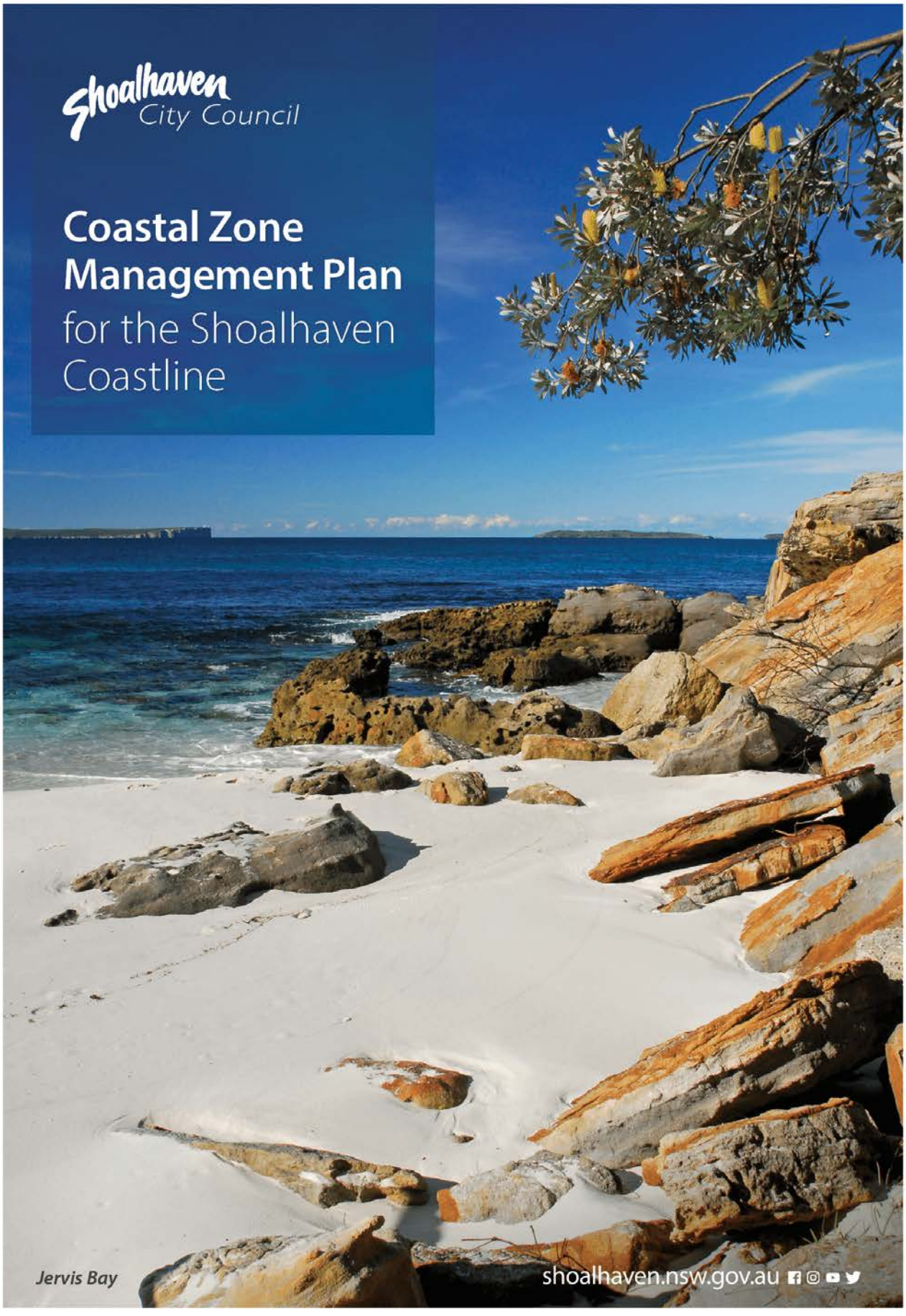
Shoalhaven City Council

Coastal Zone Management Plan for the Shoalhaven Coastline



Jervis Bay

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Document Control Sheet

Document Reference	57599E	**Synopsis**	To manage coastal risks and hazards Council is taking action to care for the coastline. Integrated and sustainable management of the coastal zone is a high priority for Council as well as for local communities. This Coastal Zone Management Plan sets out the plan for coastal management within the Shoalhaven City local government area for the next five years and beyond. During the next 5 years Council will develop a new Coastal Management Program in accordance with the latest requirements of the NSW Coastal Management Act 2016. Important actions that go beyond five years in this Coastal Zone Management Plan can be included in the Coastal Management Program.
Title	Coastal Zone Management Plan for the Shoalhaven Coastline		
Staff Contact	Kelie Clarke – Environmental Services Manager		
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Contents

Appendix 1 - Shoalhaven Coastal Hazard Mapping Review, Advisian 2016.

Appendix 2a – Shoalhaven Coastal Zone Management Plan – Risk Assessment, Advisian 2018.

Appendix 2b – Shoalhaven Coastal Zone Management Plan – Risk Mapping, Advisian 2018.

Appendix 3 – Submissions Tables.

Appendix 4 – Shoalhaven Beaches Emergency Action Sub Plans, Advisian 2018.

Appendix 5 – Shoalhaven Coastal Cliffs and Slopes Risk Management Program & Coastal Cliffs and Slopes Emergency Action Sub Plan, RoyalHaskoningDHV 2018.

Executive Summary

The Shoalhaven coastline

The coastal landscape of the Shoalhaven is a treasured natural, social and economic asset for the community. Council, often in partnership with state government agencies, manages 40 open coast beaches, bays, headlands, 11 coastal lakes and estuaries. This Coastal Zone Management Plan (CZMP) covers the Shoalhaven open coastline (including Jervis Bay). It does not include the estuaries.

To manage coastal risks and hazards, such as damage from storms, beach erosion and rising sea levels, Council is taking action to care for and manage the coastline. Integrated and sustainable management of the coastal zone is both a legal responsibility and high priority for Council as well as for local communities.

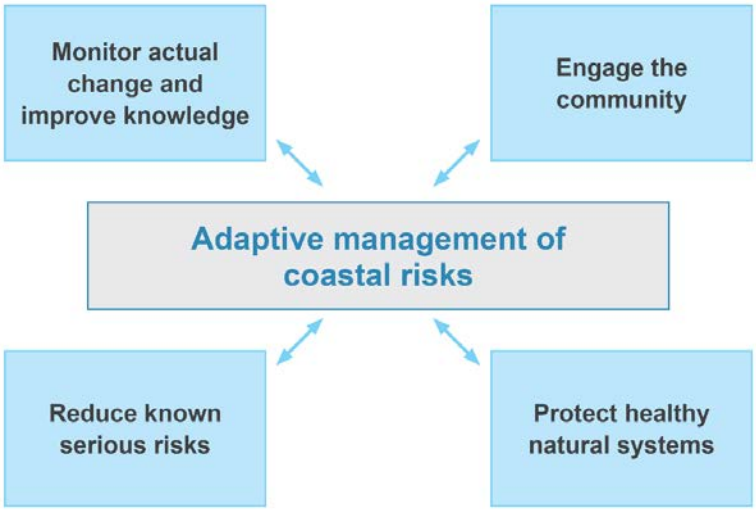
This draft Coastal Zone Management Plan sets out the plan for coastal management within the Shoalhaven City local government area for the next five years and beyond. During this time Council will develop a new Coastal Management Program in accordance with the latest requirements of the *NSW Coastal Management Act 2016*. Important actions that go beyond five years in this Coastal Zone Management Plan can be included in the Coastal Management Program.

Key strategies and action plans within the Coastal Zone Management Plan include:

- Regulating development in the coastal zone to ensure minimal environmental disturbance and long-term resident safety
- Ensuring a balance between beach stability and maintaining user amenity
- Providing mechanisms for management and risk mitigation for public and private assets in the coastal zone
- Ensuring the Shoalhaven coastline continues to be a valued natural asset for the broader community.

Taking a strategic approach

The Coastal Zone Management Plan has four main focus areas, as illustrated below. These focus areas are contained within, and interact with, an adaptive management framework. Adaptive management is a process for managing uncertainty, incomplete data and changing coastal systems to improve and refine management responses over time.



Framework for adaptive management of coastal risks and four focus areas

What Council needs to consider

Detailed studies of coastal processes, hazards and risks help us understand which issues need to take priority for sustainably managing the Shoalhaven coast. The Coastal Zone Management Plan contains detailed knowledge about coastal science. Information from technical studies gives us a deeper understanding of natural processes in particular locations. Scientific and community understanding of how beaches, dunes, lakes and estuaries respond to coastal processes, climate drivers and land management is improving.

Council develops coastal management options in response to coastal risks, that are based on the interaction of hazards and values. Options are evaluated against a range of criteria, including capacity to mitigate extreme risks, community acceptance, Council's capacity to pay, and alignment with existing programs. Adaptive responses are based on ongoing monitoring and evaluation of actual progress against expectations and targets.

The Shoalhaven coastline is highly valued by residents, ratepayers and visitors. During preparation of the Coastal Zone Management Plan, Council provided information using a special project website and listened to the community's views about important issues and potential management options.

Over the last six years Council has conducted multiple rounds of community briefings and workshops to discuss how local communities use and value the coast. Council considered community experience and observations of coastal change, objectives for the future of the coast, issues, hazards, risks and potential management responses.

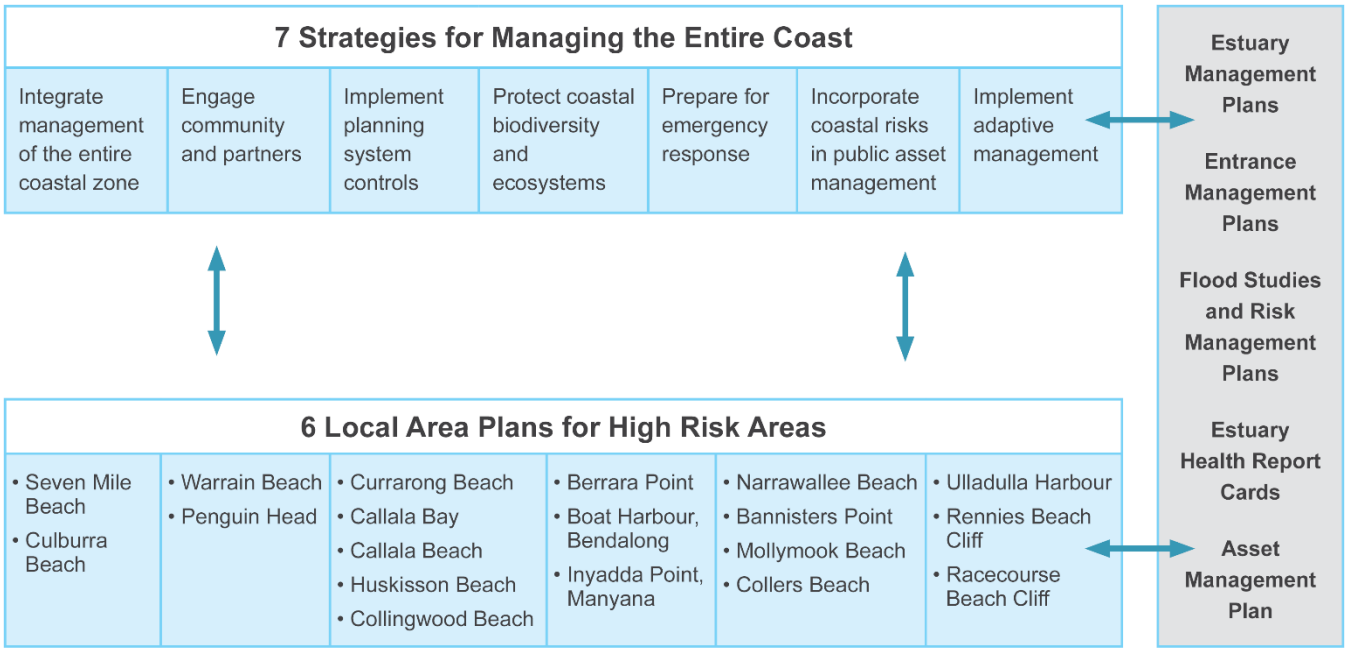
How Council responds

Strategies which apply to the whole of the Shoalhaven coastline include land use planning, emergency response management, and community involvement in monitoring and reporting.

Citywide strategies provide *general* benefit for the future management of coastal risks. They are designed to:

- Prevent risks escalating
- Raise awareness of coastal zone management issues and processes
- Protect important natural coastal systems
- Establish mechanisms to improve and refine management as new knowledge becomes available.

There are seven strategies for managing the entire coast and six local area plans, as shown over page. The six local area plans detail actions that are proposed to manage coastal risks and threats relevant to each particular area.



Relationship between area wide strategies, local area plans and estuary management plans

Implementation: setting priorities

Council has developed schedules that prioritise the broader strategy tasks and local actions. These schedules will help Council clearly identify the actions it needs to include in our corporate operational planning and budget cycles.

The strategies and actions set out in the schedules are mainly Council's responsibility. Many sections of Council will co-operate to achieve the objectives of the plan. To get the best results, Council will also need to work closely with local communities and relevant state agencies.

Taking these priorities and budget into account, Council has developed an operational program that balances the environmental priorities, community input and budget realities.

1. Introduction

1.1 Background

The coastal landscape of Shoalhaven City Council (SCC) is a treasured natural, social and economic asset for the community. The coastal zone extends 165 km along the NSW south coast, from Shoalhaven Heads to North Durras. Of the 109 beaches along the coast, Council manages 40, and of the 15 lakes and estuaries, Council manages 11. Figure 1.1 shows the extent of the Shoalhaven Coastal Zone, which this Coastal Zone Management Plan addresses. This Coastal Zone Management Plan (CZMP) covers the Shoalhaven open coastline from Shoalhaven Heads (including Jervis Bay) to North Durras but does not include the estuaries.

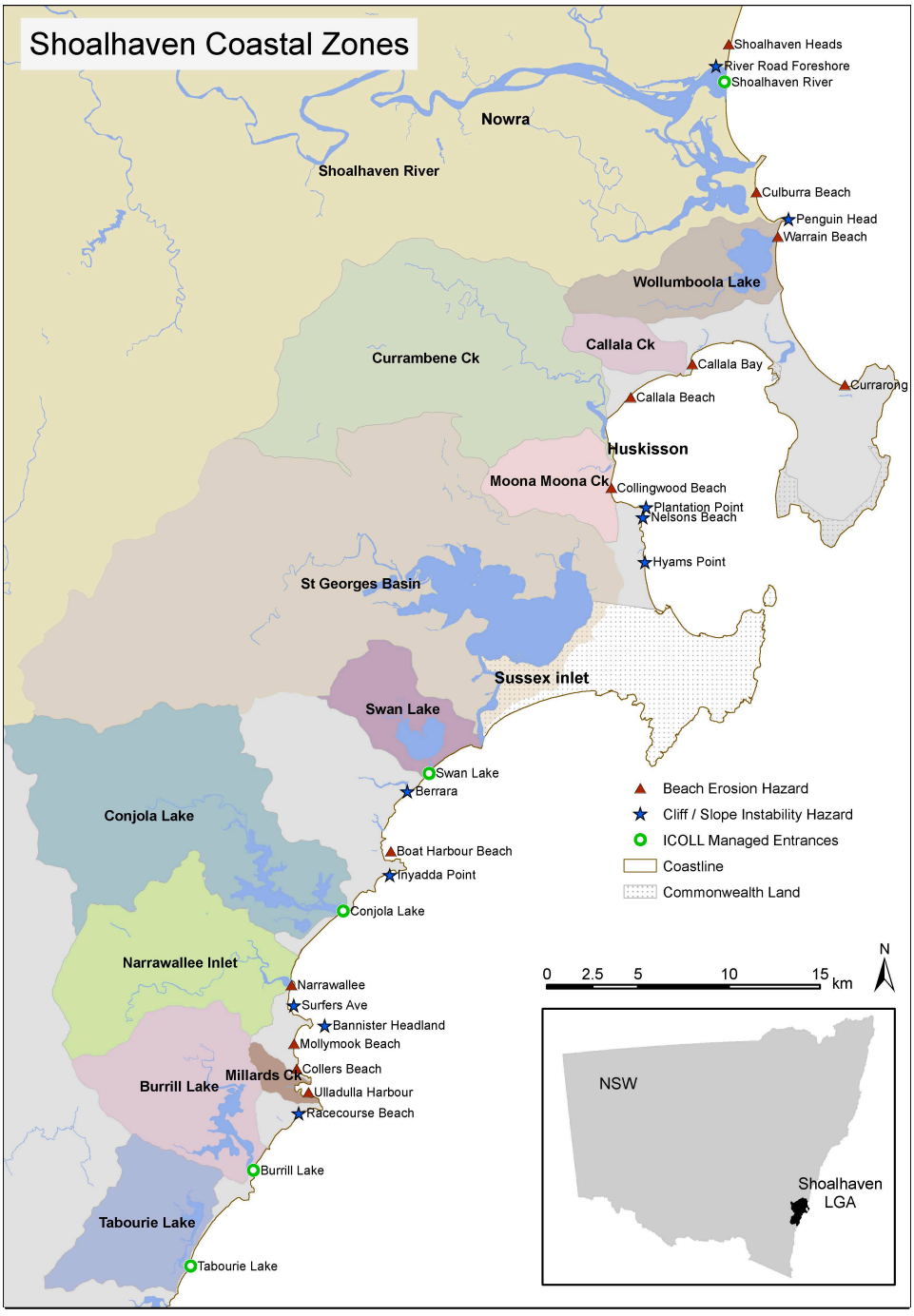


Figure 1.1 – Shoalhaven Coastal Zone

At least 55% of Shoalhaven's population (total 102,811[1]) lives in coastal areas. Residents and visitors alike enjoy the natural values of a healthy coastal zone.

Council manages beach access ways, lookouts, surf clubs, boat ramps, shared paths, parks and public amenities, natural areas, walking tracks, roads, water, storm water and sewerage infrastructure along the open coast. These assets and services support the community's enjoyment of the coast.

Integrated and sustainable management of the coastal zone is a high priority for Council and is linked to our key strategies for the Shoalhaven community. A Coastal Zone Management Plan that is adopted by Council, and certified by the Minister for the Environment, will provide a legal framework for future land use decisions along the open coast.

Council services and programs which are informed by plans for the coastal zone include:

- Land use planning through the Shoalhaven Local Environmental Plan 2014 (SLEP) and Shoalhaven Development Control Plan 2014 (SDCP)
- The Integrated Strategic Plan (ISP), including the Community Strategic Plan (CSP), Delivery Program and Operational Plan (DPOP) and Council's financials
- Asset management
- Water and sewerage services
- Biodiversity protection and invasive species control
- Recreation planning and community development
- Tourism and economic development.

Council's objectives and work programs in the coastal zone are influenced by and interact with state legislation, policies and plans. The Coastal Zone Management Plan has been prepared in accordance with the *Coastal Protection Act, 1979*, its associated Guidelines for Preparing Coastal Zone Management Plans (Office of Environment & Heritage (OEH), 2013), and other relevant NSW legislation. Figure 1.2 shows how the Coastal Zone Management Plan for the Shoalhaven coastline fits within the broader legislative and regional planning and Council's management framework.

[1] https://profile.id.com.au/shoalhaven (May 2018)

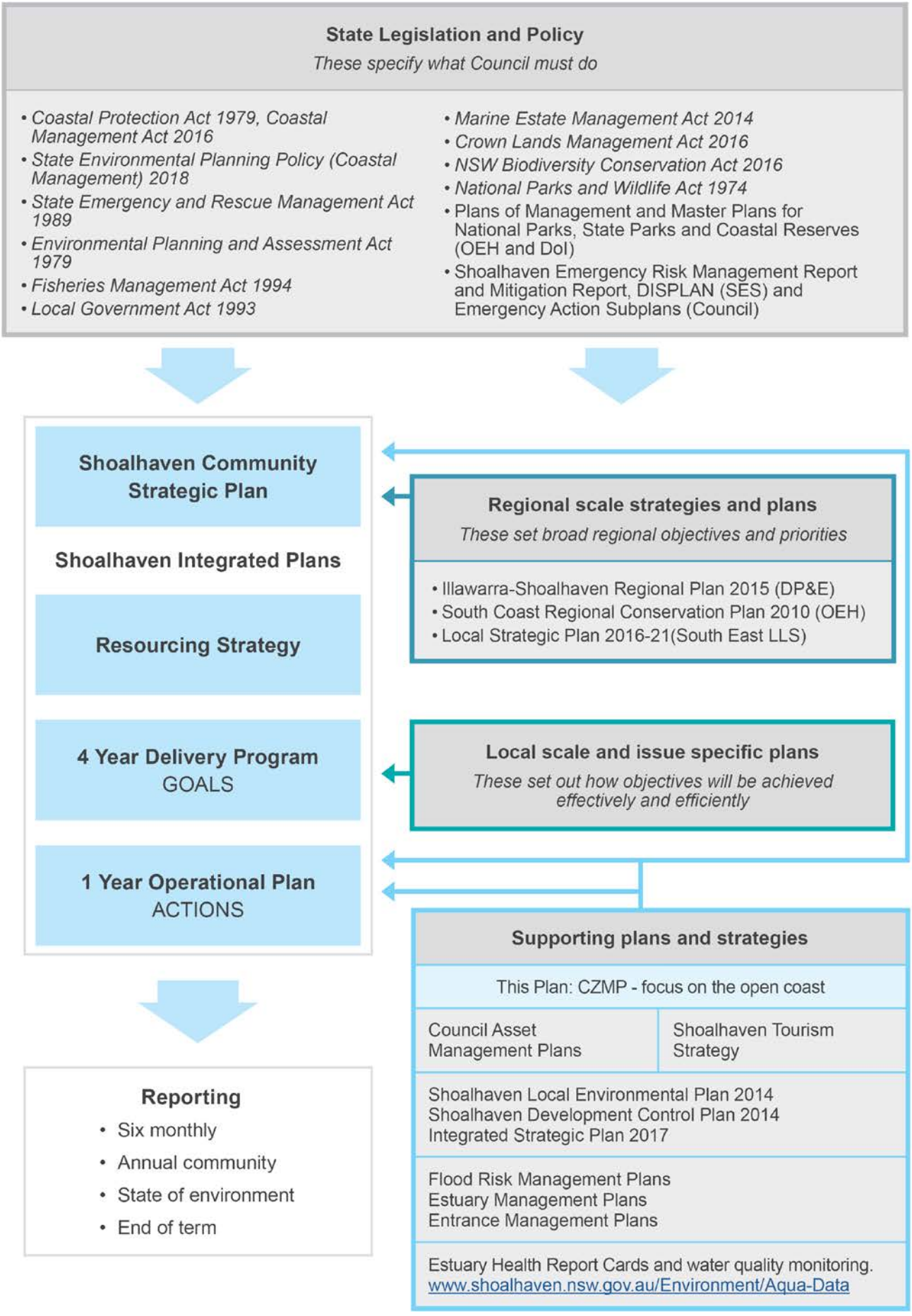


Figure 1.2 – Planning framework for the coastal zone

Council is the lead organisation for several plans which focus on managing risks associated with communities living within dynamic coastal landscapes. These plans include:

- The Coastal Zone Management Plan (this plan) – managing coastal hazards and risks on open coast areas managed by Council
- Estuary Management Plans for estuaries and coastal lakes – integrated management for the estuaries managed by Council
- Entrance Management Plans for intermittently closed and opened lakes and lagoons (ICOLLS) – when and why Council will open a lake entrance
- Flood Risk Management Plans for coastal lakes and rivers – how Council works with communities to avoid or reduce flood risks.

To inform these plans, scientific studies have been prepared by technical specialists. As new information becomes available these plans are reviewed. Council also assesses how well management plans and strategies are meeting objectives. This ongoing review and update enables Council and the community to adapt and plan using the best available knowledge of natural processes and community needs.

1.2 Coastal reforms

Since October 2012, just as the first draft of the Coastal Zone Management Plan was completed, the NSW Government began to introduce Coastal Reforms – Stage 1 and 2. These reforms have resulted in changing legislation which coastal councils must implement. Figure 1.3 over page outlines the chronology of the coastal reforms and Council's responses over the last six years.

2012

May
Draft Shoalhaven CZMP completed.

September
NSW Coastal Reforms Stage 1 announced, including withdrawal of the 2009 NSW sea level rise (SLR) benchmarks which had been used for the development of the coastal hazard lines shown in the draft 2012 CZMP.
Coastal councils were then required to set their own SLR benchmarks.
Certification of CZMPs was deferred until completion of the Stage 2 reform process.

2014

October
South Coast Regional Sea Level Rise Policy and Planning Framework Study completed in conjunction with Eurobodalla Shire Council, with support and funding from OEH.

November
NSW Coastal Reforms Stage 2 announced.

2015

February
SCC voted to adopt SLR projections of:
100mm – 2030, 230mm – 2050, 360mm – 2100
This policy will be reviewed at least every 7 years.

2016

March – July
Our Coast Our Lifestyle Community education and engagement project about management of coastal erosion.

August
Shoalhaven Coastal Hazard Mapping Review completed using SCC's SLR projections and other new data.

2017

June
Council resolved to adopt the Coastal Hazard Mapping Review and submit it with the 2012 CZMP seeking certification from the NSW Government. Certification was unsuccessful.

November
Council resolved to update the CZMP based on detailed feedback provided by DoI and OEH to secure eligibility under the NSW Coastal and Estuary Grant program whilst transitioning to a Coastal Management Program (CMP).
Concurrently, preparation of the new CMP began, with the development of a Scoping Study.

2018

Work continues on reviewing the CZMP in preparation for submission to the NSW Government.
Work also continues on the development of the new CMP.

3 April
Commencement of the Coastal Management Act 2016.

June
Following public exhibition of the CZMP 2018, it was adopted by Council and forwarded to the NSW Minister for the Environment on June 29.

Figure 1.3 – NSW Coastal Reforms and Shoalhaven City's response 2012 to 2018

1.3 Shoalhaven's future coast

To achieve this vision, Council has set the following broad aims:

- Identify and manage coastal hazard and risk
- Protect the natural environment, coastal biodiversity and Aboriginal cultural heritage
- Enhance community access and appropriate recreational facilities
- Efficiently and effectively manage the coastal zone
- Enhance the social and economic wellbeing of coastal communities.

1.4 About this plan

Council's Coastal Zone Management Plan focuses on how Council will manage coastal risks in partnership with local communities and government stakeholders. The Plan has been prepared in accordance with:

- The requirements of Part 4A of the former Coastal Protection Act 1979 and the objectives of the former NSW Coastal Policy;
- Requirements of the NSW Guidelines for the Preparation of Coastal Zone Management Plans (2013);
- Requirements of Council under the Local Government Act 1993 (such as a Shoalhaven Community Strategic Plan) and the liability provisions of Section 733 of the Act.

1.4.1 Purpose, scope and process

Coastal risks emerge from the impacts of coastal processes such as waves, currents, tides and strong winds. At times, these create hazards such as storm bite erosion of beaches and dunes, medium to long-term recession of some beaches and slope instability on cliffs and bluffs.

Coastal risk areas are those impacted by coastal hazards now or projected to be impacted by coastal hazards in the foreseeable future. When assessing coastal risks, a plan must also consider the impacts of projected climate change and sea level rise for the period to 2100. Higher risks occur when an impact is more likely and when the land which will be impacted contains assets of higher value.

This plan focuses on two sets of coastal hazards:

- Beach erosion, wave runup and long-term recession
- Coastal cliff and slope instability.

High-risk areas in Shoalhaven were first identified in the 2004 Coastline Risk Management Report. All beaches managed by Council were risk assessed 'for the 1% event (100 year ARI) occurring today and at the end of 50 year and 100 year planning periods'. Based on this criterion, 10 beaches were prioritised as being at greater risk of coastal erosion and requiring the preparation of coastal hazard studies:

- Shoalhaven Heads
- Culburra Beach
- Warrain Beach
- Currarong Beach
- Callala Beach
- Collingwood Beach
- Narrawallee Beach
- Mollymook Beach
- Collers Beach
- Boat Harbour, Bendalong (included after the 2016 east coast low (ECL) event)

The coastal cliff and slope instability locations prioritised as being a greater risk were identified in 2008, 2011, 2012 and 2018[2]:

- Penguin Head
- Plantation Point
- Hyams Point
- Berrara Point
- Inyadda Point, Manyana
- Narrawallee
- Bannisters Point
- Collers Beach Headland
- Rennies Beach
- Racecourse Beach.

[2] Coastal Slope Instability Hazard Study (SMEC, 2008), Shoalhaven Public Asset Coastal Risk Management Review (Review (BMT WBM 2012), Peer Review, Supplementary Geotechnical Observations (of the Coastal Slope Instability Hazard Study 2008) (Douglas Partners 2011), Report on Scoping Study and Stability Assessment (Various Lots Surfers Avenue, Tallwood Avenue and Bannister Head Road, Narrawallee) (Douglas Partners 2011), Shoalhaven Coastal Cliffs and Slopes Risk Management Program (Royal Haskoning DHC, 2018).

The risk areas identified above have been included in the Shoalhaven Local Environmental Plan and Shoalhaven Development Control Plan for many years.

Review of the 2004 Coastline Risk Management Report is identified as a priority action in the Coastal Zone Management Plan. With so much new information now being available about coastal hazards in a changing climate, it's very likely that the list of high-risk beaches requiring coastal hazard assessment will increase.

In addition to managing risk, the Coastal Zone Management Plan provides strategic direction about important natural and community values, such as:

- The ecological health of beaches, coastal dunes and headlands
- The social health of coastal communities
- Appropriate locations and facilities to support and encourage community use of the coast.

The other important purpose of this plan is to maintain eligibility for NSW Government funding. Without a certified Coastal Zone Management Plan, coastal councils are not eligible to apply to the Coastal and Estuary Grants Program, for implementing works. This is the program that Council uses to seek financial support for coastal and estuary works.

Figure 1.4 shows the steps in preparing a Coastal Zone Management Plan.

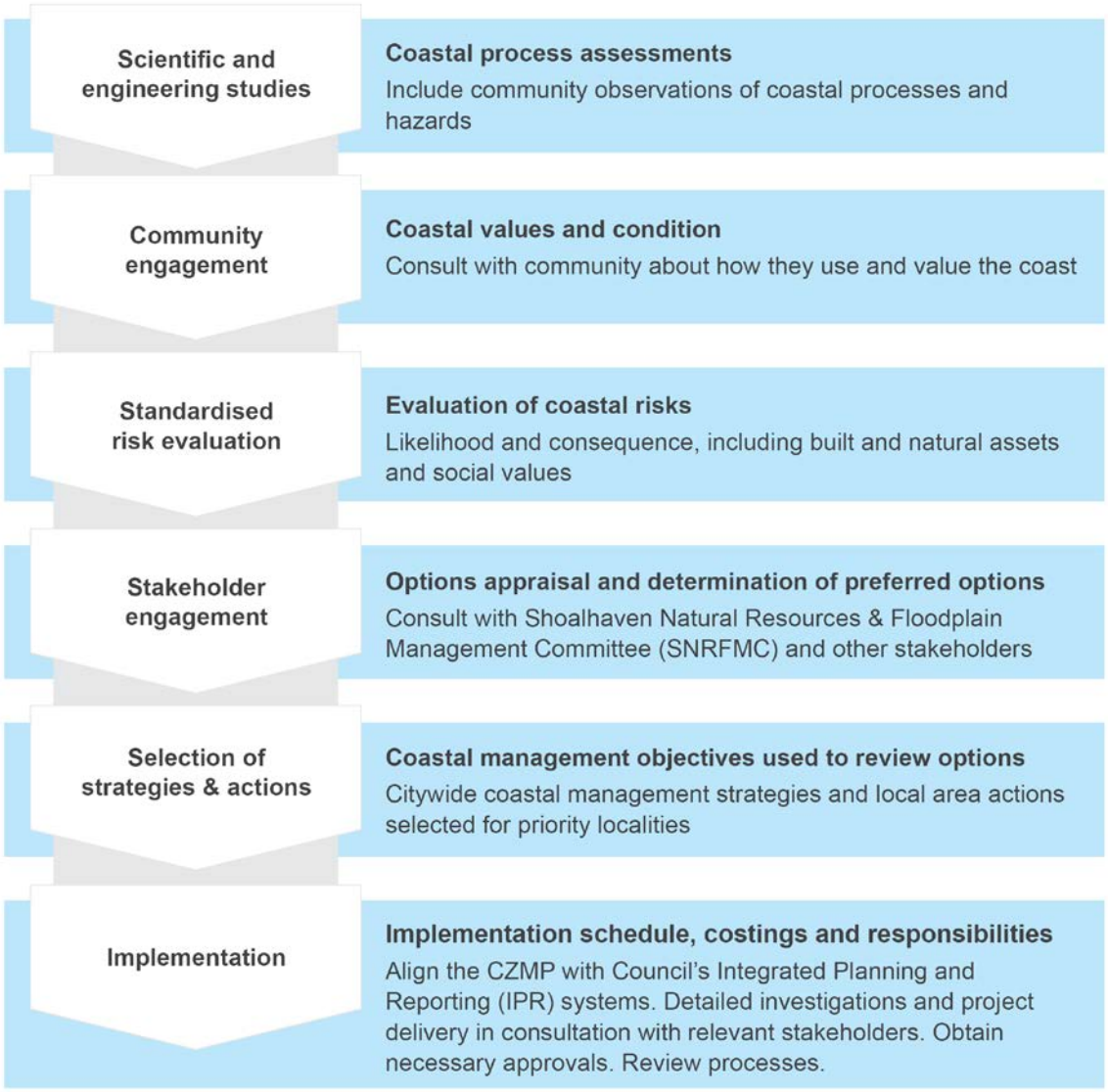


Figure 1.4 – Steps in preparing a Coastal Zone Management Plan

Concurrently with this 2018 Coastal Zone Management Plan, Council is preparing to transition to a new Coastal Management Program (CMP). The 2018 Coastal Zone Management Plan will provide the basis for the Coastal Management Program and any outstanding or ongoing Coastal Zone Management Plan actions will be transitioned into the new document.

1.4.2 Coastal management principles and objectives

The objectives of this Plan are to:

- Give effect to all relevant NSW legislation and policy, as applied to the coastal zone, in the Shoalhaven context
- Manage all coastal systems in an integrated manner that recognises the links between catchment, lake, estuary and open coast processes
- Align the Coastal Zone Management Plan with Council's estuary management plans, Local Environment Plan 2014, Development Control Plan 2014 and Integrated Strategic Plan
- Engage with the community in the review and preparation of coastal management programs
- Keep the community informed about coastal processes and management responses
- Manage the coastal zone adaptively, with a clear process for modifying management approaches as new knowledge becomes available
- Invest in effective and efficient strategies to achieve positive natural, social, cultural and economic outcomes within Council's responsibilities
- Take coastal hazards into account in Council's land use planning
- Maintain natural systems and processes to improve the health and diversity of natural systems
- Support the social and economic wellbeing of local communities by maintaining safe access to beaches and headlands and supporting recreational activities.

The relationship between principles and objectives

Council has adopted the 10 coastal zone management principles set out in the *NSW Guidelines for Preparing Coastal Zone Management Plans (DECCW, 2013)*. The principles are set out below in Table 1.1, together with Council's objectives for the Coastal Zone Management Plan.

Table 1-1 – Applying Coastal Zone Management Principles

Coastal Zone Management Principles (DECCW, 2013)	**Coastal Zone Management Plan Objectives**
1. Consider the objects of the *Coastal Protection Act 1979* and the goals, objectives and principles of the NSW Coastal Policy 1997 and the NSW Sea Level Policy Statement 2009.	1. Give effect to all relevant NSW legislation and policy, as applied in the Shoalhaven context.
2. Optimise the links between plans relating to the management of the coastal zone.	2. Manage all coastal systems in an integrated manner that recognises the links between catchment, lake, estuary and open coast processes. Align the CZMP with Council's Estuary Management Plans, Local Environment Plan 2014 and Council's Integrated Strategic Plan.
3. Involve the community in decision making and make coastal information publicly available.	3. Engage with the community in the review and preparation of coastal management programs.

