary loss of beach access and amenity during periods of beach erosion – some recovery post erosion event;
- Gradual permanent loss of beach;
- Continuation of ad-hoc management of shoreline – different treatments in different sections;
- Visual concerns regarding existing ad-hoc structures;
- Community expectation that existing solution is temporary only;
- Limited longevity of existing solution (sand bags, low rock wall) due to temporary design, wave overtopping exposure etc;
- Rocks and bags potentially spread over beach in the future following erosive storm events – public safety concern; and
- Cost: Capital costs are minimal. Maintenance costs would involve repair of existing seawalls on an as-required basis – likely following significant coastal storm events (approx. $200,000/yr).

3.4.2 Option 2a: Planned retreat –*with retention* of the Cudgen Headland SLSC and Kingscliff Beach Bowls Club buildings

Key points describing this option are as follows:

- Gradual removal and relocation of Holiday Park structures/facilities and Park infrastructure (shelters, amenities, carparking) currently located within 50yr hazard zone [*indicatively over the next 30 years*];
- Holiday Park relocated/redeveloped elsewhere [possibly at Cudgen Headland or other location];
- Existing rock and sandbag wall in front of Holiday Park and parkland to be removed (once dilapidated or significantly affected by erosion);
- Possible works required to strengthen SLSC vertical piled seawall;
- Conversion of Holiday Park to open space parkland;
- Surf Club and Bowls Club become new 'headlands'. Additional protection required around sides to prevent outflanking. Financial investment required;
- No continuous access along beach around surf club and bowls club as beach retreats;
- New pocket beach between surf club and bowls club – impacts on sediment processes, waves;
- Accelerated erosion and retreat on northern side of Bowls Club; and
- Cost: Approximately $8 million covering relocation of Holiday Park and strengthening of existing seawall in front of SLSC. SLSC building is to be retained. Maintenance costs would be approximately $200,000/year.

3.4.3 Option 2b: Planned retreat – *without retention* of the Cudgen Headland SLSC and Kingscliff Beach Bowls Club buildings

Key points describing this option are as follows:

- Gradual removal and relocation of SLSC, Holiday Park, Bowls Club and Amenities Hall structures/facilities as well as Park infrastructure (shelters, amenities, carparking) currently located within 50yr hazard zone [*indicatively over the next 30 years as infrastructure becomes impacted*];
- Holiday Park relocated/redeveloped elsewhere [possibly at Cudgen Headland or other location];
- SLSC relocated (to south, and outside 50yr hazard area);
- Bowls Club relocated (subject to a suitable site being available and with consideration of existing development approvals and leasehold arrangements);
- Existing seawalls to be removed (once dilapidated or significantly affected by erosion and impacting on beach amenity);
- Conversion of entire foreshore to open space parkland;
- Maintenance of full beach access and amenity;

- Limited impacts on coastal processes (allowing for natural processes);
- Potential exposure of Marine Parade to future erosion (longer term); and
- Cost: Approximately $15-20 million, covering relocation of Bowls Club, Holiday Park and SLSC (with removal of existing coastal structures). Maintenance costs would be less than $100,000 per year, mostly covering post-storm amenity repairs to dunes and access tracks etc.

3.4.4 Option 3: Terminal protection through seawall, sand nourishment and land use planning

Key points describing this option are as follows:

- Formalised and contiguous seawall protection from SLSC to Bowls Club (500m). Height of wall may have impacts on visual amenity / views from Park;
- Seawall to include opportunity for increased beach access / foreshore amenity (including pedestrian access along crest and onto beach at selected locations);
- Continuation of existing foreshore uses, including SLSC, Holiday Park and Bowls Club as well as future refurbishment and life-extension of uses;
- Scale-back/reconfigure Holiday Park to allow for open space recreation area that links with beach access over seawall structure;
- Beach nourishment will provide longshore demand and minimise detrimental impacts downdrift;
- No future intensification or material change of landuse behind structure beyond existing planning regime;
- Consider retreat in longer term once existing uses reach end of functional life and on-going beach nourishment becomes cost-prohibitive to maintain continuous beach access and amenity; and
- Cost: Approximately $20 – 25 million, covering the new wall in front of the Holiday Park and bulk beach nourishment. On-going maintenance costs are expected to be high, with 50% of bulk sand likely to be lost over an 8 year period (requiring on-going nourishment campaigns of approximately 250,000m^3 every 3-4 years, which is equivalent to a maintenance cost of about $800,000/yr).

4 Multi Criteria Analysis

4.1 Introduction

Multi Criteria Analysis (MCA) is an appraisal technique that aims to assist decision-making when a number of diverse attributes need to be considered without necessarily assigning monetary values to all of those interests (Department of Communities and Local Government, 2009). Hence, unlike pure economic analysis tools such as cost-benefit analysis, MCA allows decision-makers to work with both qualitative and quantitative information. In particular, MCA provides a framework within which social and environmental issues can be more explicitly included in the decision-making process and considered in tandem with economic issues.

MCA evaluates alternative management options by assessing options against a defined set of decision criteria that represent the range of values and interests of relevant stakeholders. Individual criteria can be assigned subjective weightings to increase or decrease the significance of criteria based upon their perceived degree of importance.

4.2 Adopted MCA Option Assessment Process

MCA was used to assess the short-listed options adopted for Kingscliff foreshore (refer Section 3.4). The adopted MCA process for Kingscliff involved the following stages:

(1) Identify and select criteria;

(2) Scoring each option against the selected criteria; and

(3) Weighting of criteria, sensitivity analysis and final assessment.

Stakeholders provided input to the process through interactive workshops. Four workshops were held to specifically capture feedback and input, with two workshops targeting relevant Council staff and two workshops with an external reference group. Representatives from the following government agencies and local interest groups were invited to attend the workshops: Tweed Shire Councillors; Tweed Coastal Committee; Office of Environment and Heritage; Crown Lands; Kingscliff Boardriders Club; Commercial fishers; Kingscliff Business Chamber; Kingscliff Ratepayers and Progress Association; Kingscliff Dunecare Group; Kingscliff Beach Bowls Club; Destination Tweed.

4.3 Stage 1: Identify and Select Criteria

The initial step in carrying out the MCA was to confirm stakeholder values of the Kingscliff foreshore that should be considered as part of the decision making process. A workshop activity was undertaken to capture relevant values and establish the likely influence on these values by the four options being considered. Consolidated results of the values assessment are provided in Table 4-1.

Table 4-1 Kingscliff Foreshore Values and Impacts of Short-listed Options

	Option 1 – Do nothing (business as usual)	Option 2a – Planned Retreat with Retention of SLSC and Bowls Club	Option 2b – Planned Retreat with no Retention of SLSC and Bowls Club	Option 3 – terminal seawall and beach nourishment
Presence of a sandy beach	substantially worsen	slightly worsen	improve	improve
Safe access to the beach	worsen	slightly improve	substantially improve	substantially improve
Continuous pedestrian access along the beach	substantially worsen	substantially worsen	improve	improve
Use of beach for recreation / beach lifestyle	worsen	slightly worsen	improve	improve
Visual amenity from the parkland	worsen	same	substantially improve	improve
Visual amenity from the beach	substantially worsen	slightly worsen	improve	worsen
SLSC	substantially worsen	slightly improve	substantially worsen	improve
Holiday Park	substantially worsen	substantially worsen	substantially worsen	substantially improve
Bowls Club	substantially worsen	slightly improve	substantially worsen	improve
Ecosystem services - Kingscliff	worsen	slightly worsen	improve	worsen
Ecosystem services - Dreamtime	slightly worsen	worsen	improve	worsen

Stakeholders were also asked if new values would be created as a result of adopting any of the options. Suggestions from stakeholders included:

- Employment and tourism (generated from investment by Option 3);
- Surfing conditions (generated from Option 2b);
- Provision of new community facilities (generated from Option 2b); and
- Provision of new public domain areas (generated from Option 3).

An initial list of possible criteria was compiled by BMT WBM in conjunction with Council. These possible criteria were presented to the stakeholders, who provided feedback on whether they

considered them to be important or not. Stakeholders were also encouraged to document additional criteria that they considered to be important, which were not included in the initial list. As part of the stakeholder workshops, attendees also flagged their top eight criteria for assessment in the MCA. The list of criteria initially identified, including suggestions from stakeholders, is outlined in Table 4-2 spanning the four dimensions of social/cultural, environmental, economic and governance criteria.

Table 4-2 Full Listing of Criteria Initially Considered

Social / Cultural Criteria	Environmental Criteria
Beach usage / maintain beach lifestyle Protection of critical infrastructure (e.g. Marine Parade) Access to the beach Access along the beach Visual amenity Access along the foreshore Community acceptability / expectation Preservation/protection of bowls club Preservation/protection of holiday park Preservation/protection of SLSC building and facilities Willingness of community to pay for or contribute towards works Family lifestyle Surf quality Negative social impacts from visitors Creation of central park for public use Provision of active open space / public domain (community opportunities) Employment	Rehabilitates / maintains coastal ecosystem values Minimises impact on coastal processes No (minimise) detrimental environmental impacts elsewhere Impacts on other environmental and physical processes (e.g. dredging / piping) Tourist / environmental reputation Carbon emissions Sustainability over the longer term Longer term (> 2100) solution and planning required for large scale investment Stormwater control and treatment Marine ecosystem values Resource demands for construction (quarrying, energy etc.)
Economic Criteria	**Governance Criteria**
Commercial benefits / impacts (e.g. business, tourism, relocation costs) Benefit / cost ratio Capital and Maintenance Costs (Net Present Value) Affordability (cost per user; $/m) Investment certainty Applicability of a special levy Falling values of Kingscliff residential property Employment retention / growth Opportunity costs Impacts on development potential	Technical feasibility / practicality Community safety Long-term effectiveness (+30 - 50yrs) Risk reduction priority approach (1. Risk avoidance 2. Risk mitigation/accommodation 3. Risk acceptance) Achieves multiple objectives Adaptive / flexible / reversible design Legal / approvability Duty of care Public interest Consistency with ESD principles

Based on stakeholder feedback of top eight criteria and amalgamation of like criteria, a final list of assessment criteria was developed, as presented in Table 4-3. This list was confirmed as part of the second round of workshops to ensure stakeholder acceptance of the assessment criteria.

