BMT WBM

"Where will our knowledge take you?"

Wyong Coastal Zone Management Plan 2017

Revised Draft Report

February 2017

Central Coast Council

Wyong Coastal Zone Management Plan 2017
Draft Report

Prepared for:	Central Coast 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
126 Belford Street
Broadmeadow NSW 2292
Australia
PO Box 266
Broadmeadow NSW 2292

Tel: +61 2 4940 8882
Fax: +61 2 4940 8887

ABN 54 010 830 421

www.bmtwbm.com.au

Document:	R.N20435.001.02.WCZMP-2017.docx
Title:	Wyong Coastal Zone Management Plan 2017 Draft Report
Project Manager:	Verity Rollason
Author:	Verity Rollason
Client:	Central Coast Council
Client Contact:	Toan Dam
Client Reference:	Contract No. CPA/256673

Synopsis: **This draft Coastal Zone Management Plan (CZMP) covers the coastline of the former Wyong LGA, and provides a 2017 update to the original CZMP finalised in 2011. The CZMP provides practical actions to address current and future risks to Wyong's coast from coastal processes. This CZMP also documents a revised hazard assessment and mapping for the entire Wyong coast, particularly to determine appropriate hazard estimates in zones affected by both beach and cliff (geotechnical) processes.**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	April 2016	MF		VPR	
1	August 2016	VPR	V.Rollason.	PMD	
2	8 February 2017	MF		PMD	

DISTRIBUTION

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

Executive Summary

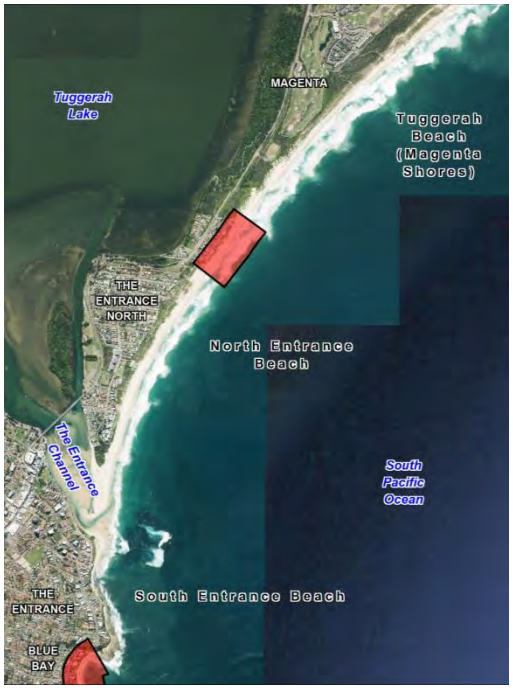
The coast of the Central Coast of NSW is a vital component of the community's identity, providing scenic, recreational and economic benefit. The coastal landscapes of long sandy beaches and rocky bluffs provide a spectacular backdrop to the region. The coast is also subject to risks from waves and sea levels that threaten recreational use and back beach development on the beaches. Five locations within the local government area (LGA) of the former Wyong Shire are at severe risk from erosion, and have been classified as erosion "Hot Spots" by the NSW Government.

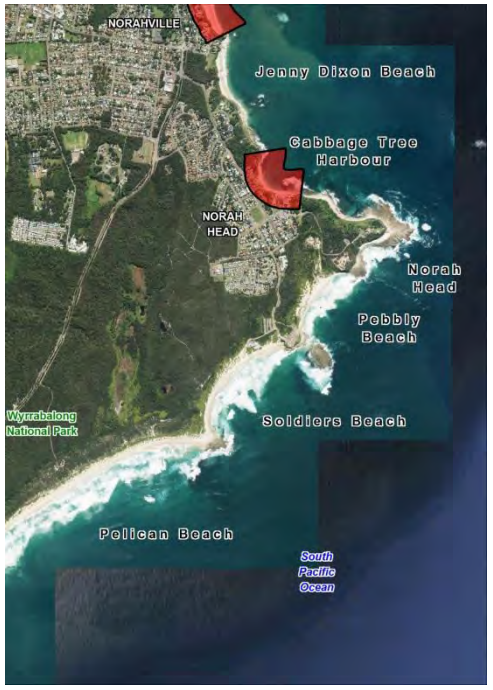
To manage these important values and minimise the known risks to the coast, this Coastal Zone Management Plan (CZMP) has been prepared. This CZMP relates only to the coastline of the former Wyong Shire LGA, which now forms part Central Coast Council LGA. Herein, references to "Wyong's coast", "the Wyong coastline", "Wyong's beaches" and so on are a reference to the coastline of the former Wyong Shire LGA. This CZMP is a revision of the CZMP for Wyong's coast completed in 2011, including elements of the hazards definition studies that underpinned it. This CZMP 2017 provides updated and new actions to be implemented over the next 5-10 years, to manage coastal risks and maintain and improve the ecological and community values of the Wyong Coast. This Wyong CZMP 2017 has been jointly funded by Central Coast Council (formerly Wyong Shire Council) and the NSW Office of Environment & Heritage (OEH).

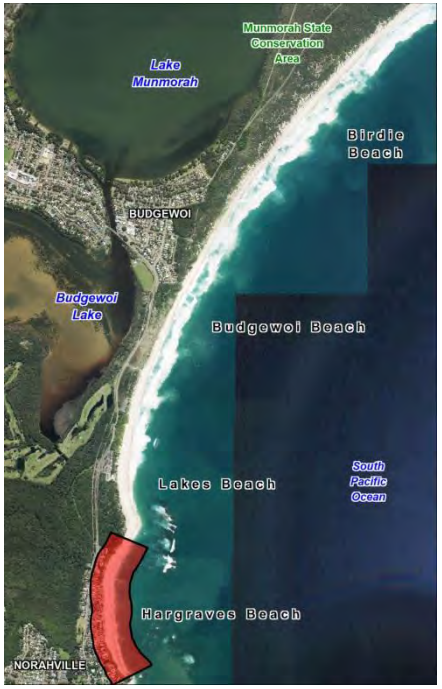
To assist with how actions in this CZMP will be applied, the Wyong coast has been organised into four management "precincts". The precincts are defined in terms of their different values and level of risk that in turn support different levels and types of community usage, development, and ecological function, and which require different management intent and actions. The proposed management intents, permissible uses and management actions for the precincts are illustrated in the figures below.

- *Hot Spot Precinct*: covers the five hot spot embayments, namely, Blue Bay, Toowoon Bay, North Entrance Beach, Hargraves Beach and Cabbage Tree Harbour. These embayments are already at imminent risk from erosion. A key action is for detailed cost-benefit analyses to select a feasible and financially viable erosion management action, to be implemented prior to irreversible damage from erosion. Management shall also focus on the community and habitat values of the "hot spots" also.
- *Recreational and Urban Use Precinct*. This precinct covers those beaches and coast that are more intensively used for recreation, are more accessible from adjacent urban land, and support more intensive urban use. Due to their higher usage, this precinct has higher community and economic values, and requires better, more numerous and more varied facilities. The precinct would also benefit from dune management that will improve the erosion protection provided.
- *Natural Coast Precinct*: This precinct covers the undeveloped and natural landscapes along the coastline, which in turn support higher ecological values, as well as the scenic value of the entire coast. Management actions in this precinct are aimed at maintaining and rehabilitating the natural habitat and landscapes, and reducing anthropogenic impacts, including sympathetic low-key recreational facilities.
- *Entrance Channel Precinct.* This covers The Entrance channel including the dynamic sand bars within it. The Entrance is affected by catchment inputs, Tuggerah Lake mixing and currents, and tidal currents, in addition to the waves, currents and water levels of the open coast. This makes the channel and sand bars highly variable and complex, requiring a different management approach from the adjacent coastline.

Hot Spot Management Precinct







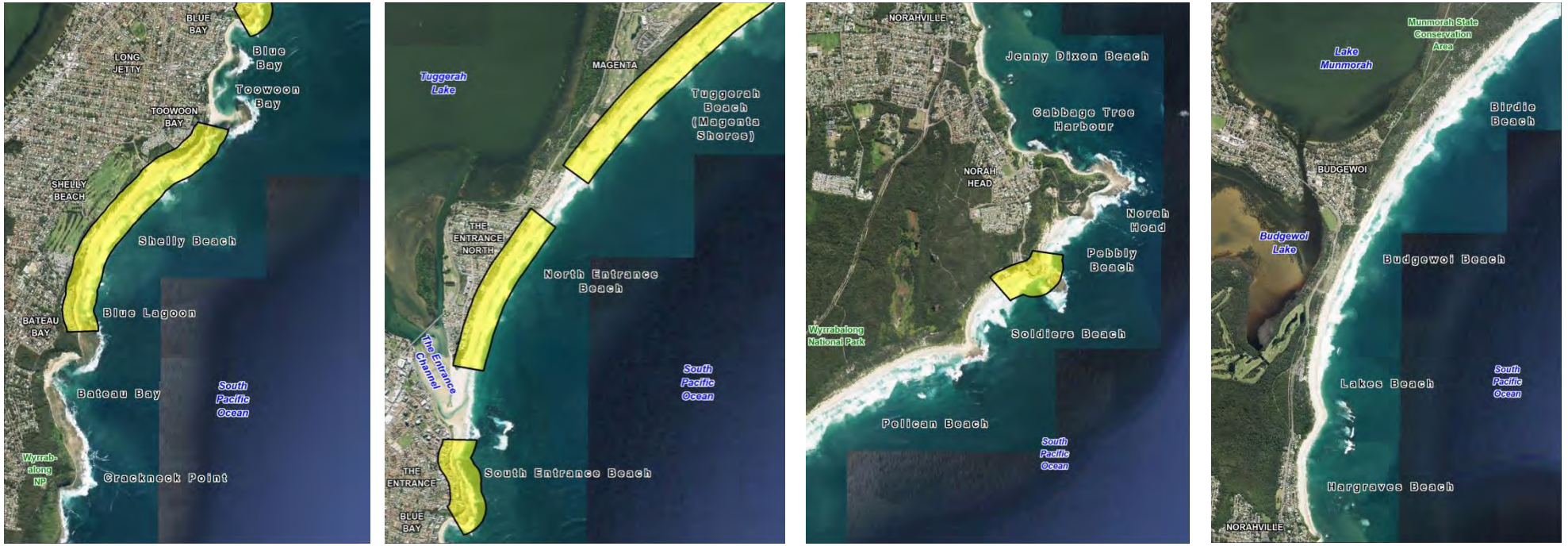
Management Intent

- To manage the immediate threats from coastal erosion
- To progressively manage the longer term threats from coastal erosion and wave overtopping
- To build community resilience to periods of reduced amenity from beach erosion, and natural changes in beach width
- To maintain and enhance the high level community and urban values, through ongoing support for facilities and access to the beach
- To prepare the community for the need for decisive action, which will be required when a trigger value of erosion is met, but need not be selected at this time

Management Actions

- **1**: Beach sand monitoring
- **6**: Dune rehabilitation works
- **8**: Investigate use of Beach Scraping
- **9**: Use of Dredged Sand from the Entrance on North Entrance Beach
- **24**: Training of Council staff for appropriate response to coastal erosion
- **16**: Update DCP Chapter 3.5 Coastal Hazards for wave overtopping
- **17**: Implement and update Chapter 3.5 as needed over time
- **23**: Checklist for all Council works in the coastal zone
- **15**: Internal Council workshop to educate on responsibilities for implementing CZMP actions
- **2**: Lobby NSW Government to collect marine LIDAR regularly
- **34**, **35**: Community Education program to improve understanding of dynamic nature of beach
- **5**: Options Feasibility Studies for Hot Spot Beaches
- **36**: Community database of erosion and inundation events
- **31**: Continue beach access maintenance and post-storm monitoring program
- **33**: Revise the Coastal Erosion Emergency Action Sub Plan(s)
- **30**: Develop a program of recreational asset upgrades
- **21**: Regular community surveys
- **14**: Maintain a Coastal Coordinator
- **13**: Continue the role of the Tuggerah Lakes Estuary, Coastline and Floodplain Management Committee
- **Section 3.6**: Managing Future Risks and recommended triggers

Recreational and Urban Management Precinct



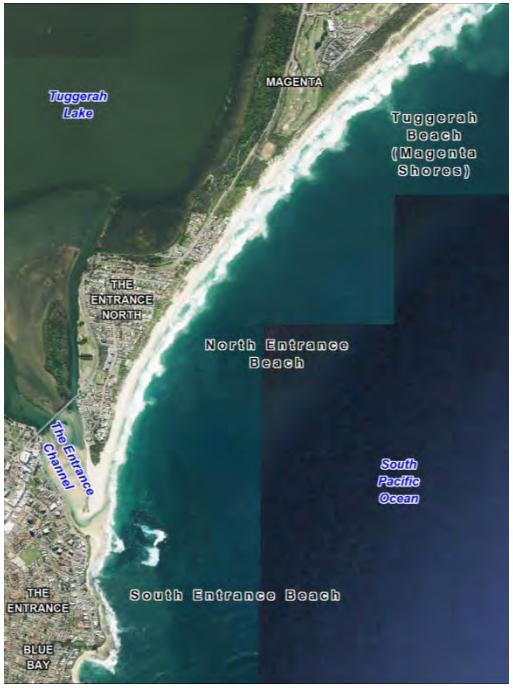
Management Intent

- To support a range of recreational activities, through ongoing improvements to facilities and access
- To support dune building to provide an erosion buffer to storms for recreational and urban back beach development
- To build the resilience of the community to the varying nature of the beach, including periods of beach erosion when sections of the beach may be temporarily inaccessible
- To allow natural coastal processes to occur through long term strategic planning for assets and urban development
- To improve our understanding and management of geotechnical risks in areas of recreational use or urban development

Management Actions

- **30**: Develop a program of recreational asset upgrades
- **6**: Dune rehabilitation works;
- **7** Continue to support volunteer dune maintenance groups
- **8**: Investigate use of Beach Scraping
- **31**: Continue beach access maintenance and post-storm monitoring program
- **11**: Assess and upgrade the Entrance seawall
- **41**: Develop coastal interpretive signage in liaison with the Aboriginal community
- **34, 35**: Community Education program to improve understanding of dynamic nature of beach
- **21**: Regular community surveys
- **36**: Community database of erosion and inundation events
- **23**: Coastal Hazards Checklist for all Council works
- **16, 17**: Update DCP Chapter 3.5 Coastal Hazards for wave overtopping, and continue to implement and update over time
- **24**: Training Council staff in appropriate response to erosion
- **25**, **27**, **28**, **29**: Include coastal and geotechnical risk in Asset Management replacement, for all council assets.
- **40**: Review POMs (for Community, Crown including Holiday Parks, and National Parks / Reserves land) to include consideration of coastal and geotechnical hazards
- **15**: Internal Council workshop to educate on responsibilities for implementing CZMP actions
- **14**: Maintain a Coastal Coordinator
- **19**: Update the LEP / DCP to include relevant provisions for managing geotechnical hazard
- **4**: Monitoring program for high risk landslip sites
- **26**: Assess stormwater assets in landslip hazard areas

Natural Coast Management Precinct



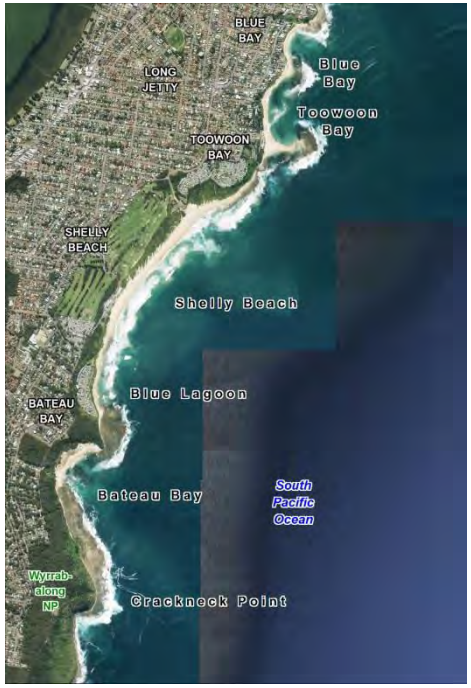
Management Intent

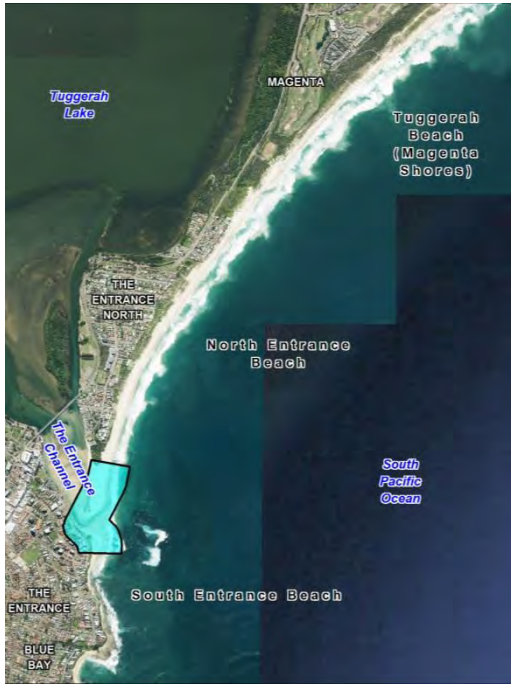
- To maintain and enhance natural landscape values (beach and rocky coast), which in turn support the scenic values of adjacent precincts
- To support high value ecological habitats and threatened species
- To allow natural coastal and geotechnical processes to occur
- To provide for limited, low key recreational access
- To provide for safe and appropriate recreational access to the rocky coast and other areas of geotechnical risk

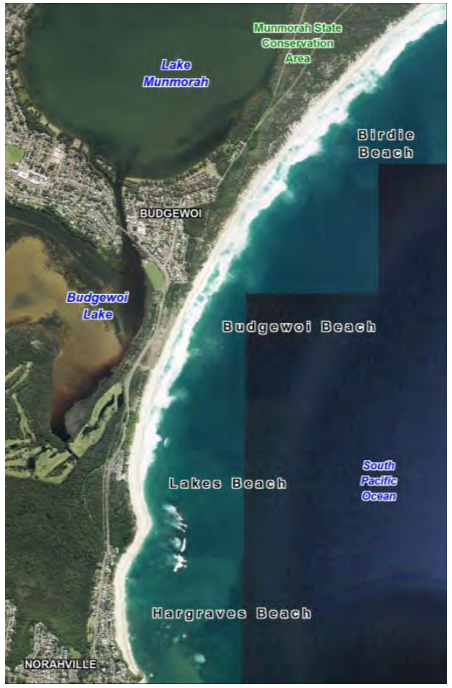
Management Actions

- **38**: Conduct benchmark survey of coastal ecological communities
- **39**: Establish conservation agreements for high value habitat where feasible
- **22**: Update DCP to provide for migration buffers for coastal wetland habitats
- **37**: Continue to work with OEH to protect shorebird nesting sites
- **6**: Dune rehabilitation works;
- **7** Continue to support volunteer dune maintenance groups
- **40**: Review POMs (for Community, Crown including Holiday Parks, and National Parks / Reserves land) to include consideration of coastal and geotechnical hazards
- **42**: Develop a decision support tool to respond to coastal threats to Aboriginal sites
- **32**: Continue to develop sections of the coastal walk
- **30**: Develop a program of recreational asset upgrades
- **41**: Develop coastal interpretive signage in liaison with the Aboriginal community
- **4**: Monitoring program for high risk landslip sites
- **19**: Update the LEP / DCP to include relevant provisions for managing geotechnical hazard

Entrance Channel Management Precinct







Management Intent

- To support the functioning of The Entrance Channel in a manner that maintains or improves water flow between the lake and coast, in a natural manner wherever possible
- To support the range of recreational and commercial activities associated with the Entrance channel and Tuggerah Lakes
- To investigate the hydrodynamics and sediment transport characteristics of The Entrance channel (including potential sea level rises), to improve our management of the Channel
- To support the unique ecological values of The Entrance channel

Management Actions

- **9**: Use of Dredged Sand from the Entrance on North Entrance Beach
- **12**: Review estuary flood studies for inclusion of sea level rise when determining potential inundation levels.
- **11**: Assess and Upgrade the Entrance seawall
- **10**: Investigate sediment transport dynamics of the Entrance channel

Contents

List of Figures

List of Tables

1 Introduction

1.1 Purpose of the Wyong Coastal Zone Management Plan

The coastline of the former Wyong Shire Local Government Area (LGA) provides a backdrop of beauty to the local area, including long sandy beaches, narrow beaches backed by cliffs, rocky bluffs, small bays enclosed by rock reefs and rock platforms. These coastal landscapes are subject to risks from waves and sea levels interacting with the sandy beaches and cliffs.

Coastal hazards exist particularly where development has unknowingly been sited within the envelope of natural beach fluctuations, and so becomes threatened by coastal processes during infrequent storm events. For example, storms in 1974 and more recently in 2009 have caused detrimental erosion of a number of Wyong's beaches. The high level of threat from coastal hazards at key locations in the former Wyong Shire prompted the NSW Government in 2010 and 2013 to list specific coastal erosion "hot spots". The hot spots include Blue Bay, Toowoon Bay, North Entrance Beach, Cabbage Tree Harbour and Hargraves Beach.

Central Coast Council (Council) with the assistance of the NSW Office of Environment and Heritage (OEH) resolved to revise the Wyong Coastal Zone Management Plan (CZMP), to manage the existing and potential future risks from coastal processes along the former Wyong Shire LGA coastline. Herein, references to "Wyong's coast", "the Wyong coastline", "Wyong's beaches" and so on are a reference to the coastline of the former Wyong Shire LGA, which now forms part of the Central Coast Council LGA.

The first *Coastal Zone Management Plan for the Wyong Coastline* was completed in 2011 by Umwelt (herein referred to as 'WCZMP 2011'). This revised Wyong CZMP 2017 provides an update to the previous WCZMP 2011, including an update to its underpinning hazard studies, namely the SMEC (2010) *Wyong Coastal Hazards Study*, and SCE (2010) *Report on the Geotechnical Issues associated with the Coastline Hazard Management Study [CPA # 170951] for the Wyong Shire Council* (the 'Geotechnical Hazard Assessment').

The Wyong CZMP 2017 sets out the actions to be implemented over the next 5 years, to manage existing coastal risks and ecological and community objectives for Wyong's coast. By 2021, it is expected that Council will translate this CZMP into a Coastal Management Program, as required by the new Coastal Management Bill 2016, which shall replace the current legislation governing coastal management.

The Wyong CZMP 2017 aims to avoid the detrimental outcomes from the interaction of coastal hazards with development and recreational access, to maintain the safety of residences, public assets, and community access to the coast. The Wyong CZMP 2017 also aims to preserve the scenic and ecological qualities of Wyong's coast and promote suitable community use and access, both of which will in turn promote economic success in the coastal zone. While the Wyong CZMP 2017 is not a statutory land use planning document, actions within this plan may inform changes to such planning and other documents, to achieve these key objectives.

1.1.1 Objectives for the Wyong CZMP

Council's vision for the Wyong coastline remains ***"Continuing community enjoyment of resilient coastal landscapes in times of change"*** (see also Umwelt, 2011).

To achieve this vision and as per the first Wyong CZMP (Umwelt, 2011), this Coastal Zone Management Plan has been prepared to:

- provide a planning context that regulates, encourages and supports appropriate development for areas affected by coastal and geotechnical hazards;
- minimise the risks associated with coastal processes;
- protect important community values of the coastline; and
- recognise that communities need clear strategic direction but also need time to adjust to changing environmental conditions.

This Wyong CZMP documents management actions to address the risks from coastal processes and preserve scenic, recreational and community values of the coast, to thereby achieve the above objectives and vision.

1.1.2 Why has the Wyong Coastal Zone Management Plan been revised?

This CZMP 2016 provides an update to the WCZMP 2011, and its underpinning studies, the SMEC (2010) *Wyong Coastal Hazard Study*, and SCE (2010) Geotechnical Hazard Assessment. The Wyong CZMP has been reviewed due to the following.

- Council resolutions of October, 2012 and May, 2013 required a revision of Coastal Hazards mapping for Wyong's coastline (details of the resolutions are given in Section 1.4.1).
- The coastal hazard mapping derived from the original coastal and geotechnical hazards studies (SMEC, 2010; SCE, 2010) was inconsistent and incomplete in some areas. The hazard lines did not seamlessly flow from beach-dune areas to cliff and bedrock controlled (bluff) areas, likely because different methodologies are needed to define hazards for beach and bluff areas. A reliable transition from beach hazard zones to bluff hazard zones was needed, to provide a complete assessment of coastal hazard to Wyong's coast.
- Since the WCZMP 2011 there have been changes to the NSW Coastal Management Framework, including Stage 1 and Stage 2 Coastal Reforms. Recent Council resolutions have reflected the outcomes of these reforms. The WCZMP 2011 also needed to be updated to reflect the current legislation, guidelines and intent for coastal management in NSW, and recent Council resolutions.
- A review of the actions in the WCZMP 2011 was needed to determine if / where priorities for action have changed based on changes in legislation and management focus, and if there is a need for new actions to treat the revised hazard estimates.

1.2 Study Area

The Wyong coastline extends some 33 km from just south of Catherine Hill Bay to Crackneck Point, as shown on Figure 1-1. The coastline consists of an attractive landscape of sandy beach and coastal dune systems, rock platforms headlands and bluffs (Umwelt, 2011a). Wyong's coast is the recreational, social, cultural and economic focus for the local community and an extensive visiting population, and has been for many generations (Umwelt, 2011a).

In addition to its scenic quality, the coastline offers many recreational and tourism opportunities, including options for swimmers and surfers of varying abilities. Around this, considerable investment has been put into private residences and recreation access and its associated infrastructure, which extends to the water's edge in some locations.

It should be noted that the Tuggerah Lakes are excluded from this plan, as they are the subject of an existing Estuary Management Plan (EMP).

1.3 Coastal Management Framework in NSW

The *Guidelines for Preparing Coastal Zone Management Plans* (OEH, 2013a) ('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 Act. The CZMP Guidelines dictate the process to be followed when preparing a CZMP including the hazards to be investigated and the timeframes for the hazard assessments and management actions (typically being the immediate, 2050 and 2100 timeframes). The stages for preparing a CZMP are illustrated in Figure 1-2.

Under Section 733 of the *Local Government Act 1993*, councils are taken to have acted in 'good faith' and thus receive an exemption from liability for land affected by coastal hazards where their actions substantially accord with the principles contained in the specified manual, in this case being the CZMP Guidelines.

How this CZMP addresses the Principles for Coastal Management and the minimum requirements for preparing CZMPs outlined in the CZMP Guidelines are provided in Appendix A. A detailed description of the coastal management principles derived for Wyong's coast from the CZMP Guidelines and input from other local, regional and NSW coastal and natural resource management frameworks is provided in Umwelt (2011a). The WCZMP (Umwelt 2011a) also provides a detailed review of the remaining legislation pertaining to the coastal zone that has remained unchanged since 2011.

Subsequent steps to complete this CZMP include:

- Public exhibition of the draft CZMP, then update of the CZMP based on consideration of Council, community and state agency comments;
- Submission of the CZMP to the Minister for Environment for certification, and if certified, Council to gazette the plan; and
- Review of the CZMP on a regular basis (5-10 years).

