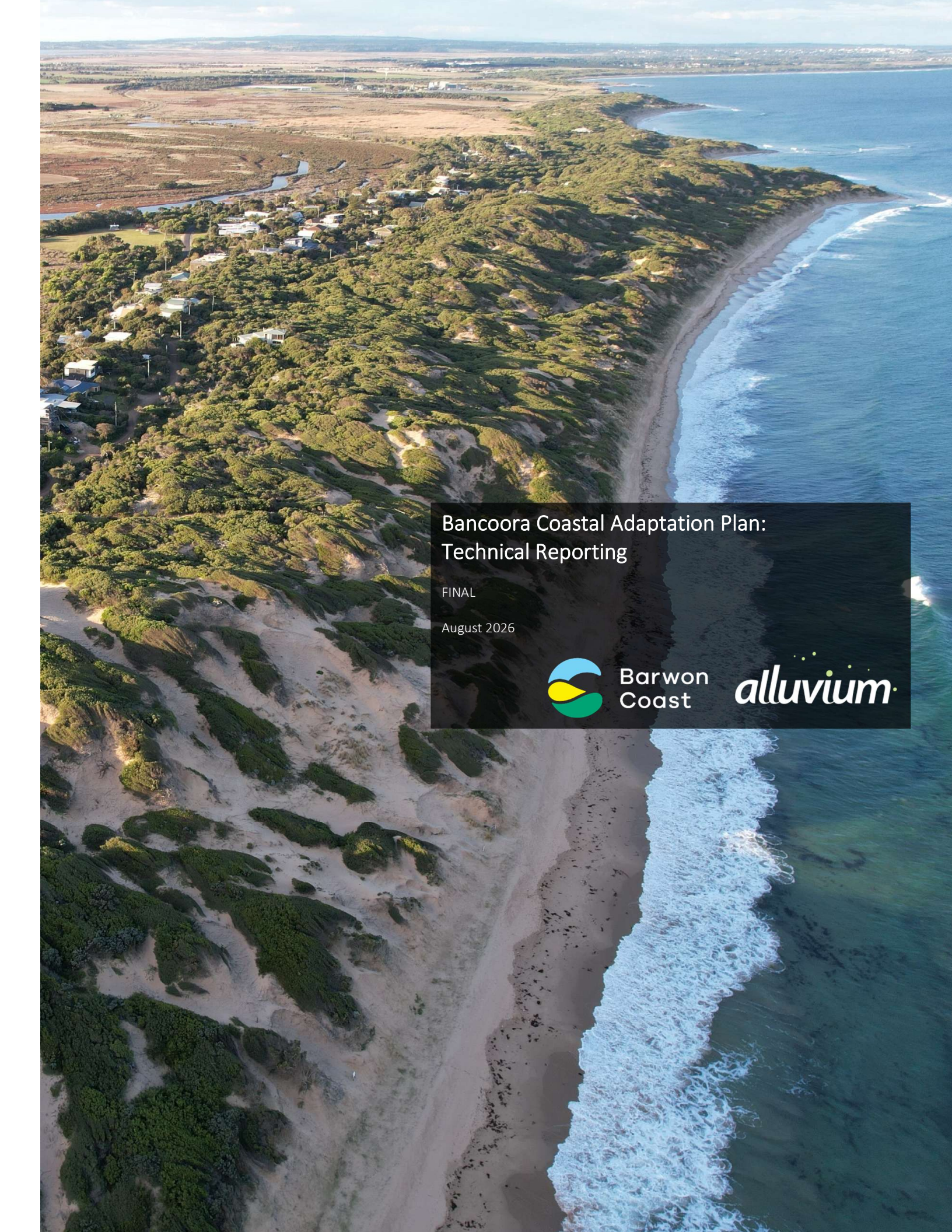




## Bancoora Coastal Adaptation Plan: Technical Reporting

FINAL

August 2026



Barwon  
Coast

*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 Melissa Barton. This piece was commissioned by Alluvium and tells our story of caring for Country, through different forms of waterbodies, from creeklines to coastlines. The artwork depicts people linked by journey lines, sharing stories, understanding and learning to care for Country and the waterways within.*

**NOTE:** This technical document was prepared progressively as individual project stages were completed and, as a result, some sections may reflect the information, assumptions, or context that applied at the time they were written. While the document remains a valid record of the technical work undertaken, it may not fully incorporate later updates or refinements. The Bancoora Coastal Adaptation Plan (Summary Plan) consolidates the outcomes of all project stages and should be relied upon for the most current and up-to-date information, noting that some elements of the detailed technical reporting reflect the project’s staged development.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for Barwon Coast Committee of Management under the contract titled “Bancoora Coastal Adaptation Plan”.

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Cover image: Breamlea Beach, Alluvium

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## Attachments

- Attachment 1: Background document review
- Attachment 2: Community engagement results
- Attachment 3: Coastal geomorphology and setting
- Attachment 4: Coastal processes and drivers
- Attachment 5: Coastal hazard data – further information
- Attachment 6: Coastal hazard mapping – all likelihood scenarios
- Attachment 7: Adaptation actions pre-screening



# 1 Introduction

Barwon Coast Committee of Management (Barwon Coast) manages approximately 22 km of coast and foreshore on the Bellarine Peninsula in Victoria. In April 2022, the management of the Breamlea coastal reserves was transferred from the City of Greater Geelong to Barwon Coast. This area includes the coastal Crown land at Bancoora Beach as well as the Breamlea foreshore.

As the coastal land manager, Barwon Coast manage natural and public assets across the Breamlea and Bancoora Beach reserves as well as the Breamlea Caravan Park. As a coastal environment, these areas are exposed to natural coastal processes. When these processes impact on coastal values, uses and infrastructure, they are termed coastal hazards.

Barwon Coast are considering future changes to the Breamlea/Bancoora coast with a changing climate and rising sea levels. Through this project, they are undertaking Stages 1-5 of the Victoria's Resilient Coast – Adapting for 2100+ (VRC) framework to inform development of a Coastal Adaptation Plan (CAP) for Bancoora. This Plan will serve as an important long-term planning document to create knowledge that provides a strong basis for decision-making surrounding future use and development in the area. This technical reporting provides additional detail on work that has informed the plan.



Barwon Coast is responsible for the planning and management of the coastal Crown land at Bancoora Beach, the Breamlea foreshore and Breamlea Caravan Park. The Bancoora CAP is primarily focused on these areas of coastal Crown land. Future adaptation actions and pathways relating to private land will not be included in this project. Further detail on the project study area is provided below.

## Coastal hazards definition

Natural coastal processes continually change the coastal landscape. The movement of water through tides, waves and currents shifts sands and sediments, reshaping coastal environments every day. At times, these natural coastal processes, including erosion, inundation (flooding), may have an adverse impact on coastal values and uses. When this occurs, these processes are often referred to as coastal hazards. Coastal hazards are projected to increase with changes in wave action, storm activity and sea level rise associated with a changing climate.



## 1.1 This document

This document reports the technical and strategic work undertaken to develop the Bancoora CAP. A separate summary document serves as the public-facing Bancoora Coastal Adaptation Plan. Table 1 provides a summary of report sections, sub-sections and content, along with reference to further information. Report sections align with stages of the VRC framework, described further, below.

**Table 1. Components of the document**

| Report section / VRC Stage                           | Report sub-sections                                                                                                                                                                                                                                                                                                          | Additional information                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 Introduction<br>(Stage 1: Scoping and preparation) | 1.2 State policy context<br>1.3 Study area<br>1.4 Approach to rightsholder, stakeholder and community engagement                                                                                                                                                                                                             | State and site-based context to set the scene for the Bancoora CAP. Includes overview of the VRC framework and State policy, the study area, rightsholders and stakeholders and approach to communication and engagement. Supplemented by a separate Project Plan and Communications and Engagement Plan.                                                                                                                                                                                            |
| Stage 2: Values, vision and objectives               | 2.1 Engaging on values<br>2.2 The study region through time<br>2.3 Wadawurrung connection to Country<br>2.4 Significant ecology<br>2.5 Coastal connection and stewardship<br>2.6 Beach recreation at Bancoora Beach and Breamlea Foreshore<br>2.7 Breamlea Caravan Park<br>2.8 Vision and objectives for adaptation planning | Establishes a values context for the study area including how we have engaged to understand values. Includes a synthesis of values for Bancoora and Breamlea coastal areas and a shared vision and objectives for the future, to inform adaptation planning.<br><br>Attachment 1 provides a document review and Attachment 2 provides results of community engagement that have both informed Stage 2.                                                                                               |
| Stage 3: Coastal processes and hazards               | 3.1 Geomorphic setting<br>3.2 Coastal processes and drivers<br>3.3 Climate change and sea level rise<br>3.4 Coastal hazards<br>3.5 Available coastal hazard information<br>3.6 Coastal hazard data and modelling methods<br>3.7 Coastal hazard mapping                                                                       | Technical information about coastal processes and drivers of coastal change. Includes an understanding of climate change, sea level rise and definition of coastal hazards.<br><br>Reviews and maps available coastal hazard information for the study area, to be carried forward into vulnerability and risk assessment. Attachments 3, 4 and 5 provide further information on: coastal geomorphology and setting, coastal processes and drivers, and available coastal hazard data, respectively. |
| Stage 4: Vulnerability and risk                      | 4.1 Vulnerability<br>4.2 Hazard exposure<br>4.3 Risk definition and framework<br>4.4 Risk assessment outcomes                                                                                                                                                                                                                | The risk assessment methodology and results. Includes high-level coastal hazard vulnerabilities across Bancoora and Breamlea and detailed risk assessment of specific values, uses and infrastructure. Risk assessment results are summarised for three sub-areas with implications for adaptation highlighted.                                                                                                                                                                                      |
| Stage 5: Adaptation pathways and planning            | 5.1 Adaptation approach and policy<br>5.2 Adaptation objectives<br>5.3 Adaptation options<br>5.4 Adaptation actions<br>5.5 Foundational adaptation actions<br>5.6 Sub-area adaptation pathways and actions                                                                                                                   | The adaptation framework, pathways and specific actions for Bancoora and Breamlea. Includes Statewide policy considerations and framework, landscape scale adaptation considerations and detailed pathways and actions for three sub-areas.                                                                                                                                                                                                                                                          |
| 6 Summary and next steps                             | 6 Summary and next steps                                                                                                                                                                                                                                                                                                     | Next steps for adaptation implementation planning for Bancoora CAP.                                                                                                                                                                                                                                                                                                                                                                                                                                  |



## 1.2 State policy context

Coastal and marine management in Victoria is led by the Department of Energy, Environment and Climate Action (DEECA)<sup>1</sup>. Several key pieces of legislation, policies and guidance material over recent years have reformed coastal and marine management. These reforms aim to support a coordinated, simpler and more integrated approach to coastal and marine management and provide the tools to identify and adapt to coastal hazards in the future.

Climate change adaptation across the marine and coastal environment is integrated across different sectors. The *Marine and Coastal Act 2018*, Marine and Coastal Policy and Marine and Coastal Strategy, direct coastal adaptation and resilience planning, at both a region and site-specific scale. Adaptation planning must be in accord with these pieces of legislation and policy. Victoria's Resilient Coast – Adapting for 2100+ (DEECA, 2023) also provides the statewide framework and guidelines for coastal hazard adaptation planning.

### **Marine and Coastal Act 2018**

The *Marine and Coastal Act 2018* replaced the previous *Coastal Management Act 1995*. It provides a coordinated, simpler, and more integrated approach to planning and managing the marine and coastal environment. This includes objectives and guiding principles for planning and management of the marine and coastal environment. The Act required the development of several key items - a Marine and Coastal Policy, including a Marine Spatial Planning Framework; and a Marine and Coastal Strategy.



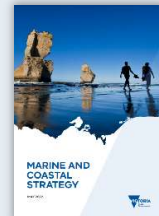
### **Marine and Coastal Policy (DELWP, 2020a)**

The Victorian Government developed the Policy in line with the Act. It came into operation in March 2020 and sets a 15-year vision for '*a healthy, dynamic and biodiverse marine and coastal environment that is valued in its own right, and that benefits the Victorian community, now and in the future.*' It guides decision makers (including local councils and land managers) in planning, management and sustainable use of coastal and marine environments. It provides direction on issues such as the impacts of climate change, adaptation and hazard planning, population growth, and ageing coastal structures.



### **Marine and Coastal Strategy (DELWP, 2022a)**

Released in 2022, DEECA led the development of the Strategy, guided by Traditional Owners, the Victorian Marine and Coastal Council (VMaCC) and other stakeholders. It is the first of three five-year strategies. The Strategy identifies priority actions for the next five years to lay the foundations for achieving the Policy's 15-year vision. This includes timeframes and responsibilities for delivery. The on-ground actions also begin implementing the objectives of the Act. Actions in the strategy include those aiming to adapt to the impacts of climate change, including applying the state-wide Victoria's Resilient Coast – Adapting for 2100+ framework and guidelines.



### **Victoria's Resilient Coast – Adapting for 2100+**

DEECA has developed a state-wide approach to long-term coastal hazard resilience and adaptation called *Victoria's Resilient Coast – Adapting for 2100+* (VRC) (DEECA, 2023).

This outlines a framework and guidelines to support local governments, land and asset managers and communities to adapt to climate change impacts on the coast. This includes guidance for developing and implementing adaptation opportunities to increase resilience and using a pathways approach to help inform decision making, planning, triggers and timing of actions.

<sup>1</sup> Formerly Department of Environment, Land, Water and Planning (DELWP) to 1 January 2023.

The VRC guidelines outline a 7-stage process for implementing the VRC framework (Figure 1).

Embedded in all stages are:

- Traditional Owner knowledge, rights and aspirations
- Partnerships and a collaborative process
- Engagement and communication

This report details the strategic and technical work to progress Stages 1-5 of a Coastal Adaptation Plan for the Bancoora foreshore. This work has been supported by the VRC grants program.



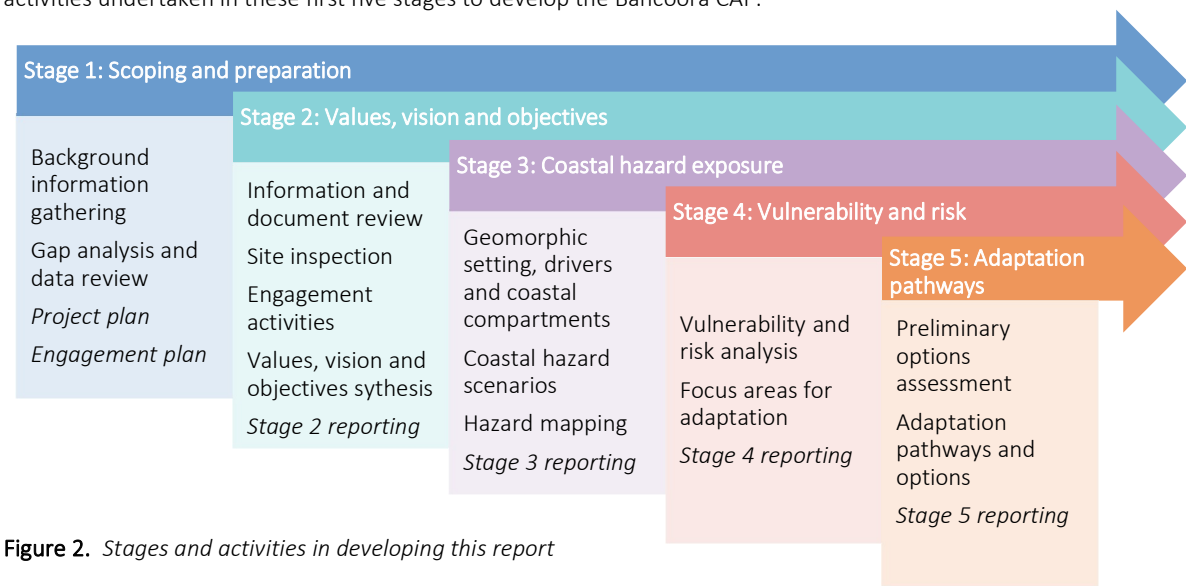
**Figure 1.** Victoria's Resilient Coast - adapting for 2100+ framework stages.

Table 2 details the seven VRC stages, the purpose of each stage and status for the Bancoora CAP. This technical document covers work completed from VRC Stages 1 to 5.

**Table 2. VRC stages and stage purpose.**

| VRC stage                                                                                                                     | Purpose                                                                                                                                                                            | Status                                        |                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>1. Scoping and preparation</b>          | Provide a foundation for adaptation Make planning aligned to best practice guidance.                                                                                               | ✓ Complete – Project Plan and Engagement Plan | <b>Embedded throughout:</b><br>Traditional Owner knowledge, rights and assertions<br>Partnerships and a collaborative process<br>Engagement and communication |
|  <b>2. Value, vision and objectives</b>    | Ensure adaptation planning is underpinned by regional and place-based values.                                                                                                      | ✓ Complete                                    |                                                                                                                                                               |
|  <b>3. Coastal hazard exposure</b>         | Assess coastal hazard exposure, including scenarios that enable best practice approaches to assessing current and emerging risk.                                                   | ✓ Complete                                    |                                                                                                                                                               |
|  <b>4. Vulnerability and risk</b>          | Explore place-based coastal hazard vulnerability and risk, to enable strategic consideration of adaptation needs/priorities                                                        | ✓ Complete                                    |                                                                                                                                                               |
|  <b>5. Adaptation actions and pathways</b> | 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.  | ✓ Complete                                    |                                                                                                                                                               |
|  <b>6. Plan and implement</b>              | Confirm the plan of action for coastal hazard risk management and adaptation and commence implementation.                                                                          | 🕒 To be commenced – separate scope            |                                                                                                                                                               |
|  <b>7. Ongoing monitoring and review</b>   | Ensure coastal hazard risk management and adaptation is accompanied by ongoing monitoring and evaluation process that enables effective implementation, learnings and improvement. | 🕒 To be commenced – separate scope            |                                                                                                                                                               |

Each stage in the VRC framework builds on the preceding stages. Figure 2 outlines the stages and related activities undertaken in these first five stages to develop the Bancoora CAP.



**Figure 2.** Stages and activities in developing this report

The Bancoora CAP provides a strategic plan and specific actions to manage coastal hazard risk now and into the future. The primary focus of the plan is to guide coastal hazard management for Barwon Coast managed land and assets in the study area.

### 1.3 Study area

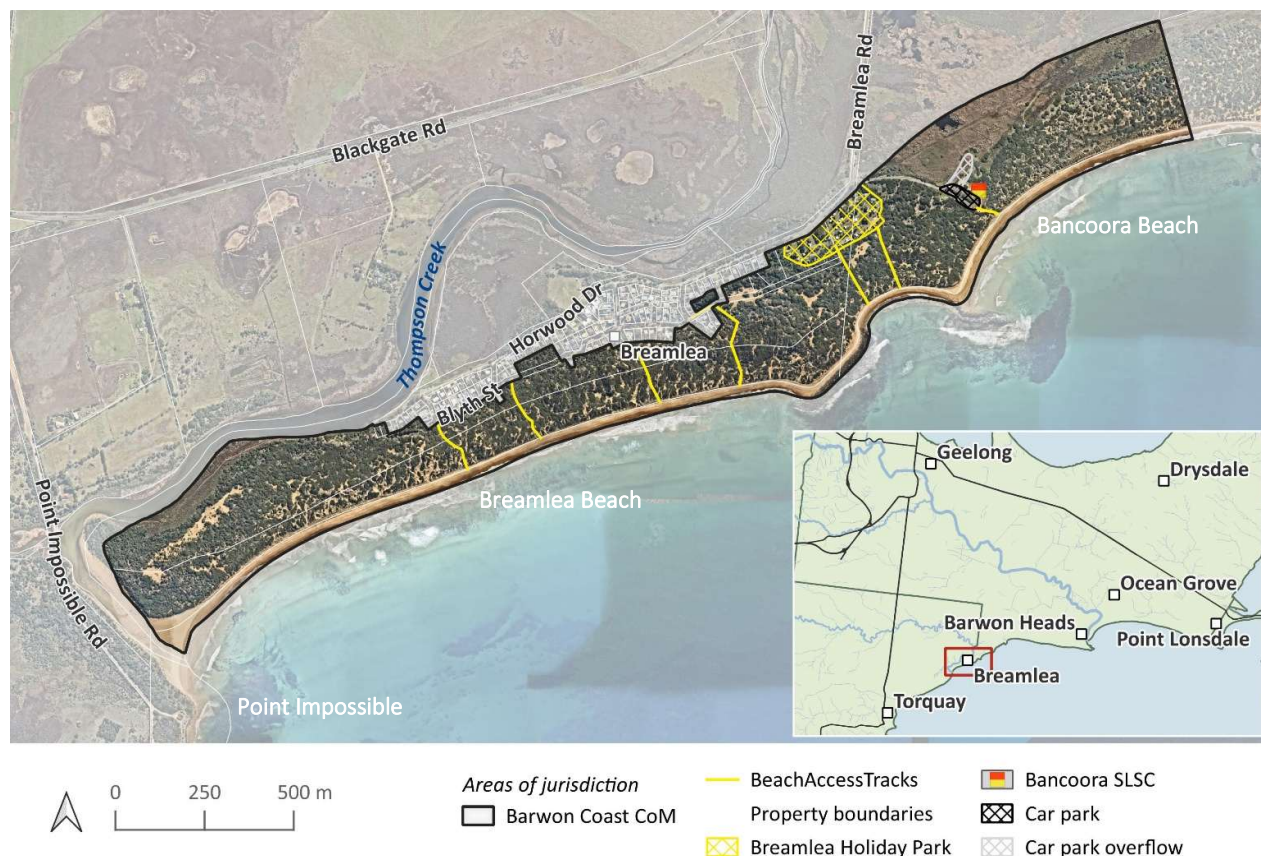
The study area encompasses the Breamlea and Bancoora coastal reserves managed by Barwon Coast (Figure 3). These reserves stretch from the Thompson Creek estuary opening in the southwest Bancoora Beach to the east. They encompass the beaches, dune systems, caravan park and Bancoora SLSC. Barwon Coast own and lease the Bancoora SLSC. The club secured \$4.15 million in funding to redevelop their facilities. As a Barwon Coast-owned asset, the outcomes of the CAP will be used to inform sustainable coastal management approaches for the SLSC redevelopment.

