Lower Shoalhaven River Coastal Management Program

CMP Stage 3 Report

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Cover image: ***Shoalhaven River, Emma Maratea, May 2022***

Acknowledgement of Country

Walawaani (welcome),

Shoalhaven City Council recognises the First Peoples of the Shoalhaven and their ongoing connection to culture and country. We acknowledge Aboriginal people as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, present and emerging.

Walawaani njindiwan (safe journey to you all)

This acknowledgment includes Dhurga language. We recognise and understand that there are many diverse languages spoken within the Shoalhaven.

Acknowledgment of Financial Assistance

Shoalhaven City Council has prepared this document with financial assistance from the NSW Government through its Coastal and Estuary Grants Program. This document does not necessarily represent the opinions of the NSW Government or the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW).

Executive Summary

The State Government requires that CMPs be prepared in accordance with the mandatory requirements for CMPs specified in the *Coastal Management Act 2016* (the CM Act) and accompanying NSW Coastal Management Manual (the Manual; OEH, 2018b).

A CMP is prepared in five stages as per the Coastal Management Manual (OEH, 2018b). This report represents Stage 3 of this process.

CMP Study Area

The study area comprises the coastal zone of the Lower Shoalhaven River including the four Coastal Management Areas (CMAs) as defined under the CM Act:

- Coastal Wetlands and Littoral Rainforests Area;
- Coastal Vulnerability Area (currently not mapped);
- Coastal Environment Area; and
- Coastal Use Area.

The study area is mapped in **Figure ES-1**.

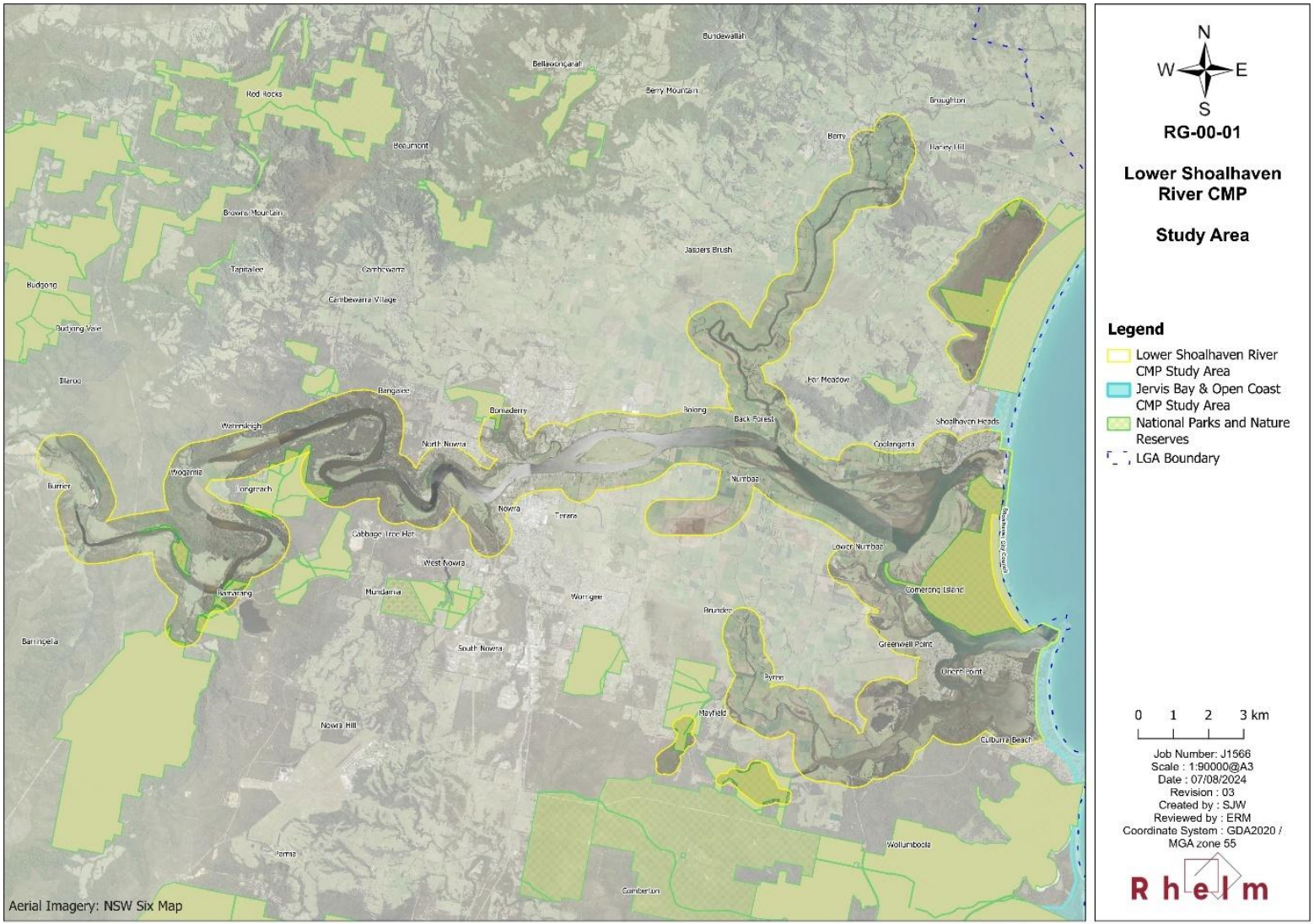

Figure ES-1 Lower Shoalhaven River CMP Study Area

Values of and Threats to the Study Area

The coastal zone supports a broad diversity of activities and uses, spanning residential, passive and active recreation, industrial and commercial, agriculture, fisheries, tourism and biodiversity conservation.

The coastal values and threats to these values were developed and confirmed in consultation with key stakeholders and based on feedback from the broader community. The coastal values and threats informed the strategic direction for the Lower Shoalhaven River CMP.

Key values related to coastal management in the Lower Shoalhaven River were related to:

- Environmental values
- Social and cultural values
- Economic values
- Coastal processes, hazards and resilience
- Land use planning
- Equity and access
- Integrated and collaborative management

Key threats for the Lower Shoalhaven River CMP study area were identified through a risk-based approach in the Scoping Study (Advisian, 2020) and in the Stage 2 Detailed Risk Assessment (Rhelm, 2023b). The outcomes of the detailed risk assessment are used to inform the identification and evaluation of potential management options. The risks identified within the Lower Shoalhaven River, can be characterised into the following risk themes:

- Bank Erosion and Berry's Canal Adjustment;
- Changes in Tidal Inundation as a Result of Sea Level Rise;
- Coastal Inundation (from coastal storms and extreme tides);
- Coincident Inundation (combination of catchment flooding and coastal inundation);
- Land Clearing and Development (urban and rural);
- Acid Sulfate Soils and Drainage Structures;
- Boating and Associated Waterway and Foreshore Usage; and
- Commercial and Recreational Fishing.

Strategic Direction for the CMP

The vision, objectives and strategic direction for the Lower Shoalhaven River CMP developed by Council provide local context that recognises the unique values and attributes of the study area and the community's aspirations for the coastal zone.

The strategic vision statement for the Lower Shoalhaven River CMP is:

We care for and protect the Lower Shoalhaven River and its catchment so that current & future generations continue to be refreshed & inspired by their coastal experience.

Supporting the vision are a series of local coastal management objectives that have been developed to align with the objects of the CM Act.

Identification and Evaluation of Coastal Management Options

A total of 215 potential management options spread across the entire Lower Shoalhaven River coastal zone were compiled via an audit of previous management plans and studies, engagement with the community and agency stakeholders, and the outcomes of the Stage 2 CMP vulnerability assessments.

Initially, a **feasibility** assessment was undertaken to 'rule out' any options that did not address an existing or future risk to the coast, to consolidate overlapping options, or to identify options that were not feasible from an engineering, legal or implementation perspective.

Of the 215 options on the long-list, a total of **50** options were identified as being feasible and progressed to the viability assessment.

The 50 options were then subjected to **viability** assessment, which involved a simple economic analysis and a multi-criteria analysis (MCA). The **acceptability** of the management option to the community, Council and key stakeholders was also considered.

These inputs were used to develop a final score and rank each of the management options against each other. A flowchart of the options evaluation process is provided in **Figure ES-2.**

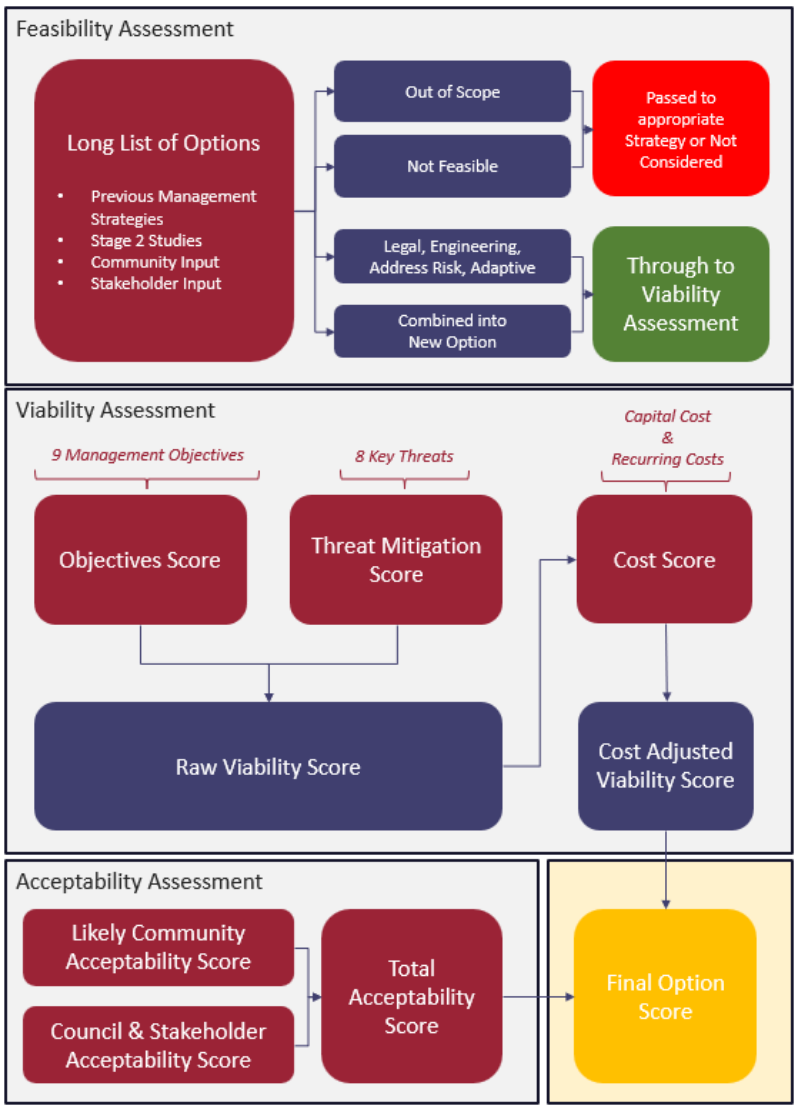

Figure ES-2 Flowchart of the Options Evaluation Process

Recommendations for the CMP

The outcomes of the viability and acceptability assessment provided a prioritised set of coastal management actions for implementation over a 10 year period. Of the 50 options assessed, 48 were recommended for refinement in Stage 4 and inclusion in the CMP implementation phase (Stage 5).

The implementation cost for all viable actions over the 10-year CMP timeframe is estimated to be approximately $24,000,000. Of this, approximately $11,000,000 is for capital works, and the remaining $13,000,000 is for operational costs, maintenance and repairs associated with capital works. A business plan will be developed for the CMP as part of Stage 4 that outlines the key components for funding the strategy, including the cost of proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms.

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1 Introduction

1.1 Overview

Shoalhaven City Council (hereafter 'Council'), with the assistance of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW), is preparing the Lower Shoalhaven River Coastal Management Program (CMP) to provide strategic direction and specific actions to address threats to the coast and maintain the ecological, social and economic values of the coastal zone.

The NSW Government requires that CMPs be prepared in accordance with the mandatory requirements specified in the *Coastal Management Act 2016* (the CM Act) and accompanying NSW Coastal Management Manual (the Manual; OEH, 2018b). A CMP outlines the strategic aims for the coordinated management of the coastal zone and identifies specific actions to mitigate the threats and issues identified for the coast that are to be implemented over the next 10 years. The CMP is an operational document for local government, State government and the broader community to take action to manage, preserve, improve, promote and rehabilitate the coast.

In effect, a CMP is a plan of action for Council, public authorities and land managers responsible for management of the coastal zone to:

- Address coastal hazard risks;
- Preserve habitats and cultural uses and values;
- Encourage sustainable agricultural, economic and built development in the coastal zone;
- Maintain or improve recreational amenity and resilience; and
- Adapt to emerging issues such as population growth and climate change.

1.2 Strategic and Statutory Context

Under Part 3 of the CM Act, local Councils are required to prepare CMPs in accordance with the coastal management framework (**Figure 1-1**), which reflects the broader suite of statutory instruments and strategies that provide for the ecologically sustainable development of the coastal zone of NSW.

The Manual (OEH, 2018b) provides information and guidance to Councils in preparing their CMPs.

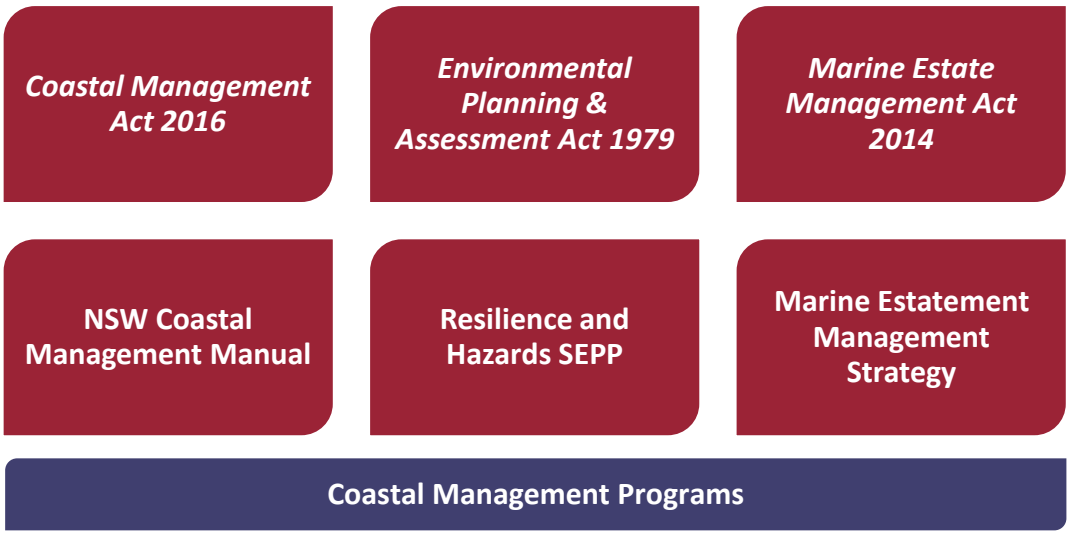

Figure 1-1 Coastal Management Framework (after: OEH, 2018b)

A CMP is prepared in five stages as illustrated in **Figure 1-2**. Previous stages that have been completed for the Lower Shoalhaven River coastal zone to date include:

- **Shoalhaven Coastal Management Program Stage 1 Scoping Study** (Scoping Study; Advisian, 2020) – which set the context and scope for the broader Council coastal zone, including recommendations for priority CMPs to be developed throughout the LGA.
- **Lower Shoalhaven River Coastal Management Program – Stage 2 Studies** – including:
  - Stage 2 Synthesis Report (Rhelm, 2023a)
  - Detailed risk assessment (Rhelm, 2023b)
  - Tidal and coastal inundation assessment (Stantec, 2023)
  - Boating study (Rhelm, 2023c)
  - Water quality and monitoring program assessment (Rhelm, 2023d)
  - Urban runoff assessment and treatment options (Rhelm, 2023e)
  - Bank and riparian condition assessment (Rhelm, 2023f)
  - Review of Entrance Management Plan (Rhelm, 2023g).