Coastal Zone Management Principles (DECCW, 2013)	Coastal Zone Management Plan Objectives
	Keep the community informed about coastal processes and management responses.
4. Base decisions on the best available information and reasonable practice; acknowledge the interrelationships between catchment, estuarine and coastal processes; adopt a continuous improvement approach.	4. Manage the coastal zone adaptively, with a clear process for modifying management approaches as new knowledge becomes available.
5. Prioritise public benefit in expenditure to cost effectively achieve the best practical long-term outcomes.	5. Invest in effective and efficient strategies to achieve positive natural, social, cultural and economic outcomes within Council's responsibilities.
6. Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risks where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long term options are implemented.	6. Take coastal hazards into account in Council's land use planning.
7. Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions.	7. Refer to objectives 4, 5 and 6
8. Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems.	8. Maintain natural systems and processes to maintain or improve the health and diversity of natural systems.
9. Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy.	9. and 10. Support the social and economic wellbeing of local communities by maintaining safe access to beaches and headlands and supporting recreational activities.
10. Support recreational activities consistent with the goals of the NSW Coastal Policy.	

1.5 Council's strategic approach to coastal zone management

The Coastal Zone Management Plan has four main focus areas, as illustrated in Figure 1.5. These focus areas are contained within, and interact with, an adaptive management framework. Adaptive management is a process for managing uncertainty, incomplete data and changing coastal systems to improve and refine management responses over time.

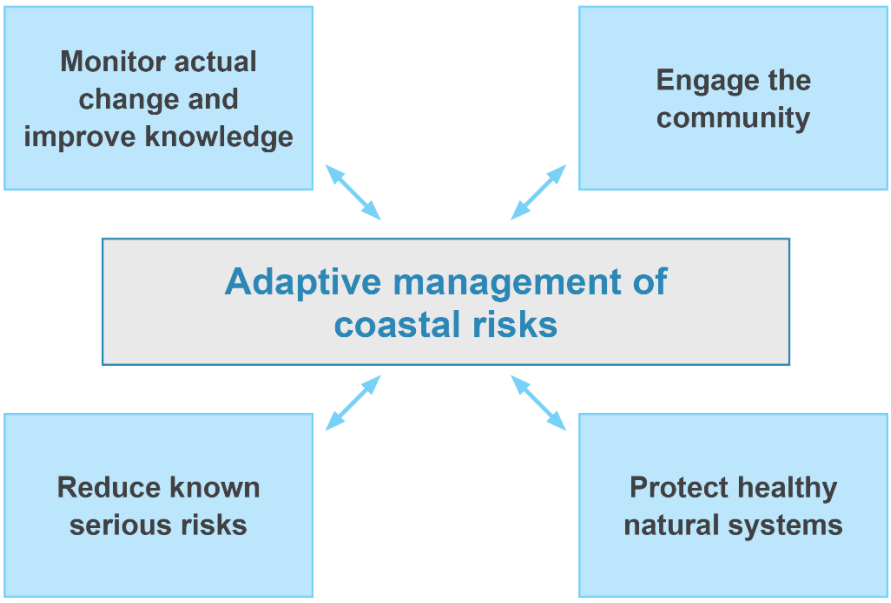


Figure 1.5 – Framework for adaptive management of coastal risks and four focus areas

1.5.1 Reduce known serious risks

The Plan uses five management approaches to reduce known serious risks, as shown in Table 1.2. More details are contained in Section 2.

Table 1-2 – Risk Management Approaches

Risk management approach	Measures and/or actions	Options Avoid, accommodate or accept (option may change as triggers are met)
Avoid risk	Planning controls and asset replacement plans for existing and future development, including homes and infrastructure.	Long term **managed retreat to avoid** risk or retreat from risk.
Change the likelihood	Beach and dune nourishment, revegetation and biodiversity programs; coastal protection works.	**Accommodate change** by building community capacity and understanding. Undertake protection and stability works to improve adaptability.
Change the consequence	Community awareness, building and infrastructure design; access management.	
Share the risk	Insurance measures and funding options for affected landowners.	**Accept risk** and manage costs – explain who pays and how.
Informed risk retention	Emergency action in the short term.	**Accept risk** and respond when events occur.

1.5.2 Engage the community

Effective coastal zone management depends on an informed and engaged community. Council will work with the community to:

- Build broad community knowledge of coastal processes and risks
- Create opportunities for local communities to be involved in protecting important values
- Provide facilities for appropriate use and enjoyment
- Monitor and report coastal change.

1.5.3 Protect healthy natural systems

A natural coastal landscape with high biodiversity is a highly valued and important feature of the Shoalhaven coastal zone. These healthy coastal ecosystems support valuable social and economic services for the community.

The Coastal Zone Management Plan supports ongoing Council and community effort to protect and enhance ecological communities on beaches, coastal dunes and headlands, reinforcing the resilience of the coastal landscape to changes in the intensity of coastal processes. Key actions include bush regeneration programs and managing access onto beaches. Council will continue to support Bushcare groups and the National Parks and Wildlife Shorebird Recovery Program.

1.5.4 Monitor change and improve knowledge

Council will work with the NSW Government, local communities, coastal experts and university researchers to build knowledge of coastal processes and to monitor changes to the coastal zone. Coastal zone monitoring has four main purposes:

- Track implementation of the Plan
- Determine how beach and dune profiles respond to management actions and to storm patterns and changes in sea level
- Assess the ecological health of dunes in response to management actions and to a changing climate
- Assess the adequacy of coastal access and facilities and community satisfaction with coastal amenity.

1.6 How adaptive management works

An adaptive management cycle has four key considerations as illustrated in Figure 1.6 over page. Managers track progress against expectations and evaluate effective responses to determine if community and environmental objectives have been met.

Council will continue to monitor the condition of the coast and shoreline responses to major storm or extreme water level events. This will ensure that Council and local communities have the best available knowledge to evaluate, review and adapt management actions.

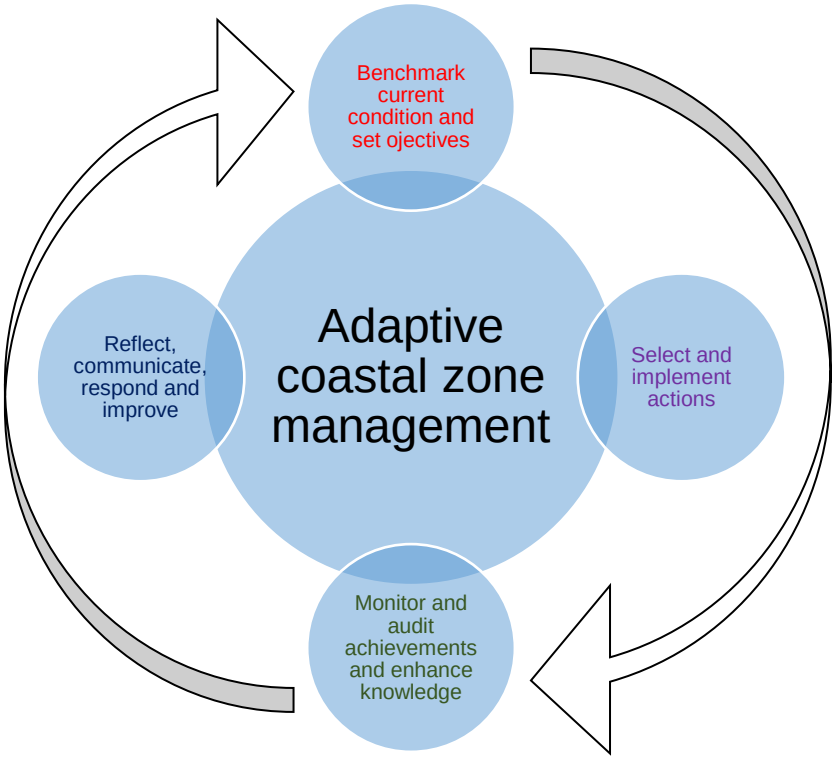


Figure 1.6 – Key considerations for adaptive coastal zone management

1.7 Timeframes for action

Prioritisation tables in Section 4 group all actions into either two year, three to five year or more than five year time frames. The Coastal Zone Management Plan will be superseded when the Shoalhaven Coastal Management Program is completed. At that time, actions will be incorporated into this new Program. Council envisages that the Coastal Zone Management Plan will remain in place for five years while the Coastal Management Program is being developed and certified.

1.7.1 Delivering actions

The strategies and actions set out in the Coastal Zone Management Plan are mainly the responsibility of Council. Many sections of Council cooperate to achieve the objectives of the Plan. Council will work closely with local communities along the coast to implement the Plan.

Council will also work closely with the NSW OEH, NSW Department of Industry (Crown Lands & Water), NSW Department of Primary Industries (Fisheries) and other agencies to ensure a consistent approach to:

- Coastal risks
- Decisions about coastal access
- Protection of important coastal ecosystem functions.

The Coastal Zone Management Plan does not duplicate existing management actions in plans made by these partners. It does make strategic recommendations to coastal management partners to help them deliver a coordinated, integrated, informed and adaptive management approach for the Shoalhaven coast.

As much as possible, the Coastal Zone Management Plan aligns with plans of management for Crown reserves, Council reserves, national parks and NSW marine parks. The Coastal Zone Management Plan also respects Aboriginal and European cultural heritage on the coast, recognising the need to ensure all

relevant approvals, permits and licences are obtained for any works resulting from the implementation of this document. The Coastal Zone Management Plan has informed the current Shoalhaven Local Environmental Plan and Shoalhaven Development Control Plan 2014, ensuring that coastal erosion risks are considered in Shoalhaven land use planning into the future.

1.8 Paying for coastal zone management

Council has the statutory role in land use planning and in carrying out works to reduce serious coastal risks to community assets and infrastructure. Council owns and/or manages coastal land on behalf of the Crown and local communities. Council works in partnership with community organisations to manage coastal vegetation, protect sensitive coastal ecosystems and provide safe and attractive beach access facilities for residents and visitors. These responsibilities incur significant costs.

Council prepares budget estimates for all proposed actions. The estimates are considered within Council's internal budget planning cycles. However, as Council has limited resources, we need to draw on funds available from other sources to implement the Coastal Zone Management Plan.

1.8.1 Funding options

There are several ways Council can provide human and financial resources to implement the Plan. We are already addressing many issues using existing staff. We are also considering:

- Fostering partnerships with landholders and community-based organisations along the coast and with key NSW agencies such as OEH, Department of Industry – Crown Lands and Water and Department of Primary Industries Fisheries to promote research and on ground works programs relevant to Council's coastal issues and priorities.
- Reviewing and reallocating priorities in delivery and operation plans so that more resources are allocated to coastal zone management
- Applying for the grant funding
- Involving the community in dune vegetation rehabilitation and dune monitoring.
- Developing partnerships with private sector businesses for some coastal management works, to foster ecological resilience and manage assets.

Relevant and possible funding opportunities include:

- NSW Government Coastal and Estuary Grant Program
- NSW Government Coastal Lands Protection Scheme
- Other State or Federal Government Grants (especially climate change adaptation and resilience building funds)
- NSW Environmental Trust
- DPI Fisheries Habitat Action Grants
- Public Reserves Management Fund Program
- New Council levies or increased land rates
- Private financial institutions (e.g. banks)

The NSW Government may provide assistance to Council; however this will be subject to grant funding availability and prioritisation on a statewide basis.

In the longer term, all landholders could contribute in some way to the costs of managing community infrastructure in coastal hazard zones. This will help maintain both ecosystem and infrastructure services. The following options, for future investigation by Council, emerged in the Our Coast Our Lifestyle community engagement project:

- Implement a special levy on affected coastal landholders, to cover the costs of maintaining beach protection, amenity and access
- Implement a citywide levy (similar to the existing storm water levy or environment levies that other Councils have implemented) to provide additional capital funds to relocate or protect community assets and infrastructure
- Require all private landholders directly impacted by coastal hazards to pay for any coastal protection works from which they benefit, including maintenance of existing protection works
- Maintain Council's Coastal Management and Infrastructure Reserve into which Council allocates funding each year with the aim of building a financial reserve to fund emergency responses to coastal storm events and implement strategic coastal management actions.

1.9 Compliance with statutory requirements

The Coastal Zone Management Plan is prepared in accordance with the statutory requirements set out in the *NSW Guidelines for the Preparation of Coastal Zone Management Plans (DECCW, 2013)* and the previous *Coastal Protection Act 1979* (amongst other key pieces of legislation, policies and guidelines). The following table is a general guide to where the relevant information, relating to the key requirements of the guidelines and Coastal Protection Act, is located in the Plan.

When the new Coastal Management Program is prepared over the coming years, it will be prepared in accordance with the *Coastal Management Act 2016.* Guidelines to help coastal councils prepare Coastal Management Programs have been developed by the State Government.

Table 1.3 – Key Requirements from the Guidelines for Preparing Coastal Zone Management Plan (DECCW 2013)

Requirements from the Guidelines for Preparing Coastal Zone Management Plan (DECCW 2013)		**Where within this report?**	**How this relates to the CPA 1979?**
The CZMP must contain a description of:	How the relevant Coastal Management Principles have been considered in preparing the Plan.	Section 1 presents the Coastal Management Principles and the project objectives that have been developed to ensure each principle is addressed.	55D (1) - Draft Plan in accordance with the Ministers guidelines.
	The community and stakeholder consultation process, the key issues raised and how they have been considered.	The consultation and engagement processes are noted in Section 2.2. Council has consulted with the community about coastal management issues over a period of 6 years, including provision of web-based information, community meetings, briefings in multiple locations and a previous exhibition of the draft Plan.	55E and F- Public consultation and consideration of submissions has been undertaken.
	How the proposed management options were identified, the process followed to evaluate the management options, and the outcomes of the process.	Section 2 shows how hazards and risks were identified. Section 3 notes how options were identified following on from the hazard studies risk assessments. Council commissioned the separate *Shoalhaven Coastal Zone Management Plan - Risk Assessment* (Advisian, 2018) to analyse risks and propose appropriate risk mitigation strategies. This document updated the	55C(1) d, e, f Management of hazards and risks has been addressed.

Requirements from the Guidelines for Preparing Coastal Zone Management Plan (DECCW 2013)		Where within this report?	How this relates to the CPA 1979?
		previous study (BWT WBM, 2011) to account for the updated hazard mapping based on new data and Council's updated sea level rise projections.	
The CZMP must contain proposed management actions over the CZMP's implementation period in a prioritised implementation schedule which contains:	Proposed funding arrangements for all actions, including any private sector funding.	Section 1.8 and Section 4 looks at funding options and monetary responsibilities.	55C (1) g - funding responsibilities for works
	Actions to be implemented through other statutory plans and processes.	Sections 3 and 4 note each of the actions, the lead agency responsible and whether changes to statutory plans, zoning or policies will be required.	55D (1) - preparing a draft Plan in accordance with the Ministers guidelines
	Actions to be carried out by a Public Authority or relating to land or other assets it owns or manages, where the Authority has agreed to these actions.	Sections 3 and 4 note each time Council needs to consult or liaise with public authorities to obtain relevant approvals, permits and/ or licenses to enable CZMP actions to be completed. Sections 3 and 4 do not list any public authorities as being responsible for implementing the actions.	Section 55C (2) b
	Proposed actions which monitor and report to the community on the plan's implementation, plus a review timetable.	Section 3.2 proposes methods of adaptive management and methods to communicate monitoring results.	55D (1) - Draft Plan in accordance with the Ministers guidelines.
The CZMP must be prepared using a process that includes: **CZMPs are to achieve a reasonable balance between any potentially conflicting uses within the coastal zone.**	Evaluating potential management options by considering social, economic and environmental factors, to identify realistic and affordable actions.	Actions are included under key strategic themes and presented in Sections 3 and 4. A detailed evaluation of a wide range of potential management options is included in the 2009 draft of the CZMP and is not repeated in this document.	55D (1) - Draft Plan in accordance with the Minister's guidelines.
	Consulting with the local community and other relevant stakeholders. The minimum consultation requirement is to publicly exhibit a draft plan for not less than 21 days, with notice of the exhibition arrangements included in a local newspaper.	The exhibition period of the CZMP will be at least the 21 days required. Submissions made during the exhibition will be reviewed and any necessary amendments made to the final draft of the CZMP before reporting it to Council for adoption.	55E (a)(b) - Public consultation of the draft Plan will comply with these requirements.
	Considering all submissions made during the consultation period. The draft plan may be amended as a result of these submissions.	Initial comments from stakeholders have been considered and addressed during the Plan update process. After the Plan goes on public exhibition any further submissions will be considered and incorporated where necessary.	55F (1)(2)(3) – Consideration of submissions will comply with these requirements.
CZMPs are to achieve a reasonable balance between any potentially conflicting uses within the coastal zone.			55F (1)(2)(3) – submissions.

2. Key Considerations

2.1 Coastal processes, hazards, risks and issues

Detailed studies of coastal processes, hazards and risks over several years have built up an understanding of the issues requiring a priority response for the sustainable management of the Shoalhaven coast. The following sections of this Plan provide more information about the coastal science and technical studies.

2.1.1 Coastal processes

The coastal landscape is dynamic. It is continually changing in response to the coastal processes. These include waves, currents, tides, winds, rainfall and long-term water levels which shape coastal landforms and the coastal landscape. These natural processes change the coast by causing beach and dune erosion, dune instability, coastal recession, flooding due to waves, movement of creek entrances, and slumping or rock fall on cliffs and bluffs. Highly variable, these coastal processes can change daily. They also change periodically with natural cycles, all of which interact with each other. Examples include:

- Monthly tidal cycles from high water springs to neap tides
- Seasonal variations in storm patterns, which affect wave energy, wave direction and rainfall
- Southern oscillation index cycles of about 7 to 10 years, which affect droughts, floods, beach orientation and lake entrance processes
- Century or longer-scale variations in climate.

Within the Shoalhaven, the beach is often perceived to be the sandy area between the waterline and the dunes. It includes the beach berm, incipient foredune formations and hind dunes. On an open coast, the overall beach system typically extends for several kilometres offshore, in water depths of around 20 metres, to the back beach dune or barrier region. It may extend up to several hundred metres inland. When examining the coastal processes of a beach system, such as those in the Shoalhaven, it is often necessary to consider this wider definition.

The hydrodynamic forces controlling the rate of these processes and hazards comprise the prevailing wave climate and water levels.

Short-term coastal erosion

Storm cut

The beach is made up of unconsolidated sands that can be mobilised under certain meteorological conditions. The dynamic nature of beaches is often witnessed during storms when waves remove the sand from the beach face and the beach berm and transport it, by a combination of longshore and rip currents, beyond the breaker zone where it is deposited in the deeper waters as sand bars. During severe storms, with long durations of severe wave conditions, the erosion continues into the frontal dune, which is attacked. A steep erosion escarpment is formed. This erosion usually takes several days to a few weeks.

In general, the beaches within Jervis Bay are more sheltered than the open coast beaches. Wave transformation modelling undertaken by SMEC (2006), and validated against physical model tests, showed that the refracted wave heights into Jervis Bay near Callala Beach were approximately half of those experienced along the open coast. While the Jervis Bay beaches are generally more sheltered, wave height is not the only factor that determines how much storm erosion would occur as a result of a particular storm.

The amount of sand eroded from the beach during a severe storm will depend on many factors including the state of the beach when the storm begins, the storm intensity (wave height, period and duration), direction of wave approach, the tide levels during the storm, and the occurrence of rips. Storm cut is the volume of beach sand that can be eroded from the subaerial (visible) part of the beach and dunes during a design storm. It has generally been defined as the volume of eroded sand as measured above mean sea level (~ 0 m AHD datum). For a particular beach, the storm cut (or storm erosion demand) may be quantified empirically with data obtained from photogrammetric surveys. Alternatively, it may be quantified analytically using a verified numerical model.

In the coastal processes studies prepared for this Plan, short-term erosion for each beach was estimated on the basis of photogrammetric data and interpreted based on the occurrence of particular storm events. For many of the beaches, the measured storm erosion demand has been interpreted to have occurred as a result of the May to June 1974 storms as shown in the table below (Advisian 2016). While the measured storm erosion demand from this storm was generally higher at the open coast beaches than the sheltered beaches, there is a significant variation based on the following factors:

- Measured storm erosion demand at some beaches was recorded adjacent to rip-heads, for example at Callala Beach, which in a storm may occur at random locations along the beach.
- The southerly approach direction of the 1974 storm meant that areas that were sheltered to the south by headlands or reefs, even those on the open coast, will have recorded lower storm erosion demands than those most exposed toward the south.
- At some of the beaches, limited supply of sand to feed the storm erosion demand is available, due to the presence of bedrock below the beach or coastal protection structures.

Table 1.4 – Beach Short Term Erosion (Storm Cut) Advisian Appendix 1 (2016)

Beach	**Short term erosion (storm cut)** *Includes creek/river/lake entrance instability where relevant
Shoalhaven Heads	*350 m^3
Culburra Beach	100 m^3 /m (south) 160 m^3 /m (central) 280 m^3 /m (north)
Warrain Beach	220 m^3 /m (north of lake entrance) *400 m^3 /m (at lake entrance)
Currarong Beach	60 m^3 /m
Callala Beach	120 m^3 /m (north & south) 180 m^3 /m (central)
Collingwood Beach	100 m^3 /m (south) 120 m^3 /m (central-north)
Narrawallee Beach	110 m^3 /m
Mollymook Beach	100 m3 /m (north) 170 m3 /m (north of nourished dune) *130 m3 /m (north of Blackwater Creek, behind nourished dune) *230 m3 /m (immediately south of Blackwater Creek entrance) 150 m3 /m (Surf Club) 90 m3 /m (south – Golf Club)
Collers Beach	105 m^3 /m

Slope instability

In Shoalhaven slope instability, on coastal cliffs and slopes, can affect assets at 10 locations (1.4.1).

Dune slumping is also treated as a slope instability hazard. Following storm cut the dune face dries out and may slump. This is due to the dune sediments losing their apparent cohesive properties that come from the negative pore pressures induced by the water in the soil mass. This subsequent slumping of the dune face causes further dune recession.

Dune slumping can be quantified with stability computations, which can serve as a guide to determining safe setback distances on frontal dunes that are prone to wave attack and slumping during storms.

Behaviour of creek and estuary entrances

Various coastal hazards can be created by both trained and natural estuary entrances. Natural entrances tend to migrate along the beach in response to freshwater flooding and coastal storm effects (NSW Government, 1990). This phenomenon has been seen at some beaches in Shoalhaven, including Mollymook, where Blackwater Creek and Mollymoke Farm Creek entrances had migrated north in some storms, threatening both public and private assets. Training walls have been constructed on the northern side of both creeks to mitigate these threats.

A major storm event can also cause entrance break through at unexpected locations. This leads to destruction of dunes that have formed near creek entrances and renders any assets behind the dunes vulnerable to future storms. At Currambene Creek (southern end of Callala Beach) a training wall was constructed to reduce the risk of creek breakout at Myola.

Longer term beach changes and shoreline recession

Following storms, ocean swell replaces the sand from the offshore bars onto the beach face where onshore winds move it back onto the frontal dune. Typically, the beach building phase, spans many months to several years. Following the build-up of the beach berm and the incipient fore dunes, and the re-growth of the sand-trapping grasses, the beach can appear fully recovered. Beach erosion is offset by beach building.

However, in some instances, not all of the sand removed from the berm and dunes is replaced during the beach building phase. Sand can be lost to sinks, resulting in longer term ongoing recession of the shoreline. Over decadal time scales, changes in wave climate can also result in beach rotation.

Currently in Shoalhaven, recession is not a major issue; however, the following beaches have been identified as experiencing shoreline recession (Advisian 2016)

- Currarong: 0.10 – 0.29 m/y
- Culburra: 0.025 m/y (south-central), zero (north)
- Callala: 0.1 – 0.15 m/y (central-north), zero (south)

All other high-risk beaches have been assessed as having a zero long term recession rate for the whole beach (Advisian 2016).

Sediment budget deficit

Once the sand has been transported offshore into the surf zone, it may be moved alongshore under the action of the waves and currents and out of the beach compartment. Some of the sand that is transported directly offshore during storms may become trapped in offshore reefs, thereby preventing its return to the beach. Other direct losses of material from the beach may include the inland transport of sand under the action of onshore winds (known as aeolian sand transport). Over the longer term, if the amount of sand taken out of the compartment by alongshore processes exceeds that moved into the compartment from

adjacent beaches or other sources, there will be a direct and permanent loss of material from the beach. There will also be a deficit in the sediment budget for the beach. This will result in an increasing potential for dune erosion during storms and long-term beach recession.

Obvious processes that may lead to a deficit in the sediment budget of a beach include sand blown off the beach by wind (aeolian sand transport causing transgressive dune migration), mining the beach for heavy minerals and beach sand extraction operations. Other processes, which are not so obvious because they occur under water, include the deposition of littoral drift into estuaries and the transport of quantities of littoral drift alongshore and out of a beach compartment, which may be larger than any inputs.

The NSW coastline can be subdivided into a series of sediment compartments, which are subdivisions of the coast separated by major obstacles such as headlands, which stop longshore transport of sediment. Council must consider the natural processes of the coast managing the coastline. The use of coastal sediment compartments as 'natural' management units must be incorporated into coastal management and coastal zone management plans. The coastal sediment compartment approach identifies local government areas that share the same compartment. This requires consultation between adjoining local councils in developing coastal management plans. Shoalhaven City Council shares the Shoalhaven sediment compartment (encompassing Seven Mile Beach) with neighbouring Kiama Council to the north.

Carvalho and Woodroffe (2015) have completed a study of the coastal compartments of the eastern coast of NSW. Compartments were delineated based on physical characteristics as well as review and interpretation of hydrologic, geomorphic and sedimentological data. The following primary sediment compartments were identified for the Shoalhaven coast:

A compartment centred on the Shoalhaven River estuary, encompassing Seven Mile Beach at Shoalhaven Heads, Culburra, Warrain and Currarong beaches;

- A compartment centred on Jervis Bay, encompassing Callala and Collingwood beaches;
- A compartment between Bannisters Point and Jervis Bay, encompassing Narrawallee beach;
- A compartment between Warden Head and Bannisters Point, encompassing Ulladulla Harbour, Collers and Mollymook beaches.

These compartments have been further subdivided into secondary and tertiary sediment compartments by the presence of smaller headlands, and based on sediment characteristics and transport. The Shoalhaven coastal compartment is dominated by the Shoalhaven River which is responsible for delivering significant quantities of sediment to the beaches in the compartment. Sand transport to the north is limited by the presence of Black Head; sand transport to the south is blocked by Beecroft Peninsula.

For the Shoalhaven River Estuary compartment, the sediment budget is highly dependent on the dynamics of the Shoalhaven River entrance. The Shoalhaven entrance dynamics have an influence on the sediment budgets at Shoalhaven Heads, Culburra, Warrain and Currarong beaches. Within the Shoalhaven sediment compartment, the following significant components of the sediment budget are identified as sources (Carvalho and Woodroffe, 2015):

- Fluvial sand and mud supply
- Erosion of river flanks (mostly along Berry's canal)
- Sediment supply from rock headland erosion
- Biogenic production

Sink components include:

- Estuarine deposition
- The flood-tidal delta
- The loss of sand from the beach to the barrier system
- Dredging around Pig Island

Areas of exchange of sediments which can act as sources and/or sinks include the beach-shoreface and the shoreface-inner shelf.

The sediment supply from the Shoalhaven River has influenced the morphology of the beaches and has had the greatest impact at Shoalhaven Heads, with the sediment supply reducing toward the south with distance from the estuary entrance.

For the other sediment compartments, sediment exchange can occur between beaches within the same compartment. There is limited sediment exchange between these compartments due to the presence of physical barriers to this transport. With no large estuaries to supply sediment to the southern compartments of the Shoalhaven coastline, the dominant process for the beaches within the other compartments is onshore-offshore sediment transport and sediment exchange between the beach-shoreface and the shoreface-inner continental shelf. At a macro level and over geologic timescales, the onshore-offshore transport sources and sinks are approximately in balance. As a result, the beaches are relatively stable over the long term.

The quantification of sediment budgets for coastal compartments is exceedingly difficult. The budget is calculated over the net quantity of sediments that cross the boundaries of the sector. The methodology, in summary, consists of quantifying the amount of sediment in a sector and calculating the addition (sources) and subtraction (sinks) due to relevant drivers and processes such as: fluvial, biogenic and geologic (dune, terrace, headland erosion) input; longshore, cross-shore and aeolian transport; estuarine sink; and human activities (Thom, 2014).

For the Shoalhaven beaches, measurements of volumetric and morphological changes at the beaches over time have been taken using photogrammetric techniques. The processes leading to those changes have been inferred based on available information. Subtraction or losses of sediment from a compartment can manifest itself on the beach as long-term beach recession, which indicates that the sediment losses from a beach are greater than the gains. For the Shoalhaven coast, long term changes have been evaluated by analysing photogrammetric data from the 1940's to 2014. As the natural fluctuations of a beach and dune are large compared with any underlying long-term trend in beach change, sometimes it can be difficult to quantify an accurate rate of erosion or accretion. Measuring beach recession by mapping the response of the dune erosion escarpment over time is often more accurate.

For the Shoalhaven beaches, the local sediment budgets have been examined by understanding the long-term trends in sediment volumes and beach dune locations over time on a beach-by-beach basis. This provides a localised view of the influences to the local sediment budget, such as loss of sand due to onshore-offshore transport into deep water, losses into and supply from local estuary entrances and losses due to anthropogenic factors such as destabilisation of dunes by destruction of vegetation or urban development of the dunes which can cut off the sediment supply to the beach.

Beach rotation

Studies of embayed beaches on the NSW coast have identified a sensitivity of shoreline alignment to wave direction. This has been linked to the Southern Oscillation Index (SOI). This is a number calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin.

Sustained negative values of the SOI usually are accompanied by sustained warming of the central and eastern tropical Pacific Ocean, a decrease in the strength of the Pacific Trade Winds and a reduction in rainfall over eastern and northern Australia. This is called an El Niño episode. During these episodes, a more benign easterly wave condition is expected on the NSW coast.

Positive values of the SOI are associated with stronger Pacific trade winds and warmer sea temperatures to the north of Australia, popularly known as a La Niña episode. Waters in the central and eastern tropical Pacific Ocean become cooler during this time. Together, these give an increased probability that eastern and northern Australia will be wetter than normal. During these episodes, severe storms may be expected on the Australian eastern seaboard.

Oceanic inundation of low lying areas

An increase in water level at the shoreline results from the breaking action of waves causing what is termed wave set-up and wave run-up. Wave set-up may be perceived as the conversion of part of the wave's kinetic energy into potential energy. The amount of wave set-up will depend on many factors including the type, size and periods of the waves, the nearshore bathymetry and the slope of the beach and foreshore. Typically, wave setup on an open-coast beach during severe storms can be around 1 metre to 2 metres.

The energy of a wave is dissipated finally as the water runs up the beach or shoreline. Wave run-up is the vertical distance the wave will reach above the level of the tide and storm surge, and can be several metres. Wave run-up at any particular site is a function of the wave height and period, the foreshore profile and slope, surface roughness and other shoreline features on which the breaking waves impinge.

If dune levels are low or the foreshore not protected by dunes, the coincidence of elevated ocean water levels and wave run-up can result in flooding and damage to structures. In Shoalhaven this has happened at sections of Culburra, Warrain, Collingwood, Narrawallee and Collers Beaches.

2.1.2 Processes acting at different time scales

The interaction between processes operating at different time scales means there is much uncertainty about exactly what conditions will prevail at specific times in the future. Council's coastal zone management proposals are designed to deal with this uncertainty and to help local communities adapt to change.

Scientific and community understanding of how beaches, dunes, lakes and estuaries respond to coastal processes, climate drivers and land management is improving. Natural system responses include changes to landforms such as beach and dune erosion, creek entrance migration and dune instability. There may also be changes to ecological health, such as water clarity, salinity, chlorophyll and dissolved oxygen, which affect algal blooms, sea grass distribution and fish populations.

2.1.3 Long-term trends in climate and sea level rise

CSIRO's State of the Climate Report (2016) concludes that sea level rose at a global-averaged rate of about 2.6 to 2.9 mm per year between 1993 and 2013 shown in Figure 2.1.

The rates of sea level rise to the north, west and southeast of Australia have been higher than the global average. Globally, sea level has risen over 20cm since the late 19th century (CSIRO, 2016), see Figure 2.2.

The *South Coast Regional Sea Level Rise Planning and Policy Framework (2014)* was prepared by Whitehead & Associates as a joint Shoalhaven City Council-Eurobodalla Shire Council project, supported by the Office of Environment & Heritage (OEH) to provide advice to both councils for selecting regional seal level rise benchmarks. They concluded that 'Sea levels offshore of the study area will rise at a similar

rate to the global average, and that any differences between the study area and Sydney will be minimal'. They also found that 'the highest value of sea level rise projected by AR5 (5th assessment report from IPCC) to 2100 do not differ largely from the information presented in previous IPCC reports, or the previous NSW state government policy.'

The document was prepared as an outcome of the NSW Government withdrawing the 2009 benchmarks (i.e. 0.4 and 0.9m above 1990 mean sea levels by 2050 and 2100) and recommending that individual councils adopt regional projections based on 'competent scientific opinion'.

Changes to the frequency of different types of storms are also predicted but details are poorly understood. On the South Coast, changes to patterns of East Coast lows (ECLs) and the southern extent of tropical cyclones are both possible. ECLs in particular drive major step changes in coastal morphology. ECLs will continue to be informed by The Eastern Seaboard Climate Change Initiative (ESCCI), which is a major research collaboration led by NSW Office of Environment and Heritage (OEH) with partner organisations (established in 2010). The research aims to improve our understanding of past, current and future ECLs and assess how they influence extreme rainfall, coastal processes and water security.[3]

The landforms we now see along the Shoalhaven coast are the result of relatively stable sea level and climatic conditions over the last 6,000 years. Over this period, sea level fluctuations on the east coast have been restricted to about two metres. This is the same order of magnitude as sea level changes that are currently projected for the next century. Coastal erosion and accretion occurred in response to these sea level changes in the past, affecting dune stability, estuary ecology and rock platform ecological communities.