Table 4-3 Final List of Selection Criteria

Social Criteria	Maintain existing beach lifestyle
	Protection of critical infrastructure on Marine Parade
	Provision of appropriate access to, and unimpeded along, the beach and foreshore
Environmental Criteria	Maintain coastal ecosystem values
	Minimise impact on natural coastal processes
	Minimise detrimental impacts on environmental and physical processes elsewhere along embayment foreshore
Economic Criteria	Commercial benefits / impacts (e.g. local business, tourism, events)
	Benefit / cost ratio
	Public cost
Governance Criteria	Provide for appropriate community safety and duty of care
	Ensure overall design is practical, feasible and adaptive
	Long term effectiveness

4.4 Stage 2: Scoring Each Option against Selected Criteria

Once the selection criteria was established, the next stage was to score the options with respect to each of the final 12 criteria. An initial criteria score was determined for the options using available background information and previous reports. This was then reviewed by stakeholders as part of the second round of workshops, who were able to suggest alternative scores providing there was fair justification for the score.

A five-point scoring scale as presented in Table 4-4 was used for this scoring. Positive values represent a favourable assessment of performance, while negative values indicate an unfavourable assessment of performance.

Table 4-4 Scoring Scale used in Assessment of Foreshore Options for Kingscliff

Score	Interpretation
+2	Highly favourable
+1	Moderately favourable
0	Neutral
-1	Moderately unfavourable
-2	Highly unfavourable

Within the scoring process, a timeframe of about 30 years was used. A neutral position (score – 0) was adopted as 'no change' from the present (2014) conditions. Table 4-5 presents the results of the scoring process.

Table 4-5 Management Option Scoring for MCA

	INITIAL SCORING BY BMT WBM					FINAL SCORING FOLLOWING STAKEHOLDER REVIEW *(italics means numbers changed from initial scoring)*				
	DO NOTHING	RETREAT WITH RETENTION	RETREAT WITHOUT RETENTION	TERMINAL PROTECTION	Principal Source of Information / Assumptions used in determining initial scoring	DO NOTHING	RETREAT WITH RETENTION	RETREAT WITHOUT RETENTION	TERMINAL PROTECTION
SOCIAL CRITERIA									
Maintain existing beach lifestyle	-2	1	2	2	Interpreted from Griffith University (2013), Workshop 1 values responses	-2	*0*	*1*	2
Protection of critical infrastructure on Marine Parade	-1	0	-1	2	Interpreted from Griffith University (2013)	-1	0	-1	2
Provision of appropriate access to, and unimpeded along, the beach and foreshore	-2	-1	2	2	Interpreted from Griffith University (2013), Workshop 1 values responses	-2	-1	2	2
ENVIRONMENTAL CRITERIA									
Maintain coastal ecosystem values	-1	-1	1	-1	Interpreted from Griffith University (2013), Workshop 1 values responses	-1	-1	1	-1
Minimise impact on natural coastal processes	-2	-2	2	1	Interpreted from Umwelt (2005a, 2005b)	-2	-2	2	1
Minimise detrimental impacts on environmental and physical processes elsewhere along embayment foreshore	-2	-2	2	1	Interpreted from Umwelt (2005a, 2005b)	-2	-2	2	1
ECONOMIC CRITERIA									
Commercial benefits / impacts (e.g. local business, tourism, events)	-2	0	0	2	Interpreted from Griffith University (2013), Workshop 1 values responses	-2	0	0	2

	INITIAL SCORING BY BMT WBM					FINAL SCORING FOLLOWING STAKEHOLDER REVIEW *(italics means numbers changed from initial scoring)*				
	DO NOTHING	RETREAT WITH RETENTION	RETREAT WITHOUT RETENTION	TERMINAL PROTECTION	Principal Source of Information / Assumptions used in determining initial scoring	DO NOTHING	RETREAT WITH RETENTION	RETREAT WITHOUT RETENTION	TERMINAL PROTECTION
Benefit / cost ratio	2	1	0	-1	Interpreted from Griffith University (2013)	2	1	0	-1
Public cost	2	0	-1	-2	Interpreted from Umwelt (2005a, 2005b), WRL (2012)	2	0	-1	-2
GOVERNANCE CRITERIA									
Provide for appropriate community safety and duty of care	-2	0	2	1	Interpreted from Griffith University (2013)	-2	0	*1*	*2*
Ensure overall design is practical, feasible and adaptive	-2	-1	2	0	Professional judgement	-2	-1	2	*1*
Long term effectiveness	-2	0	2	1	Professional judgement	-2	0	2	*2*

4.5 Stage 3: Weighting of criteria, sensitivity analysis and final assessment

Relative weightings of the assessment criteria were established through consultation with the stakeholders. In this regard, a final workshop activity was carried out wherein participants distributed 24 'points' between the 12 criteria in order to define the relative importance of each criteria and how much emphasis each has on the overall assessment. Unsurprisingly, there was considerable variability in stakeholder responses to this activity. A summary of the results of the weightings exercise is given in Table 4-6.

Table 4-6 Relative Weightings and Variability

	Weighting	Variability between responses
SOCIAL CRITERIA		
Maintain existing beach lifestyle	2.5	High
Protection of critical infrastructure on Marine Parade	2.0	High
Provision of appropriate access to, and unimpeded along, the beach and foreshore	2.0	Medium
ENVIRONMENTAL CRITERIA		
Maintain coastal ecosystem values	1.5	Medium
Minimise impact on natural coastal processes	2.0	Medium
Minimise detrimental impacts on environmental and physical processes elsewhere along embayment foreshore	2.0	Low
ECONOMIC CRITERIA		
Commercial benefits / impacts (e.g. local business, tourism, events)	2.5	High
Benefit / cost ratio	3.0	Medium
Public cost	2.0	Medium
GOVERNANCE CRITERIA		
Provide for appropriate community safety and duty of care	1.5	High
Ensure overall design is practical, feasible and adaptive	3.0	High
Long term effectiveness	1.5	High

Using the weightings as outlined above, a first pass assessment of the options has been carried out, the results of which are presented in Table 4-7. The first pass assessment shows that the Do Nothing and Planned Retreat with Retention of the SLSC and Bowls Club options both result in a net detrimental impact compared to the present day conditions and values.

Retreat without Retention and Terminal Protection with Nourishment both yielded positive results compared to present day conditions, with no clear advantage to either of these options.

Table 4-7 First Pass Results for MCA

		Weighted Scores			
	Weighting	DO NOTHING	RETREAT WITH RETENTION	RETREAT WITHOUT	TERMINAL PROTECTION
SOCIAL CRITERIA					
Maintain existing beach lifestyle	2.5	-5	0	2.5	5
Protection of critical infrastructure on Marine Parade	2.0	-2	0	-2	4
Provision of appropriate access to, and unimpeded along, the beach and foreshore	2.0	-4	-2	4	4
ENVIRONMENTAL CRITERIA					
Maintain coastal ecosystem values	1.5	-1.5	-1.5	1.5	-1.5
Minimise impact on natural coastal processes	2.0	-4	-4	4	2
Minimise detrimental impacts on environmental and physical processes elsewhere along embayment foreshore	2.0	-4	-4	4	2
ECONOMIC CRITERIA					
Commercial benefits / impacts (e.g. local business, tourism, events)	2.5	-5	0	0	5
Benefit / cost ratio	3.0	6	3	0	-3
Public cost	2.0	4	0	-2	-4
GOVERNANCE CRITERIA					
Provide for appropriate community safety and duty of care	1.5	-3	0	1.5	3
Ensure overall design is practical, feasible and adaptive	3.0	-6	-3	6	3
Long term effectiveness	1.5	-3	0	3	3
RELATIVE TOTAL SCORE		**-27.5**	**-11.5**	**22.5**	**22.5**

The sensitivity of the results to the variability in the weightings was explored to determine if alternative weightings would provide a clear distinction between the top two options. All criteria that had a high degree of variability in stakeholder weighting responses was reviewed and tested for sensitivity. For each of these criteria, an alternative weighting was determined (generally giving consideration to alternative stakeholder views). The outcomes of this sensitivity testing are provided in Table 4-8. In general, the results of the sensitivity to alternative stakeholder views did not affect the overall scores to a large degree. Where the weighting of protection of critical infrastructure on Marine Parade was increased, the Terminal Protection option emerged as preferable. Meanwhile, where the weighting

given to the commercial benefits to local businesses and operators was lowered, the Planned Retreat option became slightly favourable.

Further, the scoring is dependent on the reliability of the technical effectiveness and cost assessment of the nourishment works accompanying terminal protection. More rapid than expected loss of the nourished sand or higher than expected cost of the works would lead to a lower score for that option. It is likely that the uncertainty associated with those factors would be greater than that associated with effectiveness and costs for the retreat option. Nevertheless, the assessment made by WRL (2012) is adopted herein as the best available.

Table 4-8 Sensitivity of results based on alternative stakeholder weightings

	Initial Weighting	Alternative Weighting	TOTAL SCORE for RETREAT WITHOUT RETENTION	TOTAL SCORE for TERMINAL PROTECTION
SOCIAL CRITERIA				
Maintain existing beach lifestyle	2.5	2.0	**22.0**	**21.5**
Protection of critical infrastructure on Marine Parade	2.0	2.5	**22.0**	**23.5**
Provision of appropriate access to, and unimpeded along, the beach and foreshore	2.0	-	*22.5*	*22.5*
ENVIRONMENTAL CRITERIA				
Maintain coastal ecosystem values	1.5	-	*22.5*	*22.5*
Minimise impact on natural coastal processes	2.0	-	*22.5*	*22.5*
Minimise detrimental impacts on environmental and physical processes elsewhere along embayment foreshore	2.0	-	*22.5*	*22.5*
ECONOMIC CRITERIA				
Commercial benefits / impacts (e.g. local business, tourism, events)	2.5	2.0	**22.5**	**21.5**
Benefit / cost ratio	3.0	-	*22.5*	*22.5*
Public cost	2.0	-	*22.5*	*22.5*
GOVERNANCE CRITERIA				
Provide for appropriate community safety and duty of care	1.5	2.0	**23.0**	**23.5**
Ensure overall design is practical, feasible and adaptive	3.0	2.5	**21.5**	**22.0**
Long term effectiveness	1.5	2.0	**23.5**	**23.5**

To assist with the assessment further, sensitivity of the results were also considered based on generally increasing weightings of whole criteria groups. The results of this sensitivity testing are given in Table 4-9. Overall, if the social dimension is considered to be of higher consideration, then the Terminal Protection option is favourable. However, if the environmental dimension is to be considered more important, then the Planned Retreat option is a better outcome. Interestingly, there was no sensitivity of results to emphasis of the economic dimension. In essence, the cost factor for both the Planned Retreat and Terminal Protection options remains about the same.