This report forms the summary of ***Stage 3 - Options identification and evaluation process***. The findings from this stage will support the development of the Lower Shoalhaven River CMP that will continue in Stage 4. Stage 4 will also include the preparation of the Coastal Zone Emergency Action Subplan (CZEAS) - a plan to manage risk to built assets and life as a result of a coastal storm - and preparation, exhibition, certification and adoption of the CMP.

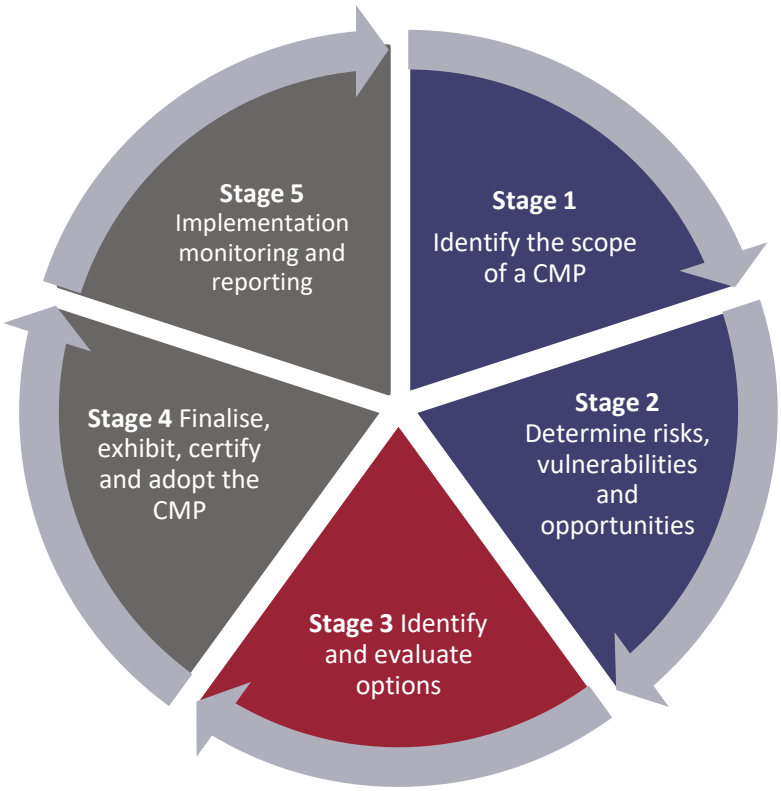

Figure 1-2 Stages in Preparing and Implementing a CMP (after: OEH, 2018b)

1.3 Purpose and Structure of this Report

This report has been prepared to document the outcomes of Stage 3 of the CMP process, including the options identification and evaluation methodology, and identify the options that are recommended for adoption as management actions in the Lower Shoalhaven River CMP (or CZEAS).

This CMP Stage 3 report has been structured as follows:

- The CMP study area, defined as the Lower Shoalhaven River coastal zone, is described in **Section 2**
- The key values and threats relating to the study area, as well as the strategic direction of the CMP are discussed in **Section 3**
- The options identification and evaluation methodology are provided in **Section 4**
- The outcomes of the evaluation process and recommendations for management actions to be included in the Lower Shoalhaven River CMP are provided in **Section 5**
- Next steps are provided in **Section 6.**

Additionally,

- Maps referenced throughout the report are collated in a compendium in **Appendix A;**
- Options feasibility assessment details are provided in **Appendix B;**
- Options viability and acceptability assessment details are provided in **Appendix C;** and
- The Closing the Loop – Community Engagement Summary Report is provided in **Appendix D.**

2 Area Covered by the CMP

The Shoalhaven River originates in the Southern Tablelands east of the Great Dividing Range. It runs through a gorge 30 kilometres east of Goulburn and flows towards the low-lying floodplains around Nowra and Bomaderry. The river has two openings to the Tasman Sea – a permanent and trained entrance at Crookhaven Heads, and an intermittent opening at Shoalhaven Heads. The Shoalhaven Heads entrance was historically the main pathway for the Shoalhaven River until the construction of Berry's Canal in 1822 connected that waterway with the lesser Crookhaven River, irreversibly altering the hydrodynamics of the estuary.

The estuary has a water surface area of 31.9 km^2 and a total catchment area of 7,086 km^2 (Advisian, 2020). The estuary comprises diverse landforms and can be divided into three zones:

- **Upper Estuary** – The river passes through steep vegetated slopes and sandstone cliffs, with discontinuous pockets of floodplains.
- **Lower Estuary** – Once downstream of Nowra, or the Bomaderry Creek junction, the river widens into a large extensive floodplain.
- **Entrance** – There are two entrances to the estuary, with the northern entrance located at Shoalhaven Heads and the southern entrance at Crookhaven Heads located north of Culburra.

Besides the primary channel of the Shoalhaven River, the key waterway features in the study area include the Crookhaven River, Broughton Creek, and Berry's Canal.

The study area for the Lower Shoalhaven CMP comprises the coastal zone of the Lower Shoalhaven River. Considerations for the border of the CMP study area include:

- Extent of the mapped Coastal Management Areas under the *State Environmental Planning Policy (Resilience and Hazards) 2021* (the Resilience and Hazards SEPP)
- Alignment with other adjacent CMPs such as the Shoalhaven Open Coast CMP.

The landward extent of the majority of the study area is defined by the Coastal Management Areas (CMAs) mapped in the *State Environmental Planning Policy (Resilience and Hazards) 2021* (the Resilience and Hazards SEPP) that are connected to the Shoalhaven River estuary.

Areas subject to coastal hazards, as determined in the Stage 2 vulnerability assessments may be included in the coastal zone (i.e. the study area) through the inclusion of a Coastal Vulnerability Area (CVA) in the future, subject to a planning proposal.

The CMP study area is shown on **Map RG-01-01** in **Appendix A**. This area does not include the CVA.

2.1 Coastal Management Areas

There are four Coastal Management Areas (CMAs) defined under the CM Act. All but the Coastal CVA are mapped under the Resilience and Hazards SEPP (RH SEPP). Designation of a CVA will require a planning proposal. This is discussed further in **Section 2.2**.

A brief description of the CMAs within the study area is provided below. All maps are provided in **Appendix A**.

- **Coastal Wetlands and Littoral Rainforests Area (CWLRA)** – There are extensive areas of Coastal Wetlands throughout the study area. There are comparatively smaller areas of Littoral Rainforest in the study area. These are mapped in **Map RG-01-02**. The management

objectives for land classified as CWLRA are centred around conservation, enhancement and rehabilitation of environmental values. The extent of CWLRA mapping can be subject to revision as ecological mapping is refined. This would be facilitated by a planning proposal undertaken by Council.

- **Coastal Vulnerability Area (CVA)** – There is presently no mapping of a CVA for the Shoalhaven River area under the Resilience and Hazards SEPP. However, large parts of the study area and areas adjacent to the study area are vulnerable to coastal hazards, as identified through the Stage 2 vulnerability assessments (Stantec, 2023; Rhelm 2023f). A discussion regarding draft mapping of a CVA is detailed in **Section 2.2** and evaluated as a potential management option through the process detailed in **Section 4**. A recommendation is made to include an action in the CMP to develop a planning proposal to update the RH SEPP mapping, including the CVA.
- **Coastal Environment Area (CEA)** – The CEA comprises land containing coastal features such as the coastal waters of the State, estuaries, coastal lakes, coastal lagoons and land adjoining these features, including headlands and rock platforms (OEH, 2018b). The extent of the Coastal Environment Area within the study area is mapped in **Map RG-01-03**.
- **Coastal Use Area (CUA)** – The CUA includes land adjacent to coastal waters, estuaries, coastal lakes and lagoons where development is or may be carried out (now or in the future) (OEH, 2018b). There are a range of social and economic activities and development within the Lower Shoalhaven Coastal Use Area, as mapped in **Map RG-01-04**.

2.2 Coastal Vulnerability Area

The requirement for the mapping of the CVA is set out in the CM Act. The purpose of the mapping is to ensure the targeted application of coastal management measures to:

- Manage safety and risk associated with current and future coastal hazards;
- Mitigate current and future risk from coastal hazards;
- Maintain the existing ecosystems;
- Maintain public amenity;
- Encourage appropriate land use; and
- Support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency.

The CM Act does not explicitly define what is to be incorporated into the CVA, but rather that it should cover "*land subject to coastal hazards*". Importantly, the CM Act requires that future risk and the impacts of climate change be incorporated into the CVA.

The Resilience and Hazards SEPP prohibits development within the CVA unless the consent authority is satisfied that:

(a) if the proposed development comprises the erection of a building or works— the building or works are engineered to withstand current and projected coastal hazards for the design life of the building or works, and

(b) the proposed development:

(i) is not likely to alter coastal processes to the detriment of the natural environment or other land, and

(ii) is not likely to reduce the public amenity, access to and use of any beach, foreshore, rock platform or headland adjacent to the proposed development, and

(iii) incorporates appropriate measures to manage risk to life and public safety from coastal hazards, and

(c) measures are in place to ensure that there are appropriate responses to, and management of, anticipated coastal processes and current and future coastal hazards.

Through the development of the CMP, it is recommended that Council undertake a planning proposal to define and map a CVA within its Local Government Area (LGA). It is noted that Council is developing multiple CMPs, each with their own process for determining the extent of coastal hazards and which areas would be included in a planning proposal. It is also noted that a planning proposal would be required should Council wish to adjust the existing mapping for any other CMA, such as the CWLRA.

Therefore, the following describes the considerations for the Lower Shoalhaven River CMP study area only, discussing which coastal hazards to include, which planning horizons to consider, and how a planning proposal would be enacted.

The primary coastal hazards as defined in the CM Act that are prevalent in the Lower Shoalhaven River CMP study area are tidal and coastal inundation (**Maps RG-01-05** and **RG-01-06**, respectively). The other hazards present are coastal lake or watercourse entrance instability (referring to the intermittent opening at Shoalhaven Heads), and erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters (**Maps RG-01-07** showing bank erosion in Berrys Canal and **RG-01-08** showing bank erosion severity throughout the estuary). Of all these hazards, the spatial extent of coastal inundation is the greatest, and has been mapped in Stage 2 (Stantec, 2023). By focusing on the extent of this hazard to define the CVA, Council would also encompass the other hazards.

Council also must decide which planning horizon to consider (e.g. 2120 or 2120 +) and what sea level rise value this planning horizon reflects. In the Stage 2 study (Stantec, 2023) 21 coastal inundation scenarios were undertaken assuming 7 different sea-level rise values and the 1 year, 20 year and 100 year average recurrence interval (ARI) coastal inundation events (**Table 2-1**).

The scenarios modelled are not associated with specific planning horizons, acknowledging the uncertainty in sea level rise projections associated with different climate change pathways. The eventual scenario that Council decides to adopt for its CVA can be determined during the planning proposal process which includes community and stakeholder engagement requirements. The development of a LGA wide CVA has been identified in other CMPs developed prior to the Lower Shoalhaven River CMP. Nonetheless, potential management option CTF_13 has been included and evaluated through the process described in **Section 4**. The outcome of this evaluation is for this option to be included in the CMP as an action.

Table 2-1 Coastal Inundation Scenarios Modelled in Stage 2 Study (Stantec, 2023)

Water Level	Shoalhaven Entrance	Sea Level Rise (m)						
		0	0.1	0.23	0.36	0.6	0.9	1.2
1 year ARI	Open[a]	x	x	x	x	x	x	x
20 year ARI	Open	x	x	x	x	x	x	x
100 year ARI	Open	x	x	x	x	x	x	x

a – entrance dimensions equivalent to the scour profile for a 100 Year ARI event

3 Key Values and Threats

The coastal zone supports a broad diversity of activities and uses, spanning residential, passive and active recreation, industrial and commercial, agriculture, fisheries, tourism and biodiversity conservation.

The Scoping Study (Advisian, 2020) and the Stage 2 Synthesis Report (Rhelm, 2023a) provide detailed description of the environmental, social and cultural, economic and future context for coastal management planning in the Lower Shoalhaven River coastal zone. These set the scope for the CMP and provide an increased understanding of the values of and priority threats to the study area.

Sections 3.1 and 3.2 summarise the values of the study area and the priority threats to these values. Importantly, these values and threats were developed and confirmed in consultation with key stakeholders and based on feedback from the broader community. The outcomes of the community engagement are reported in the Stage 2 report and community summary documents on Council's webpage. **Section 3.3** builds on this information to confirm the strategic direction for the Lower Shoalhaven River CMP.

3.1 Values of the Study Area

The Scoping Study (Advisian, 2020) provides a review of the natural and built asset values of the coastal zone. The Stage 2 Synthesis Report (Rhelm, 2023a) also discusses the coastal and community values of the study area. Additional information on community values was obtained via the online interactive mapping tool hosted by Council. A synthesis of the key coastal values as described in these sources is presented in **Table 3-1**.

Table 3-1 Key Values of the Study Area

Theme	Values
Environmental Values	• The Shoalhaven River estuarine ecosystem, including seagrass, mangroves, and saltmarsh provides multiple benefits to the community and economy. • Healthy habitats for key species and biodiversity, especially in areas like Comerong Island and Coomonderry Swamp. • Biological diversity and ecological resilience to a changing climate. • Good water quality and ecosystem health for oyster and fishing industries as well as recreation. • Manage impacts of acid sulfate soils and blackwater events to maintain ecological balance.
Social and Cultural Values	• Safe and easy access to the estuary's natural and scenic amenity. • Recreational activities like boating, fishing, and community events in safe, accessible public spaces. • Extensive Aboriginal cultural heritage sites and continued connection to Country along the estuary. • Visual amenity and unique character of the estuary landscape, valued by residents and visitors.