The Traditional Owners of this area are the Wadawurrung people who have a strong cultural connection to the natural values of the land, waters, seas and skies across the region, and are represented by the Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC).

The Bancoora CAP is primarily focused on the areas of coastal Crown land under Barwon Coast’s jurisdiction. While the plan will consider the interconnected coastal system, adjoining land uses and access to these areas, future adaptation actions and pathways relating to private land will not be included in this project.







**Figure 3.** *Bancoora Coastal Adaptation Plan study area*

### Rightsholders and stakeholders

There are a range of rightsholders, adjoining land and asset managers, authorities and stakeholders involved in the Bancoora CAP. A Project Steering Group (PSG) was established to act as the primary mechanism to engage with rightsholders and stakeholders throughout the project. Table 3 details these groups and their involvement in the PSG.

The Wadawurrung People are the Traditional Owners of the dja, warri and ngubiyt (Country, Water and Sea) of the coastal reserves on the Bellawiyi (Bellarine Peninsula) that Barwon Coast manage. Representing the Wadawurrung Peoples, the Wadawurrung Traditional Owners Corporation are key project partners.

Barwon Water, Surf Coast Shire and the Great Ocean Road Coast and Parks Authority also have land management roles in areas adjoining the study area. While not part of the core Project Steering Group, they have been kept informed of the project and their input sought at various stages, as needed.

Additional community groups have also provided valuable input into the project. These groups are detailed in Section 2.5, below.



Table 3. Rightsholders and stakeholders involved in the Bancoora CAP, and PSG members.

| Stakeholder/rightsholder                                                                                                                          |                                                               | Description                                                                          | Involvement              |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------|
|  <b>Barwon Coast</b>                                             | Barwon Coast Committee of Management                          | Land manager and lead agency                                                         | Lead                     |
|  <b>Wadawurrung Traditional Owners</b><br>Aboriginal Corporation | Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) | Registered Aboriginal Party and Traditional Owners of the study area                 | Partner and PSG          |
|  <b>VICTORIA</b><br>State Government                             | Department of Energy, Environment and Climate Action (DEECA)  | Project sponsor and statewide coastal policy and adaptation                          | PSG                      |
|  <b>CORANGAMITE CMA</b>                                          | Corangamite Catchment Management Authority (CCMA)             | Catchment management authority and waterway manager for Thompson Creek               | PSG                      |
|  <b>Parks VICTORIA</b>                                           | Parks Vitoria (PV)                                            | Adjoining land manager of Breamlea Flora and Fauna Reserve                           | PSG                      |
|  <b>CITY OF GREATER GEELONG</b>                                  | City of Greater Geelong (CoGG)                                | Local government authority for study area and adjoining land and asset manager       | PSG                      |
|  <b>Bancoora</b><br>Surf Lifesaving Club                         | Bancoora Surf Lifesaving Club (Bancoora SLSC)                 | Key asset user group within study area and involved with Bancoora SLSC redevelopment | PSG                      |
|  <b>BarwonWater</b>                                            | Barwon Water (BW)                                             | Adjoining land and asset manager east of Bancoora Beach                              | Informed / Plan feedback |
|  <b>Surf COAST SHIRE</b>                                       | Surf Coast Shire Council (SCSC)                               | Adjoining local government authority and land manager                                | Informed / Plan feedback |
|  <b>GREAT OCEAN ROAD</b><br>COAST & PARKS AUTHORITY            | Great Ocean Road Coast and Parks Authority (GORCAPA)          | Adjoining land manager westward from Point Impossible                                | Informed / Plan feedback |

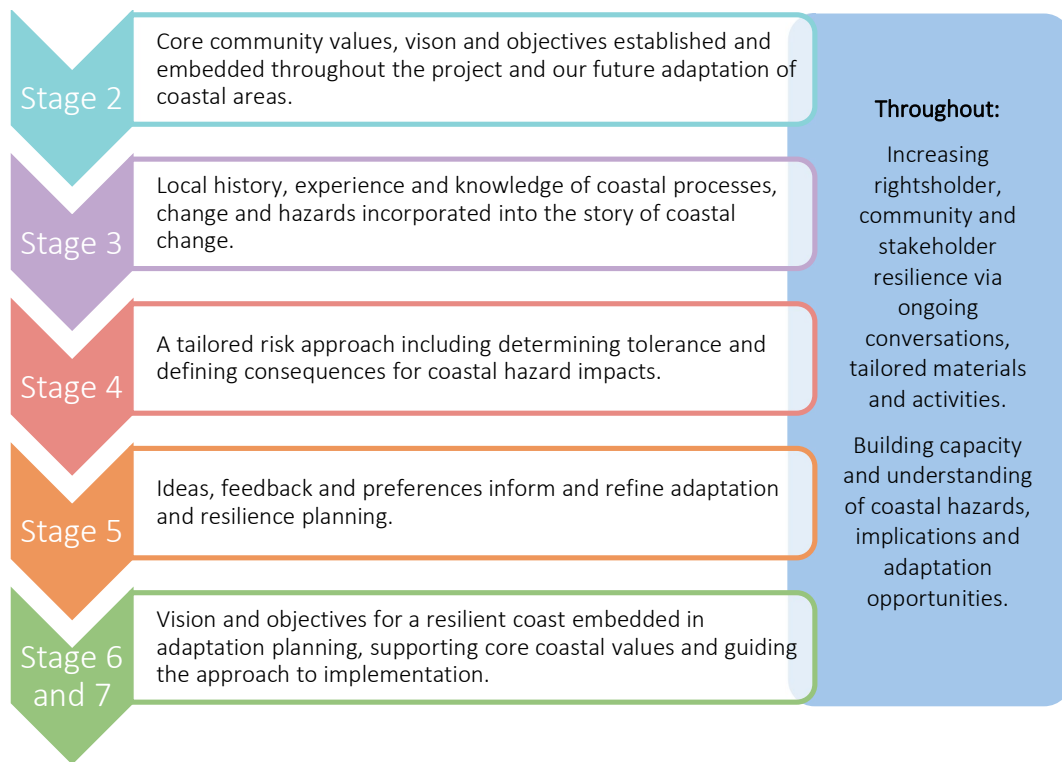
Table 4 outlines the role of the Bancoora CAP in coastal hazard management across different land and asset managers. The plan is not intended to guide coastal hazard risk and adaptation across private properties.

Table 4. Role of the Bancoora CAP in coastal hazard management

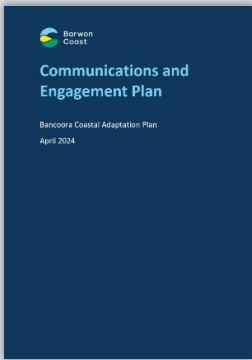
|                   |                                                                 | Land or asset management |                   |         |
|-------------------|-----------------------------------------------------------------|--------------------------|-------------------|---------|
|                   |                                                                 | Barwon Coast             | Other authorities | Private |
| Bancoora CAP role | Inform people on coastal hazard investigations                  | ✓                        | ✓                 | ✓       |
|                   | Monitor coastal hazard risk                                     | ✓                        | ✓                 | ✗       |
|                   | Plan strategically to manage coastal hazard risk and adaptation | ✓                        | ✓                 | ✗       |
|                   | Act by implementing measures to manage coastal hazard risk      | ✓                        | ✗                 | ✗       |
| ✓                 | Role of the Bancoora CAP, Barwon Coast lead                     |                          |                   |         |
| ✓                 | Bancoora CAP may inform, Barwon Coast may support               |                          |                   |         |
| ✗                 | Not the role of the Bancoora CAP, limited role for Barwon Coast |                          |                   |         |

## 1.4 Approach to rightsholder, stakeholder and community engagement

Partnerships, engagement and communication is a core aspect of adaptation planning undertaken throughout the VRC stages. Engagement can influence adaptation planning in several ways through the process (Figure 4). All engagement has been guided by a Communications and Engagement Plan, developed for the project.



**Figure 4.** How engagement influences adaptation planning.



The cover of the 'Communications and Engagement Plan' document is dark blue with white text. It includes the 'Bancoora Coast' logo, the title 'Communications and Engagement Plan', and the subtitle 'Bancoora Coastal Adaptation Plan April 2024'.

### Communications and Engagement Plan

A tailored communications and engagement plan guided engagement to develop the Bancoora CAP. This enabled a strategic and planned approach to gathering insights and perspectives of rightsholders, the community and stakeholders in adaptation and resilience planning for the area.

The plan identified key project stages and highlights various opportunities for rightsholders, community and stakeholders to be involved throughout project. To ensure consistency and clarity, it outlined the background, project goals, objectives and key messages for engagement. It also identified key audience groups, their interests and needs for engaging in the project. A project roadmap is used in preparing and delivering engagement activities and communications materials, helping to achieve desired and necessary outcomes for each stage of the project.

Two major rounds of community engagement were undertaken through developing the Bancoora CAP. The first focussed on understand community values and experiences with coastal hazards, the second focussed on presenting and gaining feedback on the draft CAP.

Further details of engagement in each Stage is detailed in sections below, with community engagement results presented in Attachment 2.



## 2 Values, vision and objectives

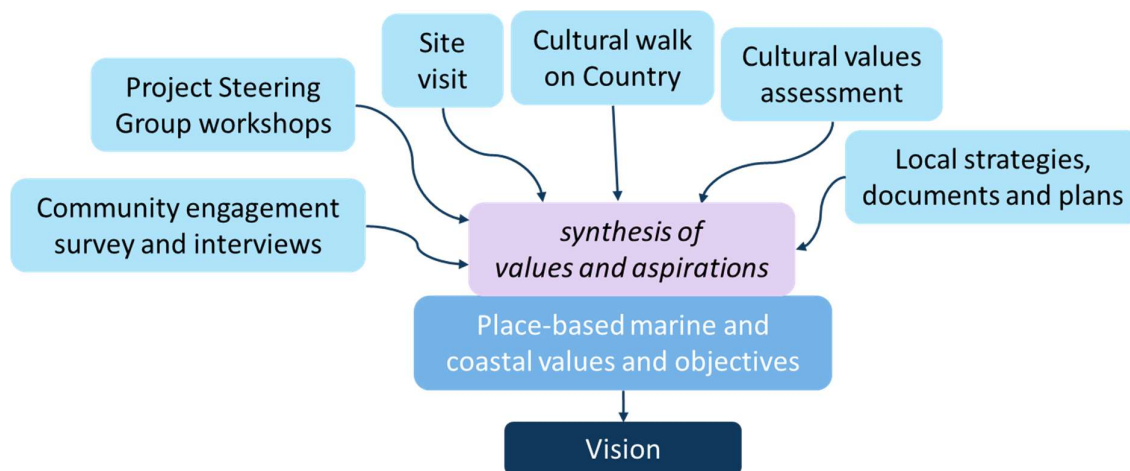
|                                                                                                                                                                                                                                                                                                                                                                            |                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Stage 2<br>Values, vision and objectives                                                                                                                                                                                                                                                                                                                                   | Ensure adaptation planning is underpinned by regional and place-based values. |
| Local marine and coastal values underpin strategic decision making and are essential to adaptation and resilience planning. Having a detailed understanding of the unique values of the Breamlea foreshore and Bancoora Beach is critical to developing a tailored adaptation plan and will help to ensure the unique character of this region is retained into the future |                                                                               |

This section explores the range of values found within the study area and what aspects are most important to consider for coastal adaptation and resilience planning. This includes:

- Wadawurrung connection to Country and aspirations.
- An understanding of the study region through time and the influences that have shaped the area we see today.
- Significant ecology and environmental values.
- The social, recreation and economic aspects of the area including coastal community groups, the Bancoora SLSC, and Breamlea Caravan Park.

Local aspirations and place-based values provide a strong foundation for strategic coastal hazard risk management. Understanding what rightsholders, the community and stakeholders value about their coastal areas, the potential threats to these values, and what they hope to see in the future, provides the foundation for strategic coastal hazard risk management and adaptation. Basing adaptation on these values and aspirations ensures a tailored approach to adaptation planning that is suitable for the local area and supports values specific to the Breamlea and Bancoora foreshore.

The outputs of all community and stakeholder engagement activities, document review and site visits have been brought together to inform our understanding of values, objectives and a vision for the Bancoora CAP (Figure 5).



**Figure 5.** Process for developing place-based values, aspirations and vision for the study area.

2.1 Engaging on values

Engagement activities in Stage 2 sought to establish an appreciation of coastal values, uses and experiences of Bancoora Beach and the Breamlea foreshore. This captured the array of interests, values and aspirations held by the area’s rightsholders, communities, and stakeholders to establish a foundation for adaptation planning. This foundation guides each subsequent stage of the planning process to ensure outcomes of adaptation planning are place-based and representative of local values and aspirations.



Our approach to understanding and documenting rightsholder, community and stakeholder values included:

- extensive literature review of existing plans, strategies, policies and documents
- a site visit with Barwon Coast and Bancoora SLSC representatives
- a cultural walk on Country with WTOAC
- an online community survey
- a series of five in-person interviews with a number of key community members and groups
- Project Steering Group workshops and meetings

We had 56 respondents to our online survey. The many respondents having a close connection to the area, being either a resident of Breamlea or of a nearby town (Figure 6).

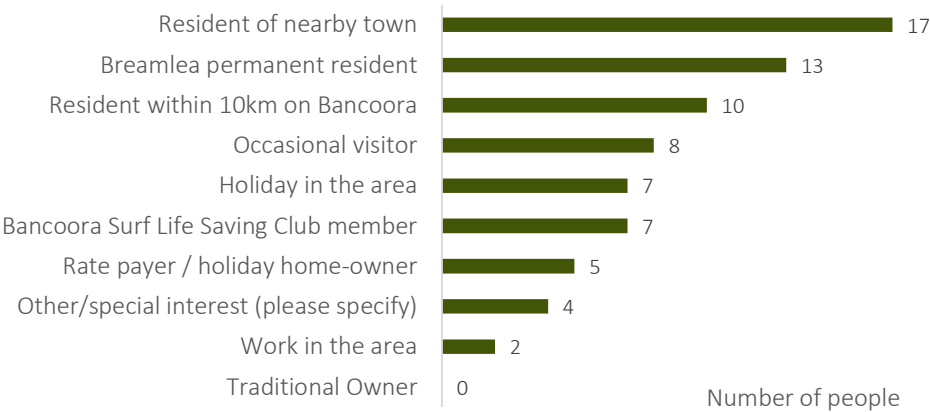


Figure 6. Results of online survey Q1: How would you describe your connection to the area.

Attachment 2 provides the results of the community engagement survey and interviews, with further synthesis in sections below.

## 2.2 The study region through time

Tucked away along Victoria's Surf Coast, Bancoora Beach and the Breamlea foreshore are places of natural beauty, simplicity and community. The area is rich in Wadawurrung cultural heritage, diverse ecosystems, and is home to a close-knit and vibrant local community. The Breamlea Caravan Park and Bancoora Life Saving Club are primary drivers of visitors and tourism and hold important economic and social value for the area. Strong recreational values are supported by natural spaces, including the beach, dunes, Thompson Creek, the Breamlea Flora and Fauna Reserve, and Karaaf Wetlands.

Understanding the area and its history of change contributes to defining a set of place-based values and objectives for the Bancoora Beach and Breamlea foreshore. The study area is Wadawurrung land and sea Country which has been continually cared for by generations of Wadawurrung people over tens of thousands of years. Wadawurrung Traditional Owners have fought hard to survive the impacts of colonisation and dispossession and have maintained this connection with Dja (Country).

This care and responsibility for Country continues today and is expressed in the *Paleert Tjaara Dja: Let's make Country good together 2020 – 2030 Wadawurrung Country Plan* (WTOAC, 2019). Country is interconnected, alive with dreaming and creation stories, imprinted with cultural values and social history. Wadawurrung Traditional Owners see no separation between cultural and natural resources and people. Caring for Country, land, sky, and waters, alongside continuation of cultural practices, is core to Wadawurrung identity as the Traditional Owners and custodians of Bancoora beach and the Breamlea foreshore.

Colonial history in the area began around the 1860s. In 1891 the SS Bancoora ran aground on what is now known as Bancoora surf beach, giving the beach its current name. By the turn of the century, the area had become known amongst settlers of Geelong as a location for summer camping. Figure 7 shows a topographic map of the area in 1915.

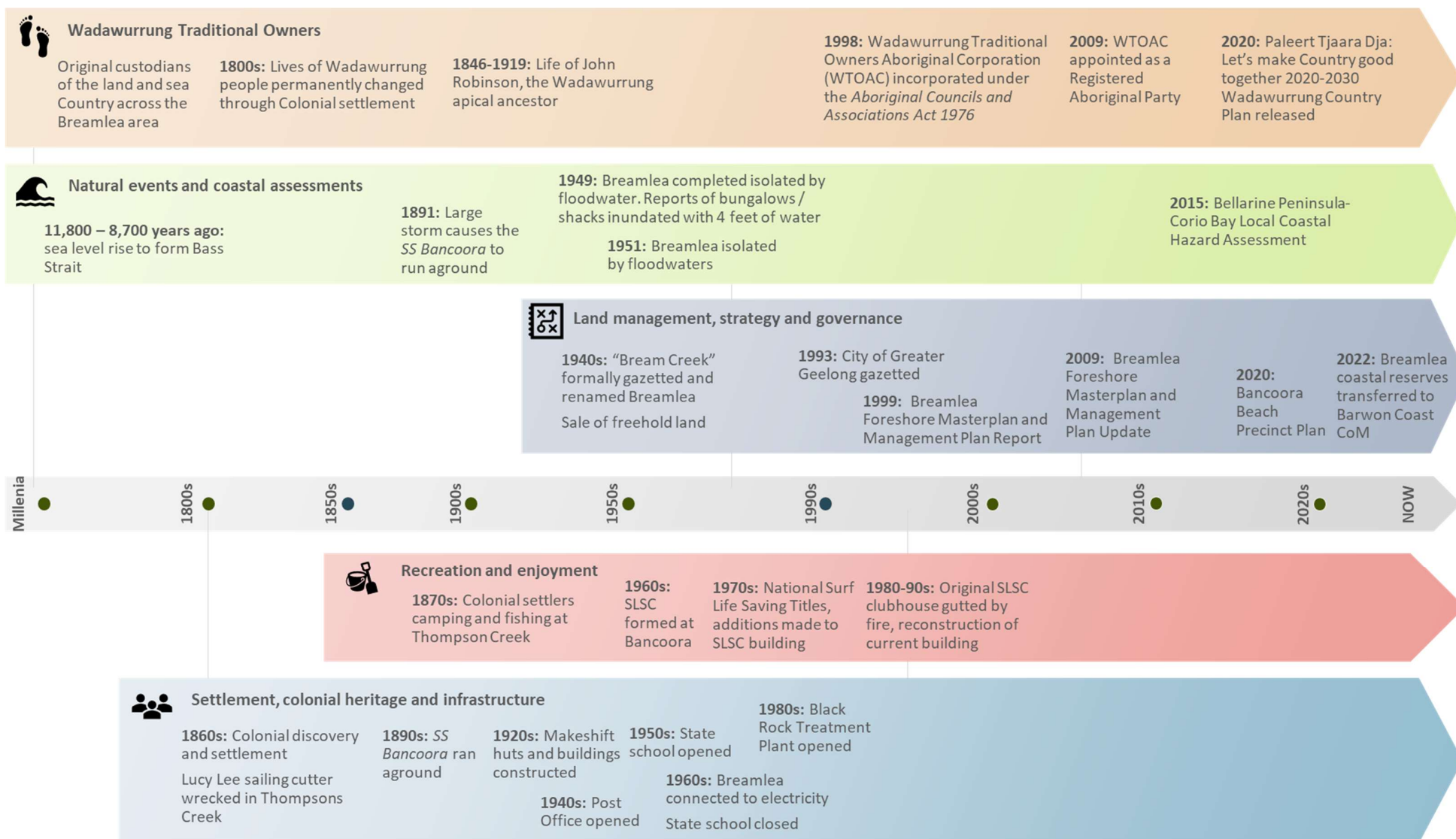


**Figure 7.** 1915 topographic map extract (State Library Victoria, 1915).

Official European surveying and public auction of land occurred in the 1940s, which included the creation of a recreation reserve and a municipal reserve (now known as Breamlea Recreation Reserve and Cahir Park, respectively) (State Library of Victoria, 2024). Further development of the township included the establishment of the Bancoora SLSC and Breamlea Caravan Park. Today, the Breamlea township includes over 100 homes, with a population of 151 people in the most recent census (ABS, 2021).