Table 4-9 Sensitivity of results based on general criteria group weightings

	TOTAL SCORE for RETREAT WITHOUT RETENTION	TOTAL SCORE for TERMINAL PROTECTION
Social emphasis	*27*	***35.5***
Environmental emphasis	***32***	*25*
Economic emphasis	*20.5*	*20.5*

4.6 Confidence in Results

The coastal zone is a highly dynamic environment subject to short-term and long-term events and climatic cycles. This means that confidence in accurately predicting future shoreline responses to such events and climatic cycles is relatively low. In particular, shoreline response to future storm events in combination with higher sea levels is not well understood. The recent update to the Tweed Coastal Hazards Assessment (BMT WBM, 2013a) provides a good indication of potential variability in future beach alignment, however, the actual shoreline response will be driven by many factors including individual storms and sustained stormy periods that cause beach recession. Similarly, the expected response of the shoreline to bulk nourishment is not well appreciated. Longshore sediment transport rates within this coastal compartment are very high. Interaction of the nourished sand with the longshore transport processes will see the sand dispersed to the north. The rate of loss of nourished sand, however, will again be dependent on a range of factors, many of which are difficult to quantify.

In terms of the MCA, many of the values maintained or enhanced in Option 3 are due to beach nourishment. If this nourishment was to be ill-effective, or if it becomes prohibitively costly to sustain (e.g. given a high loss rate from the coastal compartment), then some of the scores for the MCA would change. Similarly, for the planned retreat options, the extent of retreat due to future sea level rise is somewhat unknown, although within a reasonable planning timeframe of 30 – 50 years it is expected that the extent of shoreline retreat due to sea level rise would be modest (compared to a longer timeframe of 100+ years).

5 Coastal Management Strategy for Kingscliff

5.1 Financial Considerations

The MCA, as described in the preceding chapter, highlights there is no single management option that provides a clear benefit over other alternatives for addressing coastal management at Kingscliff in the near term. All options have advantages and disadvantages that need to be carefully considered as part of a decision making process. Therefore, given sufficient funding to support any option, either Planned Retreat without retention or Terminal Protection with nourishment would likely provide an acceptable outcome in the short to medium term (up to 50 years say) if certain limitations are overcome.

From a practical perspective, however, it is expected that funding from the State Government for coastal management at Kingscliff will be limited, as there are several coastal risk hot-spots along the entire NSW coast all competing for monetary support. Thus available finances, rather than technical or socio-economic analysis, may ultimately dictate the most appropriate course of action for Council.

5.2 Timeframes for Considerations

The coastal management strategy for Kingscliff should be based on a timeframe of 30 – 50 years. The rationale for adopting this timeframe is that it approximately accords with the lifespan of existing assets located along the shoreline (e.g. SLSC, bowls club, seawalls), and is unlikely to experience significant shoreline response to projected sea level rise (although there will still be variable shoreline response to a range of climatic cycles).

Notwithstanding the above, careful consideration of implications beyond this timeframe are still necessary. In 50+ years, if seawalls remain in place at Kingscliff (in their current location), the projected rise in sea level will likely result in:

(1) Increasing volumes of sand required to nourish the beach in front of the seawalls to maintain acceptable amenity as the seawalls become more proud of the natural shoreline alignment – this will result in an increasing cost burden for maintaining sand nourishment; or

(2) The amount of the sand in front of the seawalls is permitted to diminish, thus reducing future beach amenity.

While options in this study still consider maintaining and enhancing existing coastal structures, a likely future outcome will be that relocation of assets and planned retreat along the Kingscliff foreshore will ultimately be required. The timeframe for this is not known, however, it is recognised that the pressures driving the need for planned retreat will intensify in the future as sea level rises and the natural beach profile in front of the structures deepens.

5.3 Recommended Strategy

5.3.1 Principles

The principles that underpin the most appropriate management solution for addressing current and future coastal hazards at Kingscliff are as follows:

(1) Works are affordable to both Council and State Government. This would most likely be best achieved through staging of works over a number of years and integrating works with broader asset management programs;

(2) Works do not inhibit or preclude the potential for a full suite of options to be re-considered in the future. The approach needs to remain adaptive and flexible in order to meet future needs and demands that are not yet realised;

(3) Impacts of the existing seawalls on beach amenity need to be mitigated;

(4) Public access along the beach and/or foreshore needs to be maintained;

(5) Capitalise on the remaining functional life (and significant prior financial investment) of shoreline assets in providing amenity and value to the community;

(6) Nourishment should target opportunities for adding new sand to the coastal compartment rather than just recycling sand already within the active coastal zone;

(7) Accommodate the potential to successfully secure funding for one-off large scale works, such as river dredging; and

(8) Irrespective of the presence of any terminal protection works, planned or in place, the coastal hazard lines (as updated and adopted periodically by Council) are retained and applied to future development applications to ensure that overdevelopment or overcapitalisation with the coastal risk areas does not occur

5.3.2 Approach

It is recommended that the Kingscliff foreshore be managed on a precinct basis. The intent is to manage the precincts differently based on the different values and community uses that are prevalent in each area. The multi-criteria analysis (Chapter 4) highlighted the diversity of perspectives that need to be considered when planning for future management of the Kingscliff coastline.

By establish separate precinct management areas, Council is recognising that different values and community demands can be accommodated within different sections of the coastal zone without the need for substantial compromise or trade-offs that would otherwise be required if managed as one contiguous land unit. This way, areas important to future social and economic growth can be supported by ensuring a 'fixed' shoreline, while areas beyond this can be managed more through adaptive techniques that cater for a dynamic shoreline, and thus accord more with the general precautionary principle.

The proposed precincts (refer Figure 5-1) are as follows:

Faulks Park / Lions Park Precinct: Focus is providing natural foreshores/dunal system and maintaining a sandy beach for amenity purposes;

Cudgen Headland SLSC to Kingscliff Beach Bowls Club Precinct: Focus is on a hardened foreshore that provides protection to foreshore assets of high amenity value. Limited beach amenity is accepted in this precinct; and

Jack Bayliss Park (south) Precinct: Focus is to enhance and maintain a buffer for future on-going erosion in response to the hardened foreshore to the south. Any future nourishment would reduce the extent and severity of erosion in this precinct.

For the area between Cudgen Headland and Kingscliff Beach Bowls Club, a significant amount of foreshore protection works have been constructed over the past 5 years. There is also a general desire by the community to maximise the use of existing foreshore development. A 'protection' strategy has therefore been recommended for this precinct covering the short to medium term (up to 2050), after which time a range of options should be reconsidered, including retreat and relocation. 2050 becomes an approximate trigger timeframe as it will generally reflect the end of life for existing and potential new foreshore development, and will provide sufficient time to enable a better appreciation of actual shoreline response to expected sea level rise and the associated impacts on beach amenity at Kingscliff.

The beach in front of the hardened foreshore will continue to respond to coastal processes, including a variable wave climate and increasing sea level rise. In the absence of a formal and substantial beach nourishment program, there will be periods of diminished beach amenity between Cudgen Headland SLSC and Kingscliff Beach Bowls Club. Future sea level rise will exacerbate this, although up to 2050, the extent of sea level rise and associated shoreline response is expected to be limited. A small scale nourishment program could be established with the aim of redressing temporarily lost beach amenity rather than maintaining a suitable sand buffer for protection purposes. A large scale nourishment program could also be considered on an opportunity basis, and may extend the trigger point timeframe for reconsidering options in the future (potentially beyond 2050).

Potential wave overtopping of the existing foreshore and coastal structures would need to be managed in order to limit inundation and mitigate risks to existing and future assets behind, including the Holiday Park, the SLSC and the general parkland of Faulks Park and any new open space recreation areas established along the foreshore.

Specific steps involved in implementing the recommended strategy are presented graphically in Figure 5-2 and outlined in more detail in Table 5-2.