Theme	Values
Economic Values	• A thriving local economy based on sustainable tourism, agriculture, and waterfront activities. • Sustainable development that respects the local character and values. • Infrastructure that supports the coastal zone's development, use, and enjoyment. • Well managed resources that sustainably support a diverse range of economic activities like agriculture, oyster farming and commercial fishing.
Coastal Processes, Hazards and Resilience	• The dynamic nature of shoreline and estuarine processes and their importance to estuary health and function. • Natural and built resilience to coastal and natural hazards, including climate change and extreme weather events. • Timely and flexible responses to coastal flooding and erosion. • Effective and sustainable management strategies to mitigate erosion and maintain navigable waterways. • Well managed impacts of human activities such as boating and dredging on coastal processes.
Land Use Planning	• Ecologically sustainable development with appropriate planning and regulatory measures. • Integrated coastal management objectives with local and State planning frameworks. • Coordinated and durable bank restoration solutions.
Equity and Access	• Equitable access to the coastal zone for all, including historically underrepresented groups. • Inclusive planning to maintain and enhance public spaces for community use.
Integrated and Collaborative Management	• Coordinated and cohesive coastal management between various levels of government and community groups. • Aligned management activities with public authority policies to ensure integrated coastal zone management. • Active, informed and engaged community input in coastal management decisions. • Widespread public awareness about coastal values, processes, and the importance of sustainable management.

3.2 Threats to the Study Area

Key threats for the Lower Shoalhaven River CMP study area were identified through a risk-based approach in line with the legislation and guidance from the Manual. Rhelm (2023b) provides a full report on the detailed risk assessment undertaken for the study area including in-depth descriptions of each key risk that poses a threat to the coastal zone. The key purpose of the risk assessment was to identify tolerable and unacceptable risks in the coastal zone, which are then addressed by management actions that are determined in Stage 3 and 4 of CMP development.

A risk register was developed as part of the first pass risk assessment in the Scoping Study (Advisian, 2020), and risks for the Lower Shoalhaven River were categorised in terms of the four coastal management areas as referred to in the Resilience and Hazards SEPP:

- Coastal wetlands and littoral rainforests area;
- Coastal vulnerability area;
- Coastal environmental area; and
- Coastal use area.

The risk register was updated as part of the Stage 2 detailed risk assessment (Rhelm, 2023b) to:

- Align with Council's established risk assessment procedure (resulting in the application of revised likelihood and consequence ratings);
- Include planning horizons over the next 100 years (i.e. to 2120) in accordance with the Manual;
- Integrate the findings of the Stage 2 studies (i.e. water quality, riparian and bank erosion, tidal and coastal inundation, stormwater treatment, and boating demands); and
- Incorporate input from stakeholder and community engagement completed during Stage 2.

The risks identified within the Lower Shoalhaven River, can be characterised into the following risk themes:

- Bank Erosion and Berry's Canal Adjustment;
- Changes in Tidal Inundation as a Result of Sea Level Rise;
- Coastal Inundation (from coastal storms and extreme tides);
- Coincident Flooding (combination of catchment flooding and coastal inundation)[1];
- Land Clearing and Development (urban and rural);
- Acid Sulfate Soils and Drainage Structures;
- Boating and Associated Waterway and Foreshore Usage; and
- Commercial and Recreational Fishing.

The outcomes of the detailed risk assessment are used to inform the identification and evaluation of potential management options. They are used to ensure potential options are considered that address identified risks, particularly extreme and high risk. They are also used in the multi-criteria analysis (MCA) to evaluate the effectiveness of each potential option at mitigating identified risks. The information from the detailed risk assessment has been condensed into a summary table for present day and 2120 provided in **Table 3-2**.

[1] As defined and addressed in the Lower Shoalhaven River Flood Study (completed) and the Lower Shoalhaven Floodplain Risk Management Study Plan (currently in development)

Table 3-2 Summarised Table of Threats to the Lower Shoalhaven River Coastal Zone

Theme	Description	Present Day Risk Rating	2120 Risk Rating
Bank Erosion and Berry's Canal Adjustment	Bank erosion poses significant threats to both the environment and human activities. Severe erosion can lead to a decrease in agricultural production, loss of riparian habitats, and even the removal or reduction of endangered ecological communities. This erosion impacts recreational amenities at foreshore reserves, damages riverside infrastructure, and results in a loss of biodiversity. The sedimentation and degradation of estuarine habitats further reduce habitats for birds and waders. Additionally, bank erosion can also pose a direct risk of injury to individuals in affected areas. Adjustments to Berry's Canal, such as channel widening, will lead to erosion in the lower estuary. This can damage floodplain infrastructure, posing threats to primary production. Such adjustments can also result in the loss of habitats, bringing about changes to the estuary's ecological balance.	High	Extreme
Changes in Tidal Inundation as a Result of Sea Level Rise	Rising sea levels due to changing tides can lead to shifts in habitat balance, including shoals and other estuarine features. Tidal incursions can alter salinity levels, and changes to floodplain aquifers that affect groundwater-dependent ecosystems, public assets, and agricultural lands. The landward expansion of the intertidal and subtidal zones will result in a migration of estuarine habitats following the tide line. Without sufficient accommodation space, these habitats will be squeezed out.	Low	High
Coastal Inundation (from coastal storms and extreme tides)	Coastal inundation, characterised by elevated water levels and flooding due to coastal storm, primarily results in damage to infrastructure.	Medium	Extreme
Coincident Flooding (combination of catchment flooding and coastal inundation)[2];	While projections are highly uncertain, climate change, particularly changes in rainfall patterns, can lead to alterations in flood flows and frequency. This can result in damage to floodplain infrastructure, posing threats to primary production. Communities might face isolation due to flooding, making access to emergency services challenging. Additionally, altered rainfall patterns can lead to a loss of biodiversity in affected regions. Extracting freshwater from natural sources can lead to changes in flood flows and frequency, resulting in a significant loss of biodiversity.	Medium	Extreme

[2] As defined and addressed in the Lower Shoalhaven River Flood Study (completed) and the Lower Shoalhaven Floodplain Risk Management Study Plan (currently in development)

Theme	Description	Present Day Risk Rating	2120 Risk Rating
Land Clearing and Development (urban and rural)	Land clearing and development in both urban and rural contexts have wide-ranging impacts. They can lead to changes in habitat balance, degrade fish habitats, and promote weed encroachment. Such activities can also harm significant cultural heritage places and lead to the loss of terrestrial and riparian habitats in floodplain areas. Poor water quality, especially impacting oyster production, is a major concern. The removal or reduction of endangered ecological communities, impacts on commercial fisheries, and reduced habitats for birds and waders further diminish biodiversity.	Medium	High
Acid Sulfate Soils and Drainage Structures	The presence and operation of flood gates and drainage structures can lead to the discharge of low pH water from actual Acid Sulfate Soils and act as physical barriers to fish passage, resulting in a loss of biodiversity. There is also an opportunity in re-naturalising flows and drainage to encourage the restoration of coastal wetlands and production of Blue Carbon.	High	High
Boating and Associated Waterway and Foreshore Usage	Boating is a popular recreational activity with an expected growth in the number of boats. Conflicts can arise between users of powered and non-powered crafts. There's also a noted insufficiency in foreshore facilities for recreational use, impacting the overall boating experience. These challenges can decrease recreational amenities and pose safety risks, including potential injuries.	High	High
Commercial and Recreational Fishing	Unregulated commercial and recreational fishing can lead to a reduction in species numbers and diversity, leading to a loss of biodiversity and unsustainable fishery derived economies.	Medium	Extreme

3.3 Strategic Direction for the Lower Shoalhaven River CMP

The purpose of a CMP is to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objectives of the CM Act. The CM Act sets out the State-wide objectives for managing the NSW coastal zone, including specific objects for the four CMAs.

The vision, objectives and strategic direction for the Lower Shoalhaven River CMP provide local context and recognise the unique values and attributes of the study area and the wider community's aspirations for the coastal zone.

The long-term strategic direction for the study area is encapsulated in a vision statement established for management of the Lower Shoalhaven River coastal zone and is consistent with the objects of the CM Act and community values identified in the Stage 1 Scoping Study. From the scoping study, the preliminary strategic vision statement for the broader Shoalhaven CMP is as follows:

We care for and protect the coast so that current & future generations continue to be refreshed & inspired by their coastal experience.

Adapting this for the Lower Shoalhaven River CMP, a more localised vision statement is as follows:

We care for and protect the Lower Shoalhaven River and its catchment so that current & future generations continue to be refreshed & inspired by their coastal experience.

Supporting the vision statement are a series of locally relevant coastal management objectives that have been developed to align with the objects of the CM Act and further shape the strategic direction of the Lower Shoalhaven River CMP. These are based on and consistent with the broader objectives discussed in the Stage 1 Scoping Study. These management objectives provide guidance during the evaluation of options. They are used as criteria during the multi-criteria analysis (MCA) to determine the viability of options. The management objectives for the Lower Shoalhaven River CMP are summarised in **Table 3-3**.

Table 3-3 Lower Shoalhaven River Coastal Management Objectives

Theme	Objective
Environmental Values	Protect and enhance natural estuarine processes and environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience.
Social and Cultural Values	Support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety. Acknowledge the diversity of uses and values of the Shoalhaven River coastal zone.
Aboriginal Values	Acknowledge, protect and promote Aboriginal peoples' spiritual, social, customary and economic use and access to the coastal zone.
Coastal Processes	Recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly.
Coastal Economies	Recognise the coastal zone as a vital economic zone and support sustainable coastal economies. Especially relevant are the tourism, oyster, commercial fishing, and agriculture industries.
Land Use Planning	Facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making. This is achieved through planning instruments, development controls, and other strategic planning facilitated by local and state government.
Coastal Hazards	Mitigate current and future risks from coastal hazards, taking into account the effects of climate change. Encourage and promote plans and strategies to improve the resilience of coastal natural and built assets to the impacts of an uncertain climate future including impacts of extreme storm events.
Integrated and Collaborative Management	Promote integrated and co-ordinated coastal planning, management, reporting and response amongst and between various government, industry and community organisations, and ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone to facilitate the proper integration of their management activities.

Theme	Objective
Public Participation	Support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes, values and management actions.

4 Identification and Evaluation of Management Options

4.1 Overview

The process for developing a CMP, as detailed in the Manual (OEH, 2018b), requires local councils to pinpoint coastal management issues within the CMP's designated area and determine the necessary actions to address these issues in a cohesive and coordinated fashion. The aim is to mitigate the risks from major coastal threats and other management concerns while pursuing potential opportunities. In this context, councils will establish the importance of the coastal management actions and suggest coherent and planned strategies for their implementation.

The process prescribed in the Manual follows the four steps illustrated in **Figure 4-1** and described below**.**

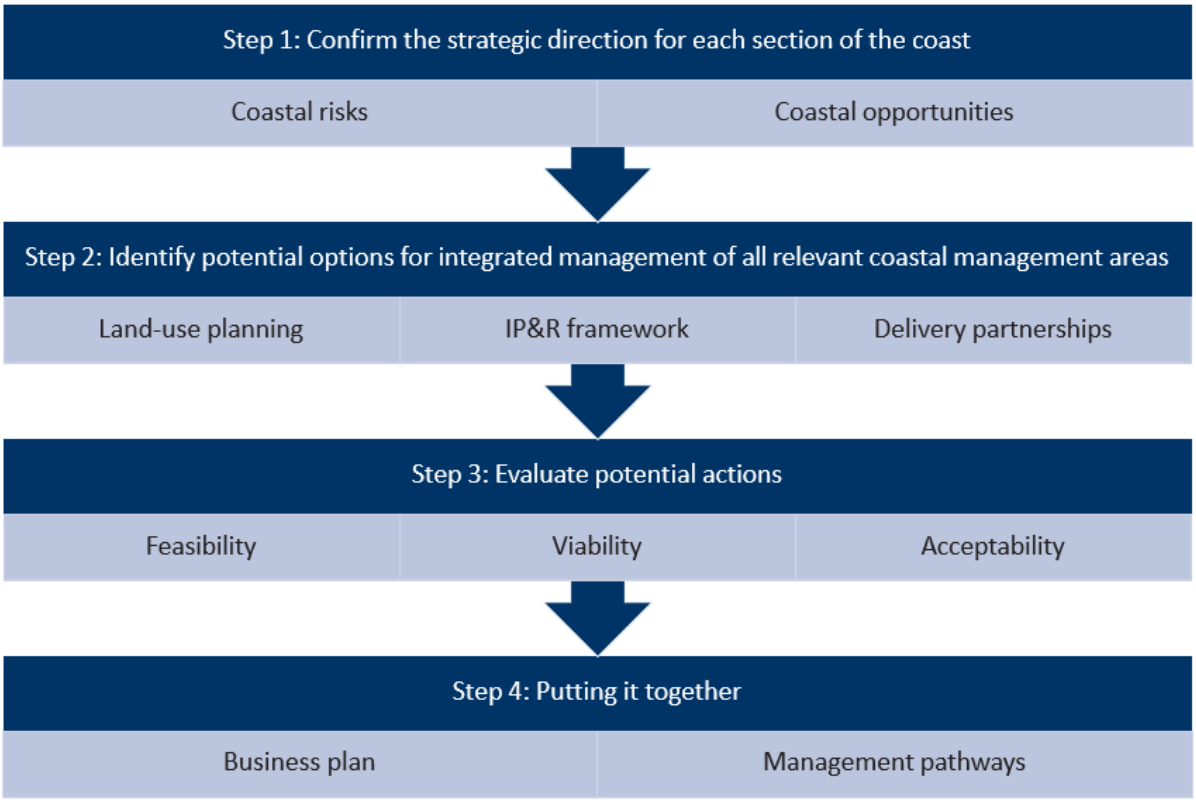

Figure 4-1 Options Identification and Evaluation Process (after: OEH, 2018b)

Step 1: Confirm the strategic direction for each section of the coast, primarily occurs in Stages 1 and 2 (supported by engagement activities) which provides an understanding of the coastal management issues, and an analysis of risks, vulnerabilities and opportunities in the study area. This information is summarised in **Section 3**. As per Step 1 in **Figure 4-1**, the key values, risks and opportunities identified provided the basis for the strategic direction of the Lower Shoalhaven River CMP detailed in **Section 3.3**.

Step 2: Identify potential options for integrated management of all relevant coastal management areas, and *Step 3: Evaluate potential management actions*, are undertaken in Stage 3. As illustrated in **Figure 4-1,** this has involved the identification of potential management options that can be implemented in

an integrated manner through the land-use planning, and Council's Internal Planning and Reporting (IP&R) frameworks, supported by delivery partnerships across government agencies.

