Cape to Cape Resilience Project

Adaptation framework - Summary paper

Final report

June 2022

alluvium

Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for **DEPARTMENT OF ENVIRONMENT, LAND, WATER AND PLANNING** under the contract titled **INVERLOCH REGIONAL AND STRATEGIC PARTNERSHIP COMMUNITY AND STAKEHOLDER ENGAGEMENT SUPPORT**.'

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Glossary of terms and abbreviations

Adaptation	The process of adjustment to actual or expected disturbances such as coastal hazards. In human systems, adaptation seeks to proactively manage or avoid harm or make use of beneficial opportunities. Some natural systems may benefit from human intervention in helping to facilitate these adjustment process.
AEP	Annual Exceedance Probability (AEP) – on average, the probability of an event occurring in any given year. A higher AEP means it is more likely the event will occur in any one year. The 10%, 5% and 1% AEPs have been modelled for the following time periods/planning horizons: present day, 2040, 2070 and 2100.
Coastal adaptation	Future modification of behaviour through change in coastal land management, land-use or infrastructure, that reduces or prevents adverse impacts associated with coastal hazards.
Coastal erosion	The process of winds, waves and coastal currents shifting sediment away from a localised area of the shoreline. For the Cape to Cape Resilience Project, coastal erosion is estimated based on short term (storm event) erosion and long term erosion from both historic change and future changes due to sea level rise.
Coastal hazards	Natural coastal processes that may negatively impact on the marine and coastal environment, including impacts on human use, values, property or infrastructure. Hazards include coastal erosion and inundation (flooding) due to storm tide and sea level rise.
Coastal vulnerability	The susceptibility of people and places along the coast to adverse impacts from coastal hazards. Includes the degree of exposure, and ability to cope with, respond to and adapt to coastal hazards.
Consequence	The consequence (impact/outcome) of a value or use being exposed to coastal hazard/s are tailored based on local stakeholder and community feedback and informed by the Cultural and Community Values studies. Consequence ratings can also vary for hazard types (erosion and inundation) and consider short and long term impacts.
DELWP	Victorian State Government Department of Environment, Land, Water and Planning
Event	Where weather conditions affecting a specific place are notably different from typical, day-to-day conditions normally experienced at that location (e.g. a storm event). Coastal storm events are driven by a wide variety of natural processes, combining meteorology (weather) such as wind, rainfall and temperature, and oceanography (conditions of the sea) such as tides, currents, and waves. Events vary in magnitude (size) and duration (time). They may last from hours up to several days.
Likelihood	Likelihood of exposure to coastal hazards is determined by the probability (chance) of an event occurring. An 'event' is a storm or weather event that may cause inundation (flooding) or erosion along the coast. An event might include high winds, high tides and/or rainfall leading to high catchment (river) flow. For this assessment, we have various scenarios from more frequent to rarer events, and multiple sea level rise scenarios as well as different catchment flows. Likelihood can be expressed as annual exceedance probability (AEP) - the probability of an event occurring in any given year.
MHWS	Mean High Water Springs - the highest water level reached by spring tides, under average meteorological conditions.
Permanent inundation	Regular inundation from tides, increasing with sea level rise
Planning horizon	A planning horizon is an indicative timeframe by which a projected sea level rise scenario is anticipated to occur. While each sea level rise projection has been linked to a time period, the stated time is indicative and may need to be revised as more localised sea level projections are developed and/or updated. For example, Victoria's policy setting requires planning for not less than 0.8 m sea level rise by 2100, however recent global estimates suggest a 1.1 m to 1.4 m sea level rise could be expected by 2100.
RaSP	Regional and Strategic Partnerships (RaSP) are a new tool under the *Marine and Coastal Act 2018*. RaSPs bring stakeholders together on regionally significant issues. The Inverloch RaSP is the first created under the Act, gazetted on 6 August 2020. The RaSP brings together Traditional Owners and nine agencies. They each have a role in managing coastal and foreshore values, assets and infrastructure in the study area.

Risk assessment	A systematic process of evaluating the potential risks (likelihood and consequence) of coastal hazards, helping to inform a response and adaptation actions.
Resilience	The capacity of social, economic, and environmental systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.
SLR	Sea Level Rise - An increase in the mean level of the ocean. Relative sea level rise occurs where there is a local increase in the ocean level relative to the land, which might be due to ocean rise and/or land subsidence.
Storm tide inundation	Inundation resulting from storm activity, combining storm surge and the predicted tide height. For the Cape to Cape Resilience Project, storm tide inundation modelling also includes a rainfall (catchment and urban) component contributing to flooding.
Vulnerability	Coastal vulnerability considers the susceptibility of people and places along the coast to adverse impacts from coastal hazards. Includes the degree of exposure, and ability to cope with, respond to and adapt to coastal hazards.
	Further definitions of terms relevant to coastal hazard adaptation and the Cape to Cape Resilience Project can be found on the Cape to Cape Resilience Project website: marineandcoasts.vic.gov.au/coastal-programs/cape-to-cape-resilience-project

1 Introduction

Alluvium Consulting Australia Pty Ltd (Alluvium) are working with the Department of Environment, Water, Land and Planning (DELWP) towards the development of a Cape to Cape Resilience Plan for the coastal communities of Inverloch, Venus Bay and surrounds. This work is being undertaken as part of the Inverloch Regional and Strategic Partnership (RaSP) which is a partnership bringing together nine agencies and Traditional Owners to address the regionally significant issue of coastal erosion and inundation affecting the study area. The partners each have a role in managing coastal and foreshore values, uses and infrastructure around Inverloch.

The Cape to Cape Resilience Project has run from early 2021 (Figure 1, and has delivered various Coastal Hazard Assessment (CHA) outcomes, and a range of key assessments - community values, cultural values, coastal risk and vulnerability and economics (including an economic base case). This summary paper brings together technical, strategic and engagement findings from this work to provide a tailored adaptation framework to guide coastal hazard adaptation planning.

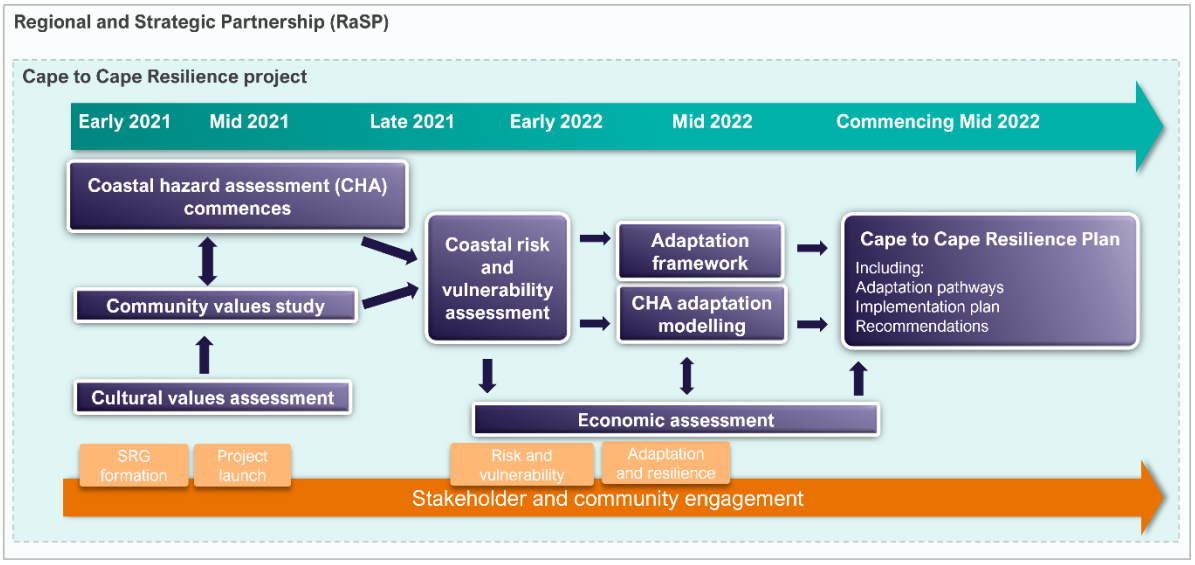


Figure 1. *Cape to Cape Resilience Project timeline*

1.1 State-wide coastal hazard adaptation

Coastal management reform in Victoria, led by DELWP, has involved the release of several key pieces of legislation, policies and guidance material over recent years. The *Marine and Coastal Act 2018* and Marine and Coastal Policy (2020) and Strategy (2022) are intended to be the primary management tools to guide coastal management in Victoria. Development of the Cape to Cape Resilience Plan considers a range of key objectives and guiding principles from the legislation in the planning and management of marine and coastal areas.

DELWP is also developing a State-wide approach to long-term coastal hazard resilience and adaptation called Victoria's Resilient Coast – Adapting for 2100+. This program includes a framework and guidelines to support state and local governments, land managers and communities to adapt to climate change impacts on the coast. Due for release in mid-2022, the guidelines will guide the development and implementation of adaptation opportunities to increase resilience, using a pathways approach to help inform decision making, planning, triggers and timing of actions.

1.2 This project

Overseen by the Inverloch RaSP, the Cape to Cape Resilience Project is a coastal hazard adaptation project that combines the latest science, technical assessments and community aspirations to develop a long-term plan to manage important coastal places, assets and other values in the future.

The project is being scoped to align with stages of the Victoria's Resilient Coast – Adapting for 2100+ program (Figure 2 and Table 1)

The project includes:

- New research through a Coastal Hazard Assessment (CHA),
- Extensive community engagement and Community and Cultural Values studies,
- A coastal risk and vulnerability assessment, and
- Coastal resilience planning to develop the Cape to Cape Resilience Plan (a medium to long term plan including adaptation pathways and implementation).

The expected outcomes of the project include:

- Identification of coastal hazards from Cape Paterson to Cape Liptrap and the extent of potential impact
- Up-to date, local information on inundation, erosion and groundwater, including data and hazard mapping for the region
- Engaged and knowledgable stakeholders who have been involved in process and are able to make informed decisions on planning and asset management.
- Research, management strategies and resilience planning shaped by an understanding of community values
- Increased community understanding of local coastal hazards and management strategies
- Strategic approach to plan short, medium and long-term management of this coastline (<5 years, 5 – 25 years, >25 years, respectively), includes managing recent changes along Inverloch's coastline.

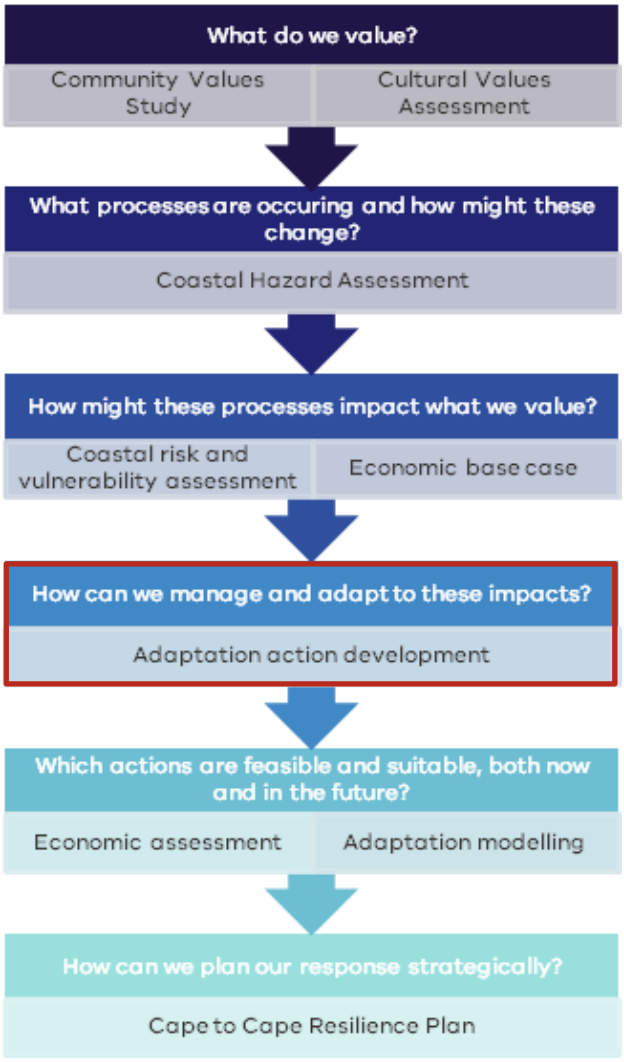


Figure 2. *Key questions and outputs of the project. Adaptation planning shown in red box.*

Table 1. Stages of the Cape to Cape Resilience Project, including purpose, key questions and deliverables.

Victoria's Resilient Coast – Adapting for 2100+ framework	Purpose	Key questions	Cape to Cape Resilience Project key deliverables	Completion timeline	Document citation	Additional products
STAGE 1 Scoping and preparation	Provide a foundation for adaptation planning aligned to best practice guidance.	• Do we need action? • Who is involved? • Where's the study area? • What is our study scope?	Project plan	Mar-21	DELWP 2021, Inverloch Regional and Strategic Partnership Project Plan, Victoria, March 2021.	Website establishment and content. DELWP & Alluvium. May 2021.
			Engagement plan	Mar - July 2021	Alluvium 2021, Cape to Cape Resilience Project Engagement Plan, Victoria, March 2021.	Project Update 1 - Introducing the Cape to Cape Resilience Project. DELWP & Alluvium. May 2021 Fact Sheet 1 - Project scene setting, introducing the RaSP. DELWP & Alluvium. May 2021. Project Update 2 - Data gathering, gap analysis, engagement commencement. DELWP & Alluvium. July 2021. Fact Sheet 2 - Coastal adaptation and hazards technical terminology. DELWP & Alluvium. July 2021.
STAGE 2 Values, vision and objectives	Ensure adaptation planning is underpinned by regional and place-based values.	• What do we value? • As a region and as a State? • What do we want the future to look like?	Community values study	Oct-21	Alluvium 2021, Cape to Cape Resilience Project Community Values Study - Engagement Report - Values and Experiences, Victoria, October 2021.	Engage Victoria online survey & on-site drop in sessions - Community values and perspectives
			Cultural values assessment	Dec-21	Bunurong Land Council Aboriginal Corporation 2021, BLCAC Cultural Values Assessment: Cape to Cape Project, Victoria, December 2021.	
STAGE 3 Coastal hazard exposure	Assess coastal hazard exposure, including scenarios that enable best practice approaches to assessing current and emerging risk.	• What processes are occurring and how might these change?	Inverloch region coastal hazard assessment	June 21 - Mar 22	Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 1 - Project Summary Report, Victoria, June 2022.	Fact Sheet 3 - Understanding coastal landscape context, processes and hazards. DELWP & Alluvium. Oct 2021. Fact Sheet 4 - Understanding coastal hazard modelling. DELWP & Alluvium. Oct 2021. Project Update 3 - Technical work (LiDAR, models, Assessment work), engagement update. DELWP & Alluvium. Nov 2021.
					Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 2 - Data Assimilation and Gap Analysis, Victoria, June 2022.	
					Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 3 - Technical Methodology , Victoria, June 2022.	
					Rosengren, N. & Miner, T., 2021, Inverloch Region Coastal Hazard Assessment – Coastal Geomorphology, Appendix A in Water Technology 2022c, Inverloch Region Coastal Hazard Assessment Report 3: Technical Methodology, Victoria, 2021.	
					Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 4 - Coastal Processes and Erosion Hazards , Victoria, June 2022.	
					Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 5 - Inundation Hazards, Victoria, June 2022.	
STAGE 4 Vulnerability and risk	Explore place-based coastal hazard vulnerability and risk, to enable strategic consideration of adaptation needs/priorities.	• How might these processes impact what we value?	Coastal hazard asset exposure assessment	April - May 22	Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 6 - Coastal Hazard Asset Exposure Assessment, Victoria, June 2022.	Project Update 4 - Technical work update (hazard mapping, values, economics), engagement update. DELWP & Alluvium. April 2022. Fact Sheet 5 – Vulnerability and Risk. **DELWP & Alluvium**. April 2022
			Coastal hazard risk and vulnerability assessment		Alluvium 2022, Cape to Cape Resilience Project - Asset and Values Risk and Vulnerability Assessment, May 2022.	
			Economic base case		Natural Capital Economics & Alluvium, 2022, Cape to Cape Resilience Project – Economics Assessment, June 2022.	
STAGE 5 Adaptation actions and pathways	identify, assess, consult on and decide which adaptation options and actions are the most appropriate for managing the current and future coastal hazard risks in the study area. This includes a diversity of integrated actions across land management, planning and design, nature based and engineering themes.	• How can we manage and adapt to these impacts?	Adaptation options and preferences	May - June 22	Alluvium 2022, Cape to Cape Resilience Project Adaptation Options - Engagement Report - Adaptation Engagement Outcomes, Victoria, , May 2022	Fact Sheet 6 – Coastal Adaptation. **DELWP & Alluvium**. April 2022 Fact Sheet 7 – Adaptation Actions. **DELWP & Alluvium**. April 2022
			Adaptation framework summary paper		Alluvium 2022, Cape to Cape Resilience Project – Adaptation Framework Summary Paper, Victoria, June 2022.	
			Adaptation feasibility modelling		Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 7 - Adaptation Action Technical Assessment, Victoria June 2022	
			Economic assessment & cost benefit analysis		Natural Capital Economics & Alluvium, 2022, Cape to Cape Resilience Project – Economics Assessment, June 2022.	
STAGE 6 Plan and implement	Confirm the plan of action for coastal hazard risk management and adaptation, and commence implementation. This includes priority actions in the adaptation pathways, shared roles and responsibilities, triggers for review and resources/requirements.	• Which options are feasible and suitable, both now and in the future? • How can we plan our response strategically?	Cape to Cape Resilience Plan		Inverloch RaSP Stage 2- TBC 2023	
			Cape to Cape Implementation plan/s		Inverloch RaSP Stage 2-& Partner Agencies TBC 2023 onwards	
STAGE 7 Ongoing monitoring and review	Ensure coastal hazard risk management and adaptation is accompanied by ongoing monitoring and evaluation process that enables effective implementation, learnings and improvement.	• How can our response be adaptive to changing conditions? • How are we tracking in implementing our plan?	Cape to Cape Resilience Plan including implementation, monitoring and evaluation		Inverloch RaSP TBC 2023 onwards	

1.3 This paper

This paper describes the development of a tailored adaptation framework to manage coastal hazards risk for the Cape to Cape region. Aligning with Victoria's Marine and Coastal Policy, the methodology considers how to use technical, strategic and engagement assessments regarding coastal hazards, to enable a strategic approach to manage coastal hazard risks, and enhance the resilience of our coastal zones.