[3] http://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/East-Coast-Lows/Eastern-Seaboard-Climate-Change-Initiative

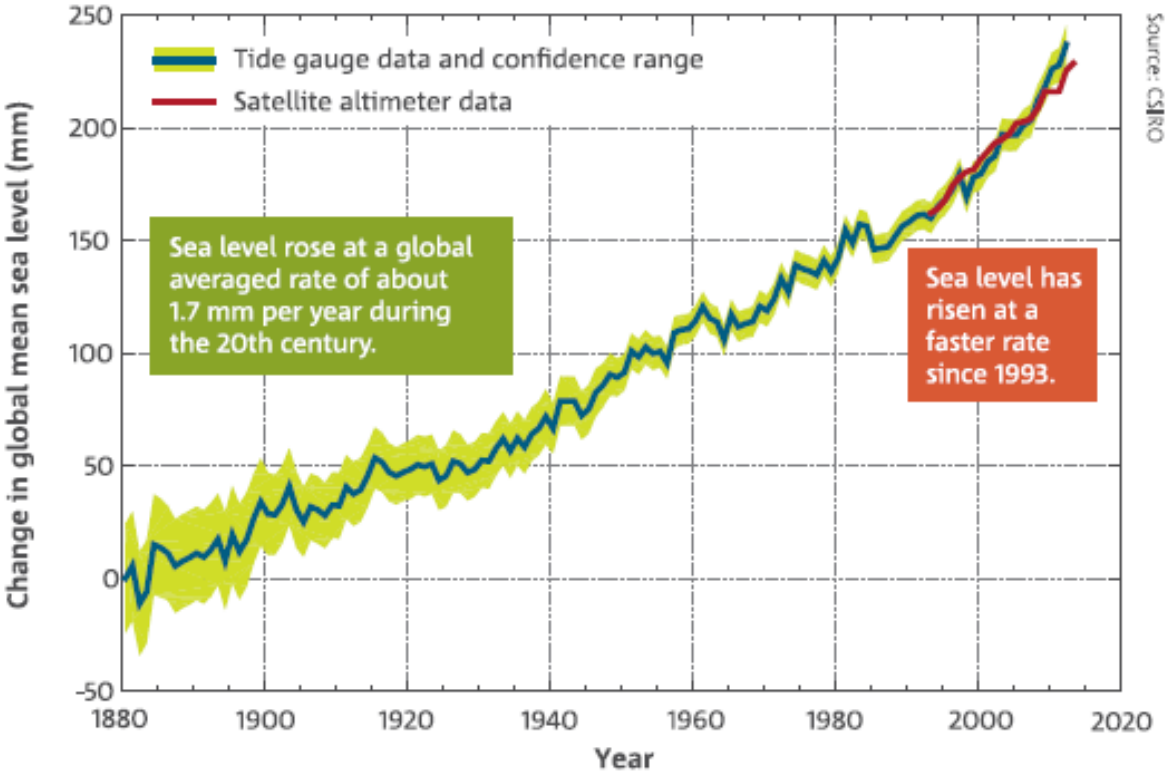


Figure 2-1 – Global average mean sea level (CSIRO, 2016)

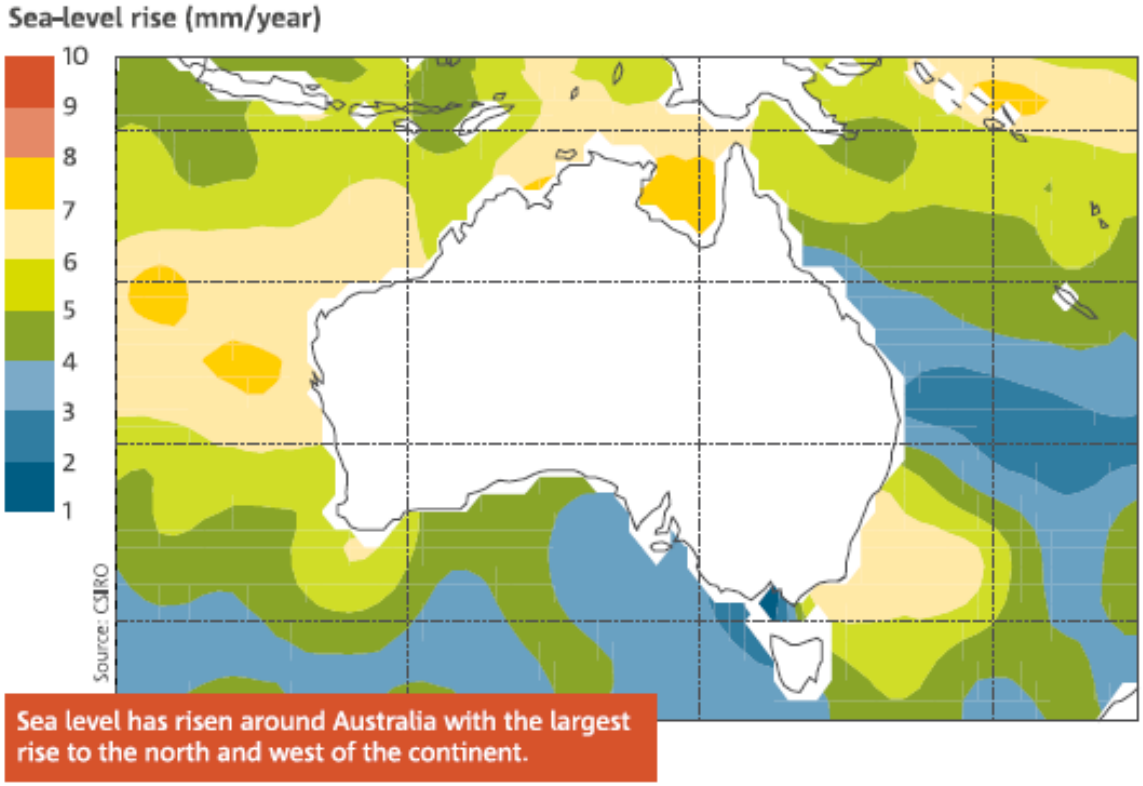


Figure 2-2 – The rate of sea-level rise around Australia from 1993 to 2015 (CSIRO, 2016)

2.1.4 Studies of coastal hazards and risks

In 2009 the *Sea Level Rise Policy Statement (NSW Government*) was adopted. It provided councils with sea level rise (SLR) planning benchmarks of 40cm and 90cm above 1990 sea levels by 2050 and 2100 respectively. In the same year, Council commissioned SMEC to update coastal hazard studies for nine Shoalhaven beaches, incorporating these state government benchmarks.

In 2012 the NSW Government withdrew the benchmarks so that councils could consider coastal hazards, and select benchmarks, locally.

In 2015, following completion and consideration of the *South Coast Regional Sea Level Planning and Policy Framework (2014)* report prepared by Whitehead & Associates as a joint Shoalhaven City Council-Eurobodalla Shire Council project, Council adopted sea level rise projections of:

- 10cm by 2030
- 23cm by 2050
- 36cm by 2100.

At this time, Council also resolved to review these projections at least every seven years to ensure that the policy is newly informed as better information about SLR becomes available.

The 2009 SMEC coastal hazard studies were reviewed in 2016 by specialist consultants, Advisian, using the adopted Council sea level rise projections (see Appendix 1).

The Advisian study noted

'The principal hazards induced by the coastal processes that are relevant for a coastal hazard risk assessment of the beaches in the study area include:

- Short-term coastal erosion from severe storms and consequent slope instability
- Long term coastline recession resulting from imbalances in the sediment budget, such as aeolian (wind-driven) sand transport, climate change and beach rotation
- Oceanic inundation of low-lying areas.

The hydrodynamic forces controlling the rate of these processes and hazards comprise the prevailing wave climate and water levels.' A summary of the relevant processes and coastal hazard parameters and the methodology adopted for undertaking the hazard assessment is provided within their study.

Further detail of the methodology used by Advisian and the results of their assessment of coastal hazards, including maps can be found in Appendix 1 and on Council's website:

http://shoalhaven.nsw.gov.au/Environment/Coastal-Landscape/Council-and-climate-change.

Coastal hazard studies for erosion, recession and inundation have been completed for the following beaches, which are partially backed by urban development and are considered to have assets at risk:

- Shoalhaven Heads
- Culburra Beach
- Warrain Beach
- Currarong Beach
- Callala Beach
- Collingwood Beach
- Boat Harbour Beach (Bendalong)
- Narrawallee Beach
- Mollymook Beach
- Collers Beach

Coastal hazard maps are included in Section 3.

The Advisian review provides updated, detailed hazard assessments for the beaches listed above. It describes the coastal processes affecting each beach and the impact of these processes on areas where property is at risk. As well as using Council's 2015 adopted SLR projections, the assessments used updated beach photogrammetry and survey transects, LiDAR data, bathymetric surveys and post storm information obtained following the June 2016 ECL.

Note: For planning purposes the NSW Planning Guideline: Adapting to Sea Level Rise (Department of Planning, 2010) and the NSW Coastal Risk Management Guide: Incorporating Sea Level Rise into Risk Assessments (DECCW, 2010) define a coastal risk area by the most landward hazard impact boundary for each time frame (i.e. the landward boundary of the Zone of Reduced Foundation Capacity). Figure 2.3 illustrates schema relating to these terms.

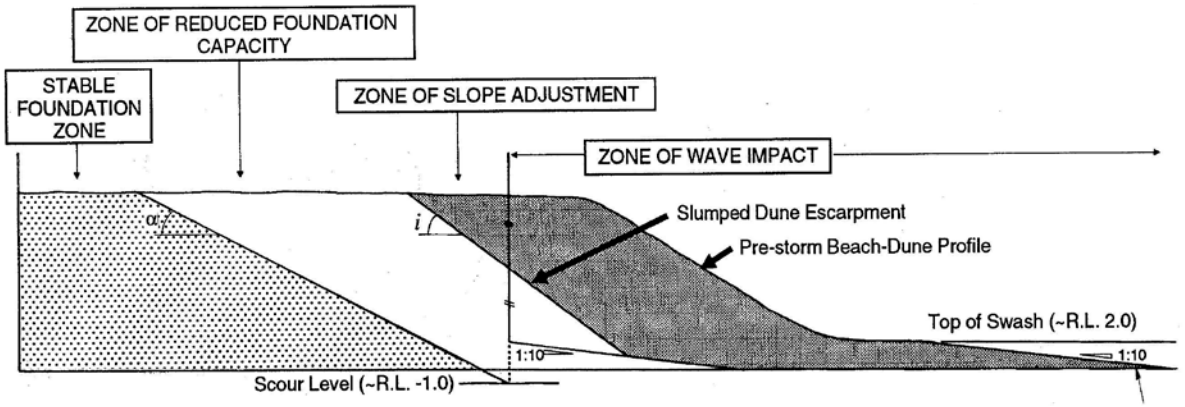


Figure 2-3 – Terms used in assessing coastal hazards (Neilson et. al.,1992)

The coastal hazard zones are predicted using the best available information and analysis techniques.

Specifically, the zones have been calculated based on:

- Known erosion impacts of the largest storm ever recorded at each beach (for most the 1974 or 1978 storm), as well as data available from the ECL of 2016. Impacts of such a storm vary at each beach and have been added to long term predicted changes in beach behaviour.
- Known long-term changes (loss or gain of sand, changes in the location of the dunes) that have been occurring at each beach since the 1940s, as a result of local coastal processes. These changes have been measured by looking at changes in beach volumes and profiles over historical records. The trends for these changes are assumed to continue into the future and are forecast for 2030, 2050 and 2100, consistent with coastal engineering best practice.
- Long-term future changes in beach behaviour that are forecast to occur, based on the best available information at the regional scale.

The immediate, 2030, 2050 and 2100 coastal hazard zones are reasonably conservative (generally worst case based on known historical evidence). However, more landward impacts are also possible, such as a very rare extreme storm or sea level rising faster than the current projections. The medium to long-term hazard zones will be reviewed as better information about sea level rise becomes available. The various coastal hazard zones to which Council refers in its planning guidance are described in Table 2.1 over page.

Table 2-1 – Coastal Hazard Zone Descriptions

Immediate hazard zone	2030 hazard zone	2050 hazard zone	2100 hazard zone
Immediate ZSA (Zone of Slope Adjustment) This area is bounded by the estimated limit of frontal dune collapse following a storm equivalent to the largest storm ever recorded on that beach. Frontal dune erosion in such a storm would occur seaward of the landward limit of this area. The boundary line indicates how far back the dune collapse would reach following such a storm. Erosion within this area could occur at any time.	2030 ZSA By 2030, some sea level rise is expected to have occurred as a result of climate change. This is predicted to lead to some landward movement of the frontal dune over time. At some of the beaches, there are local coastal processes which are known to have caused a landward movement of the frontal dune over time (e.g. at Currarong). This area is bounded by the estimated location of frontal dune collapse following a storm equivalent to the largest storm ever recorded, should that storm occur in 2030. It takes into account estimated beach changes that are expected to occur between now and 2030.	2050 ZSA Similar to 2030 except, by 2050, further sea level rise is expected to have occurred as a result of climate change. This is predicted to lead to further landward movement of the frontal dune over time. It takes into account estimated beach changes that are expected to occur between now and 2050.	2100 ZSA Similar to 2030 and 2050, except, by 2100, further sea level rise is expected to have occurred.
Impact for building: Immediate ZRFC (Zone of Reduced Foundation Capacity) In this area, the frontal dune would have a reduced capacity to carry building foundations and buildings within this zone could be damaged, if a storm equivalent to the biggest storm ever recorded on the beach, were to occur tomorrow.	2030 ZRFC In this area, buildings may suffer damage as a result of reduced capacity of the soil to carry building foundations, should a storm equivalent to the largest storm that has ever been recorded occur in 2030.	2050 ZRFC Similar to 2030, except it considers the largest storm that has ever been recorded occur in 2050.	2100 ZRFC – Similar to 2030 and 2050 except it considers the largest storm that has ever been recorded occur in 2100.

2.1.5 Risk analysis – coastal erosion and recession

Coastal erosion and recession will affect:

- Land use capability with land that is affected now or within the life of a development, potentially not being suitable for certain types of development (e.g. homes, shops, schools and hospitals)
- The feasibility and cost of repairing and maintaining the function of community infrastructure (e.g. access ways, roads, car parks, storm water drains and sewerage systems)
- Beach access, amenity and safety
- Amenity of foreshore parks and reserves
- The attractiveness of the coast for visitors (compared to now and to other landscapes).
- Dune vegetation and rock platform ecology
- Accessibility of rock platforms.

All of these impacts influence the social and economic wellbeing of communities along the Shoalhaven coastline. In addition, slope instability hazards affect some homes and assets on coastal cliffs and bluffs.

Council commissioned a risk assessment (BMT WBM, 2012) to assess coastal erosion, recession and inundation hazards over time. The risk assessment and associated risk mapping has since been updated (Advisian, 2018) to reflect the most recent coastal hazard mapping completed in 2016 (Appendix 2a and 2b).

A structured risk assessment uses a standardised matrix of likelihood and consequence to calculate risk. For the Shoalhaven coastline, BMT WBM used the hazard lines for 2025, 2050 and 2100 to define likelihood. Advisian (2018) has updated these to align with the definition of the re-defined hazard zones.

As the erosion hazard lines have been delineated using nominally a 1% AEP storm event, the present day probability that erosion would occur to the immediate zone of slope adjustment (ZSA) coincides with the 'possible' descriptor in Table 2-2. Advisian (2016) considers that by 2050, erosion up to a particular landward extent will become more likely than it is today and that by 2100 it will become more likely still.

If an asset, such as a road, has an adopted design life of, say, 30 years and it is located at the 2050 ZSA, the likelihood that the 1% AEP storm event would be exceeded within that timeframe is 20%. Therefore, the likelihood that erosion would reach the location of the road between now and 2050 is approximately 20%. The likelihood of such a storm being exceeded between now and 2100 is greater than 50%. That is, it is likely to occur between now and 2100, even though it is unlikely to occur in any particular year.

The likelihood scale used to assign risk to the various assets in the Shoalhaven is shown in Table 2.2 below.

Table 2.2 – Likelihood Scale for Coastal Risk Assessment

Likelihood descriptor	Immediate	For 2050	For 2100
Almost certain Expected to occur, many recorded incidents, strong anecdotal evidence, great opportunity, reason or means to occur. May occur or be exceeded once every 1–5 years.	Immediate ZSA line	2050 ZSA line	2100 ZSA line
Likely Will probably occur, consistent record of incidents and good anecdotal evidence; considerable opportunity, reason or means to occur. May occur or be exceeded once every 20 years.	Immediate ZSA line	2100 ZSA line	2050 ZRFC line
Possible Might occur, a few recorded incidents in the locality and some anecdotal evidence in the community; some opportunity, reason or means to occur. May occur or be exceeded once every 100 years. Will generally be close to or exceed past records of severity.	Immediate ZRFC line	2050 ZRFC line	2100 ZRFC line
Unlikely Is not expected to occur. Isolated recorded incidents in this country with anecdotal evidence in other communities. Little opportunity, reason or means to occur. May occur or be exceeded once every 250 years. Will almost always break previous records of severity.	Landward of the Immediate ZRFC line and wave inundation limit	Landward of the 2050 ZRFC line	Landward of the 2100 ZRFC line

The consequence scale for risk assessment takes into account financial, governance, environmental, health and safety and beach amenity consequences. Some consequences in the coastal zone can be described quantitatively (i.e. assigned a dollar value). With the currently available information and methodologies, many consequences can be described qualitatively only. The current risk assessment prepared for the Shoalhaven coast relies principally on quantitative consequence scales for built assets such as roads, pathways, water mains, sewerage systems (pipes and pump stations), car parks, bridges, surf clubs, community halls and other buildings. Over time, the risk assessment will be revised by Council as new methodologies and data become available for other natural, social and cultural values.

Surf clubs are an example of an asset that has important social values as well as a financial value. Surf Life Saving Australia commissioned a study on the vulnerability of surf clubs to extreme events and to climate change[4]. The study found that surf club buildings are very vulnerable because of their location on frontal dune systems. The financial and technical capacity of clubs and local Councils to respond to erosion impacts is also limited.

Storms and sea level rise increase risks for surf clubs in other ways, including:

- Loss of sand on beaches affects safety and the suitability of club areas for major competitions and events with potential social and economic impacts on the clubs and on their local communities
- Loss of club equipment, or increased safety risks when using the equipment
- Increased emergency response training requirements
- Significant coast and time to development assessment requirements for relocation or for protection works
- Lack of coordinated response strategy between clubs, local government areas, regions or states.

2.1.6 Risk analysis of geotechnical and slope instability hazards

Hazardous landslides occurred in parts of the Shoalhaven in 2008, and again in 2015. The landslides occurred in areas previously identified to be at risk of coastal cliff and slope instability. Several expert reports to assess slope instability and the risk of landslide hazards have been commissioned in the past.

Most recently, Royal Haskoning DHV has prepared the Shoalhaven Coastal Cliffs and Slopes Risk Management Program (2018) to allow Council to adequately manage emergency incidents and define future actions, in relation to cliffs and slopes in key risk areas. Relevant actions are included in Section 3 of this Coastal Zone Management Plan and the associated Emergency Action Sub Plan (Appendix 5).

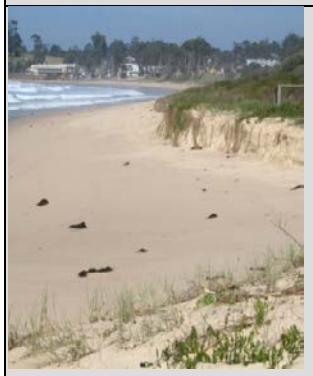
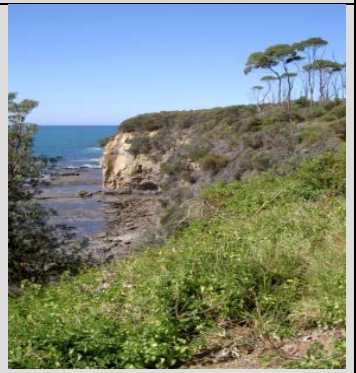
2.1.7 Evaluation process

Table 2-3 summarises how studies of community use and coastal values, coastal processes, coastal hazards and risks, p likely consequences, inform management responses and accordingly the preparation of the Coastal Zone Management Plan. Coastal management options are developed in response to coastal risks that are based on the interaction of hazards and values. Options are evaluated against a range of criteria, including capacity to mitigate extreme risks, community acceptance, Council's capacity to pay and alignment with existing programs. As noted in Section 1, an adaptive approach to management is essential to manage uncertainty in the dynamic coastal environment. Adaptive responses are based on ongoing monitoring and evaluation of actual progress against expectations and targets.

[4] Impact of Extreme Weather Events and Climate Change on Surf Life Saving Services: A Road Map for Adaptive Action, report prepared for Surf Life Saving Australia, Coastal Zone Management, (2011).

Table 2-3 – Evaluation of Coastal Values, Processes, Hazards, Risks and Consequences

STEP 1: Understand coastal processes – consider now, and for years 2030, 2050 and 2100		
Waves	Currents	Long term sea level changes
Tides	Storms – strong winds, elevated water levels and storm surge	Land slip and debris flows on cliffs and bluffs

STEP 2: Assess coastal hazards – consider now and for years 2030, 2050 and 2100					
Storm bite erosion	Long term recession – sediment deficit	Long term recession – sea level rise.	Creek entrance migration and lake entrance condition	Slope instability	Coastal inundation
					
Dramatic changes occur on the coast during major storms. Many communities have experienced the impact of occasional extreme events on the coastline. For instance, the 1974 and 1978 storms that affected the NSW coastline resulted in well documented severe erosion of the beach and dunes at Shoalhaven Heads, Currarong, Callala Beach and Collingwood Beach. The storms also resulted	Major storms are separated by long periods of calmer weather allowing beaches and dunes to recover. However, these periods can mask long term recession trends and beaches and dunes may appear more robust than they really are. Long term erosion and coastal recession occurs when sand is permanently lost from beaches and dunes.	Projected sea level rise will increase coastal recession hazards. As sea level rises, a proportional retreat of the sandy coastline is predicted. Sea level rise also affects sediment transport between embayments. The impacts of this hazard include: • Loss or disruption of safe community access to beaches, dunes and headlands, and impacts on surf clubs • Impacts on residential property – some properties along the Shoalhaven	Meandering creek entrances can add to the erosion of frontal dunes. Changes to entrance conditions, shoaling and scouring as sea level rises may affect lake ecology and beach sediment budgets. Changes to entrance dynamics affect the navigability of lake entrance channels and boating access to the ocean. Increased water levels reduce the area of	The geological structure of the Shoalhaven coastline makes some headlands and bluffs susceptible to rock fall and land slip. A geotechnical hazard assessment (SMEC 2008 & RHV 2018) has identified two high risk aspects of this hazard. On cliffs and bluffs, geotechnical instability events also recur especially at a time scale of decades. Examples include landslip (e.g. at Penguin Head, Culburra Beach) and rare rock topple events that cumulatively result in the	Coastal inundation occurs when storm waves overtop the frontal dune system, flooding low lying land and buildings or infrastructure. Extreme water level events are predicted to become more common as sea level rises. Natural and community assets that are adapted to or have been planned to be safe and serviceable at particular water levels will be impacted by

in overtopping of the Princes Highway south of Ulladulla. Homes along the Shoalhaven coastline are located within the immediate coastal erosion risk area. The 2016 ECL storms resulted in storm bites at Currarong, Culburra and Collingwood Beaches leading to the closure of many beach access ways and the erosion of some foreshore protection structures such as the Princes Highway at Ulladulla Harbour. Community access to beaches, dunes and headlands is disrupted during and after storms and coastal erosion events. Intermittent storm waves impact on breeding sites for migratory shore birds.	A number of Shoalhaven village communities have experienced slow long-term loss of beach or frontal dune landforms over a period of decades. Examples are Currarong and Callala Bay.	coast are partly or wholly within the 2050 coastal erosion hazard area at Callala Beach (82 lots), Collingwood Beach (34 lots), Culburra Beach (28 lots), Mollymook Beach (21 lots)[5] • Impacts on community assets and infrastructure, such as roads and sewerage systems at Mollymook Beach • Ongoing impacts on coastal biodiversity, associated with disruption or dislocation of endangered ecological communities on costal dunes • Specific impacts on cultural heritage sites and places.	foreshore reserve available for public recreation – both around lake shores and open ocean.	retreat of the cliff face and accumulation of sandstone boulders and cobbles on intertidal rock platforms at the base of cliffs. Important hazards include: • Potential block fall and landslip affecting public safety on headlands and rock platforms • Impacts of existing rotational slumping on private property at Culburra Beach (Penguin Headland) and a potential large slump at Inyadda Point.	more frequent high water levels. Council is also dealing with this issue through Flood Risk Management Plans and Entrance Management Strategies for coastal lakes. The coastal hazard mapping is shown in Section 3 and Council's website shows potential coastal inundation lines.

[5] Shoalhaven City Council Shoalhaven Coastal Zone Management Plan Risk Assessment – Draft (Advisian, 2018)

STEP 3: Assess community use, natural and built asset value						
Coastal ecological communities on cliffs, dunes, rock platforms and off shore	Beach amenity and recreational use, including visual appeal, access and facilities	Beach, bluff and rock platform safety	Homes and holiday homes	Economic value of tourism, fisheries	Community assets and infrastructure	Cultural values – Aboriginal and historic heritage
						
Coastal lakes and estuarine creeks along the Shoalhaven coast provide diverse, healthy and productive aquatic habitats of high ecological value, extensive areas of several endangered ecological communities and roosting, feeding and breeding habitat for migratory shorebirds. There are whale migrations along the cost each autumn and spring.	Multiple sandy beaches and rocky headlands provide a high level of naturalness and exceptional visual appeal. The coastline is almost entirely in public ownership. Diverse recreational uses include swimming, diving, surfing, boating, water skiing, fishing, coast and bush walking, picnics, art and photography, conservation activities, sightseeing.	High social and cultural value is associated with individual, family and community experiences, memories and anticipation of good times spent on safe beaches, headlands, rock platforms and coastal lakes.	Residential homes within the coastal zone are highly valued both for their lifestyle attractions and potential investment return. However, a relatively high proportion of owners are absentee landowners, with a long history of holiday occupation. Holiday properties often become permanent residences as people retire.	The coastal zone supports activities such as tourism and fisheries that have important economic values for the region. The economic value of the coastal zone to the overall economy of the region is substantial.	Infrastructure includes surf clubs, rock walls, sewerage systems, water supply and power infrastructure.	Several rock platforms and headlands are listed in the Register of the National Estate or the National Heritage List (primarily for their fossils, other geological features, heritage sites, Aboriginal cultural heritage and landscape character).

STEP 4: Evaluate coastal risks and likely consequences - consider for now, and for years 2030, 2050 and 2100

The likelihood and consequences of coastal hazards impacting on the natural, social, cultural, built and economic values of the coast.

Impacts associated with interactions between coastal values.

Consider existing controls.

Consequences associated with damage to the structure, environmental impacts (such as raw sewage discharges), health and safety impacts, resource demands etc.

This process helps Council identify the most important and urgent issues requiring management actions.

More detail about the analysis and management of coastal risks is in **Appendix 2a and 2b**.

Low risk	Medium risk	High risk	Extreme risk
Examples: Occasional minor damage or occasional inundation of access ways, walking paths.	Examples: Frequent or severe damage to beach access ways (ramps, steps, lookouts). Wave impacts or erosion on local community halls and sporting venues. Occasional shallow inundation of residential property.	Examples: Erosion of residential and commercial properties. Erosion or undermining of sea walls. Frequent marine inundation of residential properties. Frequent or permanent inundation of foreshore reserves. Damage or destruction to important cultural sites. Loss of important or endangered ecological communities or threatened and protected species.	Examples: Erosion and undermining or flooding of surf clubs, sewage reticulation infrastructure (pipes and pump stations). Golf Club at Mollymook, major roads and bridges.

STEP 5: Choose and implement coastal risk management strategies

Identify, evaluate, prioritise and implement.

Protect, accommodate, retreat, avoid, share.

Consider priority actions for now and for 2030, 2050 and 2100.

Examples include:

Land use planning (controls on the location of development, the design of development and triggers for lapse of consent).

Structural protection such as sea walls.

Purchase of land.

Beach nourishment and dune management.

Vegetation management and habitat protection.

Design and maintenance of access ways.

Asset and infrastructure maintenance and relocation schedules.

Community information, awareness, education and involvement.

Actual change monitoring in relation to triggers for management action.

Research to address knowledge gaps.

Ongoing adaptive improvement of coastal management.

(These are addressed in the Actions in Section 3 and Section 4 of this document) .

STEP 6: Monitor, review, evaluate and reflect
Is management action achieving its intended outcomes? Is the condition of the coast stable or improving? Is ecological and community resilience maintained? Have triggers for changing management been reached? What's changed and why? New science, new community aspirations, new threats, new legislation and policy. Inform the revised plan with best available knowledge about processes, condition and values. **This is the feedback loop that informs ongoing adaptive management to achieve agreed outcomes**.

2.1.8 Results of the risk assessment – beach erosion, recession and inundation

Table 2.4 summarises the highest risks for 2050 and 2100. The full risk register (Advisian, 2018) is included in Appendix 2a with specific risk mapping in Appendix 2b. Based on asset value, the highest risks are associated with surf club infrastructure and sewerage infrastructure. High risks relate to assets at Collingwood Beach, Callala Beach, Culburra Beach, Mollymook Beach, Warrain Beach and Shoalhaven Heads.

As can be seen from the nature of the assets that are rated as extreme risks in coastal erosion risk areas, these risks have serious implications for Council. Damage or destruction of these assets would disrupt essential community services, create health risks and impact on the social fabric of small communities.

The study (Advisian, 2018) indicates the following financial implications for Council from coastal hazard impacts on important community infrastructure.

- Surf clubs (estimated $5 million, 2050 and 2100)
- Wastewater infrastructure (estimated $5.3 million 2100)
- Roads, car parks and bridges (estimated $13 million at 2100).

Sound risk management practice requires that Council takes action to reduce the extreme risks, on a priority basis.

Proposed management actions to mitigate extreme and high risks are discussed in Sections 3 and 4.

Table 2-4 – Extreme Risks, 2050 and 2100

Risk 2050	**Unmitigated risk rating 2050**	**Mitigated risk rating 2050**
Mollymook SLSC	High	High
Warrain Beach SLSC	High	High
Shoalhaven Heads SLSC	Extreme	High
Pump Station, south end Mollymook	Extreme	High
Pump station near 57 Mitchell Parade, Mollymook	Extreme	Extreme
Mollymook Golf Club (private asset)	Extreme	Extreme
Risk 2100	**Unmitigated risk rating 2100**	**Mitigated risk rating 2100**
Mollymook SLSC (as above)	Extreme	High
Warrain Beach SLSC (as above)	High	High
Shoalhaven Heads SLSC (entire building)	Extreme	Extreme
Pump station at south end, Mollymook (as above)	Extreme	High
Pump station near 57 Mitchell Parade, Mollymook	Extreme	Extreme
Pump station near Beach Road, Mollymook	Extreme	Extreme
Mollymook Golf Club (private asset) (as above)	Extreme	Extreme

Table 2-5 – Residential lots and buildings within coastal hazard areas

KEY: <5 lots | 5 – 9 lots | 10 -19 lots | 20 – 50 lots | >50 lots

Beach	Asset Class	Immediate ZSA	Immediate ZRFC	2030 ZSA	2030 ZRFC	2050 ZSA	2050 ZRFC	2100 ZSA	2100 ZRFC	Inundation	Risk now	Risk 2050	Risk 2100	SDCP G6	SLEP	Recommended Future Strategy	Response Category (OEH 2013)[6]
Shoalhaven Heads	No. Lots	-	-	-	-	-	-	-	-	-	Low	Low	Low			• No private properties at risk. Implement CZMP actions for Shoalhaven Heads SLSC.	C
	No. Buildings	-	-	-	-	-	-	-	-	-							
Culburra	No. Lots	1	1	2	3	3	28	4	62	17	Low	Moderate	High	✓	✓	• Dune vegetation management and manage accessways to maintain dune resilience. • Apply development controls through SDCP and SLEP.	C
	No. Buildings	1	1	1	1	1	1	1	2	-							
Warrain Beach	No. Lots	-	-	-	-	-	-	2	-	1	Low	Low	Low			• Dune vegetation management and manage accessways to maintain dune resilience.	C
	No. Buildings	-	-	-	-	-	-	-	-	-							
Currarong	No. Lots	5	20	5	23	7	29	15	43	4	Moderate	Moderate	High	✓	✓	• Undertake detailed technical investigation of coastal hazard management options. Consider trial geotextile groyne and shoreline protection works at Beecroft Parade. • Reroute Peel St access. • Regular foreshore profile surveys. • Dune vegetation management and manage accessways to maintain dune resilience • Apply development controls through SDCP and SLEP.	A (coastal protection works would also protect essential public infrastructure)
	No. Buildings	-	9	-	9	-	19	10	21	-							
Callala Beach	No. Lots	80	82	82	82	82	82	82	82	74	High	Extreme	Extreme	✓	✓	• Apply development controls through SDCP and SLEP to reduce risk as properties are redeveloped. Immediate erosion hazard affects < 25% of area of most lots, and lots have enough area to allow setback of future development. • Dune vegetation management and manage accessways to maintain dune resilience.	C[7]
	No. Buildings	16	53	16	63	55	68	55	76	-							

[6] Council's intended response to managing risks to property from Table 6 of NSW Guidelines for Preparing Coastal Zone Management Plans (OEH 2013). The response category considers the feasibility of Council funded coastal protection works other than temporary Coastal Protection Works.

[7] For Callala Beach, although risk to private property is high, the risk can be managed through the use of the DCP/LEP for future development. Erosion risk can be managed in the short term through temporary coastal protection works (i.e. post-storm beach scraping with approval from JBMPA). Coastal protection works other than temporary coastal protection works are not considered feasible at this stage but the need for works would be reassessed in subsequent revisions of the CZMP.

															• Obtain approval from Jervis Bay Marine Park Authority (JBMPA) to undertake post-storm NABE as a coastal protection measure.	
Collingwood	No. Lots No. Buildings	- -	1 -	- -	13 -	1 -	34 -	1 -	42 1	58 -	Low	Moderate	High	✓	✓	• Apply development controls through SDCP and SLEP. • Monitor dune crest levels. • Options for managing dune heights include dune scraping. • Dune vegetation management and manage accessways to maintain dune resilience. • Obtain approval from JBMPA to undertake post-storm NABE as a coastal protection measure.	C
Bendalong	No. Lots No. Buildings	- -	- -	- -	- -	- -	- -	- -	- -	- -	Low	Low	Low			• Implement CZMP actions and future masterplan	C
Narrawallee	No. Lots No. Buildings	- -	- -	- -	- -	- -	2 -	- -	2 -	- -	Low	Low	Low			• Dune vegetation management and manage accessways to maintain dune resilience.	C
Mollymook	No. Lots No. Buildings	- 1 (Golf Club)	- 1 (Golf Club)	- 1 (Golf Club)	4 1 (Golf Club)	- 1 (Golf Club)	21 3	1 1 (Golf Club)	32 7	- -	Moderate	Moderate	Moderate	✓	✓	• Apply development controls through SDCP and SLEP. • Golf Club is a private asset at immediate risk, resilience of existing works to be assessed • Condition assessment of tripper wall at northern end of beach at creek entrance near Beach Road. • Dune vegetation management and manage accessways to maintain dune resilience. • Monitor dune nourishment and buried training wall at Blackwater creek	A (at southern end of beach, coastal protection works for Golf Club would also protect essential public infrastructure)
Collers	No. Lots No. Buildings	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	Low	Low	Low	✓	✓	• Apply development controls through SDCP and SLEP.	C

The risk assessment (Advisian Appendix 2a) identified private lots and dwellings at several beaches located within the various coastal hazard areas. The number of private lots with a portion in the zone of slope adjustment and zone of reduced foundation capacity, as well as the number of residential buildings partially within these zones, has been quantified for each beach and is presented in Table 2.5. The property risk and response categories are also shown in Table 2.5.

From Table 2.5 it can be seen that the beach with the highest number of residential lots and buildings within the coastal hazard area is Callala, followed by Currarong and Collingwood beaches.

The risk to the private assets has not been quantified in monetary terms. This is because the risk will vary depending on the value of each asset, the portion of the lot or building within the hazard area and the existing controls on each asset, such as whether individual buildings are on deep-piled foundations. However, Table 2.5 allows a qualitative assessment of the level of risk to private assets at each beach, based on the quantum of assets located within the coastal hazard area and the likelihood scale provided in Table 2.5.

Risk to private development in the coastal hazard areas is being managed through the application of development controls through the Shoalhaven Development Control Plan (DCP) and Local Environmental Plan (LEP). This includes application of foreshore setbacks and deep-piled foundations for new development. This approach is feasible in the medium term, where existing building lots have sufficient area to accommodate foreshore setbacks for new development so that it can be located outside the coastal hazard area and can accommodate future erosion within an acceptable planning horizon.