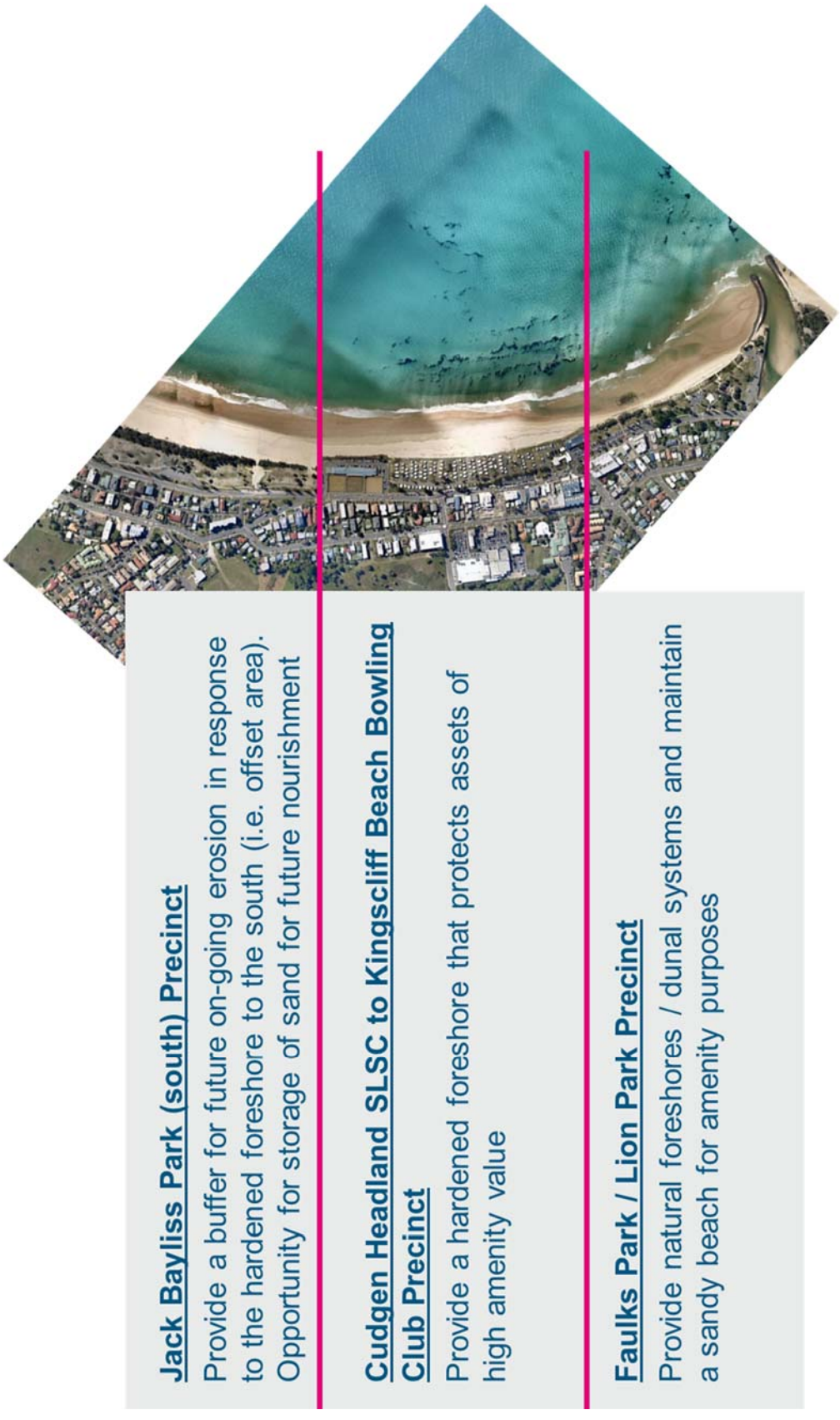


Figure 5-1 Kingscliff Foreshore Management Precincts

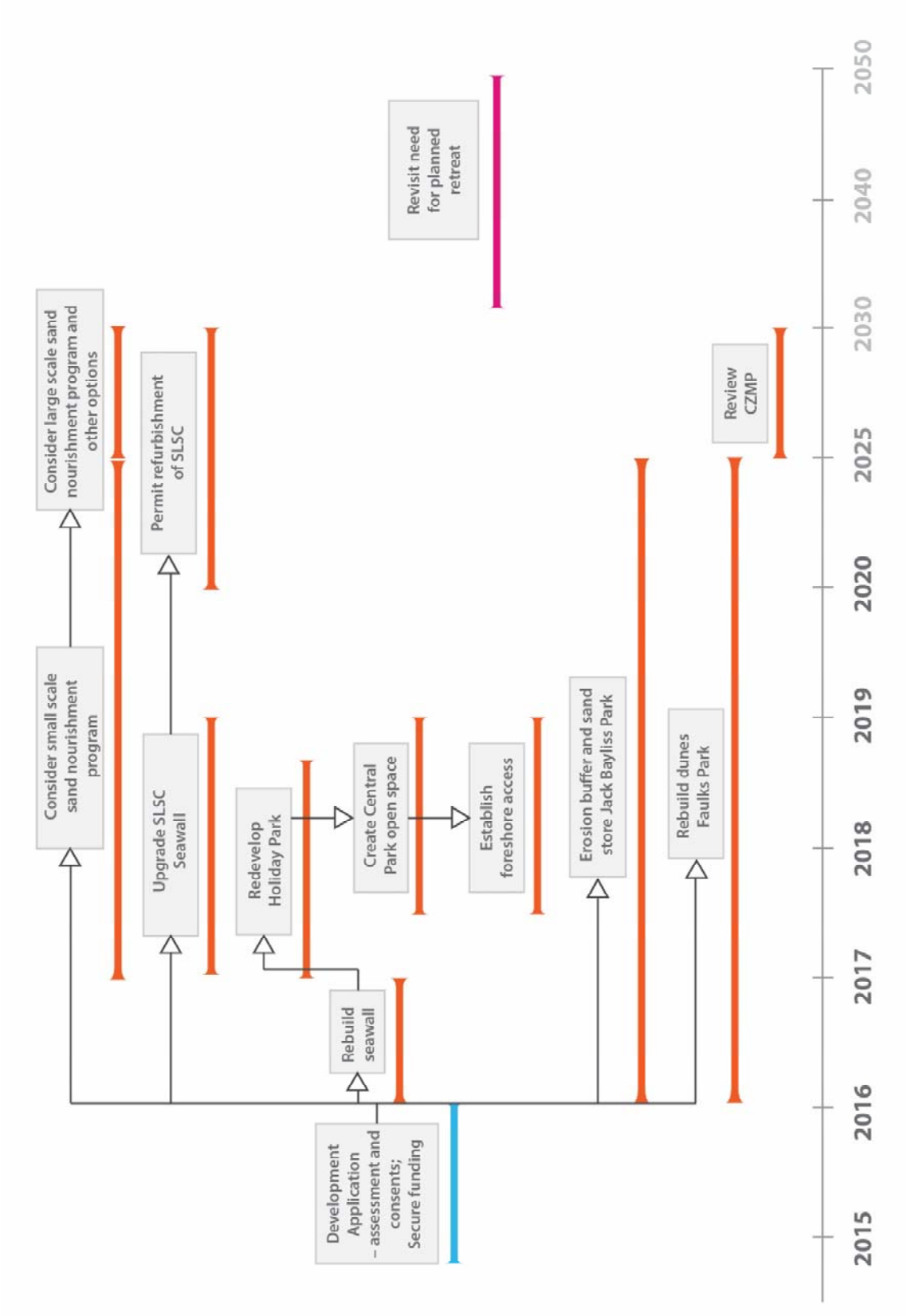


Figure 5-2 Recommended Strategy for Coastal Management (2015 – 2050)

A cost summary for the recommended strategy is presented in Table 5-1.

Table 5-1 Cost Summary for Recommended Strategy

Activities	Approximate Cost	Timeframe for expense
Coastal structures	$8.8m*	2017 - 2030
Dune rehab and foreshore access	$0.9m*	2017 - 2030
Investigations / assessments	$0.3m*	2015 – 2016
Nourishment	Depends on quantity and sand source*	2017 - 2030
Holiday Park redevelopment	$7.5m	2017 - 2018
Central Park and Facilities	$3m	2017 - 2020
Cudgen Headland SLSC refurbishment	Unknown (Club to pay)	2020 - 2030

* Eligible for part funding through the NSW Coastal Management Program.

Table 5-2 Recommended Steps for Coastal Management at Kingscliff (2015 – 2050)

Action	Timeframe	Indicative Cost	Rationale / Comment
Undertake all necessary investigations, and gain appropriate consents for undertaking works within the coastal management strategy	2015 - 2016	~$300,000	There are a number of works that would likely require development consent. A development application would therefore be required (or exemption under Part 5 of the EP&A Act), which would need to be supported by an appropriate environmental assessment document (i.e. EIS or REF). It is expected that the coastal management works could essentially be packaged into one application with integrated approval requirements.
Provide for erosion of foreshore and roll-back of coastal dunes in Jack Bayliss Park (south). Will involve re-establishment of fencing and vegetation at back of existing dunes to accommodate future landward migration.	2016 - 2020	~$100,000	The foreshore north of the Kingscliff Beach Bowls Club is already retreating. The objective of this step is to allow the erosion processes to continue without reactive pressure from the community for installing more emergency protection works. The roadway (Marine Parade) is the only major asset at risk that would require protection in the future (other parkland assets should be relocated as the dunes roll-back).
Re-establish a coastal dune along the foreshore of Faulks Park and Lions Park. Volume of sand required is approximately 20,000m^3. Source of sand can be terrestrial or marine (e.g. Tweed River or Cudgen Creek). Dunes to be vegetated and protected.	2015 – 2020	~$700,000	A new dune would be constructed on top of the existing foreshore. Seaward encroachment of the new dune should be limited to avoid short-term erosion response. Dune would be approximately two metres higher than the existing parkland levels and vegetated. The objectives of dune are to prevent overtopping and ocean inundation of the parkland, provide a barrier for sand drift off the beach, and to restore a more natural amenity where a sandy beach is backed by an established dunal system. Future sea level rise will likely result in landward migration of the shoreline. Re-establishment of a dune system allows for controlled shoreline retreat within a buffer that does not potentially compromise the amenity of the parkland behind.
Modify/protect vertical seawall in front of Cudgen Headland SLSC with an engineered wall that maximises access and amenity to the beach	2017 - 2020	$1,000,000	The existing vertical piled seawall may not be designed to withstand long periods of exposure to direct wave forces and continued exposure may compromise its structural integrity. Subject to the outcomes of an initial engineering assessment determining the structure's integrity and future resilience, this action would be to re-design and modify the wall to incorporate improved amenity and beach access north of the SLSC (e.g. stepped wall or combination of rock and concrete steps) as well as a mechanism for limiting wave overtopping of the structure.
Allow refurbishment of Cudgen Headland SLSC to extend life of development to about 2050.	2020+ (following	Not costed as part of coastal	Being exposed to a harsh coastal environment, the SLSC will require refurbishment in the short-medium term. Life expectancy of building works in this location would be relatively short (~30 years or so). Rather than a completely new