This assessment asks the following key question: *How can we strategically manage and adapt to coastal hazards impacts for the Cape to Cape region?*

It brings together technical findings of the assessments on coastal hazards, risk and vulnerability and economics, combined with an understanding of community and cultural values, and key uses and infrastructure in the region's coastal areas. Driven by an understanding of the risk and vulnerability for the region, it looks to identify appropriate adaptation response/s and informs how we might be able to manage and adapt to these impacts through adaptation.

The technical work completed during this assessment includes the following, noted in Table 2. A summary of the approach to this work is provided in the following sections. Relevant attachments which provide additional detail are also noted.

Table 2. Components of the risk and vulnerability assessments

Report Section	Technical assessment	Notes
2.1	Adaptation framework • Adaptation objectives • Adaptation options • Adaptation actions • Adaptation pathways	Linked to the VRC framework
2.2	Application of the framework	
3	Applying the framework: Cape to Cape region	Preliminary development linked to: All Cape to Cape Resilience Project deliverables to date – technical, strategic and engagement outcomes

2 Strategic approach for adaptation

2.1 Adaptation framework

Approach
A tailored adaptation framework has been developed for the Cape to Cape Resilience Project, based on best practice approaches to coastal hazard adaptation, including Victoria's strategic adaptation approach outlined in the Marine and Coastal Policy (2020) and the Victoria's Resilient Coast framework.

This reframed approach for coastal hazard management in Victoria aims to facilitate more balanced and positive management options for the long-term benefit of the State's coastline.

Guided by an appreciation of local **adaptation objectives,** an understanding of hazard exposure, vulnerability and risk and the Marine and Coastal Policy (2020), common elements of this strategic adaptation approach include:

- Assessing the available **adaptation options** that may be suitable in response to identified coastal hazard risks in different locations and over multiple planning horizons from present day to 2100.
- Assessing the range of **adaptation actions** associated the different strategic options, that could be used to manage the risk of coastal hazards.
- Developing a strategic plan for coastal adaptation with a view to 2100, with prioritised actions over a 5—10 year timeframe. This includes the development of **adaptation pathways** to guide decision making for current and future management.

This framework has been informed by:

- Best practice methods as outlined in Victoria's Resilient Coast framework and aligned with the Marine and Coastal Policy (2020)
- Consultation with stakeholders, including representatives from the Inverloch RaSP, the Stakeholder Reference Group and broader feedback from the community
- The values and objectives for different localities across the Cape to Cape region (Community Values Study, Cultural Values Assessment)
- An understanding of vulnerability and risk of coastal hazards for a diversity of values, asset types, across multiple planning horizons (from the Coastal Hazard Assessment (CHA) and the Risk and Vulnerability Assessment)
- A whole-of-coast perspective of the range of values, uses and pressures in the coastal zone.

Adaptation objectives

The purpose of clarifying adaptation objectives is to help guide appropriate adaptation response/s, and to screen adaptation options and actions, across different localities. Community perspectives on coastal values and thoughts for the future have informed an understanding of adaptation objectives across the Cape to Cape region.

These perspectives were gathered through engagement activities throughout the project (documented in the Community Values Study (Alluvium, 2021) and Cultural Values Assessment (BLC, 2021)) including via stakeholder briefings, community sessions, online activities and surveys, and direct feedback to the project team.

Important elements of future coastal resilience identified by Cape to Cape community and RaSP stakeholders include:

- Cultural, historic and spiritual connections to the coast
- Coastal landscapes, seascapes, character and views
- Healthy coastal and marine ecosystems
- Abundant and diverse native coastal and marine flora and fauna
- Natural resilience to coastal hazards and sea-level rise impacts
- Water quality that is safe and reliable for human consumption, recreational use, healthy ecosystems and primary industry
- Safe, reliable and ecologically sensitive access to coastal areas
- Desirable places to live, work, visit and play, with reliable public services and amenities
- The ability to live in a coastal community
- Clarity, consistency and confidence in foreshore management and responsibilities

Development of a strategic, proactive response to manage coastal hazards and increase the resilience of this coastline, must consider values to shape an approach that is consistent with the community's current and future aspirations for these coastal areas.

In line with these values, objectives for the adaptation approach are to:

- *Preserve, maintain and enhance these important values of the Cape to Cape region*
- *Use a strategic, adaptive approach informed by an understanding of risk and vulnerability*
- *Plan to manage current and emerging coastal hazard risks, with a view out to 2100*

These values and core objectives for coastal management and adaptation, form the basis for considering the suitability of different coastal hazard adaptation responses, and inform the multi-criteria analysis of adaptation options and actions.

Adaptation options

A range of strategic options can be used for coastal hazard risk management and adaptation. The Marine and Coastal Policy (2020) refers to these as "adaptation options."

Adaptation options are different strategic approaches to managing coastal hazard risk.

There are six strategic adaptations options, defined in Table 3. These options are to be considered in the listed hierarchal order, as per the Policy (2020).

Table 3. Strategic adaptation options, in order of consideration (as defined in the Policy (2020))

Strategic options (in order)	Definition
1. Non intervention	Allow marine and coastal processes, and the hazards they may pose, to occur.
2. Avoid	Locate new uses, development and redevelopment away from areas that are or will be negatively impacted by coastal hazards.
3. Nature-based methods	Enhancing or restoring natural features to mitigate coastal hazard risk.
4. Accommodate	Structures can be designed to reduce the exposure to, or decrease the impact of, coastal hazard risk, thus 'accommodating' the risk.
5. Retreat	Existing structures, assets or uses may be decommissioned or relocated away from areas that are, or will be, negatively impacted by coastal hazards.
6. Protect (major engineering works)	Existing physical barriers are enhanced, or new ones constructed, to mitigate the impact of coastal hazards. Protect is an option of last resort; it is often expensive, its benefits tend to be very localised, and it frequently transfers the problem to nearby areas.

These adaptation options are to be considered by land and asset managers in the development of an adaptation approach to manage coastal hazard risk.

Adaptation actions
There are a wide range of adaptation actions that align with the six strategic adaptation options that can assist in managing coastal hazard risk.

Adaptation actions are the range of tools, decisions and works that can be implemented to create adaptation pathways aligned to the strategic options.

The different types of adaptation actions are classified into three key functional types:

Functional type	Definition
Land management, planning and design	Use policy, planning instruments, guidance materials, communication, capacity building and strategic processes to enact change.
Nature-based	Use the creation or restoration of coastal habitats for hazard risk reduction. This may be achieved through restoration of habitat alone ("soft" approach), or in combination with hard structures that support habitat establishment ("hybrid" approaches).
Engineering	Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications. Includes both "hard" and "soft" engineering and can be used in conjunction with some nature-based methods

A variety of adaptation actions are being considered for managing coastal hazard risk in the Cape to Cape region. These are set out (Table 4) in line with each functional type. Additional detail on each is provided in the Attachment A.

Further details of these and other adaptation actions can be found in Victoria's Resilient Coast Adaptation Actions Compendium (DELWP, 2022).

Table 4. Adaptation actions for consideration in the Cape to Cape region

Land management, planning and design	Nature-based	Engineering
Land use Planning scheme amendments, planning overlays, rolling easements, land acquisition, access control, **Resilient design / development** Design standards, materials, setbacks,	**Coastal wetlands / blue carbon ecosystems** Mangroves, seagrass, saltmarsh **Dune ecosystems** Dune protection / vegetation, beach nourishment*/scraping	**Beach nourishment*** Beach scraping, cart and place, dredging, sand bypassing **Seawalls** **Groynes** **Breakwaters** **Flood / tidal barriers** **Drainage network** Pipes, valves (size, functionality, network location, materials) **Road network** Network, material, drainage

Adaptation pathways

Managing emerging coastal hazard risk, requires longer term strategic thinking. Adaptation pathways are a decision-making process that allow different combinations of adaptation actions to examined under various future conditions. They consider how action feasibility changes over times and identify when a change in management response may be necessary, and what may prompt that change.

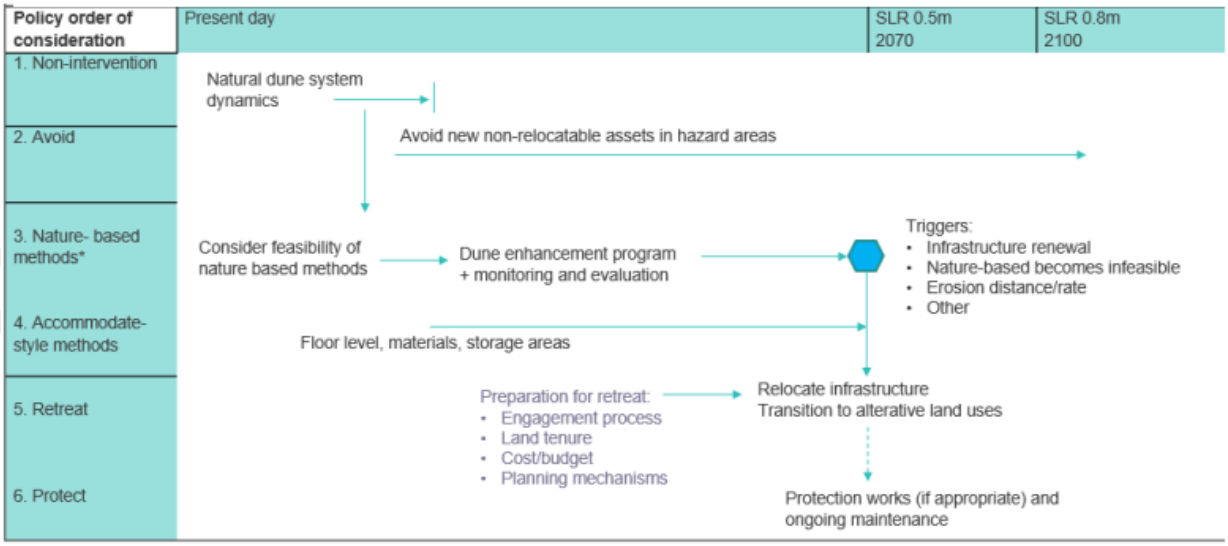
Adaptation pathways approach: a forward-looking planning process that uses pathways to identify actions for managing changing coastal hazard risk and uncertain climate conditions into the future.

Using relative sequencing, timing, and implementation triggers and thresholds, this decision-making process allows exploration of a range possible actions (and futures) to determine effective and adaptive management approaches.

Often a suite of measures is required to effectively manage coastal hazard risk, especially at a regional scale. Adaptation pathways provide clear sequencing of actions to reveal linkages and dependencies between management actions.

There are many ways adaptation pathways can be represented – tables, diagrams, flowcharts. Key information includes the range of adaptation actions to be taken over time, along a preferred adaptation pathway, trigger/decision points for change and alternative pathways.

Adaptation pathways should present clear sequencing of actions over time etc. and in the Victorian context, illustrate the preferred pathways informed by the order of consideration. Pathways might also show how multiple actions might occur in parallel – either integrated or acting independently, and how preferred pathways might it change over time in response to changing conditions.



**Nature-based methods use the creation or restoration of coastal habitats for hazard risk reduction (Morris RL, et al. 2021).*

Figure 3. *Example adaptation pathway from the VRC guidelines (VRC, 2022)*

2.2 Application of the framework

Approach

Bringing together each of the framework elements, a tailored adaptation approach can be developed to respond to coastal hazard risk identified for different localities within the Cape to Cape region.

Understanding local values and risk profiles, including what is at risk (land and assets), and how the risk profile is changing over time, can inform the adaptation response.

Stepping through the six adaptation options, there are some foundational questions to consider, to help shape a suitable adaptation approach for identified "at-risk" areas, assets and values, in line with adaptation objectives (Table 5).

Table 5. Shaping a tailored approach to adaptation

Adaptation options		Developing adaptation pathways		
Strategic options (in order)	**Definition**	**Foundation questions for building an adaptation pathway**		**Associated types of adaptation actions**
1. Non intervention	Allow marine and coastal processes, and the hazards they may pose, to occur.	Is non-intervention appropriate?	For which hazards and risks?	• Land management, planning and design
2. Avoid	Locate new uses, development and redevelopment away from areas that are or will be negatively impacted by coastal hazards.	Can we continue to avoid the hazards?	Where and for how long?	
3. Nature-based methods	Enhancing or restoring natural features to mitigate coastal hazard risk.	Can we pursue a nature-based approach?	What actions do we include?	• Land management, planning and design • Nature-based
4. Accommodate	Structures can be designed to reduce the exposure to, or decrease the impact of, coastal hazard risk, thus 'accommodating' the risk.	Can we better accommodate the hazards/risk?	What would trigger a change?	
5. Retreat	Existing structures, assets or uses may be decommissioned or relocated away from areas that are, or will be, negatively impacted by coastal hazards.	Can we retreat from the hazards/risk?	Will there need to be compromise and what are we willing to sacrifice?	• Land management, planning and design
6. Protect (major engineering works)	Existing physical barriers are enhanced, or new ones constructed, to mitigate the impact of coastal hazards. Protect is an option of last resort; it is often expensive, its benefits tend to be very localised, and it frequently transfers the problem to nearby areas.	Do we require a protect approach?		• Land management, planning and design • Engineering

The responses to these questions help to highlight key drivers of coastal hazards risk and at-risk values and assets in each location, where and when adaptation actions may be necessary to achieve adaptation option/s. This provides the foundations for tailoring a suitable management response.

How to use it

The adaptation framework elements are integrated with technical, strategic and engagement findings from Stage 1 of the Cape to Cape Resilience Project, and used to shape an adaptation response. The following process flowchart (Figure 4) outlines the next steps in tailoring suitable, strategic approach.