Title:

Locality Map of the Wyong Coastline NSW Central Coast

Figure:	Rev:
1-1	A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N 0 2.5 5km

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : K:\N20435_Wyong_CZMP_Review\GIS\MI\Workspace\DRG001_Locaility_Map_Hazards_Fig1-1.wor

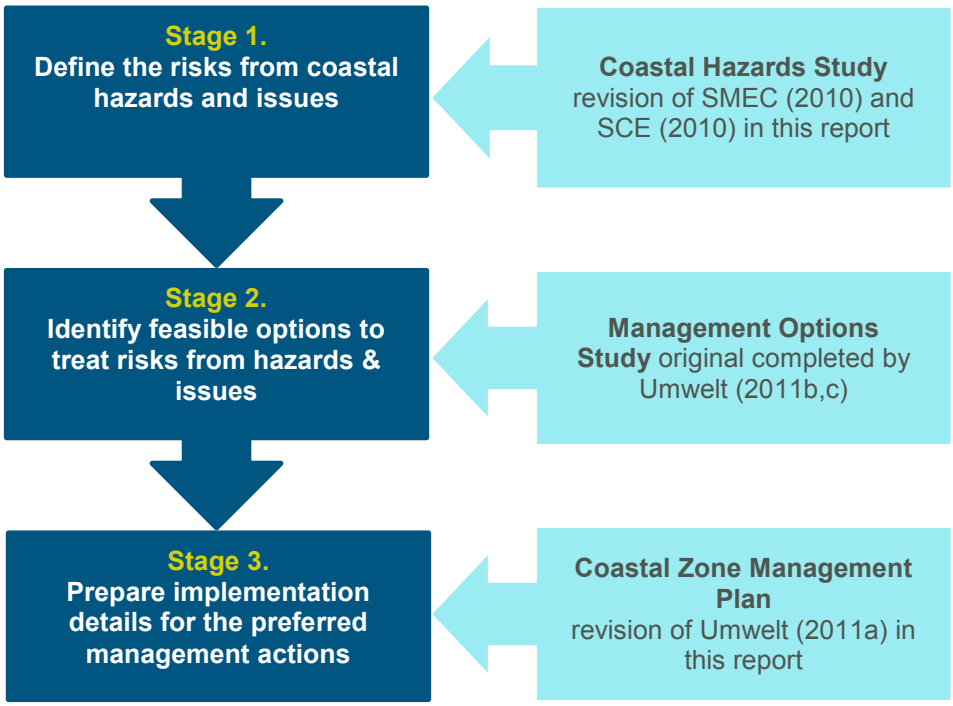


Figure 1-2 Stages of Preparation of a CZMP

1.3.1 Reforms to the Coastal Management Process

1.3.1.1 Stage 1 Coastal Reforms

The NSW Government is currently undertaking reforms to the Coastal Management Framework in NSW. Stage 1 of this process commenced in 2012 including (OEH, 2016):

- The repeal of the *NSW Sea Level Rise Policy Statement 2009* in September 2012;
- The Guidelines for Preparing Coastal Zone Management Plans were updated in April 2013 to remove reference to the Sea Level Rise Policy Statement and associated benchmarks, with the remainder of the document unchanged;
- Amendments to the *Coastal Protection Act 1979* commenced in January 2013, most notably relating to the erection of temporary coastal protection works by public and private landholders;
- The Code of Practise under the *Coastal Protection Act 1979* for temporary coastal protection works was finalised in August 2013, and included a revised listing of Authorised Locations (or "hot spots") in NSW, of which there are 5 locations in total in the Wyong coastline (see Table 1-1); and
- A planning circular regarding Section 149 Planning Certificates was released for comment in November 2013.

Table 1-1 Authorised locations on the Wyong Coast (from OEH, 2013b)

Authorised Location	Authorised Beach Access
Blue Bay Beach, Blue Bay	Blue Street
Toowoon Bay Beach, Toowoon Bay	Binburra Avenue
North Entrance Beach, The Entrance (North)	Curtis Parade
Cabbage Tree Harbour Beach, Norah Head	Bald Street Boat Ramp Area
Hargraves Beach, Noraville	Elizabeth Drive (north end)

1.3.1.2 Stage 2 Coastal Reforms

On 13 November 2015, the NSW Government commenced Stage 2 of its coastal management reforms by releasing a draft framework for coastal management for public consultation. The reforms have or shall include (OEH, 2016):

- A Coastal Management Bill, which was passed in the NSW Parliament in April 2016. This legislation shall replace the *Coastal Protection Act, 1979*, and is expected to come into force once the proposed Coastal Management State Environmental Planning Policy (SEPP) is passed in Parliament;
- an Explanation of Intended Effect for the proposed Coastal Management SEPP was placed on public exhibition until February 2016, and a full draft of the SEPP is expected to be released by the end of 2016 for public comment; and
- key elements of a draft coastal management manual were released for comment at the end of 2015, with further elements continuing to be released throughout 2016.

With the Stage 2 coastal reforms now underway, the Minister has again commenced certification of CZMPs that accord with the current CZMP guidelines.

The intention is to submit this CZMP for certification under the existing legislation (i.e. *Coastal Protection Act, 1979)*. The NSW Government has indicated that existing certified CZMPs will be able to be fast-tracked into the new framework, to capitalise on existing valid work completed to date, and to retain momentum that has been gained in preparing existing CZMPs. Following this, certified CZMPs are expected to be transferred into the proposed Coastal Management Program format by 2021.

With respect to these changes to legislation, the detailed review of all other legislation pertaining to the coastal zone contained in Umwelt 2011 remains.

1.4 Consideration of Sea Level Rise in this CZMP

1.4.1 Council's Interim Sea Level Rise Policy

Following on from the repeal of the *NSW Sea Level Rise Policy Statement 2009* in September 2012, during the Wyong Shire Council Ordinary Council Meeting of Council 10th October 2012, Council resolved under Section 7.2 Notice of Motion – Sea Level Rise Removal "that its sea level rise interim policy consist of compliance with the 1% AEP flood level and 500 mm freeboard

allowance" (p18; WSC, 2012). In regard to this interim policy, a "review of current adopted Council policies that incorporate provisions in respect of sea level rise, including the adopted Wyong Shire Coastal Zone Management Plan" was requested (p18; WSC, 2012).

During the Ordinary Council Meeting of Council 22 May 2013, Council then resolved "that Council maintain the existing hazard lines removing reference to 2050 and 2100, adopting an immediate, high and low Coastal Planning Zone" and "that Council amend the development control plan to reflect a risk based approach to develop land rather than sterilise it, which requires the applicant to demonstrate suitability within the zone" (p11, WSC, 2013a).

Through the 22 May 2013 resolutions, Council has retained consideration of sea level rise within its coastal hazard planning lines, using a risk based rather than time based approach. This is important because, even though sea level rise projections are given at particular timeframes with a stated level of certainty, there remains uncertainty about how the coastline will respond to sea level rise. Therefore, the actual timeframe of change and impact to the coast is uncertain.

The Council resolution also requires developers to demonstrate how their proposed development shall manage (remove, treat, or accept) the coastal risk. This allows for maximising the development potential of land until such time as coastal impacts to the land are evident. Similarly, the immediate, high and low hazard lines provide existing land owners with information about the potential risk to their land and property from coastal hazards.

Under Section 733 of the *Local Government Act 1993* (the LG Act), Council has a duty of care to inform its local constituents of known risks and receives 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 made substantially in accordance with the relevant manual for the hazard, in this case, the CZMP Guidelines. The incorporation of sea level rise into the assessment of coastal hazards is a requirement of the CZMP Guidelines. This legislation provides Council with a legal imperative to consider sea level rise, as it is a known and measured coastal process that will affect the likely occurrence and severity of coastal hazard impacts.

1.4.2 Sea Level Rise Measurements to Date

Global mean sea level rose about 1.6 mm/year on average during the 20th Century (CSIRO, 2016a). Since 1992, high quality measurements of sea level rise have been made by satellite altimeters. From 1992 to present, Global Mean Sea Level (GMSL) has risen at a rate of around 3.2 ± 0.4 mm/year (CSIRO, 2016b). The rate of sea level rise over the past 20 years is therefore about double that of the previous century. If the rate of sea level rise were to remain at its present level of 3.2 mm/year, sea level can be expected to be nearly 0.3 m higher than today by 2100.

Projections for sea level rise of about 0.9 m by 2100 (above 1990 sea level), as given by CSIRO (2015) and IPCC (2014), are based on the rate of sea level rise more than doubling from its present rate of 3.2 mm/year. This is not unreasonable given that the rate of sea level rise has already doubled over the last 20 years. The current rate of rise is also tracking along the rate expected under the highest carbon emission scenario modelled by CSIRO (2015) and IPCC (2014).

1.4.3 Sea Level Rise Considered in this CZMP

The repeal of the *NSW Sea Level Rise Policy Statement 2009* means that prescribed state-wide sea level rise benchmarks no longer apply to coastal hazard assessments, such as in this CZMP. 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), although no guidance was given to local councils on how to determine this. In lieu of prescriptive sea level rise benchmarks, OEH advised that councils should adopt sea level rise values that are "widely accepted by competent scientific opinion" (OEH, 2013a).

The CSIRO released new regional projections for Australia in 2015, which are the most relevant to the Wyong coast. The CSIRO (2015) suggest a 'likely' range for sea level rise of 0.45 to 0.88m by 2090 for the highest emission scenario (along which sea level rise is currently tracking, see Section 1.4.2).

The 2015 CSIRO projections are almost identical to that used to develop the former sea level rise policy benchmarks. The former sea level rise benchmarks of 0.4 m and 0.9 m rise above 1990 mean sea level by 2050 and 2100 respectively were based upon the latest reports by the IPCC (2007) and CSIRO (2007) available at that time. The recent IPCC report in 2014 also provides similar projections to the 2007 IPCC report. These benchmarks have been adopted as policy by the majority of local coastal councils in NSW.

Based upon the recent projections and the former sea level rise benchmarks, the following sea level rises were investigated in developing hazard lines for Wyong's coast, as listed in Table 1-2.

Table 1-2 Sea Level Rise Investigated in this CZMP

Hazard Line Risk Level	SLR Value Adopted	Rational and Reference
Immediate	**0.0 m**	This is consistent with OEH (2013a) and other legislative guidance for the "immediate" timeframe, or, the present sea level.
High	**0.4 m** (above 1990 levels)	This is equivalent to either: • The lower value given by CSIRO (2015) for the highest emission scenario by 2090 (of 0.45 m); or • The current rate of sea level rise of 3.2 mm/year ± 0.4 mm, extended to the end of the century (CSIRO 2016b); or • The upper value given by CSIRO (2015) for the highest emission scenario by 2050 (of 0.36 m), which is roughly consistent with previous scientific projections for 2050 given by IPCC (2007) plus CSIRO (2007). Under any of the above scenarios, we may expect to reach a 0.4 m higher sea level, therefore a "high" risk is considered appropriate.

Hazard Line Risk Level	SLR Value Adopted	Rational and Reference
Low	**0.9 m** (above 1990 levels)	This is equivalent to the upper value given by CSIRO (2015) for the highest emission scenario by 2090 (of 0.88 m), and is also consistent with previous scientific projections for 2100 (IPCC 2007 and CSIRO 2007). As the projection is an upper bound value, a "low" risk level is considered appropriate.

It should be noted that small differences of 1 to 5 cm between exact projections are likely to make no appreciable difference in the position of a hazard line. Indeed, hazard lines are a planning tool only and the hazard lines also incorporate other coastal processes (storms, etc.). At the next update of this CZMP, any revisions to sea level rise projections or further guidance from the NSW or Federal Governments should be incorporated into the hazard estimates at that time.

1.5 Community and Stakeholder Engagement

Consultation is an important component of developing a CZMP. In preparing this Plan, information has been provided and feedback sought from residents, landholders, community organisations and other coastal stakeholders (e.g. government agencies). Community and stakeholder consultation has been essential for understanding the community's values and perspectives, which have helped guide preparation of this draft Plan.

Government agency consultation to date has involved:

- State government agency consultation (WCZMP 2011)*; and
- Review of draft documents (Wyong Hazard Study 2011; WCZMP 2011, Wyong Hazard Study Review 2017; Wyong CZMP 2017) by the NSW Office of Environment and Heritage

Community consultation to date has involved:

- Publication of a project website (WCZMP 2011)*;
- Media releases (WCZMP 2011)*;
- Community survey (WCZMP 2011)*;
- Multiple project briefings to community members, precinct committees and progress associations, and members of the Tuggerah Lakes Estuary, Coastline and Floodplain Management Committee (WCZMP 2011)*
- Community survey (WCZMP, 2011)*

*Indicates tasks undertaken by Umwelt.

Further details and outcomes of the consultation undertaken for preparation of the WCZMP 2011 and associated documents are outlined within that draft document and the WCZMP Supporting Information by Umwelt (see Section 1.7 and Appendix F.5 of this document).

This draft Wyong CZMP 2017 will be placed on public exhibition for a minimum period of 21 days. Community members and coastal stakeholders will have an opportunity to submit feedback on the Wyong CZMP 2017, which will help to finalise the draft Plan prior to submission to the Minister for Planning for certification.

Once the Wyong CZMP 2017 is adopted, community engagement will be ongoing through the course if implementing the Plan. Community and stakeholder involvement will be an important factor in the success of this CZMP implementation.

1.6 Aligning the CZMP with Council's Integrated Planning and Reporting Framework

The NSW Government's Stage 2 Coastal Reforms have indicated there will be a transition to incorporating coastal zone management planning within local government's Integrated Planning and Reporting (IPR) Framework. This aims to mainstream coastal management into councils' overall service delivery and asset management responsibilities. It is also likely that streamlining actions in the CZMP with the service delivery and asset management process of Council will improve implementation of CZMPs.

To meet this aim, the Implementation Schedules of this CZMP have been designed to:

- Demonstrate the alignment between CZMP actions and the Wyong Shire Community Strategic Plan 2030 (WSC, 2013b);
- Demonstrate the alignment between CZMP actions and activities in the current Delivery Program 2015-2019;
- Flag a timeframe to implement the CZMP action in accordance with the IPR reporting period, such that:
    - Immediate Actions should be implemented in the latest Operational Plan (i.e. 2016-17),
    - Short term actions should be implemented during the current Delivery Program (2015-2019), and;
    - Long term actions should be implemented within the next 10 years, and can be integrated into later Delivery Programs (e.g. Delivery Program 2020-2025), Long Term Resourcing Strategy, and so on; and
- Provide other details (responsibility, performance measures, estimated cost / resource requirements) to enable Council to easily include CZMP actions within the IPR Framework (e.g. Operational Plan 2016-17; Capital Works Program 2016-17, etc.).

1.7 Structure and Supporting Information for this CZMP

This Wyong CZMP 2017 provides an updated plan for Wyong's Coast. It has involved a complete revision of erosion and cliff recession hazard mapping for the entire coastline, then a review of management actions to manage these hazards, and other elements of Wyong's coast.

The Wyong CZMP 2017 includes a complete revision of the hazard mapping for Wyong's coastline in Chapter 2 and Appendix B. Originally, it was only intended to provide hazard mapping in the

transition zones between beaches and bluffs. However, as the original SMEC (2010) and SCE (2010) studies could not be adequately reproduced, a complete revision of hazards mapping for the entire sandy beach and cliff coastlines, then development of hazards mapping for the transition zones between the beaches and bluffs was undertaken.

A review of actions in the WCZMP 2011 and the *Coastal Zone Management Plan for the Wyong Coastline: Supporting Information Volume 1* (herein 'the WCZMP Supporting Information') (Umwelt, 2011b) was then conducted to determine the relevance of the actions and any changes required to these actions to better address the revised hazard mapping, changes in legislation and other changes in management focus since the WCZMP 2011.

The majority of actions proposed in WCZMP 2011 were not fully implemented, and many remain suitable approaches for managing the revised coastal hazard lines, as well as other ecological and community objectives for the coast. New actions have also been investigated, particularly where elements for coastal management were not adequately covered by the WCZMP 2011. The review of actions in the WCZMP 2011 is provided in Appendix C. Proposed new actions developed out of the review are also listed in Appendix C. The revised list of actions for implementation is given in Chapter 3

Some of the background information detailed in the WCZMP Supporting Information remains relevant to this Plan, as referenced in Table 1-3 and reproduced in Appendix C

Table 1-3 Reference to Information in the WCZMP 2011 and WCZMP Supporting Information (Umwelt, 2011b)

Information	WCZMP Supporting Information Report Part/Section reference	Refer to Section
Purpose and Objectives for WCZMP 2011	Part A Section 1.1 Section 1.4 Part B Section 5.1 (Vision) Section 5.2 (Principles) Section 5.3 (Objectives)	F.1
Legislative Context of a CZMP, including local, state and federal legislation and policies that govern the coastal zone: and set out the process for preparing a CZMP.	Part A Section 1.2-1.3 Section 3.1 Part C Section 15.1 (Land Tenure) Section 15.3 (Table 15.1 – Legislation and associated Council responsibilities) Section 15.4 (inc. Table 15.4 – Legislation and associated NSW Government roles) Section 15.6 (Australian Government)	F.2
Approach to preparation of the WCZMP 2011	Part A Section 1.5 Section 3.2	F.3
Study Area, and description of the coastal zone	Part A Section 2.1-2.3	F.4
Community and Stakeholder Engagement	Part A Section 3.3 Part C Section 15.2 (Description of Stakeholders)	F.5
Description of Coastal Management Issues, including: • Impact of coastal processes on valued coastal landscapes • Increasing population and demand for access to coastal 'services'	Part A Section 4.1 Section 4.2	F.6
Implementation Schedule, detailing actions to be implemented	WCZMP 2011	F.7

Information	WCZMP Supporting Information Report Part/Section reference	Refer to Section
Management Action Plans: • Coastal Knowledge Action Plan • Coastal Emergency Response Management Plan, and the EASPs • Coastal Erosion and Recession Action Plan • Coastal Inundation Action Plan • Lake and Sea Interactions Action Plan • Geotechnical Hazards Action Plan • Building Coastal Biodiversity Resilience Action Plan • Recreation and Tourism Action Plan • Cultural Landscapes Action Plan	Part B (Chapter 7.0 – 14.0) Chapter 7.0 (Table 7.2) Chapter 8.0 (Table 8.3) EASP in Appendix 2 of the WCZMP 2011 Section 9.3 (Table 9.3, Table 9.4 – Potential Future Actions) Section 9.4 (Table 9.5) Chapter 10.0 (Table 10.2) Chapter 11.0 (Table 11.2) Chapter 12.0 (Table 12.2) Chapter 13.0 (Table 13.2) Chapter 14.0 (Table 14.2)	F.8
Potential Funding Sources and Options	Part B Section 6.4.4-6.4.7	F.9
Summary of condition and status of biodiversity, settlement and land use	Part C Section 17.1 (Biodiversity Values) Section 17.2 (Land use and assets, including residential property value; and recreational activities and assets) Section 17.3 (Cultural and heritage values)	F.10
Risk Assessment, including assessment of: • Coastal erosion and inundation risks • Other risks to coastline values	Part C (Chapter 18.0) Section 18.2, 18.3 Section 18.4	F.11
Evaluation of Management Options, including evaluation of: • options for immediate erosion and inundation risks • options for future recession and inundation Risks • options for managing lake and sea interactions • options for managing current and future geotechnical hazards • options for enhancing the resilience of coastal biodiversity • options for managing risks associated with community use of the coast • options for managing heritage and cultural values of the coast	Part D (Chapter 19.0) Section 19.3 (summary in Table 19.2) Section 19.4 (summary in Table 19.3) Section 19.5 (summary in Table 19.5) Section 19.6 (summary in Table 19.6) Section 19.7 (summary in Table 19.7) Section 19.8 (summary in Table 19.8) Section 19.9 (summary in Table 19.9)	F.12

2 Hazard Definition

2.1 Background to the Hazard Review

A number of inconsistencies and information gaps were identified in the SMEC (2010) *Wyong Coastal Hazard Study*, and SCE (2010) Geotechnical Hazard Assessment (see also Section 1.1.2). Issues were particularly identified when the coastal erosion and geotechnical hazard mapping datasets were combined for inclusion within the WCZMP 2011. Mapping issues were specifically related to mapping coverage, misalignment between sandy and rocky specific hazard lines, and a general a lack of consideration for the interrelated nature of beach erosion and cliff recession processes.

BMT WBM partnered with JK Geotechnics to undertake a re-assessment of coastal and geotechnical hazards, as detailed in the *Review of the Wyong Shire Coastal Hazard Study* (herein referred to as 'the Hazard Review'), given in Appendix B. The Hazard Review provides an update to the Wyong Coastal Hazard Study (SMEC, 2010) and Geotechnical Hazard Assessment (SCE, 2010) in relation to the following:

- coastal hazard elements including: beach erosion, dune stability, historical recession and climate change impacts;
- geotechnical hazard elements, in relation to cliff recession and non-coastal geotechnical hazards occurring within the coastal zone;
- the interaction between coastal and geotechnical processes and hazards, particularly the influence of bedrock geology on beach erosion;
- assessment of future hazard impacts in accordance with Council's interim sea level rise policy and other sea level rise considerations (see Section 1.4);
- new and updated data on coastal processes and new analytical techniques for assessing coastal hazards;
- a revised methodology for assessing cliff recession hazards; and
- a newly developed approach for mapping hazards across the transitional areas between sandy and rocky substrates.

Aspects of the SMEC (2010) and SCE (2010) studies that did not require revision are listed in Table 2-1, most notably, the coastal inundation assessment. A summary of the coastal inundation assessment by SMEC (2010) is included within BMT WBM (2016). The remaining hazard elements did not require revision and were not addressed further within the Hazard Review.

Table 2-1 Currency of Coastal Hazard and Geohazard Elements within this Hazard Re-Assessment (BMT WBM, 2016) and the Hazard Studies by SMEC (2010) and SCE (2010)

Coastal Hazards	Geohazards
The Hazard Review, Appendix B (BMT WBM / JK Geotechnics)	
• Review of Photogrammetry • Assessment of Coastal Processes and Geomorphology • Beach Erosion Hazard Definition • Dune Instability Hazard Definition • Historical Recession Hazard Definition • Future Recession Hazard Definition due to Sea Level Rise • Mapping of 'Bedrock Control' on Erosion • Erosion Hazard Mapping	• Assessment of Site Characteristics • Define Slope and Cliff Instability Mechanics • Evaluation of Cliff Recession Rate • Slope and Cliff Instability Recession Hazard Definition • Mapping of Geohazards • Mapping Hazard Transition between Sandy (Beach) and Rocky (Cliff/Slope) Substrates
SMEC (2010)	**SCE (2010)**
• Review of Historical Information (Storms)* • Description of Coastal Hazard Processes (including Erosion, Dune Instability, Recession, Wave Run-up and Overtopping)* • Coastal Inundation Hazard Definition**	• Review of Historical Information Regarding Cliff Retreat and Slope Instability) (Photographs, Survey Plans)* • Coastal Geological Mapping for Coastal Slope and Cliff Areas* • Geological / Geotechnical Notes on Wyong Coastal Geological Substrates*

* Current coastal hazard and geotechnical hazard elements that are not further addressed within BMT WBM (2016)
** SMEC's (2010) coastal inundation assessment methods and results are presented in BMT WBM (2016)

2.2 Regional Context of the Study Area

The Wyong coastline stretching northward of Yumbool and Crackneck Points towards Budgewoi Beach comprises a diverse range of sandy and rocky shoreline types, including wide open coast beaches, semi exposed coastal embayment's, a coastal entrance to major estuary system, complex sand dune systems that include old Pleistocene-age dunes and modern Holocene-age sand dunes, rocky cliffs and bluffs and numerous offshore rocky reefs. Geologically, this coastline has formed within sandstones, shales and conglomerates of the Sydney Basin, which have been eroded into valleys and hills that are now flooded by current sea levels.

From a regional perspective, the Wyong coastline faces southeast and is exposed to the dominant southeast wave climate of the Sydney to Newcastle region. The occurrence of protruding headlands, rocky reefs and coastal embayment's on a local scale result in locally variable wave climate along the shoreline.

The Wyong coastline includes two long barrier beach systems, namely the Tuggerah Beach compartment in the south and the Budgewoi Beach compartment in the north. Together, these beaches and intervening headland area impound Tuggerah Lakes, a major coastal estuary system comprised of three large interconnected coastal lakes. Both sweeping beaches face predominantly southeast and are mostly exposed to a high energy wave climate. Norah Head forms another regionally significant coastal landform, comprising a prominent rocky headland that protrudes

eastward of the surrounding coastline. It is expected this bedrock headland forms a sediment compartment boundary that limits the transport of sediment along the shoreface (over planning timeframes). On its northern side lays Cabbage Tree Harbour, a natural curving harbour that faces northeast and experiences significant shelter from south-easterly directed swells. This harbour is also starved of sediment. Together, Tuggerah Lakes and associated beach embayment's, and Norah Head are two major coastal landforms which play a significant role on the form and processes occurring across the Wyong coastline.

2.2.1 Nearshore and Offshore Environment

Large extents of submerged rocky reef extend offshore to depths of greater than 20 m from the coastal headlands at Crackneck Point, The Entrance and Norah Head. The high resolution (marine LiDAR) bathymetry indicate that three main sediment bodies are positioned between these submarine rocky outcrops, including two major sand bodies attached to Tuggerah Beach and Budgewoi Beach, and a third moderately sized sand body adjoined to Shelly Beach. No sediment transport is expected to occur between the Tuggerah and Budgewoi sand bodies. Small sediment bodies also occur at Bateau Bay, Toowoon and Blue Bays, Soldiers Beach, Pebbly Beach, Cabbage Tree Harbour and Jenny Dixon Beach, which are considered to be either isolated or 'leaky'. The large (greater than 2 km) extent of rocky reef and headland extending south from Bateau Bay towards Forrester's Beach indicates that no significant supply of sediment is sourced from downcoast.

2.2.2 Onshore Area: Beaches and Dunes

A diverse array of sand dunes occur within Wyong's coastal zone, including: foredune systems that fringe most beaches; two major barrier dune systems that together impound Tuggerah Lakes Estuary; numerous transgressive, blowout and clifftop dunes; as well as relic (Pleistocene-age) dune remnants located at Bateau Bay, Blue Lagoon and Cabbage Tree Harbour. Large coastal dunefields occur at Shelly Beach, Tuggerah Beach compartment, Soldiers Beach, Pebbly Beach and Budgewoi Beach compartment, of which many have active dune blowouts. Transgressive and dune blowout activity is much less now than naturally occurred in the early to middle 20th century as a result of post sand-mining and contemporary dune stabilisation works. A number of active dunefields are still present at Shelly, North Entrance and Soldiers beaches, for example, with a number of these active dune features arguably adding to the aesthetic character of the diverse study area.

Most well-formed dune systems situated north of North Entrance Beach have been subject to heavy mineral mining that took place throughout the 1960's and 1970's. Remediation works associated with the Rutile mining resulted in major reshaping the natural dune topography (e.g. Pelican Beach) as well as the introduction of invasive dune stabilising vegetation (e.g. Budgewoi Beach). Wyong's coastal dunes have also been subject to intense foreshore development at Blue Lagoon, Toowoon and Blue Bays, North Entrance Beach, Cabbage Tree Harbour and Hargraves Beach, noting that all these locations with the exception of Blue Lagoon are identified as coastal erosion 'hot spots'.

2.3 Coastal and Geotechnical Hazards

Coastal hazards arise where coastal processes interact with our use and development of coastal land and assets, or where human development has impeded natural coastal processes. The major coastal hazards of note defined in the Hazard Revision report include:

- *Beach Erosion*, relating to periods of intense storminess over seasons to years, and associated dune instability;
- *Long Term Recession* of sandy shorelines, relating to a long term sediment deficit to present, and due to both prevailing sediment deficits and sea level rise in the future;
- *Cliff/Bluff Geohazards*, relating to a range of cliff recession and other hillslope processes, and incorporating the effects of sea level rise in the future;
- *Coastal Inundation,* from wave runup processes during extreme storm conditions under present sea level.

Future coastal erosion and geotechnical hazards were assessed for two climate change scenarios (see also Section 1.4):

- No sea level rise, in accordance with Council current interim sea level policy;
- Sea level rise of 0.4 metres (equivalent to predictions of sea level rise by 2050 above 1990 levels), and;
- Sea level rise of 0.9 metres (equivalent to predictions of sea level rise by 2100 above 1990 levels).

2.3.1 Coastal Hazard Assessment Approach

Coastal hazards were assessed for geomorphologically common segments of beach. Coastal hazard parameters were defined though application of standard coastal engineering methods in most instances. A range of data sources were assessed to determine coastal hazards, including:

- Review of available information and data sources;
- Field inspection of geological conditions and mapping of transitional boundaries;
- Photogrammetric assessment of historical beach change, and;
- Interrogation and interpretation of remotely sensed data (historical and modern aerial photographs, terrestrial LiDAR topography and marine LiDAR bathymetry).

Beach erosion demand volumes were defined based on the available photogrammetry data. Beach profile data were processed to interrogate the envelope of volumetric variability recorded for each beach segment. The most eroded beach state relative to current condition was then adopted to define the erosion hazard relative to current conditions. The Nielsen *et al* (1992) schema was applied to map beach erosion and dune instability extents, relative to the erosion demand volumes defined for each beach segment.