The timeline in Figure 8 summarises key events that have occurred within the study region, shaping the area through time. This is not intended to be an exhaustive list.





**Figure 8.** Timeline of key events within the study region, shaping the area through time.

## 2.3 Wadawurrung connection to Country

Wadawurrung people have long appreciated this coastal region as a special place. Their connection to the study area is tied to the holistic collection of all physical, cultural and spiritual aspects of this part of Country. Country is inseparable from Wadawurrung sense of self and identity.

The coastline is a traditional supermarket for Wadawurrung, producing a vast and diverse range of resources. The mosaic of ocean, reef, rock, dune, creek, wetland and salt marsh environments in close proximity of each other are cared for and celebrated by Wadawurrung people to safeguard their abundant cultural resources.

A separate Cultural Values Study has accompanied the Coastal Adaptation Plan and will provide additional insight into cultural values across the study area.

Wadawurrung people used these resources for many purposes, including:

- crafting a wide range of tools used and traded with both close neighbouring and distance communities,
- creating ceremony materials, such as ceremony paints from the many shades of ochre from coastal cliffs,
- building large communal huts, working with the natural shape and form of Moonah trees of the area, and
- hunting, harvesting, and nurturing a vast array of food and medicinal sources present within this part of Country.



*Exposed side of a shell midden.*

The whole Bancoora and Breamlea area has cultural significance and there are many places of cultural heritage located within the study area. This includes extensive middens located in the coastal zone. The middens are a record of, and a present-day connection to, the many Wadawurrung people who periodically gathered and shared meals and stories in these carefully selected places among the dunes and rocky platforms of the coast.

Archaeological surveys of the area demonstrate that Breamlea has one of the highest densities of middens along the central west coast of Victoria (Austral Heritage Consultants, 1997). More than 60 Aboriginal archaeological sites are registered with Aboriginal Affairs Victoria within a 2 km radius of Breamlea (City of Greater Geelong, 2009). Many places of significance are also likely to be undocumented.

The area also contains places of high spiritual importance, with this part of Country important as a hospice place for Wadawurrung ancestors and with certain locations having ties to the passing of a person’s spirit. This is particularly the case for the ongoing ties to Wadawurrung Dreaming stories, such as those associated with the connewarre (black swan) (C. Eccles, personal communication, August 2, 2024).

Wadawurrung people today continue to uphold cultural responsibility associated with caring for all parts of Country located within the Breamlea and Bancoora area. The Wadawurrung Country Plan details aspirations for a stable or increased extent of native vegetation, including moonah trees, and increased breeding of shorebirds.



Connewarre (Black Swan). Credit: Michael Seyfort via [Dept of Education](#)

2.4 Significant ecology

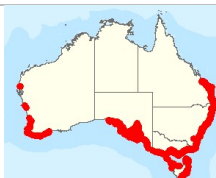
The ecology of the Breamlea and Bancoora area is highly diverse, with many landforms concentrated into the study area and its surrounds. Thompson Creek flows through extensive wetlands and coastal saltmarsh that form the Breamlea Flora and Fauna Reserve (FFR), a wetland area of approximately 213.6 hectares managed by Parks Victoria and DEECA. The saltmarsh is periodically flooded by saltwater and drained by the action of the tides. The flora present consists of a range of succulent herbs, low succulent shrubs, rushes and sedges, namely Beaded Glasswort, Marsh Saltbush, Coast Beard-heath and Seaberry Saltbush (Ecology Heritage Partners, 2020).



The permanent saline wetlands of the Breamlea FFR extend to the west of the Breamlea township, where they are more commonly known as the Karaaf Wetlands, as well as to the northeast, where they border the back of the Bancoora Surf Life Saving Club.

Thompson Creek is low energy and meanders through the low lying and flat floodplain of wetlands and saltmarsh, flowing west along the north of the township until it meets the ocean at Point Impossible. The mouth of Thompson Creek forms an intermittently open and closed estuary.

The diversity and conservation importance of the area’s ecology is recognised in national legislation. Two ecological communities within the area are recognised as threatened nationally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These are:

| Ecological community                                                                                  | Listed       | Threatened category | Distribution                                                                          |
|-------------------------------------------------------------------------------------------------------|--------------|---------------------|---------------------------------------------------------------------------------------|
| Subtropical and temperate coastal saltmarsh                                                           | August 2013  | Vulnerable          |  |
| Assemblage of species associated with open-coast salt-wedge estuaries of western and central Victoria | October 2018 | Endangered          |  |

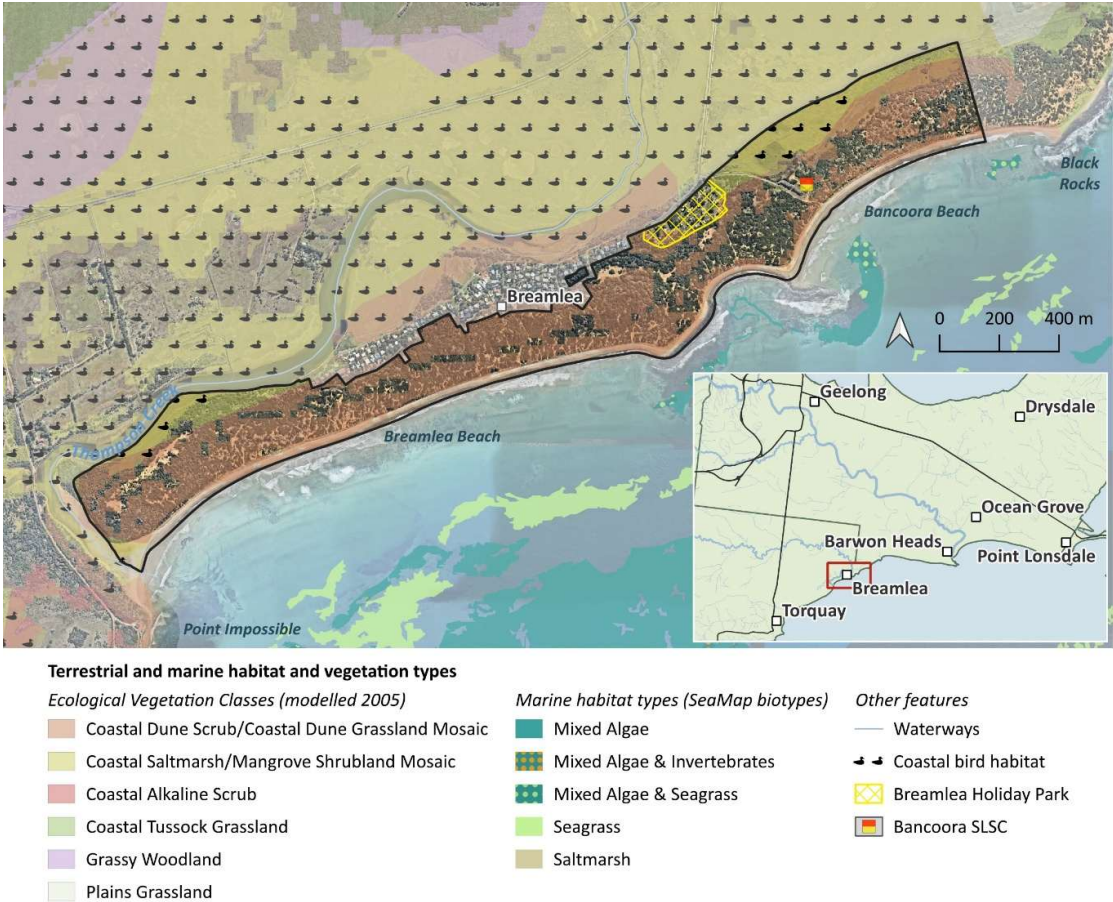
Source: EPBC Act List of Threatened Ecological Communities at the [Species Profile and Threats Database](#)



Between the saltmarsh and wetlands of Breamlea and the ocean lies the sandy beach and dunes of the Breamlea and Bancoora coast. This section of beach is backed by high dunes and punctuated by basalt rock platforms from historic lava flows from Mount Duneed. The dunes and grasslands contain sections of Coastal Dune Scrub and Coastal Dune Grassland Mosaic ecological vegetation classes (EVCs).

The flora species that dominate these areas include Coast Tea tree and Coast Wattle (both not locally native), with instances of native species such as Coast Beard-heath, Coast Sword Sedge, Chaffy Saw-sedge, Coast Blown-grass and native orchids (Ecology Heritage Partners, 2020). Moonah Woodland are thought to have historically formed part of these ecosystems, though only 4% of mature remnant trees today are currently regenerating (Thompson Berrill Landscape Design, 2009). Moonah are also central to Wadawurrung marriage stories.

Figure 9 shows the full extent of terrestrial EVCs, marine habitats and vegetation found in the area.



**Figure 9.** Map of terrestrial and marine habitat and vegetation types found in and surrounding Bancoora Beach and the Breamlea foreshore.

The profile of the Breamlea and Bancoora sand dunes is much steeper today than it historically was. This is due predominately to the introduction of Marram grass to the dunes in the 1950s. Marram grass has largely replaced the native Spinifex grass, transforming the Breamlea and Bancoora dunes to become steeper and thus more susceptible to collapse following erosion events. The high dunes now create protection from wind and waves for the built infrastructure of Breamlea and Bancoora that sit behind them.



**Marram grass** is a European grass introduced to many coastal areas of Australia as a dune stabiliser. Stimulated by sand coverage, the plant's dense growth and extensive network of roots trap shifting sand and enhance dune formation.

Credit: AJ Brown via [Agriculture Victoria](#)

The diverse and rare ecosystems found in the area's surrounds are home to a large number of threatened animal species. This includes a number of migratory bird species and other threatened faunal species listed on the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) Threatened List and the national EPBC Act List of Threatened Fauna. Key species found in the study area and its surrounds, are included below.

## Birds

**Small shorebirds / waders:** Hooded Plover<sup>\*^</sup>, Double-banded Plover<sup>M</sup>, Red-capped Plover, Silver Gull, Crested Tern, Caspian Tern<sup>\*</sup>, Red-necked Stint<sup>M</sup>, Common Greenshank<sup>M\*^</sup>, Banded Stilt<sup>M</sup>, Latham's Snipe<sup>M^</sup>

**Large waders:** White-faced Heron, Eastern Grey Egret<sup>\*</sup>, Sacred Ibis, Glossy Ibis, Yellow Spoonbill, Royal Spoonbill, Brolga<sup>\*</sup> (porrongitj)

**Waterbirds:** Grey Teal, Black Swans (connnewarre), Pied Cormorant, Pelican

**Birds found within fringing wetland vegetation:** White-fronted Chat, Golden-headed Cisticola, Orange-bellied Parrot<sup>\*^</sup>

**Woodland birds:** Superb Blue Fairy Wren, Red-browed Finch, Grey Fantail, Grey Shrike-thrush, Singing Honeyeater, Australian Magpie, Eastern Spinebill



Brolga (porrongitj)

Credit: Nicolas Rakotopare via [Bush Heritage](#)



Double-banded Plover

Credit: JJ Harrison via [Wikipedia](#)



Common Greenshank

Credit: David Paul via [Museums Victoria](#)

**Insects:** Yellow sedge-skipper Butterfly<sup>\*</sup>, Bogong Moth, Spotted Wave Moth, Fiddler Beetle, unidentified moth from the Chlorocoma genus



Bogong Moth

Credit: Ajay Narendra via [Nature](#)

**Reptiles and amphibians:** Eastern Three-lined Skink, Blue-tongued Lizard, Tiger Snake, Marbled Gecko, Southern Brown Tree Frog, Growling Grass Frog<sup>\*^</sup>, Eastern Pobblebonk, Spotted Marsh Frog



Yellow-sedge Skipper Butterfly

Credit: [Matt Endicott](#)



Three-banded Skink

Credit: [Mark Tringham](#) via [SCNS](#)



Growling Grass Frog

Credit: DEECA

**Mammals:** Echidnas, Brush-tailed Possum (walert), Bush Rat, Antechinus *spp.* <sup>\*^</sup>, Australian Fur Seal, Southern Elephant Seal<sup>^</sup>, Leopard Seal, New Zealand Fur Seals, Eastern Grey Kangaroo (goim), Swamp Wallaby (go-yin)

**Fish (kuwiyn):** Yellowfin Bream, Black Bream, Big-headed or Flathead Gudgeon, Black Bream, Greenback Flounder, Long-snouted Flounder, Small-mouthed Hardyhead, Tommy Ruff, Yellow-eyed Mullet, Common Galaxias, Australian Salmon



Bush Rat

Credit: JJ Harrison via [Wikipedia](#)



Australian Fur Seal

Credit: Mitch Reardon via [Australian Geographic](#)



Yellowfin Bream

Credit: [Australian Museum](#)

<sup>M</sup>migrates outside of Australia | <sup>\*</sup>threatened species listed under the FFG Act (Vic) | <sup>^</sup>threatened species listed under the EPBC Act (Cth)  
Where known, Wadawurrung language naming is included in brackets.



Orange-bellied Parrot, listed as critically endangered in Victoria and nationally, migrate from Tasmania to the mainland over winter. They feed on the seeds of several saltmarsh species, in particular Beaded Glasswort. The coastal saltmarsh surrounding Breamlea is a known site for the birds and is considered critical ‘core habitat’ within the region (Ecology Heritage Partners, 2020). Photo credit: [Bob McPherson](#)



Hooded Plover, listed as vulnerable in Victoria and nationally, regularly breed and nest at both Breamlea foreshore and Bancoora Beach, and along Thompson Creek. Their exposed nests are present on open sand from August to February, which places them at risk from disturbances, such as unrestrained dogs. Photo credit: [Glenn Ehmke](#)

The Greater Geelong planning scheme contains two Environmental Significance Overlays (ESOs) within the study area and its surrounds (Figure 10). These ESOs recognise the need to conserve and protect important ecological values within the area when considering development.

These ESOs include:

- ESO1: Areas of flora and fauna habitat and of geological and natural interest.
- ESO2: High value wetlands and associated habitat protection.



**Figure 10.** Environmental Significance Overlays within the study area.

In 2019, parts of the Surf Coast Shire and the City of Greater Geelong were declared a Distinctive Area and Landscape (DAL) under the *Planning and Environment Act 1987*. A subsequent declaration in 2021 allowed for a Statement of Planning Policy to be written to ensure values of this area are protected from significant land use change (DEECA, 2022).

Attributes of Breamlea that contributed to the Surf Coast qualifying as a DAL included:

| Attribute                              | Distinctive features                                                                                                                                                                                                                                                                                                      |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Outstanding environmental significance | <p>(a) Creeks, wetlands, saltmarshes, woodlands and beaches in the area provide habitat for numerous state and national threatened species.</p> <p>(b) Areas of biodiversity significance include...Karaaf Wetlands, Breamlea Flora and Fauna Reserve, Thompson Creek...</p>                                              |
| Heritage and cultural significance     | <p>(a) The area has extensive heritage and cultural value including areas of Wadawurrung heritage significance, renowned surfing locations and shipwrecks along the coast.</p> <p>(b) Coastal areas and waterways contain significant Wadawurrung heritage value and are gathering places for the Wadawurrung people.</p> |

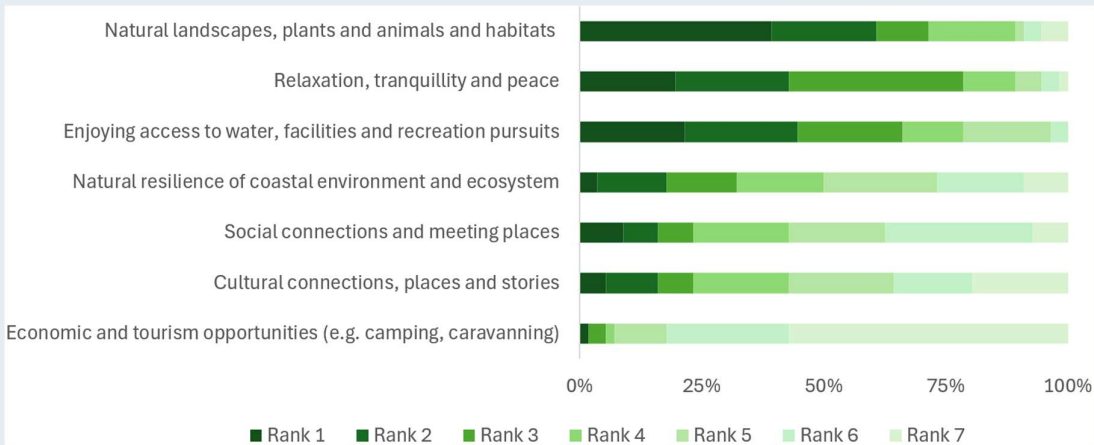


## Community perspectives on the natural environment

Results of our community survey gave a clear indication that the local community and visitors to Bancoora Beach and Breamlea foreshore care deeply for the natural environment. Many comments expressed a desire to prioritise protection of the natural environment, including ensuring that there is little further development and that on-ground management of environmental values is strengthened. We found strong knowledge of the importance of the saltmarsh and wetland environment for the preservation of important species of flora, fauna, and ecological communities as a whole. There is a community commitment to restore the dune system with native species and prevention of intrusion into these sensitive spaces.

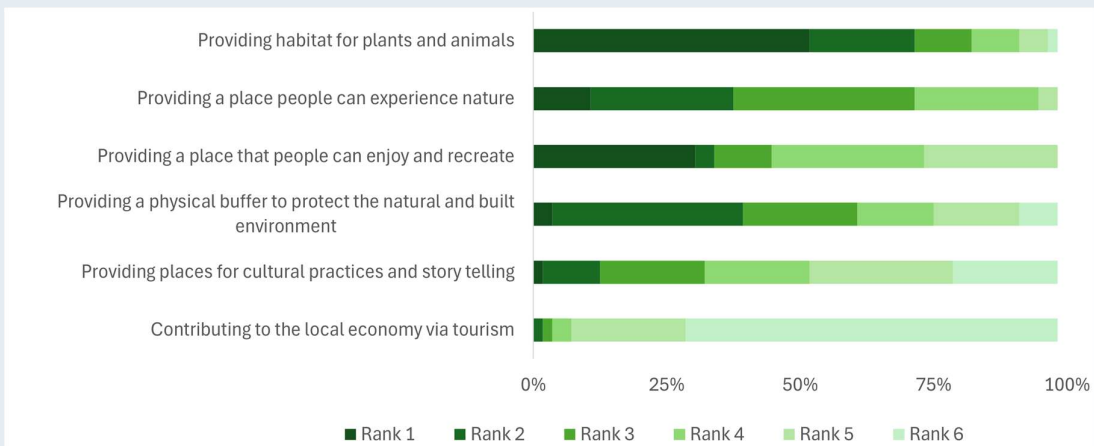


Figure 11 shows that when presented with a range of different coastal and marine values, community members ranked *Natural landscapes, plants and animals and habitats* as the most important value to them.



**Figure 11.** Survey results to the question “What do you value most about Bancoora Beach and the Breamlea foreshore?”. Respondents numbered values 1 to 7, with rank 1 being the most important.

This sentiment was reflected again in relation to coastal functions, where community members reported the most important function of the beach and coast to be *Providing habitat for plants and animals*, followed by *Providing a place people can experience nature* (Figure 12).