2.1.9 Results of the risk assessment – landslide risk management

The results of the following studies informed recommendations for landslide risk management measures:

- Coastal Slope Instability Hazard Study (SMEC, 2008)
- Shoalhaven Public Asset Coastal Risk Management Review (Review (BMT WBM 2012)
- Peer Review, Supplementary Geotechnical Observations (of the Coastal Slope Instability Hazard Study 2008) (Douglas Partners 2011)
- Report on Scoping Study and Stability Assessment (Various Lots Surfers Avenue, Tallwood Avenue & Bannister Head Road, Narrawallee) (Douglas Partners 2011)
- Shoalhaven Coastal Cliffs and Slopes Risk Management Program (Royal Haskoning DHC, 2018)

These are relevant to each of the risk areas, being:Penguin Head

- Plantation Point
- Hyams Point
- Berrara Point
- Inyadda Point, Manyana
- Narrawallee
- Bannisters Point
- Collers Beach Headland
- Rennies Beach
- Racecourse Beach

The risk areas have been included in the Shoalhaven Local Environmental Plan and Shoalhaven Development Control Plan for many years. The recommendations form an integral part of the landslide risk management (LRM) process. The measures are outlined, where applicable, to Council, private

property owners and utility owners. They include landslip remediation works, infrastructure works, access arrangements to public sites, further geotechnical assessment and monitoring and policy changes. Relevant actions, based upon the recommendations of this risk assessment and associated program, are included in Section 3 of this Coastal Zone Management Plan, along with associated mapping.

2.2 Understanding community values, concerns and issues

This section outlines how Council has consulted with stakeholders and its community during the preparation of the Coastal Zone Management Plan in 2012, 2016 and 2018.

2.2.1 Characteristics of the Shoalhaven coastal community

Some important social and economic characteristics of the Shoalhaven coastal zone, which affect community attachment to the coast and interest in its management, include:

- The coastline is almost entirely in public ownership and is therefore accessible to all the community as National Park, Crown land or Council reserve
- Two to three hours travel from Sydney and Canberra, the Shoalhaven coastline has been a favourite holiday location for decades; peak summer population of coastal villages is double or triple its normal level. In recent years the Shoalhaven has seen a significant increase in day trip visitors to the Shoalhaven coastal zone and tourism outside of peak season has increased by 40%9
- There is a relatively high proportion of absentee landowners who use coastal residences in the small villages scattered along the coast for holidays. Many of the small villages have permanent residential occupancy rates of less than 50%
- Local villages are economically dependent on income from holiday makers who use tourist parks, other accommodation, restaurants and coastal recreation activities
- There are diverse recreational uses including swimming, diving, surfing, boating, water skiing, fishing, coast and bush walking, picnics, art and photography, birdwatching, conservation activities, sightseeing and car touring. Holiday makers use the open coast, estuaries and coastal bushland environments
- High social and cultural value is associated with individual, family and community experiences, memories and anticipation of enjoyment of time spent on beaches, lakes, headlands and rock platforms
- As owners of holiday homes reach retirement age, some choose to make the coastal property their permanent residence. Increasing permanent settlement by retirees also increases the age of the population and provides a group of well-educated and aware residents with strong interests in protecting long established values of the coast
- Based on the 2016 Census, at least 55.5% of Shoalhaven's population lives in coastal areas, of which 37% live in the Huskisson/Vincentia and Ulladulla/Mollymook urban areas. These have both been identified as growth centres (Illawarra-Shoalhaven Regional Plan).

2.2.2 Community engagement during Plan preparation 2012–2018

The Shoalhaven coastline is highly valued by residents, ratepayers and visitors. During preparation of the initial draft Coastal Zone Management Plan in 2012, Council provided information using a special project website. Council listened to the community's views about important issues and potential

[9] (April – Sept Quarters, 2014- 2017, visitor numbers extracted from *Tourism Research Australia; National & International Visitor Survey*).

management options through direct feedback opportunities as well as meetings, workshops and briefings. A Council Committee was also formed that included community and government agency representatives.

Throughout the project, the website provided background about coastal hazards, coastal legislation and policy, coastal research and coastal management. It also provided Council's progress on a range of projects that affect the future quality of the coastal environment and lifestyle of residents. Copies of all draft technical reports were available on the project web site, as well as in hard copy from Council. The web site included information about the science of climate change and sea level rise, which are major concerns for coastal property owners. People were also able to submit questions and comments via the website. All comments were forwarded to Council officers for direct response.

Over this six-year period, Council conducted multiple rounds of community briefings and workshops to discuss how local communities use and value the coast. Consideration was also given to community experience and observations of coastal change, objectives for the future of the coast, issues, hazards, risks and potential management responses. Meetings were held at Nowra (Council Chambers), Callala Bay, Callala Beach, Ulladulla, Huskisson and Mollymook. Separate and concurrent to the briefings and workshops, Council engaged with coastal residents and stakeholders about potential land use planning measures such as its draft Shoalhaven Local Environmental Plan and Shoalhaven Development Control Plan 2014 for coastal risk planning areas. Consultation about the coastal planning clauses in the draft LEP provided further opportunities for community feedback on coastal hazards, risks and their management.

In 2014, the Shoalhaven Local Environment Plan and the Shoalhaven Development Control Plan 2014 were both finalised. At the time of development of the initial 2012 Plan, Council established a Coastal Committee made up of representatives of several Shoalhaven Resource and Floodplain Management Committees (NRFM). These Committee members included state agency representatives, Councillors and representatives of local community organisations. Regular Committee briefings during the development of the hazard studies, risk assessments, draft plans, plus current updates and review of the draft plans provided opportunities for stakeholders to discuss issues and provide written feedback.

2.2.3 Groups consulted

The following community groups and regional and local community organisations were consulted and contributed to the development of the draft Coastal Zone Management Plan:

- Council's Community Consultative Bodies (CCBs)
- Bushcare groups and Dunecare groups
- Other community and environment groups including surf clubs, fishing clubs, sailing clubs, environmental groups, bird watching groups and the South Coast Shore Bird Recovery Program
- Aboriginal community groups and organisations, including Wreck Bay community, Local Aboriginal Land Councils
- Businesses and Chambers of Commerce
- All interested Residents and Property Owners
- Visitors to the Shoalhaven.

2.2.4 Public exhibition 2012

During 2012 the draft Coastal Zone Management Plan was placed on public exhibition; 22 submissions from individuals, associations and community groups were received and one from a government agency. The submissions are grouped by type (general or specific) and location. Council also notes the frequency

of issues raised. Full details of the submissions and details of how these submissions were addressed in the revised Coastal Zone Management Plan and/or other studies, undertaken since 2012, are provided in Appendix 3.

2.2.5 Our Coast Our Lifestyle 2015 - 2016

In 2015 - 2016 Council engaged extensively with the community to:

- Educate the community about the risks of coastal erosion and the coastal management options that are available to respond to that risk
- Understand community preferences for those different management options and the factors Council to consider when responding to coastal erosion risks and storm damage.

Key findings are that the community:

- Is concerned about coastal erosion
- Is unaware of Council's coastal management role
- Strongly values the natural environment
- Supports Council prioritising community assets and infrastructure when spending taxpayers' money on coastal management
- Expects Council to take a long-term, cost-effective approach to managing the risk of coastal erosion, based on scientific evidence and expert advice
- Except in specific circumstances, supports soft over hard protection options, in particular for dune management
- Would support other management options for existing assets if they are the most effective option in the long term
- Is strongly concerned about new development in areas known to be at risk and does not support Council approving it, especially if it will require protecting in the future
- Considers that environmental impact and community safety are important for coastal management
- Supports the cost of coastal management being shared across the whole community, via rates or levies if necessary, and wishes Council to consider other revenue sources.

The updated draft Coastal Zone Management Plan was publicly exhibited in 2016 before Council submitted the plan for certification. The submissions are summarised in Appendix 3.

2.2.6 What the community said about the coast 2012 to 2018

Table 2.6 summarises the main community concerns, organised by locality and theme. These issues are an overview of the input from meetings, briefings and submissions from the 2012, 2016 and 2018 public exhibitions and Our Coast Our Lifestyle engagement processes. This input has been used in scoping potential coastal management responses and in evaluating the capacity of responses to meet community needs. The submissions from all exhibitions are summarised in Appendix 3.

During the 2018 exhibition, in addition to the public exhibition of the draft Coastal Zone Management Plan and Appendices, three widely advertised public information sessions were held (Nowra, Vincentia and Ulladulla) which provided the community with an added opportunity to ask questions and provide input into the updated Coastal Zone Management Plan, Emergency Action Subplans, Coastal Risk Assessment and Mapping and the Coastal Cliffs and Slopes Risk Management Report and Emergency Action Sub Plans.

Table 2-6 – Community Engagement Outcomes

Issue or concern reported by community representatives	Reported in these localities	How Council has addressed the issue or concern
Impacts of coastal processes and climate change		
Impact of climate change induced erosion and inundation on coastal dunes and beach amenity, as well as on foreshore reserve properties.	Currarong, Culburra Beach, Collingwood, Callala Bay, Callala Beach, Mollymook	Throughout the course of developing this CZMP, numerous studies to assess the impact of climate induced erosion on coastal beaches and headlands (as included in appendices, references and supporting documents). C1.7, C2.1, C2.2 See relevant sections and mapping in Section 3 – Local Area Actions. Section 2 and citywide strategies recognise review SLR projections and hazard studies over time as required or new information becomes available.
Impact of climate change driven processes on the integrity of community infrastructure including roads, pathways, sewerage systems and water supply	Currarong, Mollymook, Berrara, Ulladulla, Collingwood	Numerous risk assessments into the impact of climate induced erosion on coastal beaches and headlands (as included in appendices, references and supporting documents), including the Shoalhaven Coastal Zone Management Plan – Risk Assessment (Advisian 2018) and Shoalhaven Coastal Zone Management Plan – Risk Mapping (Advisian 2018) in Appendix 2a & 2b. Section 2 explains hazards and risks. See relevant sections and mapping in Section 3 – Local Area Actions
Impact of coastal erosion and recession on private property – damage to existing assets but also the impact of risk controls on the value of assets.	Callala Beach, Collingwood Beach, Culburra, Mollymook	Numerous risk assessments into the impact of climate induced erosion on coastal beaches and headlands (as included in appendices, references and supporting documents), including the Shoalhaven Coastal Zone Management Plan – Risk Assessment (Advisian 2018) and Shoalhaven Coastal Zone Management Plan – Risk Mapping (Advisian 2018) in Appendix 2a & 2b. See relevant sections and mapping in Section 3 – Local Area Actions, specifically LA1.10.
Adequacy of coastal hazard mapping of beaches	Collingwood Beach	The coastal hazard mapping takes into account current conditions such as existing dune heights as well as coastal inundation from historical and recent storm events. Hazard mapping has been prepared in accordance with CZMP Guidelines, current coastal engineering practice and is in line and comparable with methodologies used by other neighboring Councils.
Impact of geotechnical instability of cliffs and bluffs on private property.	Penguin Head, Bannisters Point	Numerous risk assessments into the impact of climate induced erosion on coastal cliffs and bluffs (as included in appendices, reference and supporting documents). C2.4, table 3-9, LA2.1, LA4.3, LA4.4, LA4.5, LA5.9, LA5.18, LA6.3, LA6.4. See also, relevant mapping in Local Area Actions
Impact of geotechnical instability of cliffs and bluffs on public safety (paths, viewing spaces on the edge of the bluff).	Nelson, Orion, Barfleur Beaches, Plantation Point, Hyams Beach	Numerous risk assessments into the impact of climate induced erosion on coastal cliffs and bluffs (as included in appendices, reference and supporting documents). C2.4, table 3-9, LA3.22, See also, relevant mapping in Section 3 – Local Area Actions
Urban water management - flows and quality		
Management of discharges from storm water drains and small coastal creeks. Discharges are considered to affect water quality (urban runoff and/or septic tank effluent), land surface geotechnical stability and dune erosion.	Wowley Creek, Moona Creek, Mollymook Creek, various headlands, Kioloa Creek	Not in the scope of the CZMP. Water quality monitoring data can be viewed in Aqua Data Geotechnical stability addressed as above.
Access management through coastal reserves		
Decision-making and communication processes relating to the number of tracks, spacing of tracks and maintenance	Currarong, Culburra Beach, Shoalhaven Heads, Mollymook, Narrawallee, Cudmirrah,	C4.1, pages 54-57. • Development of the Walking Track Asset Management Plan: Paths on headlands and linking beaches are usually incorporated into the Walking Tracks AMP and are risk assessed regularly.

Issue or concern reported by community representatives	Reported in these localities	How Council has addressed the issue or concern
of tracks across dunes, on headlands and along bluffs (linking beaches).	Berrara, Collingwood Beach, Gannet Beach, Cormorant Beach	• Development of The Coastal and Estuary Asset Management Plan 2015 which forms an integral part of the Coastal Zone Management Plan: Following storm events, beach access tracks assessed as being a public safety risk, are closed. If any of those tracks are then assessed to be excess to need, and following public consultation, tracks may be closed and removed from the asset register. In this way, beach access tracks are slowly being rationalised. This is also addressed in the Emergency Action Sub-Plan – Beaches (Appendix 4).
Private use of public reserve lands on dunes and bluffs, including garden encroachment, private access ways and blocking other public access (reported as both dune vegetation and equitable access to the coast issue).	Bannisters Point, Mollymook Beach, Collingwood Beach, Callala Beach	C1.8, C2.2 • Development of the Foreshore Reserves Policy, which forms an action resulting from the Coastal Zone Management Plan citywide strategies. • Reporting of encroachment issues to Council's compliance staff for individual action. • Development of a Citywide Tree Vandalism Policy.
Conflicts on beaches - most often in relation to dog exercise areas.	Shoalhaven Heads Beach, Mollymook Beach, Narrawallee Beach	Not in the scope of the Coastal Zone Management Plan – addressed in Council's policy, Access Areas for Dogs and enforced by Ranger Services. Signage and maps regarding on-leash, off-leash areas are often added to beach access sign posts.
Access suitability for diverse user groups - aged, disabled, variety of recreational users, permanent residents and visitors.	Callala, Huskisson, Vincentia, Mollymook	C2.6, LA1.5, LA1.8, LA2.4, LA3.23, LA5.6 Development of the Coastal and Estuary Asset Management Plan; beach access is being upgraded incrementally to provide for diversity e.g. passive craft launching ramps, addition of handrails to beach access tracks, contrast step marking on beach access steps, disabled access boardwalk to Conjola Beach.
Access by people, dogs and vehicles close to nesting sites for migratory shorebirds disrupts breeding success.	Applicable at most nesting areas.	C2.3, section 1.5.3 Signage regarding shorebird nesting areas added to relevant beach access sign posts, enforced by Council Ranger Services. Council staff liaise with the NPWS Shorebird Recovery Coordinator when needed.
Vegetation in foreshore reserves		
The priority given to maintaining natural coastal features including beach, dunes, headlands and intertidal rock reefs. Conservation of endangered communities, threatened species and habitat.	All locations	Section 1.5.3 Protection provided for coastal features via the Coastal Zone Management Plan and resultant policies such as the Foreshore Reserves Policy, which is consistent with the Coastal Zone Management Plan citywide strategies. Council also has planning controls in place through SLEP 2014 and administers development related aspects of the NSW Biodiversity Conservation legislation. Council liaises with Jervis Bay Marine Parks staff as needed.
Management of vegetation on coastal bluffs and cliffs, including weed removal, drainage, species selection and contribution to instability.	Penguin Headland, Racecourse Headland, Bannisters Point	C2.4, table 3-9, See relevant sections and mapping in Section 3 – Local Area Actions Management of vegetation on public land (under its care, control and management) through policies such as: • The Foreshore Reserves Policy • Building controls within Shoalhaven Development Control Plan 2014 Chapter G6 • The Coastal Slope Instability Hazard Study, SMEC 2008 • Peer Review, Supplementary Geotechnical Observations (of the Coastal Slope Instability Hazard Study 2008) Douglas Partners 2011 • Coastal Cliffs and Slopes Emergency Action Sub Plan. Royal Haskoning DHV 2018 • Coastal Erosion Road Stormwater Assessment Footprint Engineering 2015 • Council's Weed Management Policy

Issue or concern reported by community representatives	Reported in these localities	How Council has addressed the issue or concern
		• Bushcare and Parkcare Policy and Procedures (POL09/78) These policies, studies and reports are consistent with the actions within the Citywide Strategies contained within the Coastal Zone Management Plan.
Vegetation management on coastal dunes, particularly in relation to height and density of rehabilitated vegetation along urban foreshores. Narrow margin of vegetation and dune between the tidal zone, the dunes and residential development. Impact on views; intent and function of rehabilitated landscapes.	Collingwood Beach, Mollymook Beach, Narrawallee Beach, Berrara, Cormorant Beach, Gannet Beach	C1.8, C2.2 LA1.5, LA1.6, LA1.10, LA3.16, LA3.17, LA5.13, LA5.14, Management of vegetation on public lands (see comment above) through policies such as Foreshore Reserves Policy, Shoalhaven Development Control Plan 2014 Chapter G6, Collingwood Beach Vegetation Action Plan (2018 revision), Weed Management Policy, and planning controls such as SLEP 2014. These policies and plans are consistent with the Coastal Zone Management Plan citywide strategies. Council is also developing a Citywide Vegetation Vandalism Policy to address vandalism of foreshore vegetation.
Participation by Bushcare and Dunecare Groups.	Most beaches	C2.1, section1.5.3 & 3.2.2.3 Involvement of residents through the Bushcare Policy and Procedures.
Management of invasive species on coastal dunes.	All beaches	C1.9 Addressing of community concerns through Foreshore Reserves Policy, Weed Management Policy and its weed management program and Bushcare and Parkcare Policy and Procedures Provision of dedicated resources (Natural Areas Officer) Engagement of contractors to support Bushcare Group actions or where there is no Bushcare Group.
Other social and cultural concerns		
Management Plans and Reports are currently in various forms and stages of implementation. This can create confusion for local communities about how the various pieces of coastal management fit together.	All areas	Supporting documents list is the first step in making a library of coastal and estuary management document available to the public. Production of the Frontline News newsletter, Council's coastal and estuary web pages to facilitate good communications. These actions are consistent with the aims and objectives of the Coastal Zone Management Plan.
Protection and recognition of Aboriginal culturally significant sites.	All areas	C2.2, C4.6, 3.2.2.2 Description of Aboriginal Cultural Heritage for each Local Area in Section 3 Engagement of consultant archaeologists when required Due diligence by Council staff who and work closely with OEH on the protection of Aboriginal Cultural Heritage. Installation of interpretive signage, where appropriate, in coastal areas. Recognition of Aboriginal cultural heritage in vision.
General concern over water quality, particularly in high-use areas, including the impacts of fishing, mooring on seagrass beds and high-impact areas.	Jervis Bay, Mollymook	Involvement of several state and local government agencies. Protection of Jervis Bay via the provisions of the Marine Park management plan. A substantial Council water quality monitoring program. Aqua Data Protection of seagrass, saltmarsh and fringing vegetation Council (with Department of Primary Industries Fisheries when required)
Vehicles in reserves and on beaches can create safety issues and damage the natural environment.	Foreshore reserves and beach access ways	C.2.3 Administration of the provisions of the Foreshore Reserves Policy, which includes appropriate signage and prosecution action by Ranger Services.

Issue or concern reported by community representatives	Reported in these localities	How Council has addressed the issue or concern
Lack of signage for environmentally sensitive areas.	All localities	With other state agencies consistent with the citywide strategies within the Coastal Zone Management Plan: • Installation of interpretive signs at many locations around the Shoalhaven coast (e.g. Red Head (Bendalong), • Installation of saltmarsh signs at various estuarine locations (e.g. Burrill Lake, signs explaining estuarine processes e.g. Lake Conjola, Lake Tabourie) Sign installation will continue
Where concrete/rock walls have been built to protect a foreshore area, they should be properly designed and maintained and allow for safe access.	Generally provided at surf clubs and high usage areas	C6.1, LA1.1, LA5.4, LA5.5, LA5.7 Any actions relating to these works include on-going maintenance and monitoring provisions. Preparation of studies, including: • Mollymook Golf Club Coastal Hazard Assessment, Maunsell Australia 2008 • Ulladulla Harbour Coastal Erosion Remediation - Design Advice SMEC 2011 • Geotechnical Assessment of storm erosion and remedial works Ulladulla Harbour, Douglas Partners 2012 • Foreshore Stabilisation at Mollymook Beach (south) – concept design report Royal Haskoning DHV 2016 • Shoreline Protection Condition Assessment (review) GHD 2016 • Foreshore Stabilisation at Mollymook Beach (south) concept design report, Royal Haskoning DHV 2016
Estuaries not included in CZMP	Most localities	Following advice from OEH, estuary management plans could not be included in the CZMP because they were not prepared in accordance with CZMP Guidelines. At the time when EMPs were prepared they were never intended to be CZMPs. Council will continue to progressively update EMPs and incorporate into future coastal management programs as appropriate.

2.3 Protecting natural landscapes

Figure 2.4 below shows how the different landscape elements – beaches, dunes, lakes, estuaries and catchments - fit together in the coastal landscape. It also shows how management of the coastal zone draws on knowledge about coastal systems and the values of local communities. This Coastal Zone Management Plan is one part of Council's overall integrated framework for managing the coastal landscape. Estuary management plans, flood studies and plans, estuary health monitoring programs and other plans and programs described below are all part of Council's overall management framework of the coastal landscape.

Coastal landscapes continually change responding to the dominant natural forces of wind, waves, rainfall and tides. Council's understanding of how these beach and estuary systems operate within natural dynamics is improving. Council's management priorities need to recognise how we can best adapt and minimise community risk and environmental impact. Coastal Zone Management in NSW now integrates estuary and open coast management planning directions. This CZMP will, over time, be fully integrated with plans for coastal lakes and estuaries.

Estuaries

The NSW South-East Coast Region has three main estuary types:

- Wave dominated barrier estuaries
- Wave dominated deltas
- Coastal lagoons

Estuary flood plains are areas that are inundated by both catchment runoff and by oceanic waters (tides and wave overtopping of dunes). Many homes and services are currently located in flood risk areas around estuaries. Flood risks are partly managed by entrance management strategies for coastal lakes.

Estuary health monitoring

The Monitoring Evaluation and Reporting (MER) strategy was developed to form a consistent program of 'indicators' for a state-wide assessment of ecological condition of estuary systems.

Core indicators include:

- Chlorophyll a (measuring microalgae abundance), turbidity, salinity, temperature, pH and dissolved oxygen (DO)
- DO level is critical to aquatic life. Low DO causes fish kills
- Nutrients such as Nitrogen and Phosphorus track catchment inputs from erosion or land use
- Habitat mapping measures seagrass, mangroves and salt marsh communities
- Fecal Coliforms indicate sewerage pollution and is critical information for oyster producers and recreation.

The physical and ecological monitoring results are combined into an estuary health score for the system, like a school report. Scores range from D (needs a lot of improvement) to A (a healthy system functioning well).

All Council's water quality monitoring results can be found in Aqua Data

What communities value

- Knowledge of coastal processes and systems
- Certainty about planning requirements
- Safe pedestrian access to beaches, headlands and rock platforms
- Safe boating access
- Safe vehicle access at selected locations
- Healthy coastal vegetation communities
- Views across coastal waterways
- Stable coastal landforms
- Facilities for families to enjoy the coast – as residents, long term holiday makers or occasional visitors
- Residential areas near beaches and coastal waterways
- Engagement with community groups and Council's Natural Resources and Floodplain Management Committee
- Community surveys
- Joint Council and community projects such as Bushcare

Beaches and headlands

Shoalhaven has long sandy barrier beaches, rocky beaches and rocky headlands. Wave height varies (0.5 m to 1.6 m+) with beach orientation and protection by offshore reefs. Many of the open coast beaches have one or two offshore bars and are rip dominated. The height and extent of coastal dunes is also linked to embayment orientation, wave approach and exposure to strong south easterly winds, as well as the very long term geomorphic evolution of the coast.

Coastal risk management

The Shoalhaven's coastal urban areas have been, and will continue to be, exposed to the impacts of coastal hazards. These hazards include beach erosion, shoreline recession, coastal entrance instability, sand drift, coastal inundation, storm water erosion, slope instability and climate change.

The CZMP focuses on managing risks associated with these hazards.

Managing other coastal values

The CZMP is also about protecting the resilience and functions of coastal ecosystems on a changing coastline.

Flood risk management

Council is committed to sound floodplain management in accordance with the process outlined in the NSW Government's 2005 Floodplain Development Manual. To achieve this goal, the Natural Resources and Floodplain Management Committee meet regularly to assist Council in the development and implementation of Floodplain Risk Management Plans for catchments within the City's boundaries.

Council has given priority to catchments that are at a higher risk of flooding. Flood studies and floodplain risk management studies and plans have been completed for the high priority catchments - https://www.shoalhaven.nsw.gov.au/Environment/Flood-risk Flood risks around estuaries are partly managed by entrance management strategies for coastal lakes. Entrance management Plans are updated when a review of the floodplain risk management study and plan is undertaken.

Figure 2.4 – Science and values working together in the management Shoalhaven's coast

2.3.1 Community use and access issues

Coastal ecosystems are threatened by existing uses and management as well as future coastal hazards. Impact issues can arise when the location and design of coastal access facilities conflict with different user groups, who may value the coast in different ways (Table 2.7).

Information to define these issues comes from ecological condition assessments, from asset condition assessments (particularly for access ways) and from community input about values, recreational uses, concerns and management gaps.

Table 2-7 – Summary of Community Use, Access and Coastal Ecosystem Issues

Community use, access and coastal ecosystem issues
• Balancing ecological function with other ecosystem services valued by local communities – protecting and rebuilding dunes and dune vegetation • Providing species and landscaping concepts for coastal reserves on dune and headlands • Maintaining views for residents and visitors • Managing invasive species in coastal bushland (dunes and headlands), especially near urban areas • Providing adequate beach access ways to prevent trampling of dunes but not excessive access ways that will cause wind funnelling across coastal dunes, gullying on headlands • Providing cycleways and pathways between coastal communities • Maintaining safe access ways after coastal storms or other damaging events • Providing adequate disabled access in communities with high elderly population • Providing adequate of recreation, beach amenity and tourism facilities in high profile locations • Minimise poorly located and designed signage • Monitor water quality in recreational areas and natural places • Respond to whale strandings and protecting habitat for migratory shorebirds • Comply with requirements of Jervis Bay Marine Park Authority when managing or responding to coastal risk at beaches within Jervis Bay.

2.4 Monitoring change

2.4.1 Monitoring coastal condition and coastal change

Recent LiDAR data and aerial photographs provide the baseline for coastal landform condition. Ongoing change will be measured using a combination of ground survey and new LiDAR data, allowing three dimensional changes to be calculated rapidly at the landscape scale and for local areas. High resolution spatial data can also be used to monitor changes to coastal vegetation. Targeted local area photographic and ground survey will augment LiDAR for high risk localities. For instance, photo monitoring can be used to provide a record of change at regular intervals and immediately after major storm events.

Priorities for monitoring of changes to beach profile and dune height and volume include:

- Mollymook Beach
- Narrawallee Beach
- Collingwood Beach
- Currarong Beach
- Callala Beach
- Shoalhaven Heads Beach.

Council will develop priorities for monitoring the condition of coastal ecological communities in consultation with OEH, including a sample of both dune ecological communities and headland ecological communities. The extent of invasive species in important ecological communities suggests that periodic assessment of invasive species impacts should be included in any ecological monitoring program.

Council and OEH have established a water quality and ecological health scorecard program for Shoalhaven estuaries and coastal lakes. Ongoing monitoring will improve knowledge about estuary health and how it responds to catchment and ocean events.

Currently there is a lack of understanding of the:

- Baseline ecological condition of the hazard sites and associated operational areas
- Natural benthic population variability caused by natural processes and the expected recovery dynamics
- Construction impacts and potential mitigation measures to be included
- Monitoring programs that should be deployed as an integral part of the project.

Council commissioned a report to better document these ecological values and potential impacts. In 2013 Professor Steve Smith completed the study 'Design for baseline data collection, and ongoing monitoring, to assess the impact of beach scraping and nourishment at Jervis Bay' and in 2015 Dr Nathan Knott completed the *Coastal Erosion Remediation – Environmental Baseline Study Preliminary Report* at 9 sites on Jervis Bay beaches. This first round of beach sampling provided information about the spatial patterns of the biodiversity. It also identified that changes are needed to the study design. Another sampling round is needed due to limited funding and logistical problems collecting the samples.

At intervals of 5 years, Council will report on what has been achieved in terms of implementation of the Coastal Zone Management Plan and changes to the condition of the coast.

The preparation of these review reports will be an opportunity for Council committees to review priorities for the next five -year period and to note the impact of any specific events on progress towards a healthy and safe coast.

A full review of the implementation of the Coastal Zone Management Plan (or new Coastal Management Program) will be conducted after 10 years. It is expected to contain a full review of the hazard studies, based on new climate change and sea level information and any new techniques for modelling the behaviour of beaches and dunes.

2.4.2 Triggers for changes to management strategy

Uncertainty is a significant challenge for Council in managing its open coast. A fundamental principle for coastal zone management is that the coast will change over time. It has already changed and will continue to do so, in response to processes operating at various time scales.

Our assessment of coastal risks is based on assumptions and processes established in the NSW Government policy framework. Council acknowledges that actual coastal hazards may, at specific times in the future, have a greater or lesser than projected impact on natural, cultural and built assets. Actual impacts depend on interactions between patterns of major coastal storms, medium term climate cycles and longer-term changes to climate and the rate of sea level change.

Council's proposed approach to strategic management of coastal zone risks and issues gives high priority to immediate high risks. At the same time, Council is applying a precautionary approach to longer term and less certain risks and issues. A precautionary approach prepares the community for change. It includes land use controls, dune resilience works, information sharing and involvement activities, monitoring and reporting of management outcomes.

Council will regularly review the suitability of management actions for its coastal zone and for local areas. There are several reasons why the currently proposed management approach could change over time. These include:

- Reliable sea level measurements may show that sea level is rising at a rate different from the projected rate (this changes the coastal risk by changing the likelihood of an event occurring).
- The frontal dune system may recede faster or slower than predicted, whether or not sea level and other climate change parameters have changed as projected. This would change the consequence.
- Coastal storms, sediment budget imbalances and/or recession due to sea level rise mean that the frontal dune escarpment moves closer to built assets, such as houses, sewerage and road infrastructure. For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.
- A change to NSW or Australian government policy for coastal zone risk management. Such policy reviews are expected to occur when new IPCC and/or CSIRO climate change and sea level rise data and analyses are released. These could also occur at other times if the logic underlying connections between science and policy responses is shown to be inappropriate.
- New information about the costs and benefits of defend, retreat or accommodate approaches for specific localities becomes available. This could be affected, for instance, by changes to the regulatory framework for access to sand resources, or the cost of sand resources for beach nourishment.

3. Choosing the right actions

3.1 How actions were selected

Options considered in the Coastal Zone Management Plan take into account outcomes and recommendations from several detailed studies, NSW Government agency policy and technical advice, as well as community feedback. These are listed below:

- Additional actions to respond to significant coastal risk issues (or changed priorities) which have emerged since 2009. These issues may have arisen from changes to state-wide policies, community feedback to Council, or from Council's routine monitoring of the condition of coastal assets.
- Relevant planning controls from Council's Citywide Shoalhaven Development Control Plan 2014, G6 Coastal Management Areas and the Shoalhaven Local Environmental Plan 2014.
- Options shown in tables 3-1, Risk Management Options for Existing Development and 3-2, Risk Management Options for New Development
- Our Coast Our Lifestyle community engagement program (2.2.5), which specifically tested community response to the risk options in tables 3-1 and 3-2
- Community feedback from previous public exhibitions of the CZMP and various consultants' reports e.g. Shoalhaven Coastal Hazard Mapping Review 2018
- Actions resulting from detailed studies at specific locations
- Shoalhaven Public Asset Coastal Risk Management Review (BMT WBM 2012) and the Coastal Hazards Risk Assessment (Advisian 2018)
- Initiatives and requirements from agencies which contribute to the objectives and targets of the Coastal Zone Management Plan, including NSW agency policy documents
- Council's regular monitoring of coastal assets
- Actions to better integrate the Coastal Zone Management Plan with existing estuary management plans, flood risk management plans and entrance management strategies.

3.2 Evaluating and prioritising the options

A risk assessment was used to prioritise risks from the identified coastal hazards (through staff workshops, Councillor workshops and technical studies). To identify the preferred management approaches, Council also canvassed potential management options with the community and state agencies.

The purpose of the Our Coast Our Lifestyle (OCOL) community engagement program (2016), was to

- Educate the community about the risks of coastal erosion and the coastal management options that are available to respond to that risk
- Understand community preferences for those different management options and the factors Council to consider when responding to coastal erosion risks and storm damage.

A striking outcome of OCOL, noted by the consultants, was the consistency of views expressed and concerns raised, across all engagement activities and all sectors of the community. Given there were over 1,650 participants, it provides Council with robust evidence of community views on coastal management.

Five strategic approaches to managing coastal risks are available to Council's, individually or in combination (Table 3.1 and Table 3.2). Suitable strategic approaches for mitigating coastal risks affecting

existing development are different from those suitable for making decisions about future development. Relevant OCOL outcomes regarding prioritisation are:

- Supports Council prioritising community assets and infrastructure when spending taxpayers' money on coastal management
- Expects Council to take a long-term, cost-effective approach to managing the risk of coastal erosion, based on scientific evidence and expert advice
- Except in specific circumstances, supports soft over hard protection options, in particular for dune management
- Would support other management options for existing assets if they are the most effective option in the long term
- Is strongly concerned about new development in areas known to be at risk and does not support Council approving it, especially if it will require protecting in the future

The social, environmental, economic and risk factors were all used to evaluate the options and actions within this Plan. Section 4 of this Plan further prioritises the actions for Council and its partners to manage risks in the coastal zone.

Table 3-1 – Risk Management Options for Existing Development

PROTECT	ACCOMMODATE	RETREAT	SHARE	ACCEPT
Protect Structures such as sea walls, and break-walls. Build up the sand buffer by beach nourishment, dune enhancement.	Make development more resilient to coastal risks: Lease back arrangements for less intensive or more flexible/relocatable uses. Retrofit and redesign (e.g. piered foundations or raised floor levels)	Identify and act on triggers for when buildings must be moved or abandoned. Set time frames for relocation of infrastructure.	Share insurance schemes and acquisition and land swap arrangements	Plan emergency response including reparation and action during erosion events.

Table 3-2 – Risk Management Options for New Development

AVOID	ACCOMMODATE	ACCEPT	SHARE
Prohibit specific development types in coastal risk areas. Locate new critical infrastructure outside high coastal risk areas. Require set- backs.	Make development more resilient to coastal risks: Design requirements for new development such as piered foundations and relocatable structures. Develop time limited approvals	Plan emergency response and evacuation (generally only for infill areas, not greenfields sites)	Share appropriate insurance arrangements

3.3 Strategies for the coast and actions for local areas

Actions which apply to the whole of the Shoalhaven coastline (those sections managed by Council) incorporate land use planning, emergency response management and community involvement in monitoring and reporting.

These strategies and actions provide *general* benefit for the future management of coastal risks. They are designed to:

- Prevent risk escalation

- Raise awareness of coastal zone management issues and processes
- Protect important natural coastal systems
- Establish mechanisms for continuing improvement and refinement of coastal zone management as new knowledge becomes available.

There are seven strategies for managing the whole coast (3.2.1) and six local area plans (3.2.2), as shown in Figure 3.1. The local area plans focus on proposed actions to manage coastal risks and threats relevant to each area.