Historical shoreline recession rates were extracted from long term trend identified in the beach/dune volumes and dune scarp positon.

Future recession impacts without sea level rise were assessed through projection of historical recession trends (if present), and

Future recession relating to sea level rise was estimated through application of the Bruun Rule. Future climate change impacts were mapped to include any underlying historical trends. Erosion (present and or future) hazard extents were constrained in some locations by geological controls (i.e. bedrock) mapped during this study.

Coastal inundation occurring during extreme storm conditions from elevated ocean water levels coinciding with action of waves (wave runup) were calculated by SMEC (2010) using a variety of numerical models. Wave runup mapping was also completed by SMEC (2010) and this is reproduced within the Hazard Review.

2.3.2 Geotechnical Hazard Assessment Approach

Geotechnical hazards were assessed with consideration to field observations (geological conditions and mapping of transitional boundaries), aerial photograph interpretation, relevant published information and site specific information provided in SCE (2010).

Cliff recession hazard mapping methods developed by SCE (2010) were refined as part of this study. Recession distances were calculated based on local geotechnical and topographic conditions, as per the cliff recession scheme refined for this study.

Areas susceptible to **landslip and soil creep geotechnical hazards** within the coastal zone were identified in addition to cliff recession hazards, based on local knowledge and topographic evidence of slope instability.

2.3.3 Transitional Mapping between Coastal and Geotechnical Hazard Zones

Transitional mapping between sandy foreshore areas exposed to coastal erosion and rocky foreshore areas exposed to cliff recession was undertaken. Field mapping of transitional boundaries combined with interpretation of buried cliff line locations and estimation of future exposure timeframes were required to undertake geologically sensible transitional mapping.

2.4 Key Findings

The revision of hazards considered the complex geological conditions occurring along Wyong's coastline. Central to this was the mapping of geological controls on coastal hazards, such as the buried cliff lines beneath beach and dune sands. Transitional mapping between sand foreshores and rock lengths of coastline was completed in a geologically sensible manner that considered the likely exposure of mapped geological controls to coastal processes. This study builds on understanding of coastal processes, hazards and geotechnical conditions for Wyong's coastline, and provides new hazard maps for coastal planning purposes consistent with Councils current planning scheme.

2.4.1 Coastal Erosion and Recession Hazards

The response of Wyong's beaches to extreme storm events and stormy periods have been recorded in photogrammetry beach profile data for a number of beaches. Analysis completed for this study shows the envelope of beach change varies greatly depending on beach orientation and exposure. The presence of the rocky reefs and associated headlands on Wyong's coastline control both the orientation of the beaches, and the swell protection, refraction and dissipation that occurs for a range of offshore swell directions.

Beaches fronted by shallowly submerged rocky reefs were found to be significantly protected from stormy activity, with erosion demand volumes of 75 and 115 m^3/m determined for Blue Lagoon and Toowoon Bay respectively.

Southeast to east facing beaches that experience some protection from protruding headlands and reefs, such as Bateau Bay, Soldiers Beach, Hargraves Beach and Lakes Beach were found to have a moderate erosion hazard, with erosion demand volumes between 150 and 180 m^3/m. The wide open coast lengths of shoreline at Shelly Beach and between Magenta Shores to Pelican Beach were found to have the greatest exposure to erosion from this region, with erosion demands reaching volumes in excess of 300 m^3/m. Both these beaches are fully exposed to dominant southeast wave climate.

Analysis of available photogrammetry data shows that the majority of Wyong's beaches are predominately stable. However, superimposed on the short to medium term fluctuations that occur at all beaches, some sandy shorelines appear to be actively accreting while others are subject to progressive shoreline recession. For example, analysis undertaken for this study found North Entrance Beach to be receding at approximately 0.2 m/year. While the cause of this trend is not definitively understood, it may be in response to sediment loss associated with dune blow out activity and/or human intervention within the estuary entrance interrupting the natural sediment cycle for coastal compartment. It is generally considered that no significant net longshore transport of sediment occurs within the Central Coast region; however, an imbalance in alongshore sediment supply cannot be ruled out as a possible cause for the recession occurring at North Entrance Beach. Especially so considering the significant and long term accretion noted towards the middle and northern extents of the Tuggerah Beach embayment.

Lakes Beach, located in the far southern end of the Budgewoi Beach embayment, is also found to be receding with a recession rate measured at 0.1 m/year. While no photogrammetry records are available north of Lakes Beach, a near continuous 20 – 40 m wide dunefield has accreted seaward of a prominent relic (circa 1970's) erosion escarpment preserved in a tall barrier style dune along the northern half of this embayment. This varying south to north dune morphology of the Budgewoi Beach compartment has parallels with the Tuggerah Beach compartment, i.e. both southern ends are generally eroded while the middle reaches and northern ends are notably accreted. In addition, the barrier width significantly increases to the north of both beach compartments (from about 0.5 to 2 km at Tuggerah and about 0.3 to 1.2 km at Budgewoi beach embayments), indicating a net northward transport of sediment over geological timescales. More work is however required to determine if the above observations are the result of a long term coastal processes that continue today, or rather a medium term (inter-decadal) response varying wave climate.

Cabbage Tree Harbour is another receding beach, with a measured recession rate of 0.3 m/year presented in SCE (2010). This low energy shoreline is backed by a tall indurated sand bluff that has a long history of landslide activity. Local slumping of the bluff face is reported to occur from periods of increased groundwater flows and/or as a result of wave erosion of the toe slopes. Unlike modern beach-dune systems, the relic sand bluff behaves as 'one-way' erodible 'soft rock' shoreline which cannot naturally rebuild once eroded (hence a 'one-way' shoreline). Furthermore, the harbour beach is located within a sediment starved embayment located upcoast of the southern boundary to the 'Newcastle Coast' coastal compartment (secondary level compartment) (GA, 2013) and thus no downcoast source of sediment is available to this beach. Relic Pleistocene-age dunes in the form of indurated and cemented sandy bluffs also occur at Bateau Bay and Blue Lagoon. Unlike Cabbage Tree Harbour, the Bateau Bay and Blue Lagoon sand bluffs are protected by modern beach-dune systems that are capable of accretion and recovery after erosion and therefore do not behave as 'one-way' shorelines. These coastal slopes are however susceptible to geotechnical instability mechanisms of non-coastal origin, like Cabbage Tree Harbour.

2.4.2 Coastal Cliffs, Bluffs and Geotechnical Hazards

Recession of the rocky cliff faces along Wyong's coast is considered to occur primarily due to preferential weathering of sedimentary layers occurring at the cliff toe slopes, which subsequently causes the overlying sandstone blocks to topple. The sandstone blocks become detached along joint and bedding planes that are controlled by the parent geology. The primary coastal bedrock units occurring across Wyong's coastline include Patonga Claystone, Tuggerah Formation, Munmorah Conglomerate, with 2 m joint spacing occurring in the former rock unit and 4 m joint spacing occurring in the later. In addition to the joint controlled cliff face recession, it is considered that the soil profiles that overlie the bedrock substrate will also experience some readjustment in response to cliff recession.

In addition to cliff recession, there are some coastal areas susceptible to landslide and soil erosion activity. While these zones of geotechnical hazard occur within the coastal zone, the underlying geotechnical instability processes are typically not coastal related (e.g. landslide activity, soil erosion). A geotechnical hazard zone occurring at Cabbage Tree Harbour is one exception to the above rule, where the well documented landslip hazard is driven by a range of complex processes which includes toe erosion from wave action.

2.4.3 Coastal Inundation Hazard

Extreme wave runup levels determined by SMEC (2010) along the Wyong coastline were generally around 6-7 m AHD, with a maximum value of 8.1 m AHD calculated at North Entrance. SMEC (2010) identified a number of areas that could be exposed to coastal inundation from wave runup which include:

- the caravan park at Blue Lagoon;
- the caravan park at Toowoon Bay;
- some low lying houses along the southern half of Blue Bay;
- the surf club, boat shed and swimming pool at South Entrance;

- several houses along Curtis Parade at North Entrance;
- most foreshore houses along Hargraves Beach.

In many instances, the calculated wave runup levels exceed the local crest elevations (dune, coastal structure etc.), indicating that overtopping could occur under such conditions. The locations that SMEC (2010) identified to be at risk of wave overtopping include Blue Lagoon caravan park, the southern end of Blue Bay, at swimming pool at South Entrance, along Curtis Parade at North Entrance and along Hargraves Beach.

2.5 Summary of Coastal Hazards Results

A summary of the beach related coastal hazards findings is presented in Table 2-2. Table 2-3 summaries key elements of the geotechnical hazards occurring within Wyong's coast, and Table 2-4 presents the elevated water and wave runup levels determined for Wyong.

2.6 Revised Coastal Hazard Mapping

Revised mapping of erosion and geotechnical hazards was completed as part of the Review of the Wyong Coastal Zone Hazard Study (see Appendix B), which mapped the following hazards:

- Combined coastal and geotechnical hazards with sea level rise, for the immediate and future timeframes;
- Combined coastal and geotechnical hazards without sea level rise, for the immediate and future timeframes; and
- Dune instability for the immediate timeframe.

In addition to the revised maps, the wave runup mapping by SMEC (2011) has been reproduced in Appendix B.

The Coastal Hazard Planning Area maps adopted for this WCZMP 2017 are presented in Chapter 5.

Table 2-2 Summary Table for Beach Erosion Hazards

Beach Location	Beach Length (km)	Beach Orien-tation	Beach Descrip-tors[1]	Photogram. Available? / No. Years / No. Dates[2]	Erosion Demand (m^3/m)[3]	Historical Recession			Recession from SLR		
						Adop-ted Rate (m/yr)[4]	2050 Reces-sion (m)[5]	2100 Reces-sion (m)[5]	Meas-ured Beach Slope	2050 SLR Reces-sion (m)[6]	2100 SLR Reces-sion (m)[6]
Bateau Bay *(bluff recession 2050 onwards)*	0.5	SE	SP, H, R	Yes / 46yrs / 6 dates	160	Nil	Nil	Nil	46 / 29	15	29
Blue Lagoon (Shelly Beach Compartment)	0.5	E	P, R	Yes / 54yrs / 8 dates	50	Nil	Nil	Nil	34	11	28
Shelly Beach (Shelly Beach Compartment)	2.0	SE	O	Yes / 54yrs / 8 dates	290	Nil	Nil	Nil	39	13	32
Toowoon Bay	0.7	E	P, ~B, R, T	Yes / 35yrs / 9 dates	75	0.1*	4	9	35	11	28
Blue Bay	0.4	ESE	SP, R, T, C	Yes / 35yrs / 9 dates	115	0.1*	4	9	34	11	28
South Entrance Beach	0.4	E	SP, B, R, E	Yes / 54yrs / 9 dates	*Backing revetment*	N/A	N/A	N/A	N/A	N/A	N/A
The Entrance Spit (Tuggerah Compartment)	0.6	ESE	SP, R, E	Yes / 54yrs / 10 dates	*Spit breach*	N/A	N/A	N/A	N/A	N/A	N/A
North Entrance (Tuggerah Compartment)	2.8	ESE - SE	O	Yes / 54yrs / 10 dates	170	0.2	7	17	44	14	36
Magenta to Pelican (Tuggerah Compartment)	4.8	SE - SSE	O, ~H, ~T	Yes / 52yrs / 9 dates	310	Nil	Nil	Nil	37	12	30
Soldiers Beach	1.0	SE	SP, H	Yes / 43yrs / 9 dates	150	Nil	Nil	Nil	42	14	35
Pebbly Beach	0.4	SE	SP, B, H	No	150*	Nil	Nil	Nil	46	15	38
Cabbage Tree Bay	0.3	NE	P, H, R	No	75*	0.3	11	26	30	10	24

Beach Location	Beach Length (km)	Beach Orien-tation	Beach Descrip-tors[1]	Photogram. Available? / No. Years / No. Dates[2]	Erosion Demand (m^3/m)[3]	Historical Recession			Recession from SLR		
						Adop-ted Rate (m/yr)[4]	2050 Reces-sion (m)[5]	2100 Reces-sion (m)[5]	Meas-ured Beach Slope	2050 SLR Reces-sion (m)[6]	2100 SLR Reces-sion (m)[6]
Jenny Dixon Beach	0.3	ESE	SP, B, ~H, R	No	*Backing cliff*	N/A	N/A	N/A	N/A	N/A	N/A
Hargraves Beach	1.1	E	SP, ~B, ~H, R	Yes / 41yrs / 9 dates	180	Nil	Nil	Nil	43	14	36
Lakes Beach (Budgewoi Compartment)	1.0	ENE - E	SP, ~R, T	Yes / 39yrs / 8 dates	150	0.1	4	9	57	19	47
Budgewoi Beach (Budgewoi Compartment)	2.2	E - ESE	O	No	250*	0.1*	4	9	56	18	46

[1] **Beach Descriptors**: (O) open beach; (SP) semi protected beach, (P) protected beach, (B) bedrock backed beach (H) protruding headland & rocky platforms, (R) nearshore reefs present, (T) tombolo or salient present, (E) lake entrance present (C) minor creek present.
[2] **Photogrammetry** refers to beach profile information used for this hazard review which includes LiDAR topography data for some beaches.
[3] **Erosion Demand** values relative to ~2007 conditions, as discussed in Appendix B. Volumes denoted with an asterisk (*) have been adopted from geomorphological comparable beaches.
[4] **Adopted Historical Recession Rates** are based on photogrammetry analysis of beach volume and dune movement, coupled with a geomorphic appraisal of long term beach behaviour, as discussed in Section Appendix B.
[5] **Future Recession Estimates** (i.e. 2050, 2100) based on historical shoreline behaviour (i.e. adopted historical recession rates) are rounded to the nearest metre. These estimations are made relative to 2015. Recession estimation will not be realised where bedrock in encountered in the immediate backbeach environment
[6] **Sea Level Rise (SLR) Recession Estimations** are based on Councils previous benchmarks of 0.4 m by 2050 and 0.9 m by 2100, relative to 1990, and estimated based on the Brunn Rule calculations (only). These estimates have assumed a sea level rise of 3 mm/year rise between 1990 and present, as recommended by DECCW (2009b). Again, recession distances are rounded to the nearest metre. Recession estimation will not be realised where bedrock in encountered in the immediate backbeach environment
Note that future beach recession hazard lines mapped for the 2050 and 2100 sea level rise scenarios are based on a combination of historical recession estimates and Brunn Rule estimations, rounded to the nearest metre.

Table 2-3 Summary Table for Coastal Cliff and Slope Hazards

Cliff / Bluff Location	Coastal Morphology	Geology	Cliff Recession Mechanism	Recession Rate	Adopted Recession Angle	Other Slope Instability Hazards
Crackneck Point and surrounds	Tall bedrock headland with cliffs and slopes, fringed by an often wide rocky platform	Terrigal Formation, **Patonga Claystone**, Tuggerah Formation *(2 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (2 m) per planning horizon timeframe	70° for bedrock 45° for surficial colluvial soil profile	Slopes also susceptible to non-coastal geotechnical (landslip/soil creep) hazards
Bateau Bay coastal slopes	Tall indurated sand bluff (relic coastal cliff) fronted by modern beach and dune sands	**Indurated / Cemented Sands**	Slope adjustment in response to wave attack of toe slopes, when exposed	As per Bruun Rule estimates of recession due to SLR	35° for indurated sands; Sand slump as per Nielsen *et al* (1992) Zone of Slope Adjustment Schema	Slopes also susceptible to non-coastal geotechnical (landslip/soil creep) hazards
Unnamed headland, between Bateau Bay and Blue Lagoon	Bedrock headland with steep cliffs and fringed by a wide rocky platform	**Patonga Claystone**, Tuggerah Formation *(2 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (2 m) per planning horizon timeframe	70° for bedrock 30° for soil profile	None
Blue Lagoon coastal slopes	Indurated sand bluff (relic coastal cliff) protected by modern beach and dune sands	**Indurated / Cemented Sands**	*Coastal erosion unlikely in 100 year planning timeframe*			Slopes susceptible to non-coastal geotechnical (landslip/soil creep) hazards
Little Bay coastal slopes	Bedrock cliffs and rocky platform with a perched sandy beach	**Patonga Claystone**, Tuggerah Formation *(2 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (2 m) per planning horizon timeframe	70° for bedrock 30° for soil profile	None
Toowoon and Blue Bays coastal slopes	Localised bedrock cliff at Toowoon Bay and more widespread relic coastal slopes protected by beach and dunes	**Patonga Claystone**, Tuggerah Formation *(2 m joint spacing; 70° jointing angle)* (+/- highly weathered bedrock and colluvium in relic coastal slopes)	Block failure and slope adjustment (for active cliffs at Toowoon Bay only)	1 joint spacing (2 m) per planning horizon timeframe	70° for bedrock 30° for soil profile	Some slopes also susceptible to non-coastal geotechnical (landslip/soil creep) hazards

Cliff / Bluff Location	Coastal Morphology	Geology	Cliff Recession Mechanism	Recession Rate	Adopted Recession Angle	Other Slope Instability Hazards
The Entrance coastal slopes	Bedrock headland with cliffs and slopes, and fringed by rocky platform with a perched sandy beach at South Entrance	**Patonga Claystone**, Tuggerah Formation *(2 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (2 m) per planning horizon timeframe	70° for bedrock 30° for soil profile	None
Soldiers Point	Low bedrock headland with cliffs, fringed by a wide rocky shore platform	**Munmorah Conglomerate** *(4 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (4 m) per planning horizon timeframe	70° for bedrock 45° for surficial colluvial soil profile	None
Pebbly Beach	Bedrock slopes fronted by modern beach and dune sands	**Munmorah Conglomerate** *(4 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (4 m) per planning horizon timeframe	70° for bedrock 30° for deep sandy soil profile 45° for surficial colluvial soil profile	Some cliff-top sand dunes may be susceptible to slope instability
Norah Head	Protruding bedrock headland with cliffs and slopes, fringed by rocky shore platform with a perched sandy beach (Lighthouse Beach)	**Tuggerah Formation**, (+/- igneous dykes) Munmorah Conglomerate *(4 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (4 m) per planning horizon timeframe	70° for bedrock 45° for surficial colluvial soil profile	None
Cabbage Tree Harbour	Exposed tall indurated sand bluff	Indurated / Cemented Sands	Slope adjustment in response to wave attack of toe slopes, when exposed	Historical recession of 0.3 m/year *plus* Bruun Rule estimates of SLR recession	30° for indurated sands Sand bluff slumps as per Nielsen *et al.* (1992) Zone of Slope Adjustment scheme	Slopes also susceptible to non-coastal geotechnical (landslip) hazards
Jenny Dixon Beach coastal cliffs and slopes	Bedrock cliffs and slopes, backing a perched sandy beach (Jenny Dixon Beach)	**Tuggerah Formation**, (+/- igneous dykes) *(4 m joint spacing; 70° jointing angle)*	Block failure and slope adjustment	1 joint spacing (4 m) per planning horizon timeframe	70° for bedrock 45° for surficial colluvial soil profile	Some slopes also susceptible to non-coastal geotechnical (landslip/soil creep) hazards

Table 2-4 Extreme Wave Runup Levels for Wyong (1% AEP water levels combined with 1% AEP wave height) calculated by SMEC (2010)

Beach	Location	Water Level (m)	Maximum Wave Runup (m)	2% Wave Runup (m)	Significant Wave Runup (m)	1% AEP Offshore WL (mAHD)	Max Runup Height (mAHD)
Shelly Compartment	Blue Lagoon Resort - south end	1.21	4.62	4.18	3.17	1.48	**7.31**
Shelly Compartment	Blue Lagoon Resort - north end	0.99	4.35	3.96	3.00	1.48	**6.82**
Shelly Compartment	Shelly Beach SLSC	1.01	4.44	3.96	3.00	1.48	**6.93**
Shelly Compartment	North carpark beach access	1.05	4.27	3.89	2.95	1.48	**6.80**
Shelly Compartment	Far northern corner of beach	1.05	4.19	3.82	2.90	1.48	**6.72**
Toowoon Bay	Toowoon Bay SLSC car park	1.11	2.96	2.77	2.11	1.48	**5.55**
Toowoon Bay	Middle section of Toowoon Bay (~Kims Beachside Retreat)	1.20	2.92	2.74	2.09	1.48	**5.60**
Toowoon Bay	Between Toowoon Bay Rd and Beenbah Ave	1.18	3.03	2.84	2.16	1.48	**5.69**
Toowoon Bay	Far northern end of Toowoon Bay	1.14	3.07	2.87	2.18	1.48	**5.69**
Blue Bay	Southern Blue Bay	1.19	3.84	3.53	2.68	1.48	**6.51**
South Entrance	South Entrance SLSC	1.32	3.56	3.29	2.50	1.48	**6.36**
South Entrance	Boatshed	1.17	3.78	3.48	2.64	1.48	**6.43**
Tuggerah Compartment	The Entrance Spit (Karagi Reserve beach access)	1.17	3.78	3.48	2.64	1.48	**6.43**
Tuggerah Compartment	~Hargraves St beach access	0.96	3.72	3.43	2.60	1.48	**6.16**
Tuggerah Compartment	North Entrance SLSC	1.27	3.97	3.64	2.76	1.48	**6.72**
Tuggerah Compartment	Florida St beach access	1.11	4.62	4.18	3.17	1.48	**7.21**
Tuggerah Compartment	~Coogee Ave	1.16	4.93	4.44	3.36	1.48	**7.57**
Tuggerah Compartment	Curtis Pde - middle	1.19	5.43	4.86	3.67	1.48	**8.10**
Tuggerah Compartment	Tuggerah Compartment Chainage ~2.8km (from S)	1.19	5.43	4.86	3.67	1.48	**8.10**
Tuggerah Compartment	Magenta Shores - south end	1.15	5.17	4.64	3.51	1.48	**7.80**
Tuggerah Compartment	Magenta Shores - middle	1.23	5.43	4.86	3.67	1.48	**8.14**
Tuggerah Compartment	Magenta Shores - north end	1.21	5.17	4.64	3.51	1.48	**7.86**
Tuggerah Compartment	Pelican Beach, south of carpark	1.15	5.17	4.64	3.51	1.48	**7.80**
Tuggerah Compartment	Pelican Beach - north corner	1.07	4.19	3.82	2.90	1.48	**6.74**
Tuggerah Compartment	Pelican Beach - north corner	1.06	1.69	1.45	1.09	4.48	**7.23**
Soldiers Beach	Soldiers Beach - far south end Beach	1.06	4.19	3.82	2.90	1.48	**6.73**

Beach	Location	Water Level (m)	Maximum Wave Runup (m)	2% Wave Runup (m)	Significant Wave Runup (m)	1% AEP Offshore WL (mAHD)	Max Runup Height (mAHD)
Soldiers Beach	Soldiers Beach - south end of beach	1.15	4.12	3.76	2.85	1.48	**6.75**
Soldiers Beach	Middle section of Soldiers Beach	1.17	4.27	3.89	2.95	1.48	**6.92**
Soldiers Beach	Soldiers Beach SLSC	1.22	4.44	4.03	3.05	1.48	**7.14**
Hargraves Beach	Approx. 15-17 Elizabeth Dr	1.04	3.50	3.24	2.46	1.48	**6.02**
Hargraves Beach	Southern beach access	1.04	3.14	2.93	2.23	1.48	**5.66**
Hargraves Beach	Approx. 37 Elizabeth Dr	1.30	3.07	2.87	2.18	1.48	**5.85**
Hargraves Beach	Approx. 49 Elizabeth Dr	1.40	3.23	3.00	2.28	1.48	**6.11**
Hargraves Beach	Approx. 75 Budgewoi Rd	1.21	3.84	3.53	2.68	1.48	**6.53**
Hargraves Beach	Budgewoi Rd beach access	1.09	4.12	3.76	2.85	1.48	**6.69**
Hargraves Beach	Approx. 113 Budgewoi Rd	1.03	4.55	3.70	2.76	1.48	**7.06**
Hargraves Beach	Gomul St	0.95	4.39	3.58	2.66	1.48	**6.82**
Hargraves Beach	Werepi St beach access	1.09	4.35	3.96	3.00	1.48	**6.92**
Hargraves Beach	Far north end of beach	1.17	4.44	4.03	3.05	1.48	**7.09**
Lakes Beach	Lakes Beach SLSC	0.95	2.77	2.61	1.99	1.48	**5.20**
Budgewoi Beach	Dune Arm	0.93	3.45	3.20	2.43	1.48	**5.86**

3 Implementation Schedule

3.1 Development of the Recommended Actions

The WCZMP 2011 sets out Council's strategy for managing coastal risks that affect the way the community uses and enjoys the coast. A risk analysis was undertaken to inform the 2011 strategy, which is underpinned by 72 actions.

The full list of 72 actions from WCZMP (2011) has been compiled and reviewed to determine if actions remain relevant for this revised Wyong CZMP 2017, particularly with regard to the revised hazard mapping. The review also considered changes in legislation or management focus since 2011, other coastal management objectives (ecology, community) and if the action has been implemented in part or full.

Recommendations were then made as to retaining the action (with or without changes, or amalgamated with another similar action), or replacing the action with an alternative that better addresses the coastal risks and management objectives. Full details of the review of actions are provided in Appendix C.

A total of 42 actions were derived from the review and are detailed for implementation in Section 3.5. Of the original 72 actions in WCZMP 2011, 20 of them have been retained with moderate to no change. A further 22 new actions were developed for this plan. The new actions were often based upon an original action, but updated to reflect the gaps in coastal management that exist now. All 42 actions have been prescribed a new action number (1 to 42). To differentiate between the old and new actions, all actions from WCZMP 2011 have retained a reference to their original action number denoted with an "A"; and all new actions developed for this study have been given a new reference number denoted with a "B" (refer to Table 3-7).

3.2 Assets within the Coastal Hazards Zones

A general listing of the public and private assets within each of the hazard zones at each beach has been compiled in Table 3-1. This listing may guide Council as to the extent of public and private land and assets potentially at risk from coastal and geotechnical hazards.