**Figure 12.** Survey results to the question “What do you think the most important functions of the beach and coast?”. Respondents numbered values 1 to 7, with rank 1 being the most important.

Many community members recognise a healthy and undeveloped natural environment as the basis for many other aspects they value about Bancoora Beach and the Breamlea foreshore. This includes the quietness, simplicity, and nature-based recreational activities that the area offers.

## 2.5 Coastal connection and stewardship

**Stewardship** can be defined as community participation in activities that achieve positive environmental change and avoidance of environmental harm in the marine and coastal environment. This involves various ways of caring for the natural marine and coastal places that exist in and around the communities we live in.

The local communities of Breamlea and Bancoora are passionate and heavily involved in management of their coastal and marine spaces. There are several active community groups in the area that have coastal management and stewardship as a focus of their group. These include:



Originally founded in the 1930s, the **Breamlea Association** is dedicated to preserving the unique environment and character of Breamlea. It has a long history working with local land managers on projects, including the City of Greater Geelong during development of the 1999 Breamlea Foreshore Masterplan and its update in 2009, and now Barwon Coast. The Association supports community connectedness and provides a regular forum for public discussion on all topics relating to Breamlea, such as development, environmental conservation, and fire management.



**Breamlea Coastcare** is a small and active group of ~10 volunteers formed in the 2000s as part of DEECA's Coastcare Victoria program. The group collaborates with Parks Victoria, Barwon Coast, and City of Greater Geelong to monitor and manage the sensitive saltmarsh in the Breamlea Flora and Fauna Reserve and to restore native vegetation in the dunes, grassland and woodlands of Breamlea and Bancoora. Meeting weekly and hosting regular working bees, Breamlea Coastcare also engages in community education, promoting biodiversity and conservation across the area. In 2023, the group spent a total of 310 hours weeding and planting (Barwon Coast, 2023).



Formed as part of Birdlife Australia's Beach-Nesting Birds Project in 2006, the **Friends of the Hooded Plover Bellarine** group works to protect this vulnerable shorebird through conservation, monitoring, and public education. Volunteers collaborate closely with Barwon Coast to safeguard nesting areas and gather data on the resident Hooded Plover population.

Barwon Coast maintains close working relationships with each of these groups, recognising the expertise and commitment present among their members. Barwon Coast promote community stewardship and care through their own education programs and resources, such as the 'Share our Shores' campaign.



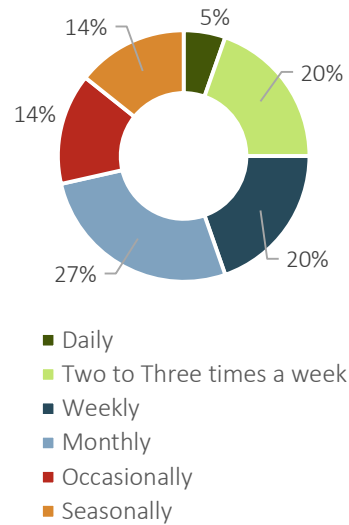
Left: revegetation work of Coastcare volunteers. Credit: [Barwon Coast](#). Right: Share Our Shores signage. Credit: [Alluvium](#)

## 2.6 Beach recreation at Bancoora Beach and Breamlea Foreshore

Bancoora Beach and the Breamlea foreshore are the social and recreational hub of the area, being visited regularly by locals and visitors.

Figure 13 shows the reported visitation frequency of our community survey respondents. It shows that 45% of community members visit the beach or foreshore at least weekly, which included all permanent residents. Those that visit less frequently were predominately residents of nearby towns, such as Barwon Heads, Torquay or Ocean Grove, or those who were holiday homeowners.

The beach and foreshore offer many different forms of recreation, attracting surfers, swimmers, and families who enjoy its patrolled waters. Bancoora is the only patrolled beach in the area, with signage advising caution for other beaches. The coast is readily accessible for locals and visitors, with six beach access paths from the township and Caravan Park to the shoreline. There is also an all abilities access path from the Bancoora SLSC to the beach, and a track linking the Breamlea Caravan Park to the picnic area and public facilities at the clubhouse and surrounds.



**Figure 13.** Visitation to Bancoora Beach and Breamlea foreshore.



The beach and foreshore are also known for their tranquillity, lack of crowds, and family friendly nature, making it an ideal place for relaxation and walking. The dunes offer a scenic backdrop for walking, with formalised paths protecting the delicate dune ecosystem. Neighbouring the beach area, Breamlea's Thompson Creek draws fishers, kayakers, and small boat enthusiasts, while the wetlands and saltmarsh provide diverse birdwatching opportunities.

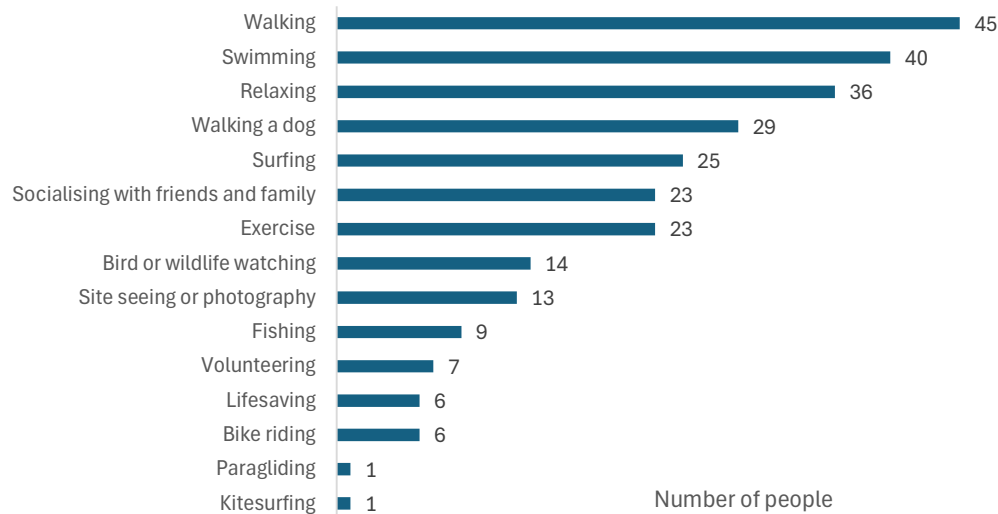


*Bancoora Beach.*



Figure 14 shows the range and popularity of activities performed at Bancoora Beach and the Breamlea foreshore, as reported by respondents to our community survey. The results show that passive activities enhanced by the natural environment are very popular.

The most common activities were *walking* (80% of people), *swimming* (71%), *relaxing* (64%), *walking a dog* (52%), *surfing* (47%), *socialising with friends and family* (41%) and *exercise* (41%).



**Figure 14.** Activities done at Bancoora Beach and / or Breamlea foreshore.

The beach is an important community hub for locals, as well as attracting beachgoers travelling from around the region to Bancoora. However, growing populations across Armstrong Creek on the outskirts of Geelong are increasing pressures on the use of the beach and the limited visitor facilities of the Breamlea township. A key issue is that parking availability at the Bancoora SLSC exceeds capacity during busy summer periods, leading to vehicles parked along local streets or in wetland environments. This overflow impacts area safety by obstructing the sole access road into and out of the township, potentially hindering emergency vehicle access.

### Bancoora Surf Life Saving Club

Founded in 1962, the Bancoora Surf Life Saving Club (SLSC) is a volunteer-led, non-profit organisation dedicated to beach safety. The club performs beach patrol services at Bancoora Beach, from late November through to late April. The club offers programs teaching children and teens water safety skills and lifesaving techniques, paving the way for future surf lifesavers.

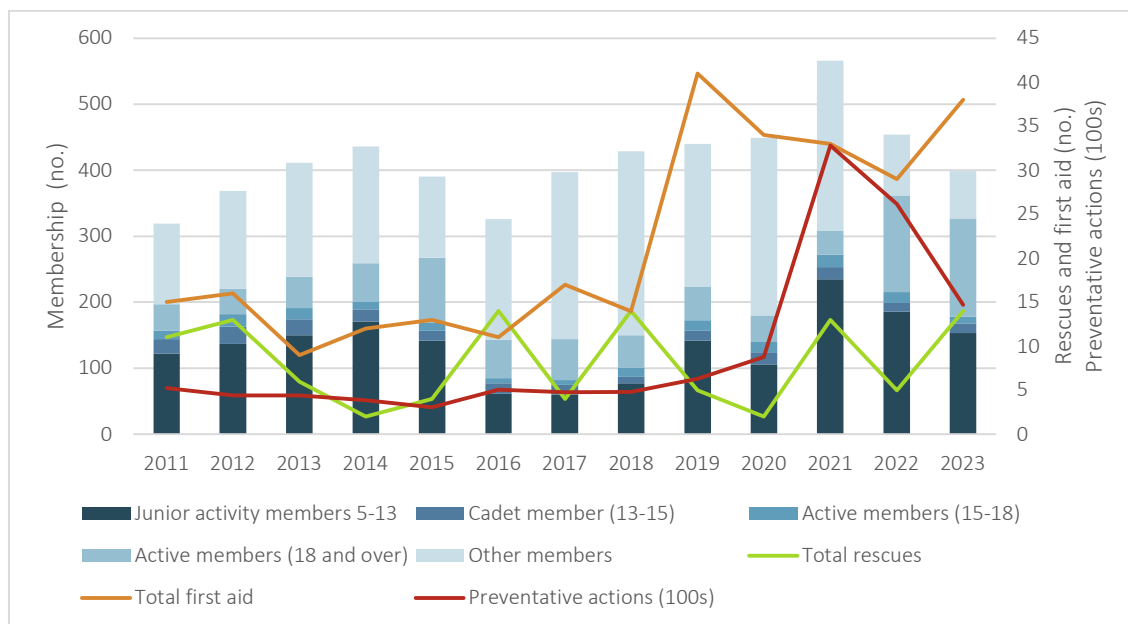
In the 2023-24 season, the club saw a record membership of over 500 members, with the popular Nippers (8-14 years) program growing to nearly 190 participants. Other programs offered include the Mozzies (5-7 years) and Young Guns (>14 years) (Bancoora SLSC, 2024).



*Bancoora SLSC surf life savers on Bancoora Beach. Credit: [Bancoora SLSC](#).*

Club members contributed 2,190 hours of patrol time in the 2023-24 season, ensuring the safety of beachgoers on weekends, public holidays, and during peak weekday periods. The club also contributes to fostering community connection through holding social events and gatherings throughout the season, such as the opening of the 'Banny' bar. The SLSC clubhouse area offers facilities for visitors that include BBQ areas, public toilets, and parking.

Figure 15 shows the membership numbers and key rescue figures for the Bancoora SLSC from 2011 to 2023.



**Figure 15.** Barcoora SLSC membership numbers (blue bars), total rescues (green line), total first aid (orange line) and preventative actions (in 100s, red line) from 2011 to 2023.

The Barcoora SLSC is currently undergoing a significant redevelopment of its clubhouse. Accuraco has been appointed as Project Manager, supported by a Project Steering Group that comprises representatives from Barwon Coast, Barcoora SLSC, and other community bodies. Working closely with stakeholders, including WTOAC and DEECA, the SLSC's Building Committee is planning to deliver an inclusive, culturally and environmentally sensitive facility.

In 2022, the club received **state funding of \$4.125 m for the redevelopment**, however, additional funds will be needed to fully realise the project.



*The Barcoora SLSC clubhouse positioned between the sand dunes and wetlands. Credit: Alluvium.*



## 2.7 Breamlea Caravan Park

The Breamlea Caravan Park has a long history with the local community. Set within Breamlea's serene bush environment, the Caravan Park contains 141 camping sites, 62 of which are 12-month permit sites, in addition to three eco-villas and a cabin (Figure 16).



**Figure 16.** Breamlea Caravan Park (Imagery: October 2022, NearMap).

Many visitors to the park are longstanding, having returned to Breamlea for decades, forming a distinct and close-knit community. The park contains a number of recreational facilities, including a recreation room, playground, basketball area and sand volleyball area. There is direct access to the beach via two dune tracks. The park is known for its sense of calmness and amenity, close to nature.





The park’s recreation room often serves as a community meeting hall for residents of Breamlea. The caravan park also includes a reception area and a small shop. The park contributes to the social cohesion and liveability of the Breamlea township and also provides a playground, picnic facilities and BBQs for visitors.

The Breamlea Caravan Park is also an important economic asset within the area for Barwon Coast. The income generated from the park contributes to the funding of Barwon Coast's coastal management operations across the Breamlea foreshore and Bancoora Beach (Barwon Coast, 2023). The Caravan Park serves as an important social and economic hub for the Breamlea community, while its revenue directly supports the region’s environmental management.



2.8 Vision and objectives for adaptation planning

A vision provides an aspirational goal to strive for into the long-term. Setting the direction for adaptation, it helps align work with community and stakeholder needs and creates a positive driver for change. The vision:

- supports key **values** which detail what is important to rightsholders, the community and stakeholders and
- summarises **adaptation objectives** which detail how adaptation may support values and guide adaptation planning.

Developing the vision, place-based values and objectives considered the current and emerging challenges and opportunities for the future of Bancoora and Breamlea. Values are not mutually exclusive, and coastal hazard and climate change impacts could impact upon multiple values.



Table 5 details the Bancoora CAP, values, objectives and vision. These also reflect the Marine and Coastal Policy Planning and decision pathway:

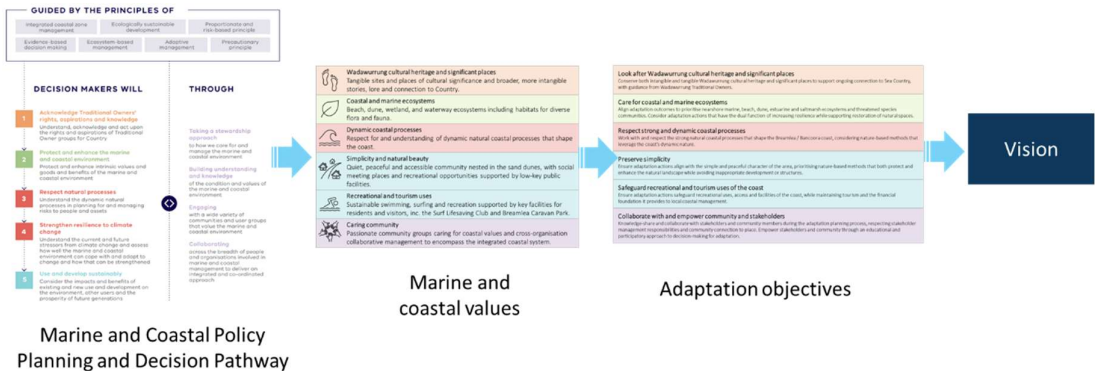


Table 5. Bancoora CAP vision, values and objectives.

| Our core values for the Bancoora CAP are:           |                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VALUES                                              |  <b>Wadawurrung cultural heritage and significant places</b><br>Tangible sites and places of cultural significance and broader, more intangible stories, lore and connection to Country.                                                                                              |
|                                                     |  <b>Coastal and marine ecosystems</b><br>Beach, dune, wetland, and waterway ecosystems including habitats for diverse flora and fauna.                                                                                                                                                |
|                                                     |  <b>A wild and dynamic coastal processes</b><br>Respect for and understanding of dynamic natural coastal processes that shape the coast.                                                                                                                                              |
|                                                     |  <b>Simplicity and natural beauty</b><br>Quiet, peaceful and accessible community nested in the sand dunes, with social meeting places and recreational opportunities supported by low-key public facilities.                                                                         |
|                                                     |  <b>Recreational and tourism uses</b><br>Sustainable swimming, surfing and recreation supported by key facilities for residents and visitors, including the Surf Lifesaving Club and Breamlea Caravan Park.                                                                           |
|                                                     |  <b>Caring and connected community</b><br>Passionate community groups caring for coastal values and cross-organisation collaborative management to encompass the integrated coastal system.                                                                                           |
| In order to support core values, adaptation will:   |                                                                                                                                                                                                                                                                                                                                                                        |
| OBJECTIVES:                                         | <b>Look after Wadawurrung cultural heritage and significant places</b><br>Collaborate with Wadawurrung Traditional Owners in adaptation to manage both intangible and tangible Wadawurrung cultural heritage and significant places, minimise impacts on Wadawurrung values and support ongoing connection to Sea Country.                                             |
|                                                     | <b>Care for coastal and marine ecosystems</b><br>Align adaptation outcomes to prioritise nearshore marine, beach, dune, estuarine and saltmarsh ecosystems and threatened species. Consider adaptation actions that have the dual function of increasing resilience while supporting restoration of natural spaces.                                                    |
|                                                     | <b>Respect strong and dynamic coastal processes</b><br>Work with and respect the strong natural coastal processes that shape the Breamlea / Bancoora coast, considering nature-based methods that leverage and support the coast's dynamic nature to continue.                                                                                                         |
|                                                     | <b>Preserve simplicity</b><br>Ensure adaptation actions align with the simple and peaceful character of the area, prioritising nature-based methods that both protect and enhance the natural landscape while avoiding inappropriate development or structures.                                                                                                        |
|                                                     | <b>Safeguard recreational and tourism uses of the coast</b><br>Ensure adaptation actions safeguard recreational uses, access and facilities of the coast, including use of and access to sandy beaches, maintaining sustainable tourism, visitation and the financial foundation these provide to local coastal management for as long as possible.                    |
|                                                     | <b>Collaborate with and empower community and stakeholders</b><br>Knowledge-share and collaborate with stakeholders and community members in adaptation, respecting stakeholder management responsibilities and community connection to place. Empower stakeholders and community through an educational and participatory approach to decision-making for adaptation. |
| Our vision encompasses these values and objectives: |                                                                                                                                                                                                                                                                                                                                                                        |
| VISION:                                             | Across the Breamlea / Bancoora coast <b>Wadawurrung cultural heritage and significant places, coastal and marine ecosystems, and recreational and tourism uses</b> are adaptive to coastal hazards. In addition, the <b>simplicity and natural beauty</b> of the area is valued by a <b>caring community</b> , that <b>respects dynamic coastal processes</b> .        |

### 3 Coastal processes and hazards

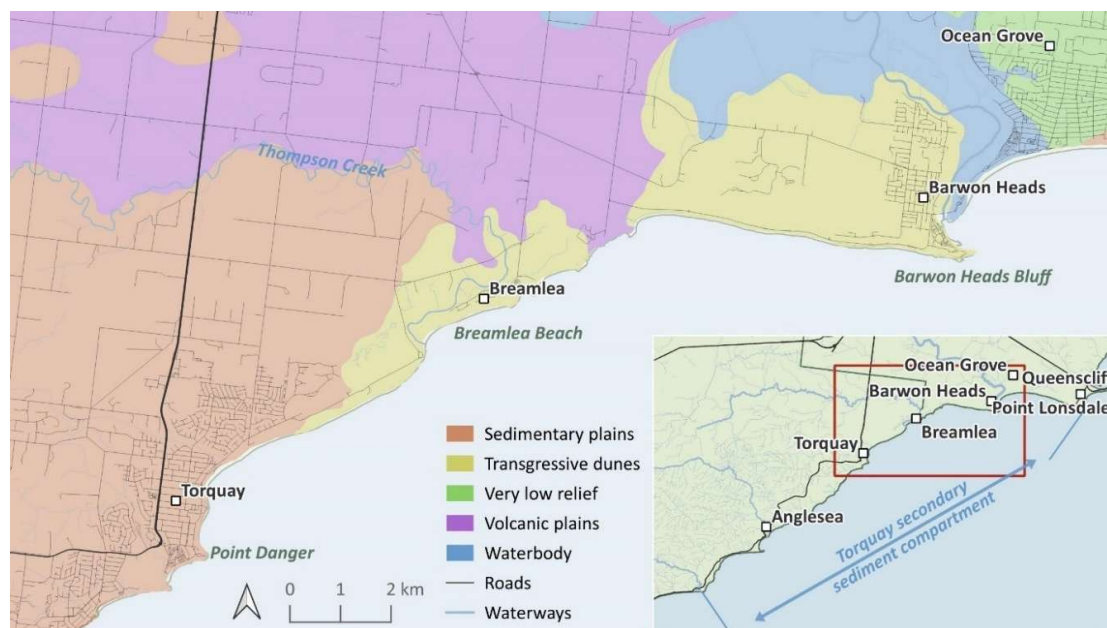
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Stage 3</b><br><b>Coastal hazard exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Assess coastal hazard exposure, including scenarios that enable best practice approaches to assessing current and emerging risk |
| <p>The local coastal setting, environmental drivers and processes underpin understanding of coastal hazard exposure. This stage examines how coastal processes and resulting hazards in the absence of adaptation intervention might change over time. Understanding coastal hazard exposure includes examining hazard data and scenarios that enable best practice approaches to risk assessment and adaptation planning. This understanding can be used to inform assessment of risk and vulnerability (Stage 4) to determine where and when an adaptation response might be required.</p> |                                                                                                                                 |

#### 3.1 Geomorphic setting

The Bancoora and Breamlea coast sits between Point Impossible to the southwest and Black Rocks to the northeast. The coast is made up of a series of beaches, headlands and rocky outcrops, facing predominantly southeast. Broadly, the Bancoora and Breamlea coast sits with the Torquay secondary coastal compartment. Most of the coastal area is a dune system with narrow sandy beaches. The Thompson Creek estuary meanders behind the township, reaching the ocean just east of Point Impossible. Further east, the volcanic plains reach the ocean and the region (known as Black or Blue Rocks) sees basalt outcrops and shore platforms.