Action	Timeframe	Indicative Cost	Rationale / Comment
	SLSC seawall works)	management works	building, which will have a longer lifespan, refurbishment will allow for controlled life extension of the existing building so that options can be reviewed again in the future without being constrained by newer development (circa 2050).
Rebuild the existing rock wall between SLSC and Bowls Club reusing existing rock material with addition of rock in accordance with design specifications. This may be undertaken in two stages – Stage 1 Kingscliff Beach Holiday Park (approx. 250m long); and Stage 2 Central Park (approx. 150m long). Stage 2 would include additional community amenity facilities, such as beach access, viewing platforms and tie into the open space area developed behind.	2017 – 2020	$8.8m (including replacement of sandbag wall)	Rock wall is flexible and more suitable for top-up and repair. A design is being developed that can reuse the existing temporary rock revetment with placement of larger rock to increase the crest height and resilience of the revetment wall to address short-medium term wave overtopping risks (for 2050 design conditions). Risks associated with significant failure of the wall due to extreme events can be managed through other management actions, including an emergency evacuation plan for the Holiday Park and relocation of some assets – see below. The existing geotextile sandbag wall is temporary only and is difficult to repair once damaged. It would be more practical to replace the wall in its entirety when required. This provides a good opportunity to enhance community amenity and access, and should integrate with the modified SLSC seawall. It is possible that the sandbag seawall could be replaced at the same time as modifying the SLSC seawall and or rebuilding the existing rock wall in front of the Holiday Park, however, this would require larger costs in the shorter term and would not deliver effective use of design life of the sandbag wall.
Reconfigure and redevelop Holiday Park to allow for creation of the Central Park public space area at southern end adjacent to SLSC and Amenities Hall.	2017 – 2018	Not costed as part of coastal management works (estimate ~ $7.5m)	The Central Park area is a major component of the Kingscliff Foreshore Masterplan and will provide community access to the beach and significant amenity to the foreshore area within the location of highest demand. The level of investment in refurbishment would be based on the economic return to Council and the demand for accommodation by future tourists. Design of works should have a design life of approximately 30 years so that options can be reviewed again in the future without being constrained by such development. Any new development such as cabins that are within close proximity (say 20 metres) of the existing seawall should be relocatable if there is a risk of foreshore erosion.
Establish pedestrian walkway along the foreshore behind the existing wall crest between the SLSC and Bowls Club	2017 – 2019	$200,000	Extreme conditions may periodically damage the walkway (through wave overtopping of the wall or localised failure of the wall). Path should therefore be flexible and easily repairable. An easement of approximately 5 metres behind the top of the wall would be appropriate to locate the walkway. This walkway will provide public access along the foreshore that does not currently exist and

Action	Timeframe	Indicative Cost	Rationale / Comment
			maintain this access during periods of beach erosion with limited access along the beach.
Construct Central Park and amenities associated with the Kingscliff Foreshore Masterplan.	2017 - 2020	~ $3m	Location of community infrastructure development should avoid the area immediately behind the sandbag seawall (say within 20 metres) as this would be replaced in Stage 2 seawall (see above). Pedestrian walkway to be continued behind sand bag wall to provide continuous foreshore access between Bowls Club and SLSC.
Consider small scale sand nourishment program and/or sand relocation options	2017 – 2020	$1,000,000 per year	Options for small scale sand nourishment would be to use terrestrial sources of sand, such as from local building excavation, or extraction from beach hind dunes at Cudgen Headland in areas dedicated for future sand storage and replenishment (see below large scale option). Small scale dredging of marine sands from Cudgen Creek could also be considered providing that nourishment does not coincide with an erosive period and that sand is placed on the subaerial beach profile primarily for beach amenity purposes. It is recognised that this sand would naturally re-profile, however, the nourishment would be considered a short-term solution until sand moves back onto the beach under natural processes following erosion.
Consider large scale nourishment program and other options	2020 - 2030	$20,000,000 capital and $200,000 per year	Options for large scale exercise could be to extract sand from Area 5 (Tweed River) and temporarily store sand at Cudgen Headland. Sand can then be transferred to Kingscliff Beach on an as-required basis via a dedicated sand pumping system directly onto the beach. Other options could involve offshore sand supplies, although a change to government policy would be required to access this for beach nourishment.
Reconsider need for retreat and relocation of assets and infrastructure	~2050	$100,000 (2015 costs) Excludes cost of monitoring.	Will need to consider the actual shoreline change in response to sea level rise and other coastal processes between 2015 and 2050. This will require monitoring of beach profiles on a regular basis through the coastal compartment. All infrastructure and assets along foreshore should be close to the end of their design life and therefore opportune for relocation to alternative sites if considered appropriate.

6 References

BMT WBM (2013a), Tweed Shire Coastal Hazards Assessment, doc. ref R.B19094.001.04, November 2013.

BMT WBM (2013b), Sediment Transport Modelling of Beach Nourishment at Kingscliff, doc. ref. L.B19094.003, March 2013.

Carley, J.T., Shand, T.D., Coghlan, I.R., Blacka, M.J., Cox, R.J., Littman, A., Fitzbibbon, B., McLean, G. and Watson, P. (2010). Beach scraping as a coastal management option, 19th NSW Coastal Conference, Batemans Bay, November 2010.

Griffith University (2013), Kingscliff Foreshore Management Options - Cost Benefit Analysis, Research Report No. 143, Anning, D., Sano, M. and Tomlinson, R., August 2013.

KBR (2010), Tweed River Sand Extraction and Delivery to Kingscliff Beach - Environmental Impact Statement, doc. ref BEJ105-TD-EV-REP-0001 Rev A, May 2014.

NSW Government (2011), Coastal Erosion at Kingscliff: Advice to the Minister for the Environment. NSW Coastal Panel, doc. ref. OEH 2012/0492, December 2011.

Short, A D. (1999), Embayed and structurally controlled beaches. In Short, A.D (ed) *Handbook of Beach and Shoreface Morphodynamics.* John Wiley and Sons, Chichester, 230-250.

Umwelt (2005a), Tweed Shire Coastline Management Study Stage 2, Management Objectives Coastline Management Study, doc. ref. 1656/R03/V4, February 2005.

Umwelt (2005b), Tweed Shire Coastline Management Plan, doc. ref. 1656/R04/V4, May 2005.

WBM Oceanics (2001), Tweed Coastline Hazard Definition Study – Final Report, doc. ref. R.B12876.002.03, October 2001.

Worley Parsons (2008), Kingscliff Beach Foreshore Protection Works Environmental Impact Statement, doc. ref. 6349.06 Rev C, Juy 2008.

WRL (2012), Kingscliff Beach Foreshore Protection Works – Alternative Terminal Seawall Designs and Beach Nourishment, Coghlan, Carley, J.T., Shand, T.D., I.R., Blacka, M.J., Cox, R.J., Davey, E.K. and Blumberg, G.P., WRL report 2011/25, December 2012.

WRL (2013), Concept Designs for a groyne field on the Far North NSW Coast, Coghlan, I., Carley, J.T., Cox, R.J., Davey, E.K. Blacka, M.J. and Lofthouse, J., 2013.

Appendix A Legislative Framework

A.1 NSW Coastal Management Framework

Coastal management in NSW is guided by the following legislation:

- *NSW Coastal Protection Act 1979*;
- NSW Coastal Policy (1997);
- *State Environment Planning Policy No. 71 – Coastal Protection*; and
- Amendments relating to coastal protection within the *Coastal Protection Act, Local Government Act 1993 and Environmental Planning and Assessment Act 1979.*

Other guidance for land use planning in the coastal zone is given by the *Coastal Design Guidelines for NSW* (DP, 2003) and the *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (DP, 2010).

The *Coastal Protection Act 1979* and *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010) (the CZMP Guidelines) outlines the requirements for the preparation of CZMPs.

A.2 Key Legislation, Policies and Guidelines

A summary of the key local, state and federal legislation, policies and guidelines pertaining to management of this study's coastal zone is provided below.

The consideration of other legislation in managing the coastal zone is vital and consideration should be given to the following legislation where relevant: *Environment Protection and Biodiversity Conservation Act 1999*, the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994*, the *National Parks and Wildlife Act 1974*, and the *Water Management Act 2000*.

A.2.1 Coastal Protection Act 1979

The NSW *Coastal Protection Act 1979* (the CP Act) provides guidance on the use, occupation and development of the coastal zone in NSW while promoting sustainable use of the areas. The CP Act also facilitates the execution of emergency and permanent coastal protection works.

The objects of the CP Act are to provide for the protection of the coastal environment of the State for the benefit of both present and future generations and, in particular:

- To protect, enhance, maintain and restore the environment of the coastal region, its associated ecosystems, ecological processes and biological diversity, and its water quality;
- To encourage, promote and secure the orderly and balanced utilisation and conservation of the coastal region and its natural and man-made resources, having regard to the principles of ecologically sustainable development;
- To recognise and foster the significant social and economic benefits to the State that result from a sustainable coastal environment, including:
    - Benefits to the environment, and

- Benefits to urban communities, fisheries, industry and recreation, and
- Benefits to culture and heritage, and
- Benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water;

- To promote public pedestrian access to the coastal region and recognise the public's right to access;
- To provide for the acquisition of land in the coastal region to promote the protection, enhancement, maintenance and restoration of the environment of the coastal region;
- To recognise the role of the community, as a partner with government, in resolving issues relating to the protection of the coastal environment; and
- To ensure co-ordination of the policies and activities of the Government and public authorities relating to the coastal region and to facilitate the proper integration of their management activities.

The CP Act allows the Minister for the Environment to direct a council with land within the coastal zone to prepare a Coastal Zone Management Plan, and gives directions as to how such Plans shall be prepared, approved, gazetted and amended where necessary. This Coastal Zone Management Plan is being prepared in accordance with the CP Act.

Recent media announcements by the Office of Environment and Heritage (OEH) in November 2014 has indicated that the CP Act will be replaced by a new coastal management Act that is "less complex and a better fit with land use planning and local government legislation". The new act will "put coastal management needs at the core of councils' planning responsibilities". The new legislation is expected to come before Parliament by the end of 2015.

A.2.1.1 Changes to the Coastal Protection Act and other legislation Amendment Bill 2010

Amendments were made in Section 55M of the CP Act and SEPP (Infrastructure) 2007 (Clause 129A) that permit any person, including private landholders, to erect long term coastal protection works with development consent, with consent contingent on the application demonstrating that potential offsite impacts can be managed (for example, with beach nourishment). The private landholders who submit such applications would fully fund the coastal protection works, with no requirement for councils or the state to assist with funding.

Amendments were made to Part 79C of the *Environmental Planning and Assessment Act 1979* (EPA Act) and SEPP (Infrastructure) 2007 (Clause 129A) that require a consent authority, in determining a development application for coastal protection works, to take into consideration the provisions of any coastal zone management plan that applies to the land to which the development application relates (in addition to matters given in Clause 8 of SEPP 71). In this case, development applications may be refused where such works are not stated to be an action in the adopted CZMP. If there is no CZMP in place, the NSW Coastal Panel shall determine the development.

For public authorities (e.g. Council), new coastal protection works (excluding seawalls or beach nourishment) are permitted without consent under SEPP (Infrastructure) 2007 (Clause 129) on the open coast or entrance to a coastal lake, provided they consider the provisions of any CZMP relating

to the land, or where there is no CZMP, notify the NSW Coastal Panel and take into consideration any response received from them within 21 days of notification. The definition of new coastal protection works excluded temporary coastal protection works. Under Clause 129, seawalls or beach nourishment are permitted with consent.