A robust and transparent methodology was used to demonstrate the rationale used to evaluate and select preferred coastal management actions for inclusion in the CMP. This method was developed with a focus on achieving the objects of the CM Act and RH SEPP, reducing risk from identified threats, and enhancing coastal values.

A summary of the methodology by which management options were identified is provided in **Section 4.2.** The evaluation method is described in **Section 4.3**.

4.2 Identification of Management Options

Identification of potential management options for inclusion in the Lower Shoalhaven River CMP involved the creation of a 'long list' of options.

The first step in identifying potential options was to collate and review existing management actions from the Shoalhaven River Estuary Management Plan (Umwelt, 2008). The list of management options was audited for their implementation status and any options that had yet to be fully implemented, or were ongoing, were identified and included in the 'long list' of potential CMP management options.

Potential management options identified in the following Stage 2 studies were also included in the long list:

- Detailed risk assessment (Rhelm, 2023b);
- Tidal and coastal inundation assessment (Stantec, 2023);
- Boating study (Rhelm, 2023c);
- Water quality and monitoring program assessment (Rhelm, 2023d);
- Urban runoff assessment and treatment options (Rhelm, 2023e);
- Bank and riparian condition assessment (Rhelm, 2023f); and
- Review of Entrance Management Plan (Rhelm, 2023g).

Potential management options were also identified through various engagement activities including workshops with Council and Agency staff, Traditional Owners, and the community (including targeted discussions with multiple established community groups: Shoalhaven Heads Estuary Taskforce and Shoalhaven Riverwatch). An interactive mapping tool was used to gather inputs from the wider community. Input from these engagement activities was incorporated into the long list of options.

A more detailed description of the engagement activities that contributed information used in the identification and evaluation of potential management options is provided in the Stage 2 Summary Report (Rhelm, 2023a). A 'Closing the Loop' document has been prepared by Council that provides specific responses to comments received from the community and is provided as **Appendix D**.

Other CMPs developed, or currently in development, both by Council and other NSW coastal councils were also reviewed and relevant actions from these were adapted into the long list.

In total, **215** potential management actions were identified from these various sources. **Table 4-1** provides an overview of the count of options from each source that have been included in the long list.

Table 4-1 Source and Count of Options in the 'Long List'

Source	Count
Adapted from the Draft Tweed River CMP	3
Adapted from the Lake Conjola CMP	2
Adapted from the Shoalhaven Open Coast and Jervis Bay CMP - LGA wide actions	17
Additional Option Identified by the Project Team	8
Combination of Community Input and Stage 2 - Bank Erosion Study	3
Combination of Community Input and Stage 2 - Boating Study	2
Combination of Community Input and Stage 2 - Review of Entrance Management Plan	1
Combination of EMP Actions Audit and Stage 2 - Boating Study	1
Community - Interactive Mapping Input - Bank Erosion	15
Community - Interactive Mapping Input - Boating	7
Community - Interactive Mapping Input - Coastal and Tidal Flooding	3
Community - Interactive Mapping Input - Economic	4
Community - Interactive Mapping Input - Environmental	9
Community - Interactive Mapping Input - Recreation (Other Than Boating)	3
Community - Interactive Mapping Input - Social & Cultural	3
Community Concern Via Email or Letter	15
DCCEEW Recommendations	4
DPI - Fisheries Recommendations	3
Lower Shoalhaven River EMP (Umwelt, 2008) - Actions Audit	34
MEMS NSW Coastal Breakwater Audit 2021, adapted from the Lake Illawarra CMP	1
NSW Gov Agency Workshop	8
Shoalhaven River Floodplain Prioritisation Study (WRL 2023)	2
Stage 2 - Bank Erosion and Riparian Condition Study	16
Stage 2 - Boating Study	23
Stage 2 - Detailed Risk Assessment	17
Stage 2 - Review of the Entrance Management Plan	1
Stage 2 - Urban Runoff Treatment	1
Stage 2 - Water Quality	4
Traditional Owner Engagement	2
UOW Honours Thesis	3
Grand Total	215

4.3 Evaluation of Potential Management Options

The process used to evaluate the potential management options is based on the guidance provided in the Part B, Stage 3 of the Manual (OEH, 2018b) as illustrated in **Figure 4-2.** This involves a multi-step process that first determines the feasibility of all potential actions, then considers the viability of feasible actions, and the acceptability of viable actions. The process utilised for the Lower Shoalhaven River CMP has been designed as fit-for-purpose, demonstrating a clear rationale for recommendations for the CMP. The feasibility assessment applied is described in **Section 4.3.1**. The viability assessment is described in **Section 4.3.2**. And the acceptability assessment is described in **Section 4.3.3**. Finally, an overview of the entire evaluation process is provided along with a step-by-step demonstration with example option in **Section 4.3.4**.

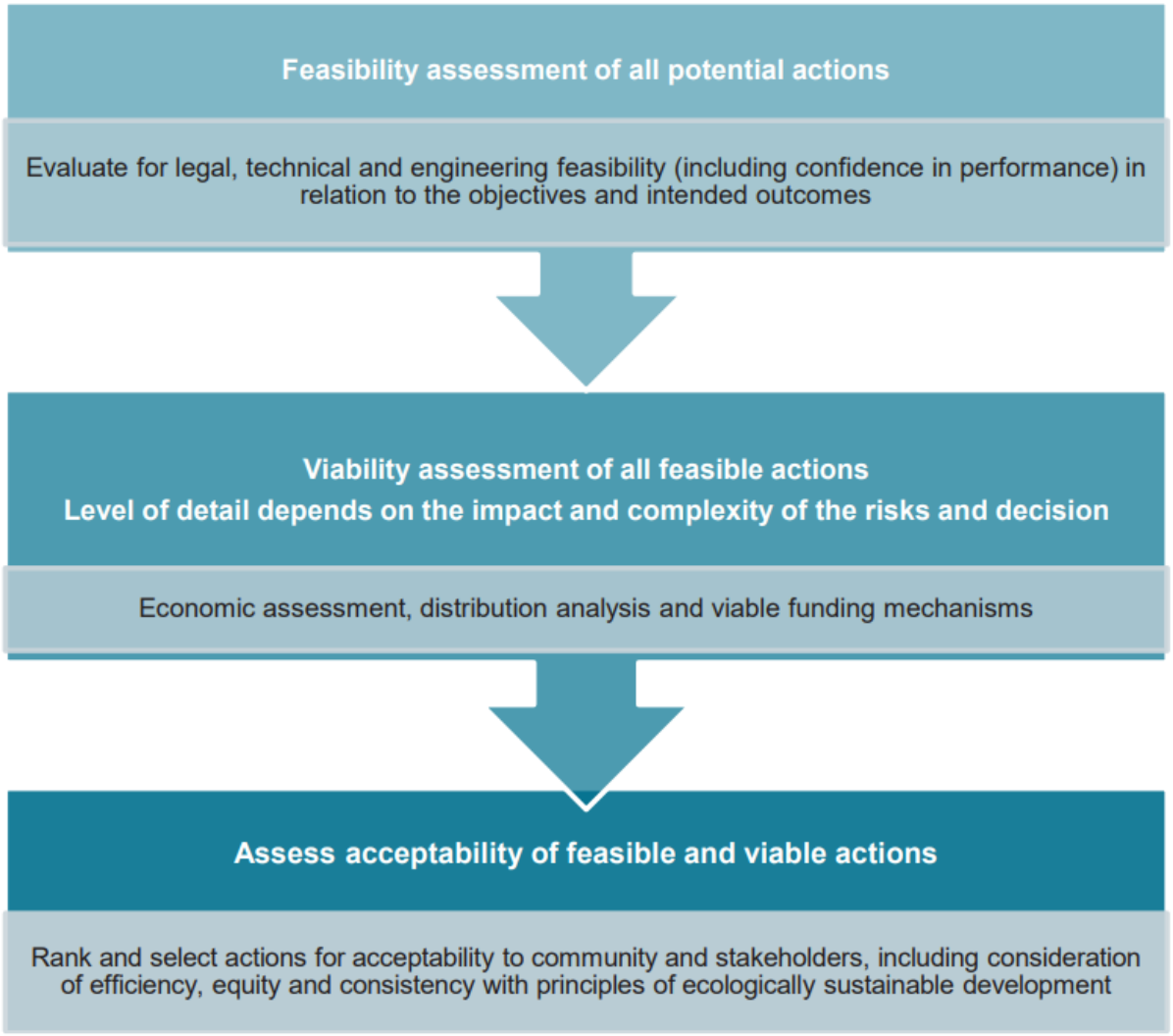

Figure 4-2 Staged Option Evaluation Process (from OEH, 2018b)

4.3.1 Feasibility Assessment

The feasibility of the management options was evaluated for their legal, technical and engineering feasibility (including confidence in performance) in relation to the objectives and intended outcomes. This evaluation was undertaken using the guidance from the Manual (OEH, 2018b), by assessing the

options against the criteria shown in **Table 4-2.** Feasible options were carried forward to a viability assessment, as described in **Section 4.3.2.**

Table 4-2 Feasibility Assessment Criteria

Feasibility Criteria	CM Manual Guidance
Statutory and policy compliance	Are consistent with the objects of the CM Act and management objectives of the coastal management areas
	Would be permissible under the legislation
	Comply with policy requirements at local, state and Commonwealth levels
Engineering feasibility	Are feasible in engineering terms (i.e. a structure can realistically be built, given the local process context)
	Are broadly able to be implemented, in terms of available capacity and capability, and would address the intended issue
Reduces risk or enhances values	Can address the identified threats and risks to the coastal zone, or enhance opportunities, based on previous experience / professional judgement
	Are likely to contribute new knowledge for effective and adaptive management; for instance, a response that is structured as a carefully controlled trial of new technology
Adaptive management	Facilitates adaptive decision making, acknowledging uncertainty about future conditions including climate change, or disagreement about which action should be taken

When evaluating the feasibility of the options, the following aspects were also considered in consultation with Council and DCCEEW:

- The timeframe over which a management option would remain effective and any limits to the effectiveness of the option (e.g. is there a threshold beyond which the response would fail or is rendered obsolete?).
- Evidence from the application of the option in similar situations.
- The potential for any unintended or unanticipated negative consequences (sometimes referred to as perverse outcomes or maladaptation).
- Whether the option is irreversible and locks in a specific future action or adaptation pathway.
- Alternatively, whether the option is a low risk or 'no regrets' option, one that maintains flexible adaptive capacity.
- The level of expertise required to evaluate the design, implementation, monitoring and review of actions.
- Whether the selection of a strategy allows for adaptive management.
- The alignment and consistency with actions in the Marine Estate Management Strategy and objects of the *Marine Estate Management Act 2014.*

During the feasibility assessment, some common reasons for precluding options from the viability assessment included:

- The option failed to address at least one of the identified threats (**Section 3.2**) in the risk assessment.
- The option would not be permissible under the current statutory framework.

- The option was not considered feasible from an engineering perspective (e.g. insufficient space for implementation or would not achieve the intended outcome).
- The option was not considered an adaptive response, potentially locking in an unsustainable management pathway, or likely leading to maladaptation.
- The option was incorporated into another option, for example, due to overlapping locations or for practicality of implementation.
- The option has already been or is being actioned by Council or another agency and does not require consideration in the CMP.
- The option is out of scope for the CMP and is best addressed through a different mechanism.

A flowchart illustrating the feasibility process is provided in **Figure 4-3**.

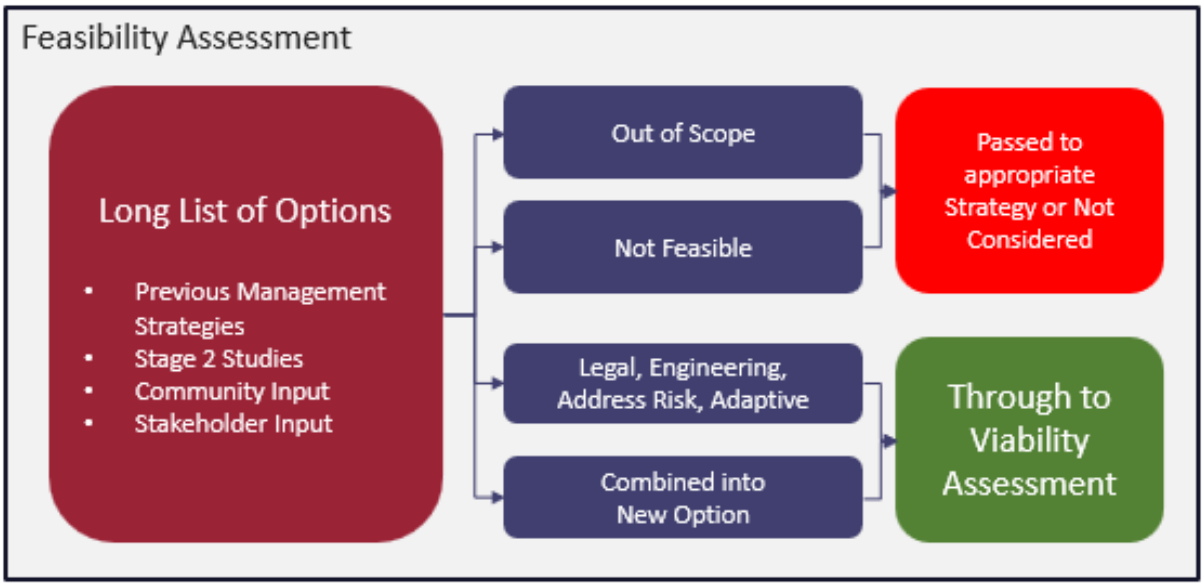

Figure 4-3 **Flowchart of the Feasibility Assessment**

Of the 215 options on the long-list, a total of **50** options were identified as being feasible and progressed to the viability assessment. Some of the options were split into sub-options. The rationale for splitting these reflects different locations for the same option, with different implementation details that are best captured individually.

Of the 50 feasible options, there are:

- Ten (10) that primarily seek to promote integrated and collaborative management.
- Seven (7) that primarily address bank erosion and Berry's Canal adjustment.
- Seven (7) that primarily seek to enhance or protect environmental values.
- Six (6) that primarily seek to address coastal hazards associated with inundation.
- Six (6) that primarily seek to promote sustainable land use planning.
- Five (5) that primarily seek to enhance or protect water quality.
- Four (4) that primarily seek to promote Aboriginal cultural values.
- Four (4) that primarily support the recreational values of boating and/or seek to address the environmental impacts associated with boating and foreshore usage.
- One (1) that primarily seeks to enhance or protect social and cultural values.

The distribution of different management approaches across the 50 feasible options includes:

- Ten (10) options that are categorised as 'Alert'.
- Seven (7) options that are categorised as 'Avoid Future Impact'.
- Twenty (20) options that are categorised as 'Active Intervention'.
- Twelve (12) options that are categorised as 'Planning for Change'.
- One (1) overarching option categorised as 'Emergency response' with details considered further in the CZEAS.