Table 3-1 Land and Assets within Coastal Hazard Zones

Beach Location	Erosion Risk - Immediate	Erosion Risk - High	Erosion Risk - Low	Cliff Recession Risk - Immediate	Cliff Recession Risk - High	Cliff Recession Risk - Low	Geotechnical Risk	Wave Runup Risk - Immediate
Crackneck Region								
Bateau Bay	• Beach accessways						• Foreshore accessways • Foreshore parkland / lookouts	
Blue Lagoon	• Blue Lagoon Beach Resort • Beach accessways						• Bateau Bay Rd • Access road: Blue Lagoon Beach Resort	• Blue Lagoon Beach Resort
Shelly Beach	• Beach accessways	• Shelly Beach Road • SLSC Car Park	• Shelly Beach SLSC					
Little Bay				• Stormwater Outlet • Foreshore accessways				
Toowoon Bay	• Kim's beachside retreat • Beach accessways	• Toowoon Bay SLSC, access road & carpark • 5 residential properties • Binburra Ave (road reserve)	• 4 residential properties • Swadling Park • Charlton Street (road reserve) • Binburra Ave		• Toowoon Bay Road • 7 residential properties	• 2 residential properties	• Multiple roads • Multiple residential properties • Kim's beachside retreat • Foreshore reserve	• Toowoon Bay carpark • Kim's beachside retreat • Multiple residential properties
Blue Bay	• Beach accessways • 21 residential properties	• 8 residential properties • Toilet block • Carpark	• 1 residential property • Warrina Rd	• 3 residential properties	• 2 residential properties		• Multiple roads • Multiple residential properties • Blue Bay Holiday Park • Foreshore reserve	• Multiple residential properties

Implementation Schedule

Beach Location	Erosion Risk - Immediate	Erosion Risk - High	Erosion Risk - Low	Cliff Recession Risk - Immediate	Cliff Recession Risk - High	Cliff Recession Risk - Low	Geotechnical Risk	Wave Runup Risk - Immediate
The Entrance / South Entrance Beach				• 20 residential properties • Marine Pde • Entrance Ocean Baths & access rd • Entrance Surf Club & watch tower • Foreshore reserve & accessways	• 1 residential property			• Entrance Ocean Baths • The Boat Shed • The Surf Club & watch tower
North Entrance Beach	• Beach accessways • 2 residential properties (Hutton Road) • 27 residential properties (Curtis Pde)	• 10 residential properties (Hutton Rd) • 1 residential properties (Curtis Pde) • Curtis Pde • Hargraves St • SLSC Carpark • Foreshore reserves	• 9 residential properties (Hutton Rd) • 4 residential properties (SLSC - Stewart St) • 12 residential properties (Curtis Pde) • Glenvale School • North Entrance SLSC & Access Rd					• Multiple residential properties (Curtis Pde)
Tuggerah and Pelican Beaches	• Beach accessways • Foreshore reserves	• Foreshore reserves						
Soldiers Beach	• Beach accessways • SLSC watch tower • Stormwater outlet		• Soldiers SLSC	• Beach accessways		• Beach carpark		
Pebbly Beach								
Norah Head				• Foreshore accessways	• Norah Head Lighthouse Reserve			

Implementation Schedule

Beach Location	Erosion Risk - Immediate	Erosion Risk - High	Erosion Risk - Low	Cliff Recession Risk - Immediate	Cliff Recession Risk - High	Cliff Recession Risk - Low	Geotechnical Risk	Wave Runup Risk - Immediate
Cabbage Tree Bay	• 3 residential properties • Carpark • Boat Ramps • Beach accessways • Toilet block	• 8 residential properties • Marine Rescue Norah Head • Bald St, Mitchell St • Lookout and foreshore (bluff top) reserve	• 4 residential properties • Carpark (bluff top)	• Foreshore accessways	• 1 residential property	• 4 residential properties • Macquarie St (road reserve)	• Multiple roads • Multiple residential properties • Foreshore reserve • Marine Rescue Norah Head	
Jenny Dixon Beach and Bluff				• Foreshore accessways • 1 residential property (Henderson St) • 7 residential properties (Roslyn Pl) • Cliff top reserves	• 1 residential property (Henderson St) • Public carpark	• 1 residential property (Henderson St)	• Multiple residential properties • Foreshore reserve and facilities	
Hargraves Beach	• Beach accessways • 11 residential properties (Budgewoi Rd)	• 18 residential properties (Elizabeth Dr) • 9 residential properties (Budgewoi Rd) • Gomul St (roadside reserve)	• 8 residential properties (Budgewoi Rd) • Gomul St (roadside reserve)	• 2 residential properties (Roslyn Pl) • 1 residential properties (Ada Ave) • 1 residential properties (Elizabeth Dr)	• 1 residential properties (Ada Ave) • 5 residential properties (Elizabeth Dr)	• Ada Ave		• Most foreshore residential properties
Lakes Beach	• Beach accessways	• Lakes SLSC • Beach carpark	• SLSC Carpark					
Budgewoi Beach	• Beach accessways		• 2 Carparks					

3.3 Management Precincts for Wyong's Coastline

To assist with how actions in this CZMP will be applied to the varying areas of the Wyong coastline, the coast has been organised into four management "precincts". The precincts are defined in terms of the different risks and values within them that support different levels and types of community usage and development, ecological habitats and function, which in turn require different management intents and actions.

The four management precincts defined for Wyong's coast are as follows.

- *Hot Spot Precinct*: covers the five hot spot embayments, namely, Blue Bay, Toowoon Bay, North Entrance Beach, Hargraves Beach and Cabbage Tree Harbour. These embayments are already at imminent risk from erosion. A key action is for detailed cost-benefit analyses to select a feasible and financially viable erosion management action. This shall be implemented as soon as practicable, and prior to irreversible damage to public or private assets and land. The "hot spots" also hold the community and habitat values, and coastal management shall focus on these attributes also.
- *Recreational and Urban Use Precinct*. This precinct covers those beaches and coast that are more intensively used for recreation, are more accessible from adjacent urban land, and support more intensive urban use; and which therefore have higher community and economic values. Due to their higher usage, these areas require better, more numerous and more varied facilities. The precinct would also benefit from dune management that will improve the erosion protection provided to the recreational amenity and adjacent urban land. Areas within this precinct that are subject to geotechnical hazards will require separate action to manage the different processes driving this risk.
- *Natural Coast Precinct*: This precinct covers the undeveloped and natural landscapes along the coastline, which in turn support higher ecological values. Management actions in this precinct are aimed at maintaining and rehabilitating the natural habitat and landscapes, and reducing anthropogenic impacts. Due to the undeveloped and somewhat inaccessible nature of most of this precinct, the recreational usage is less, and so, fewer and more low-key recreational assets are supported. For sections of rocky coast, the safety of recreational access is a key consideration.
- *Entrance Channel Precinct.* This covers The Entrance channel including the dynamic sand bars within it. The Entrance is affected by catchment inputs, Tuggerah Lake mixing and currents, and tidal currents, in addition to the waves, currents and water levels of the open coast. This makes the channel and sand bars highly variable and complex, requiring a different management approach from the adjacent coastline.

The proposed management intents and uses, and management actions for the four precincts are illustrated in Figure 3-3 to Figure 3-6. A map of the precinct coverage across the entire Wyong coastline is provided in Figure 3-1 and Figure 3-2.

Title:

Management Precincts for the Wyong CZMP, Northern Half

Figure: 3-1

Rev: A

N

0 1 2km

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath :

Title:

Management Precincts for the Wyong CZMP, Southern Half

Figure: 3-2

Rev: A

N

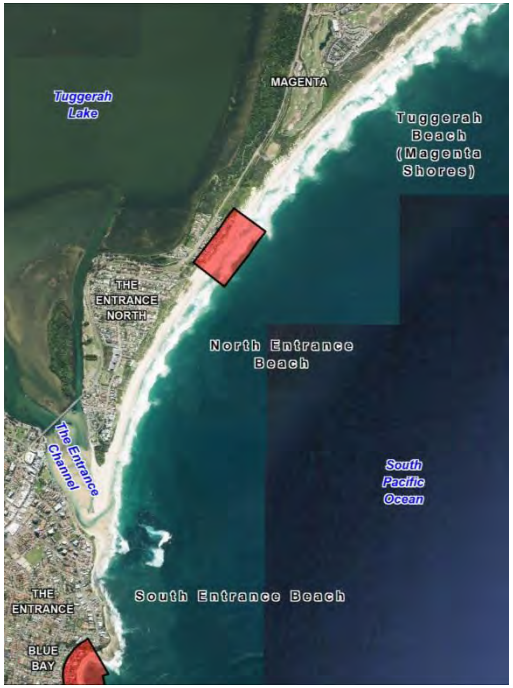
0 1 2km

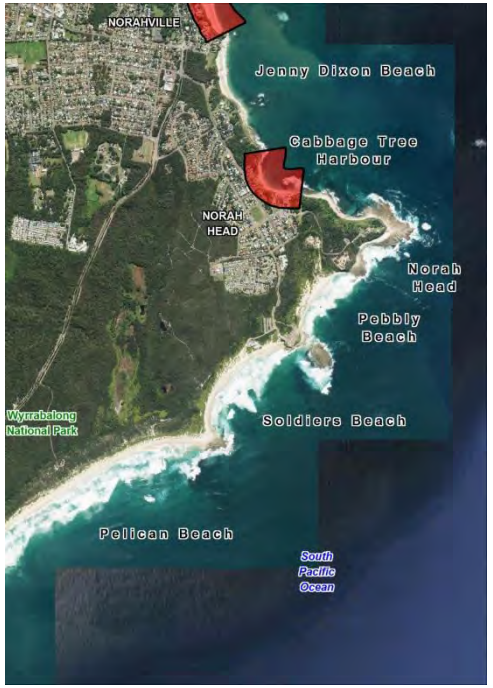
Approx. Scale

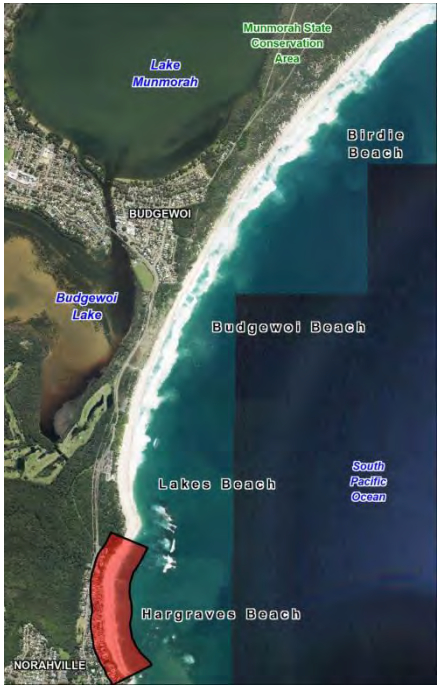
BMT WBM
www.bmtwbm.com.au

Filepath :

Hot Spot Management Precinct







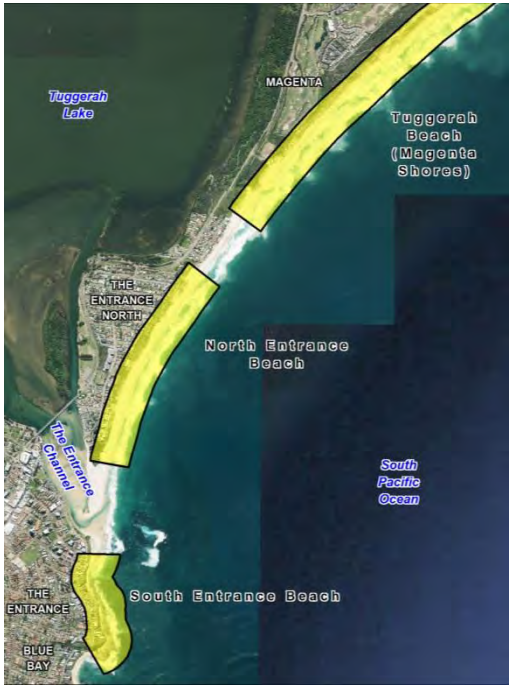
Management Intent

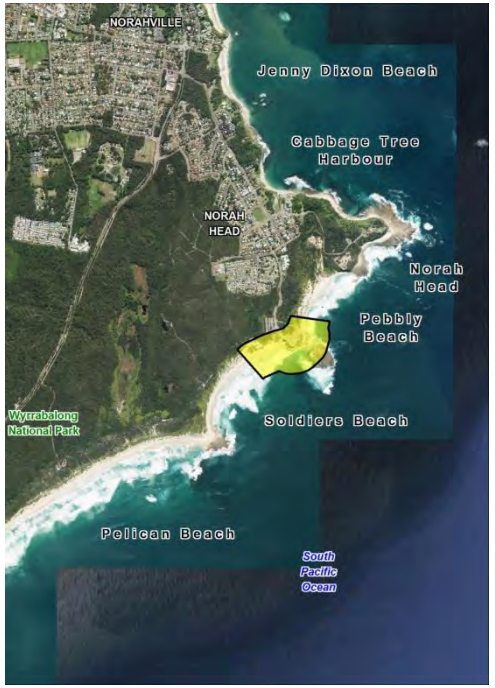
- To manage the immediate threats from coastal erosion
- To progressively manage the longer term threats from coastal erosion and wave overtopping
- To build community resilience to periods of reduced amenity from beach erosion, and natural changes in beach width
- To maintain and enhance the high level community and urban values, through ongoing support for facilities and access to the beach
- To prepare the community for the need for decisive action, which will be required when a trigger value of erosion is met, but need not be selected at this time

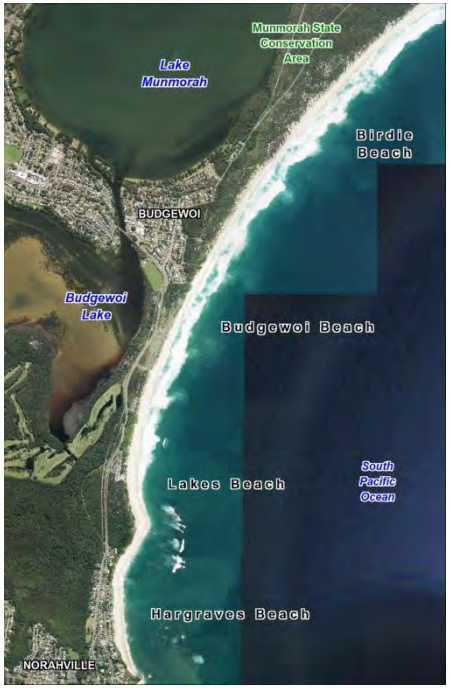
Management Actions

- **1**: Beach sand monitoring
- **6**: Dune rehabilitation works
- **8**: Investigate use of Beach Scraping
- **9**: Use of Dredged Sand from the Entrance on North Entrance Beach
- **24**: Training of Council staff for appropriate response to coastal erosion
- **16**: Update DCP Chapter 3.5 Coastal Hazards for wave overtopping
- **17**: Implement and update Chapter 3.5 as needed over time
- **23**: Checklist for all Council works in the coastal zone
- **15**: Internal Council workshop to educate on responsibilities for implementing CZMP actions
- **2**: Lobby NSW Government to collect marine LIDAR regularly
- **34, 35**: Community Education program to improve understanding of dynamic nature of beach
- **5**: Options Feasibility Studies for Hot Spot Beaches
- **36**: Community database of erosion and inundation events
- **31**: Continue beach access maintenance and post-storm monitoring program
- **33**: Revise the Coastal Erosion Emergency Action Sub Plan(s)
- **30**: Develop a program of recreational asset upgrades
- **21**: Regular community surveys
- **14**: Maintain a Coastal Coordinator
- **13**: Continue the role of the Tuggerah Lakes Estuary, Coastline and Floodplain Management Committee
- **Section 3.6**: Managing Future Risks and recommended triggers

Recreational and Urban Management Precinct







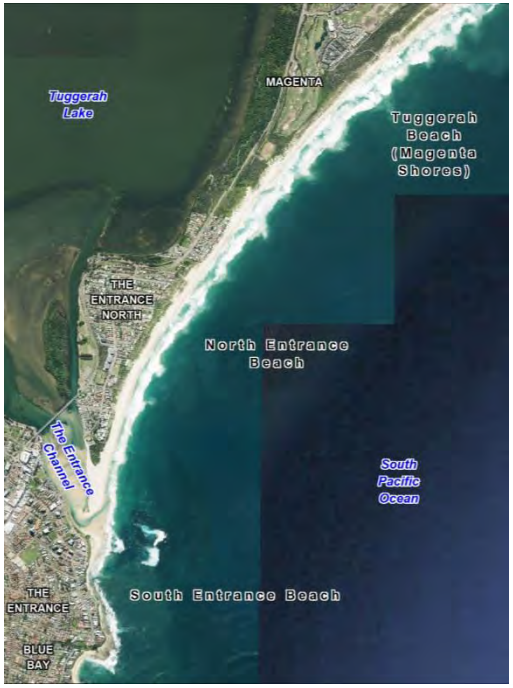
Management Intent

- To support a range of recreational activities, through ongoing improvements to facilities and access
- To support dune building to provide an erosion buffer to storms for recreational and urban back beach development
- To build the resilience of the community to the varying nature of the beach, including periods of beach erosion when sections of the beach may be temporarily inaccessible
- To allow natural coastal processes to occur through long term strategic planning for assets and urban development
- To improve our understanding and management of geotechnical risks in areas of recreational use or urban development

Management Actions

- **30**: Develop a program of recreational asset upgrades
- **6**: Dune rehabilitation works;
- **7** Continue to support volunteer dune maintenance groups
- **8**: Investigate use of Beach Scraping
- **31**: Continue beach access maintenance and post-storm monitoring program
- **11**: Assess and upgrade the Entrance seawall
- **41**: Develop coastal interpretive signage in liaison with the Aboriginal community
- **34, 35**: Community Education program to improve understanding of dynamic nature of beach
- **21**: Regular community surveys
- **36**: Community database of erosion and inundation events
- **23**: Coastal Hazards Checklist for all Council works
- **16, 17**: Update DCP Chapter 3.5 Coastal Hazards for wave overtopping, and continue to implement and update over time
- **24**: Training Council staff in appropriate response to erosion
- **25**, **27**, **28**, **29**: Include coastal and geotechnical risk in Asset Management replacement, for all council assets.
- **40**: Review POMs (for Community, Crown including Holiday Parks, and National Parks / Reserves land) to include consideration of coastal and geotechnical hazards
- **15**: Internal Council workshop to educate on responsibilities for implementing CZMP actions
- **14**: Maintain a Coastal Coordinator
- **19**: Update the LEP / DCP to include relevant provisions for managing geotechnical hazard
- **4**: Monitoring program for high risk landslip sites
- **26**: Assess stormwater assets in landslip hazard areas

Natural Coast Management Precinct



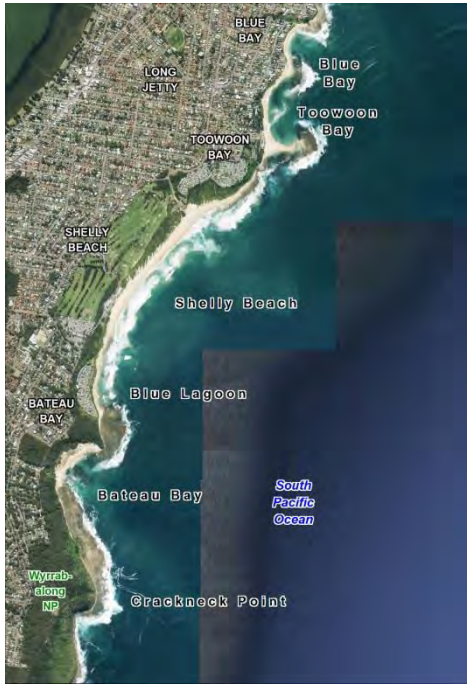
Management Intent

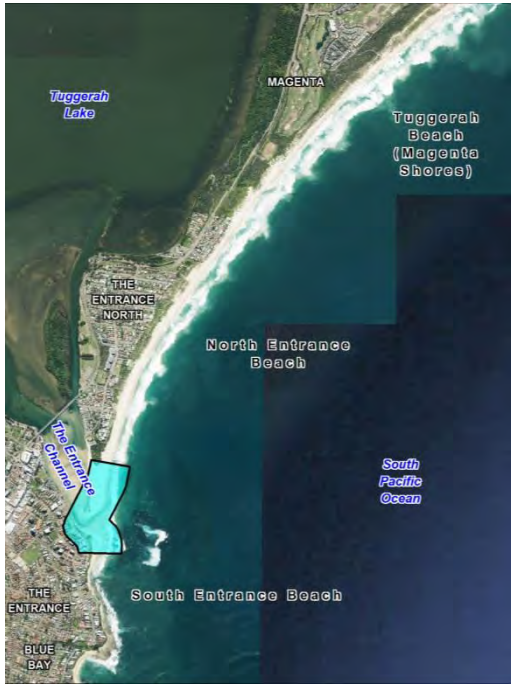
- To maintain and enhance natural landscape values (beach and rocky coast), which in turn support the scenic values of adjacent precincts
- To support high value ecological habitats and threatened species
- To allow natural coastal and geotechnical processes to occur
- To provide for limited, low key recreational access
- To provide for safe and appropriate recreational access to the rocky coast and other areas of geotechnical risk

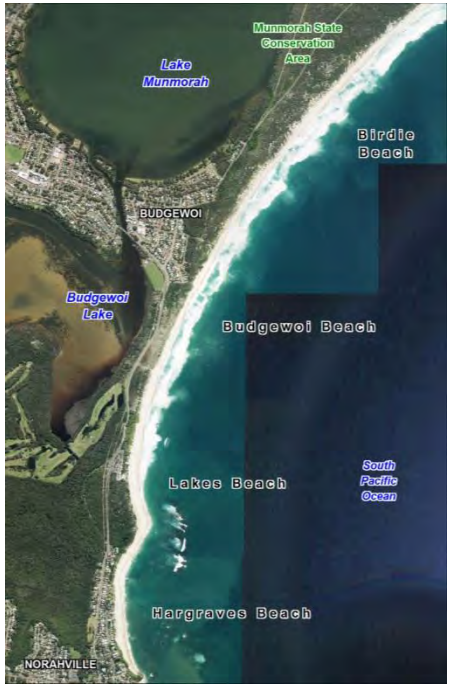
Management Actions

- **38**: Conduct benchmark survey of coastal ecological communities
- **39**: Establish conservation agreements for high value habitat where feasible
- **22**: Update DCP to provide for migration buffers for coastal wetland habitats
- **37**: Continue to work with OEH to protect shorebird nesting sites
- **6**: Dune rehabilitation works;
- **7** Continue to support volunteer dune maintenance groups
- **40**: Review POMs (for Community, Crown including Holiday Parks, and National Parks / Reserves land) to include consideration of coastal and geotechnical hazards
- **42**: Develop a decision support tool to respond to coastal threats to Aboriginal sites
- **32**: Continue to develop sections of the coastal walk
- **30**: Develop a program of recreational asset upgrades
- **41**: Develop coastal interpretive signage in liaison with the Aboriginal community
- **4**: Monitoring program for high risk landslip sites
- **19**: Update the LEP / DCP to include relevant provisions for managing geotechnical hazard

Entrance Channel Management Precinct







Management Intent

- To support the functioning of The Entrance Channel in a manner that maintains or improves water flow between the lake and coast, in a natural manner wherever possible
- To support the range of recreational and commercial activities associated with the Entrance channel and Tuggerah Lakes
- To investigate the hydrodynamics and sediment transport characteristics of The Entrance channel (including potential sea level rises), to improve our management of the Channel
- To support the unique ecological values of The Entrance channel

Management Actions

- **9**: Use of Dredged Sand from the Entrance on North Entrance Beach
- **12**: Review estuary flood studies for inclusion of sea level rise when determining potential inundation levels.
- **11**: Assess and Upgrade the Entrance seawall
- **10**: Investigate sediment transport dynamics of the Entrance channel

The precincts follow a similar approach to the management action themes introduced by Umwelt in the WCZMP 2011, as shown in Table 3-2 below.

Table 3-2 Comparison of Management Precincts (2017) with Management Action Plans (2011)

WCZMP 2016 Management Precincts	WCZMP 2011Management Action Plans
Not mappable	Coastal Knowledge Action Plan
Hot Spot	Coastal Emergency Response Management Plan, and the EASPs
Hot Spot, Recreational and Urban Use	Coastal Erosion and Recession Action Plan
Entrance Channel	Coastal Inundation Action Plan
Entrance Channel	Lake and Sea Interactions Action Plan
Recreational and Urban Use, Natural Coast	Geotechnical Hazards Action Plan
Natural Coast	Building Coastal Biodiversity Resilience Action Plan
Recreational and Urban Use	Recreation and Tourism Action Plan
Recreational and Urban Use, Natural Coast	Cultural Landscapes Action Plan

3.4 Funding Opportunities

There are a range of funding mechanisms and grant funding available to Council to assist with implementing actions in this CZMP. These funding opportunities fall under the following categories:

- Council funding mechanisms;
- State funding programs and opportunities; and
- Federal funding mechanisms.

Table 3-3, Table 3-4 and Table 3-5 provide a summary of the available funding sources and mechanisms. Additional guidance for Council for coastal management action funding can be found in the Draft NSW Coastal Management Manual (OEH, 2015).

Table 3-3 Council Funding Mechanisms

Funding Source	Details
Council Ordinary Rates	A key funding mechanism for Council are statutory rates and charges, which can be applied to private landowners and businesses. Under the *Local Government Act 1993* (LG Act), ordinary rates can be applied to all rateable land within a local government areas. This money can be used to fund delivery of community assets and services, and may also be used to implement coastal management actions.
Special Rates	Specific works, services, facilities or activities that benefit certain parcels of rateable land can be funded (in whole or part) by Council by applying special rates under the LG Act. Where a coastal management action directly benefits a property owner, special rates provide a mechanism for Council to secure contributions from those landowners over time. Special rates can be implemented in different ways. Council can issue rates over a property or alternatively entre into an arrangement with the owner for payment of a lump-sum amount. Where a property, or properties, benefit from a coastal protection service, a coastal protection service change can be applied (see below).
Coastal Protection Service Charge	The coastal protection service change can be applied on rateable land where that land benefits from a coastal protection service, such as a seawall or beach nourishment for example. The change can be applied where coastal protection works are constructed by, or on behalf of the owner or occupier (current or previous). The charge can also be applied where coastal works are constructed in a joint arrangement between an owner or occupier and a public authority or council. The change is applied to cover Council costs for construction, maintenance or repair of the works, as well as managing/remediating the impacts caused by the works.
Development Contributions	Developer contributions, enabled under the *Environmental Planning and Assessment Act 1979* may be used for coastal management in some instances, such as funding capital works to manage the development impacts on the coast or reduce risk to the development from coastal hazards.
Revenue Generated by Council	Council can also fund coastal management initiative through revenue they may generate through hire, rental or other commercial partnerships (e.g. SLSC, Holiday Parks).

Table 3-4 NSW Government Funding Mechanisms, Programs and Grants

Funding Source	Details
NSW Coastal Management Program	Under this program, the NSW Government provides grants to local government to support coastal management planning (e.g. hazards studies, management plans/programs) and actions to manage the risks of coastal hazards (e.g. erosion protection). This program can also be used to restore degraded coastal habitats (e.g. dunes and wetlands restoration). Funding of up to 50% of a project cost is available to successful applications and the programme is administered by OEH. Grant funding will be prioritised to Council applications associated with certified Plans.

Funding Source	Details
NSW Estuary Management Program	Under this program, the NSW Government provides grants to local government to support coastal management planning and actions to improve the health of NSW estuaries. Funding up to 50% of a project costs is available to successful applications and the programme is administered by OEH. Grant funding will be prioritised to Council applications associated with certified Plans.
NSW Floodplain Management Program	The NSW government provide a floodplain risk management grant program to support local government manage flood risk. Funding is provided to Councils and other authorities to undertake project that assess flooding risk and reduce the impact of flooding. Funding is administered by OEH and for successful applications is typically in the order of $2 for every $1 provided by Councils.
Building Resilience to Climate Change	The partnership program between Local Government NSW (LGNSW) and OEH aims to address climate change risks and vulnerabilities facing NSW councils. It aims encourage climate change: planning, minimisation, adaptation and implementation adaptation responses.
NSW Natural Disaster Assistance Schemes	In the event of a natural disaster, such as storm, storm surge, cyclone and tsunami, grants are available to Councils for emergency works and to restore public assets. Grants are available where a Local Government Area has been declared a Natural Disaster. Grants administered by the Office of Finance and Services (NSW Public Works) are available to help Councils to meet 100% of eligible emergency works and 75% to 100% of eligible restoration works. Grants administered by the NSW Roads and Maritime Services are available to Council to permanently restore roads and bridges to pre-disaster standards, with funding levels between 75 - 100% available.
NSW Environment Trust	Funding is available under the NSW Environment Trust to a broad range of organisations for projects that enhance the environment of NSW. Grants may be awarded for on ground rehabilitation and improvement works, research applications, land acquisition, waste reduction and promotion of environmental education. The NSW Environment Trust is an independent statutory body established by the NSW Government to make and supervise the environment grants. The Trust is administered by OEH. Suitable coastal management grant applications may relate to dune care, for example.
Public Reserve Management Fund	The Public Reserve Management Fund (PRMF) is administered by the Department of Primary Industries (Lands) and provides financial support for development, maintenance and improvement of public reserves. The funding is available to managers of NSW Crown reserve, as well as freehold showgrounds and schools or arts. Coastal crown lands could therefore receive funding from the PRMF for environment, economic and community benefit.
NSW Heritage Grant Programs	This program is administered by OEH and aims to fund projects that provide sustainable, long-term heritage benefits and provide public benefit and enjoyment from heritage. Funding may be available for the management of heritage items in the coastal environment.

Table 3-5 Federal Government Funding Mechanisms

Funding Source	Details
National Partnership Agreement on Natural Disaster Resilience	The Australian Government partners with State Governments to fund priority disaster resilience initiatives through the National Partnership Agreement on Natural Disaster Resilience. The aim of the program is to enhance Australia's resilience to natural disasters through mitigation works, measures and related activities. Funding is prioritised in terms of states natural disaster risk profile and priorities and focuses on building disaster resilient communities.
National Trusts Program	The Australia Government Department of Environment administers this program. The Trusts program provides funding for works to preserve and enhance Australian cultural heritage. The Australian Council of National Trusts coordinates activities under the program with National Trusts offices in each State and Territory. Funds may be available for items of Australian cultural heritage within the coastal environment.