Amendments were made to Section 553B of the *Local Government Act 1993* (LG Act) to allow local councils to levy a Coastal Protection Service Charge to maintain and repair coastal protection works or to manage the impacts of coastal protection works. The charge covers Council's costs for maintaining the works and restoring the beach if the works cause erosion (which may include beach nourishment). Eligible coastal protection works for the Coastal Protection Service Charge (CPSC) include:

- Works voluntarily constructed by a benefiting landowner (or landowners);
- Works constructed jointly by a public authority (e.g. Council) with voluntary contributions from benefiting landowners;
- Works that existed before section 496B of the LG Act commenced, where the landowner or a previous landowner voluntarily agree (in writing) to pay the CPSC; and
- Works that existed before section 496B of the LG Act commenced, where the landowner has voluntarily agreed to upgrade the works. A pro-rata CPSC then applies based on the incremental additional costs of maintaining the works and managing their off-site impacts.

Where works are implemented by a Council, and the Council chooses to contribute to the cost of the works, then the Council also must accept liability for a portion of the future coastal protection service charge for maintenance for the life of the works.

The annual charge is attached to the land title and becomes the responsibility of all future land owners for the life of the protection works. The amount of the charge is regularly reviewed depending on the cost of maintaining the works and in ameliorating any adverse impacts. The CPSC Guidelines provide further guidance, including how it can be used to fund the protection of private property by those property owners deemed to benefit from the works and how the amount of the rate should be calculated over the design life of the works.

Amendments were made under Part 4C of the CP Act outlining emergency coastal protection works that landholders or public authorities are permitted to carry out. The *Coastal Protection Amendment Act 2012* has now modified the allowances for such works, as detailed below.

All of the above changes provide a mechanism for Councils to allow the construction of protection works on private land to protect private property, and defer the responsibility and costs for construction to the land owners. Further, Councils can ensure that maintenance and amelioration of any adverse impacts is also borne by the land owners into the future, through the Coastal Protection Service Charge. There is no responsibility on local government or State Government to bear any of the cost for protecting private property.

A.2.1.2 Coastal Protection Amendment Act 2012

This act permitted modifications to Part 4C of the CP Act relating to coastal protection works. The key change was renaming such works from 'emergency' to 'temporary' protection works, to enable

authorised landholders to erect such works regardless of the impending occurrence of a storm, in response to coastal erosion. The works are not permitted on estuarine foreshores.

A Code of Practise is associated with the placement of temporary coastal protection works, revised in 2013. The Code of Practise outlines the height, materials and form for the placement of temporary coastal protection works, and the procedure for removal and remediation of such works. The Code of Practise contains a Schedule listing those locations at which temporary works are authorised. It is assumed that temporary works are not permitted at locations not listed in the Schedule.

The Amendment Act 2012 also simplified the process for landholders to gain approval to erect such works. Private landowners are now permitted to place temporary coastal protection works on their land without approval or a certificate from the local council or state government. Private landowners are also permitted to place these works on public land, provided they obtain a certificate for these works, and may keep such works in place for up to 2 years.

The fines for inappropriate placement of sand or sandbags (such as associated with the erection of temporary coastal protection works) have been halved, to reflect the lesser nature of such incidences. The heavy fines for placement of other non-beach materials (e.g. rocks, car bodies, bricks etc.) remain as per the 2010 CP Act amendments.

The Office of Environment and Heritage (OEH) or Councils (if they have authorised officers for this task) may order the removal of the temporary protection works where it is evident that such works are having detrimental impacts upon adjacent land or on beach amenity.

A.2.2 Crown Lands Act 1989

The *Crown Lands Act 1989* (CL Act) provides for the administration and management of Crown land for the benefit of the people of NSW. The CL Act provides principles for the proper assessment, development, reservation or dedication and conservation of Crown Lands.

Waterbodies such as beaches and foreshores and estuaries / creeks / lagoons below the mean high water mark are designated as Crown Land and managed by the Department of Primary Industries Crown Lands Division (CLD). In addition to this, there are other Crown reserves in the Kingscliff coastal zone for which Council is the reserve trust manager or trustee appointed by the Minister for Lands to care, control and manage the land in accordance with its public purpose and the principles of Crown Lands management (Section 11 of the Act).

The principles of Crown Land management as defined in Section 11 of the Act are: environmental protection principles be observed in relation to the management and administration of Crown land; natural resources of Crown Land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible; public use and enjoyment of Crown lands be encouraged; where appropriate, multiple uses of Crown land be encouraged; and where appropriate, Crown Land be used and managed in such a manner that the land and its resources are sustained in perpetuity.

In addition to these principles, the objectives of the Coastal Crown Lands Policy 1991 apply to Crown lands within the coastal zone. The policy sets specific objectives for conserving the environmental and cultural qualities of coastal Crown Land, retaining in public ownership coastal lands that are environmentally sensitive and / or required for public purpose, and providing use of coastal crown

lands for recreation, tourism, residential and commercial development with due regard to the nature and consequences of coastal processes.

On direction from the Minister, a Crown Lands Plan of Management (POM) is required to be prepared and adopted (in accordance with Division 6 of the *Crown Lands Act 1989*). The POM shall identify the key attributes and values of the area, general physical improvements to enhance the values and specify the permissible uses for the reserve, as outlines in Section 122 (7) of the CL Act.

A.2.2.1 Tweed Coast Regional Crown Reserve Plan of Management

The Plan of Management (POM) provides the strategic framework for the Regional Crown Reserve. The POM is a statutory plan under Division 6, Sections 112-116 of the *Crown Lands Act 1989*, where provisions are made for referral and consultation, public exhibition and formal adoption. The POM combines information about the reserve, its values, current and proposed future use and management issues.

The POM was developed through the establishment of a Project Reference Group (the PRG) who worked together to develop a vision, objectives and management strategies for the desired future state of the Reserve. The POM designates coastal management precincts within the Tweed Shire. The study area is located within two coastal management precincts: Kingscliff and Fingal–Tweed Heads. Key management issues for the Kingscliff precinct is the combined impacts of coastal processes of coastal erosion and long term coastal recession; coastal buffers to development; and vegetation management. Key management issues for the Fingal–Tweed Heads management precinct (Fingal Peninsula section) are the degradation of sand dunes and riverbanks.

A.2.3 Local Government Act 1993

The *Local Government Act 1993* (the LG Act) creates local governments and grants them the power to perform their functions, which involve management, development, protection, restoration, enhancement and conservation of the environment for the local government area. The functions of the local government are to be performed in a manner that are consistent with and promote the principles of ecologically sustainable development. Section 8 of the LG Act defines Councils charter and functions.

Under Section 733 of the LG Act, Council has a duty of care to inform its local constituents of known risks in order to receive an exemption from liability for acting in good faith with respect to known hazards (including coastal hazards). Under Section 733(4) of the LG Act, Council is considered to have acted in good faith where decisions are based substantially in accordance with the relevant manual for the hazard, in this case, the CZMP Guidelines.

The assessment of sea level rise is a requirement of the Guidelines for Preparing Coastal Zone Management Plans (OEH, 2013), upon which the LG Act exemption from liability is based. Similarly, object (h) of the *Coastal Protection Act 1979* is “to encourage and promote plans and strategies for adaptation to coastal climate change impacts, including projected sea level rise”. In this case, incorporation of projections for sea level rise based upon the best available information is a required component for the Kingscliff CZMP, with or without state prescribed sea level rise benchmarks.

The service functions of local councils (defined in Chapter 6 of the LG Act) includes the classification, use and management of public land, including the objectives for management of the Community Land owned by a Council (i.e. that is not Crown Land).

Plans of Management (POM) for community land must be prepared under Section 35 of the LG Act. Section 35 of the LG Act provides that community land only be used in accordance with the Plan of Management applying to the parcel of community land; any law permitting the use of the land for a specified purpose or otherwise regulating the use of the land; and the provisions of Division 2 Chapter 6 of the LG Act.

Community land can be divided into a range of categories under Section 36 of the LG Act, and each of these categories have their own core objectives specified under the Act. The division of community lands is important as the LG Act requires Council to only grant a lease, licence or another estate (other than in respect of public utilities) for a purpose consistent with the core objectives of the category of that community land.

A.2.4 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) is the key NSW legislation for planning and land use. The EPA Act provides a system of environmental planning and assessment for NSW, and involves developing plans to regulate competing land uses, through 'environmental planning instruments'. The EPA Act establishes three types of environment planning instruments (EPI):

- State Environmental Planning Policies (SEPP);
- Regional Environmental Plans (REP); and
- Local Environmental Plans (LEP).

Approval processes for "development" and "works" in NSW are provided for in Part 3A (now repealed), Part 4, Part 5 and Part 5A of the EPA Act.

The relevant SEPPs are discussed below. The Tweed LEP outlines land use zones across the entire LGA and permitted development (with and without consent) within those zones, including the coastal zone. There are no former REPs that are considered specifically relevant to management of the coastline within the study area.

A.2.4.1 State Environmental Planning Policy No. 71 – Coastal Protection

The NSW Government is currently revising the planning system in NSW (refer A New Planning System for NSW White Paper, NSW Government, 2013), which will involve the repeal of all State Environmental Planning Policies (SEPPs), with the new planning legislation expected to come into force 2014/2015. The SEPPs are expected to be rolled into all local planning provisions (i.e. LEPs) as relevant. Until that time, however, the SEPPs remain in force.

State Environmental Planning Policy No. 71 – Coastal Protection (SEPP 71) aims to protect and manage the natural, cultural, recreational and economic attributes of the NSW coast. SEPP 71 aims for development in the NSW coastal zone to be appropriate and suitably located, in accordance with the principles of the Ecologically Sustainable Development (ESD). The policy provides for: the

protection of and improvement to public access compatible with the natural attributes coastal foreshores; and protects and preserves Aboriginal cultural heritage, visual amenities of the coast, the beach environment and amenity, native coastal vegetation, marine environment of New South Wales, and rocky platforms.

SEPP 71 applies to all lands within the coastal zone of NSW, which is defined on gazetted maps under the SEPP, therefore, all of the land in the study area will be included in the Kingscliff CZMP. SEPP 71 provides matters for consideration in Clause 8 that are to be taken into account: by a council when preparing its LEP for land within the coastal zone; and by a consent authority (e.g. Council) when determining a development application on land within the coastal zone.