Of the 165 options that did not progress to the viability assessment:

- 126 were combined or integrated into other more comprehensive options that progressed to the viability assessment.
- Twelve (12) have already been implemented by Council or another agency or will be completed as part of the CMP development process.
- Twelve (12) did not meet the criteria listed in **Table 4-2,** including[3]:
  - Nine (9) were deemed to be not feasible from a statutory or policy perspective.
  - Three (3) were deemed to be not feasible from an engineering perspective.
  - Ten (10) were deemed to be not feasible because of their ineffectiveness to address any of the key threats.
  - Five (5) were deemed to be not feasible due to a lack of adaptability to future conditions.
- Fifteen (15) were considered to be out of scope of the CMP and best addressed through a different management framework.

The feasibility assessment in tabular format is provided in **Appendix B.** This includes additional information about the rationale for each options assessment outcome. The feasibility outcomes for site-specific management options are mapped in the accompanying map **RG-01-10** in **Appendix A**.

4.3.2 Viability Assessment

The viability of coastal management options was assessed on a semi-quantitative basis using a multi-criteria assessment (MCA). The criteria adopted for the MCA were based on the values, threats and management objectives identified in **Section 3**. A high-level estimate of capital and recurring costs of the option over the life of the CMP (assumed to be 10 years) was also factored into the assessment.

The structure of the MCA is driven by the need to confirm consistency with the CM Act and the requirements of the Manual, as well as the need to ensure the CMP contains actions that can be realistically funded and implemented. The MCA was used to compare and contrast the feasible management options.

A simple flowchart illustrating the MCA process is provided in **Figure 4-4**. This is followed by a more detailed description of the various components that contributed to each options viability score.

[3] Note that some options did not meet multiple of these criteria.

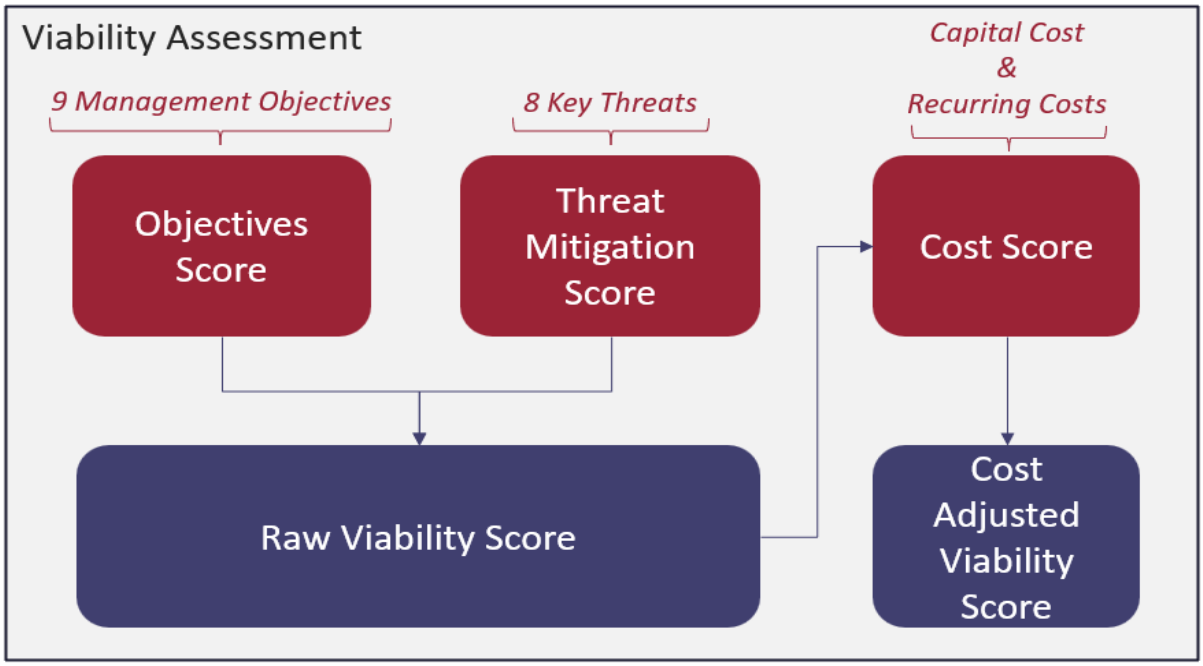

Figure 4-4 Flowchart of the Viability Assessment

Objectives Score – scores were applied to each management option with respect to the option's impact on achieving each of the nine (9) management objectives (refer **Table 3-3**). Scores were determined using the descriptors in **Table 4-3**. The score for each individual management objective was then summed to produce an overall *Objectives Score*. No weightings were applied.

$$\textit{Objective Score = Sum of each of the 9 individual objectives scores}$$

Threat Mitigation Score – each option was scored with respect to how effectively it would address each of the eight (8) individual threats listed in **Table 3-2**. The scores were applied in accordance with the descriptors in **Table 4-3** and then weighted based on their present day risk level as shown in **Table 3-2**. This score was then divided by 2, making the maximum *Threat Mitigation Score* and maximum *Objectives Score* equal and leading to an equal weight for each. The final *Threat Mitigation Score* was determined according to the following formula:

$$\textit{Threat Mitigation Score} = \sum \left[(\textit{Individual Threat Score} \times W) / 2 \right]$$

where W is the weighting for each threat, defined by:

- *W=4 for present day Extreme risk*
- *W=3 for present day High risk*
- *W=2 for present day Medium risk*
- *W=1 for present day Low risk*

Table 4-3 Objectives and Threat Mitigation Scoring System

Description of Impact	Score
Direct, positive contribution to threat reduction or achievement of objective	2
Indirect or minor positive contribution to threat reduction or achievement of objective	1
No or neutral impact contribution to threat reduction or achievement of objective	0
Indirect or minor increase in threat or negative impact on objective	-1
Direct increase in threat or negative impact on objective	-2

Raw Viability Score – comprises the sum of the *Threat Mitigation Score* and *Objectives Score*. The theoretical maximum *Raw Viability Score* that could be achieved if a feasible option scored perfectly across all management objectives and key threats would be 36.

***Raw Viability Score** = Objectives Score + Threat Mitigation Score*

Cost Score – the capital cost and annually recurrent costs were estimated for each feasible option along with the year(s) of implementation to consider the total cost over the 10-year CMP implementation period. A *Cost Score* was then determined as shown in in accordance with **Table 4-4.**

Table 4-4 Cost Adjusted Scoring System

Cost of Implementation	Score
<$10,000	1
>$10,000 to <$100,000	2
>$100,000 to <$1,000,000	3
>$1,000,000	4

Cost Adjusted Viability Score – was calculated by dividing the *Raw Viability Score* by the *Cost Score*, providing an indication of value for money. The theoretical maximum *Cost Adjusted Viability Score*, achieved by an option with a perfect *Raw Viability Score* and a total cost of implementation less than $10,000 would be 36. The same option with a cost of implementation greater than $1,000,000 would achieve a *Cost Adjusted Viability Score* of 9.

***Cost Adjusted Viability Score** = Raw Viability Score / Cost Score*

In summary, a higher *Raw Viability Score* indicates a strong management action that supports the management objectives, and/or addresses key threats. A high *Cost Adjusted Viability Score* indicates a strong management action that provides good value for money.

4.3.3 Acceptability Assessment

Following the viability assessment, all feasible options were also subject to an acceptability assessment. A simple flowchart illustrating the acceptability assessment process is provided in **Figure 4-5**. This is followed by a more detailed description of the various components that contributed to each options *Acceptability Score*.

Figure 4-5 Flowchart of the Acceptability Assessment

Likely Community Acceptability Score – was based on community sentiment gauged during the community drop-in sessions, the inputs received from the community via the interactive mapping tool, and comments received via email or letters to Council. It is intended that these scores be reviewed following public exhibition of the Draft CMP.

Council & Stakeholder Acceptability Score – was confirmed by Council, DCCEEW and other government stakeholders based on existing policy, funding, and governance.

Both the *Likely Community Acceptability Score* and the *Council & Stakeholder Acceptability Score* were determined in accordance with the descriptors in **Table 4-5.**

Table 4-5 Community and Stakeholder Acceptability Scoring System

Likely acceptance	Score
Strong support / wide level of general support	2
Option likely to be supported by some groups or stakeholders and not supported by others.	1
Option likely to face broader opposition and may require careful consideration if it is to be implemented.	0

Acceptability Score – was obtained by summing the *Likely Community Acceptability Score* and the *Council & Stakeholder Acceptability Score*. No weighting was applied. The maximum *Acceptability Score* an option could achieve would be 4, with a minimum score of 0.

***Acceptability Score** = Likely Community Acceptability Score + Council & Stakeholder Acceptability Score*

4.3.4 Final Option Score

The *Final Option Score* reflects the effectiveness of the option to achieve coastal management objectives and address coastal threats. The value for money is considered through the application of a cost adjustment factor.

The *Final Option Score* was determined by summing the *Cost Adjusted Viability Score* and the *Acceptability Score.* The theoretical maximum *Final Option Score* that could be achieved would be 40. A breakdown of the possible range of scores is provided in **Table 4-6**.

A low score does not necessarily mean the option should not proceed; it might reflect a higher cost required to achieve the intended benefit or may result in the option being of a lower priority than other options.

Table 4-6 Potential Range for Options Evaluation Scores

Score component	Theoretical Minimum	Theoretical Maximum
Objective Score	-18	18
Threat Mitigation Score	-18	18
Raw Viability Score	**-36**	**36**
Cost Score	1	4
Cost Adjusted Viability Score	**-36**	**36**
Likely Community Acceptability Score	0	2
Council & Stakeholder Acceptability Score	0	2
Acceptability Score	**0**	**4**
Final Option Score	**-36**	**40**

A flowchart illustrating the entire options valuation is provided in **Figure 4-6**. This is followed by **Table 4-7** which provides an example demonstrating the viability and acceptability assessment as it has been applied to a potential management option.

The outcomes of the Viability and Acceptability Assessments are provided for all feasible options in **Appendix C**.

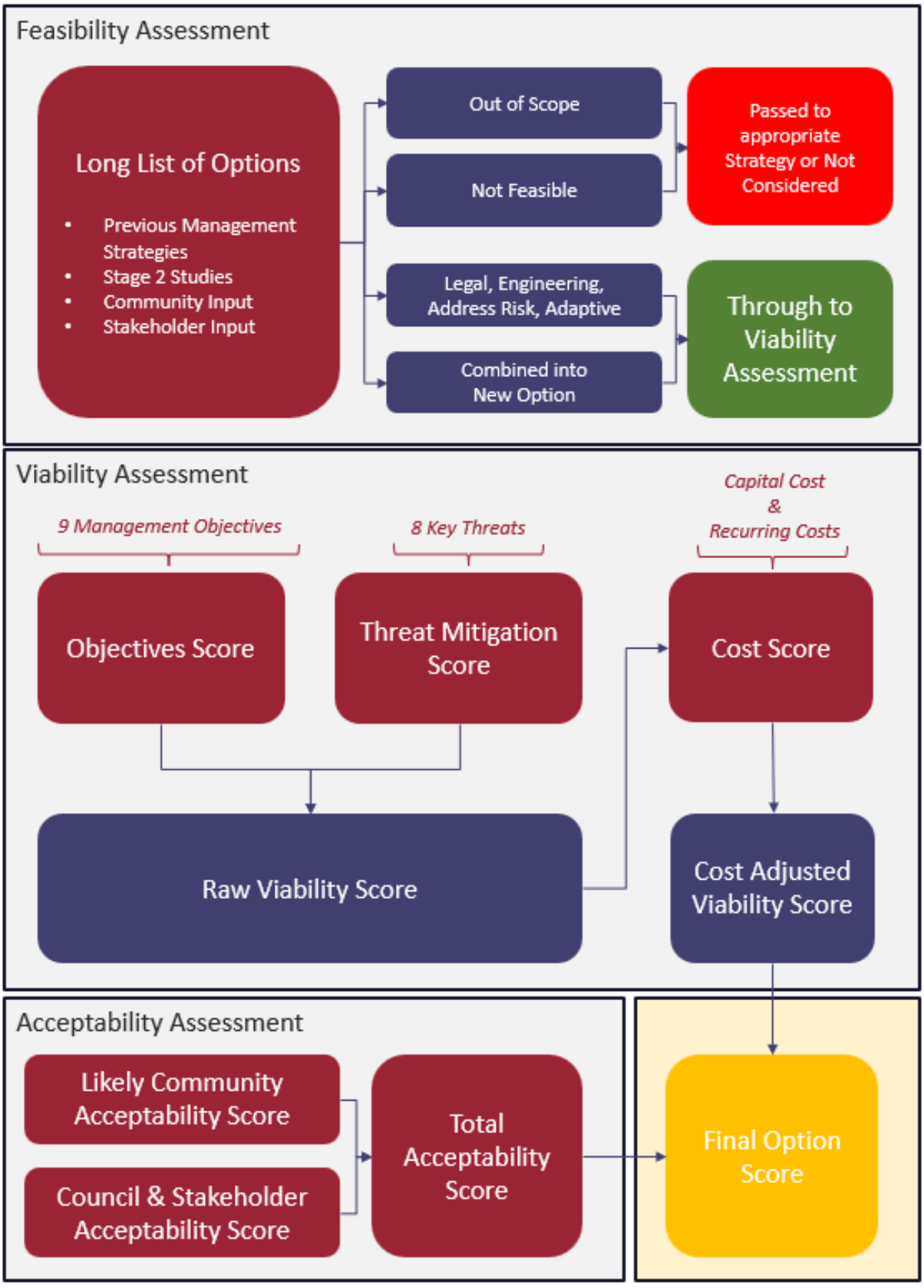

Figure 4-6 **Flowchart of the Entire Options Evaluation Process**

Table 4-7 Demonstration of the Viability and Acceptability Assessment Applied to a Potential Management Option

Option Description	**Option ENV_43 – Revise and implement Council's water quality monitoring program in line with the recommendations of the Stage 2 assessment**		
	A review of available water quality datasets and reports was undertaken during Stage 2 of the CMP to evaluate the current monitoring and reporting activities in the context of their objectives or aims and several recommendations to improve data quality and reporting are provided. A water quality monitoring framework has been developed to improve data quality and reporting. Align with the SCC Integrated Environmental Monitoring Program. Opportunistically support the scientific understanding of estuarine water quality processes. This can be facilitated through partnerships with universities and government research programs.		
Objectives Score	**Management Objective**	**Score**	**Rationale**
	Environmental Values	**2**	An improved water quality monitoring program directly contributes to the protection and enhancement of the coastal zone's environmental health.
	Social and Cultural Values	**1**	High-quality water monitoring can indirectly support social and cultural values by ensuring the environmental quality that supports various recreational activities.
	Aboriginal Values	**0**	This action is unrelated to Aboriginal values.
	Coastal Processes	**1**	Understanding and maintaining water quality is essential for the health of coastal processes and ecosystems.
	Coastal Economies	**2**	Good water quality is vital for coastal economies, especially for industries like tourism and fishing, which depend on a healthy environment.
	Land Use Planning	**2**	A rigorous monitoring program informs and supports sustainable land use decisions and development controls.
	Coastal Hazards	**0**	This action is unrelated to coastal hazards.
	Integrated and Collaborative Management	**2**	Collaborating with universities and government research programs indicates a high level of integration and shared responsibility in environmental monitoring.
	Public Participation	**2**	Opportunities for community engagement in monitoring activities can support public education and stewardship.
	Objectives Score	**12**	
Threats Mitigation Score	**Threat (with Weighting)**	**Score**	**Rationale**
	Bank Erosion and Berry's Canal Adjustment (Weighting = 3)	**0** x 3	This action is unrelated to bank erosion.
	Changes in Tidal Inundation as a Result of Sea Level Rise (Weighting = 1)	**0** x 1	This action is unrelated to tidal inundation.
	Coastal Inundation (from Coastal Storms and Extreme Tides) (Weighting = 2)	**1** x 2	Monitoring can play a role in understanding the effects of coastal inundation on water quality and ecosystem health.
	Changes in Coincident inundation (combination of catchment flooding and coastal inundation) (Weighting = 2)	**2** x 2	Monitoring water quality is directly related to managing the impacts of flooding and freshwater flows on estuarine systems.