The detail regarding expected costs, sources of funding and responsibility for leading the response is outlined in the implementation schedules in Section 4. Council will make implementation choices based on needs and priorities across the whole of the City's coastline. In general, work will begin on actions that reduce extreme or very high risks and for which funding is available.

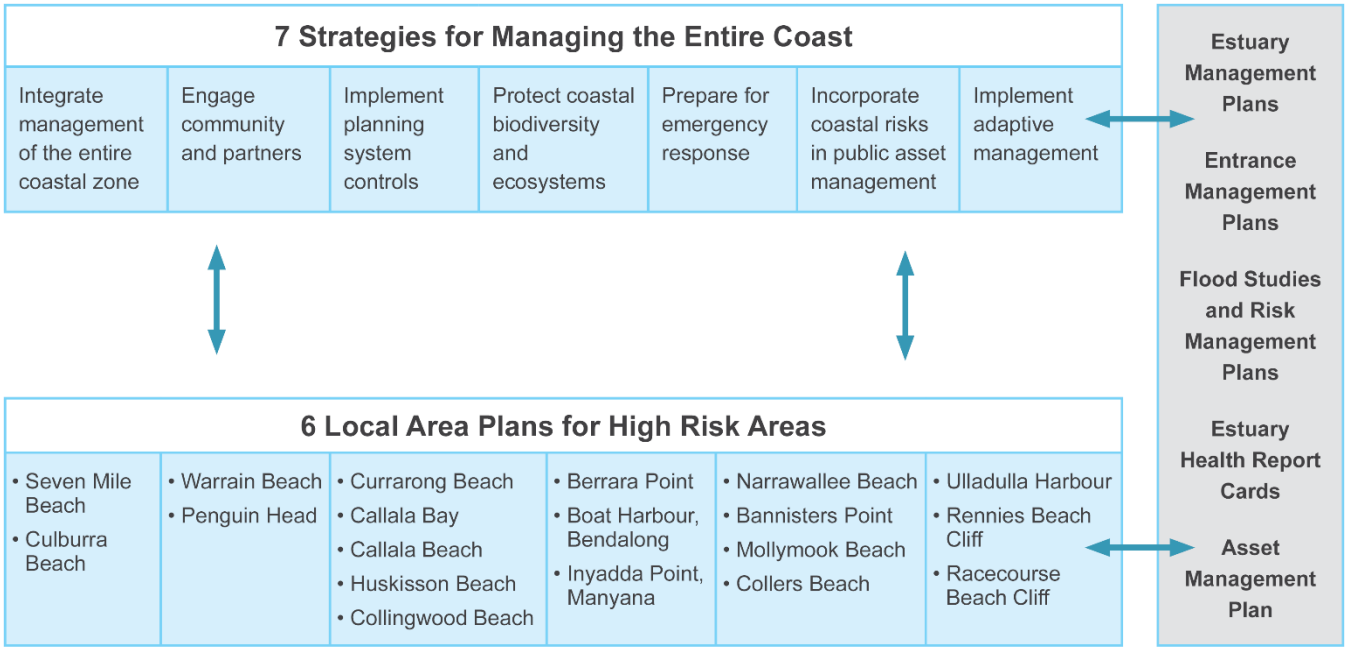


Figure 3-1 – Citywide strategies and local area plans

3.2.1 Strategies for the whole coast (Citywide)

Strategy 1: Integrate management of the entire coastal zone

Council manages a very large coastal landscape. Council embraces the concepts of integrated management of the natural values that support the wellbeing of our communities and recognise coastal hazards that could threaten local community assets now and into the future.

Strategy 1 outlines the first steps towards more complete integration of Council's coastal zone management activities.

Table 3-3 – Strategy 1 actions

Action	What is proposed	Responsibility
C1.1	In consultation with the community, identify coastal zone objectives and principles, for application in future reviews of this Plan and future coastal management programs.	Council

Action	What is proposed	Responsibility
C1.2	Present information on Council's website and in community engagement activities that shows how coastal zone systems function and how integrated management responses benefits Council's and local communities. This will include reporting on long term improvements to efficiency and to the condition of coastal zone systems.	Council
C1.3	Work with all sections of Council to improve integration of coastal zone risk management and protection.	Council
C1.4	Investigate and scope feasible, long-term funding options for effective, integrated management of the Shoalhaven coastal zone. Funding strategies will include Council rates and levies, leveraged by grant applications.	Council New funding mechanisms would require approval from the NSW Government.
C1.5	Review and update Council's Coastline Risk Management Report 2004.	Council Environmental Services
C1.6	Review and assess management coastal erosion concept designs, and other technical reports containing management options for high risk beaches to identify appropriate future actions for community consultation and progression to detailed design where appropriate.	Council Environmental Services
C1.7	Collate all monitoring actions within the Coastal Zone Management Plan, and other supporting documents, to develop an Environmental Monitoring Program (EMP), which will address matters such as dune crest height monitoring, effectiveness of sustainable tourism strategies, plastics and rubbish, water quality, encroachment or trampling from access ways and dune vegetation vandalism. The EMP will include 'citizen science' opportunities.	Council Environmental Services
C1.8	Maintain the Ecological Monitoring Program (which forms part of the EMP above) to ensure assessment of the extent of invasive species impact.	Council Environmental Services
C1.9	At intervals of five years, report on what has been achieved in terms of implementation of the Coastal Zone Management Plan.	Council Environmental Services
C1.10	Each year, review actions to ensure they are appropriate and current, and remove actions if implementation has been successful. These reviews will be reported in Council's annual report.	Council Environmental Services
C1.11	After 10 years, conduct a full review of the implementation of the Coastal Zone Management Plan (or new Coastal Management Program).	Council Environmental Services
C1.12	Maintain a full-time coastal zone coordinator position to coordinate design investigations, develop the implementation strategy (including long-term funding options) and build Council's capacity to respond.	Council Environmental Services

Strategy 2: Engage communities and partners

The community continues to be interested in protecting the natural environment while also supporting local recreation and tourism businesses. These matters are addressed in Strategy 2.

Table 3-4 – Strategy 2 actions

Action	What is proposed	Responsibility
C2.1	Prepare and deliver community information for residents at key risk beaches and other emerging priority coastal areas.	Council Environmental Services and Communications and Media

Action	What is proposed	Responsibility
	Community information could include regular updates on Council's website, social media sites, educational signage, presentations at community meetings, field days, training for Bushcare volunteers, Frontline News.	
C2.2	Engage with foreshore reserve property owners, residents and beach goers around risk, environmental, cultural and social issues such as: • The value of dune vegetation (e.g. trapping wind-blown sand and maintaining dune resilience, ecological functions and buffering against coastal hazards) • Recognising Aboriginal cultural heritage on the coast • The importance of foreshore vegetation in providing shade and wind protection, filtering runoff, improving water quality and providing habitat • Managing the interface between coastal bushland and private property, including edge impacts, encroachments, garden refuse dumping, storm water discharges, vegetation retention, fire protection zones and weed management • Illegal pruning, poisoning and removal of trees, private vehicle access and illegal structures/items which restrict public use of the reserve. Enforce regulations in high conservation value areas as a priority	Council Environmental Services and Communications and Media
C2.3	Continue to work collaboratively with National Parks and Wildlife Service staff and volunteers to implement the NSW South Coast Shorebird Recovery Program to: • Raise awareness amongst residents and visitors of migratory shorebirds which are protected under international agreements, federal and state legislation • Manage the impacts of vehicles, pest animals and dogs on beaches, especially in regard to the breeding success of migratory shorebirds	Council Environmental Services and Communications and Media
C2.4	Prepare information for landholders living adjacent to geotechnical hazards and how they can contribute to risk reduction through: • Maintaining an adequate surface drainage path into and out of the property • Draining piped storm water away from steep slopes to avoid saturation and scouring • Maintaining vegetation cover of appropriate species • Repairing leaking or broken underground drainage or sewer pipes as soon as faults are identified • Periodically inspecting the property to observe changes	Council Environmental Services and Communications and Media
C2.5	Collaborate with Council's Tourism and Visitor's Services staff to encourage sustainable tourism strategies and 'citizen science' opportunities	Council Environmental Services and Tourism
C2.6	Review relevant asset management plans and incorporate opportunities for disabled access where feasible. Investigate opportunities for disabled access at beaches and progress to detailed design where appropriate.	Council's Access Committee, Community & Recreation, relevant asset custodians, in consultation with Department of Industry – Crown Lands & Water where relevant

Strategy 3: Implement planning system controls

Council manages coastal risks for existing and future development through controls in the Shoalhaven Local Environmental Plan 2014 and Shoalhaven Development Control Plan 2014.

These planning measures:

- Avoid future risk by preventing intensification of land use in coastal risk areas, without unnecessarily sterilising the use of these lands in the short to medium term.
- Adapt to existing and future risks by requiring certain design features in new development (or retrofitted to existing development in coastal risk areas).
- Inform land holders about coastal risks that affect their property.

The planning controls will be linked to specific risks for different types of development. Triggers defined by the proximity of a storm bite erosion scarp to development can be used to specify when an existing development must be removed, relocated or redesigned to adapt to the changing coastal risk profile.

Council conducted detailed consultation about coastal risk clauses in its draft LEP in 2011 and 2013 and DCP in 2014.

Table 3-5 – Strategy 3 Actions

Action	What is proposed	Responsibility
C3.1	Update and maintain notation to section 10.7 (5) certificates for properties affected by coastal hazards consistent with NSW Government legislation.	Council
C3.2	Implement and maintain planning controls, in Shoalhaven Local Environmental Plan 2014 and Shoalhaven Development Control Plan 2014 G6 Coastal Management Areas, which require specific information and assessment for proposed development in coastal hazard areas.	Council
C3.3	Use appropriate zoning in the Shoalhaven Local Environmental Plan to protect frontal dune systems from development that reduces resilience to coastal hazards.	Council
C3.4	Make necessary amendments to the Shoalhaven Local Environmental Plan 2014 and Shoalhaven Development Control Plan 2014, including: • Council to require geotechnical assessments to support applications for landslip remediation works on private property, including confirmation that risk will be reduced to levels considered acceptable (geotechnical engineer to approve the design of the remediation measures and works) • Development consent conditions to include maintenance requirements for new developments on sloping blocks within risk areas • All risk areas to be included in the appropriate locations in the Shoalhaven Local Environmental Plan 2014 and/ or Shoalhaven Development Control Plan 2014 • Mapping in Shoalhaven Development Control Plan 2014 and SLEP 2014 (Coastal Risk Planning) to be updated to reflect the revised Coastal Hazard Mapping for beaches (Advisan, 2016)	Council

Strategy 4: Protect coastal biodiversity and ecosystems

The community highly values the coastal foreshore reserves at beaches and on headlands along the Shoalhaven coastline. These reserves provide the 'naturalness' that many people have identified as important to them. However, many of the coastal ecological communities in these reserves are threatened by pressures from adjoining land uses and by invasive species.

There are differing community perspectives about the appropriate balance between biodiversity protection and amenity enhancement in coastal reserves. Strategy 4 focuses on detailed planning and on-ground actions to protect biodiversity and reduce the encroachment of the urban footprint into natural areas.

Reserves on coastal dunes and headlands are affected by a number of invasive plants. Council has weed control programs on public reserves, provides resources and encourages local community involvement.

Table 3-6 – Strategy 4 actions

Action	What is proposed	Responsibility
C4.1	Update the Coastal Asset Management Plan to include a beach access strategy that includes a methodology for rationalisation of beach accesses based on environmental, social and economic risks	Council Environmental Services
C4.2	Review and update plans of management and the Foreshore Reserves Policy 2005 to ensure consistency with the Coastal Zone Management Plan	Council

Action	What is proposed	Responsibility
C4.3	Maintain and enhance ecological communities in coastal reserves (including dunes), considering appropriate ecological strategies for urban (foreshore recreation reserve) and non-urban areas	Council Environmental Services
C4.4	Wherever possible, use zoning and planning controls in Shoalhaven Development Control Plan 2014 to maintain open spaces where coastal dunes and associated habitats can roll landward in response to climate change and sea level rise. On the open coast, this management action is linked to planning for vegetated foreshore reserves on coastal dunes.	Council Environmental Services and Strategy Planning
C4.5	Support bush regeneration programs in coastal reserves	Council Environmental Services
C4.6	Incorporate measures to protect Aboriginal cultural heritage. This will include appropriate Aboriginal cultural heritage due diligence assessments for all coastal works **Where actions are proposed on Crown land, Aboriginal Land Claims lodged under the NSW Aboriginal Land Rights Act 1983 must be considered. Any works will need to be compliant with the *Commonwealth Native Title Act 1993*.**	Council's Aboriginal community liaison officer and Environmental Services. Works and Services - for new structures or facilities in reserves

Strategy 5: Prepare for emergency response

For some existing development in coastal risk areas, Council and the relevant local communities have chosen to accept coastal erosion risk in the short term and manage impacts as they occur during or after coastal storm events. This was particularly relevant to localities that were recognised as coastal hotspots or authorised locations under the *Coastal Protection Act 1979*.

The Coastal Management Act 2016 does not include authorised locations but identifies coastal hotspots. There are currently no identified hotspots in Shoalhaven.

The following beaches were recognised as authorised locations under the Coastal Protection Act,

- Part of Mollymook Beach
- Part of Collingwood Beach
- Part of Callala Beach.

An Emergency Action Sub Plan was prepared for these beaches in 2011 (Appendix 4) as well as for Culburra Beach, Currarong Beach, Narrawallee Beach and beaches where Surf Lifesaving Club buildings are located. The Plan was updated in 2018. It explains the actions that may be taken by Council before and after a storm.

Table 3-7 – Strategy 5 actions

Action	What is proposed	Responsibility
C5.1	Activate emergency action sub-plans as required	Council Environmental Services and Asset Management
C5.2	Prepare and implement Nature Assisted Beach Enhancement (beach scraping) plans for all Council managed beaches to support the emergency action sub-plans.	Council Environmental Services
C5.3	As part of any beach scraping activities, establish a monitoring program to continue investigations of baseline ecological condition or diversity for affected beaches. The monitoring program will be established in consultation with DPI Fisheries.	Council Environmental Services

Beach access management

Managing beach access is an important component of coastal management. It requires a balance between meeting community needs and protecting dune values which in turn protects the public and private assets behind the dunes.

Beach access ways:

- Segment vegetation and therefore impact on habitat and ecosystem health
- Reduce dune resilience to storm erosion by allowing pathways for wave runup during storms
- Allow a wind funneling effect that can result in the loss of sand from beaches, reducing dune resilience.

Currently, Council maintains 220 beach accesses. These accesses are spread over the 40 beach compartments managed by Council.

Many coastal access ways were inherited from the NSW Government's Beach Improvement Program in the 1980s and 1990s following the extreme storms of the 1970s. As part of this program beaches were re-formed, dune fencing was constructed to protect dune plantings and fenced beach access ways were created through the replanted dunes. Much of this fencing has been removed, as it has reached the end of its life, and/or vegetation growth has successfully taken on the role of keeping people 'on track'.

In addition to these formalised beach access ways, many more tracks have emerged over time, as informal 'desire lines' and have gradually become part of the maintained asset base.

Council considers that access to Council managed beaches is adequate and, in many places, more than adequate.

Due to the incremental accumulation of beach access ways, some beaches have too many accesses and, for the reasons outlined above, are compromising dune resilience. An excess of access ways is also an unnecessary drain on Council's coastal maintenance budget. However, maintaining adequate public access to beaches is a key priority of this Plan and this is reflected in the actions.

Many beach accesses are closed post storm, to manage public risk (consistent with the Emergency Action Sub Plan in Appendix 4). Some of these accesses will then be permanently decommissioned, following discussion with communities and there is sufficient alternative access. At other times, access may be closed because vegetation maintenance is withdrawn to maintain dune resilience and there is sufficient alternative access.

Rationalisation of beach access ways has resulted in a net reduction of 15 since 2015.

Beach access ways are listed in Council's asset register, together with other coastal assets, and shown on Council's GIS mapping system. They will be also included in the updated Asset Management Plan when it is reviewed and adopted by Council in 2019.

A Nature Assisted Beach Enhancement (NABE), also known as beach scraping, plan will be prepared (Action 5.2) to provide guidance for post storm beach repair for the 40 beaches managed by Council and has also been included in the Emergency Action Subplan for Beaches in Appendix 4. This plan will support the Emergency Action Sub Plan.

Depending on the direction of the storm, and with reference to the plan, beach scraping will be implemented at the relevant beaches. Post storm, and following beach scraping, most beach accesses can be re-opened for safe public use.

Table 3.8 below Lists all coastal assets, including access ways, together with potential risks at each location.

Table 3-8 – Coastal assets and risk rating

Beach / foreshore area	Coastal assets	Potential risks
Shoalhaven Heads	7 beach accesses 1 lookout 2 service vehicle accesses	erosion accretion (vehicle access at SLC) inundation
Culburra Beach/Penguin Head	19 beach accesses 2 lookouts (beach) 3 lookouts (Penguin Head)	erosion inundation slope instability (Penguin Head)
Warrain Beach	10 beach accesses 3 lookouts 1 service vehicle access	erosion inundation
Currarong Beach & Abrahams Bosom Beach	5 beach access ways 1 tractor access (Currarong) 1 beach access (Abrahams Bosom)	erosion inundation accretion (at Peel St)
Callala Bay – beach and cliffs	9 beach accesses	erosion inundation
Callala Beach	18 beach accesses 2 lookouts	erosion inundation
Huskisson urban area, includes Shark Net Beach and Huskisson Beach	14 beach accesses 3 lookouts	erosion inundation
Collingwood Beach	14 beach accesses	erosion inundation
Vincentia south, includes Orion, Barfler, Nelsons and Blenheim Beaches	12 beach accesses 1 lookout 1 service vehicle access	erosion inundation
Hyams Beach	2 beach accesses 1 lookout	erosion inundation
Cudmirrah Beach	2 beach accesses 1 service vehicle access 1 lookout	erosion inundation
Cudmirrah / Berrara foreshore, includes Kirby Beach	9 beach accesses 5 lookouts 1 service vehicle access	erosion inundation
Manyana Foreshore, includes Inyadda (south) Beach, Inyadda Point and Manyana Beach (to Cunjurong Pt)	8 beach accesses 2 lookouts	erosion inundation
Conjola coast	3 beach accesses 1 boardwalk 1 lookout	erosion inundation
Narrawallee Beach Jones Beach (north side of Bannister Point)	11 beach accesses 1 beach access at Jones Beach	erosion inundation
Mollymook Beach	12 beach accesses 2 service vehicle accesses 2 creek training walls, foreshore protection structures (south Mollymook)	erosion, inundation
Bogey Hole/Collers Beach	4 beach accesses	erosion, inundation
Ulladulla Harbour	2 beach accesses Foreshore protection structure	erosion, inundation
Rennies Beach/The Bombie	5 beach accesses 4 lookouts	erosion, inundation
Burrill Beach/Dolphin Point	7 beach accesses 1 lookout	erosion, inundation
Wairo Beach	5 beach accesses 2 lookouts 1 service vehicle access	erosion, inundation
Bawley Point shoreline, includes Bawley, Cormorant & Gannet beaches.	20 beach accesses 3 lookouts 2 service vehicle accesses	erosion, inundation
Racecourse (1 beach access on an easement), Shelly (1 beach access on an easement), Kioloa (south end) Beaches.	6 beach accesses 1 lookout 1 service vehicle access Shoreline protection structures at Kioloa boat ramp.	erosion, inundation

Strategy 6: Incorporate coastal risk in public asset management

Council manages roads, water and sewerage infrastructure on behalf of its communities. Council also supports local community recreational and socio-economic activities by providing community buildings, surf clubs, pathways, parks and reserves. Many of these community assets are within coastal hazard areas.

Strategy 6 outlines how Council will manage these assets.

Table 3-9 – Strategy 6 actions

Action	What is proposed	Responsibility
C6.1	Review and update all asset management plans (AMPs), relevant to the coastal zone. AMPs by asset type will be updated by relevant asset custodian. Include an asset management approach to provide for replacement, relocation or retrofitting of public assets that are currently in coastal risk areas including surf clubs and sewer, water and sewerage infrastructure, foreshore protection infrastructure, roads and access paths. Align the asset management plans with emergency action sub-plans	Council Asset Management and relevant asset custodians, in consultation with DoI – Crown Lands & Water where relevant
C6.2	Implement high priority recommendations from the Coastal Erosion Stormwater Impact Assessment (Footprint Sustainable Engineering, 2015)	Council Asset & Works
C6.3	Review the coastal cliff and slopes hazard lines and extent of risk areas, to be informed by the on-going geotechnical assessment of foreshore sites undertaken to date.	Council Environmental Services
C6.4	Incorporate monitoring of public land and infrastructure, including viewing platforms, stormwater drainage, sewer and water infrastructure in identified coastal cliffs and slopes risk areas, to ascertain any leaks or requirements for repair, into Council's maintenance programs. Relocate viewing platforms where necessary.	Council Environmental Services
C6.5	Undertake a hydraulic assessment to assess stormwater drainage adjacent to or within identified coastal cliffs and slopes risk areas	Council Environmental Services

Strategy 7: Implement adaptive management procedures

Understanding how coastal systems respond to storms, medium term weather patterns and long term climate change is an evolving process. Actual timeframes and scales of coastal change are uncertain.

To ensure that coastal risk management actions continue to use the best available science and implement best practice coastal management, Council will track implementation progress and outcomes within an adaptive framework. Council will also work with partner organisations to address current knowledge limitations about coastal processes, hazards and risks, particularly in response to climate change and sea level rise. These studies will provide greater certainty for planners and communities.

Table 3-10 – Strategy 7 actions

Action	What is proposed	Responsibility
C7.1	Establish coastal monitoring program to collect baseline condition data for post storm beach erosion, king tide monitoring and entrance condition (e.g. use LiDAR data for beaches and dunes, when available from the NSW Government, to analyse change to coastal landforms and vegetation). Utilise 'citizen scientists' where applicable.	Council Environmental Services team. Support from OEH
C7.2	Carry out surveys to ground-truth and map the distribution and condition of EECs in coastal erosion risk areas using the Biodiversity Conservation Act, Biodiversity Assessment Methodology.	Council Environmental Services

Action	What is proposed	Responsibility
C7.3	Continue to collaborate with universities, government agencies and others in research that focuses on: • Climate change impacts on coastal processes and coastal landforms, including new data on sea level rise, storm behaviour, sediment transport processes and coastal recession modelling • Impact of sea level rise on rock platform communities • Coastal lake entrance behaviour (sediment budget, morphology, opening and closing regimes) with sea level rise and other aspects of climate change and climate variability • Ecological services and functions of dune species and most effective vegetation structure to enhance dune resilience • Monitoring the impacts of erosion remediation works at Currarong Beach • Assessing and monitoring the impacts of NABE works at all beaches where it's implemented	Council Environmental Services
C7.4	Continue the role of the Council's Natural Resources & Floodplain Management Committee in implementing the Coastal Zone Management Plan. In particular the Committee will be involved in reviewing and evaluating progress and outcomes from implementing the Coastal Zone Management Plan.	Council Environmental Services

Note: Additional Information for Actions C7.1 is available in section 2.4.

3.2.2 Local area plans

Six local area plans are tailored to the coastal risks and issues of concern for areas made up of small communities along the Shoalhaven coast.

The six areas align with Council's community engagement framework and are based on areas of similar physical and social coastal character, such as:

- Coastal embayments and sediment compartments, bounded by major headlands
- Similar types of settlements
- Land use and land tenure (e.g. areas dominated by national park lands or by tourism and recreation uses)
- General locality and access.

3.2.2.1 Plans and actions to care for local areas

Each local area plan provides a brief introduction to the character of the area and the priority local issues. These issues are derived from the coastal erosion risks, coastal slope instability risks and community input on other important matters. Coastal hazard maps are provided for each area.

The six local area plans give more detail about how the whole of coast strategies (Strategies 1 to 7) will be implemented at the local scale. They show how different aspects of coastal zone management fit together for each local area along the coast.

The implementation priority for actions is shown is Section 4.

For each of the local areas, the following general information applies regarding Aboriginal cultural heritage, bushcare and land management arrangements in coastal reserves.

3.2.2.2 Aboriginal cultural heritage

Aboriginal people have used the rich resources of the South Coast for more than 20,000 years and this long association continues today. Therefore, much of the coastline has the potential to contain important Aboriginal cultural heritage items.

Council uses the NSW Aboriginal Heritage Impact Management System (AHIMS) database through its internal GIS system to assist staff with the identification of known sites. Council follows the NSW Due Diligence Code of Practice for the Protection of Aboriginal Objects when carrying out activities that may harm Aboriginal objects.

Council also works closely with NSW Office of Environment and Heritage to protect Aboriginal objects. Through an Aboriginal Heritage Impact Permit (AHIP) Council applies for consent to undertake works that may harm Aboriginal objects across the coastal landscape. Information from the cultural heritage reports (included in the AHIP applications), together with other local knowledge, is provided in the introduction to each Local Area Plan.

3.2.2.3 Bushcare

Bushcare Groups supported by Council operate at most beaches with an urban interface. Activities generally focus on ecological restoration on dunes and in coastal reserves. Bushcare groups are valuable partners for ecosystem management in coastal areas where active groups exist.

3.2.2.4 Land management arrangements in coastal reserves

The total area of coastal reserves (excluding national parks and state forests) in the Shoalhaven local government area (LGA) is approximately 2,085 ha.

Figure 3.2 below shows the breakdown of tenure and management of these reserves.

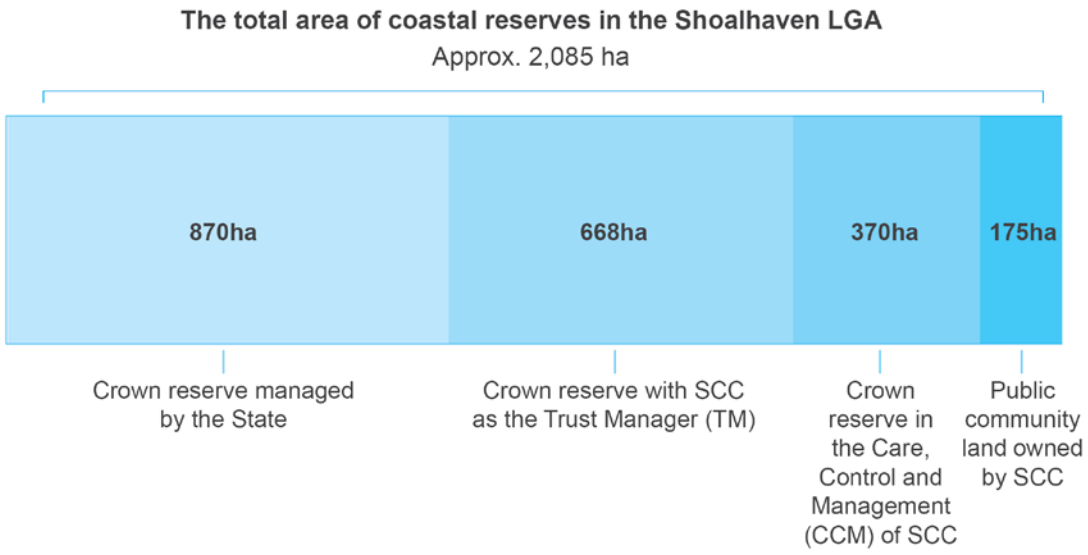


Figure 3-2 – Coastal reserve land tenure/management arrangements

The Crown Land Management Act 2016 will come into force on Sunday 1 July 2018. From the commencement of the new Act, Council will be automatically appointed as Crown land manager for all reserves which they are currently the appointed reserve trust manager. The Act authorises councils to manage this Crown land as if it were public land under the Local Government Act 1993 (LG Act) with the default classification of community land.

It will be important that council prepares plans of management under the LG Act for coastal Crown land that it manages, and that these plans align with relevant strategies and actions in this CZMP.

Depending on the management arrangements in place for coastal Crown land affected by the actions set out in this CZMP, Council may need to consult with and seek approval from the Department of Industry – Lands & Water (Crown Lands), to carry out activities and works on this land, for example to construct foreshore coastal protection works, dredging and beach nourishment, beach scraping activities. Approvals

will be subject to a range of considerations including potential impacts on the environment and coastal processes, beach amenity and access.

Where actions are proposed on Crown land, Aboriginal Land Claims lodged under the NSW Aboriginal Land Rights Act 1983 must be considered. In addition, any works will need to be compliant with the Commonwealth Native Title Act 1993.

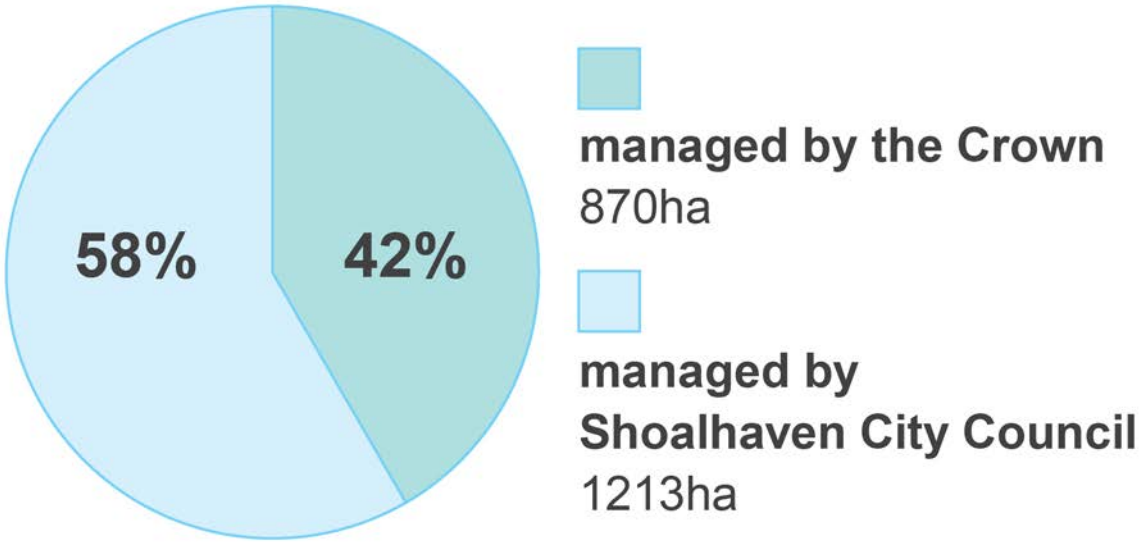


Figure 3-3 – Management responsibility of coastal reserves

Generally, Crown land identified as 'local land' will be transferred to Council, as community land. The proportion of Crown land that Council manages is therefore likely to change.

The other major change will allow Council to apply the *Local Government Act* to locally significant Crown land. The requirement to develop plans of management for each reserve will be phased in over time.

Council consults with, and seeks approval from, the Department of Industry to carry out activities such as foreshore protection works on Crown reserves still managed by the NSW Government.

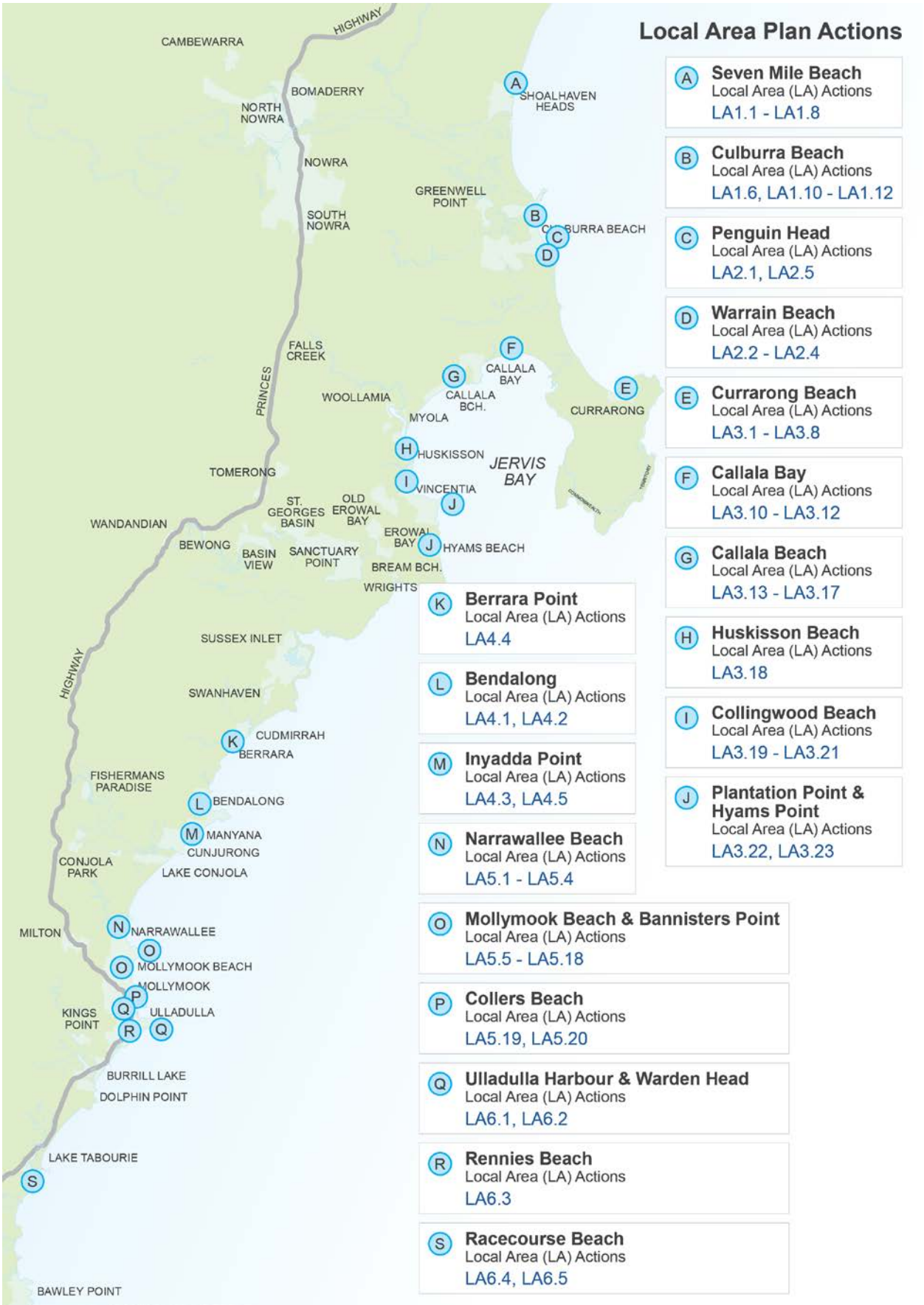


Figure 3-4 - Local Area Plan Actions

Local Area Plan 1: Seven Mile Beach and Culburra Beach

This area includes the long barrier beaches to the north and south of the mouth of the Shoalhaven River estuary. Settlements are separated by national park and nature reserve.

Shoalhaven Heads is a small coastal town on the northern side of the Shoalhaven River entrance. There is a large tourist park, located near the surf club and patrolled beach area. South of the Crookhaven River, Culburra, has access to two long ocean beaches; Culburra Beach and Warrain Beach (see Local Plan Area 2 for Warrain Beach).

Identified Aboriginal cultural heritage values in this area focus mainly on Crookhaven Headland. It was, and continues to be, a focal point for traditional cultural activities. The Jerrinja Aboriginal people have continued to live in the area adjacent to the headland at 'Roseby Park' (formerly an Aboriginal reserve). This is also the location of the Jerrinja Local Aboriginal Land Council office.