3.5 Implementation Table

Recommended actions and details to assist in their implementation (including their relationship to the Community Strategic Plan and associated IPR Framework, responsible department within Council or elsewhere, timeframes and targets, and estimated costing) are detailed in Table 3-7.

For ease of reference, definition is provided in Table 3-6 below for acronyms used in the Implementation Table.

Table 3-6 Acronyms used in the Implementation Table

Acronym	Definition
CSP	Community Strategic Plan
4YDP	Four Year Delivery Program
OP	Operational Plan
IPR	Integrated Planning and Reporting framework
AMP	Asset Management Plan
DCP	Development Control Plan
LEP	Local Environmental Plan
POM	Plan of Management
EASP	Coastal Erosion Action Sub Plan
FRMP	Floodplain Risk Management Plan
WCZMP 2017	This current 2016 Wyong Coastal Zone Management Plan
WCZMP 2011	The previous Wyong Coastal Zone Management Plan prepared by Umwelt in 2011.

Acronym	Definition
GIS	Geographical Information Systems
Council	Central Coast Council
Crown Lands	NSW Department of Primary Industries – Lands
LALC	Local Aboriginal Land Council
NPWS	National Parks and Wildlife Services (a division of the NSW Office of Environment and Heritage)
OEH	NSW Office of Environment and Heritage
SLSC	Surf Life Saving Club
N/A	Not applicable
TBC	To be confirmed
Hot Spots	Refers to the 5 Authorised Locations or coastal erosion “hot spots” in the Wyong LGA, namely: Blue Bay, Toowoon Bay, North Entrance Beach, Cabbage Tree Harbour and Hargraves Beach.

Table 3-7 Wyong CZMP 2017 Implementation Table

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
1 *(Ref. No. B1)*	**Continue the beach sand monitoring program after storms, using the most efficient technology**	Council is already running a very efficient beach monitoring program using UAV's (drones) to collect aerial photogrammetry after storms, and this should be continued. The monitoring data shall be used to • check if and when trigger points for council assets at immediate risk are reached (refer Action 25 for listing of Council assets), and • revise the coastal hazard assessments (every 5-10 years).	**CSP Objective 5, Coastal Zone Management delivery focus.** **Action to be added to 4YDP or OP 2016-17, and ongoing.**	Waterways and Asset Management	$30,000 per monitoring run of entire coastline. *(NSW grant funding)*	**High Priority**: Hot spot locations. **Medium Priority:** entire Wyong coastline (which is likely to be more cost effective than single beach surveys, and can be helpful when tracking trends in beach response to climate).
2 *(Ref. No. B2)*	**Lobby NSW government to collect marine LiDAR (out to 30 - 40 m water depth) at regular intervals (5-10 yearly)**	Bathymetric data is essential for both understanding the nearshore zone and local sediment supply. It is also vital data for running coastal process models, including shoreline evolution models. The program could be pursued individually by Council, however is likely to be more cost effective if run statewide, as is the case for topographic data collection (LiDAR) programs (see Action 3 below).	**CSP Objective 5, Coastal Zone Management delivery focus.** **Action to be added to 4YDP or OP 2016-17, and ongoing.**	Waterways and Asset Management	Staff time. *(recurrent council funds)*	Entire Wyong coastline.
3 *(Ref. No. A1)*	**Continue to demonstrate support for the NSW Government's 2-3 yearly LiDAR collection program, and Waverider buoy wave monitoring programs**	These NSW Government programs are already highly successful, providing a consistent quality data set for all councils. Council should continue to express their support for these programs to the NSW Government, to promote their continual inclusion in future budgets.	**CSP Objective 5, Coastal Zone Management delivery focus.** **Action to be added to 4YDP and ongoing.**	Waterways and Asset Management	Staff time. *(recurrent council funds)*	Supports Action 1.
4 *(Ref. No. B3)*	**Develop a monitoring program for sites at high risk of landslip and geotechnical hazard by June 2017**	The monitoring program could involve, for example, drilling of boreholes, and installation and monitoring of inclinometers (which detect land movement) and piezometers (which detect groundwater depth and flows). This monitoring data could provide a warning of likely landslip. A monitoring program is recommended as an alternative to Action A89 (3D modelling) from WCZMP 2011, as 3D modelling is extremely expensive, and requires extensive monitoring data as input to generating a reasonable model If at a later date it is decided that 3D modelling would be beneficial for understanding and mapping geotechnical risk, the data from this monitoring program would provide vital input data.	**CSP Objective 5, Coastal Zone Management delivery focus.** **Action to be added OP 2016-17, and ongoing for implementation.**	Waterways and Asset Management	$5,000 for minor consultancy to design the monitoring program. *(NSW grant funding)* Costs for running monitoring program to be determined as part of the design.	**High Priority**: Cabbage Tree Harbour, behind Bateau Bay, behind Blue Bay. **Low Priority**: Old landslips evident from ridge lines at Crackneck Point and Jenny Dixon Beach.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
5 *(Ref. No. B12)*	**Undertake an Options Feasibility Study (involving economic cost-benefit analysis and funding model) for each Hot Spot location, to determine the action required to manage the existing coastal erosion risk**	Following storms in June 2016, Hot Spot beaches may be at or below the sand volume buffer required to protect existing land and properties from a subsequent erosion event. That is, the trigger for more decisive action at some or all of the Hot Spots may have been breached. The breaching of a trigger requires that an economic cost benefit analysis and funding model be completed to identify a site-specific risk management action that is financially and technically viable. The Options Study should be promptly followed by sourcing the appropriate approvals, funding etc. to implement the preferred action before the remaining sand buffer is breached, and irrevocable damage to land and assets occurs. This action therefore involves: • Calculate the sand volume remaining on each of the Hot Spot beaches (i.e. using drone Lidar survey after the June 2016 storms). • Prioritise the undertaking of Option Studies based on the extent to which the remaining sand volume is at or below the trigger volume required at each Hot Spot (see Table 3-8) • Commission and commence the Options Studies, to include a detailed economic cost-benefit analysis, funding model and business case to be completed (which may include contributions from various sources including benefiting landholders), to adequately determine economically and technically viable actions specific to the Hot Spot location. • Commence implementation of the preferred action identified in the Options Study (i.e. approvals, sourcing of funding etc.), prior to the remaining sand volumes being eroded and damage occurring to at risk land and properties.	**CSP Objective 5, Beach Maintenance and Coastal Zone Management delivery focus.** **Immediate (2016) review of sand volume data** **Priority Options Study(s) included in OP 2016-17, for completion by 2017.** **Remaining Options Studies included int 4YDP for completion by June 2019.** **Commence implementation of the recommended action as each study is completed.**	Waterways and Asset Management	Staff time or minor consultancy (up to $5,000) to conduct sand volume calculations. *(recurrent council funds)* External consultancy for each Options Study(s) (approx. $30,000). *(seek NSW grant funding)* Implementation of recommended action will likely require co-ordinating funds from a range of sources, as detailed in each Options Study. *(Council funds (e.g. Coastal Protection Service Change +/- seek grant funding)*	Hot Spot Beaches. Prioritisation to be determined based on calculation of remaining sand volumes and comparison with trigger volumes for each beach given in Table 3-8.

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
6 *(Ref. No. B5)*	**Undertake regular dune rehabilitation to encourage sand accretion, stabilisation and growth of frontal dunes**	Dune stabilisation provides a buffer of sand to be eroded during storm events. Where dune heights are maintained above ~ 7 m AHD, dunes can also act as a suitable barrier to wave overtopping. As required, this action may also involve the preparation and implementation of vegetation management plans to specify species selection, planting, weed removal and fencing plans for dune rehabilitation areas. *This action supports the continued implementation of dune stabilisation and maintenance activities by the OSR Natural Areas team, such as dune reshaping, revegetation, mulching, weed control, pest control, litter control, use of dune-forming fences, and beach access and pedestrian control. Small projects are completed each year, with larger projects every 2-3 years.*	**CSP Objective 5, Beach Maintenance delivery focus.** **Action to be added to 4YDP and ongoing.**	Open Space and Recreation (Natural Areas)	Existing budget plus seek grant funding assistance from partner organisations (i.e. OEH, Crown Lands). *(recurrent Council funds + seek grant funding)*	**High Priority:** Hot Spots. **Medium Priority**: Shelly, Blue Lagoon, Tuggerah (Magenta), Lakes / Budgewoi (north of Lakes SLSC) Soldiers, Pebbly. Action supports and is supported by Action 7.
7 *(Ref. No. A51)*	**Continue to support volunteer Landcare/ Dunecare / Coastcare groups to maintain and enhance the condition and function of native vegetation on coastal dunes, including weed removal and replanting**	Existing dune care activities by volunteers should continue to be supported by Council, to maintain healthy dune barriers. These groups undertake minor as well as extensive dune restoration and coastal maintenance projects. Support is provided in the form of resources and technical advice is provided to groups for approved activities on identified Council-controlled land. *Existing groups cover: Budgewoi to Hargreaves Beaches (including Lakes Beach); Norah Head (headland mostly); The Entrance North, Magenta, and North Shelly Beach.*	**CSP Objective 6, Community Environmental Management focus.** **Action to be added to 4YDP and ongoing.**	Open Space and Recreation (Natural Areas)	Existing budget plus seek grant funding assistance from partner organisations (i.e. OEH, Crown Lands). *(recurrent Council funds + seek grant funding)*	Locations: Existing groups at Budgewoi to Hargreaves Beaches; Norah Head; The Entrance North, Magenta, North Shelly Beach. New groups also to be encouraged. Action supported by Action 6, and supports Action 8.
8 *(Ref. No. B6)*	**Investigate the viability of beach scraping on Wyong's beaches, and develop a prioritised list of beaches where beach scraping may be beneficial by June 2018**	This action involves investigating the viability of beach scraping in Wyong, and if found to be viable, recommending a prioritised list of suitable locations. Beach scraping does not add any sand reserves to the beach. It acts to speed up beach recovery. The knowledge and ability to undertake beach scraping would be another tool available to Council when undertaking dune and beach repair and maintenance.	**CSP Objective 5, Beach Maintenance delivery focus.** **Action to be added to OP 2017-18.**	Open Space and Recreation, with support from Waterways and Asset Management	Minor consultancy ($10,000) for investigation and recommendations. *(recurrent Council funds)*	Should it be pursued, beach scraping shall be supported by dune rehabilitation (Actions 6 and 7).
9 *(Ref. No. A9)*	**Continue to dredge sand from the active tidal delta in The Entrance Channel and place the sand on North Entrance Beach, and The Entrance Beach if required / sand is available**	Recommended improvements to the dredging and placement program arising from Action 10 should be incorporated into this strategy, when they become available. As required, sand may also be placed on The Entrance Beach.	**CSP Objective 6, Lake Dredging delivery focus.** **Action to be added to 4YDP and ongoing.**	Waterways and Asset Management	~$50,000 per episode. Seek grant funding via NSW Government dredging strategy. *(seek NSW grant funding)*	Include outcomes from Action 10 when they become available.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
10 *(Ref. No. A67)*	**Investigate the sediment transport dynamics of The Entrance channel and adjacent beaches by June 2020**	The study should include: • A detailed monitoring program to track how dredged sand placed on North Entrance beach is redistributed to adjacent beaches / the Entrance channel; • The potential effects of sea level rise on currents and sediment transport / deposition in The Entrance (through "coastal recession"), and the subsequent implications for dredging and sand placement on adjacent beaches; • Recommendations for sand placement on North Entrance to yield greater retention of sand on the beach. Council could consider pursuing this action as a research project in partnership with a University. Note: Cardno (2013) completed a *Tuggerah Lake The Entrance Morphodynamic Modelling* report that investigated the effect of placing training walls in the Entrance on water quality in the lake, retaining a clear entrance, and providing any protection to Curtis Parade via sand build up. This report may be useful background to the Action 10 study.	**CSP Objective 6, Lake Dredging delivery focus.** **Action to be added to 4YDP for completion by June 2020.**	Waterways and Asset Management	Consultancy ($50,000) to conduct sand monitoring and modelling investigations. *(seek NSW grant funding)*	Location: North Entrance Beach and The Entrance Channel Recommended changes to the dredging program derived from this action shall be incorporated into Action 9. Regular beach monitoring will be conducted through Action 1.
11 *(Ref. No. A66)*	**Review the structural integrity of The Entrance seawall by 2018 and schedule structural upgrades as necessary**	Hazard lines have assumed this seawall is sufficient to provide protection at present. Investigation of the structural integrity in a coastal engineering context, then appropriate upgrade is a high priority to ensure continued functioning of this seawall as a protection structure. Structural assessment of the buried seawall sections, fronting Marine Parade, behind South Entrance Beach, will require mechanical excavation of the fronting dunes and/or geophysical investigation (e.g. ground penetrating radar). *Note: Council intends to refurbish the seawall at Memorial Park over 2015-16.*	**CSP Objective 5, Beach Maintenance delivery focus.** **Action to be added to 4YDP for completion by June 2018, with upgrades completed thereafter.**	Waterways and Asset Management	Minor consultancy to conduct structural review of exposed seawall sections ($5,000). Structural integrity assessment of buried seawall section will be more costly ($40,000). Cost of upgrades to be determined as part of the review. *(seek NSW grant funding)*	Seawall extending from The Entrance Surf Club north then westward along the southern boundary of The Entrance channel, to Memorial Park.

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
12 *(Ref. No. B9)*	**By June 2017, conduct a desktop review of all estuary flood studies completed to date, to determine if ocean water levels (with and without sea level rise) have been included within the flood assessment. Develop a prioritised list of coastal catchments for which flood studies must be revised to include ocean water levels, with consequent revision of flood planning levels**	This action firstly involves a basic desktop review of all Flood Studies completed to date, to determine if oceanic water levels (with and without sea level rise) have been included. The review shall also check that briefs for proposed FRMPs (Wallarah and Spring Creek, Wyong River, Ourimbah Creek) require inclusion of oceanic water levels in the flood study. Based upon the review, a prioritised list of flood studies and associated FRMPs / Flood Planning levels to be revised shall be compiled, and scheduled into future 4YDPs for completion (subject to grant funding). This action seeks to avoid the use of inferior coastal inundation "bathtub"-style topographic assessments, instead of coincident flood modelling of rainfall and oceanic levels.	**CSP Objective 9c Floodplain Risk Management Plans delivery focus.** **Action to be added to OP 2016-17, with inclusion of prioritised flood study revisions into 4YDP thereafter.**	Waterways and Asset Management	Staff time or minor consultancy ($5,000) for review of existing studies and next proposed studies. *(recurrent Council funds)*	All estuaries in the Wyong LGA with existing or proposed flood studies.
13 *(Ref. No. A56)*	**Continue the role of the Tuggerah Lakes Estuary, Coastline and Floodplain Management Committee, to support ongoing integration of coastal, estuary and flood risk management**	*No further details.*	**CSP Objective 5, Coastal Zone Management focus.** **Action to be added to OP 2016-17 and ongoing.**	Waterways and Asset Management	Staff time. *(recurrent Council funds)*	N/A
14 *(Ref. No. A83)*	**Maintain a coastal zone management coordinator position**	This action aims to continue support for the existing coastal zone management coordinator position at Council.	**CSP Objective 5, Coastal Zone Management focus.** **Action to be added to 4YDP and ongoing.**	Waterways and Asset Management	Continuation of existing budget. *(recurrent Council funds)*	N/A
15 *(Ref. No. B19)*	**Conduct an implementation workshop by June 2017, to educate staff from relevant Council units of the actions in the WCZMP 2016 they are responsible for implementing**	WCZMP will require input and implementation by all facets of Council (environment, planning, engineering, asset management, works crews etc). An implementation workshop is recommended as an inclusive way to bring all relevant staff together to explain the purpose of and their responsibilities within the WCZMP.	**CSP Objective 5, Coastal Zone Management focus.** **Action to be added to OP 2016-17.**	Waterways and Asset Management to coordinate workshop	Minor consultancy ($10,000) to run workshop. *(seek NSW grant funding)* Staff time. *(recurrent Council funds)*	N/A

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
16 *(Ref. No. B8)*	**Update Draft Chapter 3.5 Coastal Hazards to include controls for wave overtopping, including consideration of sea level rise for proposed new or modifications to existing coastal structures (e.g. seawalls) by June 2017**	The risk of wave overtopping at present and future is relevant to the upkeep and replacement of existing coastal protection structures, and the construction of new coastal structures (most notably, seawalls). As these hard shorelines would be expected to exist into the future, managing the risks from wave overtopping including sea level rise is required in DCP Chapter 3.5, to apply to protection structure development applications.	**CSP Objective 5 (Coastal Zone Management) and 9c (DCP and Policy) delivery focus.** **Action to be added to OP 2016-17.**	Development and Rezoning with assistance from Waterways and Asset Management for technical elements	Staff time or minor consultancy ($5,000). *(recurrent Council funds)*	DCP applies to all proposed developments within the coastal hazard zones.
17 *(Ref. No. A6)*	**Continue to implement Wyong DCP 2013 Chapter 3.5 Coastal Hazards; update the DCP as new planning approaches and / or new coastal risk information arises (approximately by June 2021); Insert the revised (2017) hazard maps and remove reference to the 'combined bluff, Beach and dunes zones'**	DCP Chapter 3.5 details controls for managing development in coastal hazards areas (see Appendix E). The DCP Chapter should continue to be updated as new planning approaches for coastal hazards are developed, and new coastal hazard / risk information arises. Replace the 2011 combined hazard mapping with the updated (2017) coastal hazard maps in the DCP Chapter. The updated (2017) mapping does not adopt the 'combined bluff, beach and dunes zones', as specific hazard types and extents have now been defined for those areas of uncertainty. As such, all reference to the now redundant 'combined bluff, beach and dunes zones' should be removed from the DCP.	**CSP Objective 5 (Coastal Zone Management) and 9c (DCP and Policy) delivery focus.** **Action to be added to 4YDP for completion in 2021-22.**	Development and Rezoning	Staff time. *(recurrent Council funds)*	DCP applies to all proposed developments within the coastal hazard zones.
18 *(Ref. No. A33)*	**Undertake negotiations with NSW Department of Planning and Environment to develop appropriate notification of coastal hazard on Section 149 Planning Certificates by June 2018**	Appropriate wording for Section 149 notifications of coastal hazard is still under discussion within the Department of Planning and Environment (DPE). The action should be progressed via negotiations with DPE on appropriate wording. Note also that the areas affected by Coastal Hazards will be delineated by the latest Coastal Hazards maps given in the CZMP, and denoted as "immediate, high and low risk" areas.	**CSP Objective 5 (Coastal Zone Management) and 9c (DCP and Policy) delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Development and Rezoning, with assistance from Waterways and Asset Management for technical elements	Staff time. *(recurrent Council funds)*	Section 149 Planning Certificates may apply to all existing properties in the current and future hazard zone.

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
19 *(Ref. No. B18)*	**Update the LEP and / or DCP to include appropriate provisions for managing geotechnical hazards by June 2018**	The DCP controls require urgent review and update to reflect controls for geotechnical hazard, either within DCP Chapter 3.5 or as a separate Geotechnical Hazard Chapter in the DCP. If required, there are also separate LEP optional clauses available for geotechnical hazards. At present, the geotechnical hazard areas are included in DCP Chapter 3.5 Coastal Hazards, however the controls specified for these hazard areas are the same as that for coastal hazards. Such controls may not be applicable, especially in areas subject to geotechnical risk not driven by coastal processes. The new hazard maps in this WCZMP 2016 identify areas subject to "geotechnical hazard" due to coastal processes and driven by other processes separate to coastal processes. In addition the geotechnical hazard areas are not able to be delineated as "immediate, high, and low".	**CSP Objective 5 (Coastal Zone Management) and 9c (DCP and Policy) delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Development and Rezoning	Staff time or minor consultancy ($15,000). *(seek NSW grant funding)*	DCP to apply to all developments in geotechnical hazard zones.
20 *(Ref. No. A74)*	**Make Australian GeoGuides available on Council's website, as reference material for good practice by landowners and Council**	The GeoGuides provide guidance on siting of development. They are peer reviewed and published by the Australian Geomechanics Society. It is therefore efficient for Council to utilise this existing material to promote best practice by landowners and Council.	**CSP Objective 9c DCP and Policy delivery focus.** **Action to be added to OP 2016-17.**	Development and Rezoning.	Staff time. *(recurrent Council funds)*	All proposed developments within geotechnical hazard zones.
21 *(Ref. No. A53)*	**Conduct regular surveys of beach users to determine recreational usage and demand patterns, and views and understanding of coastal risks and risk management**	The surveys should also include questions regarding the community's views and understanding of coastal risks, including sea level rise, and potential options for managing such risks in future.	**CSP Objective 5, Coastal Zone Management focus.** **Action to be added to OP 2016-17 and ongoing.**	Waterways and Asset Management	Staff time. *(recurrent Council funds)*	Council managed beaches.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
22 *(Ref. No. B7)*	**Update DCP (e.g. Chapter 3.10 Wetlands Management) to include consideration of migration buffers for sea level rise for wetland communities by June 2021**	Given that in general there is limited land in public ownership that is not already appropriately zoned for use as a retreat buffer, it is recommended that this action focus on including /developing new DCP provisions to provide buffers around wetland and other coastal ecological communities for sea level rise migration, as part of new developments (including infill and re-developments). A full copy of DCP Chapter 3.10 is provided in Appendix E. *Note*: DCP Chapter 3.4 Conservation Areas for Northern Wyong Shire provides for the maintenance or improvement of green corridors, conservation links and habitat networks in Northern Wyong Shire, when developments are proposed in such areas as specified on a map accompanying the DCP. DCP Chapter 3.10 Wetlands Management requires an assessment for any proposed development of the wetland buffer, and any proposed mitigation measures to retain and preserve that environment.	**CSP Objective 5 new delivery focus, e.g. Biodiversity.** **Action to be added to 4YDP and completed by June 2021.**	Development and Rezoning, with assistance from Property Management	Staff time, or minor consultancy ($5,000). *(recurrent Council funds)*	Wyong LGA coastal habitats.
23 *(Ref. No. B10)*	**Prepare a checklist or Council guideline outlining development controls for coastal hazards to apply to all Council works (developments, infrastructure etc.) in the coastal zone by June 2017**	The checklist / policy should capture Part 5 developments, strategic planning for major infrastructure (roads, stormwater, sewer etc), and other works not requiring development consent by Council in the coastal zone. The controls may be similar or the same as detailed in the DCP Chapter 3.5 Coastal Hazards, and the geotechnical development controls (to be developed through Action 19).	**CSP Objective 5 (Coastal Zone Management) and 9c (DCP and Policy) delivery focus.** **Action to be added to OP 2016-17.**	Development and Rezoning, with assistance from Waterways and Asset Management for technical elements	Staff time or minor consultancy ($5,000). *(recurrent Council funds)*	All council works or developments in the coastal or geotechnical hazard zones.
24 *(Ref. No. B4)*	**Undertake training of relevant Council staff regarding appropriate response to coastal erosion events by June 2018**	This action should focus on training Council staff who work in the coastal zone regarding the appropriate and legal response to coastal erosion events. (including works, engineering, open space and recreation beach maintenance and Landcare in addition to environment staff) The aim of the action is to facilitate better implementation of the EASPs and CZMP objectives, and to avoid ad hoc protection or other works (sandbags, rocks etc.) in the coastal zone, particularly where these may leave a legacy of liability and maintenance on Council for years to come. The action shall promote the internal council checklist also (see Action 1).	**CSP Objective 5, Coastal Zone Management delivery focus.** **Action to be added to OP 2017-18.**	Waterway and Asset Management to coordinate training. Relevant council departments to attend training	Minor consultancy to develop training materials and conduct training workshops ($15,000). *(seek NSW grant funding)*	N/A

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
25 *(Ref. No. A12)*	**Document coastal risk in Asset Management Plans for all affected roads and drainage assets by June 2018**	For all transportation infrastructure and stormwater drainage assets, document the risk of coastal hazard (immediate, high, low, geotechnical), and the preferred asset replacement action to manage that hazard (relocate, retrofit / redesign, manage to fail) in the AMP, as follows. • Document in the AMP the hazard type (erosion, wave run up, geotechnical) and risk of impact (immediate, high, low, geotechnical) for all transport assets (roads, carparks etc.), stormwater assets (pits, pipes, open drains etc.), within the area affected by coastal hazards as shown on the hazard maps. • Determine an appropriate hazard management action for assets at immediate risk, then assets at high risk. The hazard management action should as a minimum consider relocation of the asset, retrofit/redesign, protection (providing the works will not adversely affect the adjacent beach), or manage to fail. • The appropriate hazard management action shall be listed in the Asset Management Plan and included in the asset replacement cost. • Determine appropriate triggers to implement asset replacement, particularly for assets at immediate risk (e.g. distance from the erosion scarp, foundation capacity distance from asset towards the beach, etc) • The hazard management action shall be implemented either: when the asset is due for replacement due to normal factors (i.e. wear and tear); or the coastal hazard impact is imminent, as indicated by reaching the monitoring trigger point. • Inform the Monitoring program of the trigger distances / levels for those assets at immediate risk, to be checked after routine monitoring data is collected.	**CSP Objective 2, Assets and Planning delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Roads and Drainage	Staff time or minor consultancy ($15,000). *(seek NSW grant funding)*	**High Priority:** All roads, carparks, cycleways, and stormwater pipes, drains and outlets within the immediate or high coastal hazard or geotechnical hazard zone. **Medium Priority:** All roads, carparks, cycleways, and stormwater pipes, drains and outlets within the low coastal hazard zone.
26 *(Ref. No. A70)*	**Undertake an inspection of stormwater outlets within the geotechnical hazard zones to determine if they may contribute to landslide risk by June 2019**	This action shall involve: • Overlaying the geotechnical hazard maps and stormwater assets in GIS, to identify if and where such assets may exist (see also Action 25); • Inspection of the stormwater assets within geotechnical hazard areas to determine if and where stormwater drainage may contribute to landslide risk; and • Recommended action if a landslide risk is identified.	**CSP Objective 2, Drainage Planning delivery focus.** **Action to be added to 4YDP for completion by June 2019.**	Roads and Drainage	Staff time for GIS work. *(recurrent Council funds)* Minor geotechnical consultancy to assess stormwater assets ($15,000). *(seek NSW grant funding)*	Stormwater outlets in geotechnical hazard zones. Action could be coupled with Action 25.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
27 *(Ref. No. B20)*	**Document coastal risk in Asset Management Plans for all water and sewerage assets by June 2018**	For all water and sewerage infrastructure, document the risk of coastal hazard (immediate, high, low, geotechnical), and the preferred asset replacement action to manage that hazard (relocate, retrofit / redesign, manage to fail) in the Asset Management Plan (AMP), as follows. • Document in the AMP the hazard type (erosion, wave run up, geotechnical) and risk of impact (immediate, high, low, geotechnical) for all sewerage assets (pump stations, rising mains, gravity mains) and water assets that are within the area affected by coastal hazards as shown on the hazard maps. • Determine an appropriate hazard management action for assets at immediate risk, then assets at high risk. The hazard management action should as a minimum consider relocation of the asset, retrofit/redesign, protection (providing the works will not adversely affect the adjacent beach), or manage to fail. • The appropriate hazard management action shall be listed in the Asset Management Plan and included in the asset replacement cost. • Determine appropriate triggers to implement asset replacement, particularly for assets at immediate risk (e.g. distance from the erosion scarp, foundation capacity distance from asset towards the beach, etc) • The hazard management action shall be implemented either: when the asset is due for replacement due to normal factors (i.e. wear and tear); or the coastal hazard impact is imminent, as indicated by reaching the monitoring trigger point. • Inform the Monitoring program of the trigger distances / levels for those assets at immediate risk, to be checked after routine monitoring data is collected.	**CSP Objective 3, Potable Water and Treated Effluent delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Wyong Water	Staff time or minor consultancy ($10,000). *(recurrent Council funds)*	**High Priority:** All sewer pipes, pits, pump stations, and water pipes within the immediate or high coastal hazard or geotechnical hazard zone. **Medium Priority:** All sewer pipes, pits, pump stations, and water pipes within the low coastal hazard zone.
28 *(Ref. No. B21)*	**Document coastal risk in Asset Management Plans for all other larger Council assets (e.g. public buildings such as SLSCs, toilet blocks etc.) by June 2018**	Repeat as for Action 25 for all other Council assets (that are not recreational assets), e.g. large public buildings, toilet blocks, Council's SLSCs etc. *Note: a separate recreational asset inventory for smaller scale assets is detailed in Actions 29 and 30 below.*	**CSP Objective 3, Community Infrastructure delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Property Management	Staff time or minor consultancy ($5,000). *(recurrent Council funds)*	All major council buildings (SLSCs, toilet blocks, community halls, etc.) within the coastal or geotechnical hazard zone.