The present-day landscape of the Surf Coast was produced during the mid-Holocene marine transgression (approximately between 11,800 – 8,700 years before present) when sea level rose submerging the Bass Basin to form Bass Strait and its unique coast (Harris and Heap, 2009). The Breamlea and Bancoora landscape is a function of the region's local geology and tectonics.

The underlying geology of the study area varies and is mainly comprised of Holocene and Pleistocene sedimentary and dune deposits (Figure 17). There is an extensive area of low-lying floodplain surrounding Thompson Creek, with the barrier dune system separating this from the open ocean. Low-lying wetland areas extend across the Thompson Creek estuary through to where the geology changes to basalt lava flows associated with Mount Duneed and the land elevation becomes higher towards Black Rocks. The Black Rocks area and surrounding volcanic plains are relatively unique in that the volcanic plains reach the ocean.



**Figure 17.** Geomorphological management units across the Bancoora/Breamlea coast



Key features of the study area summarised from Cardno (2015a), from west to east include:

### **Point Impossible**

The headland at Point Impossible is soft sandstone bedrock cliff with rocky reefs and shore platforms. The headland is bordered by Whites Beach to the southwest and the Thompson Creek estuary to the northeast. There is a small beach in front of the car park. The Point provides some protection for the Breamlea Beaches from southwesterly swells. The Great Ocean Road Coast and Parks Authority manage the Point and westwards to Warrnambool.



*Photo: Looking southwest across Point Impossible*

### **Thompson Creek estuary**

The Thompson Creek estuary is an intermittently open/closed estuary. The mouth opens and closes in response to catchment flows and coastal processes. When there is low flow in the creek a beach berm builds up which separates the estuary from the ocean (i.e. the estuary is closed). If the mouth remains closed for a long time, any freshwater inflow builds up behind the berm and the water levels in the estuary rises. The entrance opens naturally when the water level in the estuary is higher than the berm.



*Photo: Looking southwest across the Thompson Creek estuary*

### **Breamlea and Bancoora beaches**

The Breamlea and Bancoora beaches are relatively wide with low angle slopes and some tidal rock platforms. The two beaches exhibit a characteristic crescent shape between volcanic boulder outcrops, with a third, small pocket beach (called Stingray / Buckleys Bay) between. Sediments taken from Bancoora Beach show that the dune sample is mostly fine sediment, with the swash sample containing more medium and coarse grain sizes. The Breamlea barrier dune ranges in height from 0 m AHD to over 20 m AHD, the landward side is covered with private dwellings. The beaches are slightly skewed to the east, indicating the dominant longshore drift is from the southwest to northeast.



*Photo: Looking southwest along Breamlea Beach*

### **Black Rocks**

The northeast end of Bancoora Beach is held by volcanic boulders, eroded from the inland volcanic area of Mt. Duneed. These boulders front a higher bluff, around 5 metres above the water. The Barwon Water Black Rock Water Reclamation Plant sits on top of this bluff. A 1.2 km pipeline extends from the bluff and sits along the ocean floor.



*Photo: Looking northeast across Black Rocks*

Attachment 3 provides further information on the geomorphic and landscape setting of the study area. This includes maps and profiles of elevation across the study area.

## 3.2 Coastal processes and drivers

Natural marine and coastal processes include many complex, changing and connected actions. Drivers of change such as wind, waves and tides work to move water and sand. These changes can be at either regional or local scales, and over long or short timeframes. These processes shift and evolve, creating dynamic and complex systems. Key coastal processes and drivers of change include:



### Astronomical tides

Astronomical tides are the tidal water levels that result from Earth's rotation and gravitational effects of the Earth, sun and moon. Understanding these tidal ranges helps us understand the range of water levels expected under 'normal' conditions (i.e. not in storm events). The tides along the Surf Coast follow a semi-diurnal pattern, that is, the region experiences two high and two low tides each day. The Highest Astronomical Tide (HAT) and Lowest Astronomical Tide (LAT) across the region are between +1.3 m AHD and -1.5 m AHD, meaning the tidal water levels can vary by about 2.8 m.



### Climate drivers

Weather fronts travelling from west to east, most frequent during the winter months, are the main cause of elevated sea levels along Victoria's southern coast. Natural variability in climate drivers also affects weather patterns from year to year. This influences the year-to-year frequency of extreme sea levels. These climate drivers include the Southern Annular Mode (SAM) and El Niño Southern Oscillation (ENSO). Under climate change, there is potential for more high-pressure systems along the Victorian coast and further anticlockwise rotation of wave direction. The frequency of extreme La Niña events is also predicted to increase. This may result in an increase in easterly trade winds approaching the Victorian coast and an increase in erosion and westward sediment transport at Breamlea and Bancoora.



### Wind climate

In winter (June to August), the most prevalent winds across the study area are northerlies; while in summer (December to February) southerly winds (mainly southeast to south westerly) are prevalent. Spring and autumn represent a transition between the two dominant seasons and the wind patterns are a mixture of the summer and winter patterns. Available historical wind data (from ~1990 to 2023, Attachment 4) shows this trend. It is also evident that mean wind speeds are generally higher in winter and spring months (July to October) and that wind speeds are generally higher in the afternoon (3pm), compared to the morning (9am).



### Wave climate

While the predicted largest wave heights in deep water offshore from the coast are from the southwest, these large waves are refracted (bent around headlands) before they reach the surf coast. This means that waves from the southwest are not necessarily the largest waves reaching the coast. The largest waves reaching the coast tend to be from the south to east, which have smaller offshore wave heights, but can move towards the coast with fewer barriers such as headlands.



### Sediment transport

Across the study region, net transport is in an easterly direction. As part of the Bellarine LCHA, Cardno (2015a), net sediment transport was estimated to be in the order of ~560,000 m<sup>3</sup>/year. These rates represent an annual mean rate and longshore sediment transport could be quite different when an extreme storm occurs.

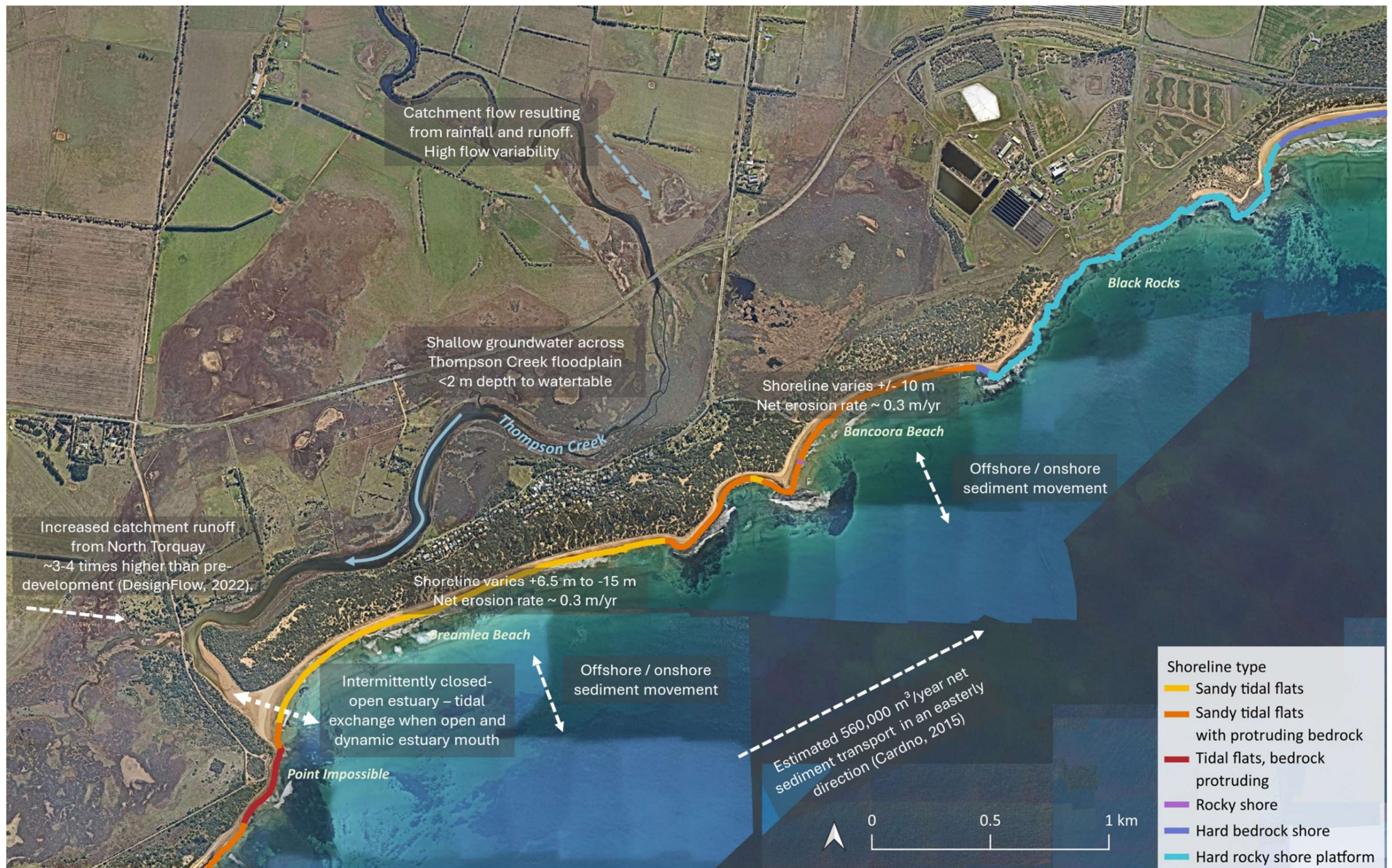


### Geological controls

Geological controls such as natural rocky outcrops, headlands and artificial structures also influence longshore sediment transport. Due to the positioning between rocky headlands, Breamlea and Bancoora beaches are within a semi-closed sediment compartment. This means the sediment transport operates between the headlands, with small volumes of sediment coming from cross-shore and small volumes being lost alongshore.

Figure 18 summarises the shoreline types and coastal processes across the Breamlea and Bancoora area. Further information on climate drivers and coastal processes is provided in Attachment 4.





**Figure 18.** Coastal processes summary and shoreline classification (Smartline, Geoscience Australia, 2016) summarised from various sources.



### 3.3 Climate change and sea level rise

Sea level rise (SLR) has been observed in the last century and is expected with high certainty to accelerate in the coming decades and beyond, even if carbon emissions are reduced and stabilised globally. According to climate models, global sea levels are expected to rise under a range of emission scenarios and socio-economic pathways in the coming decades and centuries. Sea level is predicted to rise for centuries to millennia in the longer term due to continuing deep ocean warming and ice sheet melting and will remain elevated for thousands of years. In the shorter term, it is certain that global mean sea level will continue to rise over the 21<sup>st</sup> century.

Sea level rise and other changes in climate drivers can influence how coastal processes may change across the study area. The implications of potential changes to the climatology of the southern regions of Australia, as well as possible sea level rise need to be considered and incorporated into future planning. Sea level rise as a consequence of future climate change will result in potentially greater depths of water over the wide flat seabed slopes, allowing greater wave energy reaching the nearshore waters.

#### **Impacts of climate change on the study area:**

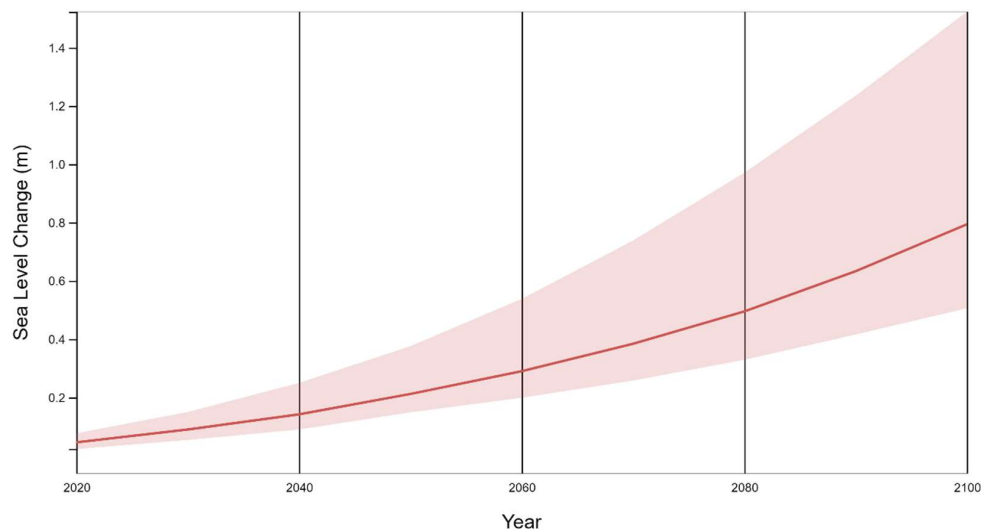
With respect to climate change, McInnes *et al.* (2011) found that, for the Surf Coast region, there is expected to be an anticlockwise shift in predominant wind direction. This means the direction at which waves approach the coast will be rotated and waves from the east will be higher than present. These changes affect sand movement along (alongshore) and perpendicular to (offshore/onshore) the coast. McInnes *et al.* (2011) also concluded that there may also be a greater frequency of storm events, resulting in less time for beaches to recover from erosion between events.

Sea level rise increase of 0.8m from baseline levels is in line with current International Panel of Climate Change (IPCC) projections for the Victorian Coast, under the High-Warming Low Confidence scenario (Figure 19). The Shared Socioeconomic Pathway scenario represents a conservative case wherein no additional climate policy is enacted by the year 2100. Planning for sea level rise of no less than 0.8 m by 2100 is also part of the Victorian Marine and Coastal Policy.

#### **Victorian Marine and Coastal Policy:**

*Policy 6.1: Plan for sea level rise of not less than 0.8 metres by 2100, and allow for the combined effects of tides, storm surges, flooding, coastal processes and local conditions such as topography and geology, when assessing risks and coastal impacts associated with climate change.*

Benchmarks are currently under review by DEECA. The timing of this project and existing coastal hazard data availability means that technical and strategic work for this project will align with the current policy requirements, adopting the planning benchmark of no less than mean sea level (MSL) + 0.8 m by 2100. Where data exists, higher sea level rise scenarios will be considered.



**Figure 19.** Sea level rise projections for Lorne under High-Warming Low Confidence scenario, adapted from the IPCC Sixth Annual Report. Source: NASA SLR projection tool.

### 3.4 Coastal hazards

Natural coastal processes such as short- and long-term erosion and inundation shape the diverse features of the coastal zone. These processes are often referred to as coastal hazards when they impact on safety, environmental, cultural, social and economic values, uses and infrastructure.

Coastal hazards considered in adaptation planning include coastal erosion, storm tide inundation, permanent inundation, estuary dynamics and groundwater intrusion. The level to which these processes can be assessed is dependent on the information and data available for the study area. These processes are described further below, with available coastal hazard information detailed in Section 3.5.

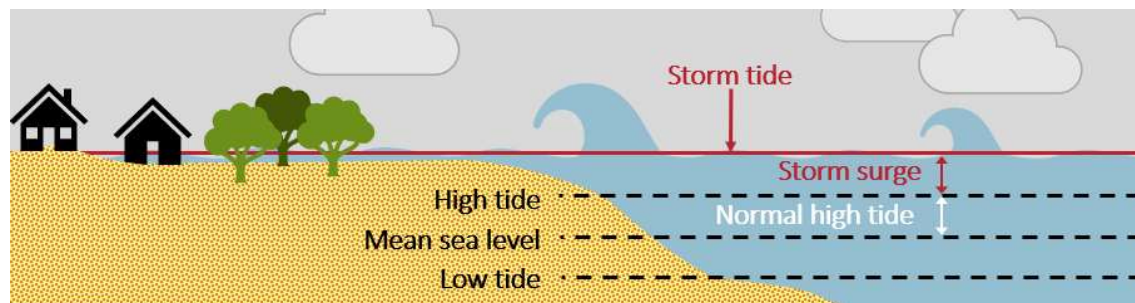
#### Storm tide inundation

Storm tide inundation is the temporary inundation (flooding) of low-lying coastal land from a locally elevated sea level (storm tide). Combined influences cause storm tides, including:

- the predicted tide (regular changes in water levels associated with movements of the moon and sun)
- low pressure air systems causing increases in sea level (storm surge)
- high wind-generated waves associated with severe storms.

Storm tides inundate low-lying land for periods of hours to days, including coastal wetlands, marshes, inlets and estuaries. Storm tide inundation can also combine with catchment flooding from severe rainfall events, increasing the extent, depth or duration of inundation in some areas.

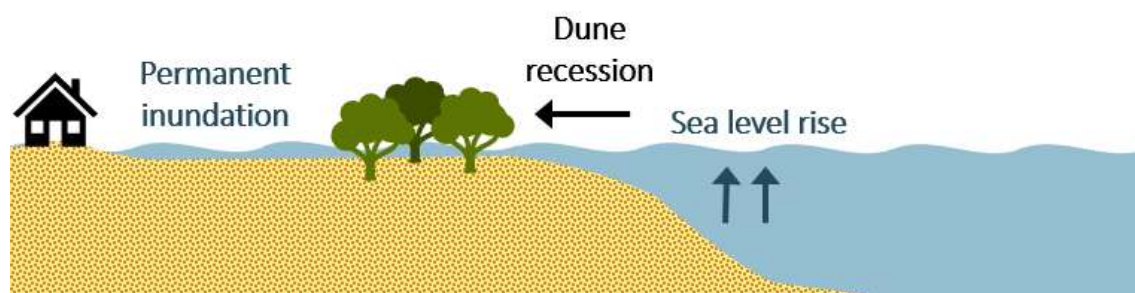
Storm tide inundation can be modelled using both static (bathtub fill) and dynamic (modelling the movement of water) methods.



#### Permanent inundation (increasing tidal areas due to sea level rise)

Tidal inundation is the regular or permanent inundation of land due to rising sea levels. Tidal areas are generally modelled using a static (bathtub fill) method or by projecting a tidal plane + sea level rise across an area. While termed permanent inundation, these areas represent where regular tides are likely to reach. The Highest Astronomical Tide (HAT) is often used as a representation of the highest tide expected to occur under average meteorological conditions.

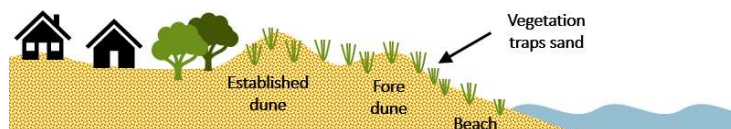
Sea level rise also exacerbates existing risks of coastal erosion and storm tide inundation.



## Erosion

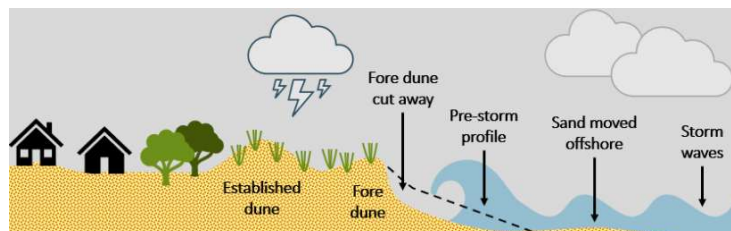
Sandy beaches, such as those at Bancoora and Breamlea, tend to experience erosion associated with storm events. Sand is moved offshore during storm conditions, then gradually rebuilds in calmer periods.

### Normal beach calm conditions



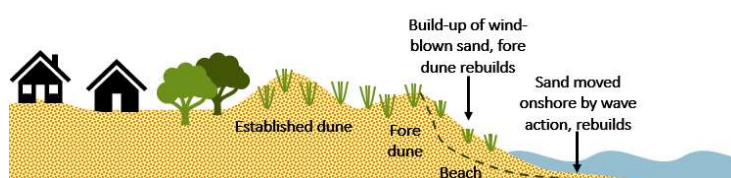
Natural dune systems go through periods of erosion and accretion. Dune vegetation has a key role in assisting dune growth, by helping trap sand.