An Aboriginal Cultural Heritage Report (1998), prepared for the Crookhaven Headland Plan of Management, notes that the area 'has been the subject of archaeological inspection and recording since the early 1970s .. providing insight into the cultural significance and values attached to the area.' The Aboriginal Site Register records several of these: a natural ceremonial King's Chair, natural water holes, ceremonial artefacts, shell middens (one with quartz flakes), a tribal burial and a traditional swimming hole. While most of these items are representative of coastal archaeological sites, the ceremonial artefacts site (concealed) is very rare and the King's Chair is unique.

Key issues

Figures 3.5 and 3.6 show coastal hazards for these localities.

Shoalhaven Heads

Community infrastructure (SLSC, SLSC car park, boatshed, viewing platform) is at ***high*** risk rating in 2050.

SLSC is at ***extreme*** risk rating in 2100.

River and oceanic flooding of low lying residential areas.

Threats to shore bird habitat from recreational use.

Spacing of access tracks and general compatibility of diverse beach uses.

Culburra (Culburra Beach)

Large car park and access loop road is at ***high*** risk rating in 2050.

Other issues and risks

More than 30 lots could be affected by coastal erosion in the 2050 planning period.

Other community infrastructure (including car parks) and wastewater infrastructure is at low/ medium risk in 2050 planning period.

Shoalhaven Heads SLSC 1978 Storm

Culburra Beach

Table 3-11 – Local Area Plan 1 Actions - Seven Mile Beach, Culburra Beach

Strategic risk management

Accommodate coastal change (short term), moving to managed retreat. Shoalhaven Heads Surf Club is already protected by rock revetment which changes the likelihood of coastal hazard impacts.

Triggers for change

- Asset life of Shoalhaven Heads Surf Club
- Asset life of sewerage and water infrastructure
- Cost benefit of ongoing rock protection at Shoalhaven Heads Surf Club and capacity to mitigate offsite impacts.

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
Seven Mile Beach			
LA1.1	Assess the condition of the rock revetment in front of the Shoalhaven Heads Surf Club if and when it's exposed during a major storm. The revetment was designed and constructed following the 1970s storms	Council Asset Management and Environmental Services	
LA1.2	Audit site constraints and foundation capacity for the Shoalhaven Heads surf club, to inform decisions about the timing of relocation	Council Asset Management	
LA1.3	Investigate zoning, land tenure and approval processes for relocation of the Shoalhaven Heads Surf Club landward of its current position, outside the 2050 coastal erosion risk area. The move will be triggered by the asset life of the existing building, or significant storm damage to the building, and the cost compared to the benefit of maintaining the existing rock protection. This surf club was seaward of the dune alignment after the 1974 storms.	Council Asset Management in consultation with DoI – Crown Lands & Water	
LA1.4	Depending on outcome of LA1.3, at end of building asset life or in the event of significant storm damage, relocate surf club landward and construct on deep piled foundations.	Council Asset Management in consultation with DoI – Crown Lands & Water	
LA1.5	Prepare a dune action plan to manage the dune height and beach access in front of the Shoalhaven Heads SLSC. Lower dune if needed for safety.	Council Environmental Services	Initial dune lowering, conducted in December 2017.
LA1.6	Maintain dune vegetation at both Shoalhaven Heads and Culburra to promote dune stability and minimise loss of sand from the littoral systems that would contribute to long term recession of the beach.	Council Environmental Services	Beach surveys are undertaken by Council following significant storm events.
LA1.7	Develop a design for reuse of excavated 'dry notch' (flood notch) sand, and other suitable sand, at the river entrance for: • Erosion sites fronting River Road • Low dune crest locations • The northern side of the entrance area, to increase the volume of the beach and dunes, and provide interim protection from large southerly waves during storms. **Note that dredging and nourishment works will require approvals under the Crown Lands Act**	In consultation with relevant public authorities including, OEH, DoI – Crown Lands & Water	The River Road Foreshore - Assessment of Coastal Management Options, was prepared following the June 2016 storm and will be implemented during 2018/19.

	1989 or Crown Land Management Act 2016 which commences 1 July 2018.		
LA1.8	Repair and replace or relocate the beach access infrastructure, including viewing platforms, if and when required following a large storm. Consider designing and installing a beach access and viewing platform for people with disabilities where possible as part of future upgrades or replacement where feasible.	Council Environmental Services	
Culburra Beach			
LA1.9	Engage with foreshore reserve property owners, residents and beach goers around the values of dune vegetation (e.g. trapping wind-blown sand and maintaining dune resilience, ecological functions and buffering against coastal hazards, the importance of foreshore vegetation in providing shade and wind protection, filtering runoff, improving water quality and providing habitat).	Council Environmental Services	
LA1.10	Consult with residents along Culburra Beach about reducing the frequency of pedestrian access ways from private dwellings across the dunes. The aim is to reduce pressures on dune vegetation and to enhance the resilience of dune landforms.	Council Environmental Services	

Figure 3-5 - Coastal Hazard Map Seven Mile Beach

Figure 3-6 - Coastal Hazard Map Culburra Beach

Local Area Plan 2: Warrain Beach and Penguin Head

Warrain Beach is a long sandy embayment stretching south from Penguin Head to Beecroft Head and includes the entrance to Lake Wollumboola. Lake Wollumboola is managed by Jervis Bay National Park. The lake and beach are important habitat for migratory shorebirds in the summer months. The local community has strongly supported conservation management of the lake and local beaches to protect natural values and low-key recreation opportunities.

The Nowra Culburra Surf Club is located at the northern end of Warrain Beach.

Identified Aboriginal cultural heritage in this area of the coast consists mainly of middens (17), indicating important food sources for the Jerrinja people. AHIMS also identifies a well or waterhole, many artefacts and a burial site in the dunes at the northern end of Lake Wollumboola.

Aboriginal people camped at Kinghorn Point and around Lake Wollumboola. Kinghorn Point is the subject of an AHIP due to the presence of a shell midden which is being disturbed by vehicle traffic. The road has recently been re-routed (2017) and the area of the carpark reduced. Once the AHIP is completed, repairs to the beach access and dune face will be undertaken. Due the large number of recorded sites, and its proximity to Roseby Park, this coastal area is of high social and cultural value for Aboriginal people.

Key issues

Figures 3.7 and 3.8 show coastal hazards for these localities.

Warrain Beach

Nowra Culburra (Warrain Beach) Surf Club is at ***high*** risk rating in 2050.

Warrain Beach car park and sewerage infrastructure are within the 2050 coastal erosion risk area (low risk rating). .

Shorebird nesting sites near Lake Wollumboola are affected by high tides, wave events and predators.

Nowra Culburra Surf Club – Warrain Beach

Penguin Head

Few properties will be affected in the immediate timeframe. However, risk to cliff properties will increase through time (rotational slumping hazards).

There are also concerns about the interaction of vegetation management on headlands and bluffs, and slope instability.

Penguin Head

Table 3-12 – Local Area Plan 2 Actions - Warrain Beach, Penguin Head

Strategic risk management

Accommodate coastal risks (short term, existing development), moving to managed retreat as coastal recession becomes more apparent. Avoid risk for new development.

Triggers for change

- Asset life of Nowra Culburra (Warrain Beach) Surf Club, car park, public roads and gravity mains

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
LA2.1	At Penguin Head, implement emergency response actions in the Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.1 to manage risk to safety and assets.	Council Environmental Services, Assets & Works	
LA2.2	Audit site constraints and foundation capacity at Nowra Culburra Surf Club to inform decisions about future relocation or reconstruction on deep-piled foundations.	Council Asset Management	
LA2.3	Investigate zoning, land tenure and approval processes for relocation of the Nowra Culburra Surf Club landward of its current position, outside the 2050 coastal erosion risk area. The move will be triggered by the asset life of the existing building or significant storm damage to the building.	Council Assets & Works in consultation with DoI – Crown Lands & Water	
LA2.4	Investigate opportunities for disabled access to the beach at Nowra Culburra Surf Club. Note: Beach wheelchairs are available, free of charge at several locations.	Council Environmental Services and Community & Recreation	Council Disability Inclusion Action Plan 2017, Actions A2.4.6 & 7, refer to improving access to beaches and calm water sites
LA2.5	Undertake a geotechnical assessment to assess the impact of potential cliff and slope instability to provide suitable and site specific Landslide Remediation Management recommendations for the lookout at Penguin Head or consider relocation of this assets where feasible.	Council Environmental Services	

Figure 3-7 - Coastal Hazard Map Warrain Beach

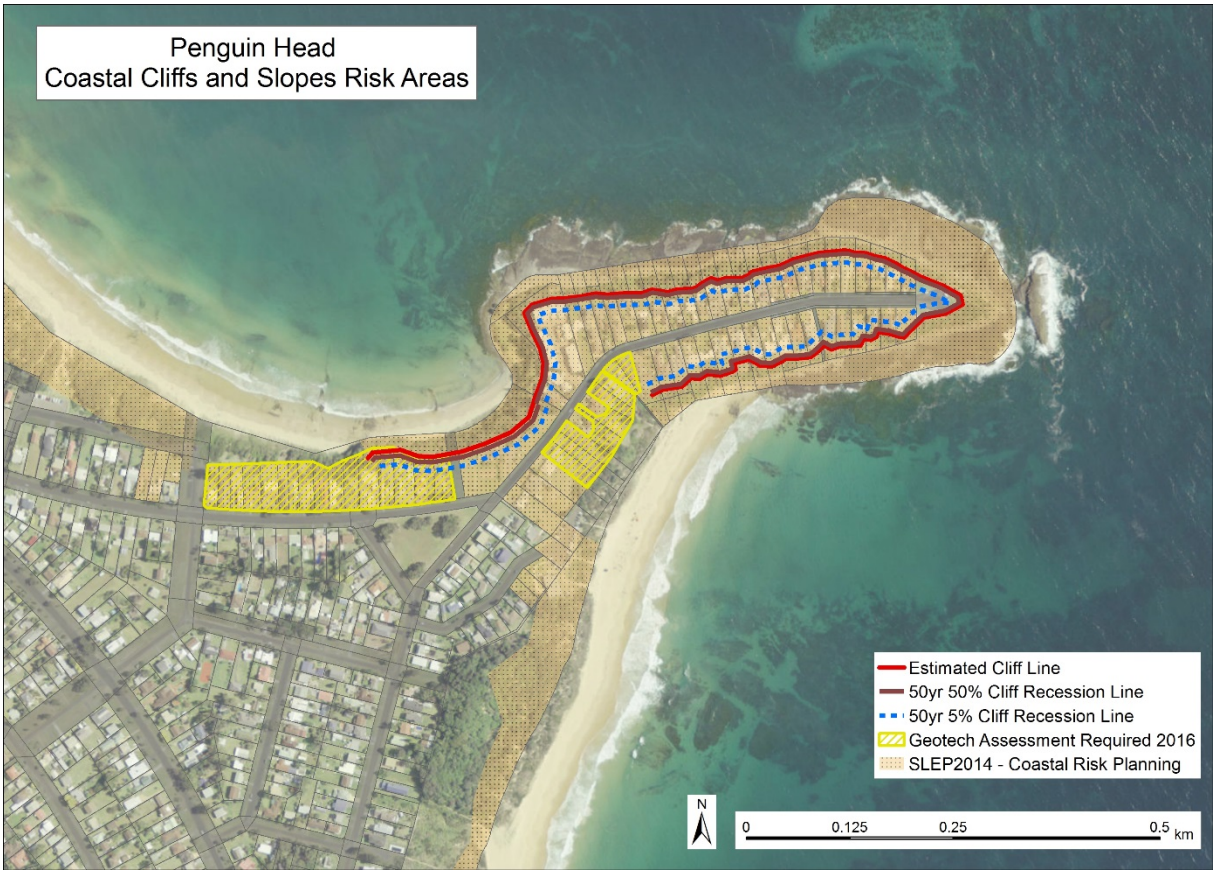


Figure 3-8 - Coastal Cliffs and Slopes Risk Areas Penguin Head

Local Area Plan 3: Jervis Bay Marine Park (JBMP) Area

The Jervis Bay Marine Park area includes the larger centres of Huskisson and Vincentia and the smaller villages of Currarong, Callala Bay, Callala Beach and Hyams Beach. The villages are separated by National Park. The white sands of Jervis Bay, the low wave energy and low gradient beaches are a major attraction for visitors. Both residents and visitors also value foreshore access ways for walking and cycling.

Depending on the direction of the storm, different beaches are impacted. Callala Beach, which faces east, was more exposed to erosion in the 1974 storm. Currarong Beach, which faces north, was more heavily impacted during the June 2016 storm.

The ACHAR prepared for the shared path project on the Callala Bay headland states, 'The wider area is known to contain many archaeological sites and is part of an Aboriginal traditional cultural landscape.' There are middens at Callala Point and on the northern bank of Callala Creek and another large midden of mud oyster was found on the southern side of the headland during investigations for the shared path AHIP.

Another significant midden was exposed at Currarong Beach during the June 2016 ECL.

Key issues

Figures 3.9 to 3.14 show coastal hazards for these localities.

Currarong

Currarong has experienced beach erosion during severe storms over many years.

The June 2016 storm caused severe erosion and all beach access stairs were destroyed.

The eastern end of the beach is at immediate risk, including water infrastructure, community infrastructure, private buildings and several lots.

Community infrastructure (car park, amenities, playground, roads) and water infrastructure is at ***high*** risk rating in 2050.

Council's caravan park and properties on Currarong Creek are potentially affected by flooding.

Currarong - erosion post storm June 2016

Callala Bay

A low gradient beach, susceptible to erosion at high tides, with slow recovery.

Access ways and the reserve edge are intermittently undermined.

A coastal hazard study was undertaken in 2003 for Callala Bay. It concluded the boat ramp, constructed in the 1970s interrupted natural sand migration which accelerated erosion on the northern side of the ramp. The new ramp, built in 2000, partially addressed this with a permeable structure and erosion rates have slowed.

No private property will be at risk in the 50 year planning period.

Callala Bay - erosion post storm 2005

Callala Beach

Sixteen residences are within the immediate coastal erosion risk area (ZSA). Every private property along the seaward side of Quay Rd is partially within the immediate hazard area (ZRFC).

Community infrastructure at immediate risk are the community centre, tennis club and tennis courts.

Callala Beach

Community infrastructure (tennis club and amenities) is at ***high*** risk rating in 2050.

Collingwood Beach

Community infrastructure (car park, picnic shelter, cycleway) and roads (Ilfracombe Ave/ Beach St) are at ***high*** risk rating in 2050.

Ninety lots are potentially affected by coastal recession (ZRFC) by 2100.

Collingwood Beach

Huskisson Beach

Community infrastructure (including picnic shelters and a cycleway) have been identified as being in the erosion hazard area at Huskisson Beach.

There are no private properties at risk from coastal erosion at Huskisson Beach.

Huskisson

Plantation Point and Hyams Point

At Plantation Point the public reserve and Plantation Point Parade are impacted by cliff recession lines.

Plantation Point

Hyams Point

Table 3-13 – Local Area Plan 3 Actions - Currarong Beach

Strategic risk management

Accommodate change by protecting healthy natural systems and building community capacity, with preparation for long-term managed retreat of community infrastructure and assets and planning controls to prevent increases in risk. In the short to medium term, accommodate change by building community capacity and by targeted land management, combined with planning controls to avoid future risk. For Currarong, this includes immediately trialling limited coastal protection works.

Triggers for change

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
Currarong Beach			
LA3.1	Undertake technical studies to investigate the feasibility of medium term, to long term, relocation of water and road infrastructure along the eastern end of Warrain Crescent to the landward boundary of housing lots – currently these assets are on the seaward boundary. Similarly, where sewerage infrastructure is provided, investigate feasibility of locating it to a more landward position.	Council Asset Management and Shoalhaven Water	
LA3.2	Undertake a detailed, technical investigation of coastal hazard management options for Currarong Beach that are feasible for this location, cognisant of coastal processes and risks (over defined timeframes), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy in consultation with key stakeholders including DoI Crown Lands. Currarong Beach is a receding beach (Advisian 2016) and, following the June 2016 ECL, the beach was left vulnerable with a major erosion scarp and 20,000m^3 of sand lost. It became clear that beach erosion remediation measures, investigated in 2011 (SMEC) needed to be reassessed. This is to reduce risks to erosion of the dune, the beach and public access to it, public reserve, the road (Warrain Cres), water and sewage infrastructure. Prepare asset management plan for any erosion and remediation works to ensure ongoing maintenance as required, monitoring program to determine efficacy of works and management of any impacts.	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP (for necessary approvals and permits)	Draft technical design report and REF for the trial groyne, beach nourishment and beach access works, are complete. The REF includes arrangements for monitoring, maintenance and managing impacts associated with the works, during the 5 year trial. Approvals and feedback being sought from NSW Government. All design, reports and works are subject to an Aboriginal Heritage Impact Assessment and Permit and ongoing community consultation. Works subject to community consultation, obtaining necessary approvals and budget availability.
LA3.3	Undertake a detailed, technical investigation of coastal hazard management options for shoreline in front of Beecroft Parade, that are feasible for this location, cognisant of coastal processes and risks (over defined time frames), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	The report above includes a design option for protection works at Beecroft Parade. Draft technical design report and REF are complete. The REF includes arrangements for monitoring, maintenance and managing impacts associated

	in consultation with key stakeholders including DoI Crown Lands. Currarong coast faces north, erosion impacts were severe as a result of the June 2016 storm, including the shoreline in front of Beecroft Parade. Any erosion and remediation works will include an asset management plan to ensure ongoing maintenance as required and management of any impacts.		with the works. Approvals and feedback being sought from NSW Government. All design, reports and works are subject to an Aboriginal Heritage Impact Assessment and Permit and ongoing community consultation. Works subject to community consultation, obtaining necessary approvals and budget availability
LA3.4	Undertake a cost benefit analysis, if required, for the erosion protection works in LA3.2 and LA3.3 above	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	
LA3.5	Undertake ongoing regular foreshore profile surveys to inform refinement of erosion/ long term recession hazard for Beecroft Parade area.	Council Environmental Services	Monitoring will begin following completion of works
LA3.6	Monitor dune crest and profile. Manage dune heights with beach scraping and dune nourishment, if sand source is available Note that beach scraping and nourishment works may require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	Beach surveys are undertaken by Council following significant storm events
LA3.7	Construct two beach accesses between Warrain Crescent and Peel Street. This will provide Currarong Beach with five reconstructed beach accesses, all of which were destroyed in the June 2016 storm.	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	Works subject to community consultation, obtaining necessary approvals and budget availability
LA3.8	Re-route the Peel Street beach access to address sand loss from beach. Fence and revegetate the nourished dune and beach accesses that have been closed to stabilise the dune	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	Works subject to community consultation, obtaining necessary approvals and budget availability. Fencing and revegetation works will be undertaken following completion of the erosion remediation works.
LA3.1, LA3.2, LA3.3, LA3.7 and LA3.8	Location of proposed actions LA3.1, LA3.2, LA3.3, LA3.7 and LA3.8		

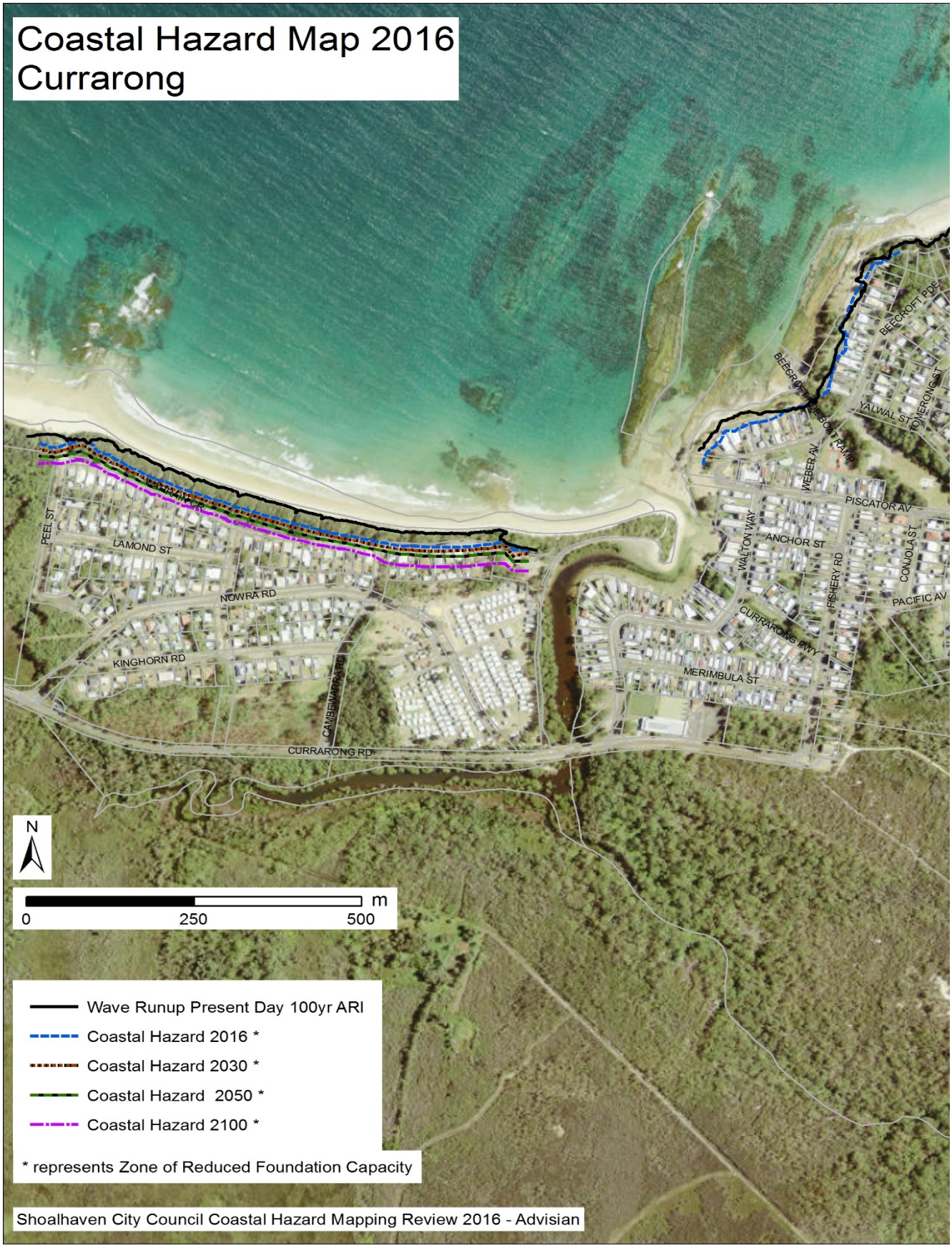


Figure 3-9 - Coastal Hazard Map Currarong

Table 3-14 – Local Area Plan 3 Actions - Callala Bay, Callala Beach

Strategic risk management

Accommodate change by protecting healthy natural systems and building community capacity, with preparation for long term managed retreat of community infrastructure and assets and planning controls to prevent increases in risk. In the short to medium term, accommodate change by building community capacity and by targeted land management, combined with planning controls to avoid future risk.

Triggers for change

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
Callala Bay			
LA3.9	Undertake a detailed, technical investigation of small scale coastal hazard management options that are feasible at Callala Bay to protect public infrastructure if required, cognisant of coastal processes and risks (over defined time frames), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy in consultation with key stakeholders including DoI Crown Lands.	Council Environmental Services and Asset Management in consultation with DoI – Crown Lands & Water, OEH and JBMP	
LA3.10	Investigate foreshore protection options to stabilise the shoreline at Sheaffe Street, Callala Bay. The works are proposed to protect the road, control storm water flows across the beach and slow loss of sand to the north.	Council Asset Management	A draft landscape plan has been prepared for the area between Sheaffe St and the sailing club. It includes storm water redesign and rock protection. The plan is yet to be adopted by Council.
LA3.11	Investigate site constraints (coastal hazards, topography and land availability) and foundation capacity of the Callala Bay Sailing Club to inform management of this asset.	Council Asset Management	
Callala Beach			
LA3.12	At Callala Beach, monitor dune crest levels. A minimum of 6.0m AHD may minimise the risk of wave overtopping. Options for managing dune heights include beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Council Environmental Services in consultation with DoI – Crown Lands & Water, OEH and JBMP	Beach surveys are undertaken by Council following significant storm events
LA3.13	Monitor beachfront area and implement post-storm emergency action measures when required to repair or replace public beach access	Council Environmental Services	

LA3.14	Investigate future relocation of tennis club and amenities. Audit site constraints and foundation capacity of community buildings and infrastructure. Apply requirements of Shoalhaven DCP to future upgrades of tennis club buildings and infrastructure as well as development on private lots.	Council Environmental Services, Asset Management and specialist consultants as required.	
LA3.15	Engage with foreshore reserve property owners, residents and beach goers around the values of dune vegetation (e.g. trapping wind-blown sand and maintaining dune resilience, ecological functions and buffering against coastal hazards, the importance of foreshore vegetation in providing shade and wind protection, filtering runoff, improving water quality and providing habitat)	Council Environmental Services	
LA3.16	Consult with residents along Callala Beach about reducing the frequency of pedestrian access ways from private dwellings across the dunes. The aim is to reduce pressures on dune vegetation and to enhance the resilience of dune landforms, while still providing access ways in appropriate locations along the beach.	Council Environmental Services	

Figure 3.10 - Coastal Hazard Map Callala Beach

Table 3-15 – Local Area Plan 3 Actions - Huskisson Beach, Collingwood Beach

Strategic risk management

Accommodate change by protecting healthy natural systems and building community capacity, with preparation for long term managed retreat of community infrastructure and assets and planning controls to prevent increases in risk. In the short to medium term, accommodate change by building community capacity and by targeted land management, combined with planning controls to avoid future risk.

Triggers for change

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
Huskisson Beach			
LA3.17	Continue to consult with the community and implement the Huskisson Beach Management Action Plan.	Council Environmental Services and Assets & Works	Ongoing operational works
Collingwood Beach			
LA3.18	Initiate technical studies to investigate feasibility of future relocation of sewerage infrastructure along the beach front reserve at Collingwood Beach, between Argyle and Berry Streets	Council Asset Management and Shoalhaven Water	
LA3.19	At Collingwood Beach, monitor dune crest levels to minimise wave overtopping onto shared path and road, accept risk and repair cycleway if subject to erosion. A minimum of 5.0m AHD may minimise the risk of wave overtopping. Manage dune heights with beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Council Environmental Services team in consultation with DoI – Crown Lands & Water, OEH and JBMP.	Beach surveys are undertaken by Council following significant storm events
LA3.20	Implement a two-year trial at two sites – one for revegetation and one for managing views (resolved by Council following preparation of a draft vegetation management plan for the Collingwood Beach Reserve). Any vegetation action plan must reduce the likelihood of erosion (Advisian 2018).	Council Environmental Services in consultation with DoI – Crown Lands & Water, JBMP, OEH and community.	Council resolved to implement a 5 year trial in two sites – one for revegetation and one for selected pruning.
Plantation Point and Hyams Point			
LA3.21	At Plantation Point and Hyams Point, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Sections 2.2 and 2.3 to manage risk to safety and assets.	Council Environmental Services	The draft Coastal Cliffs and Slopes Emergency Action Sub Plan is yet to be adopted by Council
LA3.22	Investigate opportunities for disabled access at Plantation Point (Barfleur Beach)	Environmental Services and Recreation and Community	Council's Disability Inclusion Action Plan 2017, Actions A2.4.6 & 7, refer to improving access to beaches and calm water sites

Figure 3.11 - Coastal Hazard Map Huskisson Beach

Figure 3.12 - Coastal Hazard Map Collingwood Beach

Figure 3.13 - Coastal Cliffs and Slopes Risk Areas Plantation Point

Figure 3.14 - Coastal Cliffs and Slopes Risk Areas Hyams Point

3.2.2.5 Beach management in Jervis Bay Marine Park

http://www.nationalparks.nsw.gov.au/visit-a-park/parks/jervis-bay-national-park

Private and public assets are at risk from coastal erosion and recession at four villages adjacent to the Jervis Bay Marine Park. For each of these locations, the proposed management includes beach scraping to manage the local sand resources to provide a more resilient frontal dune system. Beach scraping is defined (Carley et. al. 2010) as 'the movement of sand from the intertidal zone to the dune or upper beach by mechanical means.' Beach scraping is designed to mimic and speed up natural beach and dune recovery processes after storms. It does not involve importing sand from outside the active littoral compartment of the beach.

The foreshore around Jervis Bay lies within the Jervis Bay Marine Park. The villages where beach scraping works are proposed are within Habitat Protection Zones in the Park. Any action that has the potential to disturb habitat within the Jervis Bay Marine Park must comply with the *Marine Estate Management Act 2014*, Regulations and Zoning.

Marine Parks (Zoning Plans) Regulation (1999), Clause 1.13, specifically addresses dredging for beach replenishment in Sanctuary Zones in Jervis Bay Marine Park. Beach scraping is within the definition of dredging for beach replenishment in the Regulation.

Beach replenishment activity means the excavation of or extraction of sand or other material for the purpose of replenishing a beach. Dredging activity means any activity that involves the excavation of land submerged (whether permanently or intermittently) by water.

Under Clause 1.13 it is an offence to carry out dredging for beach replenishment without the consent of the relevant Minister. In particular, the Minister must not grant consent for dredging for beach replenishment in a sanctuary zone unless the Minister is (a) satisfied that the activity is necessary to prevent a serious risk of injury to a person, damage to property or harm to the environment, or (b) the activity is dredging activity and it is being carried out as part of an organised research activity.

To carry out beach scraping (or other beach replenishment) and dune nourishment works at beaches around the shore of Jervis Bay or at Currarong, Council must first obtain the consent of the Ministers responsible for Marine Parks and Primary Industries, and Environment.

Separately, the Fisheries Management Act sets out provisions to protect marine vegetation (mangroves, seagrass and seaweeds whether alive or dead) from 'harm'. 'Harm' includes 'gather, cut, pull up, destroy, poison, dig up, remove, injure, prevent light from reaching or otherwise harm the marine vegetation, or any part of it'. A permit is required from NSW Department of Primary Industries to harm marine vegetation, including seagrasses. NSW Department of Primary Industries will generally not permit collection of seagrass from declared Intertidal Protected Areas, Aquatic Reserves and Marine Parks (NSW Department of Primary Industries 2007). These regulations mean that Council must be able to demonstrate that proposed intertidal beach scraping will not harm seagrass (alive or dead).

There is relatively limited research evidence about the significance of impacts of beach scraping on beach biodiversity, particularly in low wave energy environments such as Jervis Bay and/or environments where there is a low level of other disturbance. As part of proposed beach scraping activities, Council proposes to continue investigations of baseline ecological condition and diversity for affected beaches and monitor changes over time. The monitoring program will be established in consultation with Department of Primary Industries Fisheries.

Local Area Plan 4: Berrara, Bendalong, Inyadda Point, Manyana

The coastline of the central Shoalhaven is highly valued by residents and visitors for the natural environment. Recreational values are based on beaches, estuary swimming, good surfing breaks, fishing (rock, estuary and near shore) and coastal walks.

There are multiple coastal walking tracks that pass through coastal reserves and connect the villages, as well as short local area walks along coastal creeks and lagoon shorelines.

The villages are popular family holiday destinations, with camping grounds and cabin accommodation. Peak summer population is three to five times the normal population of the villages. Unlike the larger centres to the north and south, the area is still not crowded for most of the year.

Identified Aboriginal cultural heritage in this area of the coast consists of middens, stone artefacts and, in two locations, burials. Boat Harbour beach at Bendalong has been the focus of an AHIP to begin beach remediation works and a range of other operational activities. The ACHAR refers to a burial that was discovered many years ago under a fire pit, a midden and silcrete artefacts. At another recorded site closer to Manyana, more silcrete artefacts were found, together with a midden, on either side of a creek. At Conjola, skeletal remains were exposed following erosion of the sand dune on the southern side of the lake.

Key issues

Figures 3.15 and 3.17 show the coastal hazard areas.

Residential areas are not affected by beach erosion hazards.

Properties at Berrara Point and Inyadda Point are impacted by cliff recession lines.

Visitor infrastructure, including walking paths, picnic areas and boat ramps, is low key.

High value ecological communities are affected by invasive species.

Berrara

Bendalong

Boat Harbour Beach Bendalong emerged as being at risk of coastal erosion following the June 2016 storm.

A Coastal Hazard report was prepared as for other coastal erosion risk beaches.

Red Point Rd (beach access road only) is at ***high*** risk rating at 2050.

Bendalong

Table 3-16 – Local Area Plan 4 Actions - Berrara, Bendalong, Manyana

Strategic risk management

In the short to medium term, accommodate change by building community awareness and capacity and the resilience of natural systems. Monitor actual changes in slope instability hazards; use planning controls to require additional knowledge of hazards.