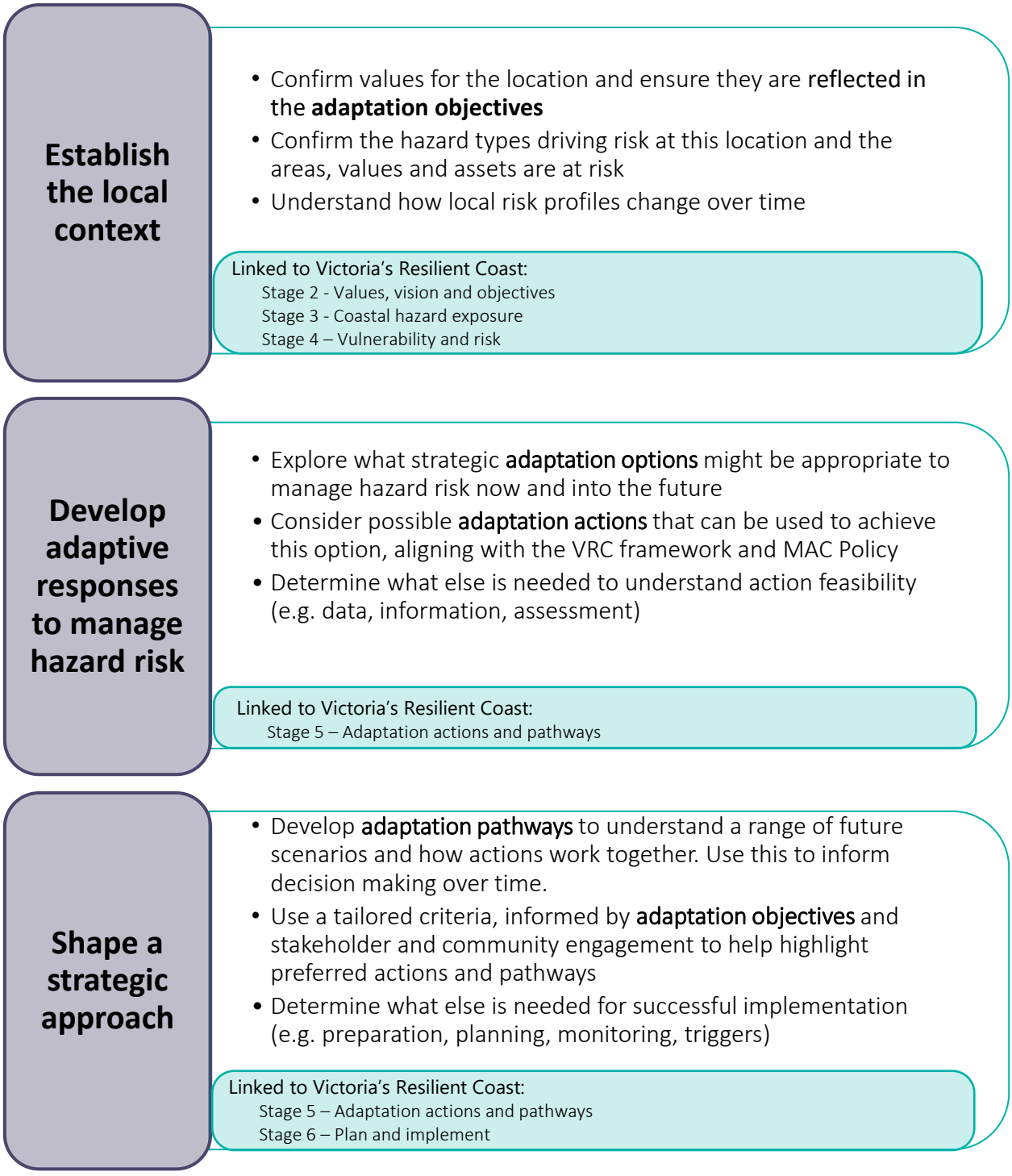


Figure 4. *A process for applying the adaptation framework*

Importantly, each of these steps must be undertaken in collaboration with project stakeholders, with assessments and decisions to reflect and align with engagement outcomes from earlier stages of the project.

These steps will be undertaken in more detail as part of Stage 2 of the Cape to Cape Resilience Project.

3 Applying the framework: Cape to Cape region

3.1 Stage 1 deliverables and outcomes

Stage 1 of the Cape to Cape Resilience Project has produced a variety of technical, strategic and engagement assessments and understanding in relation to the region's coastal hazards.

Stage 2 will build up the work to date, at both a regional and localised scale, to develop appropriate adaptation response/s. Some preliminary thinking has already begun for Inverloch.

Table 6. Cape to Cape Resilience Project deliverables aligned with VRC Stages (refer Table 1 for further deliverable detail)

	Victoria's Resilient Coast – Adapting for 2100+ framework	Purpose	Key questions	Cape to Cape Resilience Project key deliverables
STAGE 1 Cape to Cape Resilience Project	STAGE 1 Scoping and preparation	Provide a foundation for adaptation planning aligned to best practice guidance.	• Do we need action? • Who is involved? • Where's the study area? • What is our study scope?	Project plan Engagement plan
	STAGE 2 Values, vision and objectives	Ensure adaptation planning is underpinned by regional and place-based values.	• What do we value? • As a region and as a State? • What do we want the future to look like?	Community values study Cultural values assessment
	STAGE 3 Coastal hazard exposure	Assess coastal hazard exposure, including scenarios that enable best practice approaches to assessing current and emerging risk.	• What processes are occurring and how might these change?	Inverloch region coastal hazard assessment
	STAGE 4 Vulnerability and risk	Explore place-based coastal hazard vulnerability and risk, to enable strategic consideration of adaptation needs/priorities.	• How might these processes impact what we value?	Coastal hazard asset exposure assessment Coastal hazard risk and vulnerability assessment Economic base case
	STAGE 5 Adaptation actions and pathways	Identify, assess, consult on and decide which adaptation options and actions are the most appropriate for managing the current and future coastal hazard risks in the study area. This includes a diversity of integrated actions across land management, planning and design, nature based and engineering themes.	• How can we manage and adapt to these impacts?	Adaptation options and preferences Adaptation framework summary paper Adaptation feasibility modelling Economic assessment & cost benefit analysis
STAGE 2 Cape to Cape Resilience Project	STAGE 6 Plan and implement	Confirm the plan of action for coastal hazard risk management and adaptation, and commence implementation. This includes priority actions in the adaptation pathways, shared roles and responsibilities, triggers for review and resources/requirements.	• Which options are feasible and suitable, both now and in the future? • How can we plan our response strategically?	Cape to Cape Resilience Plan Cape to Cape Implementation plan/s
	STAGE 7 Ongoing monitoring and review	Ensure coastal hazard risk management and adaptation is accompanied by ongoing monitoring and evaluation process that enables effective implementation, learnings and improvement.	• How can our response be adaptive to changing conditions? • How are we tracking in implementing our plan?	Cape to Cape Resilience Plan including implementation, monitoring and evaluation

Adaptation actions and preferences

Engaging on adaptation

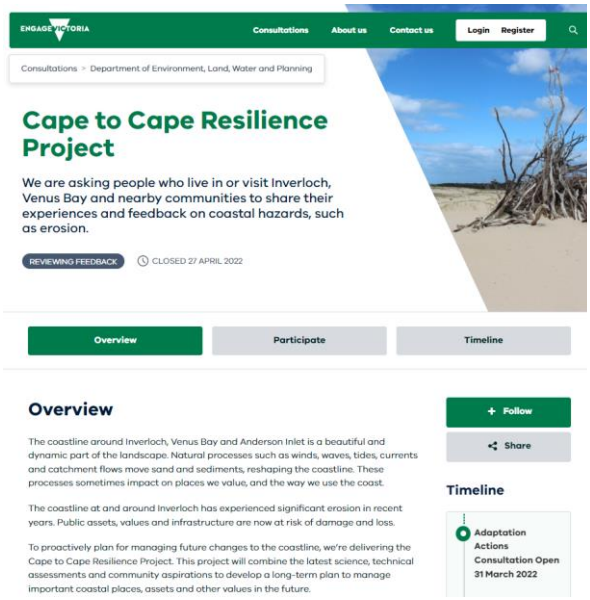
Combined with our Community Values Study (Alluvium, 2021) from last year, and further stakeholder discussions, a survey regarding adaptation actions was undertaken with community in April 2022 (summary in Attachment B). Stage 1 stakeholder workshop discussions with RaSP members and with the Stakeholder Reference Group have also provided relevant insight on adaptation preferences and considerations.

The survey asked people to:

- Share their preferences between different adaptation actions used in coastal management
- Contribute ideas to build resilience, adapt to change and help retain what they value into the future

People were also given the opportunity to view the coastal hazard maps both online, and in person at our pop-up and drop-in sessions, to better understand where actions might be required to manage risk.

This understanding will be used to help inform the development of a suitable adaptation approach to manage coastal hazards for the Cape to Cape region, now and into the future, as part of Stage 2 of the Cape to Cape Resilience Project. This knowledge can be integrated into different elements of the adaptation framework - objectives, the adaptation options and the adaptation actions.



Tailored criteria

There are many different factors to consider when selecting coastal hazard adaptation actions. Tailored criteria were developed to help shortlist and select appropriate adaptation actions. Criteria have been based on key stakeholder and community values, objectives and perspectives collated during the project, in particular by survey feedback on coastal values, adaptation actions and preferences. This list was further refined through stakeholder discussions and activities with RaSP members and with the Stakeholder Reference Group.

Table 7. Criteria to assess adaptation actions

Criteria	Description
Access and usage	Ability to increase usage and access the foreshore or surrounding areas, including by people with disability and reduced mobility.
Adaptability	Longevity of the solution, in relation to potential future sea level rise.
Approvals	Alignment with the principles and intent of Victorian policy, levels of approvals and permits required, and the likelihood obtaining approvals.
Co-benefits/ outcomes	Option results in multiple benefits. In addition to its primary intended outcome – e.g. hazard reduction combined with habitat improvement, or with amenity/recreation.
Cultural heritage	Conservation of cultural heritage values, including sensitive sites and places, access and ability to continue cultural practices.
Environmental	Impact on coastal processes regime, environmental and marine values. Includes consideration of the surrounding environment.
Hazard reduction / risk mitigation	Design life and level of risk mitigation to foreshore and assets. Closely linked to retaining current values - environment, recreation, social, cultural, economic.
Safety	Risks to public safety.
Value (cost)	Whole of life costs, including capital costs and ongoing maintenance requirements.
Visual (natural) amenity	Conservation of the existing natural vistas of the Cape to Cape coastline and recreational activities.

Tailored rankings and weightings were calculated for the criteria using a pairwise method (Table 8). RaSP members and Stakeholder Reference Group members were given the chance to step through and compare and score each individual criteria together, deciding if they were of equal importance, or if one was more or less important than the other. This allowed the criteria that stakeholders nominated as being of higher importance in decision making, to be reflected in scaled weightings.

Table 8. Rank and weighting criteria – tailored through pairwise analysis with Cape to Cape Project stakeholders

Criteria	Rank	Weighting
Environmental	**1**	12.4%
Safety	**1**	12.4%
Hazard reduction / risk mitigation	**3**	11.7%
Cultural heritage	**4**	10.6%
Adaptability	**5**	10.5%
Co-benefits/ outcomes	**6**	9.8%
Visual (natural) amenity	**7**	9.3%
Value (cost)	**8**	9.2%
Approvals	**9**	8.3%
Access and usage	**10**	5.9%

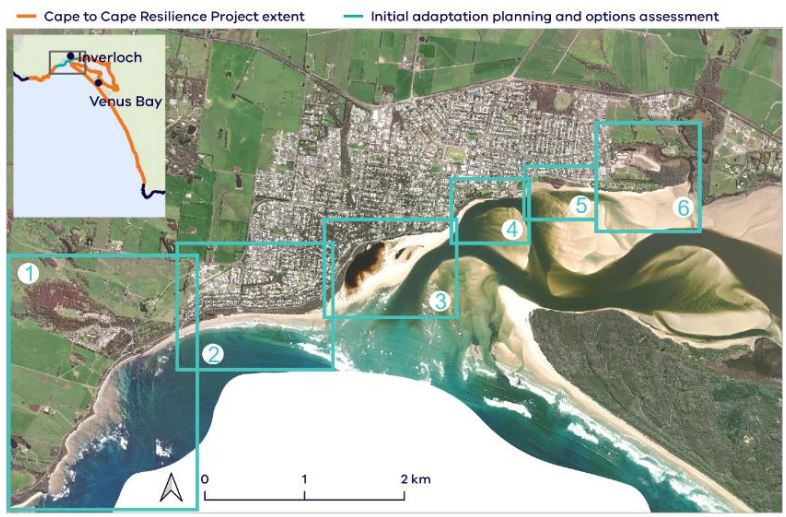
Environmental impacts and the level of hazard reduction /risk mitigation and the ability to be adaptable were the top three most important criteria as nominated by the broader community engagement (Attachment B).

3.2 Preliminary thinking for Inverloch

In response to recent hazard exposure along Inverloch's foreshore, and the higher exposure and risk for some of these areas, the initial focus of the coastal hazard adaptation response is on the 6 km of coastline from Flat Rocks to Screw Creek.

To inform the development of targeted adaptation for the Inverloch area, the Inverloch area has been split further into six sub-localities, based on coastal hazards and processes, natural features and drivers of risk (Figure 5).

This provides a more detailed appreciation of values, uses and infrastructure and the current and emerging risk along Inverloch's foreshore.



1. Flat Rocks to Wreck Creek (Bunurong Rd)
2. Inverloch Surf Beach - (Bunurong Rd to Ozone St)
3. Coastal reserve (Ayr Creek) – Inlet Entrance to the Glade
4. Inverloch Boat Ramp
5. Inverloch Foreshore Dog Beach (Toys Backwater)
6. Inverloch Foreshore – Holiday Park to Screw Creek

Figure 5. *Inverloch sub-localities*

Establish the local context

Working with project stakeholders (members of the RaSP) and targeted community groups and members the six Inverloch sub-localities will be examined to confirm understanding of values and coastal hazard risk and vulnerability at each location.

Establish the local context

- Confirm values for the location and ensure they are reflected in the **adaptation objectives**
- Confirm the hazard types driving risk at this location and the areas, values and assets are at risk
- Understand how local risk profiles change over time

Linked to Victoria's Resilient Coast:
Stage 2 - Values, vision and objectives
Stage 3 - Coastal hazard exposure
Stage 4 – Vulnerability and risk

The following summary tables start to provide an initial overview of the localised context and understanding for each sub-locality in Inverloch:

- Local values uses and infrastructure (Table 9)
- Local risk-ratings, by hazard type (Table 10)
- Values, uses and infrastructure at risk (Table 11)

Table 9. Key values, uses and infrastructure for each Inverloch sub-locality

Sub-locality	Key values, uses and infrastructure in this location
Flat Rocks to Wreck Creek (Bunurong Rd)	• Access and throughfare between Inverloch and Cape Paterson • Scenic coastal drive and tourism/recreation destinations • Environmental and habitat values – dune vegetation, cliff vegetation • Yallock-Bulluk Marine and Coastal Park and Bunurong Marine National Park • Public and private land, assets and services
Inverloch Surf Beach (Bunurong Rd to Ozone St)	• Sandy, wide beach and dunes • Natural amenity and coastal views • Recreational and tourism values as a sandy surf beach • Public safety and services provided by Inverloch SLSC • Hazard buffer provided by the dunes • Cultural and heritage values – including *Amazon* historic shipwreck • Environmental and habitat values – including dune and creek vegetation • Public and private land, assets and services
Inverloch Coastal Reserve (Ayr Creek) – Inlet Entrance to the Glade	• Wide, sandy, vegetated dunes • Natural amenity and views – including Inverloch teepees • Recreational and tourism values as a sandy beach and coastline • Ayr Creek/lagoon – estuarine ecosystems • Hazard buffer provided by the dunes • Environmental and habitat values – including dune, creek and lagoon vegetation • Public and private land, assets and services
Inverloch Boat Ramp	• On/near water facilities - boat ramp & Inverloch jetty • Assets and buildings – Yacht club, bowling green • Recreational values – boating, fishing, water access • Coastal and water views from the jetty • Adjacent parking facilities • Public and private land, assets and services
Inverloch Foreshore Dog Beach / Toys Backwater	• Sandy, vegetated in some sections • Natural amenity (open parkland –reserve) • Recreational values – sandy dog beach • Local heritage values - old structures (historic seawall) • Environmental and habitat values – mangroves, saltmarsh, coastal heath • Public and private land, assets and services
Inverloch Foreshore – Holiday Park to Screw Creek	• Sandy, vegetated foreshore • Environmental and habitat values – mangroves, saltmarsh, coastal heath, creek ecosystem • Recreational values – including adjacent camping • Public and private land, assets and services

Table 10. Risk rating by hazard type, for each Inverloch sub-locality

Risk rating:	Low	Medium	Significant	High
	Low	Med	Sign	High

	Erosion				Temporary inundation				Permanent inundation			
	Present day	2040	2070	2100	Present day	2040	2070	2100	Present day	2040	2070	2100
	0.0m SLR	0.2 m SLR	0.5m SLR	0.8 m SLR	0.0m SLR	0.2 m SLR	0.5m SLR	0.8 m SLR	0.0m SLR	0.2 m SLR	0.5m SLR	0.8 m SLR
1. Flat Rocks to Wreck Creek (Bunurong Rd)	Med*	Med	Sign *	Sign	Med*	Med*	Med	Med	Low	Low	Low	Low
2. Inverloch Surf Beach (Bunurong Rd to Ozone St)	Med*	Med	Sign	High	Low	Med*	Med	Med	Low	Low	Low	Low
3. Inverloch coastal reserve (Ayr Creek) – Inlet Entrance to the Glade	Low	Med*	Med*	Sign*	Med*	Med*	Med*	Med*	Low	Low	Low	Low
4. Inverloch Boat Ramp	Low	Low **	Low**	Low **	Low	Med*	Med*	Med	Low	Low	Low	Med
5. Inverloch Foreshore Dog Beach	Med*	Med*	Med	Sign	Low	Med*	Med*	Med	Low	Low	Low	Low
6. Inverloch Foreshore – Holiday Park to Screw Creek ***	Low	Low	Low	Low	Med*	Med*	Med	Med	Low	Med*	Med*	Sign*