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
29 *(Ref. No. B14)*	**Undertake an inventory of all recreational assets in the coastal zone (type, location in GIS, condition, and risk from coastal or geotechnical hazards), to form a new or updated Asset Management Plan by June 2018**	An inventory of recreational assets and their current condition is required for review against immediate coastal and geotechnical hazard risks and for use in determining priorities for new facilities (see Action 30). The inventory shall also include coastal access structures such as stairways and lookouts within geotechnical hazard zones. Asset locations should be logged in GIS, and categorised as either "major" (i.e. expected to last > 30 years, or cost > $1 M) or minor (i.e. not expected to last > 25 years, or of minor cost). Assets to then be overlain with the hazard maps to determine: • Minor or major assets within the immediate coastal risk zone and within geotechnical hazard zones; and • Major assets only within the "high" hazard zone. The coastal and geotechnical risk and action to manage the risk should be added into the AMP. Minor assets can be sacrificed and replaced as impacts occur, or relocatable (e.g. lifeguard observation towers). For major assets, need to decide if asset will be relocated, retrofit/redesigned, protected (providing the works will not adversely affect the adjacent beach), or managed to fail. This can then be implemented when asset replacement is due, or when the risk impact becomes imminent.	**CSP Objective 3, Recreational Areas delivery focus.** **Action to be added to 4YDP for completion by June 2018.**	Open Space and Recreation / Waterway and Asset Management	Staff time or minor consultancy ($15,000). *(seek NSW grant funding)*	All recreational facilities (beach accessways, viewing platforms, picnic facilities, playgrounds, amenities, showers, etc) within the coastal or geotechnical hazard zones. Supports Action 30. Imminence of risk to major assets will be determined via Action 1.
30 *(Ref. No. B16)*	**Develop a prioritised program of upgrades and additions to recreational infrastructure along the coast by June 2020, based on asset condition (as identified in the recreational asset inventory, see Action 29), coastal or geotechnical risk, risks to public safety, and recreational demand (based upon community survey, see Action 21)**	This action aims to provide or upgrade recreational facilities such as beach accessways, viewing platforms, picnic facilities, playgrounds etc. at the beaches based upon community need in a coordinated manner (note maintenance after storms is also undertaken, see Action 31). If required, the upgrades may be facilitated through new or revised Masterplans or POMs at a beach location (noting that existing POMs are generic only, and not beach specific). Improvements to beach accessways shall also cater for suitable disabled access. Coordination with Property Management regarding assets under their control may be needed in some localities. *Council already undertakes beach access and facilities renewal programs (e.g. CRS.28, CRS.29, CRS.30, CRS.31 under Objective 3).*	**CSP Objective 3, Recreational Areas delivery focus.** **Action to be added to 4YDP for completion by June 2020, with implementation thereafter.**	Open Space and Recreation (with coordination with Property Management if required)	Staff time to develop program. *(recurrent Council funds)* Cost of upgrades and additions to be determined via the program.	Locations to be determined via program. Supported by Actions 29 and 21.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
31 *(Ref. No. B15)*	**Continue to implement beach access control, maintenance and post-storm monitoring program**	Council undertakes the following activities: • providing formed and unformed beach accesses and closing unauthorised accesses. Formed accesses include stairways, board and chain, viewing platforms, and geotextile surfaces (e.g. holey belt, turf protector). Unformed accesses have natural surfaces. Use of geotextile bags is under consideration in the design of beach accesses at some locations; • Pedestrian control fencing to restrict pedestrian damage to vegetation and dunes; • dune-forming fencing (especially at the beach end) to control sand movement; • minor sand works manually or by tractor/bucket or excavator to maintain eroded accesses; • Regular asset data collection and inspections; • Temporary closure of beach accesses to allow natural sand replenishment or stabilisation; • Post storm maintenance and response is responsive to coastal events, e.g. “retreat” (at Magenta), modification (Uwa St. Budgewoi) etc.; and • General maintenance (planting, pruning, mowing, brush-cutting, weed control, pest control (e.g. rabbits, foxes), rubbish and dumped waste removal, fencing repairs, signage). This action aims to support continued implementation and improvements to Council’s existing program, such as formalised post-storm monitoring (particularly in cases where the Coastal Erosion EAP is not activated), the continued responsiveness in beach access replacement taking account of coastal erosion (i.e., retreat, modified, etc.), and logging of need for repairs to the inventory of recreational infrastructure (Action 29).	**CSP Objective 5, Beach maintenance delivery focus.** **Action to be added to OP 2016-17, with implementation thereafter.**	Open Space and Recreation, with support from Waterways and Asset Management	Staff time or minor consultancy ($5,000) to develop the program. *(recurrent Council funds)*	Program to be developed for entire coast. Post-storm assessment likely to focus on hot spot beaches, and beaches with higher density of recreational assets (e.g. Shelly, Blue, Soldiers, Lakes / Budgewoi, Tuggerah (Magenta Shores))

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
32 *(Ref. No. A47)*	**Continue to develop sections of the coastal walk, in accordance with recreational facility priorities identified through Action 30**	Future walks shall be modelled on the Coast to Lake path and beach walk between the Entrance Channel and Toowoon Bay, to locate fixed infrastructure on stable foundations off dunal systems and use signage to direct movement over routes subject to instability from coastal processes, consistent with NPWS track guidelines. Shared usage of the path, such as with bikes/mountain bikes, or disabled access, should also be considered.	**CSP Objective 3, Recreational Areas delivery focus.** **Action to be added to 4YDP and ongoing, as funds permit.**	Open Space and Recreation	Staff time (or minor consultancy) to design new coastal walk sections. Council budget to cover construction costs. *(recurrent Council funds)*	Locations to be determined via Action 30.
33 *(Ref. No. B22)*	**Revise the Coastal Erosion AEP(s) to: (a) reflect the removal of temporary coastal protection works from the Coastal Management Bill 2016 (b) provide appropriate advice on emergency actions for the remainder of the coast (i.e. outside of the "hot spots") and (c) better reflect the roles and responsibilities of the SES and BOM (as per the DISPLAN and SERM Act) and Council**	The temporary protection works elements of the legislation have been omitted from the Coastal Management Bill 2016, and therefore no longer apply to "hot spots". The emergency/ temporary coastal protection works elements of the legislation were highly contentious and confusing since introduced. The list of authorised locations has also changed since the Coastal Erosion EAP was written in 2011. The Coastal Erosion EAP does not accurately reflect the roles and responsibilities of the SES and BOM during storms (as per Council's DISPLAN and the governing SERM legislation), nor Council in responding to coastal erosion events.	**CSP Objective 5, Beach maintenance delivery focus.** **Action to be added to OP 2016-17.**	Waterways and Asset Management	Minor consultancy ($5,000). *(seek NSW grant funding)*	**High Priority:** Hot Spots. **Medium Priority:** Remainder of Council managed beaches.

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
34 *(Ref. No. B11)*	**Undertake a broad education program to improve the understanding of the dynamic and varying nature of beaches and the coast, commencing by June 2018**	Community education shall focus on: • The dynamic nature of the beach and natural periods of erosion and recovery, and Council's intended response (i.e. closure of access ways until they can be repaired, allowing beach recovery rather than ad hoc protection) • the valuable role of dune vegetation in providing an erosion buffer as well as habitat values; • the sensitivity and protection of nesting shorebirds; • promotion of community activities, such as the event database (Action 36); and • other aspects of coastal management, as required. The education would be invaluable to: • Build the resilience of the community to natural and expected periods of beach erosion, when accessways and beaches may be temporarily inaccessible, and reduce pressure for ad hoc protection responses; and • Empower the community to provide constructive feedback on coastal management initiatives, via an improved understanding of coastal variability. In WCZMP 2011, Action A5 required Council to provide information regarding coastal erosion emergencies. Such warnings are already issued by the BOM and SES, and Council is not required to replicate this role.	**CSP Objective 1 (Community Engagement) and 6 (Community Environmental Management).** **4YDP Ref No 1-001-14 could be amended to include the CZMP as a relevant strategy.** **Action to be added to the 4YDP for development of the program by June 2018, with implementation ongoing thereafter.**	Community Partnerships and Planning, with support from Waterways and Asset Management (e.g. to develop technical content, identify stakeholders etc.).	Minor consultancy / staff time to develop materials ($5,000). Expansion of existing Council budget to cover staff resourcing needs. *(Council funds)*	Entire Wyong LGA Supports Action 36.
35 *(Ref. No. B13)*	**By 2018, commence education through the existing surf clubs and surf life saving community regarding natural periods of beach erosion and recovery, the valuable role of dune vegetation, nesting shorebirds, and other coastal management elements as required**	This action involves Council setting up an avenue for education within the local surf clubs, and through volunteer Dunecare (Landcare) groups. This could be via the Beach Liaison Committee. The available audience and resources of the surf club community is an invaluable platform for furthering education regarding aspects noted for Action 34 above (i.e. the varying nature of beaches, including periods of beach erosion and recovery, and may also promote: the valuable role of dune vegetation in buffering from erosion and providing habitat, the protection of nesting shorebirds (e.g. from trampling by dogs, people, etc.), particularly if they nest on or near patrolled beaches; the event database (Action 36); and other coastal management aspects as required). In this regard, this education program may utilise material developed for Action 34.	**CSP Objective 1 (Community Engagement) and 6 (Community Environmental Management).** **4YDP Ref No 1-001-14 could be amended to include the CZMP as a relevant strategy.** **Action to be added to the 4YDP and ongoing.**	Community Partnerships and Planning, with support from Waterways and Asset Management	Expansion of existing Council budget to cover staff resourcing needs. *(Council funds)*	High priority: All SLSCs within the LGA. Medium Priority: All volunteer Dunecare groups. Supported by Action 34. Supports Action 36

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
36 *(Ref. No. A65)*	**Develop and maintain a database of coastal events, including inundation events and erosion events on the beaches**	The database could commence with a search and request to the general public for information on past events (date, location, impact, photographs, response). The database would then be maintained with collection of this data for future events, particularly sought from the local community. To provide ongoing data, the database should be advertised during other coastal education activities (Action 34, Action 35).	**CSP Objective 6, Community Environmental Management delivery focus.** **Action to be added to 4YDP to commence by June 2021 and ongoing.**	Waterways and Asset Management	Staff time. *(recurrent Council funds)*	Supported by Action 34
37 *(Ref. No. A75)*	**Continue to work with OEH, Crown Lands to protect nesting and roosting habitats for protected shorebirds such as Little Tern**	Locations used as nesting sites can vary seasonally. This action shall include identification of all nesting and roosting sites in the LGA to be protected on a seasonal basis. After sites are identified, promoting their protection through the SLSCs (see Action 35) may be considered.	**CSP Objective 5 (new focus e.g. Biodiversity).** **Action to be added to OP 2016-17 and ongoing.**	Open Space and Recreation	Staff time. Seek funding assistance from OEH; and from Crown Lands for nesting sites on Crown Land. *(seek NSW grant funding)*	Sites vary seasonally, have included Norah Head, North Entrance Channel in the past. May use Action 35 to promote protection of sites via the SLSCs.
38 *(Ref. No. A81)*	**Conduct a benchmark survey of the condition of coastal ecological communities, with outcomes mapped in Council's GIS system, by June 2021**	Action outcomes could feed into future reviews of the Biodiversity Strategy (see Objective 6, 4YDP Ref. No 6-003-14).	**CSP Objective 5 (new focus e.g. Biodiversity) Action to be added to 4YDP and completed by June 2021.**	Natural and Environmental Assets	Consultancy to conduct survey and mapping ($30,000). *(seek grant funding)*	Vegetated coastal land outside of the National Parks and Reserves.
39 *(Ref. No. A32)*	**Where feasible establish conservation agreements for high value ecological communities in coastal reserves, by June 2021**	This action applies only to high value conservation lands outside of existing National Parks and reserves (i.e. action does not include land managed by NPWS).	**CSP Objective 5 (new focus e.g. Biodiversity) Action to be added to 4YDP and completed by June 2021.**	Natural and Environmental Assets	Staff time. *(recurrent Council funds)*	Applicable locations will be based upon outcomes of Action 38.
40 *(Ref. No. A71)*	**Undertake review of POMs for community, crown and national parks land, including Holiday Parks, to include consideration of erosion, overtopping and geotechnical hazards**	Action can be undertaken when the POMs are due for revision. Action will require written agreement from NPWS for updating POMs relating to their land; and Crown Lands for updating POMs for Crown Lands not being managed by Council.	**CSP Objective 5 (Coastal Zone Management) and 9c. Action to be added to 4YDP and completed on an as needs basis.**	Property Management NPWS and Crown Lands (requires written agreement)	Staff time, or $5,000 for minor consultancy assistance per review. *(seek NSW grant funding)*	All POMs covering the coastal zone, including the Holiday Parks at Budgewoi, Norah Head and Toowoon Bay.

Implementation Schedule

CZMP Action No.	Action / Target	Further Details	CSP Objective and IPR Integration	Responsible Unit	Cost / Resources	Locations / Related Actions
41 *(Ref. No. A77)*	**Liaise with the local Aboriginal community to determine the information to be used in interpretative signage along the coast, by June 2021**	*No further details.*	**CSP Objective 6 (new focus e.g. Cultural Heritage).** **Action to be added to 4YDP and completed by June 2021.**		Staff time. *(recurrent Council funds)*	N/A
42 *(Ref. No. B17)*	**Liaise with the LALC, NPWS and other appropriate stakeholders to develop a procedure or decision support tool that outlines the protocols to be followed if significant Aboriginal sites are threatened or uncovered by erosion**	The decision support tool aims to help determine the most appropriate course of action for Aboriginal assets at risk from coastal hazards. The preferred course of action may not always be protection, and other options (e.g. relocation) will be outlined in the tool. The tool may detail: • Persons to be notified when sites are uncovered (i.e. LALC, NPWS); • Monitoring for sites under threat, until a course of action is decided; • The options available to manage the threat (e.g. relocate, protect, allow to be eroded / inundated) and their pros and cons; and • The preferred action for particular types of sites (e.g. protection for middens, relocation for burial sites etc.).	**CSP Objective 6 (new focus e.g. Cultural Heritage).** **Action to be added to 4YDP and completed by June 2021.** **In advance, funding and assessment of Soldiers Beach Midden by 2018.**		Staff time or minor consultancy to develop tool ($10,000, including consultation). *(seek grant funding)*	**High Priority:** Soldiers Beach headland midden needs funding and protection measures. **Remaining Sites:** Site inspections on as needs basis.

3.6 Triggers for Implementing Action

Fisk and Kay (2010) provide a method for setting triggers for climate change adaptation action along a time continuum, as shown in Figure 3-7. There are two trigger points: one to flag that the risk is imminent and decisive action needs to be determined; and the other to flag when the action must be implemented in order to avoid an undesirable impact.

A key part of the strategy for managing future risks is setting the first trigger to allow enough time for Council, the community and stakeholders to select the preferred action, and gather the funds and approvals necessary to implement it, before the second trigger is reached.

In order to support the implementation of actions for all land and assets at risk, beach-specific erosion triggers and inundation triggers have been detailed in the following sections.

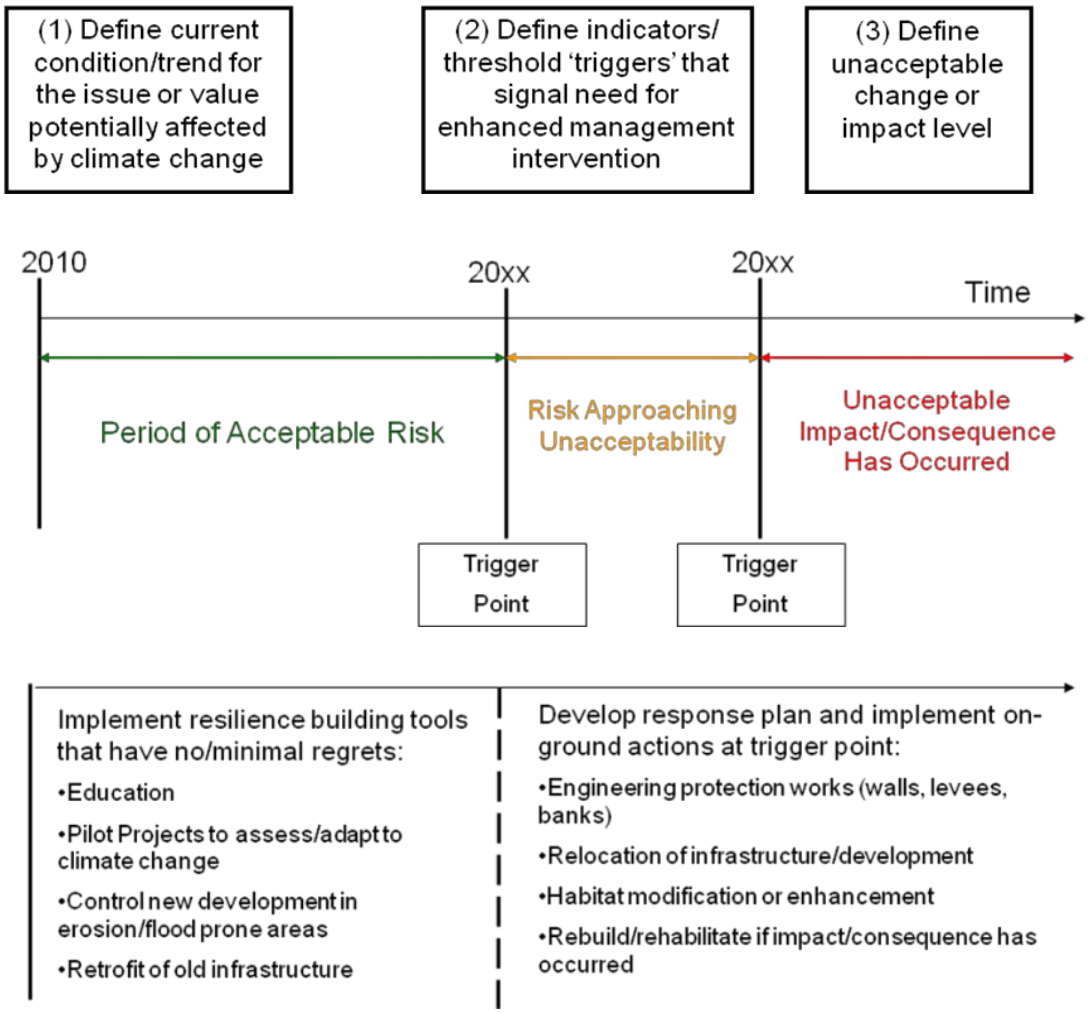


Figure 3-7 Continuum Model for Climate Change Adaptation Action

3.6.1 Erosion Triggers

Unlike flooding risks which may occur at any time, erosion tends to occur over years with preceding events giving warning of the approaching threat. Such time warnings can be used to advantage in setting measurable triggers.

The Hazards Review (see Appendix B) included a beach-specific assessment of historical erosion volumes to determine an upper limit of erosion for future events. This information has been used to develop beach specific trigger volumes in Table 3-8 and described below.

The erosion trigger specified in Table 3-8 should be used in conjunction with the data from the beach sand monitoring program (Action 3) to determine the volumes remaining on a beach, and therefore, where a trigger has been breached. Breaching of an erosion trigger shall then prompt either the implementation of a preferred action (such as for public infrastructure as determined through Actions 25, 27 and 28); or an Options Feasibility Study for the Hot Spot locations (as per Action 5). The Hot Spots are at imminent risk but as yet a suitable action for to treat erosion has not been determined.

After the erosion trigger has been breached, the structural stability and safety of the asset should be determined by a suitably qualified geotechnical engineer, termed the “implementation trigger” in Table 3-8. The zone of reduced foundation capacity (ZRFC) calculation given by Nielsen, *et al*. (1992) may be applied, provided that the actual soil type and substrate beneath the asset is used in the calculation (i.e. ‘homogeneous sand’ should not be assumed when calculating the ZRFC for determining site specific safety).

While a preferred action may have been identified, there will be a time lag between the breaching of an erosion trigger and acquiring the funding and approvals to implement the preferred action. This second “implementation trigger” therefore confirms the safety of at risk assets until such time as action can be taken.

After recent storms in June 2016, many of the Hot Spot locations may be at or below the sand volume required to provide adequate buffering of a subsequent storm (i.e. the trigger volume given in Table 3-8). The beach sand monitoring data collected immediately after the June 2016 storm should be assessed to determine if, and to what extent the trigger volumes at each Hot Spot beaches have been breached. That is, the calculation must determine the sand volume remaining on the beach, not the volume of sand eroded.

For Hot Spots where the trigger volume has been breached, until such time as site-specific Options Feasibility Studies can be completed (see Action 5) and preferred action implemented, a suitably qualified geotechnical or structural engineer should assess the stability of key assets at the Hot Spot beaches, and appropriate action to maintain the safety of the public undertaken.

Table 3-8 Erosion Trigger Volumes for Wyong's Beaches

Beach Location	Beach Length (km)	1. Erosion Trigger *Sand volume required as a buffer (m^3/m)*	2. Implementation Trigger: *Check public and property safety until action can be implemented*
Bateau Bay	0.5	160	Site specific assessment and ZRFC* calculation, to determine public and property safety. To be conducted by a suitably qualified practitioner. Undertake appropriate action to secure the site, if safety has been breached.
Blue Lagoon *(Shelly Beach Compartment)*	0.5	50	
Shelly Beach *(Shelly Beach Compartment)*	2.0	290	
Toowoon Bay	0.7	75	
Blue Bay	0.4	115	
South Entrance Beach	0.4	*N/A (Backing revetment)*	
The Entrance Spit *(Tuggerah Compartment)*	0.6	*N/A (Spit breach)*	
North Entrance *(Tuggerah Compartment)*	2.8	170	
Magenta to Pelican *(Tuggerah Compartment)*	4.8	310	
Soldiers Beach	1.0	150	
Pebbly Beach	0.4	150	
Cabbage Tree Bay	0.3	75	
Jenny Dixon Beach	0.3	*N/A (Backing cliff)*	
Hargraves Beach	1.1	180	
Lakes Beach *(Budgewoi Compartment)*	1.0	150	
Budgewoi Beach *(Budgewoi Compartment)*	2.2	250	

** ZRFC = zone of reduced foundation capacity. Must take account of site specific soil and substrate, not assume homogenous sand.*

3.6.2 Wave Overtopping and Inundation Triggers

The 'trigger point' may relate to a frequency of overtopping of a particular asset, and this will be site specific. For example, inundation or wave run up through an amenities block may not be an issue if it occurs infrequently (e.g. yearly), but will become disruptive and dangerous should it occur regularly (e.g. weekly). Similarly, inundation of an electrical substation is unlikely to be tolerable even infrequently.

Two phases of the trigger should be set, and may both be related to inundation frequency. For example, the first 'trigger point' may be when inundation becomes a nuisance, or even the first occurrence of inundation; the second 'trigger point' may be when the frequency of inundation becomes disruptive or dangerous, as detailed in Table 3-9 below.

Table 3-9 Recommended Trigger Points for Overtopping and Inundation

Hazard	1. Planning Trigger: *Prepare funds etc for Action.*	2. Implementation Trigger: *Implement Action to avoid unacceptable impact.*
Inundation, wave run up	Frequency of inundation is a nuisance, (as determined on a site by site basis, e.g. 1/yr; 1/month etc.)	Frequency of inundation is intolerable (i.e. disruptive, dangerous and / or costly, as determined on a site by site basis, e.g. 1/yr; 1/month etc.)

3.7 Pathway to Managing Significant Coastal Risks

This Wyong CZMP 2017 provides actions that can be implemented over the next 5-10 years to reduce coastal risks. Significant coastal risks across the Wyong coastline are associated with the coastal erosion and cliff instability hazards and particularly for areas mapped within the "immediate" coastal hazard risk zone. This includes residential properties and associated infrastructure at immediate risk of coastal hazard impacts. The *draft Coastal Erosion Emergency Action Subplans* (Coastal Erosion EAP) outline emergency response procedures for residential properties located at coastal erosion hotspots (see Appendix D). As stated in the Coastal Erosion EAP, foreshore landowners at "authorised locations" are permitted to implement temporary coastal protection works (in line with current legislation and guidelines, and following approval from Council). Council emphasises that the responsibility for "temporary coastal protection works" of private property will remain with the landowners. Permissible 'one off' temporary protection works includes placement of sand or sand filled geotextile bags only. Implementation of the Coastal Erosion EAP will provide for a temporary reduction in immediate coastal risks, however it does not provide a medium-long term solution for the 'at risk' coastal locations. Action 5: Options Feasibility Study for the Hot Spot Locations will enable the development of a suitable action(s) for to treat erosion at these locations. A key component of Action 5 is to subject the preferred management options to a detailed and site specific cost benefit analysis. Council will not approve protection of existing assets or private development where the works could increase risks to other landowners or to community use of the coastal landscape.

Medium to long term management of coastal risks targets reduction of consequences or likelihood of hazard impacts and long term risk avoidance, through temporary protection works (see Coastal Erosion EAP in Appendix D), land use planning (see Actions 16, 17, 18 and 19) and asset management planning (e.g. relocation of assets once impacted or when replacement is required; see Action 25, 27, 28, 29 and 30). In the longer term, Council's risk treatment strategy is planned or managed retreat (unless Action 14 outcomes identify alternate management pathways for Erosion Hotspot locations).

For future risks with long timeframes, such as delineated by the "high" or "low" risk coastal hazard zones, it is not possible to determine the most suitable action at present. Indeed, a preferred action need not be determined until it is clear that the risk of damage is imminent. Instead, identifying a trigger to alert that a risk is imminent is valuable, even though it is unlikely that triggers for future risks will be reached over the life of this CZMP (5-10 years).

Identifying a trigger for action enables Council and others to be prepared should a risk present itself earlier than anticipated, but does not commit Council or others to a specific course of action. This approach avoids costly, large-scale, difficult and / or unpalatable actions being implemented until it is certain that they are needed. Recommended triggers are detailed in the following section.

The time period between now and when a risk becomes certain can be used to increase information / data upon which to base future decisions and improve certainty regarding the likely impacts of coastal hazards (particularly sea level rise). This period may also see an improvement in management approaches (such as within the typical "protect, accommodate or retreat" suite of actions) and /or funding to treat particular risks (e.g. changes to funding and sand sources for beach nourishment, funding of land acquisition etc., that are not currently viable options for any council).

4 Plan Review and Revision

The Wyong CZMP 2017 requires evaluation and reporting regarding the success of its implementation, and thus the success of managing existing and future coastal risks. Where implementation performance is sub-optimal, the evaluation process should identify contingencies to remedy the situation.

This Wyong CZMP 2017 forms the second iteration of coastal management for Wyong's coast. The CZMP, and the studies that underpin it, should be revised every 5-10 years.

4.1 Annual Internal Communication and Implementation Audit

The importance of internal communications within Council cannot be over emphasised in the success or otherwise of implementation of CZMPs. To support the integration of this CZMP with Council's day to day operations, it is recommended that 12 months after the CZMP is adopted, and henceforth at yearly intervals, key Council Staff responsible for its implementation and the regional OEH Coastal representative undertake an internal workshop to gauge the status of adoption of the CZMP and general understanding of its objectives within Council. The workshop would include a refresher of the CZMP contents, to reinvigorate existing staff and for new staff.

4.2 Annual Report: Linking Review of Implementation of CZMP Actions with the IPR Framework

Council delivers an Annual Report to document its progress in implementing the Delivery Program and Operational Plan activities over each financial year period. Performance indicators are included for each action in the Operational Plan.