Triggers for change

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
LA4.1	Prepare and implement the Boat Harbour Master Plan and the Stormwater Upgrade Plan	Council Environmental Services, Recreation & Community and Asset Management	
LA4.2	Prepare and implement bush regeneration plan for coastal reserves around the Bendalong Point Holiday Haven Tourist Park	Council Environmental Services and Holiday Haven	Prepare plan 2018 -19
LA4.3	At Inyadda Point, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.5 to manage risk to safety and assets.	Council Environmental Services	
LA4.4	At Berrara Point, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.4 to manage risk to safety and assets.	Council Environmental Services	
LA4.5	Rehabilitate the landslide area on public land at Inyadda Point consistent with the Landslide Risk Assessment undertaken for this area[10]	Council Environmental Services and Development Services	

[10] Coffey 2016

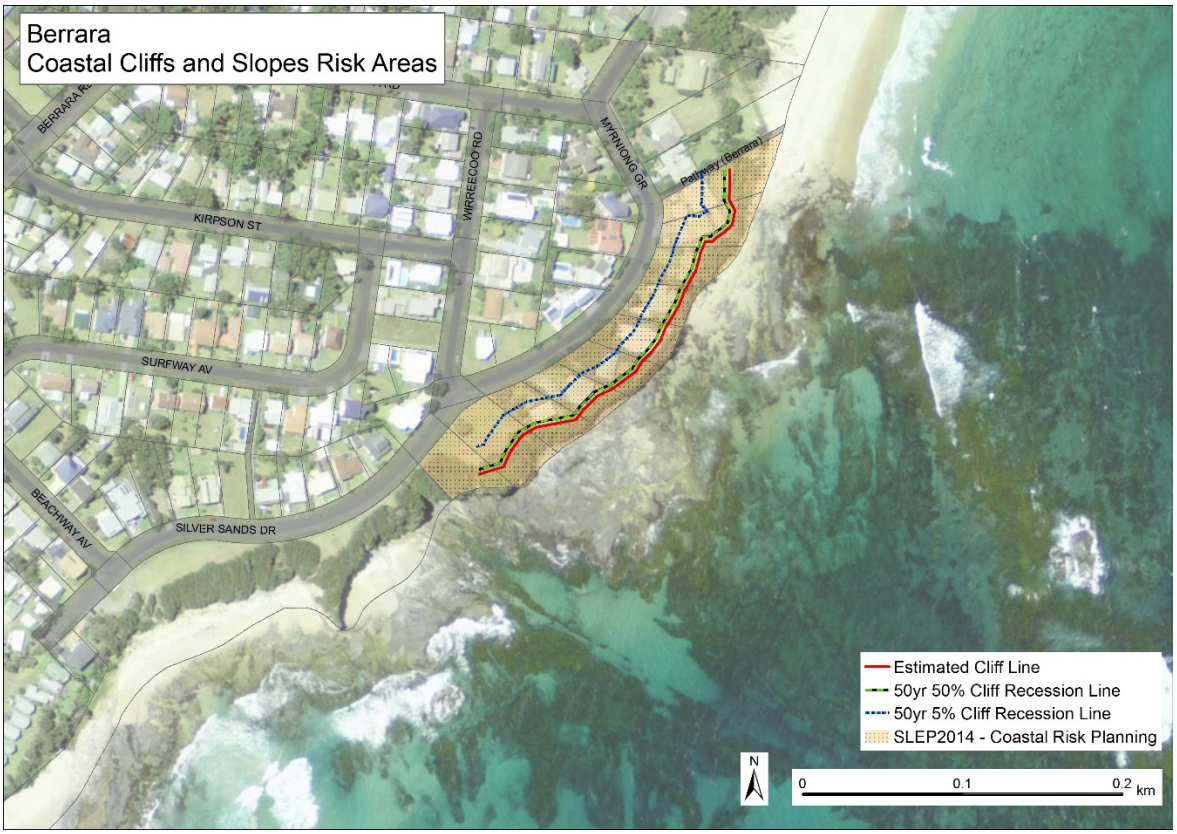


Figure 3.15 - Coastal Cliffs and Slopes Risk Areas Berrara

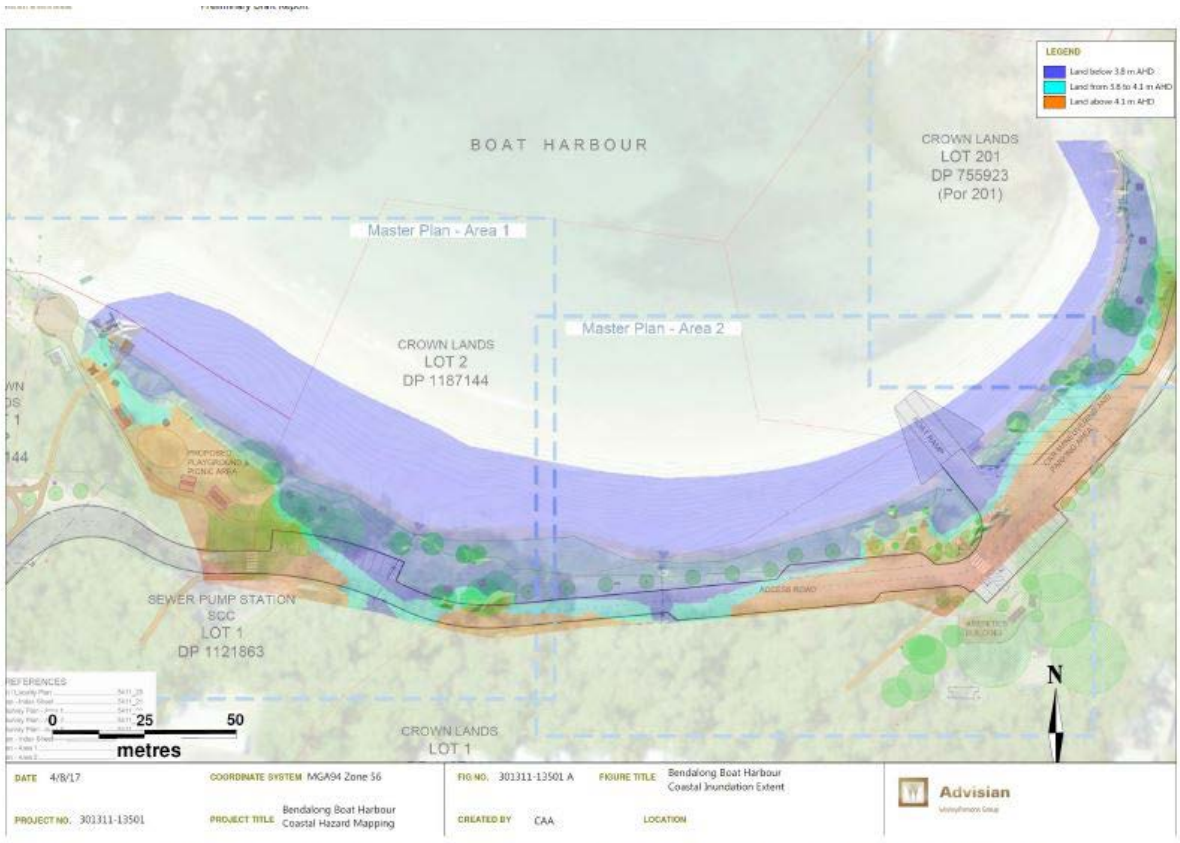


Figure 3.16 - Bendalong Boat Harbour Risk Map

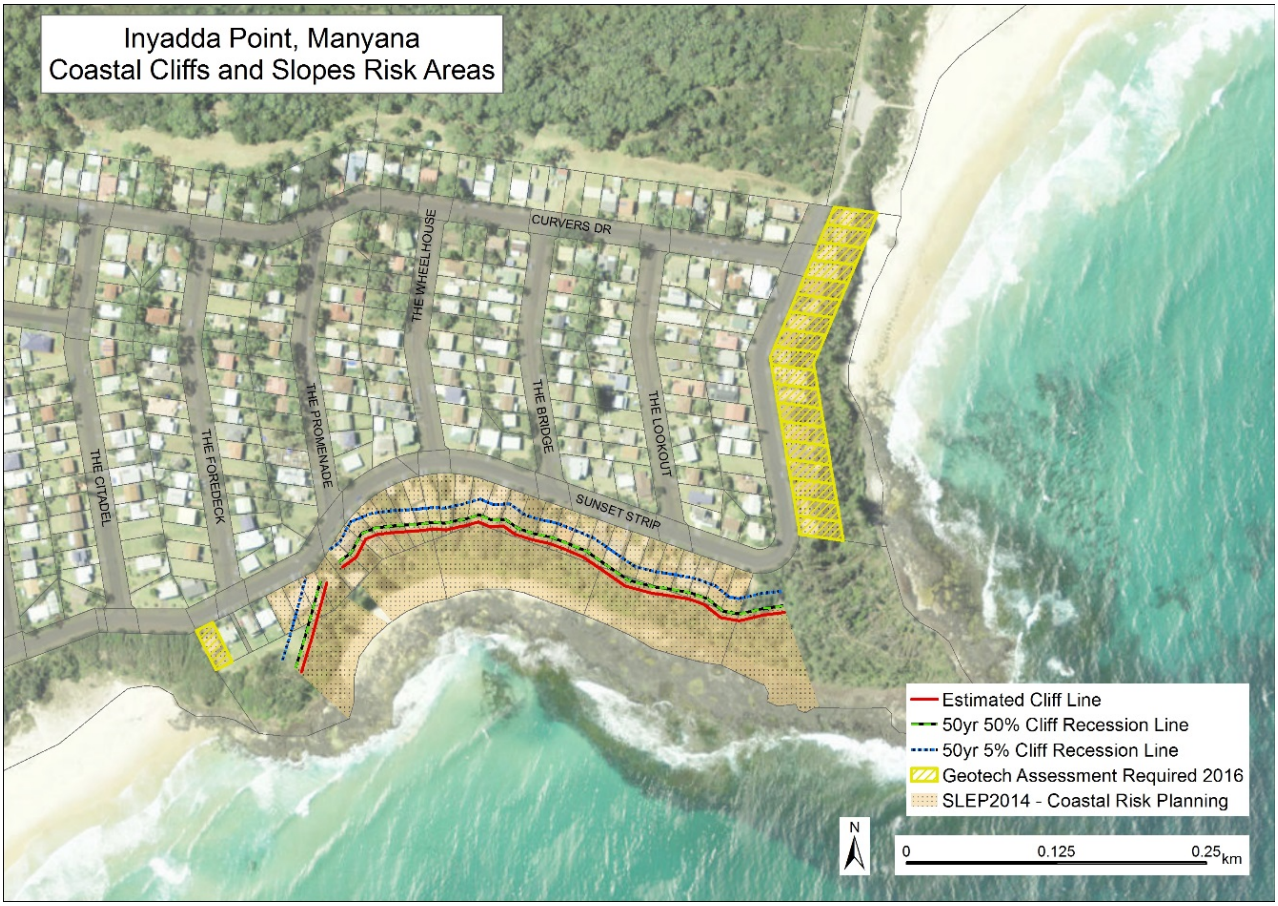


Figure 3.17- Coastal Cliffs and Slopes Risk Areas Inyadda Point, Manyana

Local Area Plan 5: Narrawallee Beach, Bannisters Point, Mollymook Beach and Collers Beach

Narrawallee is an established residential area, separated from Mollymook by bushland reserve and Bannisters Point. Residential development is separated from the beach by an extensive bushland foreshore reserve, enhancing the 'natural' atmosphere.

Mollymook and Bannisters Point is an established seaside residential area, developed in the 1960s and 1970s. Mollymook is a highly urbanised beach with very high summer visitation rates. The Mollymook Surf Club is at the southern end of the beach and both ends of the beach are patrolled during peak holiday times. The Mollymook Golf Club is also at the southern end of the beach. Low dunes and narrow foreshore reserves provide easy public beach access at multiple locations.

Collers Beach is a pocket beach, just south of Mollymook Beach with high value, residential development immediately adjacent.

There are few recorded Aboriginal sites in this area as most of the subdivision development occurred in the 1960s and 70s. There is one recorded midden site and one unrecorded midden site in Narrawallee although, we can assume that Narrawallee Inlet would have been a valuable food resource for Aboriginal people.

Key issues

Figures 3.18 to 3.22 shows coastal hazard areas.

Narrawallee

Wastewater infrastructure is at ***high*** risk rating at 2050.

Low frontal dunes at the southern end of Narrawallee Beach are susceptible to wave overtopping.

Narrawallee

Mollymook

Wastewater infrastructure (small pump station opposite 57 Mitchell Pde) and Golf Club (private) are at ***extreme*** risk rating at 2050, and further wastewater infrastructure (Beach Rd pump station) is at ***extreme*** risk rating at 2100.

Community infrastructure (SLSC), Mitchell Parade and further wastewater infrastructure are at ***high*** risk rating at 2050.

Bannisters Headland is affected by slope instability which affects the safety of public access and the design of private residences.

Exposed rock protection Mollymook (adjacent Golf Club) – post storm 2015

Collers Beach

Wastewater infrastructure (pump station) is at ***high*** risk rating at 2050.

4 properties require further geotechnical assessment.

Collers Beach

Table 3-17 – Local Area Plan 5 Actions - Mollymook Beach, Narrawallee Beach, Collers Beach

Strategic risk management

Accommodate change by protecting healthy natural systems and building community capacity, with preparation for long term managed retreat of community infrastructure and assets and planning controls to prevent increases in risk. Some assets in this area are already protected by sea walls.

Triggers for change

- Asset life of sea walls, roads, water and sewerage infrastructure.
- Actual recession of the dune escarpment and/or actual changes to slope stability.

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure.

Action	What is proposed	Responsibility	Status
Narrawallee Beach			
LA5.1	At Narrawallee Beach, monitor dune crest levels. A minimum of 6.0m AHD may minimise the risk of wave overtopping. Options for managing dune heights include post storm beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Council Environmental Services in consultation with DoI – Crown Lands & Water	Beach surveys are undertaken by Council following significant storm events
LA5.2	At Surfers Avenue and Bannister Head Road Narrawallee, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Sections 2.6 to manage risk to safety and assets.	Council Environmental Services and Assets & Works	
LA5.3	Investigate whether localised protection for the sewerage assets is required and the feasibility of the relocation of the sewerage infrastructure.	Council Environmental Services and Shoalhaven Water	
LA5.4	Install groundwater monitoring instrumentation at Surfers Avenue and Tallwood Avenue Narrawallee to better understanding of groundwater levels and ground movements.	Council Environmental Services	
Mollymook Beach and Bannisters Point			
LA5.5	Prepare Cost Benefit Analysis to determine the most feasible management option (such as protect or retreat and relocate) at the southern end of Mollymook Beach to protect both public and private assets.	Council Asset Management and Environmental Services in consultation with DoI – Crown Lands & Water and OEH	Cost Benefit Analysis and coastal hazard are currently being prepared. This information will determine future actions
LA5.6	Subject to outcome of LA5.5, consider implementation of recommendations of above mentioned Cost Benefit Analysis, and undertake detailed design, planning and approvals process for works required to protect assets most at risk, such as seawall reconstruction, sandstone block wall, concrete wall and new revetment as required. Modifications should include provision for safe disabled access onto the beach.	Council Asset Management and Environmental Services in consultation with DoI – Crown Lands & Water and OEH	

	If works proceed, prepare an asset management plan for the ongoing maintenance and monitoring.		
LA5.7	Ongoing monitoring of buried training wall at Blackwater Creek to measure effectiveness in mitigating coastal hazards (see location map below).	Council Environmental Services in consultation with DoI – Crown Lands & Water	Annually
LA5.8	A minimum dune height of 5.5m AHD may minimise the risk of wave overtopping. Options for managing dune heights include beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Council Environmental Services in consultation with DoI – Crown Lands & Water	Beach surveys are undertaken by Council following significant storms. Dune height was raised to 5.5m AHD in conjunction with construction of the Blackwater Creek training wall in 2016.
LA5.9	At Bannisters Point, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.7 to manage risk to safety and assets.	Council Environmental Services and Assets & Works	
LA5.10	Audit site constraints and foundation capacity of community buildings and infrastructure at Mollymook, including surf club and wastewater pump stations, to inform decisions about future relocation or reconstruction on deep-piled foundations and timing of these actions may need to be implemented.	Council Environmental Services, Shoalhaven Water and Assets & Works, along with appropriate specialist consultant.	
LA5.11	Undertake technical studies and planning for relocation or protection of Council owned sewer infrastructure including a pipeline and pumping stations that are located seaward of the Mollymook Beach 50 year ZSA (in the areas outside the study area for the cost-benefit study currently underway).	Council Environmental Services, Shoalhaven Water and Assets & Works, along with appropriate specialist consultant.	
LA5.12	Undertake condition assessment of existing training wall at Mollymoke Farm Creek at the northern end of beach.	Council Asset Management	
LA5.13	Investigate localised protection options consistent with the Coastal Erosion Stormwater Impact Assessment (Footprint Sustainable Engineering, 2015) around the two stormwater outlets on Mitchell Parade (e.g. opposite 55 Mitchell Parade) as these are the locations where the Mitchell Parade roadway is at highest erosion risk	Council Asset Management, Shoalhaven Water and Environmental Services.	
LA5.14	Engage with foreshore reserve property owners, residents and beach goers about the values of dune vegetation e.g. trapping wind-blown sand and maintaining dune resilience, ecological functions and buffering against coastal hazards, the importance of foreshore vegetation in providing shade and wind protection, filtering runoff, improving water quality and providing habitat.	Council Environmental Services	
LA5.15	Consult with residents along Mollymook Beach about reducing the frequency of pedestrian access ways from private dwellings across the dunes. The aim is to reduce pressures on dune vegetation and to enhance the resilience of dune landforms, whilst still providing opportunity for passive craft launching	Council Environmental Services	

	ramps and addition of handrails to access way in appropriate locations along the beach.		
LA5.16	Rehabilitate the landslide area at Mitchell Parade if required, consistent with the Landslide Risk Assessment undertaken for this area (Coffey, 2016) and assess and improve drainage and sewer infrastructure in the vicinity of the landslide area where feasible.	Council Environmental Services	
LA5.17	Undertake geotechnical assessment to assess the impact from potential cliff and slope instability to provide suitable and site-specific landslide risk management (LRM) recommendations for lookout at Bannisters Point or consider relocation of assets where feasible.	Council Environmental Services	
Collers Beach			
LA5.18	At Collers Beach cliff, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Sections 2.8 to manage risk to safety and assets.	Council Environmental Services and Assets & Works	
LA5.19	Investigate whether localised protection, redesign or landward relocation of the sewerage assets at Collers Beach is required.	Council Environmental Services, Assets & Works and Shoalhaven Water	

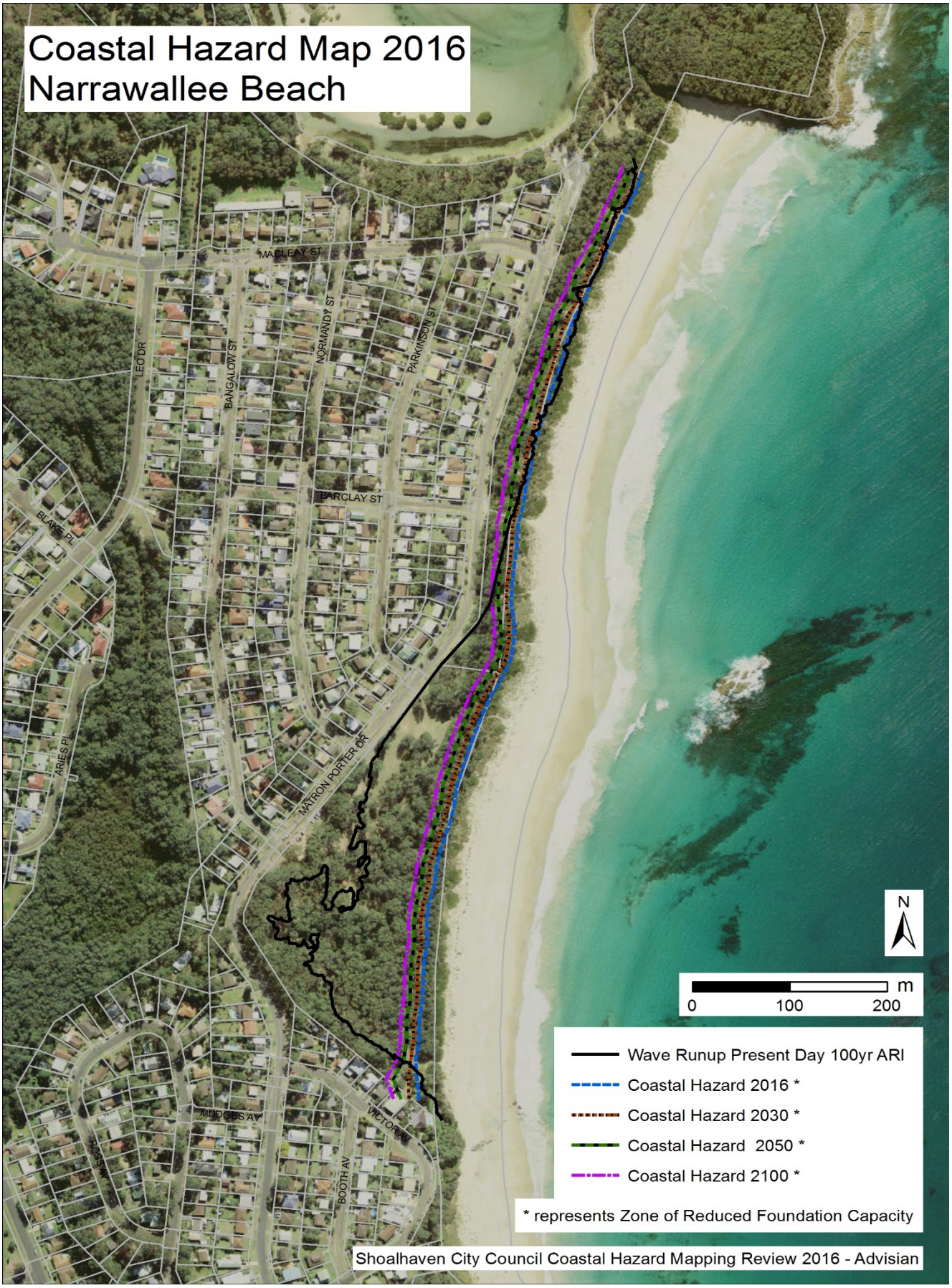


Figure 3.18 - Coastal Hazard Map Narrawallee Beach

Figure 3.19 - Coastal Hazard Map Mollymook Beach

Figure 3.20 - Coastal Hazard Map Collers Beach

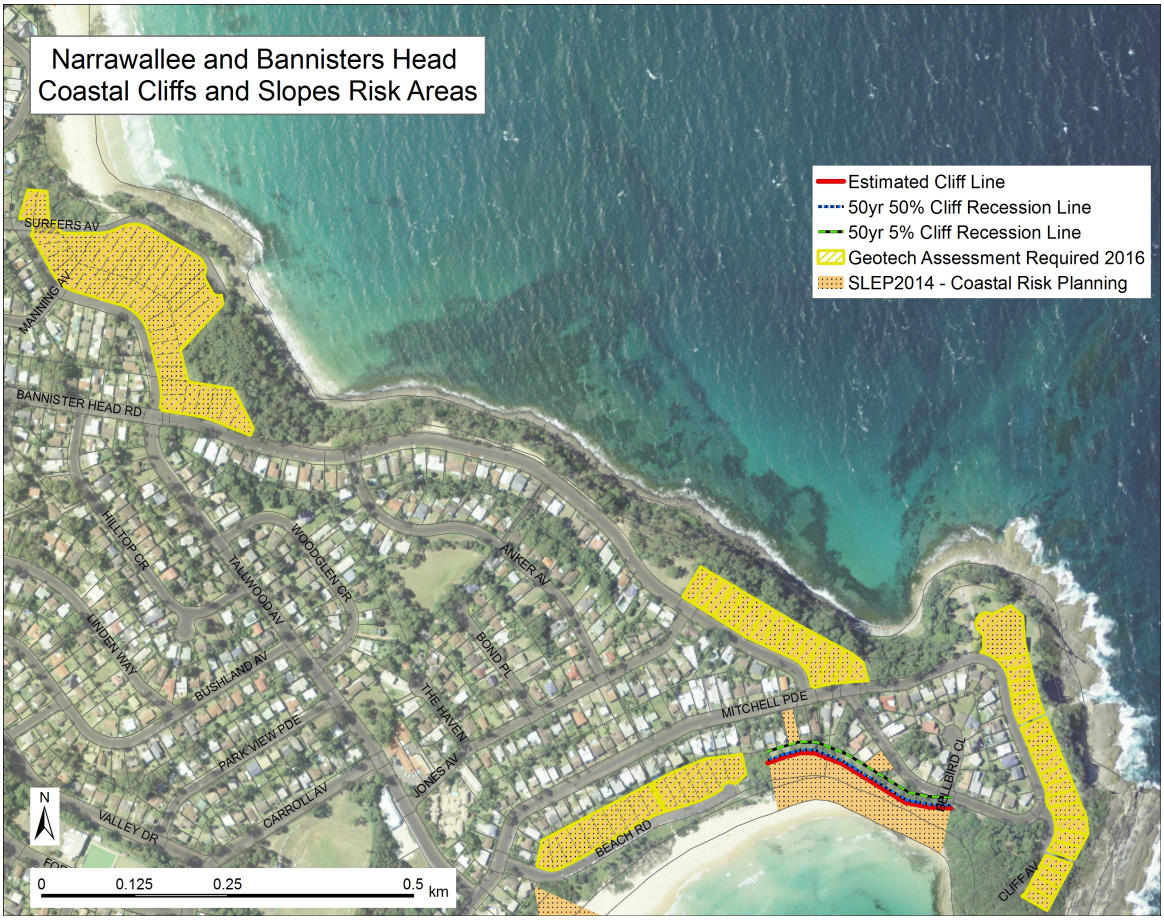


Figure 3.21- Coastal Cliffs and Slopes Risk Areas Narrawallee and Bannisters Head

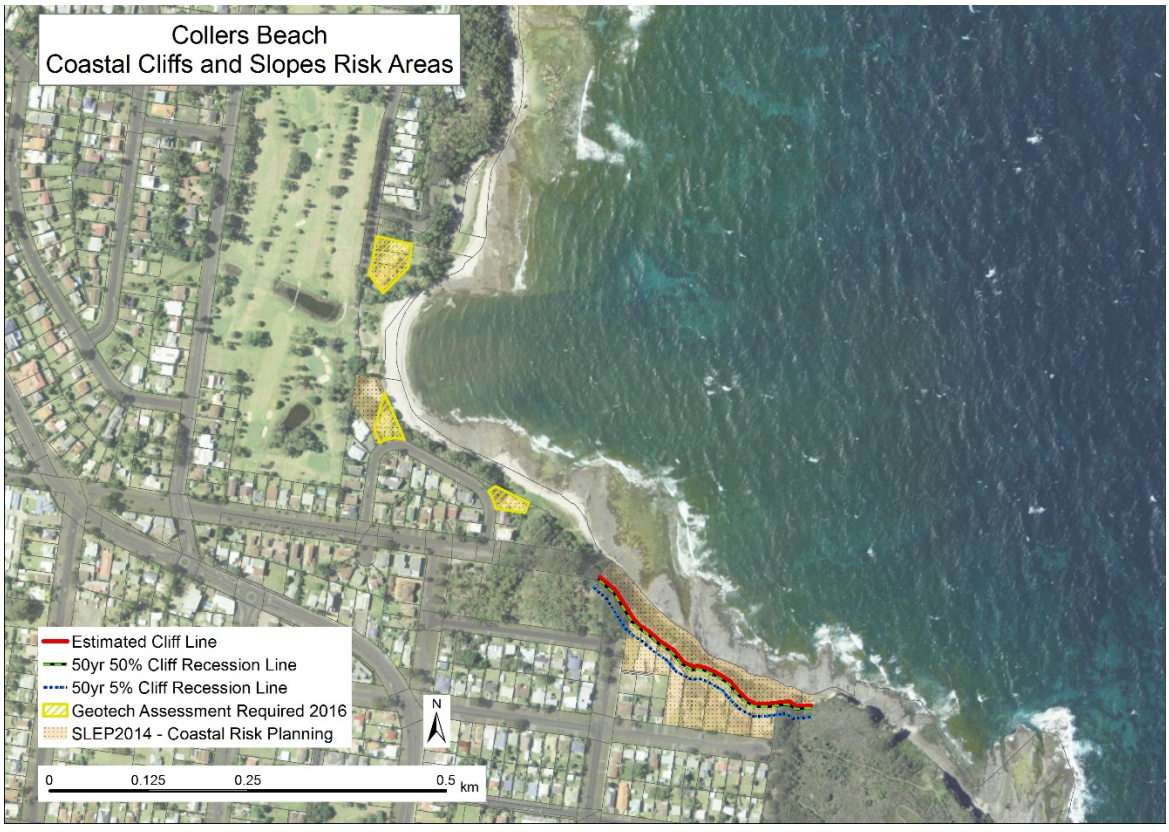


Figure 3.22 - Coastal Cliffs and Slopes Risk Areas Collers Beach

Local Area Plan 6: Ulladulla Harbour, Rennies Beach and Racecourse Beach

Ulladulla is the urban and commercial centre for southern Shoalhaven. The Princes Highway passes through the centre of town, adjacent to the Ulladulla Harbour shoreline. Ulladulla has a strong Indigenous and European marine and fishing heritage. Urban development is framed by large reserves on the headlands, with strong natural and cultural values.

Rennies Beach is a relatively isolated beach, with steep stairway access at two locations. The beach is backed by steep bluff and bushland reserve.

Evidence of Aboriginal cultural heritage around Ulladulla Harbour is mainly found in historical records rather than documented sites. The Harbour was one of the first places in Shoalhaven to be occupied by Europeans with the town being gazetted in 1829. There are illustrations and texts depicting Aboriginal people living around the Harbour and fishing from bark canoes. The rock platforms would also have been a rich food resource. Right up to the 1940s Aboriginal people still camped on the southern headland where a freshwater spring flowed into the Harbour and today there is an area known locally as the 'Danceground' on the headland where large numbers of Aboriginal people gathered for ceremonies.

Key issues

Figure 3.23 show the coastal hazard areas.

Private properties at Rennies Beach and Racecourse Beach are impacted by cliff recession.

Rennies Beach

The sea wall around the shore of Ulladulla Harbour is subject to storm damage, with related risks for safety and for the stability of the Princes Highway.

The shoreline is continuing to adjust to changed hydrodynamic conditions associated with the construction of the breakwaters.

Ulladulla Harbour

Ulladulla Harbour – repair rock protection post June 2016 storm

Ulladulla Harbour – beach scraping post June 2016 storm

Table 3-18 – Local Area Plan 6 Actions - Ulladulla Harbour, Rennies Beach, Racecourse Beach

Strategic risk management

Accommodate change by building community awareness and capacity and by targeted protection of healthy natural systems. Hazard likelihood is already managed by coastal protection works at Ulladulla Harbour, but a design review and seawall reconstruction are required. Planning controls will require additional information from proponents in coastal hazard areas on cliffs and bluffs.

Triggers for change

- Evidence of change in slope instability risk profile.
- Cost-benefit analysis of maintenance of coastal protection structures

Note: For major infrastructure assets subject to a high or extreme level of risk, a trigger distance greater than 20m would be appropriate to change from a monitoring and reporting approach to detailed feasibility and design studies and/or to on ground works (protection or relocation). The appropriate trigger is influenced by the type of asset, expected asset life, local risk to the asset and the types of risks associated with failure**.**

Action	What is proposed	Responsibility	Status
LA6.1	Monitor and maintain the rock protection structure on the landward shore of Ulladulla Harbour to provide protection for the public reserve and the Princes Highway.	Council Environmental Services and Assets and Works	Rock protection structure repaired and extended following the June 2016 ECL
LA6.2	Prepare a management plan for Warden Head public reserves. The plan will be prepared in consultation with Ulladulla Local Aboriginal Land Council, including the preparation of a Memorandum of Understanding about the maintenance of walking tracks on the headland. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	Any works will be in collaboration with DoI - Crown Lands & Water & Ulladulla Aboriginal Land Council, with particular reference to Crown land Lot 30 DP 821467 and Lot 290 DP 755967 (Por 290).	
LA6.3	At Rennies Beach, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.9 to manage risk to safety and assets.	Council Environmental Services and Assets & Works	
LA6.4	At Racecourse Beach, implement emergency response actions in the draft Coastal Cliffs and Slopes Emergency Action Sub Plan, Appendix 5, Section 2.10 to manage risk to safety and assets.	Council Environmental Services and Assets & Works	
LA6.5	Undertake a geotechnical assessment to assess the impact from potential cliff and slope instability to provide suitable and site specific recommendations for the carpark at Racecourse Beach or consider relocation of these assets where feasible.	Council Environmental Services	

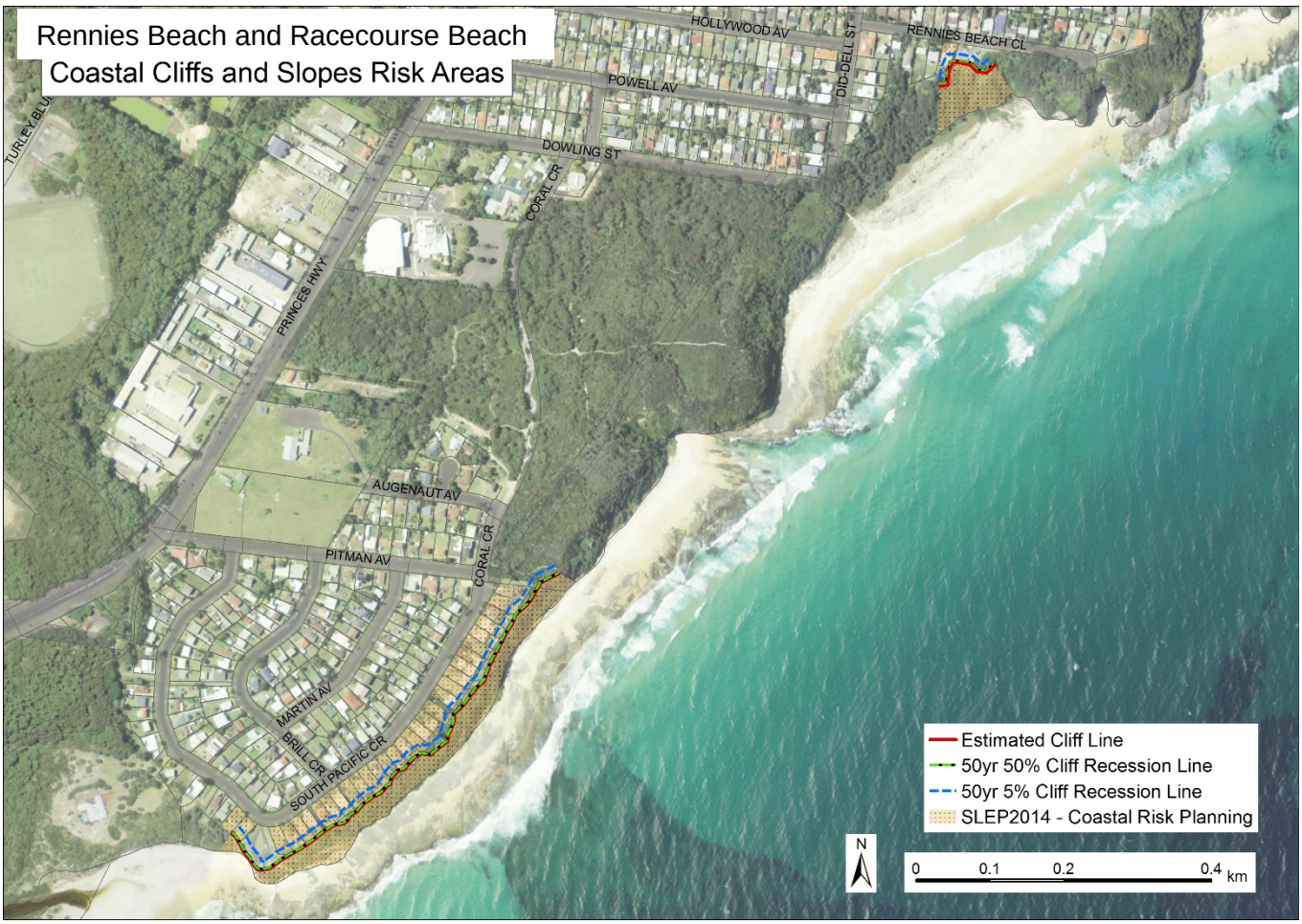


Figure 3.23- Coastal Cliffs and Slopes Risk Areas Rennies & Racecourse Beaches

4. Implementation

4.1 Implementation priorities

Council has identified strategies and actions to achieve its vision for the coast.

In the implementation tables over page, actions are grouped into two, five and beyond year priorities.

Higher priority actions are selected on the basis of extreme and very high risks. These are actions that:

- Reduce risk as a precautionary measure (a high priority for land use planning provisions for coastal risk areas)
- Protect or enhance the biodiversity values of coastal ecological communities, at the same time building the resilience of frontal dune systems, are a high priority.
- Build community awareness, knowledge and resilience
- Establish an adaptive management framework.
- Achieve several of these criteria, compared to those which achieve only single criteria.

The options appraisal process, including outcomes of the OCOL community engagement program, and desired action tables are detailed in Section 3. Council has further assessed priorities after considering desired actions, priorities and budget. The implementation priorities balance the risks, environmental priorities, community input and budget realities that Council must address. The implementation tables highlight the priority actions that will:

- Ensure there are resources for managing the implementation process
- Build resilience of beach and dune landforms and coastal ecosystems
- Clarify the likely asset life and foundation capacity of built assets in immediate (or short term) coastal hazard zones
- Build community understanding of coastal processes and coastal zone management interactions to prepare for change.

The estimated cost of implementation in the first two years is more than $3.3M, excluding construction of the South Mollymook foreshore protection structure. The cost of these actions exceed Council's existing budget capacity, therefore Council will need to seek external grant funding to supplement it's budget.

4.2. Implementation schedules

All actions which appear in this Plan, either as Citywide Strategies or in the Local Area Action Plans, are grouped in the three tables below and according to the criteria listed at 4.2.

The priority listing in each implementation schedule below includes 1, 2 and 3, with 1 being the highest priority within that time period.

As a component of the completion of the new Coastal Management Program, all unimplemented actions from the Coastal Zone Management Plan 2018 will be transferred into the new document.

The instigation of all actions included in the Implementation Schedules below is the responsibility of Council.