** at some locations within the area*

*** assumes presence of coastal protection structures at boat ramp. In absence of structures, risk rating would increase*

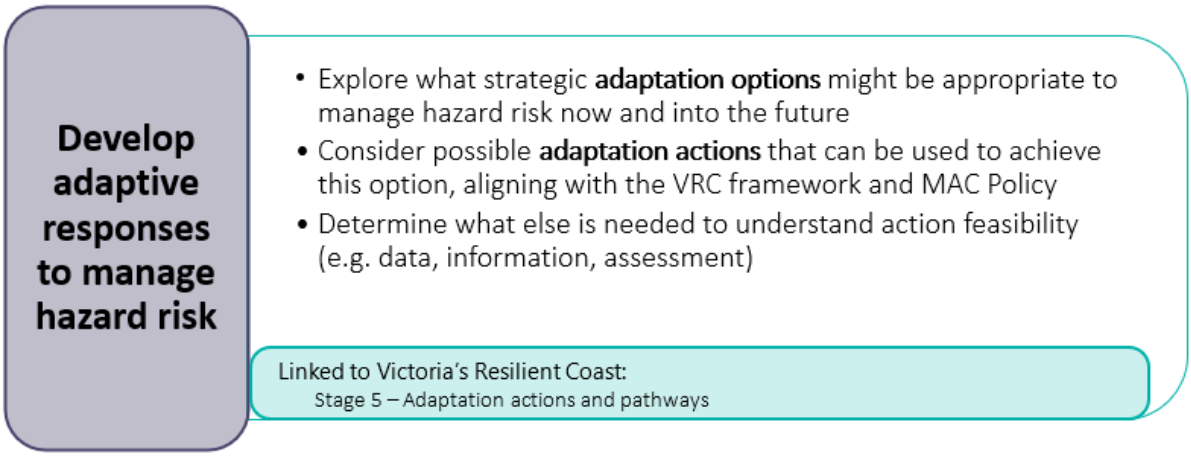
**** refer to risk assessment on development areas. Recent development works may have modified topography, lowering inundation risk*

Table 11. Values, uses and infrastructure at risk for each Inverloch sub-locality

Sub-locality	Key values, uses and infrastructure at risk
Flat Rocks to Wreck Creek (Bunurong Rd)	• Temporary/permanent access disruption (roads) • Public/traffic safety • Linear infrastructure networks in road reserve • Reduction/loss of visual amenity
Inverloch Surf Beach (Bunurong Rd to Ozone St)	• Reduction/loss of amenity and recreation of sandy beach • Reduction/loss of hazard buffer (Surf Pde and surrounds) • Ecosystem impacts • Public utilities/infrastructure networks (incl sewerage pump station) and major linear networks in road reserve, and facility impacts (Inverloch SLSC) • Temporary/permanent access disruption (roads, utilities) • Private property/asset impacts (flooding via Wreck Creek) • Private property/asset impacts (erosion at Surf Pde)
Inverloch Coastal reserve (Ayr Creek) – Inlet Entrance to the Glade	• Temporary/permanent access disruption (roads – Surf Pde and Ramsey Blvd, and to the reserve) • Public utilities/infrastructure networks (incl sewerage pump station) • Temporary/permanent impacts to coastal reserve, access, facilities – carpark, toilet block, picnic facilities • Ecosystem impacts, including on freshwater systems • Public utilities/infrastructure networks
Inverloch Boat Ramp	• Erosion remains low provided protection structure maintained • Temporary/permanent access disruption (ramp, parking, roads) • Public utilities/infrastructure networks (incl sewerage pump station) • Ramp functionality/public safety in storm and high tide events
Inverloch Foreshore Dog Beach	• Public safety risk (falling, stability) of earthen erosion scarp. *Note that a rock bag seawall has been recently constructed at this location.* • Reduction/loss of amenity and recreation of dog beach • Reduction/loss of hazard buffer • Public utilities/infrastructure networks • Erosion impacts - coastal reserve and (low economic value) facilities • Temporary/permanent access disruption (roads) • By 2100, private property impacts (erosion - The Esplanade)
Inverloch Foreshore – Holiday Park to Screw Creek	• Temporary/permanent access disruption (roads) • Private property and asset - flooding impacts/damages. Includes Holiday Park cabins, some new development areas. • Loss of commercial viability of foreshore camping – increasing storm-tide flooding and eventually permanent inundation • Public utilities/infrastructure networks (incl sewerage PS)

Develop adaptive response to manage hazard risk
The localised context of values and hazard risk is then used to inform the exploration of possible adaptation options and actions.

Working with community and stakeholders, a list of possible adaptation options and actions for consideration will be developed. This process will consider how different actions and options align with local community values and adaptation action preferences (as understood from Stage 1 engagement activities (Attachment B)), and with guidance from VRC framework and MAC Policy.



Based on the Victoria's Resilient Coast Adaptation Actions Compendium (DELWP 2022), where adaptation actions are presented by functional type, the following tables bring together some preliminary ideas for possible adaptation options and actions for each sub-locality in Inverloch:

- Preliminary screening of adaptation options (Table 12)
- Preliminary screening of adaptation actions (Table 13)

Table 14 highlights where additional information may be required to help inform adaptation action development.

Table 12. Preliminary screening of adaptation options, by Inverloch sub-locality

Adaptation option	Inverloch sub localities					
	1 Flat Rocks to Wreck Creek (Bunurong Rd)	2 Inverloch Surf Beach (Bunurong Rd to Ozone St)	3 Inverloch Coastal reserve (Ayr Creek) – Inlet Entrance to the Glade	4 Inverloch Boat Ramp	5 Inverloch Foreshore Dog Beach	6 Inverloch Foreshore – Holiday Park to Screw Creek
1. Non intervention	X	X	X	X	X	X
2. Avoid	✓	✓	✓	✓	✓	✓
3. Nature-based methods	✓	✓	✓	✓	✓	✓
4. Accommodate	✓	✓	✓	✓	✓	✓
5. Retreat	✓	✓	✓	✓	✓	✓
6. Protect (major engineering works)	✓	✓	✓	✓	✓	✓

Table 13. Preliminary screening of adaptation actions, by Inverloch sub-locality

Applicable **Potentially applicable** **Not applicable**

Adaptation actions		Inverloch sub localities					
Functional Type	Action	1 Flat Rocks to Wreck Creek (Bunurong Rd)	2 Inverloch Surf Beach (Bunurong Rd to Ozone St)	3 Inverloch Coastal reserve (Ayr Creek) – Inlet Entrance to the Glade	4 Inverloch Boat Ramp	5 Inverloch Foreshore Dog Beach	6 Inverloch Foreshore – Holiday Park to Screw Creek
Land management, planning and design							
Land use	Land acquisition						
	Controlled Access						
	Planning Scheme Zone Amendment						
	Planning Overlay						
	Rolling easements						
	Relocation of infrastructure						
Resilient Design / Development	Development setbacks						
	Resilient design / materials						
Nature Based							
Coastal wetlands / blue carbon ecosystems	Kelp forests						
	Mangrove forests						
	Seagrass						
	Saltmarsh						
Dune ecosystems	Beach scraping / nourishment						
	Dune protection / vegetation						
	Use of on-site natural materials						
Hybrid actions	Shellfish reefs						
	Living seawalls						
	Sand fencing						
Engineering							
Beach nourishment	Beach scraping						
	Cart and place						
	Dredge and pump						
	Sand by-pass system						
Dredging	Management of channels / dynamics						
Seawalls	Geobag revetment / walls						
	Rock revetment						
	Vertical seawall						
Groynes	Rock						
	Geobag						
	Timber						
Breakwaters	Offshore						
	Nearshore						
Flood / tidal barriers	Levees / dykes						
	Tidal /surge barriers						
	Tidal gates						
	Saline groundwater intrusion barriers						
Drainage network	Pipes, valves (size, function)						

Table 14. Additional information to inform adaptation action development

Necessary | Potentially necessary | Not necessary | Not applicable

Adaptation actions		Coastal modelling	Economic modelling	Policy and process change	Data and monitoring	Approvals	Funding	Stakeholder and community engagement
Land management, planning and design								
Land use	Land acquisition							
	Controlled Access							
	Planning Scheme Zone Amendment							
	Planning Overlay							
	Rolling easements							
	Relocation of infrastructure							
Resilient Design / Development	Development setbacks							
	Resilient design / materials							
Nature Based								
Coastal wetlands / blue carbon ecosystems	Kelp forests							
	Mangrove forests							
	Seagrass							
	Saltmarsh							
Dune ecosystems	Beach scraping / nourishment							
	Dune protection / vegetation							
	Use of on-site natural materials							
Hybrid actions	Shellfish reefs							
	Living seawalls							
	Sand fencing							
Engineering								
Beach nourishment	Beach scraping							
	Cart and place							
	Dredge and pump							
	Sand by-pass system							
Dredging	Management of channels / dynamics							
Seawalls	Geobag revetment / walls							
	Rock revetment							
	Vertical seawall							
Groynes	Rock							
	Geobag							
	Timber							
Breakwaters	Offshore							
	Nearshore							
Flood / tidal barriers	Levees / dykes							
	Tidal /surge barriers							
	Tidal gates							
	Saline groundwater intrusion barriers							
Drainage network	Pipes, valves (size, function)							

Some additional assessment for adaptation actions has already been undertaken as part of Stage 1 Cape to Cape Resilience Project (Table 15).

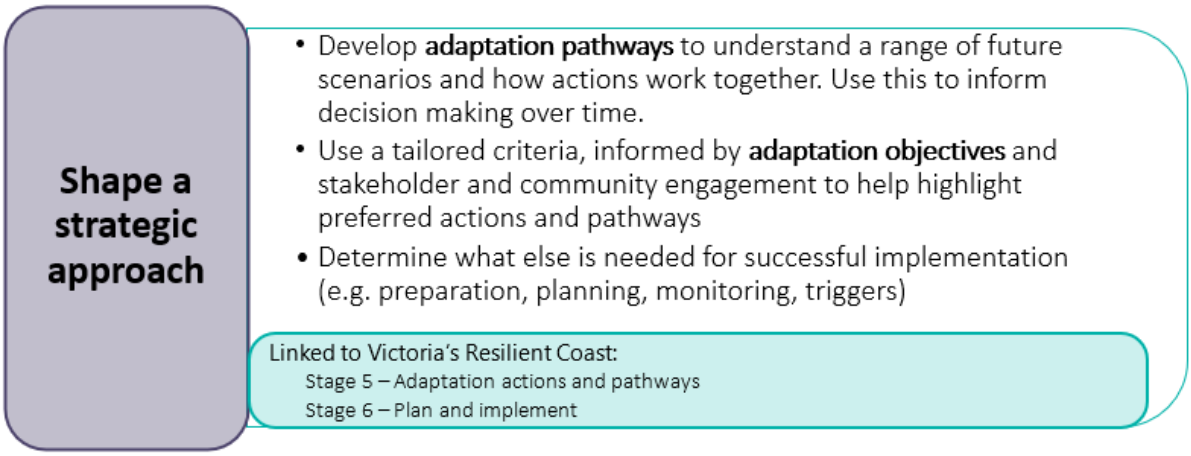
Table 15. Additional adaptation assessment in Stage 1

	Inverloch sub localities		
	1	2	
	Flat Rocks to Wreck Creek (Bunurong Rd)	Inverloch Surf Beach (Bunurong Rd to Ozone St)	Report reference
Coastal modelling and assessment			
• technical feasibility of a suite of coastal hazard adaptation actions for the Inverloch foreshore • focuses on engineering adaptation actions • uses preliminary modelling and multi criteria analysis to consider suitability of engineering actions at different locations	✓	✓	Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 7 - Adaptation Actions Technical Assessment, Victoria June 2022
Economic modelling			
• Cost benefit analysis (CBA) and threshold analysis for the suite of conceptual engineering adaptation actions developed and examined in Water Technology adaptation modelling and assessment • All actions have been assessed against the impacts of erosion as the primary focus, using erosion damages from economic base case. • Uses CBA results demonstrate economic case for the engineering adaptation action	✓	✓	Natural Capital Economics & Alluvium, 2022, Cape to Cape Resilience Project – Economics Assessment, June 2022.

These Stage 1 adaptation assessments have had a shorter-term focus on the recent hazard exposure along Inverloch's foreshore and areas identified as currently at-risk. Adaptation actions have predominantly focussed on actions for erosion mitigation, with design storms and modelling methods based on present day conditions for these areas.

Shape a strategic approach
This step is to be done in Stage 2 of the Cape to Cape Resilience Project.

This step will require close collaboration with RaSP stakeholders along with more detailed, targeted technical and strategic assessment. Community engagement will also be vital to successful planning and delivery.



Working with stakeholders, the list of possible adaptation actions and options will be reviewed and refined for individual sub-localities, using the changing risk profile to understanding possible timing and sequences of implementation and necessary preparation and action dependencies between actions.

Using action criteria (see section 3.1) proposed measures will be evaluated to understand their suitability for the Cape to Cape region. Increased understanding of feasibility from additional modelling, economics and other assessments should also be incorporated into decision making.

Adaptation pathways provide a means to visualise action sequencing, timing and understand their suitability in the longer term. Shortlisted actions will be incorporated into a pathway template and which can then be used as a tool to work through with stakeholders, to step through different options and actions, and convey and communicate implications and decision making.

Below is a preliminary adaptation pathways approach for sub-locality: *2-Inverloch Surf Beach (Bunurong Rd to Ozone St)* (Figure 6).

It includes:

- emerging risk profile by hazard type (out to 2100)
- the six strategic adaptation options in order as per the MAC Policy (2020)
- a range of possible adaptation actions for the locality
- consideration of different stages for each action – preparation, triggers, and implementation
- preliminary feasibility screening for over time
- highlighting where additional assessment may be necessary to determine feasibility

This preliminary pathway is intended for discussion purposes, listing some possible adaptation actions for consideration, presented in line with relevant strategic adaptation options. It does not yet include outcomes of more detailed assessment on feasibility, values alignment, integration of changing risk profiles for each hazard type, necessary triggers or linkages between different actions.