SEPP 71 also outlines the conditions for which the Minister for Planning becomes the consent authority for 'significant coastal development', that is, development on land within 100 m of and below mean high water mark of the sea, a bay or an estuary. Development applications received by Council on such lands must be sent to the Director-General of Planning, and Council is required to take any additional matters specified by the Director-General into account when determining the application (in addition to the 'matters for consideration' given in Clause 8).

SEPP 71 also outlines development controls in Part 4 for which consent cannot be granted to applications that, in the opinion of the consent authority:

- Will or is likely to impede or diminish to any extent the physical, land based right of access of the public to or along the coastal foreshore;
- Where effluent is proposed to be disposed of by means of a non-reticulated system, will or is likely to have a negative effect on the water of the sea or any nearby beach, or an estuary, a coastal lake, a coastal creek or other similar body of water, or a rock platform; or
- Will or is likely to, discharge untreated stormwater into the sea, a beach, or an estuary, a coastal lake, a coastal creek or other similar body of water, or onto a rock platform.

A master plan is to be adopted by Minister for Planning (or otherwise waived the need for a master plan as per Clause 18), prior to Council granting consent for subdivision of land:

- Within a residential zone or rural residential zone if part or all of the land is in a 'sensitive coastal location'; or
- Within a residential zone that is not within a 'sensitive coastal location' into more than 25 lots, or 25 lots or less, if the land proposed to be subdivided and any adjoining or neighbouring land in the same ownership could be subdivided into more than 25 lots; or
- Within a rural residential zone that is not identified as a sensitive coastal location into more than 5 lots.

SEPP 71 defines 'sensitive coastal location' to mean land within:

- 100 m above mean high water mark of the sea, a bay or an estuary;
- A coastal lake, or within 100 m of the water's edge of a coastal lake;
- A declared Ramsar Wetland, or within 100 m of a declared Ramsar Wetland;

- A declared World Heritage Property, or within 100 m of a declared World Heritage Property;
- A declared aquatic reserves under the *Fisheries Management Act 1994*, or within 100 m of such;
- A declared marine park under the *Marine Parks Act 1997*, or within 100 m of a marine park;
- Coastal lakes (which includes all four of Gosford's Coastal lagoons), Ramsar wetlands and World Heritage areas;
- Marine parks and aquatic reserves under the *Fisheries Management Act*; land within 100 metres of any of the above;
- Within 100 m of land reserved under the *National Parks and Wildlife Act 1974*;
- Within 100 m of SEPP 14 Coastal Wetlands; and
- Residential land within 100 m of SEPP 26 Littoral Rainforests.

A.2.4.2 SEPP No. 14 – Coastal Wetlands

SEPP Coastal Wetlands aims to protect wetlands and wetland species by limiting the development of wetlands along the NSW coast. Wetlands listed under SEPP 14 are of close proximity to the study area. Wetlands associated with Cudgen Creek lie south of the study area while the several SEPP 14 wetlands are located around the southern half of Wommin Lake, inland of Dreamtime Beach, and extend further south adjacent to Fingal Road, the Pacific Highway and north east of Chinderah Bay Drive. All areas are outside of Crown Land.

A.2.4.3 SEPP No. 26 – Littoral Rainforest

SEPP Littoral Rainforest aims to conserve areas of Littoral rainforest species that are in their natural state by restricting new development within a 100 m buffer zone. Littoral rainforest species listed under SEPP 26 are mapped to the south of Fingal Head at the northern end of Dreamtime Beach.

A.2.4.4 SEPP (Infrastructure) 2007

SEPP (Infrastructure) 2007 provides a consistent planning regime for infrastructure and the provision of services across NSW, including consultation with relevant public authorities during the assessment process. The intent of the SEPP is to support greater flexibility in the location of infrastructure and service facilities along with improved regulatory certainty and efficiency for the State.

Division 25 of the SEPP outlines development permitted with and without consent for the purpose of 'waterway or foreshore management activities', which are defined as:

(a) Riparian corridor and bank management, including erosion control, bank stabilisation, resnagging, weed management, revegetation and the creation of foreshore access ways;

(b) Instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows or tidal flows for ecological purposes;

(c) Coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways;

(d) Coastal protection works;

(e) Salt interception schemes to improve water quality in surface freshwater systems; and

(f) Installation or upgrade of waterway gauging stations for water accounting purposes.

Development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority (e.g. Council) without consent on any land, which may include:

- Construction works;
- Routine maintenance works;
- Emergency works, including works required as a result of flooding, storms or coastal erosion (noting that this excludes emergency coastal protection works within the meaning of the *Coastal Protection Act 1979*);
- Environmental management works; and
- New coastal protection works on the open coast or entrance to a coastal lake (despite Clause 129A, see below), provided the public authority considers the provisions of any CZMP relating to the land on which the works are proposed, or where there is no CZMP, notify the NSW Coastal Panel and take into consideration any response received from them within 21 days of notification. The 'new coastal protection works' excludes beach nourishment or sand placement, presumably so that councils can undertake beach nourishment without requiring such action to be a stated action in the CZMP or gaining approval from the Coastal Panel.

Thus in the study area, Council is permitted to undertake activities such as beach nourishment, environmental rehabilitation, seawalls (provided this is consistent with the CZMP) etc., provided they undertake a Review of Environmental Factors (REF) (under Part 5 of the EPA Act) and gain any approvals / licences required under any other Acts relating to the land or works (e.g. *Crown Lands Act 19*89, *Fisheries Management Act 1994*, *Water Management Act 2000* etc.).

Under Clause 129A, development for the purposes of a seawall or beach nourishment may be carried out by any person with consent on the open coast or entrance to a coastal lake. In determining the application, the consent authority must consider the provisions of any CZMP relating to the land on which the works are proposed, the matters stated in Clause 8 of SEPP 71, and any guidelines for assessing and managing the impacts of the works issued by the Director-General (noting that preconditions for granting consent for coastal protection works are stated in Section 55M of the *Coastal Protection Act 1979*).

A.2.5 NSW Coastal Policy 1997

The NSW Coastal Policy 1997 (the Policy) sets the strategic framework for coordinated, integrated and ecologically sustainable development of the coast. The Policy details nine goals and associated objectives and strategic actions for achieving ecologically sustainable development in NSW. Preparation of coastal zone management plans is one of the strategic actions given by the Policy, with the plans to be consistent with the Policy's goals and objectives.

The nine goals of the NSW Coastal Policy (refer to policy for objectives associated with these goals) are:

(1) To protect, rehabilitate and improve the natural environment;

(2) To recognise and accommodate natural processes and climate change;

(3) To protect and enhance the aesthetic qualities of the coastal zone;

(4) To protect and conserve cultural heritage;

(5) To promote ecologically sustainable development and use of resources;

(6) To provide for ecologically sustainable human settlement;

(7) To provide for appropriate public access and use;

(8) To provide information to enable effective management; and

(9) To provide for integrated planning and management.

A.2.6 Tweed Local Environmental Plans

The Tweed Shire has three Local Environmental Plans:

- Tweed Local Environment Plan 2014;
- Tweed Local Environment Plan 2000; and
- Tweed City Centre Local Environment Plan 2012.

The Tweed Local Environmental Plan (LEP) 2000 was gazetted in April 2000 and provides land use zonings and legal provisions for development and environmental protection throughout the Shire.

In April 2014, the Tweed Local Environment Plan 2014 came into effect and provides local environmental planning provisions for land in accordance with the requirements of the Standard Instrument (Local Environmental Plans) Order 2006. The LEP 2014 repeals the North Coast Regional Environmental Plan, SEPP 1: Development Standards and SEPP (Rural Lands) 2008 Clause 9 to the land to which the LEP 2014 applies. The intent of SEPP (Rural Lands) 2008 Clause 9 has been integrated into the LEP 2014 Clause 4.2.

The LEP 2014 excludes the following areas:

- The Tweed Central Business District which is subject to the Tweed City LEP 2012;
- The areas mapped as “Deferred Matters” in the LEP 2014, to which the LEP 2000 will continue to apply (see below); and
- Kings Forest and the Rise (Bilambil) development sites, which are subject to State Environmental Planning Policy (SEPP) Major Development 2005.

The Tweed Shire coastline encompassing Dreamtime Beach and Kingscliff Beach are areas mapped as “Deferred Matters” from the LEP 2014 (referred to in figures Land Zoning Map Sheets LZN022 and LZN023 of the LEP 2014); the LEP 2000 will therefore continue to apply to these areas. The Tweed City Centre Local Environment Plan 2012 is not applicable to the study area.

Both the LEP 2014 and 2000 set out specific aims for the use and development of land in the Tweed, including the coastline. The LEP establishes the zonings for all land in the LGA, and the objectives and permitted development (with or without consent) given for each land zone. Each zone identified

by the LEP has an associated land use table which identifies the various types of development permitted with and without consent; or development prohibited. Most land along the Kingscliff coastline is zoned for public recreation (mostly public and some private) and Deferred Matter.

Part 7 of the LEP 2014 includes coastal risk planning (Part 7.5) as additional local provision and includes the study area. The objectives of this clause are:

(a) To avoid significant adverse impacts from coastal hazards,

(b) To ensure uses of land identified as coastal risk are compatible with the risks presented by coastal hazards,

(c) To enable the evacuation of land identified as coastal risk in an emergency,

(d) To avoid development that increases the severity of coastal hazards.

The clause states that development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development:

(a) Is not likely to cause detrimental increases in coastal risks to other development or properties, and

(b) Is not likely to alter coastal processes and the impacts of coastal hazards to the detriment of the environment, and

(c) Incorporates appropriate measures to manage risk to life from coastal risks, and

(d) Is likely to avoid or minimise adverse effects from the impact of coastal processes and the exposure to coastal hazards, particularly if the development is located seaward of the immediate hazard line, and

(e) Provides for the relocation, modification or removal of the development to adapt to the impact of coastal processes and coastal hazards, and

(f) Has regard to the impacts of sea level rise.

Similar to the above section, Part 5 of the LEP 2014 states that any proposed development will not:

(a) Be significantly affected by coastal hazards, or

(b) Have a significant impact on coastal hazards, or

(c) Increase the risk of coastal hazards in relation to any other land.