Table 4-2– Actions in the short term (0-2 years) ranked by priority

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
C1.2	Present information on Council's website and in community engagement activities that shows how coastal zone systems function and how integrated management responses benefits Council's and local communities. This will include reporting on long term improvements to efficiency and to the condition of coastal zone systems.	3	Create awareness and improve capacity to respond	Whole of coast	Council – existing operational budgets and seek funding from NSW coastal and estuary grant program and/or other funding sources	3 years
C1.3	Work with all sections of Council to improve integration of coastal zone risk management and protection.	1	Create awareness and improve capacity to respond	Whole of coast	Council – existing operational budgets	1 year
C1.7	Collate all monitoring actions within the Coastal Zone Management Plan (CZMP), and other supporting documents, to develop an Environmental Monitoring Program (EMP). The EMP will address matters such as: dune crest height monitoring, effectiveness of sustainable tourism strategies, plastics and rubbish, water quality, encroachment and trampling from access ways and dune vegetation vandalism. The EMP will include 'citizen science' opportunities.	1	Important component of integrated management and evaluation	Whole of coast	Council – existing operational budgets	2 years
C1.10	Each year, review actions to ensure they are appropriate and current, and remove actions if	1	Important component of integrated management and evaluation	Whole of coast	Council – existing operational budgets	Annually

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	implementation has been successful. These reviews will be reported in Council's annual report.					
C1.12	Maintain a full-time coastal zone coordinator position to coordinate design investigations, develop the implementation strategy (including long-term funding options) and build Council's capacity to respond.	Council	Important component of integrated management and evaluation	Whole of coast	Council - $120,000 per annum Council budget	1 year
C2.1	Prepare and deliver community information for residents at high risk beaches and other emerging priority coastal areas. Community information could include regular updates on Council's website, social media sites, educational signage, presentations at community meetings, field days, training for Bushcare volunteers, Frontline News.	1	Important component of community engagement	Whole of coast	$10,000 From Council operational budgets and seek funding from NSW coastal and estuary grant program and/or other funding sources	2 years
C2.4	Prepare information for landholders living adjacent to geotechnical hazards and how they can contribute to risk reduction through: • Maintaining an adequate surface drainage path into and out of the property • Draining pipe storm water away from steep slopes to avoid saturation and scouring • Maintaining vegetation cover of appropriate species • Repairing leaking or broken underground drainage or sewer pipes as soon as faults are identified • Periodically inspecting the property to observe changes	1	Important component of community engagement	Private land near geotechnical hazards	$10,000 - from existing operational budgets	2 years
C2.5	Collaborate with Council Tourism and Visitor's Services staff to encourage sustainable tourism strategies and 'citizen science' opportunities.	2	Important component of community engagement and partnering	Whole of coast	Council – $20,000 from existing operational budgets	2 years
C3.1	Update and maintain notation to section 10.7 (5) certificates for properties affected by coastal hazards consistent with NSW Government legislation.	1	Implement planning system controls	Whole of coast	Council – existing operational budgets	1 year

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
C3.2	Implement and maintain planning controls, in Shoalhaven Local Environmental Plan 2014 and Shoalhaven Development Control Plan 2014 G6 Coastal Management Areas, which requires specific information and assessment for proposed development in coastal hazard areas.	1	Important component of implementing planning system controls	Whole of coast	$30,000 – Council budget	3 years
C3.4	Make necessary amendments to the Shoalhaven Local Environmental Plan 2014 and Shoalhaven Development Control Plan 2014, including that: • Council to require geotechnical assessments to support applications for landslip remediation works on private property, including confirmation that risk will be reduced to levels considered acceptable (geotechnical engineer to approve the design of the remediation measures and works) • Development consent conditions to include maintenance requirements for new developments on sloping blocks within risk areas • All risk areas to be included in the appropriate locations in the Shoalhaven Local Environmental Plan 2014 and/ or Shoalhaven Development Control Plan 2014 • Mapping in Shoalhaven Development Control Plan 2014 and Shoalhaven Local Environmental Plan 2014 (Coastal Risk Planning) to be updated to reflect the revised Coastal Hazard Mapping for beaches (Advisan, 2016).	1	Implement planning system controls	Whole of coast	$10,000 – Council budget	1 year
C4.1	Update the Coastal Asset Management Plan to include a beach access strategy that includes a methodology for rationalisation of beach accesses based on environmental, social and economic risks.	2	Important component of integrated management and managing risk	Whole of coast	$20,000 (seek potential $10,000 OEH funding)	1 year
C4.3	Maintain and enhance ecological communities in coastal reserves (including dunes), considering appropriate ecological strategies for urban (foreshore recreation reserve) and non-urban areas.	1	Protection of coastal biodiversity and ecosystems	Whole of coast	Council – existing operational budgets and seek	1 year

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
					supporting funding from OEH	
C4.5	Support bush regeneration programs in coastal reserves.	1	Protection of coastal biodiversity and ecosystems	Whole of coast	$50,000 p.a from existing Bushcare budget, OEH	3 years
C4.6	Incorporate measures to protect Aboriginal cultural heritage. This will include appropriate Aboriginal cultural heritage due diligence assessments for all coastal works.	1	Important component of integrated management and planning system control	Whole of coast	Ongoing and part of individual project costs	2 years
C5.1 LA2.1 LA3.21 LA4.3 LA4.4 LA5.2 LA5.4 LA5.9 LA5.16 LA5.18 LA6.3 LA6.4	Activate Coastal Cliffs and Slopes Emergency Action Sub Plans as required[11]	1	Important component of managing risk	Whole of coast	Dependent on timing and extent of event; seek supporting funding from OEH or other grant programs	3 years
C6.2	Implement high priority recommendations from the Coastal Erosion Stormwater Impact Assessment (Footprint Sustainable Engineering, 2015)	1	Important component of managing risk	Whole of coast	$50,000 annually seek supporting funding from OEH or other grant programs;	1 year
C6.4	Incorporate monitoring of public land and infrastructure, including viewing platforms, stormwater drainage, sewer and water infrastructure in identified coastal cliffs and slopes risk areas, to ascertain any	1	Important component of managing risk	Identified risk areas in coastal cliffs and slopes	$60,000 annually; seek supporting funding from OEH	3 years

[11] Appendix 4 – Shoalhaven Beaches Emergency Action Sub Plans, Advisian 2018 and Appendix 5 – Shoalhaven Coastal Cliffs and Slopes Risk Management Program & Coastal Cliffs and Slopes Emergency Action Sub Plan, RoyalHaskoningDHV 2018.2.1

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	leaks or requirements for repair, into Council's maintenance programs. Relocate viewing platforms where necessary.				or other grant programs	
C6.5	Undertake a catchment wide hydraulic assessment to assess stormwater drainage adjacent to or within identified coastal cliffs and slopes risk areas	1	Important component of managing risk	Identified risk areas in coastal cliffs and slopes	$200,000; seek supporting funding from OEH or other grant programs	5 years
C7.1	Establish coastal monitoring program (which forms part of the EMP in C1.7) to collect baseline condition data for post storm beach erosion, king tide monitoring and entrance condition e.g. use LiDAR data for beaches and dunes, when available from the NSW Government, to analyse change to coastal landforms and vegetation. Use 'citizen scientists' where applicable.	1	Important component of integrated management and evaluation	Whole of coast	Allow $30,000 from Council over 2 years, OEH funding or other grant programs	2 years
C7.3	Continue to collaborate with universities, government agencies and others in research that focuses on: • Climate change impacts on coastal processes and coastal landforms, including new data on sea level rise, storm behaviour, sediment transport processes and coastal recession modelling • Impact of sea level rise on rock platform communities • Coastal lake entrance behaviour (sediment budget, morphology, opening and closing regimes) with sea level rise and other aspects of climate change and climate variability • Ecological services and functions of dune species and most effective vegetation structure to enhance dune resilience • Monitoring the impacts of erosion remediation works at Currarong Beach • Assessing and monitoring the impacts of NABE works at all beaches where it's implemented.	2	Implement adaptive management procedures	Whole of coast	Ongoing; Council operation budgets; seek supporting funding from OEH or other grant programs	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
C7.4	Continue the role of the Council Natural Resources & Floodplain Management Committee in implementing the CZMP. In particular, involve the Committee in reviewing and evaluating progress and outcomes from implementing the CZMP.	1	Implement adaptive management procedures	Whole of coast	Ongoing Council operational budgets	3 years
LA1.5	Prepare a dune management plan to manage the dune height and beach access in front of the Shoalhaven Heads SLSC. Lower dunes if required for safety.	1	Important component of risk management for surf life saving	Shoalhaven Heads	$10,000 annually from Council operational budgets	3 years
LA1.6	Maintain dune vegetation at both Shoalhaven Heads (Seven Mile beach) and Culburra to promote dune stability and minimise loss of sand from the littoral systems that would contribute to long term recession of the beach.	1	Council	Shoalhaven Heads and Culburra	Council – existing natural areas and Bushcare budgets, (supplement with grant funding e.g. OEH)	3 years
LA1.10 LA3.16	Consult with residents along Culburra Beach, Callala Beach and Mollymook about reducing the frequency of pedestrian access ways from private dwellings across the dunes. The aim is to reduce pressures on dune vegetation and to enhance the resilience of dune landforms.	3	Important component of risk management and protection of coastal biodiversity and ecosystems	Culburra Beach Callala Beach Mollymook	Council – existing operational budget (supplement with grant funding e.g. OEH or other grant programs)	3 years
LA3.2	Undertake a detailed, technical investigation of coastal hazard management options for Currarong Beach that are feasible for this location, cognisant of coastal processes and risks (over defined timeframes), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy in consultation with key stakeholders including DoI Crown Lands. Currarong Beach is a receding beach (Advisian 2016) and, following the June 2016 ECL, the beach was left vulnerable with a major erosion scarp and 20,000m3 of sand lost. It became clear that beach erosion remediation measures, investigated in 2011 (SMEC) needed to be reassessed. This is to reduce risks to erosion of the dune, the beach and public access to it,	1	Important component of risk management	Currarong	$750,000 (seek 50% grant funding from OEH or other grant programs)	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	public reserve, the road (Warrain Cres), water and sewage infrastructure. Prepare asset management plan for any erosion and remediation works to ensure ongoing maintenance as required, monitoring program to determine efficacy of works and management of any impacts.					
LA3.3	Undertake a detailed, technical investigation of coastal hazard management options for shoreline in front of Beecroft Parade, that are feasible for this location, cognisant of coastal processes and risks (over defined time frames), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy in consultation with key stakeholders including DoI Crown Lands. Currarong coast faces north, erosion impacts were severe as a result of the June 2016 storm, including the shoreline in front of Beecroft Parade. Any erosion and remediation works will include an asset management plan to ensure ongoing maintenance as required and management of any impacts.	1	Important component of risk management	Currarong	$100,000 for technical investigation $600,000 for works subject to technical review and approval from agencies (seek 50% grant funding from OEH or other grant programs)	3 years
LA3.4	Undertake a Cost Benefit Analysis, if required, for the erosion protection works in LA3.2 and LA3.3.	1	Important component of risk management	Currarong	$100,000 (seek 50% grant funding from OEH)	2 years
LA3.5	Undertake ongoing regular foreshore profile surveys to inform refinement of erosion or long term recession hazard for Beecroft Parade area (part of the Coastal Management Program & EMP – see Actions C1.7 & C7.1).	1	Important component of risk management	Currarong	A cost component of C1.7.	3 years
LA3.6	Monitor dune crest and profile. Options for managing dune heights include beach scraping and dune nourishment if sand source is available. Note that beach scraping and nourishment works may require approvals under the Crown Lands Act 1989 or	1	Important component of risk management	Currarong	A cost component of C1.7. $40,000 (to investigate sand availability for beach scraping and nourishment if necessary)	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	Crown Land Management Act 2016 which commences 1 July 2018.				Council operational budgets and OEH funding or other grant programs	
LA3.19	At Collingwood Beach, monitor dune crest levels to minimise wave overtopping onto shared path and road, accept risk and repair cycleway if subject to erosion. A minimum of 5.0m AHD may minimise the risk of wave overtopping. Options for managing dune heights include beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	1	Important component of risk management	Collingwood Beach	A cost component of C1.7. $40,000 (to investigate sand availability for beach scraping and nourishment if necessary and seek funding) Council operational budgets and OEH funding or other grant programs	3 years
LA3.7	Construct two beach accesses between Warrain Crescent and Peel Street. This will provide Currarong Beach with five reconstructed beach accesses, all of which were destroyed in the June 2016 storm.	2	Important component of risk management and providing opportunities for recreation planning and community development	Currarong	$90,000 Council operation budgets and OEH funding or other grant programs	3 years
LA3.12	At Callala Beach, monitor dune crest levels. A minimum of 6.0m AHD may minimise the risk of wave overtopping. Options for managing dune heights include beach scraping and dune nourishment, if sand source is available (see Action C1.7 and C7.1). Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	1	Important component of risk management and evaluation	Callala Beach	A cost component of C1.7. $40,000 (to investigate sand availability for beach scraping and nourishment if necessary and seek funding); Council operational budgets and OEH funding or other grant programs	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
LA5.8	At Mollymook Beach, monitor dune crest levels. A minimum of 5.5m AHD may minimise the risk of wave overtopping. Options for managing dune heights include beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	1	Important component of risk management and evaluation	Mollymook	A cost component of C1.7. $40,000 (to investigate sand availability for beach scraping and nourishment if necessary); Council operational budgets and OEH funding or other grant programs	3 years
LA5.11	Undertake technical studies and planning for relocation or protection of Council owned sewer infrastructure including a pipeline and pumping stations that are located seaward of the Mollymook Beach 50 year ZSA (in the areas outside the study area for the cost-benefit study currently underway).	1	Important component of risk management and evaluation	Mollymook	$60,000 Council operational budgets and OEH funding or other grant programs	1 year
LA5.12	Assess condition of existing tripper wall at northern end of beach at creek entrance near Beach Road.	1	Important component of risk management and evaluation	Mollymook	$10,000 Council operational budgets and OEH funding or other grant programs	1 year
LA5.13	Investigate localised protection options consistent with the Coastal Erosion Stormwater Impact Assessment (Footprint Sustainable Engineering, 2015) around the stormwater drains along Mitchell Parade (e.g. opposite 55 Mitchell Parade) as these are the locations where the Mitchell Parade roadway is at highest erosion risk.	1	Important component of risk management	Mollymook	$100,000 Council operational budgets and OEH funding or other grant programs	1 year
LA5.19	Investigate whether localised protection, redesign or landward relocation of the sewerage assets at Collers Beach is required.	1	Important component of risk management	Collers Beach	$20,000 (excluding design) Council operational budgets and OEH	2 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
					funding or other grant programs	
LA3.17	Continue to implement the Huskisson Beach Management Action Plan and opportunities for passive craft launching ramps and addition of handrails to access ways in appropriate locations along the beach.	2	Important component of risk management and providing opportunities for recreation planning and community development	Huskisson Beach	$15,000 Council operational budgets and OEH funding or other grant programs	3 years
LA3.20	Implement a two-year trial at two sites – one for revegetation and one for managing views (resolved by Council following preparation of a draft vegetation management plan for the Collingwood Beach Reserve). Any vegetation action plan must reduce the likelihood of erosion (Advisian 2018).	1	Important component of risk management and protection of coastal biodiversity and ecosystems	Collingwood Beach	$90,000 Council operational budgets and OEH funding or other grant programs	2 years
LA3.22	Investigate opportunities for disabled access at Plantation Point.	1	Important component of providing opportunities for recreation planning and community development	Plantation Point	$230,000 (seek grant funding) Council operational budgets and OEH funding or other grant programs	2 years
LA4.2	Prepare and implement bush regeneration plan for coastal reserves around the Bendalong Point Holiday Haven Tourist Park.	2	Important component of risk management and protection of coastal biodiversity and ecosystems	Bendalong	$20,000 to prepare plan, $15,000 p.a Council operational budgets and OEH funding or other grant programs	3 years
LA4.5 LA5.16	Rehabilitate area of public land at Inyadda Point and Mitchell Parade, Mollymook consistent with the Landslide Risk Assessment undertaken for this area as required.	1	Important component of risk management and protection of coastal biodiversity and ecosystems	Inyadda Point Mollymook	$250,000 (seek 50% grant funding) Council operational budgets and OEH funding or other grant programs	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
LA5.1	At Narrawallee Beach, monitor dune crest levels. A minimum of 6.0m AHD may minimise the risk of wave overtopping. Options for manging dune heights include beach scraping and dune nourishment, if sand source is available. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	1	Important component of risk management and protection of coastal biodiversity and ecosystems	Narrawallee Beach	A cost component of C1.7. $40,000 (to investigate sand availability for beach scraping and nourishment if necessary and seek funding) Council operational budgets and OEH funding or other grant programs	3 years
LA5.5	Prepare cost benefit analysis to determine the most feasible management option (such as protect or retreat and relocate) at the southern end of Mollymook Beach. This relates to both public and private assets.	1	Important component of risk management	Mollymook	$100,000 ($50,000 OEH grant funding) Council operational budgets and OEH funding or other grant programs	1 year
LA5.6	Consider implementation of recommendations of abovementioned cost benefit analysis, LA5.5 at South Mollymook Beach. Undertake detailed design, planning and approvals process for works required to protect assets most at risk (e.g. seawall reconstruction, sandstone block wall, concrete wall and new revetment. Modifications should include provision for safe disabled access onto the beach) as required. If works proceed, prepare asset management plan for on-going maintenance and monitoring of works.	1	Important component of risk management	Mollymook	$150,000 (design, planning, approvals) $3,500,000 (construction) (Seek at least 50% grant funding from sources such as OEH and contribution from private asset owners)	1 year
LA5.7	Continue to monitor buried training wall at North Mollymook to measure effectiveness of mitigating	1	Important component of risk management	Mollymook	A cost component of C1.7.	3 years

Action	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	coastal hazards (part of the Coastal Management Program & EMP – see Actions C1.7 & C7.1).				Council operational budgets and OEH funding or other grant programs	
LA2.5	Undertake a geotechnical assessment to assess the impact from potential cliff and slope instability to provide suitable and site specific LRM recommendations for lookout at Penguin Head or consider relocation of these assets where feasible.	2	Important component of risk management	Penguin Head	$10,000 Council operational budgets and OEH funding or other grant programs	3 years
LA6.5	Geotechnical assessment to assess the impact from potential cliff and slope instability to provide suitable and site specific recommendations for the carpark at Racecourse Beach or consider relocation of these assets where feasible.	2	Important component of risk management	Racecourse Beach	$10,000 Council operational budgets and OEH funding or other grant programs	3 years
LA5.17	Undertake geotechnical assessment to assess the impact from potential cliff and slope instability to provide suitable and site-specific landslide risk management (LRM) recommendations for lookout at Bannisters Point or consider relocation of assets where feasible.	2	Important component of risk management	Bannisters Point	$10,000 Council operational budgets and OEH funding or other grant programs	3 years

Table 4-3 – Actions for 3 to 5 years ranked by priority

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
C1.4	Investigate and scope feasible, long-term funding options for effective, integrated management of the Shoalhaven coastal zone. Funding strategies will include Council rates and levies, leveraged by grant applications.	1	Shares costs of coastal management	Whole of coast	$25,000 Council operational budgets and OEH funding or other grant programs	3 years
C1.5	Review and update Council's Coastline Risk Management Report 2004.	1	Identify priority risk areas	Whole of coast	$40,000	1 year

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
					Council operational budgets and OEH funding or other grant programs	
C1.6	Review and assess coastal erosion concept designs, and other technical reports containing management options for high risk beaches to identify appropriate future actions for community consultation and progression to detailed design where appropriate.	1	Address potential risks	High risk locations	Allow $100,000 for review, assessment and community engagement, plus Council officer time for negotiation with OEH and MPA	2 years
C1.8	Maintain the Ecological Monitoring Program (which forms part of the EMP C1.7) to ensure assessment of the extent of invasive species impact.	1	Important component of integrated management and evaluation	Whole of coast	Council – existing operational budgets	2 years
C1.9	At intervals of 5 years, report on what has been achieved in terms of implementation of the CZMP.	1	Important component of adaptive management procedures	Whole of coast	Council – existing operational budget	5 years
C5.2	Prepare and implement Nature Assisted Beach Enhancement (beach scraping) plans for all Council managed beaches to support the emergency action sub-plans.	3	Important component of managing risk	Whole of coast	$20,000 Council operational budgets and OEH funding or other grant programs	3 years
C5.3	As part of any beach scraping activities, establish a monitoring program to continue investigations of baseline ecological condition/diversity for affected beaches. The monitoring program would be established in consultation with DPI Fisheries.	3	Important component of managing risk and protection of coastal biodiversity and ecosystems	Whole of coast	$10,000	3 years
C7.2	Carry out surveys to ground-truth and map the distribution and condition of EECs in coastal erosion risk areas using the Biodiversity Conservation Act, Biodiversity Assessment Methodology.	3	Important component of protecting coastal biodiversity and ecosystems	Identified EECs	$25,000 for each monitoring or assessment area seek funding from OEH	5 years
LA1.1	Assess the condition of the rock revetment in front of the Shoalhaven Heads Surf Club if and when it's exposed during a major storm. The revetment was designed and constructed following the 1970s storms.	1	Important component of risk management	Shoalhaven Heads	Dependent on timing and extent of event but allow $50,000 Council operational budgets and OEH funding or other grant programs	3 years

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
LA1.2 LA2.2 LA5.10	Audit site constraints and foundation capacity for the Shoalhaven Heads SLSC building, Nowra Culburra (Warrain Beach) SLSC Building and community buildings and infrastructure at Mollymook, including SLSC building and wastewater pump stations, to inform decisions about the timing of relocation or reconstruction on deep-piled foundations.	2	Important component of risk management	Shoalhaven Heads Warrain Beach Mollymook	$150,000 (seek OEH funding or other grant programs)	3 years
LA1.4	Depending on outcome of LA1.3, at end of building asset life or in the event of significant storm damage, relocate surf club landward and construct on deep piled foundations.	2	Important component of risk management	Shoalhaven Heads	>$1,000,000 (seek at least 50% grant funding)	10 years
LA1.7	Develop a design for reuse of excavated 'dry notch' (flood notch) sand, and other suitable sand, at the River entrance for • Erosion sites fronting River Road • Low dune crest locations • The northern side of the entrance area, to increase the volume of the beach and dunes, and provide interim protection from large southerly waves during storms. Note that dredging and nourishment works will require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	1	Important component of risk management and protection of coastal biodiversity and ecosystems	Shoalhaven Heads	Council – existing operational budget and seek OEH funding	3 years
LA1.8	Repair and replace or relocate the beach access infrastructure, including viewing platforms, if and when required following a large storm. Consider designing and installing a beach access and viewing platform for people with disabilities where possible as part of future upgrades or replacement where feasible.	1	Important component of risk management	Shoalhaven Heads	Dependent on timing and extent of event (seek 50% grant funding from OEH and other sources)	5 years
C2.2 LA1.9 LA3.15 LA5.14	Engage with foreshore reserve property owners, residents and beach goers about the values of dune vegetation e.g. trapping wind-blown sand and maintaining dune resilience, ecological functions and buffering against coastal hazards, the importance of foreshore vegetation in providing shade and wind protection, filtering runoff, improving water quality and providing habitat.	1	Important component of risk management and protection of coastal biodiversity and ecosystems	Whole of coast	$40,000 (seek 50% grant funding from OEH or other sources)	3 years
LA3.1	Undertake technical studies to investigate the feasibility of medium term, to long term, relocation of water and	1	Important component of risk management	Currarong	Staff time or consultancy $50,000 (excluding	3 years

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
	road infrastructure along the eastern end of Warrain Crescent to the landward boundary of housing lots (assets are currently on the seaward boundary). Similarly, where sewerage infrastructure is provided, investigate feasibility of locating it to a more landward position.				construction and easement acquisition costs)	
LA3.13	Monitor beachfront area and implement post-storm emergency action measures when required to repair or replace public beach access.	1	Important component of risk management	Callala Beach	Dependent on timing and extent of event (seek 50% grant funding)	5 years
LA3.14	Investigate future relocation of tennis club and amenities. Audit site constraints and foundation capacity of community buildings and infrastructure. Apply requirements of Shoalhaven DCP to future upgrades of tennis club buildings and infrastructure as well as development on private lots.	2	Important component of risk management	Callala Beach	$50,000 (seek 50% grant funding)	5 years
C2.3	Continue to work collaboratively with NPWS staff and volunteers to implement the NSW South Coast Shorebird Recovery Program to: • Raise awareness amongst residents and visitors of migratory shorebirds which are protected under international agreements, federal and state legislation • Manage the impacts of vehicles, pest animals and dogs on beaches, especially in regard to the breeding success of migratory shorebirds.	1	Important component of protection of coastal biodiversity and ecosystems	Whole of coast	$5,000 Council operational bugets	5 years
C2.6 LA2.4 LA5.7	Review relevant asset management plans and incorporate opportunities for disabled access where feasible. Investigate opportunities for disabled access at beaches and progress to detailed design where appropriate.	1	Important component of providing opportunities for recreation planning and community development	Whole of coast	$15,000 (seek grant funding opportunities) $50,000 (excluding detailed design) OEH funding or other grant programs	5 years

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
C3.3	Use appropriate zoning in the Shoalhaven Local Environmental Plan to protect frontal dune systems from development that reduces resilience to coastal hazards	2	Important component of implementing planning system controls	Whole of coast	$30,000 (seek funding)	3 years
C4.2	Review and update plans of management and the Foreshore Reserves Policy 2005 to ensure consistency with this CZMP.	1	Important component of implementing planning system controls	Whole of coast	$30,000 (seek funding)	1 year
C6.1	Review and update all asset management plans (AMPs), relevant to the coastal zone. AMPs will be updated by relevant asset custodian. Include an asset management approach provision for replacement, relocation or retrofitting of public assets that are currently in coastal risk areas including surf clubs and sewer, water and sewerage infrastructure, foreshore protection infrastructure, roads and access paths. Align the asset management plans with emergency action sub-plans.	1	Important component of integrating management and risk management	Whole of coast	$150,000 (seek funding)	3 years
LA3.8	Re-route the Peel Street beach access to address sand loss from beach. Fence and revegetate the nourished dune and beach accesses that have been closed to stabilise the dune.	1	Important component of risk management and providing opportunities for recreation planning and community development.	Currarong	$15,000 (seek 50% funding from OEH)	3 years
LA3.9	Undertake a detailed, technical investigation of small scale coastal hazard management options that are feasible at Callala Bay to protect public infrastructure if required, cognisant of coastal processes and risks (over defined time frames), as well as the social, environmental and economic impacts of the options, including its benefits and costs. Develop and implement a management strategy in consultation with key stakeholders including DoI Crown Lands.	2	Important component of risk management and providing opportunities for recreation planning and community development.	Callala Bay	$30,000 (seek 50% funding from OEH)	3 years

	What is proposed	Priority	Why this action is a high priority	Location	Cost estimate & likely funding source	Review period
LA3.10	Investigate foreshore protection options to stabilise the shoreline at Sheaffe Street, Callala Bay. The works are to protect the road, control storm water flows across the beach and slow loss of sand to the north.	2	Important component of risk management	Callala Bay	$15,000 (excluding detailed design) (seek 50% funding from OEH))	3 years
LA3.11	Investigate site constraints (coastal hazards, topography and land availability) and foundation capacity of the Callala Bay Sailing Club to inform management of this asset.	1	Important component of risk management and providing opportunities for recreation planning and community development.	Callala Bay	$30,000 (OEH funding or other grant programs)	3 years
LA4.1	Prepare and implement the Boat Harbour Master Plan and the Stormwater Upgrade Plan.	1	Important component of risk management and providing opportunities for recreation planning and community development.	Bendalong	$100,000 (seek OEH funding or other grant programs)	2 years
LA5.3	Investigate whether localised protection for the sewerage assets is required and the feasibility of the relocation of the sewerage infrastructure.	1	Important component of risk management	Narrawallee	$50,000 (OEH funding or other grant programs)	1 year
LA6.2	Prepare a management plan for Warden Head public reserves. The plan will be prepared in consultation with Ulladulla Local Aboriginal Land Council, including the preparation of a memorandum of understanding about the maintenance of walking tracks on the headland. Note that beach scraping and nourishment works are likely to require approvals under the Crown Lands Act 1989 or Crown Land Management Act 2016 which commences 1 July 2018.	3	Protection of Aboriginal cultural heritage, recreation planning and community development and protection of coastal biodiversity and ecosystems	Ulladulla	$100,000 (OEH funding or other grant programs)	2 years
LA3.18	Investigate potential for medium, to long term relocation of sewerage infrastructure along the beach front reserve at Collingwood Beach, between Argyle Street and Berry Street.	2	Important component of risk management	Collingwood Beach	$150,000 (OEH funding or other grant programs)	3 years

Table 4-4 – Actions proposed for beyond 5 years

Action	What is proposed	Rank	Rationale for this action	Location	Cost estimate & likely funding source	Review period
C1.11 C1.1	After 10 years, conduct a full review of the implementation of the CZMP (or new CMP). As part of this review, in consultation with the community, identify coastal zone objectives and principles, for application in future reviews of this Plan and future coastal management programs.	1	Important component of integrating management of the entire coastline.	Whole of coast	$200,000 (OEH funding or other grant programs)	10 years
C4.4	Wherever possible, use zoning and planning controls in Shoalhaven Development Control Plan 2014 to maintain open spaces where coastal dune terrain and associated habitats can roll landward in response to climate change and sea level rise. On the open coast, this management action is linked to planning for vegetated foreshore reserves on coastal dunes.	3	Important component of implementing planning system controls, adaptive management procedures and protection of coastal biodiversity and ecosystems	Whole of coast	$40,000 Council budgets	4 years
C6.3	Review the coastal cliff and slopes hazard lines and extent of risk areas. Review will be informed by the on-going geotechnical assessment of foreshore sites completed to date.	1	Important component of risk management and implementation of planning system controls	Coastal cliffs and slopes	$150,000 (OEH funding or other grant programs)	5 years
LA1.3 LA2.3 LA5.10	Investigate zoning, land tenure and approval processes for relocation of the Shoalhaven Heads, Nowra Culburra and Mollymook Surf Club landward of its current position, outside the 2050 coastal erosion risk area. The move will be triggered by the asset life of the existing building or significant storm damage to the building.	1	Important component of risk management	Shoalhaven Heads Warrain Beach Mollymook	$200,000 (OEH funding or other grant programs)	5 years
LA6.1	Monitor and maintain the rock protection structure on the landward shore of Ulladulla Harbour to provide protection for the public reserve and the Princes Highway.	1	Important component of risk management and recreation planning and community development	Ulladulla	$20,000 to assess, $100,000 repairs (OEH funding or other grant programs)	5 years

Glossary

Accreting	Forming (a composite whole) by gradual accumulation.
Aeolian	Relating to or arising from the action of the wind.
Bathymetry	The measurement of depth of water in oceans, seas, or lakes.
Littoral Drift	The transport of non-cohesive sediments, i.e. mainly sand, along the foreshore and the shoreface due to the action of the breaking waves and the longshore current.
LiDAR	Light detection and ranging.
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
CCB	Community Consultative Body
CZMP	Coastal Zone Management Plan
CMP	Coastal Management Plan
ECL	East Coast Low
ESCCI	Eastern Seaboard Climate Change Initiative
DCP	Development Control Plan
ICOLL	Intermittently Closed and Opened Lakes and Lagoons
IPCC	Intergovernmental Panel on Climate Change
LEP	Local Environmental Plan
NRFM	Natural Resources & Floodplain Management
OCOL	Our Coast Our Lifestyle
OEH	Office of Environment & Heritage
SLEP	Shoalhaven Local Environmental Plan
SLR	Sea Level Rise
SOI	Southern Oscillation Index
ZSA	Zone of Slope Adjustment
ZRFC	Zone of Reduced Foundation Capacity

Reference List

- NSW Coastal Management Act 2016
- NSW Coastal Protection Act 1997
- NSW Environmental Planning & Assessment Act 1979
- NSW Crown Land Management Act 2016
- NSW Aboriginal Land Rights Act 1983
- NSW Native Title Act 1993
- NSW Local Government Act 1993
- NSW Biodiversity Conservation Act 2016
- NSW National Parks & Wildlife Act 1974
- NSW State Emergency and Rescue Management Act 1989
- NSW Marine Estate Management Act 2014 (Regulations and Zonings 1999)
- NSW Fisheries Management Act 1994
- NSW Guidelines for Preparation of Coastal Zone Management Plans (2013)
- NSW Aboriginal Heritage Impact Management System(AHIMS) Database
- NSW Due Diligence Code of Practice for the Protection of Aboriginal Objects
- NSW Dune Management Manual
- NSW Guidelines for ICOLL Management
- NSW National Parks Plans of Management – Comerong Island and Seven Mile Beach
- NSW Planning Guideline: Adapting to Sea Level Rise (2010)
- NSW Coastal Risk Management Guide: Incorporating Sea Level Rise into Risk Assessments (2010)
- Shoalhaven Emergency Risk Management Report & Mitigation Report
- DISPLAN (SES)
- Illawarra -Shoalhaven Regional Plan
- CSIRO State of the Climate Report 2016
- Healthy Rivers Commission Independent Inquiry into Coastal Lakes
- Jervis Bay National Park Management Plan
- Register of the National Estate
- National Heritage List
- The Council's Foreshore Reserves Policy
- Shoalhaven Public Asset Coastal Risk Management Review (BMT WBM 2012)
- Coastal Slope Instability Hazard Study (SMEC 2008)
- Peer Review, Supplementary Geotechnical Observations (of the Coastal Slope Instability Hazard Study 2008) Douglas Partners 2011
- Report on Scoping Study and Stability Assessment (Various Lots Surfers Avenue, Tallwood Avenue & Bannister Head Road, Narrawallee) (Douglas Partners 2011)
- Shoalhaven Coastal Cliffs and Slopes Risk Management Program (Royal Haskoning DHC, 2018)
- Council's Weed Management Policy
- Council Bushcare/ Parkcare Policy & Procedures (POL09/78)

- Council Population Profile 2016
- Council Management Options for Improving Flows of the Shoalhaven River at Shoalhaven Heads
- Council Currarong Dunecare Action Plan
- Council Currarong Creek NRM Strategy
- Council Local DISPLAN
- Council Coastal Erosion Road Stormwater Assessment (Assets & Works Group) 2015
- Council Drainage Asset Management Plan
- Council Disability Inclusion Action
- Council River Road Erosion Design 2017
- Council River Road Foreshore -Shoalhaven Heads – Assessment of Coastal Management Options Plan 2017-2012
- Council Narrawallee Inlet NRM Strategy 2002
- Council Narrawallee Inlet Sustainability Assessment & Management Strategy 2009
- Council Narrawallee Surfers Ave/Bannisters Head Road/Tallwood Ave. Geotechnical Study & Stability Assessment 2012
- Council Millards Creek Corridor Management Plan 2007
- Council Monitoring Evaluating and Reporting (MER) Strategy
- Council Aboriginal Cultural Heritage Report (Council's Crookhaven Headland Plan of Management) 1998
- Shoalhaven Local Environmental Plan 2014
- Shoalhaven Development Control Plan 2014
- Coastal Erosion Stormwater Impact Assessment (Footprint Sustainable Engineering, 2015)
- Neilson et al 1992
- Vulnerability of Surf Clubs (CZM, 2011)
- Prof. Steve Smith 'Design for Baseline Data Collection and on-going Monitoring to Assess the Impact of Beach Scraping and Nourishment at Jervis Bay' 2013
- Dr Nathan Knott 'Coastal Erosion Remediation – Environmental Baseline Study – Preliminary Report' 2015
- Royal Haskoning, 'Currarong Coastal Erosion Protection Technical Design Report' 2017
- Environmentally Friendly Sea Walls (OEH) 2012
- Carley et al. 2010

Acknowledgements (also included on document control page)

- Umwelt(Aust) Pty Ltd 2012
- SMEC Pty Ltd