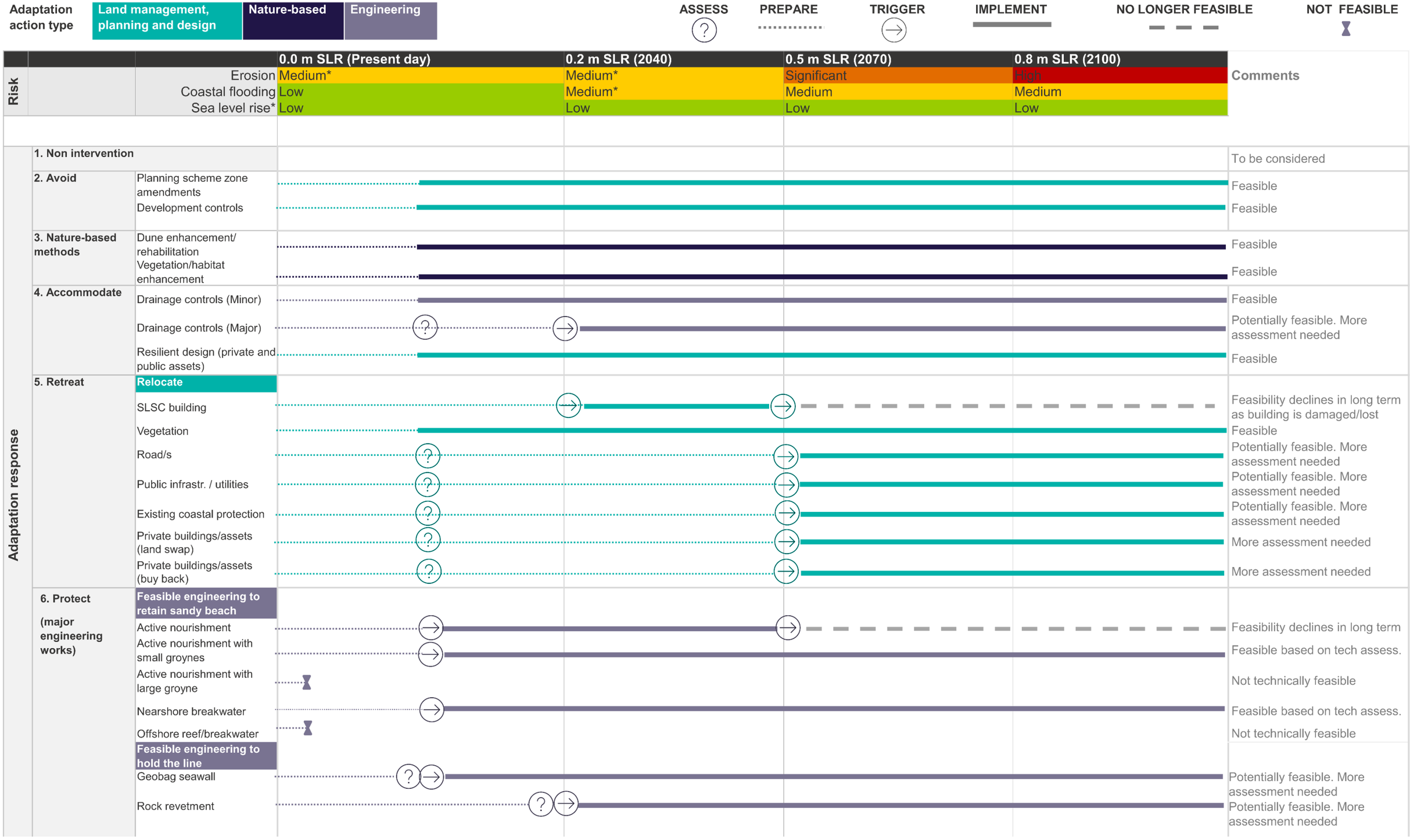


Figure 6 *Template for preliminary adaptation planning using a pathways approach. For sub-locality: 2-Inverloch Surf Beach (Bunurong Rd to Ozone St).*

**Note. This preliminary pathway template is intended for discussion purposes, listing some possible adaptation actions for consideration, presented in line with relevant strategic adaptation options. It doesn't include more detailed assessment on feasibility, performance, integration of changing risk profiles for each hazard type, necessary triggers or linkages between different actions.*

4 Next steps

The next stages of the Cape to Cape Resilience Project will explore and develop the strategic adaptation response, and associated adaptation actions, across the different sub-areas of Inverloch and the broader Cape to Cape region.

Guided by stakeholder and community engagement, adaptation planning will further utilise the outcomes of the coastal hazard assessment, the risk assessment and the economic base case with a range of more detailed assessments (coastal modelling and economic assessment) to shape longer-term adaptation pathways and the Coastal Resilience Plan for the region.

5 References

Alluvium 2021, Cape to Cape Resilience Project Community Values Study - Engagement Report - Values and Experiences, Victoria, October 2021.

Alluvium 2021, Cape to Cape Resilience Project Engagement Plan, Victoria, March 2021.

Alluvium 2022, Cape to Cape Resilience Project – Adaptation Framework Summary Paper, Victoria, June 2022.

Alluvium 2022, Cape to Cape Resilience Project - Asset and Values Risk and Vulnerability Assessment, May 2022.

Alluvium 2022, Cape to Cape Resilience Project - Adaptation Engagement Outcomes, Victoria, October 2021.

Bunurong Land Council Aboriginal Corporation 2021, BLCAC Cultural Values Assessment: Cape to Cape Project, Victoria, December 2021.

DELWP 2021, Inverloch Regional and Strategic Partnership Project Plan, Victoria, March 2021.

Inverloch RaSP Stage 2- TBC 2023

Inverloch RaSP Stage 2-& Partner Agencies TBC 2023 onwards

Inverloch RaSP TBC 2023 onwards

Natural Capital Economics & Alluvium, 2022, Cape to Cape Resilience Project – Economics Assessment, June 2022.

Rosengren, N. & Miner, T., 2021, Inverloch Region Coastal Hazard Assessment – Coastal Geomorphology, Appendix A in Water Technology 2022c, Inverloch Region Coastal Hazard Assessment Report 3: Technical Methodology, Victoria, 2021.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 1 - Project Summary Report, Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 2 - Data Assimilation and Gap Analysis, Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 3 - Technical Methodology , Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 4 - Coastal Processes and Erosion Hazards , Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 5 - Inundation Hazards, Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 6 - Coastal Hazard Asset Exposure Assessment, Victoria, June 2022.

Water Technology 2022, Inverloch Region Coastal Hazard Assessment - Report 7 – Adaptation Action Technical Assessment, Victoria June 2022

Attachment A – Factsheet: Adaptation Actions

Cape to Cape Resilience Project

Factsheet #7: Adaptation actions

This fact sheet provides a summary of some of the adaptation actions available to manage coastal hazard risk. It considers how each action works, the hazard risks they help manage and how they fit with Victoria's policy approach to adaptation.

> Further information about how we are strategically planning our coastal hazard adaptation in Victoria can be found in ***Factsheet #6 A strategic approach to adaptation***

There is a wide range of adaptation actions that can be used to assist with managing coastal hazard risk.

This document presents information on a range of adaptation actions. These actions have been classified under three main types, as shown in the table below.

Type	Adaptation action
Land management, planning and design Use policy, planning instruments, guidance materials, communication, capacity building and strategic processes to enact change.	**Land use** Planning scheme amendments, planning overlays, rolling easements, land acquisition, access control
	Resilient design / development Design standards, materials, setbacks
Nature-based Use the creation or restoration of coastal habitats for hazard risk reduction. This may be achieved through restoration of habitat alone ("soft" approach), or in combination with hard structures that support habitat establishment ("hybrid" approaches).	**Coastal wetlands / blue carbon ecosystems** Mangroves, seagrass, saltmarsh
	Dune ecosystems Dune protection / vegetation, beach nourishment*/scraping
	Hybrid actions Sand fencing, living shorelines
Engineering Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications. Includes both "hard" and "soft" engineering and can be used in conjunction with some nature-based methods.	**Beach nourishment*** Beach scraping, cart and place, dredging, sand bypassing
	Seawalls
	Groynes
	Breakwaters
	Flood / tidal barriers
	Drainage network Pipes, valves (size, functionality, network location, materials)
	Road network Network, material, drainage

**Beach nourishment is only considered nature-based if design includes focus on habitat creation. Otherwise, it is engineering.*

The following tables in this document have been framed around the three types of actions - land management, planning and design, nature-based and engineering.

For each adaptation action, these tables outline:

- Adaptation action description
- Coastal hazard risk managed by this action
- Considerations (Pros / Cons)
- Where it fits with the MAC Policy

Adaptation options are different strategic approaches to managing coastal hazard risk, and in Victoria are considered in the order of non-intervention, avoid, nature-based, accommodate, retreat and protect.

Adaptation actions are the range of tools, decisions and works that can be implemented to create adaptation pathways aligned to the strategic options.

Adaptation action description

A high-level description has been provided for each action, outlining how it acts to reduce hazard risk along with some examples of different designs and types, and possible materials.

Coastal hazard risk managed by this action

Some actions can help to reduce both erosion and inundation risks, while others are intended to manage just erosion or just coastal flooding. The type of hazard risk that each action can influence has been considered, and looks at the following hazard types:

- Short term erosion
- Long term erosion
- Storm tide inundation
- Permanent inundation
- Estuary dynamics
- Saline intrusion

Considerations (Pros / Cons)

While adaptation actions might work well to reduce coastal hazard risk, there are many other things that also need to be considered when choosing the most suitable actions at an at-risk location.

We have highlighted some of the pros and cons of different actions. This includes consideration of some other impacts the action may have at or away from the sites, challenges or complexities associated with its implementation, and opportunities and additional benefits the action may provide.

Where it fits with Marine and Coastal Policy

As we plan how we manage (mitigate) coastal hazard risk and suitability of different actions, the Marine and Coastal Policy requires us to take a strategic approach.

There are six **adaptation options** (different strategic approaches) to consider when developing an adaptation planning. Each adaptation option must be considered in the policy-defined order when planning a suitable adaptation response.

We have shown where each adaptation action fits within these adaptation options

Example - where this action fits with both Avoid and Accommodate strategies

MAC Policy approach	
1. Non intervention	
2. Avoid	✓
3. Nature-based methods	
4. Accommodate	✓
5. Retreat	
6. Protect (major engineering works)	

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Accessibility

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Land management, planning and design

Use policy, planning instruments, guidance materials, communication, capacity building and strategic processes to enact change.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Land use Uses a range of planning and development mechanisms, controls and tools informed by understanding of coastal hazard risk to guide and control current and future development. Aims to limit inappropriate use and development and transitioning existing at-risk areas.  	**Planning scheme amendments** Planning schemes identify various policies and provisions that guide land use and development. Guiding the measures that control how land can be used (i.e. setbacks, overlays, zones), integrating up-to-date understanding of coastal hazards into planning schemes will assist in mitigating risk. **Planning overlays** Used to identify land that has special protection / requires permits, including potential issues needing management like erosion or flooding risks. They establish additional requirements and considerations for development within the overlay area. **Rolling easements** Reduce coastal hazards risk to people and assets over time by changing the way the land covered by the easement can be used. **Land acquisition** Involves transferring land at unacceptable risk from coastal hazards from private ownership to public ownership. Can use individual or combinations of mechanisms, such as land buy-backs (voluntary or compulsory), land swaps or land lease-backs. **Relocating infrastructure** Planned landward migration of assets on public land that are in coastal hazard areas to reduce their exposure to coastal hazards. **Access control** Implementing restrictions on the volume, timing, or mode of access to sensitive or hazardous area.	• Short term erosion • Long term erosion • Storm tide inundation • Permanent inundation • Estuary dynamics • Saline intrusion	**Pros** • Ensures decisions made on future development are informed • Proactive management for future conditions to avoid and limit future costs • Can provide a clear, robust process and guidance to inform decision making, important for communication and compliance • Prompts consideration of longer term now, providing for pre-planning and preparation **Cons** • Can have potential impacts on individuals (home/asset owners) • Potential for mechanisms/tools and decisions they inform to be challenged or disputed if seen as unfavourable • Approvals requirements for land acquisition or swap schemes are complex, lengthy and costly (i.e. require planning scheme amendments such as for compulsory acquisition) • Potential legal implications and costs	MAC Policy approach 1. Non intervention 2. Avoid ✓ 3. Nature-based methods 4. Accommodate ✓ 5. Retreat 6. Protect (major engineering works)

Land management, planning and design

Use policy, planning instruments, guidance materials, communication, capacity building and strategic processes to enact change.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Resilient design / development Using smart and informed design and siting (placement) for development in the coastal zone, that considers and accounts for marine and coastal surrounds and dynamic conditions. 	**Design standards, materials** Standards to guide appropriate and resilient design for development in marine and coastal environments. Guidance to support adaptable design for changing conditions (raising floors, movable structures) and accounts for impacts of surrounding environment on materials, longevity and maintenance. **Setbacks** Used to create designated areas to limit development, providing space for shoreline to move over time, including further landward under the influence of coastal processes and sea level rise (i.e. set house/structures back a certain distance from the coast).	• Short term erosion • Long term erosion • Storm tide inundation • Permanent inundation • Estuary dynamics • Saline intrusion	**Pros** • Proactive design for future conditions to avoid and limit future costs (i.e. damages, maintenance) **Cons** • Costs associate with resilient design • Can have potential impacts on individuals (home/asset owners) • Potential for design requirements to be challenged if seen as unfavourable	MAC Policy approach 1. Non intervention 2. Avoid ✓ 3. Nature-based methods 4. Accommodate ✓ 5. Retreat 6. Protect (major engineering works)

Nature-based

Use the creation or restoration of coastal habitats for hazard risk reduction.

This may be achieved through restoration of habitat alone ("soft" approach), or in combination with hard structures that support habitat establishment ("hybrid" approaches).

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Coastal wetlands / blue carbon ecosystems Resilience via natural systems, stabilising shorelines, absorbing wave energy, slowing and limiting flooding, providing nearshore buffers. These "blue-carbon" ecosystems also absorb carbon from the atmosphere. 	Natural systems can play an important role in providing natural resilience for coastal areas. Mangroves, seagrass, saltmarsh communities and kelp forests can each limit impacts of coastal hazards. Coastal wetland systems and estuaries support these communities and can also act as a physical natural buffer between more built up and developed.	• Short term erosion • Long term erosion • Storm tide inundation • Estuary dynamics	**Pros** • Ecosystem benefits • Natural amenity – look and feel • Can be used to create and enhance habitat • Increases buffer between the sea and more built-up/developed areas from storms and wave attack **Cons** • Establishment takes time • Can be severely impacted in extreme events • Uncertainty around performance and response of these ecosystems, especially under climate change • Requires space set aside to enable landward migration	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods ✓ 4. Accommodate 5. Retreat 6. Protect * (major engineering works) *Methods may use hybrid approaches with structures and engineering
Dune ecosystems Protecting, building, and maintaining healthy dune habitats which trap sand and act as a buffer against short-term storm erosion. 	Dune management is a nature-based measure that aims to mitigate impacts of coastal hazards. This can be achieved through a combination of vegetation management and access control. Beach nourishment and sand scraping can also be used to add/redistribute sand in the dune system.	• Short term erosion • Storm tide inundation	**Pros** • Ecosystem benefits • Natural amenity – look and feel • Can be used to create and enhance habitat • Increases dune buffer from storms and wave attack **Cons** • Establishment takes time • Can be severely impacted in extreme events • Relies upon sediment supply in the system • Can impact where people can/can't go and how people interact with their coast	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods ✓ 4. Accommodate 5. Retreat 6. Protect * (major engineering works) *Methods may use hybrid approaches with structures and engineering

Nature-based

Use the creation or restoration of coastal habitats for hazard risk reduction.

This may be achieved through restoration of habitat alone ("soft" approach), or in combination with hard structures that support habitat establishment ("hybrid" approaches).

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Hybrid actions Combinations of natural and engineered solutions ("hybrid" approaches) to help support ecosystems, such habitat establishment and enhancement. 	Complementing features and structures that aid the establishment and performance of nature-based solutions. Engineered support can vary. Examples include creating surfaces/foundations and conditions for aquatic and marine growth, sheltering to reducing wave action and water level impacts, as well as physical structural support allowing ecological communities and systems time to grow and establish. Living shorelines, artificial reefs and sand fencing are examples of hybrid actions.	• Short term erosion • Long term erosion • Storm tide inundation • Estuary dynamics • Offshore sediment dynamics	**Pros** • Ecosystem benefits • Some natural amenity – look and feel • Can be used to create and enhance habitat **Cons** • Establishment takes time • Cost and local and off-site impacts of larger scale hard structures • Uncertainty around performance and response of these ecosystems, especially under climate change scenarios	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods ✓ 4. Accommodate 5. Retreat 6. Protect (major engineering works) * *Methods may use hybrid approaches with structures and engineering

Engineering

Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications.