A.2.7 Tweed Development Control Plan 2008

The Tweed Development Control Plan 2008 (DCP) contains detailed guidelines that illustrate the controls that apply to a particular type of development or in a particular area. A DCP implements the Far North Coast Regional Strategy (see below) and supplements the LEPs. The DCP is made according to the *Environmental Planning and Assessment Act 1979*. The purpose of the DCP is to:

(1) Achieve development that is consistent with the social, economic and environmental values of the shire

(2) Promote ecologically sustainable development and aims to provide a safe living and working environment

(3) Form part of a range of documents that provides a guide towards a more sustainable future for the Tweed Shire

(4) Provide design issues, performance criteria and standards for development both on a shire wide basis and those that relate specifically to particular development areas.

Section B9 of the DCP, Tweed Coast Strategy, ensures that due consideration is given to all relevant physical, social and economic factors affecting the land and includes the study area. The section provides the framework for the essential planning for the coast to:

- Accommodate the anticipated development of the coast
- Meet the requirements of the current and future communities
- Protect the essential values of the coast
- Coordination of infrastructure provision
- Environmental Protection
- Sustainable development
- Integration of development.

Section B25 of the Tweed DCP, Coastal Hazards, was adopted by Council in November 2011 and applies to any development on land seaward of the Immediate Hazard Line (referred to on Figures 1.1 to 1.26 inclusive of the DCP). The aim of this section is to:

- Provide guidelines for the development of the land having regard to minimising the coastal hazards risks (a function of likelihood and consequence) to development on land in proximity to the Tweed Coast
- Establish if the proposed development or activity is appropriate to be carried out, and the conditions of development consent that should be applied if it is to be carried out, having regard to the coastal hazard lines established in the Tweed Coastline Hazard Definition Study 2001 (as amended)
- Minimise the risk to life and property from coastal hazards associated with development and building on land that is in proximity to the Tweed Coast
- Maintain public access to public land on the Tweed Coast.

Development Applications in different hazard zones require different types of supporting information in relation to coastal hazards risk. Supporting information may include:

- Specialist coastal engineering report
- Geotechnical report
- Structural engineering report
- Survey Plan

- Coastal Risk Management Report (all development on land that is seaward of the 2100 line).

Following the making of the LEP 2014, the Tweed DCP 2008 includes a number of references to the LEP 2000 and many definitions which may no longer apply, or may contradict the LEP 2014. The provisions of the LEP 2014 take precedence over any provisions of the Tweed DCP 2008.

A.2.8 Tweed Shire Coastline Management Plan 2005

The Tweed Shire Coastline Management Plan (Umwelt, 2005b) was adopted by Council in 2005 and provides an integrated management planning framework that aims for a balance between the long term use of the coastline and its conservation.

The plan was developed in three stages. Stage 1 identified the values that make the Tweed coastline important in a local, regional and national sense, and explored the issues that need to be addressed to maintain those values. Following the quantification of coastline hazards and values of the Tweed, Stage 2 involved the preparation of the Tweed Shire Coastline Management Study. The study focused on the development of management objectives and identification of management options.

Stage 3 included the development of the Coastline Management Plan which has provided strategic and practical guidance for future management of the Tweed coastline. The plan identifies the implementation of a protection strategy in the form of a 500 m long rock seawall combined with beach nourishment as the primary management action for Kingscliff Beach.

A.2.9 Tweed Community Strategic Plan 2013/2023

The Tweed Community Strategic Plan 2013/2023 (the TCS Plan) is the peak visionary document which identifies and documents the main priorities and aspirations for the future of Tweed Shire covering a 10-year period. The TCS Plan has been adapted from the Tweed Community Strategic Plan 2011/2021, which was produced with substantial active involvement by the community.

The State Government has required all NSW councils to implement the framework, to ensure local government operations and strategic planning are meeting the needs of the community. The plan is the visionary document at the highest level of a new integrated planning and reporting framework implemented by Council in late 2010 and early 2011. The new framework requires Tweed Shire Council to have in place: a 10-year Community Strategic Plan, a four-year Delivery Program and an annual Operational Plan.

During the engagement process of the 2011/2021 TCS Plan, the community informed Council of their highest rating priorities for their vision for the Tweed for the next 10 years. ‘Caring for the Environment’ was voted as one of the priorities and is a theme of the 2013/2023 TCS Plan. Key objectives set out in the TCS Plan in relation to the Tweed coastline include:

- Protect the environment and natural beauty of the Tweed (Objective 4.1):
  - Retain open space and greenbelts for conservation and for all people to enjoy
  - Protect, regulate and maintain natural assets (the coastline, coastal and inland waterways, biodiversity, bushland and scenic landscapes) for current and future generations
  - Manage and regulate the natural and built environments.

- Manage the Tweed coastline to ensure a balance between utilisation and conservation (Objective 4.4):
  - Recognise and accommodate natural processes and climate change
  - Protect and enhance the aesthetic qualities of the coastal zone
  - Provide for appropriate public access and use.

A.2.10 Guidelines for Preparing Coastal Zone Management Plans (2010)

Guidelines for preparing Coastal Zone Management Plans (CZMP Guidelines) were finalised by OEH in December 2010, and adopted in early 2011. The CZMP Guidelines specify the requirements for preparing a coastal zone management plan in accordance with the *Coastal Protection Act 1979*, including requirements additional to those specified in the CP Act. The guidelines specify the use of a risk based approach to preparation of a CZMP and actions for managing coastal hazards. The CZMP Guidelines documents the ISO 31000:2009 risk process which requires the likelihood and consequence of coastal risks to be analysed and combined to determine the level of risk. The highest risks are then treated as a priority over lower risks.

Under Section 733 of the *Local Government Act 1993*, councils are taken to have acted in 'good faith' and receive an exemption from liability where their actions were done substantially in accordance with the coastal management principles given in the CZMP Guidelines. Intended changes to the section 117 of the *Environmental Planning and Assessment Act 1979* will require the CZMP Guidelines be taken into consideration when councils prepare their local environment plans (LEPs).

The *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010) replace the Coastline Management Manual (and other documents).

A.2.11 Sea Level Rise Benchmarks

Previously, the NSW Sea Level Rise Policy Statement (DECCW, 2009) (the Policy Statement) set benchmarks of a 0.4 metre rise in sea level by 2050 and 0.9 metre rise by 2100 above 1990 sea mean sea level as the standard to be used in all forms of coastal assessment and planning, including coastal hazards definition studies. These values represent the best estimates for the NSW Coast at the present time, as they are based upon reports by the IPCC (2007) and CSIRO (2007).

The NSW Government repealed the NSW Sea Level Rise Policy Statement 2009 in September 2012, meaning that the state-wide sea level rise benchmarks no longer apply to coastal assessments. The NSW Government indicated that local councils "have the flexibility to determine their own sea level rise projections to suit their local conditions" (NSW Environment and Heritage, 2012). In lieu of sea level rise benchmarks, the OEH has suggested that Councils should adopt sea level rise values that are widely accepted by competent scientific opinion, or indeed, investigate a range of sea level rises (pers. comm., Mike Sharpin, OEH, 25th October, 2012).

As discussed previously in Section A.2.3, the *Local Government Act 1993* under Section 733(2), states Council has a duty of care to inform its local constituents of known risks in order to receive an exemption from liability for acting in good faith with respect to coastal hazards. Under Section 733(4) of that Act, Council is considered to have acted in good faith where decisions are based substantially

in accordance with the relevant manual, in this case, the Guidelines for Preparing Coastal Zone Management Plans (OEH, 2013).

Tweed Shire Council therefore has a legal imperative to consider sea level rise, as it is a known and measured coastal process that will affect the likelihood of land being affected by coastal hazards. The assessment of sea level rise is a requirement of the Guidelines for Preparing Coastal Zone Management Plans (OEH, 2013), upon which the *Local Government Act* 1993 exemption from liability is based. Furthermore, it is a requirement of the CZMP Guidelines upon which the good faith exemption is based for the impacts of sea level rise upon risks from coastal hazards to be investigated (refer p 10, OEH, 2013). Similarly, object (h) of the *Coastal Protection Act 1979* is "to encourage and promote plans and strategies for adaptation to coastal climate change impacts, including projected sea level rise".

BRW. CLIENT CHOICE AWARDS 2013
australia's best professional service firms
WINNER

BMT WBM

BMT WBM Bangalow	6/20 Byron Street, Bangalow 2479 Tel +61 2 6687 0466 Fax +61 2 66870422 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Brisbane	Level 8, 200 Creek Street, Brisbane 4000 PO Box 203, Spring Hill QLD 4004 Tel +61 7 3831 6744 Fax +61 7 3832 3627 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Denver	8200 S. Akron Street, #B120 Centennial, Denver Colorado 80112 USA Tel +1 303 792 9814 Fax +1 303 792 9742 Email denver@bmtwbm.com Web www.bmtwbm.com
BMT WBM London	International House, 1st Floor St Katharine's Way, London E1W 1AY Email london@bmtwbm.co.uk Web www.bmtwbm.com
BMT WBM Mackay	PO Box 4447, Mackay QLD 4740 Tel +61 7 4953 5144 Fax +61 7 4953 5132 Email mackay@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Melbourne	Level 5, 99 King Street, Melbourne 3000 PO Box 604, Collins Street West VIC 8007 Tel +61 3 8620 6100 Fax +61 3 8620 6105 Email melbourne@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Newcastle	126 Belford Street, Broadmeadow 2292 PO Box 266, Broadmeadow NSW 2292 Tel +61 2 4940 8882 Fax +61 2 4940 8887 Email newcastle@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Perth	Level 3, 20 Parkland Road, Osborne, WA 6017 PO Box 1027, Innaloo WA 6918 Tel +61 8 9328 2029 Fax +61 8 9486 7588 Email perth@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Sydney	Level 1, 256-258 Norton Street, Leichhardt 2040 PO Box 194, Leichhardt NSW 2040 Tel +61 2 8987 2900 Fax +61 2 8987 2999 Email sydney@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Vancouver	Suite 401, 611 Alexander Street Vancouver British Columbia V6A 1E1 Canada Tel +1 604 683 5777 Fax +1 604 608 3232 Email vancouver@bmtwbm.com Web www.bmtwbm.com