### Storm conditions



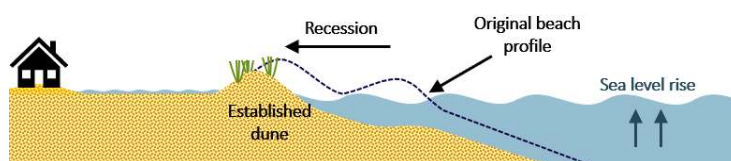
Erosion can occur when winds, waves and coastal currents shift sediment away or along the shoreline, sometimes just offshore. Short term erosion (storm bite) is associated with big storms.

### Dune rebuilds during calm conditions



In calm conditions, wind and waves act to transport sand onshore, building up the dune. For a stable beach, all the sand moved offshore in a storm eventually moves back onto the beach, and the shoreline position stays the same over time.

### Long term recession and inundation



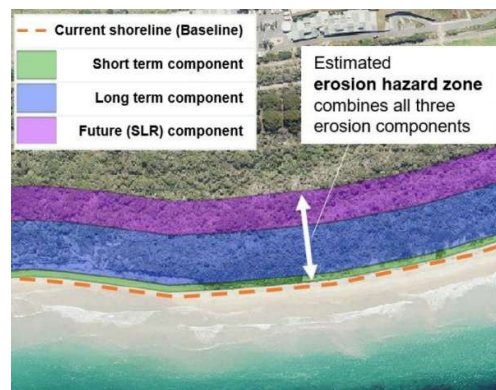
In some cases, changes in sediment supply or climate conditions (such as bigger or more frequent storms), means the beach may not rebuild fully between storm events.

With less sand retained on the beach over time, long-term erosion (recession) may occur; this means the shoreline position (e.g. vegetated dunes and high tide beach) moves incrementally landward (over several decades).

Erosion prone areas can be modelled (Figure 20), by considering:

- **Short term shoreline change** arising due to storms. This considers the ability of the shore to recover (rebuild). This is influenced by shoreline type. Some sandy shores can rebuild over time, while cliffs and softer sediments, are unable to rebuild.
- **Long term shoreline change** based on ongoing trends and fluctuations through monitoring decades of change.
- **Shoreline response to sea level rise** shifting further landward due to increasing water levels and waves reaching further inland, based on shoreline elevation and shape, type (i.e. sand, rock, cliff etc.) and how it might respond to wave action.

Factors for dune slumping or instability are also considered.

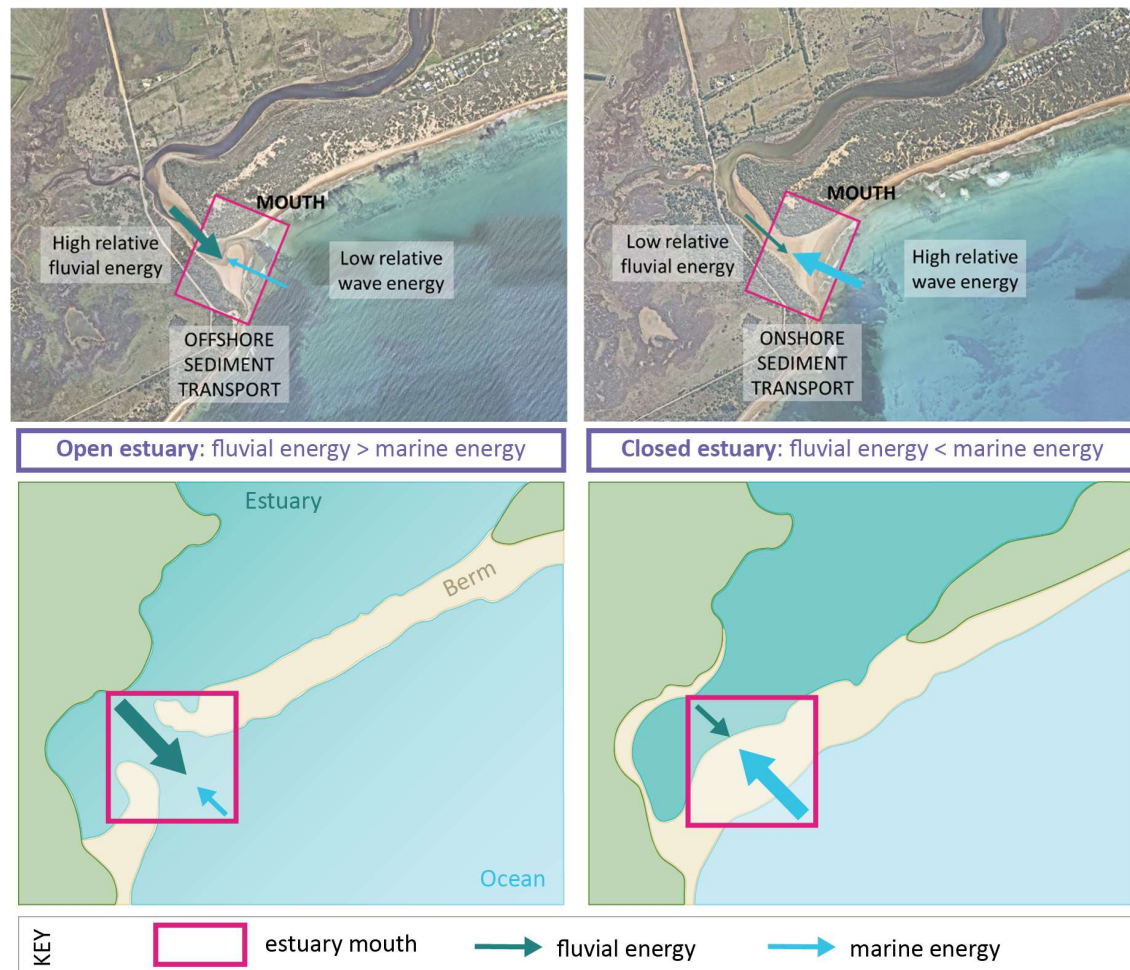


**Figure 20.** Components of erosion hazard zones (setbacks) from a baseline.



## Estuary dynamics

The Thompson Creek estuary is classified as an Intermittently Closed and Open Lake and Lagoon (ICOLL). These types of estuaries experience periodic closure in times of low river (fluvial) flow and high onshore sediment transport (Figure 21). When river flow increases, the estuary can open. The dynamic entrance conditions make these estuaries highly sensitive to environmental change and important habitats for bird and aquatic species.



**Figure 21.** An estuary in an open state (left) because fluvial energy exceeds marine wave energy versus an estuary in a closed state (right) because marine wave energy exceeds fluvial energy.

There is no preferred state for an estuary, as both open and closed states are a part of the natural estuary cycle. Artificial estuary openings are considered as a management option when high water levels have a significant impact on the environmental, social and economic values of the estuary. There are several risks associated with artificial entrance opening including loss of oxygenated surface water, impacts to vegetation, fish kills, poor water quality and unsuccessful opening (i.e. the estuary closes again soon after). Estuary managers (in this case the Corangamite CMA) will carefully consider the risks associated with artificial estuary openings.

### **Estuary response to sea level rise:**

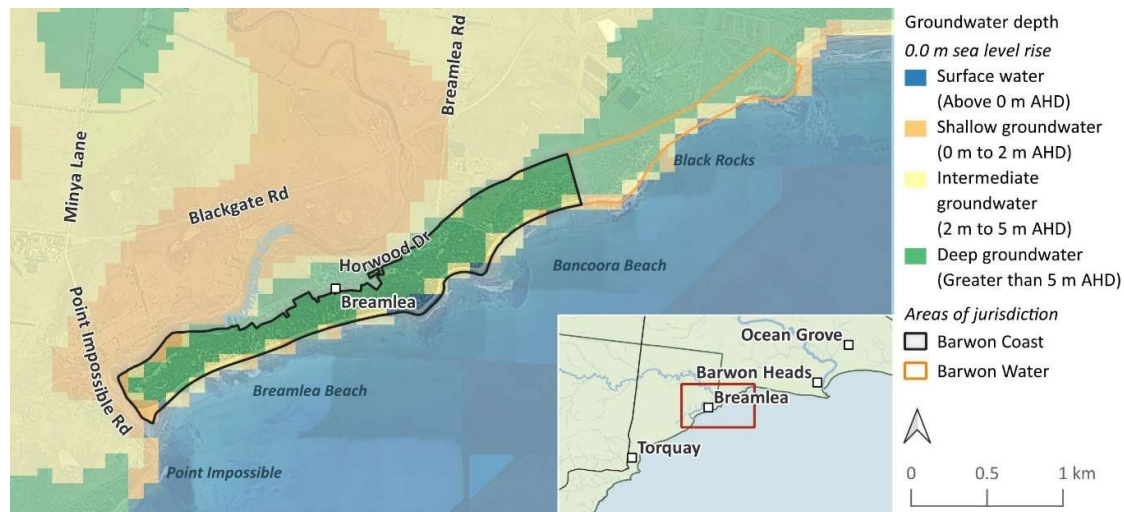
Estuaries are dynamic environments. They typically have a number of complex processes which drive the shape and limits of the estuary, including accretion (local sand build-up) and erosion (local sand loss). The ability to predict future response of these shorelines to sea level rise is often limited as the complex interplay between processes differs vastly for different systems, resulting in different outcomes. Generally, in estuarine environments, sea level rise may cause an increase in the area that becomes tidally inundated.

## Groundwater

Groundwater is important for ecosystems, waterways, and lakes. It is also used for agriculture, industry, and home use. Coastal processes and sea level rise can impact on groundwater depth and salinity. These changes can impact the many values and uses of groundwater. Groundwater can provide:

- baseflow to rivers, streams, and swamps
- environmental water flows to ecological systems and groundwater-dependent ecosystems
- water sources to support commercial industries and agricultural production
- cultural and heritage features such as mineral springs and wells

The Breamlea and Bancoora area sees shallow groundwater around the Thompson Creek floodplain (Figure 22). The study area is situated in a local groundwater flow system where groundwater generally flows shorter distances (<5 km). These systems are fastest to respond to change. Groundwater salinity in the region is around 1,000-3,500 mg/l. This means groundwater is brackish, suitable only for certain irrigation crops and stock use.

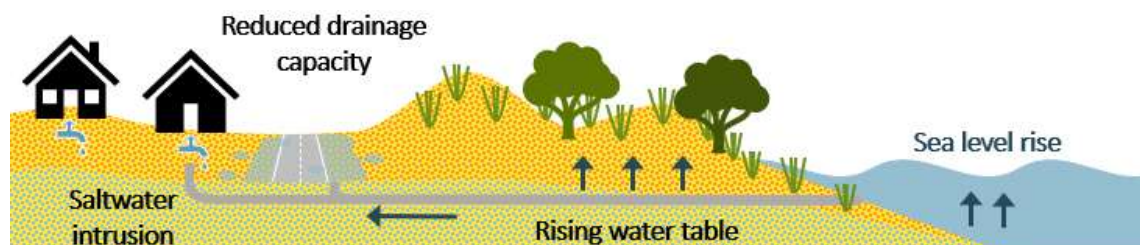


**Figure 22.** Current groundwater depths at Breamlea - Port Phillip Bay Coastal Hazard Assessment

Groundwater systems are hugely complex. Occurring almost everywhere below the surface, they combine many different environmental processes. Near our coasts, interactions between surface water, seawater and groundwater are particularly complex. Groundwater is often discharging to the sea, while seawater sometimes recharges groundwater aquifers. Freshwater and saltwater have different salinity levels, which influences the density of water, and interactions and mixing between fresh and salt water.

Under natural conditions, fresh groundwater moves towards the sea in coastal areas. Discharging fresh groundwater tends to form a 'salt wedge' with seawater along the coast. Saltwater is denser (heavier) and sits below fresher, less dense (lighter) water. The amount of saltwater generally reduces with distance from the coast. The salt wedge will likely move further inland with rising sea levels or due to decreasing groundwater discharges. This means areas further inland may have saltier groundwater.

Given groundwater systems are complex, changes are often considered at a higher or conceptual level, without detailed modelling available.



### 3.5 Available coastal hazard information

#### State requirements

In accordance with the State Government approach and requirements for coastal hazard assessment and adaptation planning, technical assessments have sought to adopt a best practice approach. Best practice adaptation planning should consider a range of planning horizons and associated sea level rise scenarios over the short, medium and long term to 2100+. Where coastal hazard information is available, assessment of higher sea levels can also inform the risk and vulnerability assessment and test the ‘sensitivity’ of assessments to higher sea level rise benchmarks.

A planning horizon is an indicative timeframe by which a projected sea level rise scenario is anticipated to occur. Planning horizons do not represent a step change in projected sea level, but an indication of the time period by which a certain sea level rise is expected to occur. For example, a sea level rise of MSL + 0.8 m is expected by, if not before, the year 2100. Table 6 details planning horizons for the Bancoora CAP.

Table 6. Planning horizons and sea level rise.

| Planning horizon | Time step      | Indicative time period | Sea level rise (SLR) |
|------------------|----------------|------------------------|----------------------|
| Short term       | 0 to 25 years  | Present day            | Mean sea level (MSL) |
|                  |                | 2040                   | MSL + 0.2m           |
| Medium term      | 25 to 50 years | 2070                   | MSL + 0.5m           |
| Long term        | 50 to 75 years | 2100                   | MSL + 0.8m           |
| Sensitivity      | 75 years +     | 2100+                  | MSL + 1.1 to 1.4 m   |

#### “Present day” sea level:

The concept of “present day” mean sea level (MSL) can often be misleading. Depending on the timing and approach taken for various coastal hazard assessments, this baseline mean sea level may vary and can be outdated by decades or more. Assessments also often use topographic and water level information that predates the assessment itself, sometimes by a number of years. This means that “present day” (i.e. 2024) sea levels may be closer to a “short term” scenario (i.e. +0.2 m SLR). Baseline sea levels are discussed further below.

#### Planning horizons:

While specific years (2040, 2070, 2100) are provided in planning horizon descriptions, these are indicative only and the corresponding sea level is expected **by** this year. As sea level rise is a gradual change these years do not represent a step change in sea levels. Uncertainty in rates of rising sea levels and future projections may alter these years. Planning for indicative short-, medium- and long-term changes informs adaptation.

State policy requires us to consider the combined effects of tides, storm surges, flooding, coastal processes and local conditions such as topography and geology. This includes considering a range of coastal hazard types.

Best practices approaches also include a range of hazard event likelihoods, where possible. This means multiple storm event Annual Exceedance Probabilities (AEPs) and considering both:

- large, but rarer (less likely) storm and flood events, and
- smaller, but more frequent (more likely) events.



**Event** - Where weather conditions affecting a specific place are notably different from typical, day-to-day conditions normally experienced at that location (for example, a storm event).

**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.

For example, a 1% AEP event represents an event that has a 1% chance of occurring in any given year.



## Coastal modelling considerations and limitations

Coastal models are built using extensive scientific knowledge and research, but they can only provide a simplified representation of the real world. There are some uncertainties in modelling complex coastal processes and mapping coastal hazards. However, overall, these models help improve our understanding and fill knowledge gaps. In interpreting coastal hazard modelling, there are several modelling methodology considerations and limitations. For the Bancoora CAP these include:



### Baseline sea level

Coastal hazard assessments use a 'baseline' sea level from which to add sea level rise scenarios. Mean sea level, the mean high water mark or other tidal planes are generally used as a baseline. This baseline may be derived from observed sea levels from preceding years. Most coastal hazard assessments reviewed for the Bancoora CAP use a baseline sea level calculated around 1990, indicative of a late 20<sup>th</sup> century mean sea level. Since 1990, monitoring stations at Lorne have recorded sea level rise of 2.8 mm/yr. This means since 1990, sea levels have already risen by nearly 0.1 m. Present day (i.e. 2024) or short-term sea levels may be better represented by a 0.2 m sea level rise scenario.



### Ground and seabed elevations

Coastal hazard extents and depths are estimated based on ground and seabed elevation (topography and bathymetry) data available at the time of the assessment. These 'present-day' elevations are generally used in all scenarios. Future scenario modelling does not incorporate any landform/morphological change (e.g. inundation extents varying due to erosion or changed dune morphology). Any changes to ground and seabed elevations since data capture, or in response to coastal processes are not incorporated into modelled results. For the study area, the most recent elevation and bathymetry data used in assessments was captured around 2007.



### Static vs. hydrodynamic modelling methods

Coastal inundation modelling can use either static (bathtub) or hydrodynamic modelling techniques, or a combination of both. A static 'bathtub' concept is quite simplistic, based on water levels and ground surface elevations. This method fills the sea like a bathtub when you add water. Lower parts (low-lying coastal land) fill up first, then higher parts, until water levels reach the design level. These are less sophisticated methods than hydrodynamic storm-tide modelling. Hydrodynamic models account for timing and movement of water across the landscape. This might account for flow paths and connectivity (e.g. drains and culverts), friction of various surfaces, the time variation of sea-level and river flows, and coastal protection structures. Hydrodynamic modelling is deemed a more accurate representation of the way water likely moves across a landscape.



### Storm event frequency and probability

In available coastal hazard information, only one AEP event has been considered as the design scenario (a 1% AEP). This is a rare and significant event. More frequent events (e.g. a 10% AEP), although smaller in magnitude have the potential to have a significant effect, especially in very low-lying or exposed areas. The concentration on a large infrequent event limits the amount of information available to plan for short term or more frequent events. Estimation of storm event probability also relies upon past wind, wave, rainfall and tide records. With relatively short records and a changing climate there is some uncertainty in estimation of storm event probability.



### Gridded cell inundation modelling

In coastal models, areas are generally represented as a grid. Therefore, the coastal hazard extent is based on a series of grid-sized square cells. When the grid cell is relatively small (e.g. 1 m), this gives a relatively accurate representation of surface elevation of extent. However, when grid cells are larger (e.g. 30 m) there may be elevation differences within the gridded cell and extents appear 'blocky'. This may over or underestimate hazard extents in some areas but is only a significant consideration for the lower resolution models with larger grid cell sizes.



### Combined catchment and coastal events

Some coastal models will include modelling of combined catchment (rainfall/river flow) and coastal (tide and wave) events. Through the Bellarine Peninsula – Corio Bay Local Coastal Hazard Assessment (Bellarine LCHA), it was determined that for the nearby Barwon River, the occurrence of catchment-driven and coastal driven inundation at the same time, is unlikely. While bathtub models generally don't account for combined catchment and coastal inundation, some hydrodynamic models do include these processes.

Full limitations are detailed in the associated reporting for each coastal hazard study.

### Hazard data available for the study area

There is no one set of coastal hazard data for the whole study area that meets all best practice adaptation requirements, as per the VRC guidance. Given this, the data used is the 'best fit' mix of state-wide, regional and localised assessments.