Includes both "hard" and "soft" engineering and can be used in conjunction with some nature-based methods.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Beach nourishment Artificially moving sand onto the beach. 	**Beach scraping** Moving sand from lower beach to upper beach areas. **Cart and place, dredge and pump** Relocating or importing sand. **Sand bypass** Pumping sand around a natural or constructed obstacle to restore or enhance natural sediment flow.	• Short term erosion • Long term erosion • Accretion • Estuary dynamics • Offshore sediment dynamics	**Pros** • Increases beach width and the sand available as a buffer for storms and wave attack • Natural amenity – sandy look and feel • Can be used to create and enhance habitat **Cons** • Expensive, temporary	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat 6. Protect ✓ (major engineering works)

Engineering

Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications.
Includes both “hard” and “soft” engineering and can be used in conjunction with some nature-based methods.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Dredging Removal of sediment to manage offshore channels and hydrodynamics. 	**Mechanical dredgers** Use machinery (excavators) to move and place sand. Examples include bucket, bucket ladder, grab, backhoe dredgers. **Hydraulic dredgers** Moves sand in a liquid form, pumping dredged material from/to locations. Examples include suction dredgers, trailing suction hopper, water injection dredgers.	• Estuary dynamics • Offshore sediment dynamics	**Pros** • Dredged material can be used for beach nourishment. • Can improve channels navigability and alignment **Cons** • Impacts water quality - increases turbidity • Destructive to benthic habitats • Sediment-bound pollutant transport/spread • Complex to confidently model and design • Expensive • May require regular program to maintain alignment	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat 6. Protect (major engineering works) ✓
Seawalls Structures built along shores to stabilise shoreline and protect land behind either by absorbing or reflecting wave energy . 	**Revetment walls** Multi-layered, sloped structures that absorb wave energy. Generally made of rock armour or sand filled geo-fabric bags and designed to have some voids between units. **Vertical seawall** Vertical or near vertical walls, with a solid and impervious design that reflect waves. Generally use materials such as rock, concrete, masonry, timber, iron sheet piling.	• Short term erosion • Long term erosion • Storm tide inundation • Permanent inundation • Estuary dynamics	**Pros** • Long-lasting (if rock, concrete etc.) • Effective protection of assets **Cons** • Expensive • Requires ongoing maintenance and upgrade • Can impact natural coastal processes structures modify/restrict dune and sand dynamics • Can increase erosion at the end of structure • Can lead to narrow / no beach in front of structure.	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat 6. Protect (major engineering works) ✓
Groynes Structures built perpendicular the shore to trap sand that moves along the shore.	Structure/s help to trap sand, resulting in sand build up and increasing beach width on the updrift side. Groyne can be built as a single structure, or as a “groyne field” with multiple groynes at regular spacing. Generally use materials such as geo-fabric bags, rocks or timber.	• Short term erosion • Long term erosion • Estuary dynamics	**Pros** • Can increase beach width updrift • Can be used to stabilise river and creek entrances (training walls) **Cons** • Expensive	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat

Engineering

Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications.
Includes both “hard” and “soft” engineering and can be used in conjunction with some nature-based methods.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
			• Can starve downdrift shoreline of sediment supply leading to recession • Significant impact on visual amenity	6. Protect (major engineering works) ✓
Breakwaters Structures built in or on the water which intercept waves and reduce wave energy reaching the shoreline, aiding sand build-up. 	Aimed at reducing wave energy and limiting waves, breakwater designs and features include: • “attached” to the shore, or “detached” (offshore) • protruding above the water (“emergent”), or sitting below water surface (“submerged “) • made of various materials - rock, concrete or synthetics (incl. geo-fabric bags, polymer units) • fixed/rigid or floating structures	• Short term erosion • Long term erosion • Storm tide inundation	**Pros** • Near/offshore position limits structure footprint on beach • Long-lasting • Effective protection of assets • Opportunities for habitat creation and ecosystem enhancement (e.g. artificial reefs) **Cons** • Expensive • Complex to confidently model and design • Can result in scouring at and around structures • Can significantly alter natural coastal processes, especially sediment transport • Often bigger and more expensive than onshore structure as need to cope with bigger waves and deeper water conditions • Complex to build structure in offshore environment	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat 6. Protect (major engineering works) ✓

Engineering

Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications.
Includes both “hard” and “soft” engineering and can be used in conjunction with some nature-based methods.

Action	Description	What hazards can it help to manage?	Considerations (pros/cons)	Where it fits with MAC Policy
Flood / tidal barriers Structures used to protect low-lying coastal land from inundation by preventing water from flooding a specific area. 	Structures that prevent land from being inundated from flood events. Includes: Elevated mounds or walls, such as **levees** or **dykes**. Generally made from earth, rock, concrete, geo-fabric bags or other materials. Levees aim to prevent low-lying land from being inundated in flood events, while dykes can prevent areas becoming permanently inundated (regular inundation due to tides). **Storm surge barriers** are physical barriers that prevent storm surges travelling inland along rivers, lagoons, inlets or other waterways.	• Storm tide inundation • Permanent inundation • Saline intrusion	**Pros** • Effective protection of assets **Cons** • Can be expensive, especially region wide earth works or large physical barriers • Designs needs to be suitable to the hazard type i.e.– short-term and long-term flooding require different approaches. • Potential for structure to fail in an event (if condition not maintained).	MAC Policy approach 1. Non intervention 2. Avoid 3. Nature-based methods 4. Accommodate 5. Retreat 6. Protect (major engineering works) ✓
Infrastructure networks Modifications and upgrades to the infrastructure (including reconfiguration, relocation and resilient design) to ensure functionality, capacity and performance of the network/s into the future, with projected coastal hazard risk. 	Infrastructure network changes could include: **Drainage network-** pipe sizing, material types, network configurations, and location, siting of critical network assets, altering network gradients, outlet design to limit sea water backflows, protection and armouring. **Road network-** road surface, material types, network configurations, moving roads, providing alternate traffic corridors, improved drainage, protection and armouring.	• Short term erosion • Long term erosion • Storm tide inundation • Permanent inundation • Saline intrusion	**Pros** • Forward planning for networks may help maximise existing infrastructure and expected design life • Proactive design for future conditions to avoid and limit future costs (i.e. damages, maintenance) • Effective protection of assets **Cons** • Can be expensive to retrofit and modify existing network • Complexity in relation to networks where siting and proximity of infrastructure to coastal areas is linked to network functionality (i.e. drainage outlets) • Moving roads requires long term strategic planning significant funding	MAC Policy approach 1. Non intervention 2. Avoid ✓ 3. Nature-based methods 4. Accommodate ✓ 5. Retreat ✓ 6. Protect (major engineering works) ✓

Attachment B – Adaptation engagement summary

Cape to Cape Resilience Project

Community engagement: Adaptation actions

Community engagement: Adaptation actions

From late March to late April this year, we asked people who live in or visit Inverloch, Venus Bay and nearby communities to share their feedback on coastal hazards, coastal management and adaptation ideas. This update provides an overview of the online engagement outcomes from EngageVic.

What were we asking?

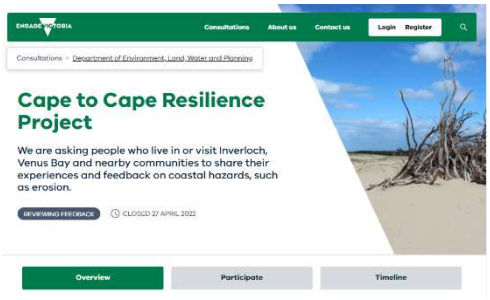
To help inform the discussion on ways to adapt to and manage coastal hazards in the future, the survey explored a range of questions relating to possible coastal adaptation actions for the Cape to Cape region.

We asked people to:

- Share their preferences between different adaptation actions used in coastal management
- Contribute ideas to build resilience, adapt to change and help retain what they value into the future

People were also given the opportunity to view the coastal hazard map both online, and in person at our pop-up sessions, to see where actions may be needed.

We've heard a range of perspectives from many people and we thank everyone who contributed through the survey.



Coastal hazard adaptations actions survey

Please take our 15-minute survey to provide us with your perspectives on:

- Coastal hazard adaptation actions
- Your experiences or observations of coastal adaptation
- Your thoughts on adaptation for Inverloch and the Cape to Cape region

Your responses will help inform the discussion on ways to adapt to and manage coastal hazards in the future.

Who did we hear from?

We had a total of 658 visitors to the website and 65 surveys completed.

What we heard

Findings from the survey have been summarised under the following themes:

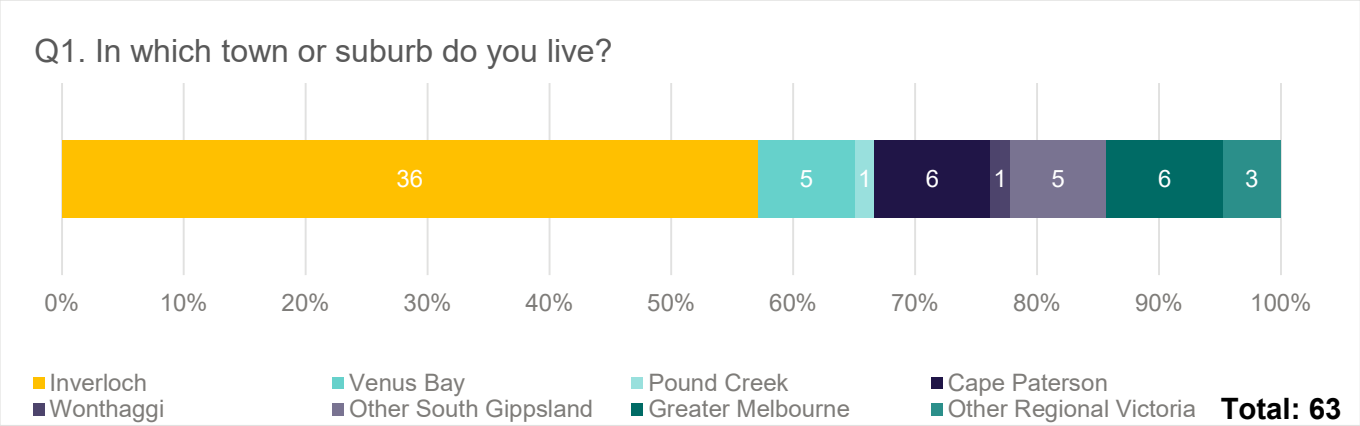
- **Demographics**
- **Coastal hazard impacts**
- **Role of the individual in adaptation**
- **Adaptation actions**

The next pages describe some of the themes for feedback under these groups.

Demographics

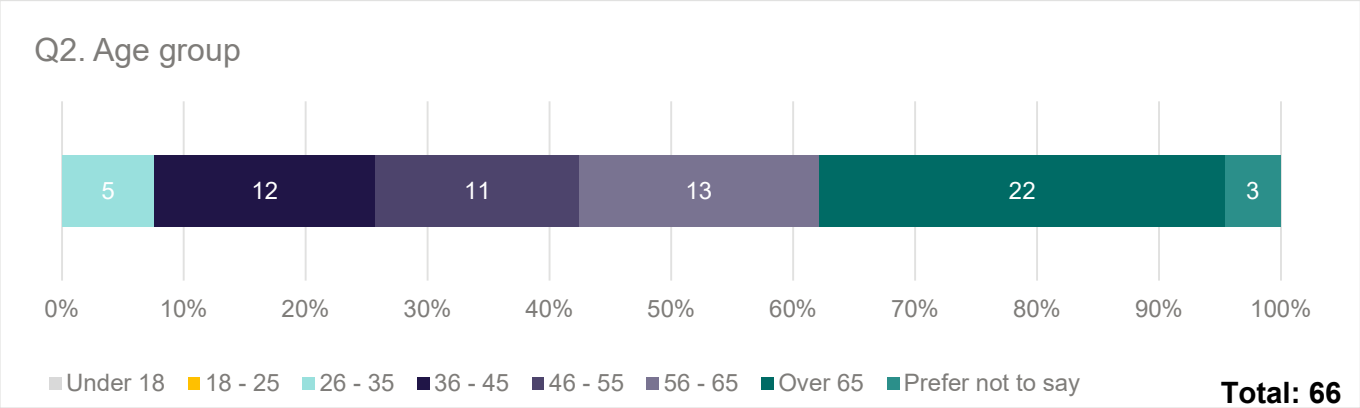
Most respondents were from Inverloch or the Cape to Cape Region

Over three quarters of respondents were from the Cape to Cape area. Some also had holiday homes in the area, while they lived permanently elsewhere.



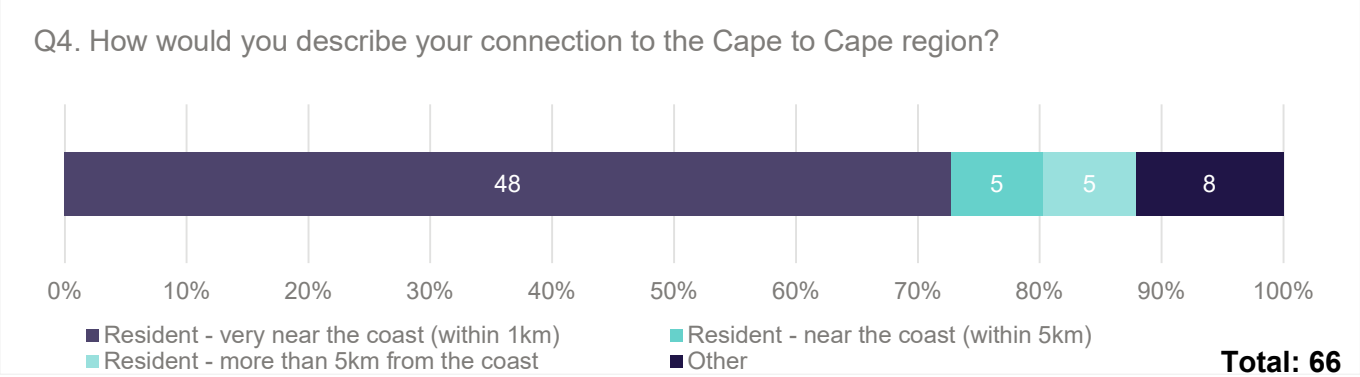
Respondents were generally older community members

Over half of respondents were over 55, with no representation of people under 25. There were also no respondents who identify as either Aboriginal or Torres Strait Islander



Most respondents live very near the coast

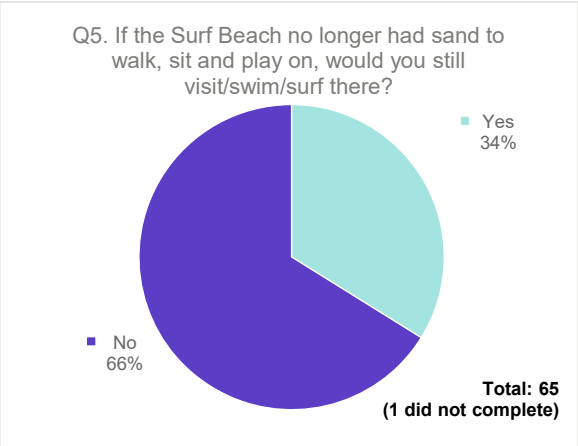
Nearly three quarters of respondents live within 1km of the coast.

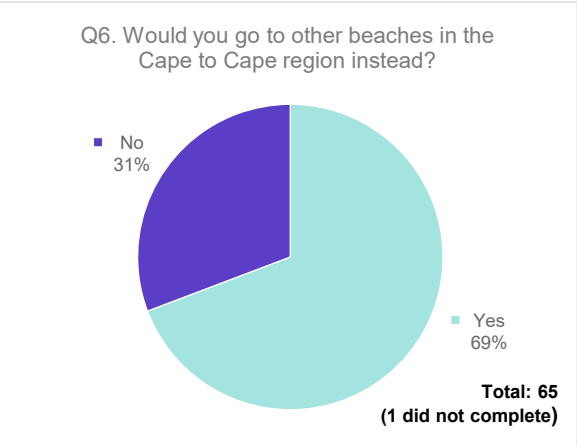


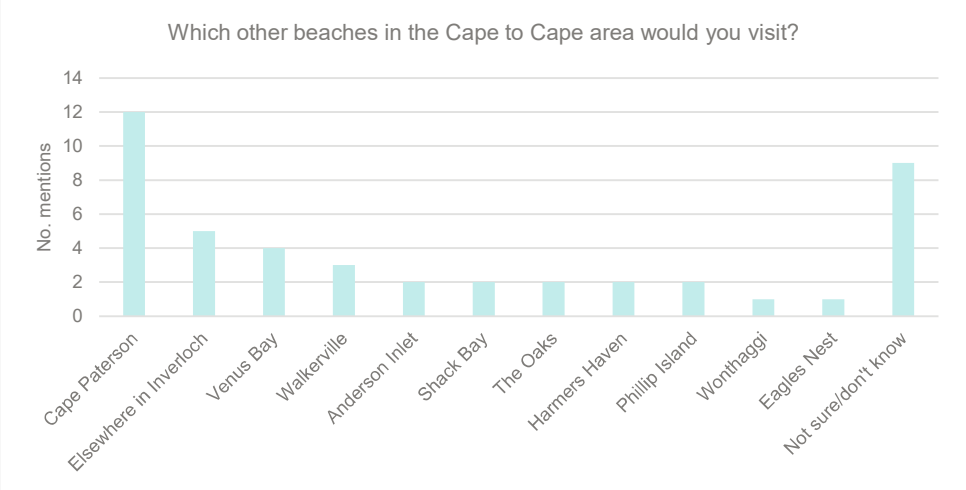
Coastal hazard impacts

Most people said that if the surf beach no longer had sand, they wouldn't visit, but would visit other beaches nearby

Two thirds of people said that if the surf beach no longer had sand, they wouldn't visit. However, two thirds also said they would visit another beach in the Cape to Cape region. The most popular alternative beaches were Cape Paterson, Venus Bay or elsewhere along the Inverloch foreshore. Some people said they weren't sure and they'd go to wherever had a sandy beach at the time.