	Land Clearing and Development (Urban and Rural) (Weighting = 3)	**2** x 2	Water quality data can inform policies and practices to mitigate the impacts of development on coastal waters.
	Acid Sulfate Soils and Drainage Structures (Weighting = 2)	2 x 3	The program can aid in the detection and management of water quality issues arising from acid sulfate soils and drainage.
	Boating and Associated Waterway and Foreshore Usage (Weighting = 3)	**1** x 3	Improved water quality supports recreational activities and reduces the environmental impact of boating.
	Commercial and Recreational Fishing (Weighting = 2)	**2** x 2	Monitoring of water quality is directly related to maintaining the health of fish habitats and supporting sustainable fishing practices.
	Threat Score	23 /2 = **11.5**	
Raw Viability Score		12 + 11.5 = **23.5**	
Cost Adjusted Score	**Capital Cost**	$50,000	
	Timing	Year 1 and Ongoing	
	Frequency Annual Costs Accrued (1-10)	9	
	Recurrent Annual Cost	$30,000	
	Total Cost for CMP Over 10 Years	$320,000	
	Notes on Cost	Costs reflect establishing the WQ program and implementing the sampling regime.	
	Cost Score	**3**	
Cost Adjusted Viability Score		23.5 / 3 = **7.83**	
Likely Community Acceptability Score		**2**	
Council & Stakeholder Acceptability Score		**2**	
Acceptability Score		**4**	
Final Option Score		7.83 + 4 = **11.83**	

5 Determining Actions for Inclusion in the CMP

5.1 Options Evaluation Outcomes

The decision as to which options should be recommended for inclusion as actions in the CMP is influenced by a range of factors, principally what is feasible with respect to available resources and funding. The evaluation process also provides useful information for prioritising the program of works in the CMP.

Table 5-1 provides a list of all of the management options sorted by *Final Option Score.* Each option's *Raw Viability Score* and its rank by that metric is also provided. More detailed options descriptions are provided in **Appendices B and C**.

It is also useful to consider the geographical spread and different types of options that would be included in the CMP. Reference should be made to the map of site-specific management options that progressed to the viability assessment, provided in **Map RG-01-10** in **Appendix A** along with the accompanying detailed options table in **Appendix C** for further information on where management options were proposed, the capital and annually recurrent costs of implementation of each option and timeframe proposed for implementation.

5.2 Options Not Recommended for Inclusion in the CMP

Some feasible management options were not recommended for the CMP. This process was informed by consideration of the cost of implementation of the management option and the potential benefits that might or might not be realised. Feasible management options that were not recommended for the CMP and an explanation of the rationale for not including them is provided below:

BOAT_12 – Investigate dredging shoals where there is a risk to safe navigation that cannot be managed using navigational aids.

The management option BOAT_12 was not recommended for inclusion in the CMP because of the low risk profile associated with not implementing and high environmental impact of dredging shoals in the study area. The option scored poorly in the multi-criteria analysis (MCA) for the criteria of cost-effectiveness, social acceptability, ecological value and alignment with the objectives of the CMP. The option also faced significant regulatory and technical challenges, as dredging activities would require approvals from multiple agencies and could potentially affect the hydrodynamic and sediment transport processes in the estuary. Dredging is also a costly action, further reducing the viability for incorporating it into the CMP.

Furthermore, the option was not supported by the findings of a recently completed dredging feasibility assessment for the navigation channel at Shoalhaven Heads conducted by Advisian (2023). This study was commissioned in support of community concerns about the area, which is considered a high priority candidate for navigational channel dredging. This investigation concluded that the existing channel linking two boat ramps at Shoalhaven Heads was suitable under most conditions for normal boating operation and the vessels that are typically used in calm weather. The study also found that the most inaccessible conditions for the channel were when the water was rough and the wind was strong, which are times when boats are not advised to be on the water anyway. The study also recommends ongoing monitoring of the channel, with the potential for dredging to be revisited should inaccessible channel shallowing be observed.

As such, this option has been already undertaken at the high priority location of Shoalhaven Heads, and further investigations in the study area have been assessed to be unwarranted, costly and environmentally detrimental, and was not considered further in the CMP.

CS_03 – Removal of mangroves at Shoalhaven Heads beach

The management option CS_03 was also not recommended for inclusion in the CMP. The option aims to enable the continued removal of mangrove seedlings from a designated area of Shoalhaven Heads foreshore to improve the amenity and recreational value of the area, which is an important tourism destination and local economic driver. Fisheries Permit (PN19/338) has previously allowed for the removal of mangrove seedlings in the area east of the River Road boat ramp on the foreshore adjacent to the caravan park shown in **Figure 5-1**, however this permit has an expiration date of 4 October 2024. An analysis of this action under the CMP framework has been undertaken as it falls under the remit of this CMP.

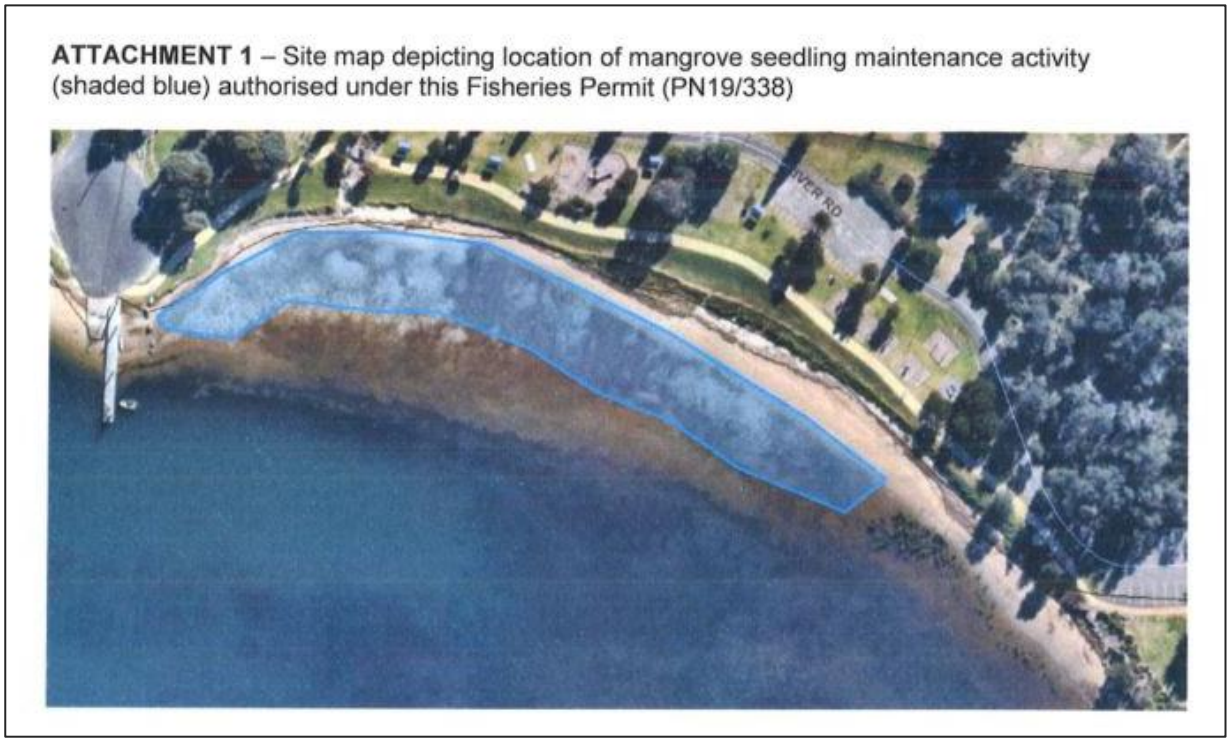

Figure 5-1 Site map depicting location of mangrove seedling maintenance activity (shaded blue) authorised under Fisheries Permit (PN19/338).

Mangroves provide multiple benefits to the local Shoalhaven Heads area and the broader estuary including assisting with stabilising the shoreline, reducing erosion, filtering pollutants, enhancing water quality, sequestering carbon, providing habitat and food for fish and wildlife, and supporting biodiversity. These benefits are also valued by both residents and visitors, contributing to the appeal of the location as a tourist destination and the associated economic benefits. Removing mangroves would reduce these benefits and potentially increase the vulnerability of the estuary to climate change and sea level rise, which will put increasing pressure on intertidal estuarine ecosystems.

When the MCA was applied to this option, it scored well for only one criterion being that it supports social values associated with foreshore recreation. It scored neutral or negative for the other criteria. As such, on balance, it does not support the objectives of the CMP (which are based on the Objects of the CM Act), nor sufficiently mitigate any of the key threats. Therefore, the option was not considered appropriate for inclusion in the CMP. It should be noted that Council can still apply or a Fisheries Permit or this activity (should it wish to do so) through other strategic plans and operational mechanisms.

In contrast, the CMP also assessed the viability of an option to implementing a living shoreline and associated user amenity opportunities (Option BE_46) at Shoalhaven Heads Beach. This option seeks to enhance the recreational amenity and tourism-related appeal while also vastly improving the ecological functionality of this shoreline. These two options were considered in comparison, and based on its provision of multiple benefits and much stronger alignment with the CM Act objectives, BE_46 has been put forward as the recommended CMP action in this location. A rendering of a living shoreline option from the Wagonga Inlet is provided in Figure as an example.

Figure 5-2 Rendering of a Living Shoreline option. (Source – Eurobodalla Shire Council).

Additionally, in further recognition of the importance of foreshore recreation and amenity space, a number of other options seek to maintain and improve the adjacent foreshore area for this purpose. Together these consist of a holistic Shoalhaven Heads key location plan that supports the continued, sustainable and enhanced recreational value of the area.

5.3 Options Considered for Cost-Benefit Analysis

In accordance with the requirements of the Manual, a Cost Benefit Analysis (CBA) is typically required for any options that are costly (e.g. >$5M), complex or for which there is a high risk of implementation or effectiveness.

The only option with a capital cost greater than $5 million, is *BE_43 - Comprehensive bank stabilisation and riparian restoration on high-priority public foreshores*. In reality this option is a package of relatively simple works with a clear public benefit. Therefore, a CBA is not recommended for this option.

None of the options are considered of a degree of complexity that would require a CBA.

5.4 Options Requiring Detailed Description

There are several options that serve to benefit from a more detailed description to provide guidance on their funding and implementation. These detailed descriptions are to be developed during Stage 4 of the CMP process and will be included in the Draft CMP for Public Exhibition. Detailed descriptions will be provided in the CMP for the following options:

- **BE_43** – Bank stabilisation and riparian restoration on high-priority public foreshores;
- A combined description for **BOAT_37** – Boat ramp consolidation / optimisation & **BOAT_38** – Develop and implement a comprehensive boat ramp facility upgrade and asset management program;
- **CS_16** – Protection of Midden at Crookhaven Heads;
- **CTF_20** – Implement updated Entrance Management Plan and undertake additional review;
- A combined description for **ECON_08** – Develop and implement a program for regular and ongoing monitoring of coastal assets and infrastructure & **CTF_16** - Review and update all asset management plans (AMPs), relevant to the coastal zone within the CMP study area & **CTF_16a** – Review and update floodgate asset management plans (AMPs);
- A combined description for **ENV_09** – Inclusion of additional Beachwatch sites & **ENV_43** – Revise and implement Council's water quality monitoring program for the Lower Shoalhaven River;
- **ENV_42** – Enhance urban runoff treatment through infrastructure development and capacity building in urban areas of the Lower Shoalhaven River coastal zone; and
- **ENV_62** – Expand estuary ecosystem education signage throughout the Lower Shoalhaven River area.

There will also be key location overviews that provide a detailed description of the suite of actions that apply to certain areas of the Lower Shoalhaven. These overviews will illustrate how multiple actions work together to address key management issues in an integrated fashion. The following areas will be covered by the key location overviews in the CMP:

Shoalhaven Heads including an overview of:

- **BE_43e** – Beach nourishment near Hay Avenue west of the existing rock revetment
- **BE_44** – Beach nourishment along the toe of the existing rock revetment
- **BE_46** – Design and implement a living shoreline bank stabilisation solution along the foreshore adjacent to the caravan park at Shoalhaven Heads
- **ENV_09** – Inclusion of Shoalhaven Heads as a Beachwatch site
- **ENV_42b** – Undertake necessary detailed designs and construct a trash rack at Shoalhaven Heads
- **REC_04** – Enhance public access points along the foreshore, with a special focus on improving accessibility for people with disabilities.