Table 7 provides an overview of available coastal hazard information across the study area. The information includes review of the following factors:

|                             |                                                                                                                                                     |                                                                                                                                                                                                                                                                    |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Hazard type</b>          | Storm tide inundation                                                                                                                               | Temporary inundation due to the effects of storms                                                                                                                                                                                                                  |
|                             | Permanent inundation                                                                                                                                | Permanent/regular inundation due to sea level rise                                                                                                                                                                                                                 |
|                             | Erosion                                                                                                                                             | Including sandy beach, cliff erosion and short/long term erosion                                                                                                                                                                                                   |
|                             | Estuary dynamics                                                                                                                                    | The dynamic movement and changes in form through accretion and erosion of estuary mouths                                                                                                                                                                           |
|                             | Groundwater                                                                                                                                         | The influence of groundwater interactions and shallowing of water tables or increases in salinity                                                                                                                                                                  |
| <b>Level of information</b> |                                                                    | Spatially explicit coastal hazard modelling, mapping or data (extents) that could be utilised in spatial coastal hazard exposure assessments.                                                                                                                      |
|                             |                                                                    | Spatial data, quantitative or qualitative information on coastal landscapes, processes or vulnerability applicable to coastal hazard assessment and adaptation. Includes interpretation of existing coastal hazard modelling, data, or monitoring data collection. |
|                             |                                                                   | Qualitative information related to coastal hazard adaptation or coastal processes that may inform coastal hazard assessments, but is not directly applicable to exposure assessments                                                                               |
|                             |                                                                  | Not assessed or no information available for the study area                                                                                                                                                                                                        |
| <b>Planning horizons</b>    | Periods, time steps, indicative years and/or relevant sea level rise figures. May include sensitivity scenarios.                                    |                                                                                                                                                                                                                                                                    |
| <b>Scenarios/methods</b>    | Modelled scenarios and related methods. May include range of storm events (AEPs), hazard likelihoods or inclusion/exclusion of catchment processes. |                                                                                                                                                                                                                                                                    |
| <b>Suitability</b>          | High                                                                                                                                                | Best-available coastal hazard assessment information to be utilised in risk assessment and adaptation planning.                                                                                                                                                    |
|                             | Med                                                                                                                                                 | Provides some information which may be used to inform risk assessment and adaptation planning.                                                                                                                                                                     |
|                             | Low                                                                                                                                                 | Provides only high level background information or is not applicable to the study location (e.g. no risk identified in study area).                                                                                                                                |

Table 7. Review of available coastal hazard data and information for the study area.

| Study/ assessment                                                                                         | Description                                                                                                                                                                                                                                                                                                                                                                                            | Hazard type           |                      |              |                  |              | Planning horizons                   |            |             |                         | Scenarios / methods                                                                                                                                                                                                                                                                                                                                                                   | Suitability                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|--------------|------------------|--------------|-------------------------------------|------------|-------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                        | Storm tide inundation | Permanent inundation | Erosion      | Estuary dynamics | Groundwater  | Baseline                            | Short term | Medium term | Long term               |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                        |
| State or nationwide data                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                        |                       |                      |              |                  |              |                                     |            |             |                         |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                        |
| ‘Future Coasts’ Program (2007-2011) – DEECA (as DSE) modelled by CSIRO                                    | Included a state-wide assessment of physical impacts of sea level rise and storms on Victoria’s coast, informing the development of guidelines, tools and recommendations for coastal planning and policy. This included estimates of projected sea levels and associated flood risk for Victoria’s coast.                                                                                             |                       |                      |              |                  |              | 0.0 m ~1990 mean sea level baseline | 0.2 m      | 0.47 m      | 0.82 m                  | <u>Permanent inundation</u> : Bathtub model<br><u>Storm tide</u> : 1 in 100 yr ARI (1% AEP), including wind forcing. Static ‘bathtub’ models combining sea levels / storm tide levels with sea level rise projections and dynamic wind forcing factors.                                                                                                                               | <b>High</b> : For permanent inundation, best available information. To supplement other assessments where no other information exists.                 |
| SmartLine Geoscience Australia (2009)                                                                     | The Smartline map divides the coast into distinct segments; within each, multiple GIS attributes describe dominant coastal landforms. This data set provides understanding of shoreline type and geomorphology.                                                                                                                                                                                        |                       |                      |              |                  |              | -                                   | -          | -           | -                       | Qualitative assessment of shoreline attributes including landforms, geology, geomorphology, erodibility and instability.                                                                                                                                                                                                                                                              | <b>Medium</b> : Provides contextual information about shoreline type and characteristics.                                                              |
| Statewide Victorian Coastal Hazard Assessment (VCHA) (2017) – DEECA (as DELWP) modelled by Spatial Vision | A second-pass state-wide assessment of erosion and inundation hazards resulting from future climate change scenarios was completed in 2017 to inform the Victorian Coastal Monitoring Program. Outputs include Erosion Vulnerability and Inundation Geodatabases. Utilises Future Coasts and SmartLine data as inputs.                                                                                 |                       |                      |              |                  |              | 0.0 m ~1990 sea level baseline      | 0.2 m      | 0.47 m      | 0.82 m                  | Semi-quantitative erosion vulnerability scores applied to each 50 m section of coast, based on exposure (orientation, waves, fetch etc), sensitivity (erodibility), impact and adaptive capacity.                                                                                                                                                                                     | <b>Low</b> : Provides contextual information about coastal hazards, based off other assessments.                                                       |
| Statewide Coastal Cliff Hazard Assessment (2023) Tonkin + Taylor for DEECA                                | The Statewide Coastal Cliff Hazard Assessment is a state-wide assessment of coastal cliff instability and/or erosion, including a risk-based assessment. This included assessment of both cliff top and bottom, based erosion. As a predominantly sandy shoreline, no areas in the Breamlea/Bancoora areas were considered at risk of cliff erosion.                                                   |                       |                      | <br>(cliff)  |                  |              | 0.0 m ~1990 mean sea level baseline | 0.2 m      | 0.5 m       | 0.8 m<br>1.1 m<br>1.4 m | Mapped Areas Susceptible to Coastal Cliff Instability and/or Erosion (ASCCIE) associated with areas at the cliff top and Areas Susceptible to Talus Runout (ASTaR) associated with areas at the bottom the cliff.                                                                                                                                                                     | <b>Low</b> : No cliff coastlines mapped within project extent. Areas outside of the identified ASCCIE and ASTaR considered unlikely to be susceptible. |
| DEA Coastlines<br>Digital Earth Australia (Geoscience Australia) (data since 1988 – ongoing)              | DEA coastlines uses LANDSAT aerial images from 1984 to validate a shoreline position in time (using the average tidal position for a given day to represent the shoreline). Once validated, an annual median shoreline position is drawn, representing the median or ‘most representative’ position of the shoreline at approximately mean sea level tide (0 m Above Mean Sea Level) for a given year. |                       |                      |              |                  |              | Since 1984 - Current / ongoing      |            |             |                         | Each year’s shoreline is used to calculate an average rate of coastal change (m/year), where the most recent annual shoreline is used as a baseline for measuring rates of change.                                                                                                                                                                                                    | <b>Medium</b> : Provides information on annual shoreline movement across the last 40 years.                                                            |
| Local / regional coastal hazard assessments                                                               |                                                                                                                                                                                                                                                                                                                                                                                                        |                       |                      |              |                  |              |                                     |            |             |                         |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                        |
| Bellarine Peninsula – Corio Bay LCHA (2015) – Cardno for City of Greater Geelong and Stakeholders         | This assessment, delivered as a pilot project as part of Victorian Government’s Future Coasts Program, provides information on the extent of coastal hazards for the Bellarine Peninsula and Corio Bay coastal environments, including both open coast and Port Phillip Bay shorelines. Its focus was primarily on inundation hazards, with erosion hazards also considered and mapped.                |                       |                      |              |                  |              | 0.0 m ~1990 mean sea level baseline | 0.2 m      | 0.5 m       | 0.8 m<br>1.1 m<br>1.4 m | <u>Storm tide</u> : 1% AEP event. Hydrodynamic modelling, including inundation times and depths. Uses 20 m grid cell resolution. Includes modelling of inundation time.<br><u>Erosion</u> : Combines factors for short term erosion associated with storms (2 x 1% AEP storm bite modelling), long term recession rates, slope adjustment factor and recession due to sea level rise. | <b>High</b> : best available erosion and storm tide inundation modelling, to be supplemented with other assessments / studies.                         |
| Port Phillip Bay Coastal Hazard Assessment (2024) – various authors for DEECA                             | Based on best-available data and information, the PPBCHA used sophisticated coastal modelling and analyses to further regional scale understanding of coastal hazards in the Bay. Erosion and inundation studies as part of the PPBCHA do not extend to the Breamlea area. However, conceptual modelling of groundwater systems in the region did extend into the broader Barwon coast region.         |                       |                      |              |                  |              | 0.0 m ~2014 (35 yr hindcast)        | 0.2 m      | 0.5 m       | 0.8 m<br>1.1 m<br>1.4 m | <u>Groundwater</u> : Modelled shallow groundwater extents, based on conceptual understanding developed through analysis of bore/monitoring information and existing studies. Uses 50 m grid cell resolution.                                                                                                                                                                          | <b>Medium</b> : only and best available groundwater hazard information. Conceptual information only at coarse grid size.                               |
| Site specific                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                        |                       |                      |              |                  |              |                                     |            |             |                         |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                        |
| Victorian Coastal Monitoring Program (2017 – ongoing) – DEECA                                             | A VCMP site exists at Point Impossible with drone survey measurements collected sporadically since 2019. This site includes a small area of coast within the study extent at the Thompson Creek estuary mouth.                                                                                                                                                                                         |                       |                      |              |                  |              | Historic - current / ongoing        |            |             |                         | Drone monitoring including photo and elevation data. Coverage of the Thompson Creek estuary varies between surveys.                                                                                                                                                                                                                                                                   | <b>Low</b> : Poor coverage of study area                                                                                                               |
| Estuary watch – Thompson Creek Estuary                                                                    | A citizen science program for monitoring estuary health. The Thompson Creek site has been monitored though various methods since around 2007. This provides understanding of water quality parameters, entrance conditions and other observations on estuary changes.                                                                                                                                  | <br><br><br>          | <br><br><br>         | <br><br><br> | <br><br><br>     | <br><br><br> | Historic - current / ongoing        |            |             |                         | Photopoint, monitoring and visual observation methods. Coverage and frequency varies over time.                                                                                                                                                                                                                                                                                       | <b>Medium</b> : provides contextual information on recent estuary trends and opening/closure regime.                                                   |



There is no consistent dataset which meets best practice requirements for the study area. The Bellarine Peninsula – Corio Bay Local Coastal Hazard Assessment (Bellarine LCHA) (2015), ‘Future Coasts’ Program (2007-2011), and Port Phillip Bay Coastal Hazard Assessment (PPBCHA) (2024) are the best available coastal hazard studies for the study area. The level of reporting for these assessments vary, so it may not always be clear what the exact inputs and modelling approaches have been undertaken.

The Bellarine LCHA provides localised coastal hazard information for the Breamlea/Bancoora area including hydrodynamic inundation modelling and open coast beach erosion extents. Available statewide data (Future Coasts) provides supplementary information on tidal areas (sea level rise). Conceptual modelling of groundwater systems in the region is included in the PPBCHA. Table 8 provides further detail on available hazard study approaches and outputs for each hazard type. These are further expanded and mapped in sections below.

**Table 8. Coastal hazard study approaches and outputs for different hazard types. .**

| Statewide data / models<br>(incl. Future Coasts)                                                                                                                                                                      | Bellarine Peninsula – Corio<br>Bay Local Coastal Hazard<br>Assessment                                                                                                               | Port Phillip Bay Coastal<br>Hazard Assessment                                                                                     | Comments                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Storm tide inundation (temporary)</b>                                                                                                                                                                              |                                                                                                                                                                                     |                                                                                                                                   |                                                                                                                                                                                       |
| Static ‘bathtub’ models combining storm tide levels with sea level rise projections and dynamic wind forcing factors.                                                                                                 | Hydrodynamic modelling accounting for flow paths, friction and time-variation in water levels, includes modelling of inundation times and depths. 20 m grid cell size.              | Outside study extent                                                                                                              | Bellarine LCHA is the best available storm tide inundation modelling for the study area. Deemed a better representation than statewide static models, which will supplement analysis. |
| <b>Permanent inundation (tidal areas due to SLR)</b>                                                                                                                                                                  |                                                                                                                                                                                     |                                                                                                                                   |                                                                                                                                                                                       |
| Static ‘bathtub’ models, combining local tide levels with sea level rise projections.                                                                                                                                 | Outside study extent                                                                                                                                                                | Outside study extent                                                                                                              | Statewide data is the only and best available information mapping tidal areas for the study area.                                                                                     |
| <b>Open coast erosion</b>                                                                                                                                                                                             |                                                                                                                                                                                     |                                                                                                                                   |                                                                                                                                                                                       |
| Semi-quantitative erosion vulnerability rating applied to each 50 m section of coast, based on exposure (orientation, waves, fetch etc), sensitivity (erodibility), impact and adaptive capacity. No spatial extents. | Erosion setback calculation includes factors for short term erosion associated with storms, long term recession rates, slope adjustment factor and recession due to sea level rise. | Outside study extent                                                                                                              | Bellarine LCHA is best available erosion modelling. To be supplemented with understanding of erosion vulnerability, geology, and landscape setting.                                   |
| <b>Estuary dynamics</b>                                                                                                                                                                                               |                                                                                                                                                                                     |                                                                                                                                   |                                                                                                                                                                                       |
| No assessment undertaken                                                                                                                                                                                              | No assessment undertaken                                                                                                                                                            | No assessment undertaken                                                                                                          | No mapped extents available. To be considered conceptually                                                                                                                            |
| <b>Groundwater</b>                                                                                                                                                                                                    |                                                                                                                                                                                     |                                                                                                                                   |                                                                                                                                                                                       |
| No assessment undertaken                                                                                                                                                                                              | No assessment undertaken                                                                                                                                                            | Conceptual understanding of shallow (<2 m deep) groundwater extents based on bore information, previous studies. 50 m grid cells. | PPBCHA is only and best available groundwater hazard information, although still at higher conceptual level. To be considered conceptually.                                           |

The best available datasets all have different modelling approaches, different sea level rise scenarios / planning horizons and account for different processes. Table 9 summarises these modelling scenarios for the different studies. The hazard data and modelling methods are outlined in sections below, with further detail in Attachment 5.

Table 9. Summary of best available coastal hazard modelling scenarios.

|                          |                                                          | Short-term                           |     |     | Medium-term    |     |                | Long-term      |     |                | Sensitivity     |   |     |     |     |     |  |
|--------------------------|----------------------------------------------------------|--------------------------------------|-----|-----|----------------|-----|----------------|----------------|-----|----------------|-----------------|---|-----|-----|-----|-----|--|
|                          |                                                          | By 2040                              |     |     | By 2070        |     |                | By 2100        |     |                | 2100+           |   |     |     |     |     |  |
|                          |                                                          | (up to 25 yrs)                       |     |     | (25 to 50 yrs) |     |                | (50 to 75 yrs) |     |                | (beyond 75 yrs) |   |     |     |     |     |  |
|                          |                                                          | Sea level rise (from ~1990 baseline) |     |     |                |     |                |                |     |                |                 |   |     |     |     |     |  |
| Study                    | Scenario                                                 | 0                                    | 0.1 | 0.2 | 0.3            | 0.4 | 0.5            | 0.6            | 0.7 | 0.8            | 0.9             | 1 | 1.1 | 1.2 | 1.3 | 1.4 |  |
| STORM TIDE INUNDATION    |                                                          |                                      |     |     |                |     |                |                |     |                |                 |   |     |     |     |     |  |
| Bellarine-Corio Bay LCHA | Storm tide 1% AEP                                        | ✓                                    |     | ✓   |                |     | ✓              |                |     | ✓              |                 |   | ✓   |     |     | ✓   |  |
| Future Coasts            | Storm tide 1% AEP*                                       | ✓                                    |     | ✓   |                |     | ✓ <sup>#</sup> |                |     | ✓ <sup>#</sup> |                 |   |     |     |     |     |  |
| PERMANENT INUNDATION     |                                                          |                                      |     |     |                |     |                |                |     |                |                 |   |     |     |     |     |  |
| Future Coasts            | Sea level rise (bathtub)                                 | ✓                                    |     | ✓   |                |     | ✓ <sup>#</sup> |                |     | ✓ <sup>#</sup> |                 |   |     |     |     |     |  |
| OPEN COAST EROSION       |                                                          |                                      |     |     |                |     |                |                |     |                |                 |   |     |     |     |     |  |
| Bellarine-Corio Bay LCHA | Calculated erosion setback <sup>^</sup>                  | ✓                                    |     | ✓   |                |     | ✓              |                |     | ✓              |                 |   | ✓   |     |     | ✓   |  |
| Shallow groundwater      |                                                          |                                      |     |     |                |     |                |                |     |                |                 |   |     |     |     |     |  |
| Port Phillip Bay CHA     | Shallow (0 – 2 m depth) groundwater extents <sup>†</sup> | ✓                                    |     | ✓   |                |     | ✓              |                |     | ✓              |                 |   | ✓   |     |     | ✓   |  |

\*Different (bathtub) modelling approach to other Bellarine-Corio Bay LCHA scenarios

#Future Coasts SLR of 0.47 m and 0.82 m considered comparable with 0.5 m and 0.8 m, respectively.

^Combined factors to calculate erosion setback, including 2 x 1 % AEP storm events

†Extents represent areas of 'shallow' groundwater where the water table is within 0-2 m deep from the ground surface.

Where the Bellarine LCHA data is available, this is prioritised for assessment. However, other statewide mapped coastal hazard data is utilised to fill gaps and extend the analysis to account for uncertainty, sensitivities or data gaps. Qualitative information and understanding will also supplement the assessment, where suitable. Coastal monitoring and improving knowledge of coastal processes over time should complement coastal modelling. Adaptation actions can seek to improve data availability for identified knowledge or data gaps. An adaptive pathways approach also supports planning for and changing actions, based on new information, observed changes or updated knowledge.

### 3.6 Coastal hazard data and modelling methods

This section steps through the best available data for each hazard type (storm tide inundation, permanent inundation, open coast erosion, estuary dynamics and shallow groundwater). This includes summarising the modelling approach and methods, including key considerations or limitations. Further information is provided in Attachment 5.

#### Storm tide inundation

Through the Bellarine LCHA (Cardno, 2015a), storm tide inundation was modelled for the Breamlea / Thompson Creek system. For the eastern area from Bancoora Beach / Black Rocks to the Barwon River estuary no inundation modelling was completed as there was deemed to be minimal risk of inundation.

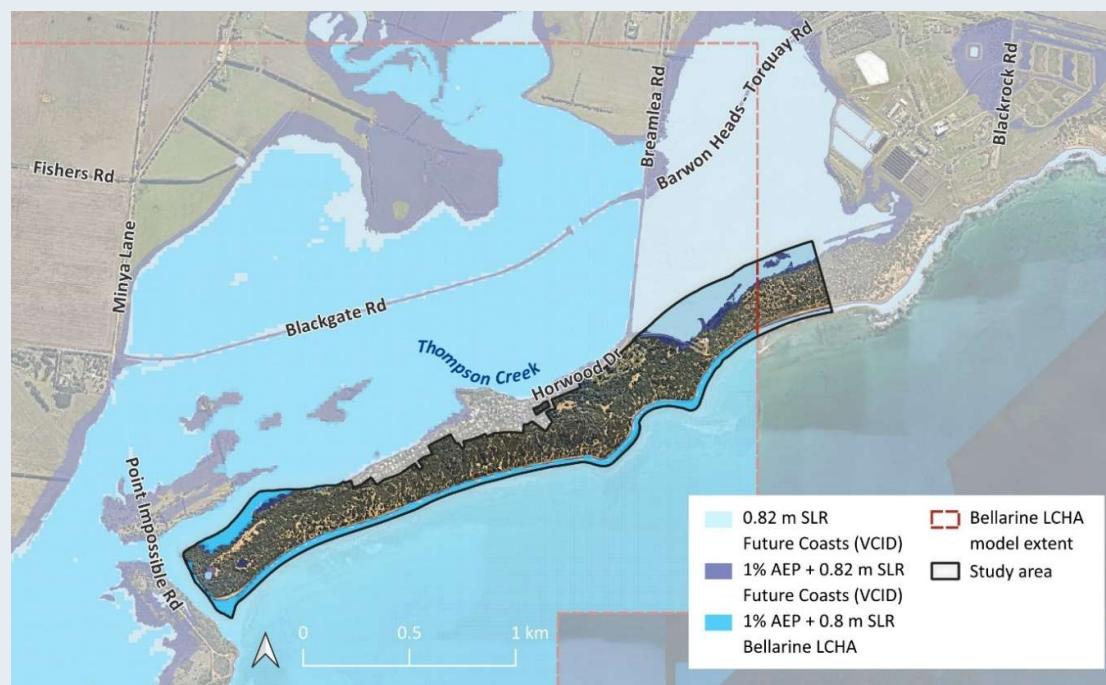
The assessment utilised hydrodynamic modelling of a 1% AEP storm tide event, run over six sea level rise scenarios. Each of the scenarios were run dynamically for at least one tidal cycle in order to capture the peak event. Key model parameters such as grid size, topographic data, inclusion of structures/culverts and adopted scenarios is provided in Attachment 5. Full reporting of methods is provided by Cardno (2015b).

The Statewide (Future Coasts) data also provides mapped extents of storm tide inundation for a 1% AEP for a range sea level rise scenarios. This assessment used a static or 'bathtub' fill approach.

The two data sources have different modelling methods. When the two data sources are compared, there is a large area of lower elevations that the Future Coasts (bathtub) modelling showing as permanently inundated in the 0.8 m SLR scenario (Figure 23). Anecdotal evidence and site visits found this area to be generally wet, although inundation regimes were reported to have changed over time. The area may also be inundated by a combination of local/catchment rainfall runoff, storm tide and/or groundwater processes.

### Modelling connectivity through Breamlea Road

In the Bellarine LCHA modelling, Breamlea Road appears to act as a kind of levee, with inundation not occurring east of Breamlea Road until a 1.4 m SLR scenario. The Statewide (Future Coasts) data shows this area as being inundated currently and increasing inundation extents with sea level rise. Figure 23 compares these two datasets showing mapped coastal inundation extents in a 0.8 m sea level rise scenario.