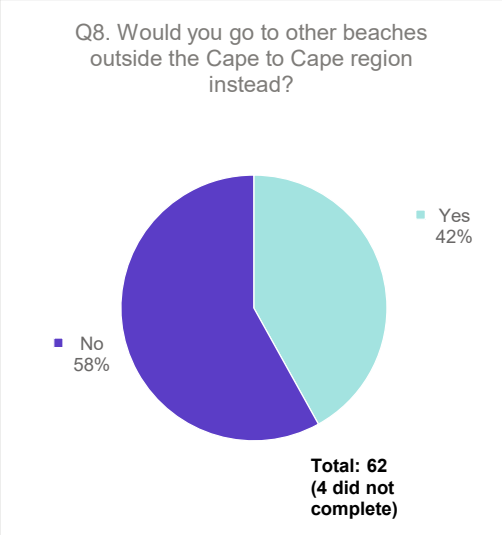


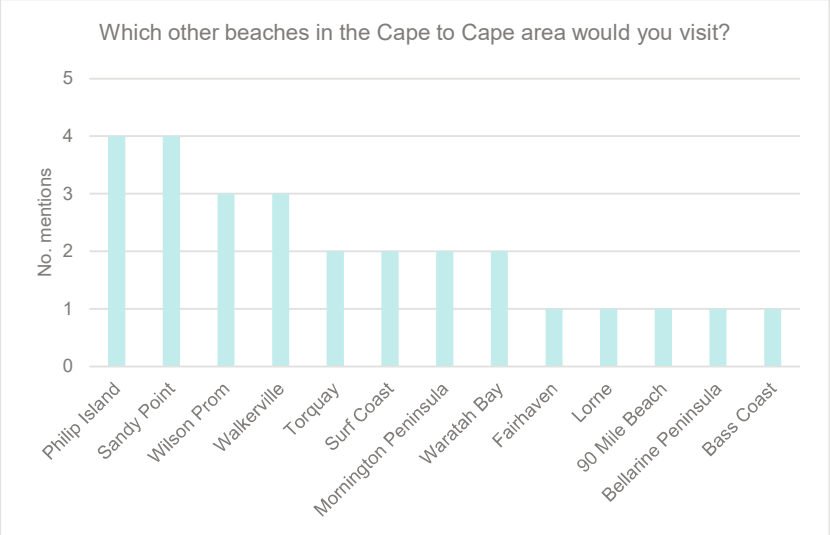




Of those that said they would go to beaches outside the Cape to Cape region, most people would still go to the South Gippsland region

Other popular beaches that people would go to outside the Cape to Cape region included Phillip Island, Sandy Point, Wilsons Prom and Walkerville.

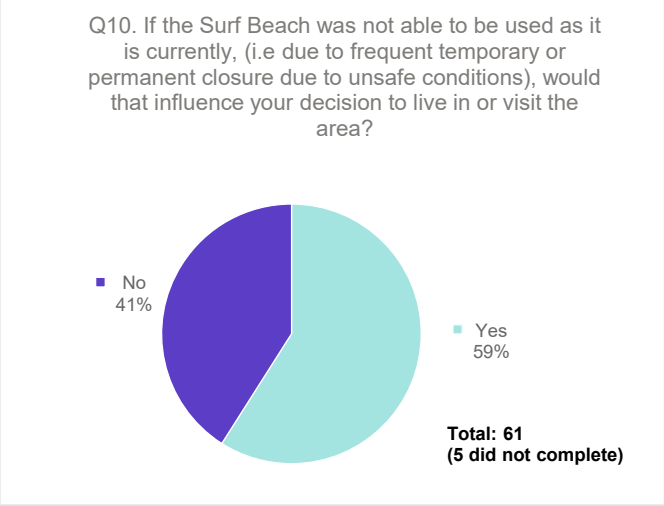


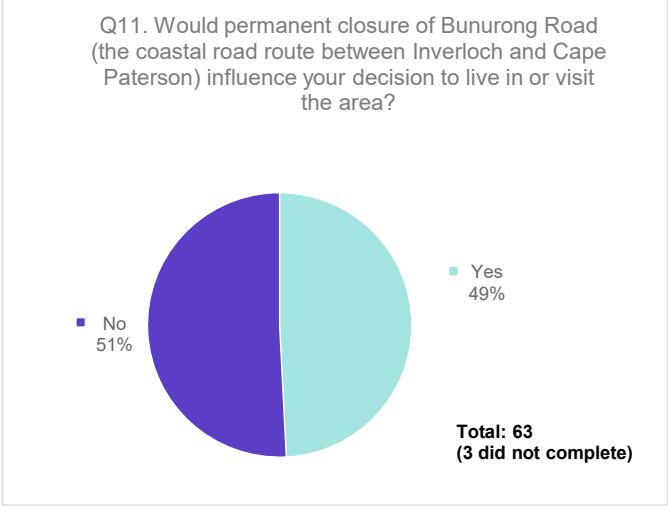


The availability of the surf beach and access through Bunurong Road influences people's decision to visit or live in the area

Nearly 60% of people said that if the Surf Beach was not able to be used it would influence their decision to live in or visit the area.

Around half of people said permanent closure of Bunurong Road would influence their decision to live in or visit the area.



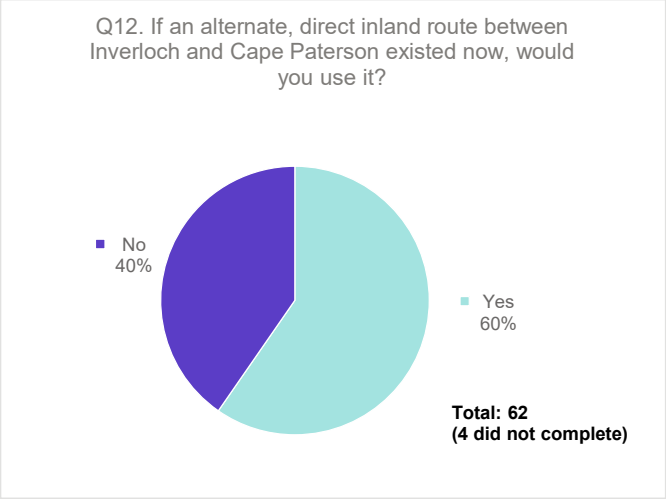


Most people are happy to utilise an inland route between Inverloch and Cape Paterson

60% of people said they would use an alternative direct inland route between Inverloch and Cape Paterson if one existed now. The main reasons for this preference were the time it would save and provision for a safer route, particularly for cyclists. Some people also noted that an inland route would probably have less impact on the sensitive coastal environments.

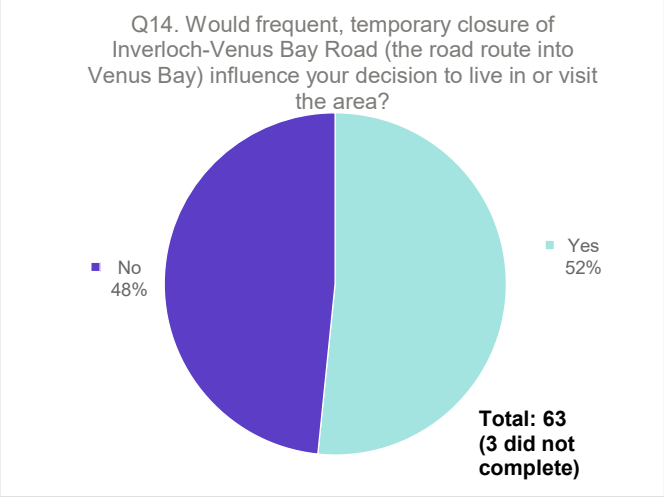
Of the 40% of people who said they wouldn't use the road, most of the reasons given were because they enjoyed the views, vistas and coastal experience of the coastal road. Some also access the beaches and coastal attractions along the road, such as Eagles Nest, some citing access to properties as well.

Some people conceded that whilst they enjoy the coastal road at the moment, they may consider using an alternative route in the future if the current road was no longer viable.



People were split on whether temporary closure of Inverloch Venus-Bay Road would influence their decision to live in or visit the area

People were split around 50:50 on whether a temporary closure of the road would influence their decision to live in or visit the area.

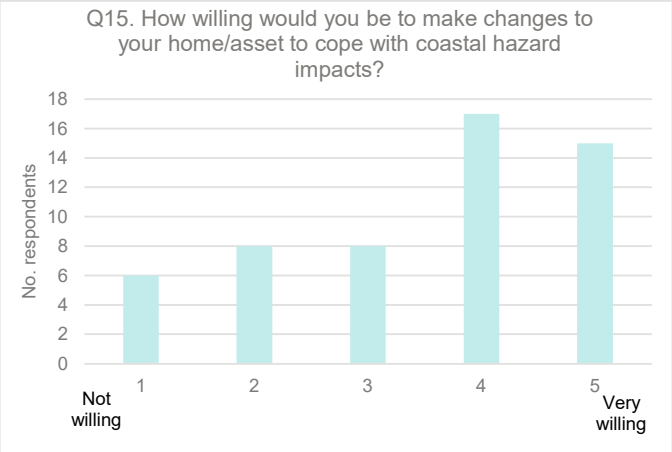


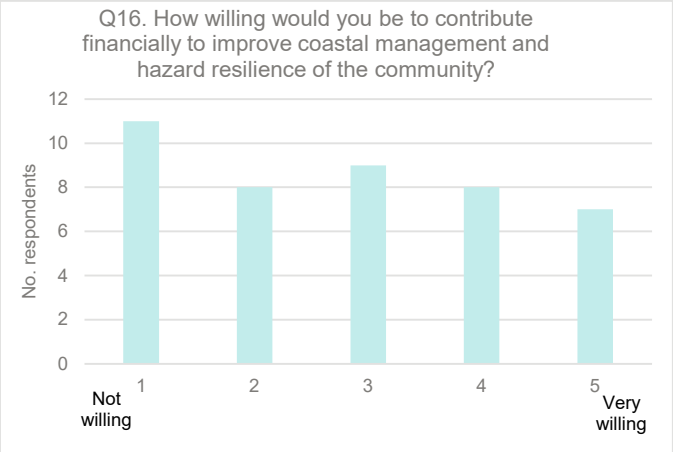
Role of the individual in adaptation

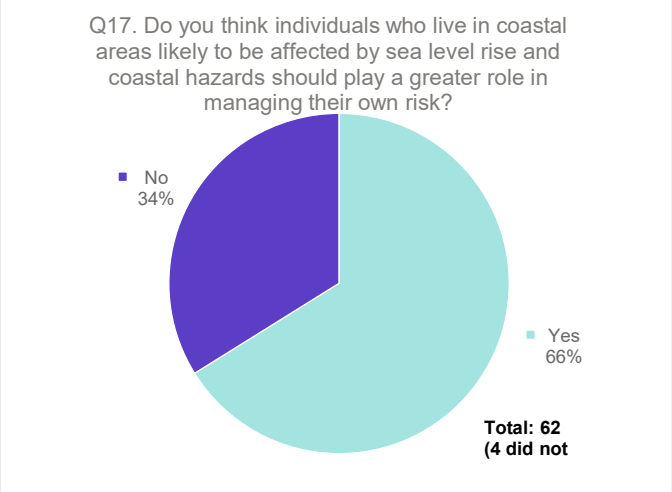
People were generally willing to make changes to their own home/asset to cope with coastal hazards, but were split on whether they'd be willing to financially contribute to improve coastal management and hazard resilience for the rest of the community

Nearly 60% of people said they were willing or very willing to make changes to their home/asset to cope with coastal hazard impacts. However, when it came to contributing financially to improve coastal management and hazard resilience of the community, people were split, with a quarter not willing to contribute.

Similarly, two thirds of people believe that individuals who live in coastal areas likely to be affected by sea level rise and coastal hazards should play a greater role in managing their own risk.







Many respondents are personally taking action on climate change in a range of ways

There are numerous ways in which the community is taking action on climate change, some of the responses included:

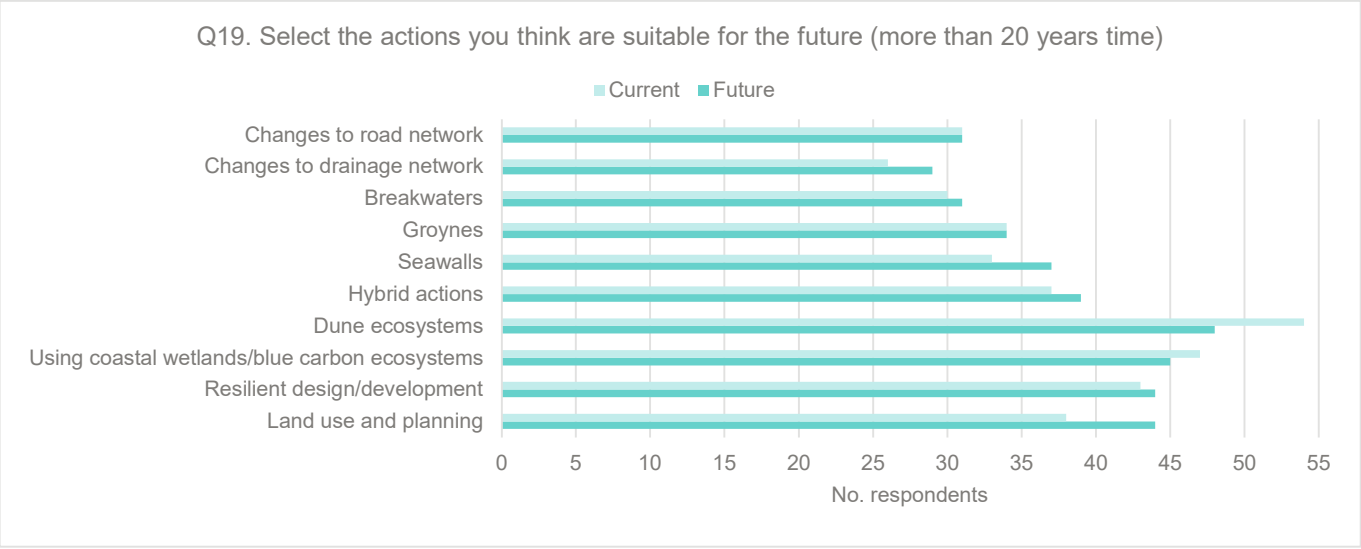
- Solar power and hot water
- Power and water saving devices (light bulbs, shower heads, etc.)
- Energy saving home upgrades – double glazing, insulation etc.
- Waste and energy saving – recycling, responsible car use, etc.
- Electric vehicles

Adaptation actions

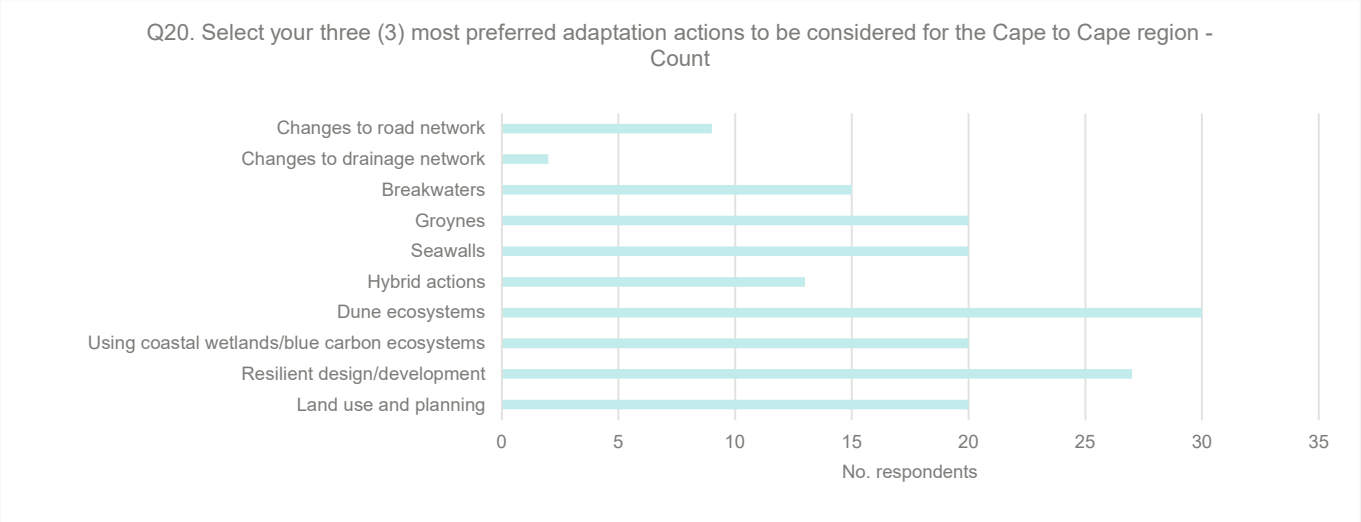
Dune protection and beach nourishment were seen as the most suitable actions for the region both now and into the future

Dune protection and beach nourishment were seen as suitable, although perhaps becoming less suitable into the future. When thinking into the future (>20 years) land use planning was seen to be more important; given early land use planning can help us avoid coastal hazard risk in the future, opportunities to implement better planning earlier (at present) could prove to be advantageous.