In the Implementation Schedule of this CZMP, each action has been given a performance indicator over a particular timeframe. This can be used to feed the actions into Council's Delivery Program and Operational Plan or longer term Financial Plan. The performance measures shall also be used to gauge whether the actions have been implemented or not, which can then be reported in the Annual Report. This provides for a yearly evaluation of the implementation status of CZMP actions.

Where actions have not been included in the IPR Framework, a yearly evaluation of those CZMP actions by Council's Natural Resource Management Coastal Team is recommended.

If it is determined that an action has not been implemented in accordance with the nominated performance indicator and timeframe, then one or both of the following contingencies should be adopted:

- Determine the cause for the delay in implementation. If delays are funding based, then seek alternative sources of funding. If delays are resource-based, seek additional assistance from stakeholder agencies and / or consider using an external consultancy to coordinate implementation of the action(s); and
- Modify and update the CZMP to reflect a timeframe for implementation of the action that is more achievable. The revised Plan would need to be endorsed by all relevant stakeholders and agencies responsible for implementation.

4.3 Bringing the Plan into the new CMP Framework

As noted in Section 1.3.1, the NSW Government is currently undertaking reforms of the Coastal Management Framework in NSW. The intention is to submit this CZMP for certification under the existing legislation. It will then be necessary for this CZMP to be integrated into the new format by 2021. The NSW Government has indicated that existing certified CZMPs will be able to be fast-tracked into the new framework, to avoid discarding the existing valid work and retain momentum for existing actions.

Under the new framework, CZMPs will become coastal management programs (CMPs), to be implemented via local councils' Integrated Planning and Reporting (IPR) Framework. Links between actions in this CZMP and the objectives of Council's existing Delivery Program have been given in the Implementation Schedule, to assist in transferring this CZMP into the new format.

4.4 Plan Review: Success of CZMP Actions in Mitigating Risk

A review should be conducted after five years to measure the performance of the Plan in terms of actually managing and reducing the risks to the community associated with existing and future coastal hazards. That is, 'how has the Plan made a difference?' and 'has the level of residual risk been reduced?'. Given that the CZMP will need to be brought into the new CMP format by 2021 (see Section 4.3 above), this review and update could be conducted in that time.

The main mechanism for gauging whether the Plan has been successful is to re-evaluate the risks through a follow-up risk reassessment process. As for the first risk assessment, all of the existing controls that assist with managing current and future risks should be included when assessing the level of risk. There are two specific questions to be answered:

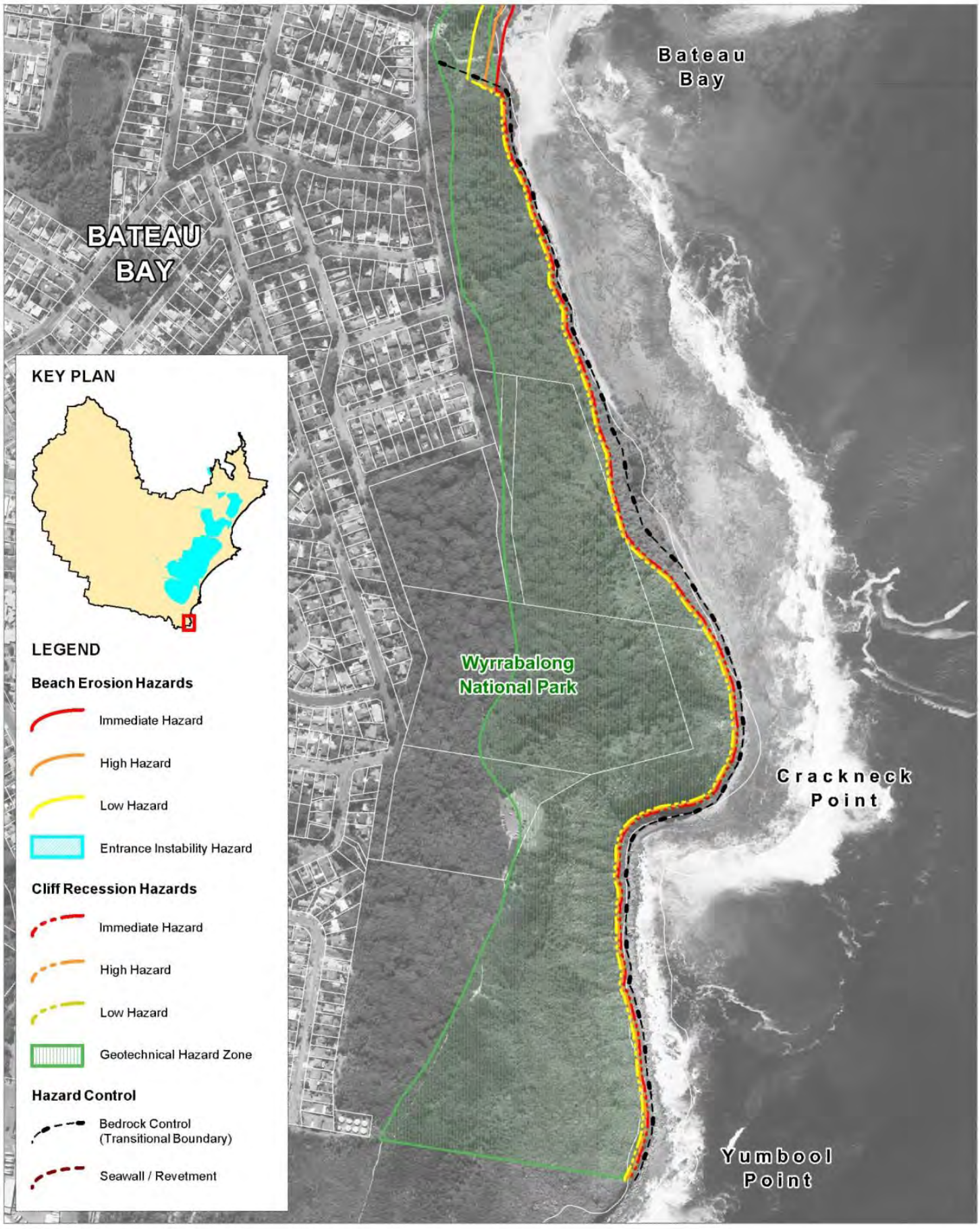
- Has the level of risk changed? (including for those risks in this plan that are currently assessed as low); and
- Have the extreme or high risks been adequately managed / mitigated? (i.e., has the level of risk been reduced to a tolerable level through management?).

If it is determined that the risks have not been adequately managed / mitigated, or that new intolerable risks have arisen, the following contingencies should be adopted:

- Carry out a formal review of the implemented management strategies, identifying possible avenues for increasing the effectiveness of the strategy in managing the risks along the coastline (including new risks);
- Commence implementation of additional/back-up management strategies that may assist in meeting the objectives of the Plan (possibly 'fast-tracking' some longer term strategies as necessary);
- Reconsider the urgency of management for key risks. For example, accommodating future changes may no longer be feasible, and upscaling from passive to active management may be needed, e.g. shifting from development controls to planned retreat, asset relocation etc.

Any such changes to the Plan would need to be endorsed by the stakeholders and relevant government agencies, as well as the public.

5 Coastal Hazard Planning Maps



Title:

DRAFT Coastal Hazard Planning Area Map Crackneck

Figure: 7-01

Rev: A

N

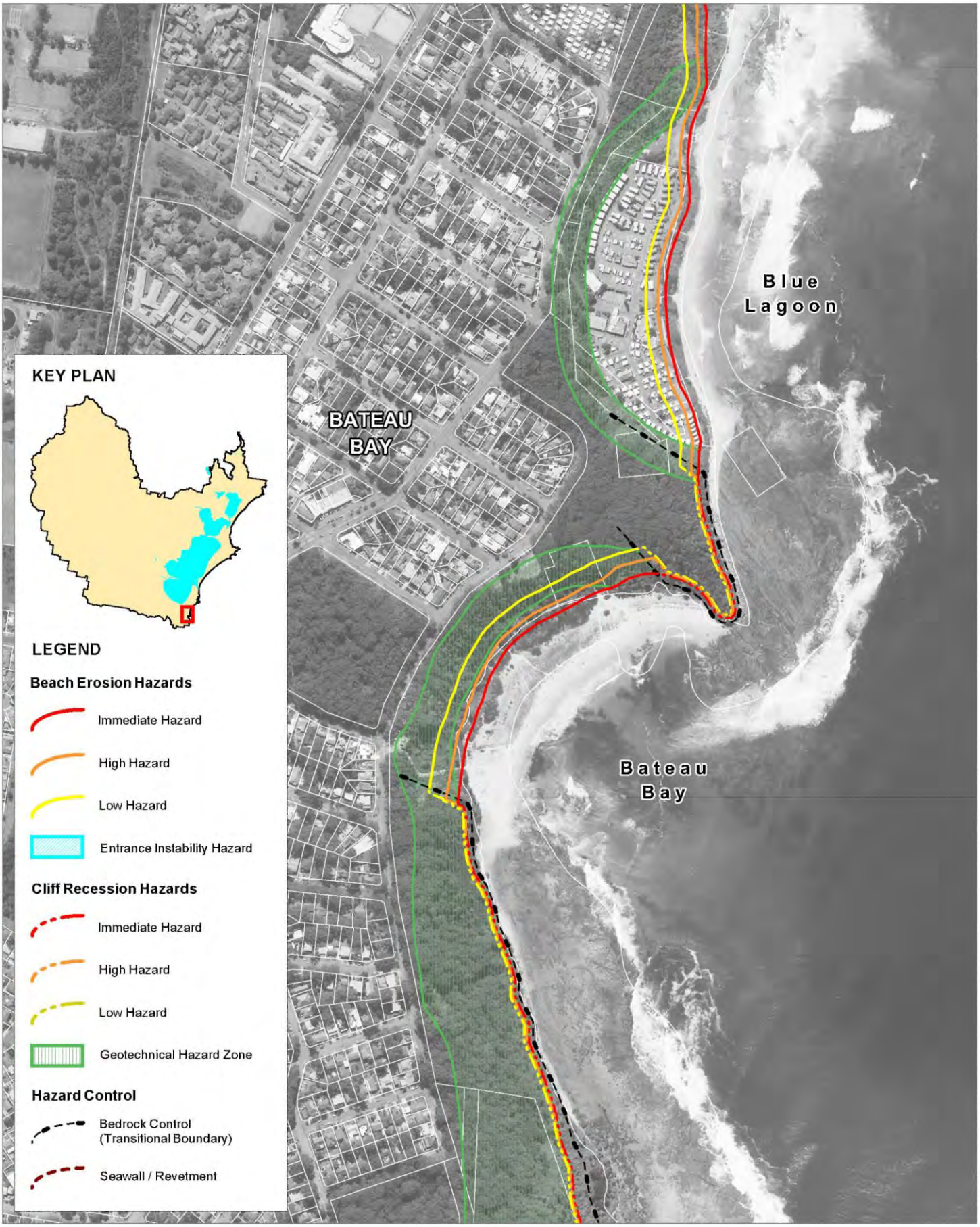
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Bateau Bay

Figure: 7-02

Rev: A

N

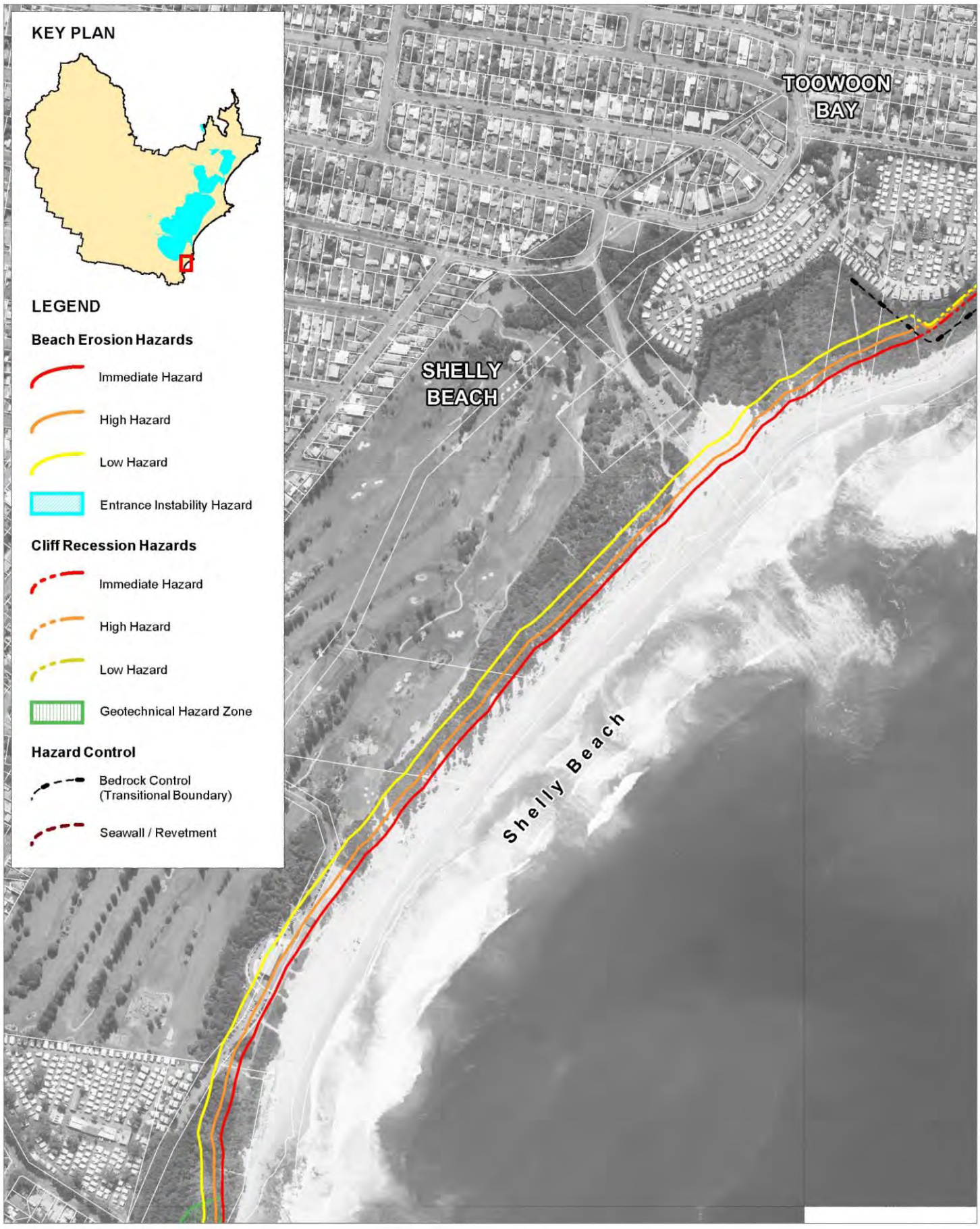
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map Shelly Beach

Figure: 7-03

Rev: A

N

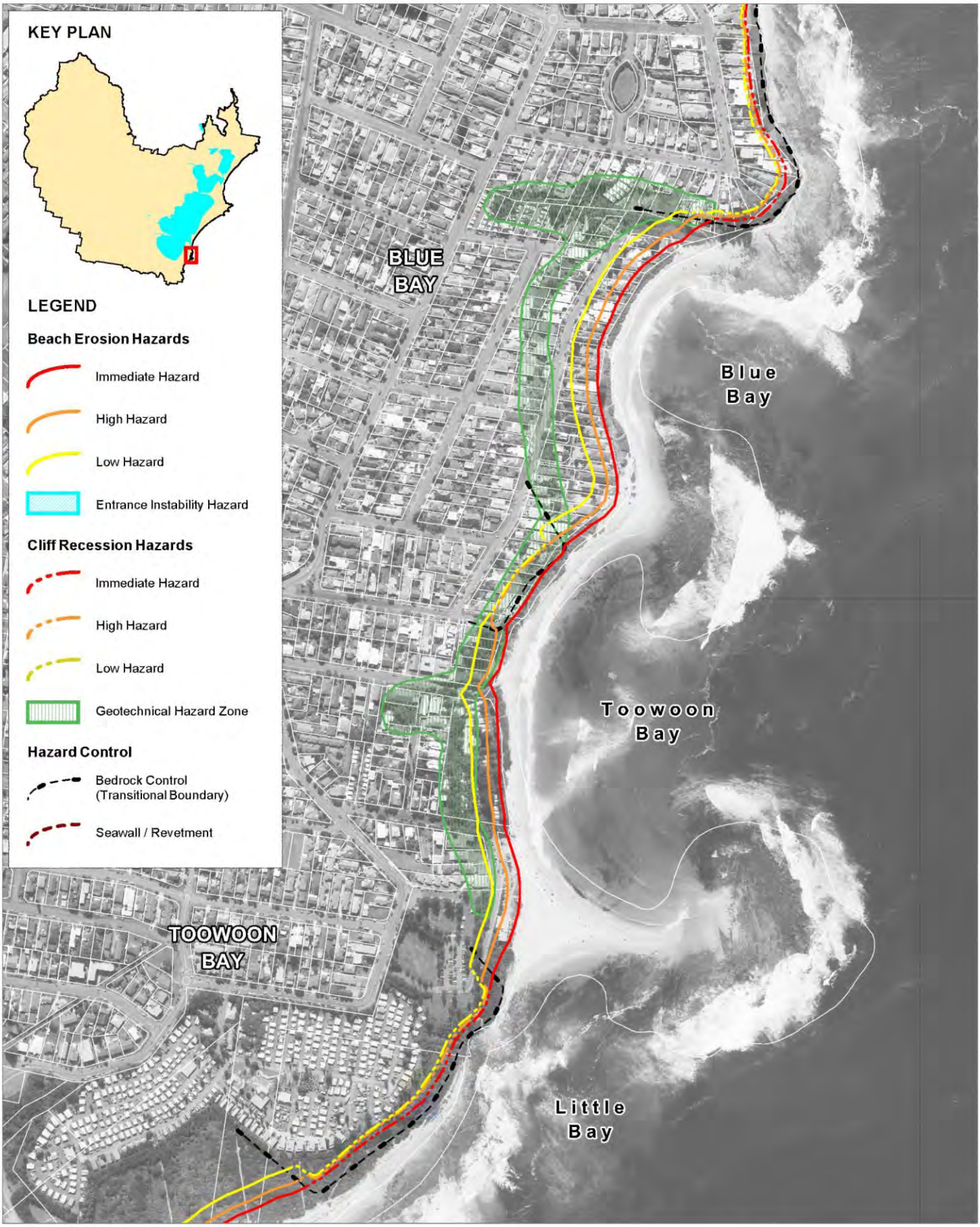
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map Toowoon and Blue Bay

Figure: 7-04

Rev: A

N

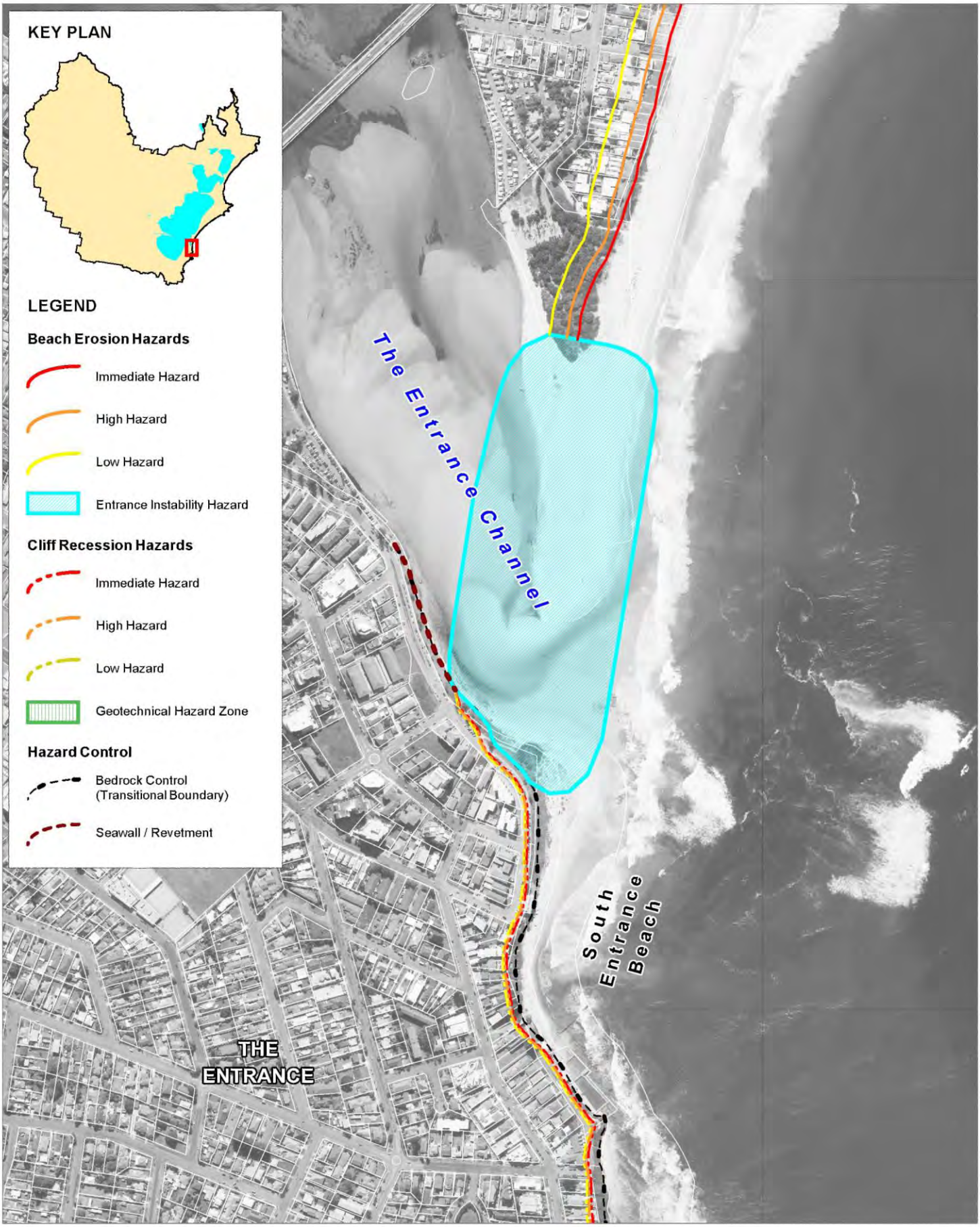
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
The Entrance

Figure: 7-05

Rev: A

N

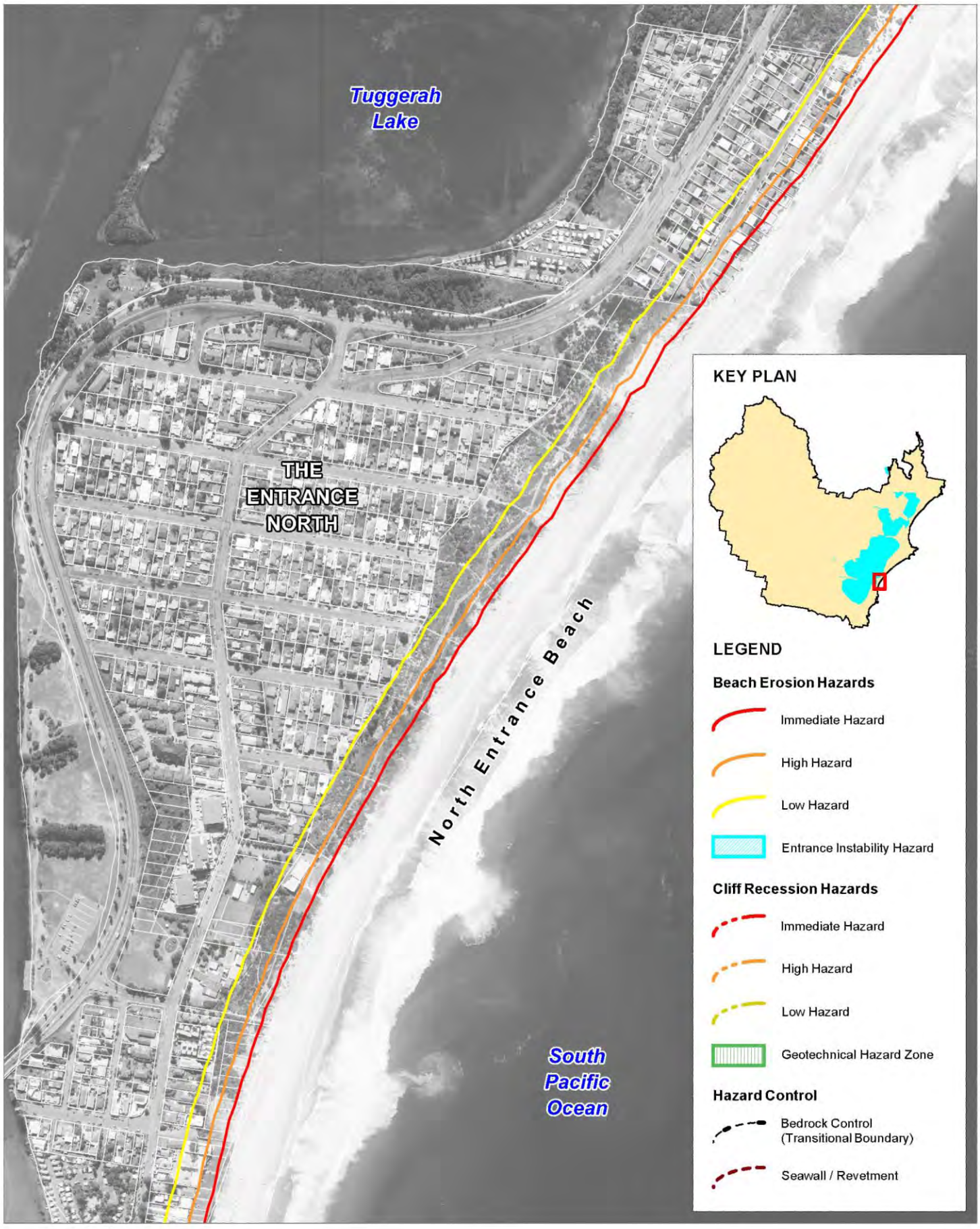
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map North Entrance Beach

Figure: 7-06

Rev: A

N

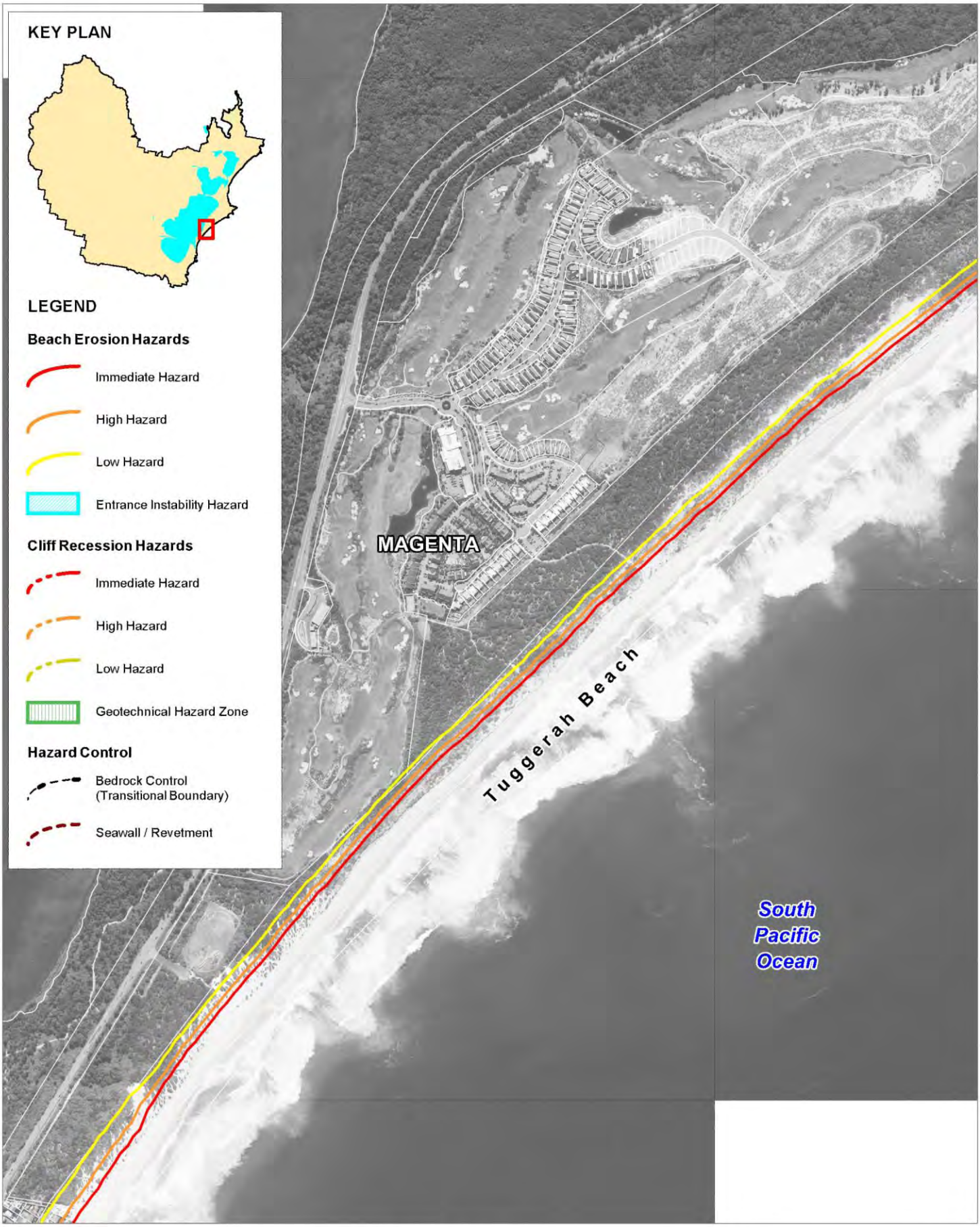
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Tuggerah Beach (Magenta)