Greenwell Point including an overview of:

- **BE_17** – Monitor and maintain the existing foreshore protection structures at Greenwell Point
- **BE_42** – Develop an adaptation strategy for land loss along Berry's Canal
- **CTF_08** – Prepare a climate change adaptation strategy for Greenwell Point

- **ECON_10** – Support agricultural sector climate change adaptation
- **ENV_46** – Cost-benefit analysis and feasibility study(ies) of alternative floodplain land use options

Table 5-1 List of All Management Options Sorted by *Final Option Score (FOS)*

Option ID	Management Option	Objectives score	Threat Score	Raw Viability Score	Rank by RVS	Cost Score	Cost Adjusted Viability Score	Community Acceptability	Stakeholder Acceptability	Total Acceptability Score	Final Option Score	Rank by FOS	Proceed to CMP?
ECON_10	Support agricultural sector productivity, resilience and adaptation	18	13	31.0	1	1	31.0	2	2	4	35.0	1	Yes
ECON_06	Review Council's coastal management planning policies every 10 years	15	13	28.0	3	1	28.0	2	2	4	32.0	2	Yes
CS_15	Provide opportunities and help build capacity to local Aboriginal Ranger Programs, to enhance their role in management of Sea Country	17	10.5	27.5	4	1	27.5	2	2	4	31.5	3	Yes
ENV_31	Enact the CMPs Monitoring, Evaluation and Reporting (MER) Program to track progress and report on outcomes	18	9	27.0	5	1	27.0	2	2	4	31.0	4	Yes
CTF_09	Maintain planning controls to reduce future coastal hazard impacts	12	10.5	22.5	24	1	22.5	2	2	4	26.5	5	Yes
ENV_41	Support implementation of the Domestic Waterfront Structures Landowners Consent Strategy Shoalhaven River and Crookhaven River Estuaries (DPI, 2022)	13	10.5	23.5	18	1	23.5	1	2	3	26.5	5	Yes
ENV_41a	Removal of derelict domestic waterfront structures	13	10.5	23.5	18	1	23.5	1	2	3	26.5	5	Yes
ENV_41b	Continued compliance action for unauthorised vegetation harm and waterfront works	13	10.5	23.5	18	1	23.5	1	2	3	26.5	5	Yes
ECON_04	Establish a CMP Governance Framework	12	9	21.0	30	1	21.0	2	2	4	25.0	9	Yes
ENV_58	Support multi-stakeholder projects to implement actions in priority subcatchments identified in the Shoalhaven River Floodplain Prioritisation Study (WRL 2023) and NSW Blue Carbon Strategy	12	10	22.0	26	1	22.0	1	2	3	25.0	9	Yes
ENV_63	Investigate opportunities and support implementation of oyster reef restoration activities within the estuary	12	8	20.0	36	1	20.0	2	2	4	24.0	11	Yes
ENV_44	Continue septic system performance assessments and regulation	10	4	14.0	52	1	14.0	2	2	4	18.0	12	Yes
ENV_51	Develop and implement water quality controls into future development	8	5	13.0	54	1	13.0	2	2	4	17.0	13	Yes
BE_43h	Undertake necessary detailed investigations and stabilisation works at site BOM_13 (Site ID and map provided in Detailed Description)	16	9	25.0	7	2	12.5	2	2	4	16.5	14	Yes
BE_38	Support private land bank stabilisation and restoration	14	9	23.0	22	2	11.5	2	2	4	15.5	15	Yes
CS_12	Develop and execute a communications plan for Stage 5 of the CMP	13	9	22.0	26	2	11.0	2	2	4	15.0	16	Yes
ENV_62	Develop and deliver an estuary management and ecosystem education/communications program	11	11	22.0	26	2	11.0	2	2	4	15.0	16	Yes
ECON_13	Monitor existing breakwall infrastructure at Crookhaven Heads	11	9.5	20.5	32	2	10.3	2	2	4	14.3	18	Yes
ECON_14	Continue ongoing collaboration with state government agencies and research institutions	13	7.5	20.5	32	2	10.3	2	2	4	14.3	18	Yes
CTF_13	Undertake a Planning Proposal to adopt a CVA and CWLRA (pending further information)	14	9	23.0	22	2	11.5	1	1	2	13.5	20	Yes
ECON_08	Develop and implement a program for regular and ongoing monitoring of coastal assets and infrastructure	14	14.5	28.5	2	3	9.5	2	2	4	13.5	20	Yes
ECON_11	Review water sharing plans in the light of climate change and increasing population	13	5.5	18.5	41	2	9.3	2	2	4	13.3	22	Yes
ENV_64	Resurvey the estuary in 10 years' time to determine the location, condition, extent and vulnerability of oyster reefs in the estuary	12	6.5	18.5	41	2	9.3	2	2	4	13.3	22	Yes
ENV_46	Cost-benefit analysis and feasibility study(ies) of alternative floodplain land use options	15	11.5	26.5	6	3	8.8	2	2	4	12.8	24	Yes
BE_43d	Undertake necessary detailed investigations and stabilisation works at site BOM_11 (Site ID and map provided in Detailed Description)	16	9	25.0	7	3	8.3	2	2	4	12.3	25	Yes
BE_43e	Undertake necessary detailed investigations and stabilisation works at site SH_02 (Site ID and map provided in Detailed Description)	16	9	25.0	7	3	8.3	2	2	4	12.3	25	Yes
BE_43f	Undertake necessary detailed investigations and stabilisation works at site CH_19 (Site ID and map provided in Detailed Description)	16	9	25.0	7	3	8.3	2	2	4	12.3	25	Yes
BE_43g	Undertake necessary detailed investigations and stabilisation works at sites SR_094 & SR_096 (Site ID and map provided in Detailed Description)	16	9	25.0	7	3	8.3	2	2	4	12.3	25	Yes
CTF_08	Prepare a climate change adaptation strategy for Greenwell Point	16	9	25.0	7	3	8.3	2	2	4	12.3	25	Yes
CTF_16a	Review and update floodgate and associated drainage infrastructure asset management plans (AMPs)	14	11	25.0	7	3	8.3	2	2	4	12.3	25	Yes

Option ID	Management Option	Objectives score	Threat Score	Raw Viability Score	Rank by RVS	Cost Score	Cost Adjusted Viability Score	Community Acceptability	Stakeholder Acceptability	Total Acceptability Score	Final Option Score	Rank by FOS	Proceed to CMP?
ENV_43	Revise and implement Council's water quality monitoring program for the Lower Shoalhaven River	12	11.5	23.5	18	3	7.8	2	2	4	11.8	31	Yes
ENV_19	Minimise vehicle access to floodplain wetland areas in Nature Reserves	10	7.5	17.5	43	2	8.8	1	2	3	11.8	32	Yes
CS_14	Engage with relevant Local Aboriginal Land Councils and local Traditional Owner Groups to develop a cultural educational and awareness program	12	2.5	14.5	48	2	7.3	2	2	4	11.3	33	Yes
ENV_42a	Undertake necessary detailed designs for establishment of a wetland at Terara (site UWQ_03 from Stage 2 Study)	8	6.5	14.5	48	2	7.3	2	2	4	11.3	33	Yes
CTF_16	Review and update all asset management plans (AMPs), relevant to the coastal zone within the CMP study area	14	7	21.0	30	3	7.0	2	2	4	11.0	35	Yes
CS_16	Protection of Midden at Crookhaven Heads	14	6.5	20.5	32	3	6.8	2	2	4	10.8	36	Yes
ENV_32	Continue Council's program of mapping threatened ecological communities (TECs) across coastal reserves	12	8.5	20.5	32	3	6.8	2	2	4	10.8	36	Yes
CS_13	Undertake a LGA wide coastal zone Aboriginal Cultural Heritage Survey, and development of local protection/management plans	14	6	20.0	36	3	6.7	2	2	4	10.7	38	Yes
ENV_39	Implement environment protection works to enhance ecological communities in coastal reserves within the CMP Study Area	12	8	20.0	36	3	6.7	2	2	4	10.7	38	Yes
BE_42	Develop an adaptation strategy for land loss along Berry's Canal	14	5.5	19.5	39	3	6.5	2	2	4	10.5	40	Yes
CTF_20	Implement updated Entrance Management Plan and undertake additional review	12	7.5	19.5	39	3	6.5	2	2	4	10.5	40	Yes
BE_43a	Undertake necessary detailed investigations and stabilisation works at site SR_018 (Site ID and map provided in Detailed Description)	16	9	25.0	7	4	6.3	2	2	4	10.3	42	Yes
BE_43b	Undertake necessary detailed investigations and stabilisation works at sites SR_061, SR_062, SR_063 & SR_064 (Site ID and map provided in Detailed Description)	16	9	25.0	7	4	6.3	2	2	4	10.3	42	Yes
BE_43c	Undertake necessary detailed investigations and stabilisation works at sites SR_071, SR_073 & SR_082 (Site ID and map provided in Detailed Description)	16	9	25.0	7	4	6.3	2	2	4	10.3	42	Yes
BOAT_37	Boat Ramp and Facilities Consolidation and Rationalisation Plan	10	4	14.0	52	2	7.0	1	2	3	10.0	45	Yes
ECON_05	Establish one new Full Time Equivalent (FTE) Coast & Estuary Officer roles within Council	15	9	24.0	17	4	6.0	2	2	4	10.0	45	Yes
BE_44	Beach nourishment along the toe of the existing rock revetment at Shoalhaven Heads	10	7	17.0	44	3	5.7	2	2	4	9.7	47	Yes
REC_04	Improve public foreshore access to include all-ability access	14	3	17.0	44	3	5.7	2	2	4	9.7	47	Yes
BE_46	Design and implement a living shoreline bank stabilisation solution along the foreshore adjacent to the caravan park at Shoalhaven Heads	14	8.5	22.5	24	4	5.6	2	2	4	9.6	49	Yes
BOAT_40	Support and promote LGA-wide boating education measures targeting both local and visiting recreational boaters	7	4	11.0	57	2	5.5	2	2	4	9.5	50	Yes
BE_45	Implement a bank stabilisation solution along the Crookhaven River shoreline adjacent to Crookhaven Heads	13	8.5	21.5	29	4	5.4	2	2	4	9.4	51	Yes
BOAT_38	Develop and implement a comprehensive boat ramp facility upgrade and asset management program	9	7	16.0	47	3	5.3	2	2	4	9.3	52	Yes
ENV_09	Inclusion of additional Beachwatch sites	8	4.5	12.5	56	2	6.3	2	1	3	9.3	53	Yes
ENV_42b	Undertake necessary detailed designs and construct a trash rack at Shoalhaven Heads (site UWQ_04 from Stage 2 Study)	8	6.5	14.5	48	3	4.8	2	2	4	8.8	54	Yes
ENV_42c	Undertake necessary detailed designs and construct a trash rack at Bomaderry (site UWQ_05 from Stage 2 Study)	8	6.5	14.5	48	3	4.8	2	2	4	8.8	54	Yes
ENV_21	Update Council Plans of Management (POMs) for locations in the coastal zone to support objectives of the CMP	11	5.5	16.5	46	3	5.5	1	2	3	8.5	56	Yes
REC_03	Keep foreshore recreational areas cleared from post-flood debris and maintained for tourism purposes, including Shoalhaven Heads, Greenwell Point, and Orient Point.	7	0	7.0	59	2	3.5	2	2	4	7.5	57	Yes
BE_17	Monitor and maintain the existing foreshore protection structures at Greenwell Point	7	3	10.0	58	3	3.3	2	2	4	7.3	58	Yes
CTF_14	Prepare and implement Coastal Zone Emergency Action Subplan (CZEAS)	11	2	13.0	54	3	4.3	1	1	2	6.3	59	Yes
BOAT_12	Investigate dredging shoals where there is a risk to safe navigation that cannot be managed using navigational aids	1	-1	0.0	60	2	0.0	1	0	1	1.0	60	No
CS_03	Removal of mangroves at Shoalhaven heads beach	-6	-7.5	-13.5	61	2	-6.8	1	0	1	-5.8	61	No

5.5 Analysis of Potential Cost Distribution

The costs associated with the implementation of the CMP, can largely be categorised as follows:

- **Capital costs** are one off costs associated with constructed works (e.g. bank stabilisation, living shorelines).
- **Recurring costs** including ongoing operational costs for actions that are recurrent over several years (e.g. an annual monitoring program), and maintenance costs associated with the implementation of capital works, e.g. maintenance of bank protection works.

The implementation cost for all viable actions over the 10-year CMP timeframe is estimated to be approximately $24,000,000. Of this, approximately $11,000,000 is for capital works, and the remaining $13,000,000 is for operational costs, maintenance and repairs associated with capital works.

A business plan will be developed for the CMP as part of Stage 4 that outlines the key components for funding the strategy, including the cost of proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms.

An estimated cost distribution over the 10-year CMP implementation period is provided in **Figure 5-2** and **Figure 5-3**.

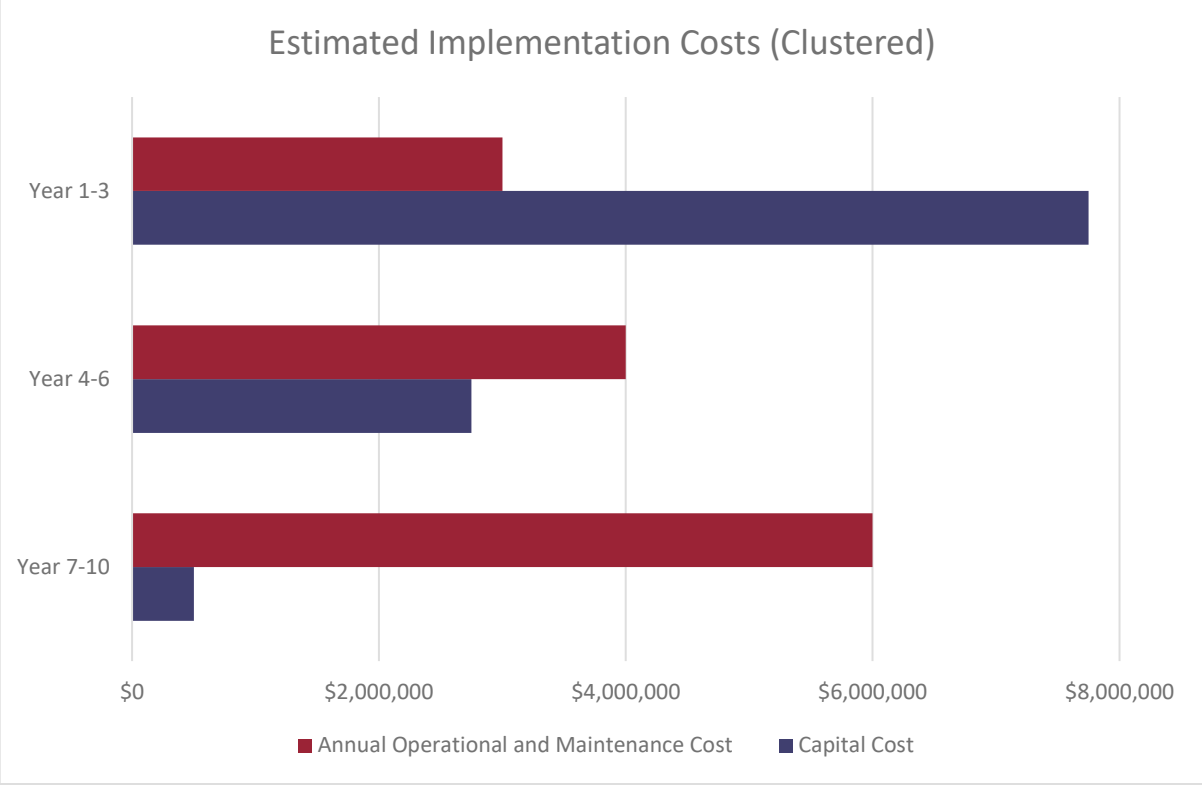

Figure 5-2 Cost Distribution Over the 10-Year CMP Implementation Period (Clustered)