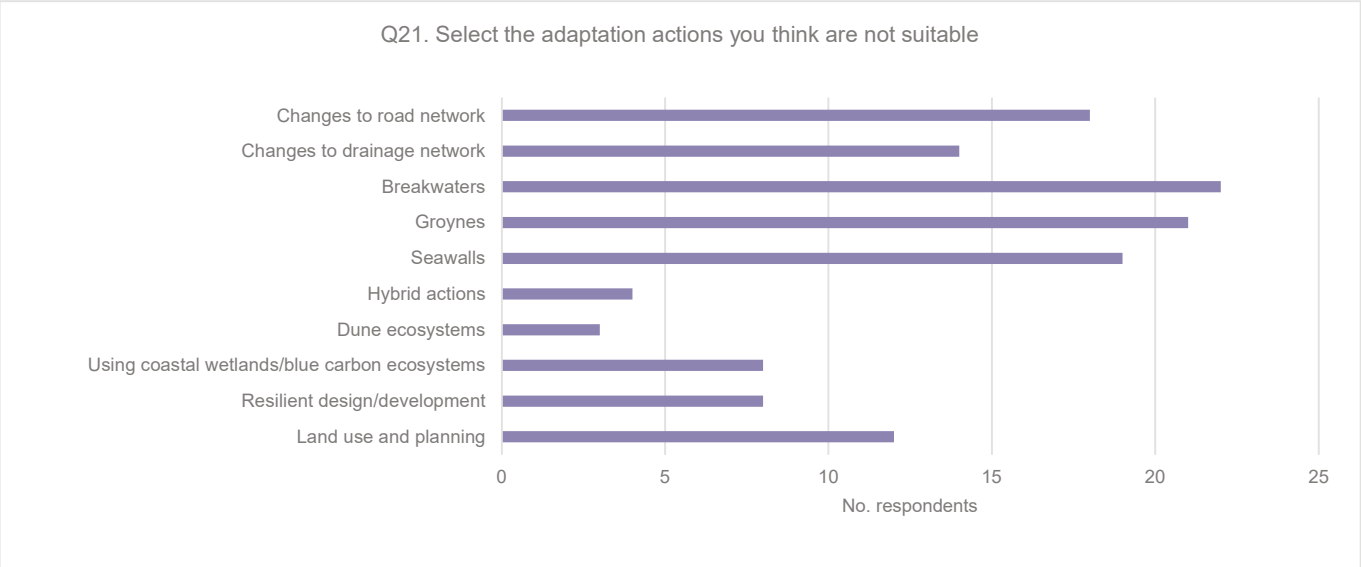
While dune ecosystems and using coastal wetlands / blue carbon ecosystems were largely preferred, the community is split on the most suitable adaptation options.

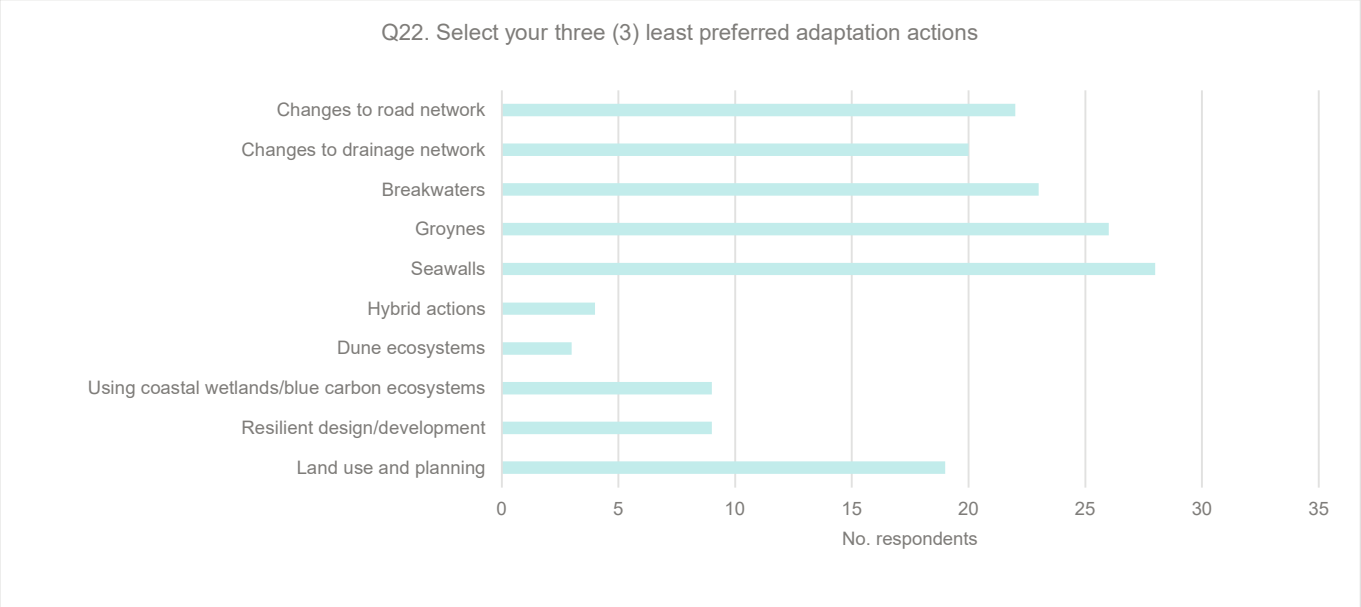


When asked to select their **most preferred option**, respondents had preference for Dune ecosystems and resilient design/development.



Many people felt that engineered solutions such as breakwaters, groynes and seawalls were not suitable or were generally least preferred.



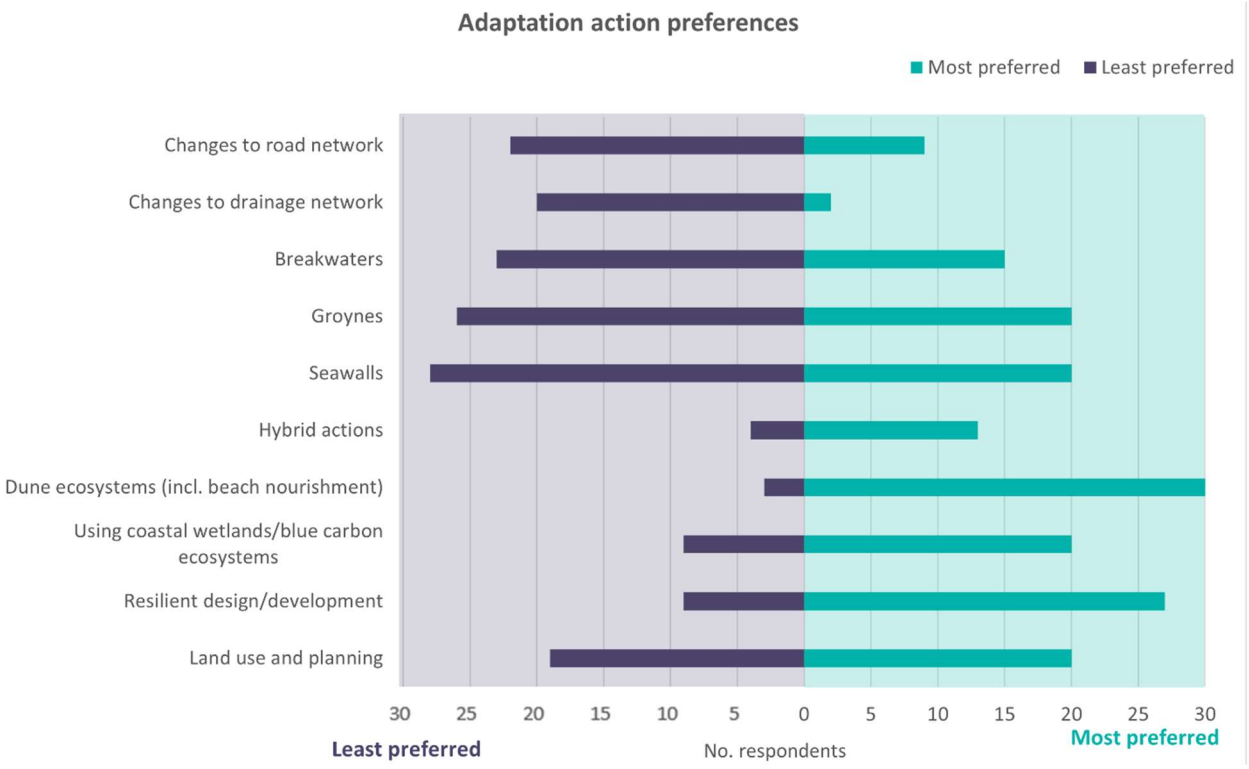


When asked to comment on other ideas for other adaptation actions, topics raised:

- suggested land buy back
- considered that multiple actions will probably need to be implemented
- looked to options that provide multiple benefits such as potential ability to harness wind and/or wave energy
- considered the cost of options and suggested levees or fees for the community to contribute.

Adaptation action preferences are divided

Combining people's most preferred and least preferred adaptation actions, showed that responses were divided, with support and opposition for all action types.



Most support for hard infrastructure such as groynes, breakwaters and seawalls came from local respondents from Inverloch, whereas people from other locations said these were their least preferred options.

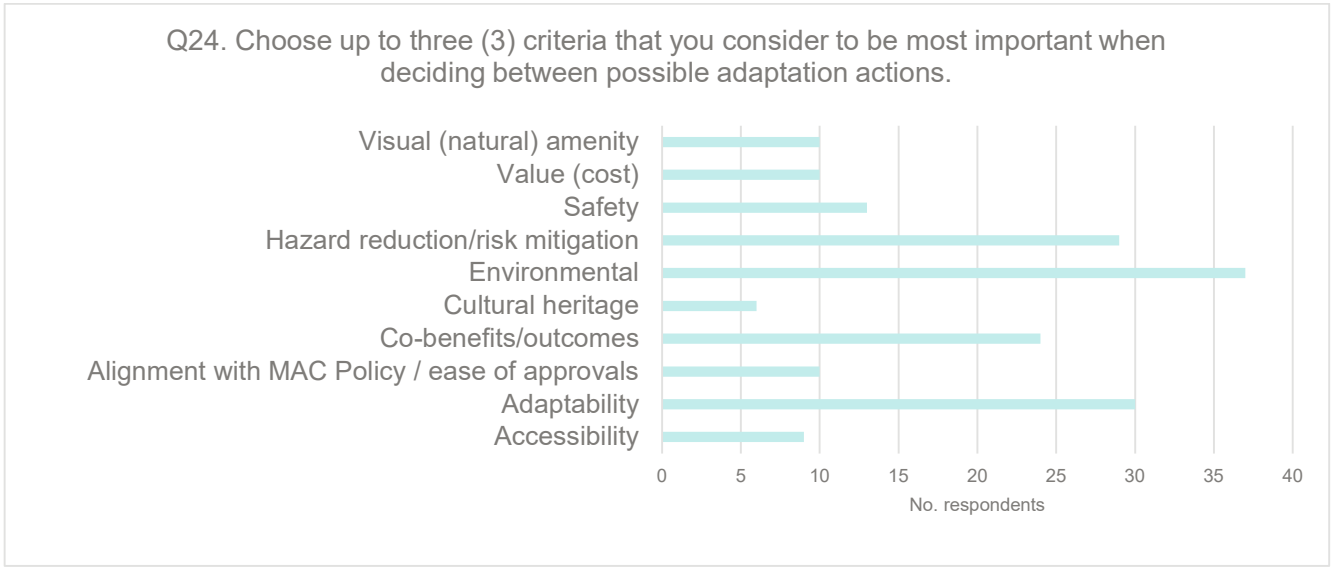
Respondents were given the opportunity to expand on their reasons driving their preferences on adaptation actions

Open-ended responses from respondents provided further context relating to the individual adaptation action preferences. This highlighted some of the positive considerations as well as some of the concerns with different adaptation actions. A summary of these responses is shown in the table on the next page.

Functional type	Adaptation actions	Positive considerations	Concerns
Land management, planning and design Use policy, planning instruments, guidance materials, communication, capacity building and strategic processes to enact change.	**Land use** Access control, planning overlays, planning scheme amendments, rolling easements, land acquisition	• Land use on dune systems needs to be relevant to the sea. • Land buy back is inevitable, we can't afford to attempt to fight the sea • It's the only real long term solution and saves money in the future. Educate people now about likely future changes. • If we plan now, there will be fewer problems in the future (minimised exposure) • The area is overdeveloped which is starting to impact us now, we need to plan for the future. • Helps with public education of risks	• Want to protect the investment made by existing landholders • Property owners should not be penalised for buying a property previously approved. • Purchasers buy land based on planning controls at the time, which set long-term expectations of what the land can be used for
	Resilient design / development Design standards, materials, setbacks	• May be necessity in response to emergencies • Some land should never have been developed, so upgrades/relocation over time is needed	
Nature-based Use the creation or restoration of coastal habitats for hazard risk reduction. This may be achieved through restoration of habitat alone ("soft" approach), or in combination with hard structures that support habitat establishment ("hybrid" approaches).	**Coastal wetlands / blue carbon ecosystems** Mangroves, seagrass, saltmarsh	• Provide natural hazard protection • Creates more greenspace/habitat • Act as carbon sink and refuge for displaced/retreating species	• Not effective in high-energy environments
	Dune ecosystems Dune protection / vegetation, beach nourishment*/scraping	• Without vegetation, the amenity and environment of the area will be significantly deteriorated.	
	Hybrid actions Sand fencing	• All approaches should be used in combination	
Engineering Use engineering and design to develop coastal structures, engineered changes to landform, and infrastructure modifications. Includes both "hard" and "soft" engineering and can be used in conjunction with some nature-based methods.	**Beach nourishment*** Beach scraping, Cart and place, dredging, sand bypassing	• Provides hazard protection while retaining natural amenity and sandy beach • Sand can be supplied from Anderson Inlet	• A 'Band aid' solution that masks natural coastal behaviour and becomes difficult to stop, once started • A long-term sand supply is sometimes difficult to find
	Seawalls	• Engineering solutions can help protect the remaining foreshore ecosystem or amenity values • Can be used as a 'stop-gap' to buy us time to move infrastructure • Could be funded by residents at most risk of losing property	• Would permanently alter the appearance of the beach • Would cause loss of beach – the key feature and identity of Inverloch • Would exacerbate erosion issues in another area and redicrect wave energy elsewhere. End up having to continuously extend a seawall • Would impact visual aesthetic/appeal of the beach
	Groynes	• Could augment existing rocky reef • Assists with sand retention	• Would permanently alter the appearance of the beach • Untested, with uncertain impacts on sediment dynamics and could result in unintended consequences • Expensive and difficult to remove • Visually intrusive
	Breakwaters	• Could provide multiple benefits, e.g. create new marine biodiversity/habitat and recreation benefits (surf break) • Allow nourishment/recovery of a sandy beach and reduces amenity impacts, retaining tourism • Thought to reduce energy reaching coast and reduce erosion	• Unknown changes to wave patterns and wave action • Significant (and unknown) interference with natural processes • Very high cost for benefit that may or may not be realised
	Drainage network Pipes, valves (size, functionality, network location, materials)	• Planning now will reduce problems in the future.	
	Road network Network, material, drainage	• Road will need to be relocated eventually. • Can be achieved and budgeted over time • Can be achieved with minimal disruption	

When deciding on adaptation actions, people felt that the environmental impacts, the level of hazard/risk mitigation and the ability to be adaptable were important considerations.

Nearly half of respondents selected these three criteria as being important. Providing co-benefits/outcomes was also seen as important.



When asked what else would be important to consider, people highlighted the importance of timely action and also felt that protection of private assets should be considered.

What next?

Combined with our Community Values Study from last year, and further stakeholder discussions, we are compiling all of the feedback we heard from the survey and our in-person community pop-up information sessions in April 2022.

This understanding will be used to help inform the development of a suitable adaptation approach to manage coastal hazards for the Cape to Cape region, now and into the future, as part of Stage 2 of the Cape to Cape Resilience Project.

How can I get involved?

To ensure you keep up to date with the Cape to Cape Resilience Project and upcoming events and activities:

- **Visit the project website at marineandcoasts.vic.gov.au/coastal-programs/cape-to-cape-resilience-project**
- **Sign-up to receive progress updates and notifications – email capetocape.project@delwp.vic.gov.au**
- **Read our latest factsheets via the website**
- **Ask us a question – email capetocape.project@delwp.vic.gov.au**

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