Figure: 7-07

Rev: A

N

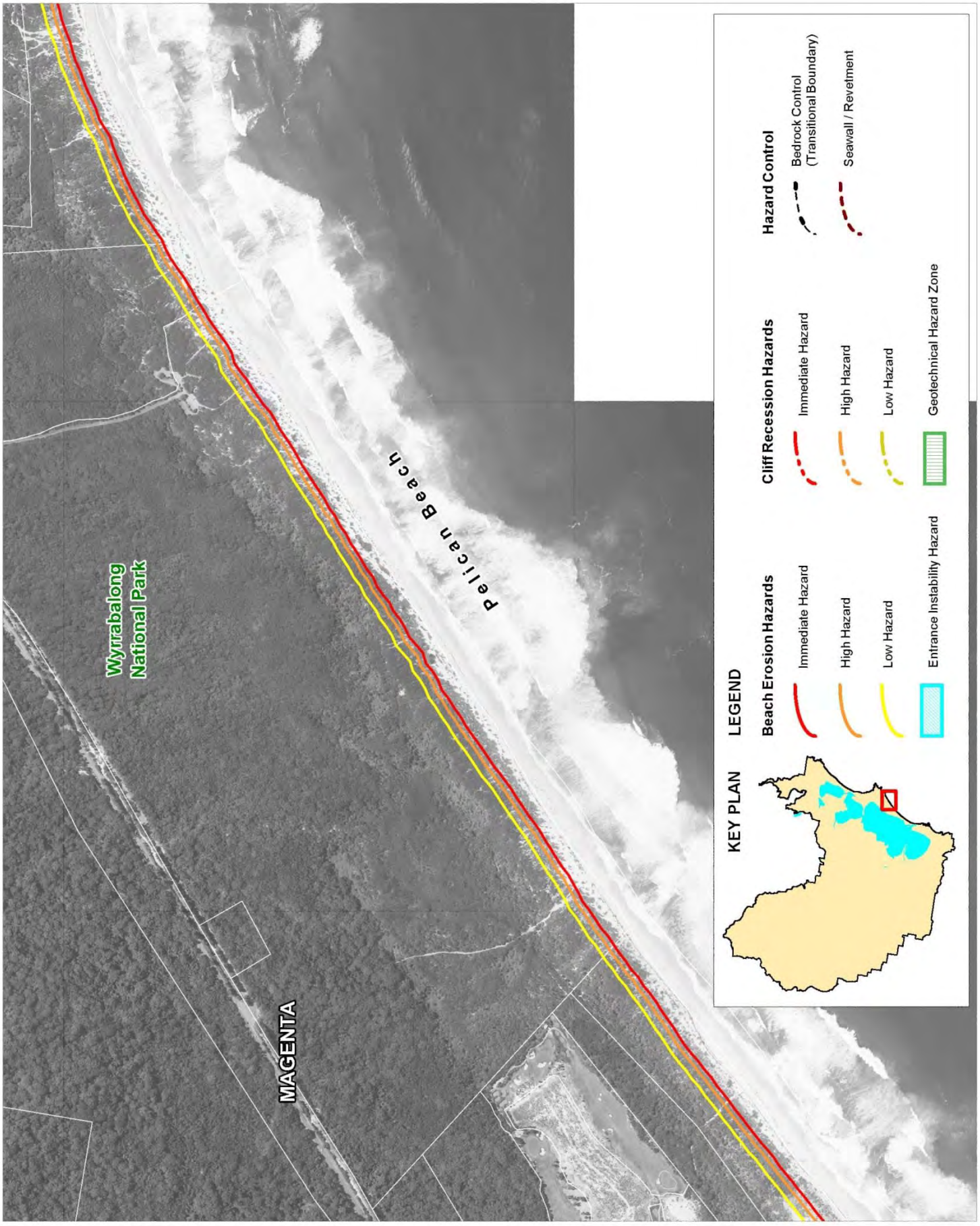
0 200 400m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Pelican Beach

Figure: **7-08**

Rev: **A**

N

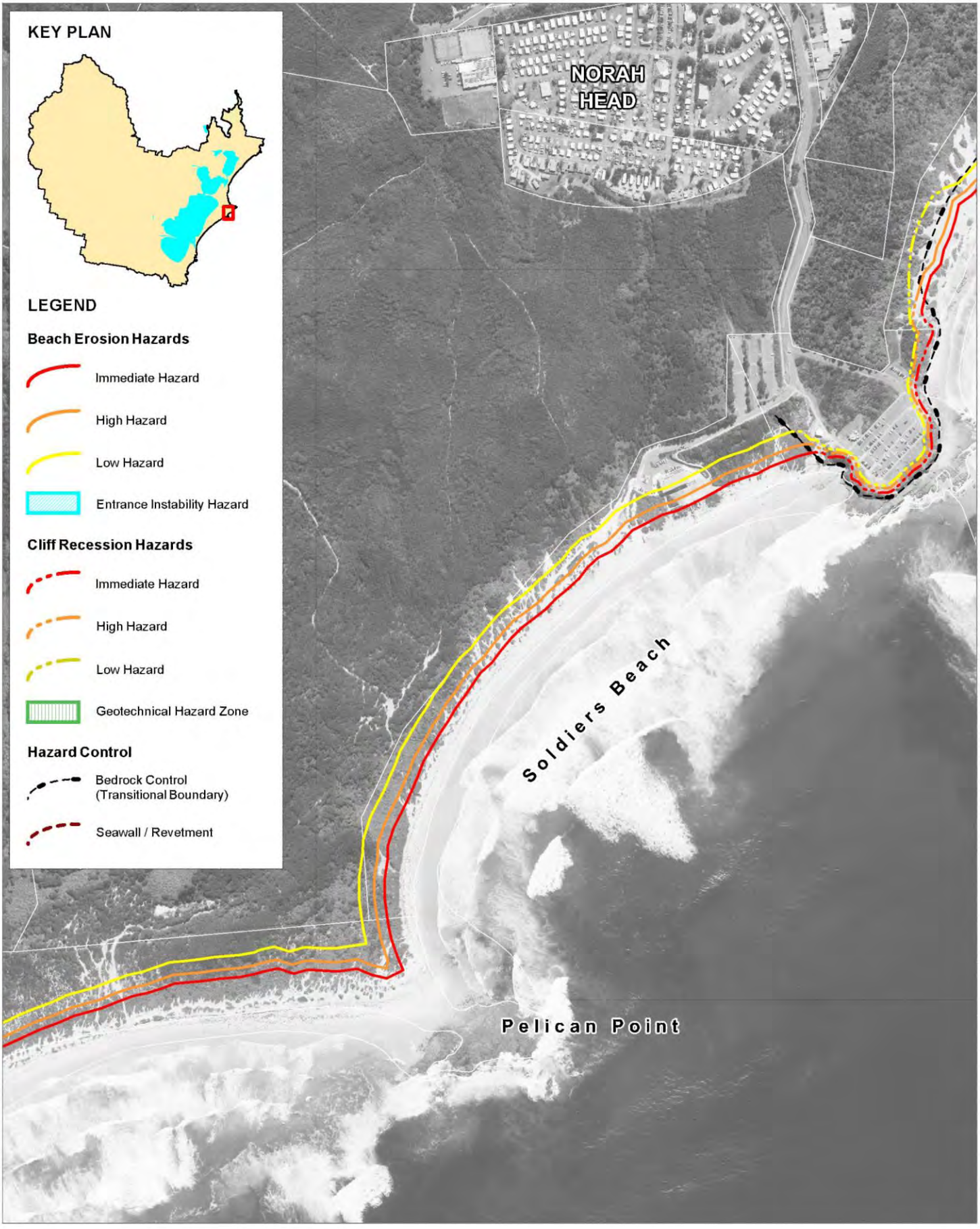
0 200 400m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Soldiers Beach

Figure: 7-09

Rev: A

N

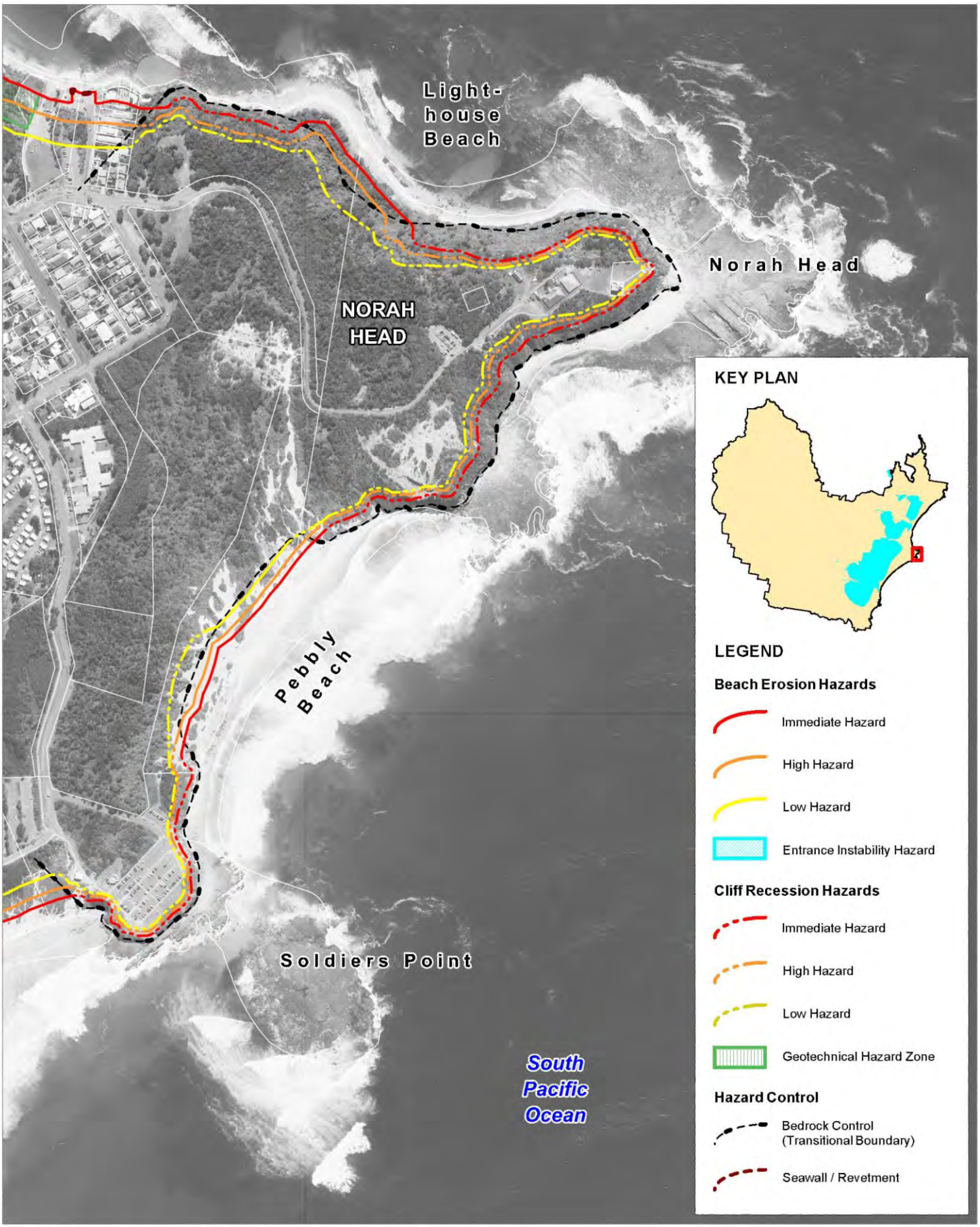
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Norah Head

Figure: 7-10

Rev: A

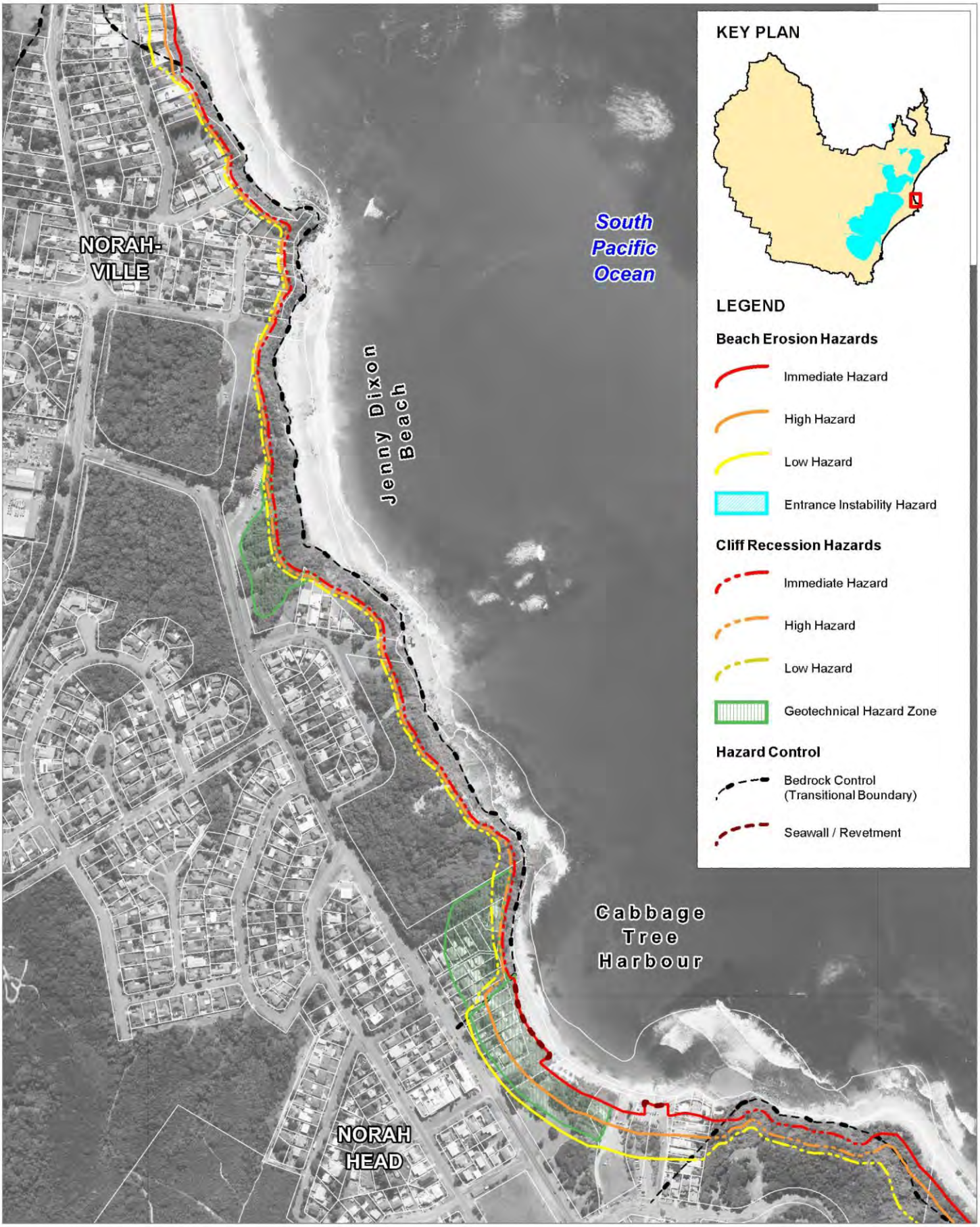
N

0 125 250m

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map Cabbage Tree Harbour

Figure: 7-11

Rev: A

N

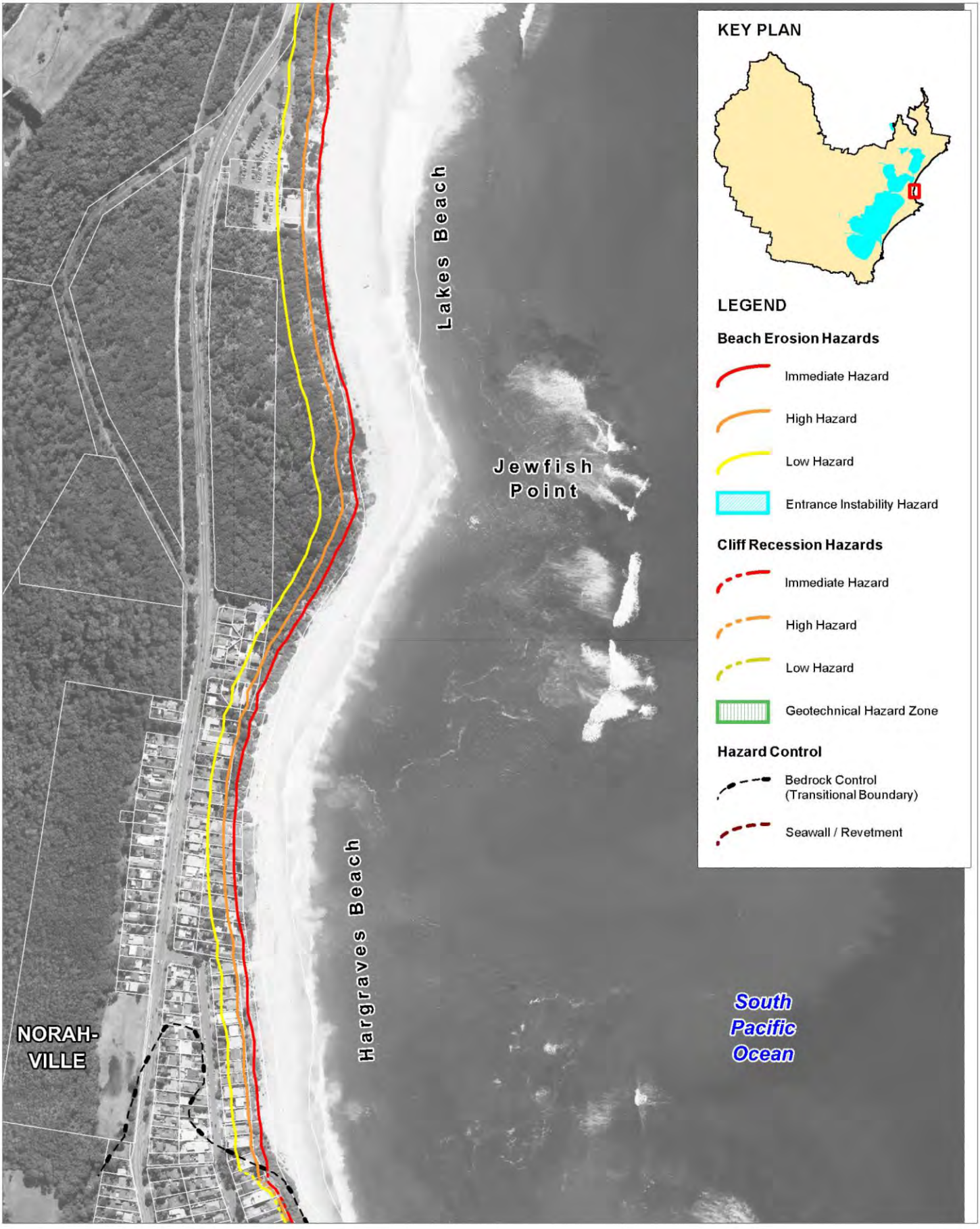
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Hargraves Beach

Figure: 7-12

Rev: A

N

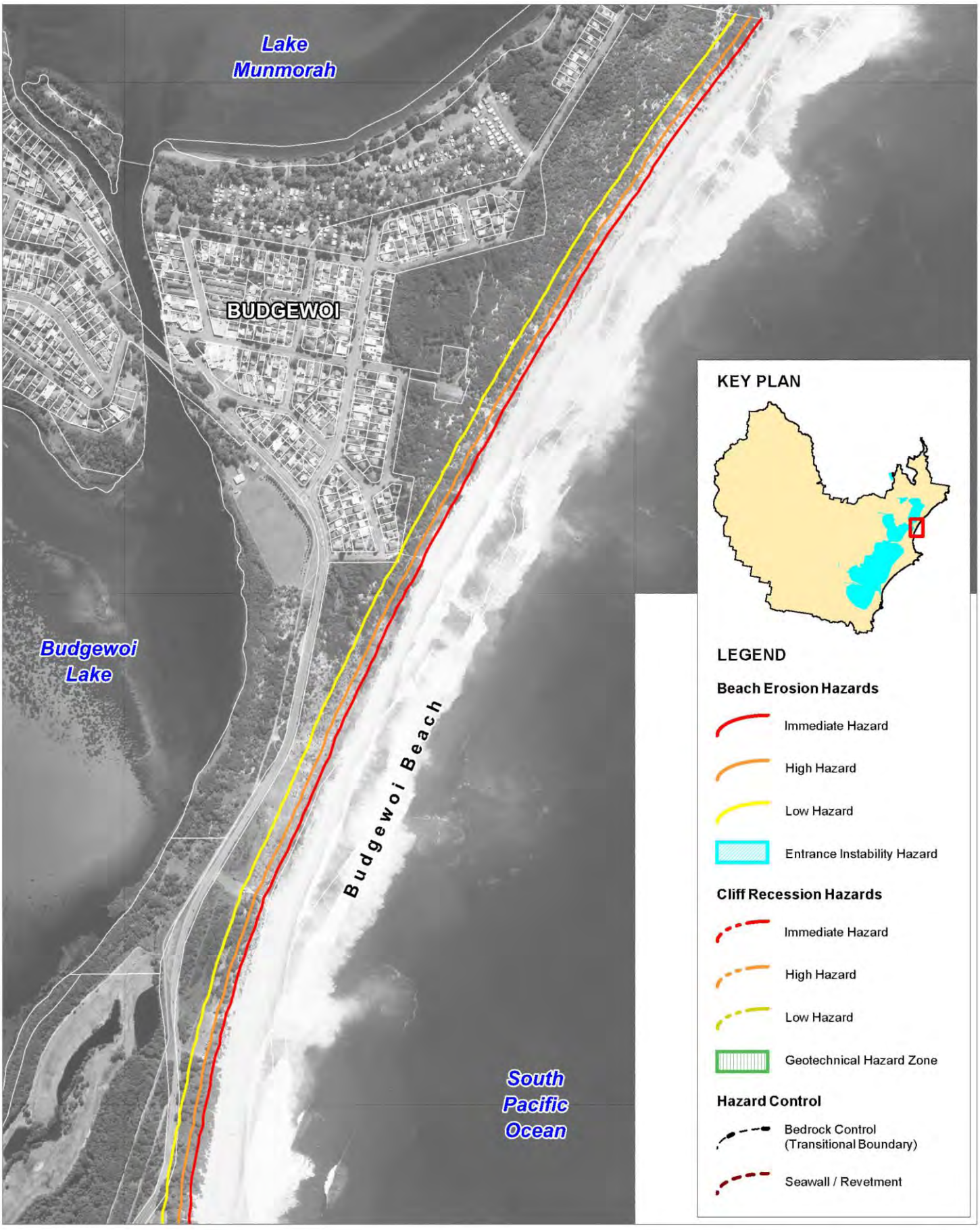
0 125 250m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath :



Title:

DRAFT Coastal Hazard Planning Area Map
Budgewoi Beach

Figure: 7-13

Rev: A

N

0 200 400m

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath :

6 References

BMT WBM (2017) *Review of the Wyong Coastal Zone Hazard Study*, Draft Report prepared for Central Coast Council, January 2017.

CSIRO (2015), *Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report*, prepared by CSIRO and Bureau of Meteorology, Australia.

CSIRO (2016a), Historical Sea Level Changes: Last few hundred years accessed online 24/02/2016 at: http://www.cmar.csiro.au/sealevel/sl_hist_few_hundred.html

CSIRO (2016b), Historical Sea Level Changes: Last decades accessed online 24/02/2016 at: http://www.cmar.csiro.au/sealevel/sl_hist_last_decades.html and

NSW Chief Scientist and Engineer (2012). *Assessment of the science behind the NSW Government's sea level rise planning benchmarks*, prepared for Minister for Environment, April 2012.

NSW Environment and Heritage (2012) Sea Level Rise web-page available at http://www.environment.nsw.gov.au/climatechange/sealevel.htm. Accessed 1/11/12.

OEH (2013a), *Guidelines for Preparing Coastal Zone Management Plans*, April, 2013.

OEH (2013b), *Code of Practice under the Coastal Protection Act 1979*, August 2013.

OEH (2015), *Funding Mechanisms to Implement Coastal Management Actions: Guidance for Local Councils (Consultation Draft).* Part C: Coastal Management Toolkit, NSW Coastal Management Manual, December 2015.

OEH (2016a) Coastal Reforms Overview, accessed online 25/02/2016 at: http://www.environment.nsw.gov.au/coasts/coastreforms.htm

Umwelt (2011a), *Coastal Zone Management Plan for the Wyong Coastline*, prepared for Wyong Shire Council by Umwelt (Australia) Pty Ltd, December 2011.

Umwelt (2011b), *Coastal Zone Management Plan for the Wyong Coastline: Supporting Information Volume 1*, prepared for Wyong Shire Council by Umwelt (Australia) Pty Ltd, November 2011.

SMEC (2010), *Wyong Coastal Hazard Study*, Final Draft Report, prepared for Umwelt Australia Pty Ltd, October 2010.

SCE (2010), *Report on the Geotechnical Issues associated with the Coastline Hazard Management Study [CPA # 170951] for the Wyong Shire Council*, prepared by Shirley Consulting Engineers [SCE] as a sub-consultant to Umwelt (Australia) Pty Ltd, 31 May 2010.

WSC (2012), *Wyong Shire Council Minutes of the Ordinary Council Meeting of Council*, 10 October 2012.

WSC (2013a), *Wyong Shire Council Minutes of the Ordinary Council Meeting of Council*, 22 May 2013.

WSC (2013b), *Wyong Shire Community Strategic Plan 2030*, revised 2013.

Appendix A Meeting the Minimum Requirements

Appendix B Review of the Wyong Coastal Zone Hazard Study (BMT WBM, 2017)

Appendix C Review of Actions in the 2011 Wyong CZMP

Appendix D Emergency Action Subplan for 'Authorised Locations' – Review and Update

Appendix E LEP and DCP Recommendations Relevant to the Wyong CZMP 2017

Appendix F Referenced Information from the WCZMP 2011 and WCZMP Supporting Information (Umwelt 2011a, 2011b)

Appendix G Previous Coastal Management Planning Studies and Supporting Information for Wyong (Umwelt 2011a, 2011b, 2011c)

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