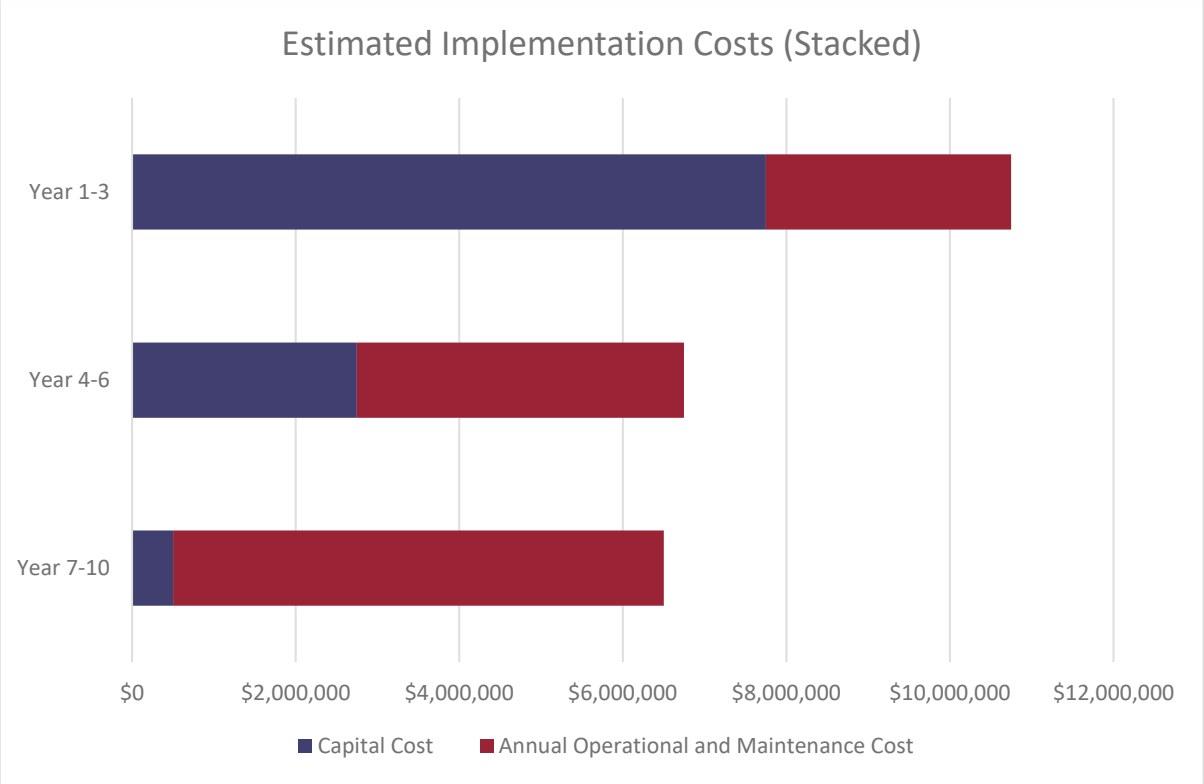

Figure 5-3 Cost Distribution Over the 10-Year CMP Implementation Period (Stacked)

It is noted that this includes the total cost of implementation, including options that may be implemented by agencies other than Council. In addition, the portion of the cost that may potentially be sourced via the various grant programs available is also included in the total cost. If successful with a grant application, the total cost to Council would be much lower. Irrespective, the purpose of this analysis is simply to consider the key factors that would influence the total cost of implementation of the CMP over the 10 years.

6 Conclusion

6.1 Next Steps

Following finalisation of this Stage 3 Report, the CMP will progress to Stage 4 of the CMP process and the following activities will be undertaken:

- Production of detailed action descriptions and key location overviews;
- Refinement of the options to be included as actions in the CMP through engagement with relevant agencies and the public during Stage 4;
- Preparing a business plan;
- Obtaining stakeholder agreement in writing for any management actions for which they are primarily (or hold shared) responsibility for implementing, or which are proposed on land for which they are the identified landowner;
- Preparation of the Coastal Zone Emergency Action Subplan (CZEAS);
- Initial review of the draft CMP and CZEAS by the State Government agencies and other organisations identified as having responsibility or support for management actions.
- Public exhibition of the draft CMP and CZEAS;
- Updating of the CMP in response to submissions received. This may result in modifications to the management actions in the CMP, the addition of new management actions and updating of the acceptability scoring based on community and stakeholder feedback received;
- Adoption of the Final CMP and CZEAS by Council; and
- Certification of the final CMP by the Minister, after which it will have statutory effect and proceed to Stage 5 of the CMP process, the implementation phase. The CMP and the progress of the management actions will be reviewed periodically to ensure the actions remain relevant and the implementation of the plan is being achieved.

7 References

Advisian (2020) *Shoalhaven CMP Stage 1 Scoping Study.*

OEH (2018a) *Coastal Management Glossary*. State of NSW and Office of Environment and Heritage.

OEH (2018b) *NSW Coastal Management Manual.* State of NSW and Office of Environment and Heritage.

Rhelm (2023a) *Lower Shoalhaven River CMP Stage 2 Summary Report.* Developed for Shoalhaven City Council.

Rhelm (2023b) *Lower Shoalhaven River CMP Stage 2 - Detailed Risk Assessment.* Developed for Shoalhaven City Council.

Rhelm (2023c) *Lower Shoalhaven River CMP Stage 2 - Bank Erosion Assessment.* Developed for Shoalhaven City Council.

Rhelm (2023d) *Lower Shoalhaven River CMP Stage 2 - Boating Study.* Developed for Shoalhaven City Council.

Rhelm (2023e) *Lower Shoalhaven River CMP Stage 2 - Water Quality and Monitoring Program Assessment.* Developed for Shoalhaven City Council.

Rhelm (2023f) *Lower Shoalhaven River CMP Stage 2 - Urban Runoff Assessment and Treatment Options.* Developed for Shoalhaven City Council.

Rhelm (2023g) *Review of Shoalhaven Heads Entrance Management Strategy.* Developed for Shoalhaven City Council.

Stantec (2023) *Lower Shoalhaven River CMP Stage 2 - Tidal and coastal inundation assessment.* Developed for Shoalhaven City Council.

Glossary and Abbreviations

Where possible, definitions for terms have been sourced from the Coastal Management Glossary (OEH, 2018a).

Abbreviation / Term	Term
Active intervention	A strategic approach to coastal management that includes coastal management actions that seek to protect assets or accommodate change in any of the coastal management areas, while maintaining current systems and values.
Adaptation	Adjustment in natural or human systems in response to actual or expected climate change or its effect, to moderate harm or to take advantage of beneficial opportunities.
Alert	A strategic approach to coastal management that includes coastal management actions that seek to 'watch and wait' such as monitoring change and setting thresholds, low regret responses and research to improve knowledge.
Average Recurrence Interval (ARI)	The average time between which a threshold is reached or exceeded (e.g. large wave height or high water level) of a given magnitude. Also known as Return Period.
Avoid future impact	A strategic approach to coastal management that includes recommending proactive land use planning and encouraging new development only in locations of low-risk.
Bank erosion	Refers to the landward movement of the foreshore or riverbank associated with flood waters, locally generated wind waves, waves generated by watercraft, and influenced by factors such as tide levels and precipitation. Other contributing factors to bank erosion can include unrestricted access, upstream changes in hydrology, and vegetation condition.
Bank restoration	The process of stabilising an estuarine foreshore or riverbank utilising a variety of methods including revegetation, bank reprofiling, and stabilisation using engineered structures.
Beach erosion	A coastal hazard defined in the CM Act. Refers to landward movement of the shoreline and/or a reduction in beach volume, usually associated with storm events or a series of events, which occurs within the beach fluctuation zone. Beach erosion occurs due to one or more process drivers; wind, waves, tides, currents, ocean water level, and downslope movement of material due to gravity.
Beach nourishment	Beach restoration or augmentation using clean dredged or fill sand. Dredged sand is usually hydraulically pumped and placed directly onto an eroded beach or placed in the littoral transport system. When the sand is dredged in combination with constructing, improving, or maintaining a navigation project, beach nourishment is a form of beneficial use of dredged material.
CBA	Cost-benefit Analysis
CEA	Coastal Environment Area
CM Act	NSW *Coastal Management Act 2016*
Coastal hazard	Defined in the CM Act to mean the following: • beach erosion • shoreline recession • coastal lake or watercourse entrance instability • coastal inundation • coastal cliff or slope instability • tidal inundation • erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters.

Abbreviation / Term	Term
Coastal lake or watercourse entrance instability	A coastal hazard defined in the CM Act. Refers to the variety of potential hazards and risks associated with the dynamic nature of both natural and trained entrances. Coastal lake and watercourse entrances are highly active environments with their shape constantly changing in response to processes such as alongshore sediment transport, tidal flows, storms and catchment flooding.
Coastal inundation	A coastal hazard defined in the CM Act. Flooding of low lying areas by ocean waters, caused by a higher than normal sea level (e.g. due to storm tide).
Coastal Management Area (or CMA)	Any one of four areas that make up the coastal zone as defined in the CM Act. These are the coastal wetlands and littoral rainforests area, coastal vulnerability area, coastal environment area, and the coastal use area.
Coastal Management Program (CMP)	A long-term strategy for the coordinated management of land within the coastal zone, prepared and adopted under Part 3 of the CM Act.
Coastal processes	Coastal processes are the set of mechanisms that operate at the land-water interface. These processes incorporate sediment transport and are governed by factors such as tide, wave and wind energy.
Coastal protection works	The CM Act defines coastal protection works as: a) beach nourishment b) activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters, including (but not limited to) seawalls, revetments and groynes.
Coastal threat	A process or activity that is putting pressure on or impacting on the health or function of a coastal ecosystem, or on the amenity and social or cultural value of the coastal landscape.
Council	Shoalhaven City Council
CUA	Coastal Use Area
CVA	Coastal Vulnerability Area
CWLRA	Coastal Wetlands and Littoral Rainforests Area
CZEAS	Coastal Zone Emergency Action Subplan
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DPIRD	NSW Department of Primary Industries and Regional Development. This includes Fisheries & Forestry, and Agriculture & Biosecurity.
Emergency response	A strategic approach to coastal management that includes coastal management actions to address residual risk in emergency situations.
Erosion and inundation of foreshores caused by tidal waters and the action of waves, including the interaction of those waters with catchment floodwaters	A coastal hazard defined in the CM Act. See bank erosion
Foreshore	The part of the shore, lying between the crest of the seaward berm (or upper limit of wave wash at high tide) and the ordinary low water mark, that is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall; or the beach face, the portion of the shore extending from the low water line up to the limit of wave

Abbreviation / Term	Term
	uprush at high tide. The CM Act defines the foreshore as 'the area of land between highest astronomical tide and the lowest astronomical tide'.
Highest astronomical tide (HAT)	The highest level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions.
LALC	Local Aboriginal Land Council
LGA	Local Government Area
m	Metres
The Manual	The NSW Coastal Management Manual (OEH, 2018b).
MEMS	Marine Estate Management Strategy
Multi-criteria analysis (MCA)	A logical and structured decision-making tool for complex problems involving multiple factors or criteria, where a consensus is difficult to achieve. It may involve processes such as ranking, rating (with relative or ordinal scales) or pairwise comparisons. The process allows participants to consider, discuss and test complex trade-offs among alternatives.
No or low regrets options	Options which would be justified under any plausible future scenario (i.e. they are best practice in any circumstance), and similarly, actions which require only moderate investment to achieve a beneficial outcome.
NPWS	NSW National Parks & Wildlife Service
NSW IP&R Framework	The NSW Local Government Integrated Planning & Reporting Framework
OCJB CMP	Shoalhaven Open Coast and Jervis Bay Coastal Management Program
OEH	NSW Office of Environment and Heritage (renamed to DCCEEW)
Planning for change	A strategic approach to coastal management that includes coastal management actions that seek to facilitate habitat migration and transformative changes to natural systems. For built areas, this includes planning to relocate or redevelop assets to consider the dynamic and ambulatory nature of the shoreline. It may be timed to commence as opportunities arise or when thresholds of exposure, impact and risk are exceeded.
Resilience	The ability of a system (human or natural) to adapt to changing conditions (including hazards or threats, variability and extremes), and rapidly recover from disruption due to emergencies. Resilient systems or communities have the capacity to 'bounce back' after a disrupting event such as a major storm or an extended heat wave, to moderate potential damages, take advantage of opportunities, maintain or restore function or to cope with the consequences.
Revetment or seawall	A type of coastal protection work which protects assets from coastal erosion by armouring the shore with erosion–resistant material. Large rocks/boulders, concrete or other hard materials are used, depending on the specific design requirements.
Riparian	Pertaining to the banks of a body of water, such as an estuary.
SCC	Shoalhaven City Council
SEPP	State Environmental Planning Policy
Shoreline recession	A coastal hazard defined in the CM Act. Refers to continuing landward movement of the shoreline, that is, a net landward movement of the shoreline, generally assessed over a period of several years. As shoreline recession occurs the beach fluctuation zone is translated landward.
Threats	In the coastal management context, a threat is a process or activity which puts pressure on one or more coastal assets or values. Threats may include land uses (e.g.

Abbreviation / Term	Term
	urban, recreation), land management, climate change, industrial discharges, stormwater runoff, overfishing, invasive species as well as the pressures from coastal hazards.
Threshold	Can be identified for aspects of coastal systems, to highlight tipping points for irreversible change. An ecological threshold is the point at which there is an abrupt change in the structure, quality, or functioning of an ecosystem or where external changes produce large and persistent responses in an ecosystem. A species threshold may disrupt aspects of the species population, productivity, reproduction, or habitat in response to a stressor. Such 'tipping points' can lead to unwanted changes in ecosystems and may slow the recovery of ecosystems or limit their ability to achieve more resilient states following a disturbance. Similarly, a social or economic threshold of change in a coastal community indicates the point at which the structure, function, social connectedness, equality or economic activity of the community changes beyond recovery. Thresholds can also be defined for coastal water levels as they relate to the resilience of certain types of development.
Tidal inundation	A coastal hazard defined in the CM Act. The inundation of land by tidal action under average meteorological conditions and the incursion of sea water onto low lying land that is not normally inundated, during a high sea level event such as a king tide or due to longer-term sea level rise.
TO	Traditional Owner
Wind waves	Ocean waves resulting from the action of the wind on the surface of the water.

Appendix A

Compendium of Maps

Appendix B

Feasibility Assessment

Appendix C

Viability and Acceptability Assessment

Appendix D

Closing The Loop – Community Engagement Summary

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