**Figure 23.** Bellarine LCHA and Future Coasts inundation modelling for: permanent inundation (Future Coasts only), and storm tide inundation (Future Coasts and Bellarine LCHA) under a 0.8 m SLR scenario.

As a dynamic inundation model, the Bellarine LCHA is considered the best available storm tide inundation modelling. It better represents the time taken for water to inundate certain areas and connectivity through drains and culverts, whereas the Future Coasts data assumes all lower-lying areas below a certain level are inundated.

In our risk and vulnerability assessment, other data, scenarios, local knowledge, and site observations will be considered to assess the vulnerability of this area to storm tide inundation. These assessments may also highlight the need for further investigation and importance of Breamlea Road acting as a ‘levee’ type structure.

Available coastal hazard modelling scenarios for storm tide inundation are summarised in Table 10. All of the resulting hazard extents from these scenarios are mapped in Attachment 5.

**Table 10.** Storm-tide hazard scenarios.

|                          |                    | Short-term                           |     |     | Medium-term               |     |     | Long-term                 |     |     | Sensitivity           |   |     |     |     |     |
|--------------------------|--------------------|--------------------------------------|-----|-----|---------------------------|-----|-----|---------------------------|-----|-----|-----------------------|---|-----|-----|-----|-----|
|                          |                    | By 2040<br>(up to 25 yrs)            |     |     | By 2070<br>(25 to 50 yrs) |     |     | By 2100<br>(50 to 75 yrs) |     |     | 2100+ (beyond 75 yrs) |   |     |     |     |     |
|                          |                    | Sea level rise (from ~1990 baseline) |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Study                    | Scenario           | 0                                    | 0.1 | 0.2 | 0.3                       | 0.4 | 0.5 | 0.6                       | 0.7 | 0.8 | 0.9                   | 1 | 1.1 | 1.2 | 1.3 | 1.4 |
| STORM TIDE INUNDATION    |                    |                                      |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Bellarine-Corio Bay LCHA | Storm tide 1% AEP  | ✓                                    |     | ✓   |                           |     | ✓   |                           |     | ✓   |                       |   | ✓   |     |     | ✓   |
| Future Coasts            | Storm tide 1% AEP* | ✓                                    |     | ✓   |                           |     | ✓#  |                           |     | ✓#  |                       |   |     |     |     |     |

\*Different (bathtub) modelling approach to other Bellarine-Corio Bay LCHA scenarios

#Future Coasts SLR of 0.47 m and 0.82 m considered comparable with 0.5 m and 0.8 m, respectively.



### Permanent inundation (tidal areas)

The Bellarine LCHA does not include mapping in the Bancoora/Breamlea area for permanent inundation (tidal areas). The best available coastal hazard mapping for permanent inundation is the Victorian Coastal Inundation Dataset (VCID) from the Statewide (Future Coasts) work.

This Statewide permanent inundation modelling is representative of high tide + SLR scenarios. Assessment involved the use of sea level rise scenarios implicit in the IPCC's A1F1 emissions scenario as a basis for CSIRO modelling of projected sea levels and associated flood risk for Victoria's coast. The modelled 0.47 m and 0.82 m scenarios have been assumed to the equivalent of the 0.5 m and 0.8 m planning horizon for consistency across hazard types. Sea level rise scenarios for the Future Coasts data are limited to 0.82 m.

The Future Coasts permanent inundation modelling uses simple bathtub models to examine increasing water levels. These are less sophisticated methods compared to the Bellarine LCHA storm-tide modelling. They combine local tides with sea level rise projections (high tide + SLR scenarios). This does not account for the dynamic movement of water across the landscape and includes areas that are disconnected from the open ocean.

The extents are based on topographic data captured in 2008/09. In some areas significant modification to the landscape may have occurred since this time (human-induced and/or natural process).

While this is the best available permanent inundation information, the use of this data will be combined with understanding of hydrodynamic storm tide modelling, local observations, conditions, and surface elevations to assess local vulnerabilities to permanent inundation.

Available coastal hazard modelling scenarios for permanent inundation are summarised in Table 11. All of the resulting hazard extents from these scenarios are mapped in Attachment 5.

**Table 11. Permanent inundation scenarios.**

|                      |                          | Short-term                           |     |     | Medium-term               |     |     | Long-term                 |     |     | Sensitivity           |   |     |     |     |     |
|----------------------|--------------------------|--------------------------------------|-----|-----|---------------------------|-----|-----|---------------------------|-----|-----|-----------------------|---|-----|-----|-----|-----|
|                      |                          | By 2040<br>(up to 25 yrs)            |     |     | By 2070<br>(25 to 50 yrs) |     |     | By 2100<br>(50 to 75 yrs) |     |     | 2100+ (beyond 75 yrs) |   |     |     |     |     |
|                      |                          | Sea level rise (from ~1990 baseline) |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Study                | Scenario                 | 0                                    | 0.1 | 0.2 | 0.3                       | 0.4 | 0.5 | 0.6                       | 0.7 | 0.8 | 0.9                   | 1 | 1.1 | 1.2 | 1.3 | 1.4 |
| PERMANENT INUNDATION |                          |                                      |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Future Coasts        | Sea level rise (bathtub) | ✓                                    |     | ✓   |                           |     | ✓#  |                           |     | ✓#  |                       |   |     |     |     |     |

#Future Coasts SLR of 0.47 m and 0.82 m considered comparable with 0.5 m and 0.8 m, respectively.

## Open coast erosion

Through the Bellarine LCHA (Cardno 2015b), open coast erosion extents were modelled for the Breamlea / Bancoora beach system. As a sandy open coast environment, four factors were considered in the defined hazard extents (Table 12). These factors were combined and translated into a horizontal distance of shoreline recession, applied for various sea level rise scenarios.

**Table 12. Factors in determining open coast erosion hazard extents for the Bellarine LCHA.**

| Factor                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Short-term / storm bite erosion | Accounts for erosion due to storm events. Two back-to-back 1% AEP storm events are used in the defined erosion hazard area. The design storm (applied twice) combined wave heights and water levels. Modelling also considers: <ul style="list-style-type: none"> <li>• Orientation of beach to dominant wave direction</li> <li>• Wave climate and water levels</li> <li>• The bathymetry – deepness, profile, nearshore reefs or strata</li> <li>• Sediment grain size</li> </ul> |
| Long term recession rates       | Accounts for longer term sediment loss due to ongoing coastal processes. This factor was determined through historic aerial photography analysis (from 1944 to 2001)                                                                                                                                                                                                                                                                                                                |
| Recession due to sea level rise | Accounts for shoreline recession due to the effects of sea level rise. This factor was calculated using empirical calculations (the Bruun Rule) for open coast environments.                                                                                                                                                                                                                                                                                                        |
| Slope adjustment                | A factor to account for slope stability and reduced foundation capacity                                                                                                                                                                                                                                                                                                                                                                                                             |

Beach profile data for the assessment was sourced in 2007 with extents determined at set points along the shoreline and interpolated between to create an erosion hazard setback line. Further information about erosion modelling methods are provided in Attachment 5 and in the assessment reporting (Cardno 2015b).

This data is considered the best-available erosion modelling and incorporates understanding of local coastal processes, shoreline types and conditions for the study site.

Available coastal hazard modelling scenarios for open coast erosion are summarised in Table 13. All of the resulting hazard extents from these scenarios are mapped in Attachment 5.

**Table 13. Open coast erosion scenarios.**

|                          |                             | Short-term                           |     |     | Medium-term    |     |     | Long-term      |     |     | Sensitivity           |   |     |     |     |     |
|--------------------------|-----------------------------|--------------------------------------|-----|-----|----------------|-----|-----|----------------|-----|-----|-----------------------|---|-----|-----|-----|-----|
|                          |                             | By 2040                              |     |     | By 2070        |     |     | By 2100        |     |     | 2100+ (beyond 75 yrs) |   |     |     |     |     |
|                          |                             | (up to 25 yrs)                       |     |     | (25 to 50 yrs) |     |     | (50 to 75 yrs) |     |     |                       |   |     |     |     |     |
|                          |                             | Sea level rise (from ~1990 baseline) |     |     |                |     |     |                |     |     |                       |   |     |     |     |     |
| Study                    | Scenario                    | 0                                    | 0.1 | 0.2 | 0.3            | 0.4 | 0.5 | 0.6            | 0.7 | 0.8 | 0.9                   | 1 | 1.1 | 1.2 | 1.3 | 1.4 |
| OPEN COAST EROSION       |                             |                                      |     |     |                |     |     |                |     |     |                       |   |     |     |     |     |
| Bellarine-Corio Bay LCHA | Calculated erosion setback^ | ✓                                    |     | ✓   |                |     | ✓   |                |     | ✓   |                       |   | ✓   |     |     | ✓   |

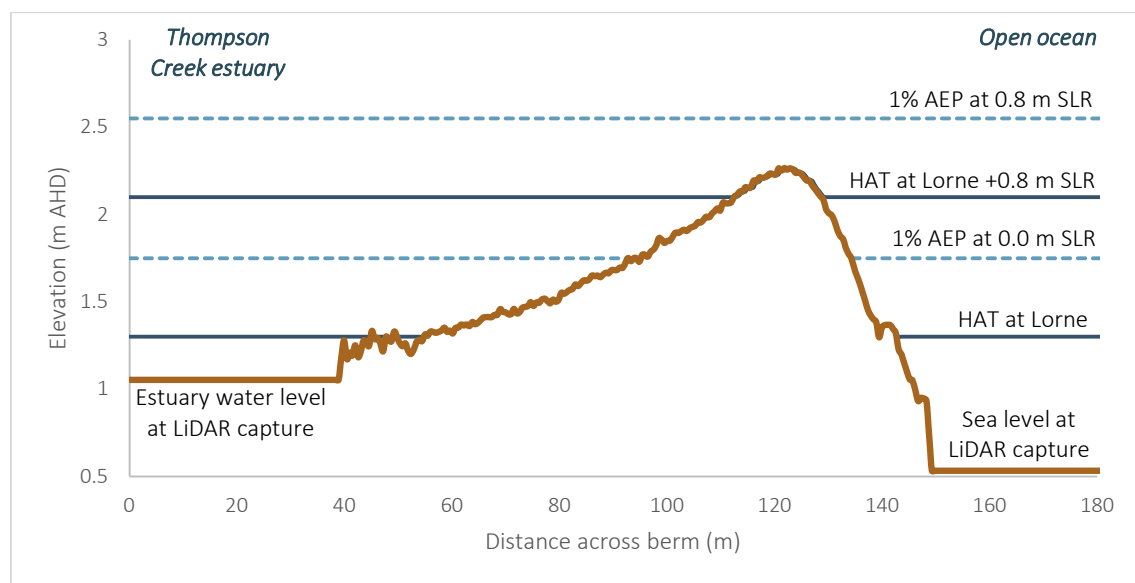
<sup>a</sup>Combined factors to calculate erosion setback, including 2 x 1 % AEP storm events

## Estuary dynamics

The Thomsons Creek estuary is highly dynamic, changing in response to tides, sea level, storm events and catchment runoff. A changing climate, including rising seas and changed storm and rainfall conditions, could result in changes to the channel alignment, sediment dynamics, berm form and entrance opening and closure regime. Each estuary exhibits unique responses to a changing climate and sea level rise, based on estuarine setting, wave climate and other environmental factors.

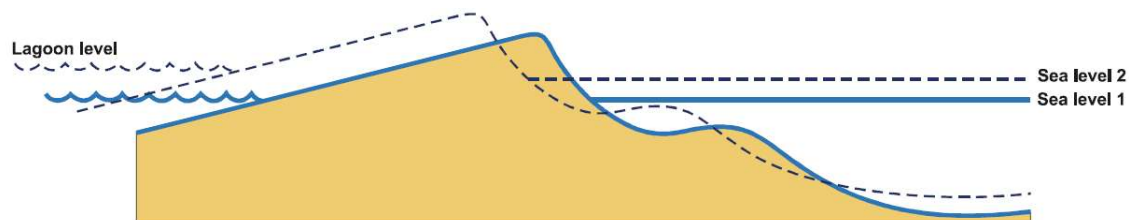
Dedicated studies on the dynamics of the Thompson Creek estuary are not available. EstuaryWatch mouth condition assessments have been conducted irregularly from 2001 to 2009. These are detailed further in Attachment 3, including monitoring of opening and closure. During monitoring, the berm height has been reported to be around 0.3 to 1.7 metres above estuary water level and between 0.3 and 2.7 m above sea level (at the time of monitoring).

Figure 24 provides an example cross section of the Thompson Creek estuary berm (captured in 2021 LiDAR) along with reported storm tide inundation heights, as per Cardno (2015a) and Highest Astronomical Tide (HAT) recorded at Lorne. This shows the relative elevation of water level heights with present day berm heights.



**Figure 24.** Cross section of Thompson Creek estuary berm captured in 2021, with Highest Astronomical Tide (HAT) at Lorne and 1% AEP storm tide levels, as reported by Cardno (2015a).

Generally, for intermittently closed-open lakes and lagoon (ICOLL) estuary systems an increase in mean sea level is likely to move the berm upward and landward (Figure 25). Water levels in the estuary would also increase by an equivalent amount to the sea level rise as this water level is controlled by entrance berm height (Haines and Thom, 2007). ICOLL response to sea level rise is, however, complex and the magnitude of entrance changes will depend on characteristics of individual estuaries. Estuary dynamics are therefore only considered conceptually for the Bancoora CAP.



**Figure 25.** Landward and upward shift in beach profile due to sea level rise (Haines and Thom, 2007).



## Shallow groundwater

Through the Port Phillip Bay Coastal Hazard Assessment (PPBCHA), groundwater depth and salinity was conceptually modelled and included the Breamlea/Bancoora area. Interactions between surface water, seawater and groundwater are particularly complex near to coasts. Groundwater is often discharging to the sea, while seawater sometimes recharges groundwater aquifers.

Groundwater systems experience changes in water table depths and salinity in response to many factors. When these changes impact on our use of groundwater or cause inundation (flooding) of land, these are considered hazards. A water table less than two metres below the natural surface in urban areas is usually considered a hazard. Water table depths are predicted to shift due to changes in groundwater recharge (inflows) and discharge (outflows) rates. Climate change and rising sea levels, along with changing land uses and groundwater management may result in changes to the groundwater systems.

Conceptual modelling (by CSIRO for the PPBCHA) has been used to approximate how changing conditions, including sea level rise, might affect water table depths and the groundwater system. Groundwater modelling estimated water table depths across the region.

**Groundwater hazard definition** - For this project, groundwater hazards were defined as areas where water table depths were shallow (at a depth of 0 m to 0.2 m below the ground surface). We have extents of shallow groundwater for each sea level rise scenario (0.0 m to 1.4 m). Changing surface water (where shallow groundwater becomes surface water as water table rises) was also considered in future scenarios.

Groundwater data has been used as provided by CSIRO for the PPBCHA, with no further data refinement. As groundwater hazards are only considered at a conceptual level, and with coarsely grided datasets, exposure and risk assessment in later stages is only captured as high-level vulnerabilities.

Our assessment has only considered changes to water table depths and shallow water table areas. Effects of increasing salinity due to saline intrusion associated with sea level rise had not been assessed. Groundwater interactions are complex. Further analysis and interpretation requires specialist analysis (beyond the scope of this project).

Available coastal hazard modelling scenarios for shallow groundwater are summarised in Table 14. Attachment 5 provides further information on modelling approaches and methods. Full methodology reporting is available in McInnes *et al.* (2022).

**Table 14. Shallow groundwater scenarios.**

|                      |                                              | Short-term                           |     |     | Medium-term               |     |     | Long-term                 |     |     | Sensitivity           |   |     |     |     |     |
|----------------------|----------------------------------------------|--------------------------------------|-----|-----|---------------------------|-----|-----|---------------------------|-----|-----|-----------------------|---|-----|-----|-----|-----|
|                      |                                              | By 2040<br>(up to 25 yrs)            |     |     | By 2070<br>(25 to 50 yrs) |     |     | By 2100<br>(50 to 75 yrs) |     |     | 2100+ (beyond 75 yrs) |   |     |     |     |     |
|                      |                                              | Sea level rise (from ~1990 baseline) |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Study                | Scenario                                     | 0                                    | 0.1 | 0.2 | 0.3                       | 0.4 | 0.5 | 0.6                       | 0.7 | 0.8 | 0.9                   | 1 | 1.1 | 1.2 | 1.3 | 1.4 |
| Shallow groundwater  |                                              |                                      |     |     |                           |     |     |                           |     |     |                       |   |     |     |     |     |
| Port Phillip Bay CHA | Shallow (0 – 2 m depth) groundwater extents† | ✓                                    |     | ✓   |                           |     | ✓   |                           |     | ✓   |                       |   | ✓   |     |     | ✓   |

<sup>†</sup>Extents represent areas of 'shallow' groundwater where the watertable is within 0-2 m deep from the ground surface.

### 3.7 Coastal hazard mapping

Figure 26, Figure 27, Figure 28, and Figure 29 show selected coastal hazard mapping scenarios for the short (0-0.2 m SLR), medium (0.2-0.5 m SLR), long term (0.5-0.8 m SLR), and sensitivity scenarios (0.8 – 1.1 m SLR), respectively. Mapped information shows the possible extents of permanent inundation (tidal areas), storm tide inundation and open coast erosion over these planning horizons. Table 15 presents these mapped scenarios.

#### Storm tide inundation hazard mapping

Hazard maps show areas potentially affected by short-term (temporary) inundation in the absence of future adaptation (intervention). They do not represent a 'loss' of coastal land. They also do not indicate that the region will be flooded by storm tides all at the same time – flooding and impacted areas will be dependent on the storm event characteristics (storm drivers, timing, duration and direction).

Storm tide inundation modelling also does not account for the combined effects of catchment (rainfall) floods. The Bellarine LCHA 1% AEP scenarios for 0.2 m, 0.5 m and 0.8 m SLR are mapped.

Mapped 1% AEP storm tide inundation extents from the Bellarine LCHA and Statewide Future Coasts studies for all available scenarios are presented in Attachment 5. The Bellarine LCHA also assessed the duration of inundation. This mapping is presented in Attachment 5 and shows the duration for which inundation is greater than 30 cm for a 1% AEP event with 0.8 m SLR.

#### Storm-tide inundation hazard maps use coloured bands which:

- show areas potentially temporarily affected by hazards
- are in absence of any management measures
- use present day ground and seabed elevations and current shoreline positions
- highlight inundation areas arising due to certain local weather (storm) conditions.

#### Permanent inundation hazard mapping

Hazard maps show areas potentially affected by permanent inundation. This is regular inundation from tides due to sea level rise. This estimate is in the absence of future adaptation (intervention).

The Statewide Future Coasts permanent inundation scenarios for 0.0 m, 0.20 m, 0.47 m SLR are mapped. Mapped permanent inundation extents from the and The Statewide Future Coasts study for all available scenarios are presented in Attachment 5.

#### Permanent inundation hazard maps use coloured bands which:

- show areas that will potentially be regularly inundated from tides due to sea level rise
- are in absence of any management measures
- use present day ground and seabed elevations and current shoreline positions

#### Open coast erosion hazard mapping

Hazard maps show areas potentially affected by short and/or longer-term coastal erosion processes in the absence of future adaptation (intervention). They do not represent a 'loss' of coastal land or that these areas are being eroded all at the same time. Erosion and impacted areas will be dependent on the storm event characteristics (storm drivers, timing, duration and direction).

The Bellarine LCHA calculated erosion hazard setbacks for 0.0 m, 0.2 m and 0.5 m SLR are mapped. This includes a short term (storm bite) component representing two back-to-back 1% AEP storm events. Mapped erosion hazards from the Bellarine LCHA for all available scenarios are presented in Attachment 5.

#### Erosion hazard maps use coloured bands which:

- indicate areas potentially affected by short and/or longer-term coastal erosion processes
- are in absence of any management measures
- highlight areas that may be susceptible to erosion for certain local weather (storm) conditions.
- use present day ground and seabed elevations and current shoreline positions and profiles for all projections (current and future)

#### Shallow groundwater hazard mapping

Mapped shallow groundwater extents (water table depth 0 to -2 m AHD) from the PPBCHA are presented separately in Attachment 5 for all available planning horizons.

Table 15. Mapped coastal hazard scenarios summary for Figure 26 to Figure 29

|                                               | Short<br>(Figure 26)<br>By 2040<br>(up to 25 yrs) | Medium<br>(Figure 27)<br>By 2070<br>(25 to 50 yrs) | Long<br>(Figure 28)<br>By 2100<br>(50 to 75 yrs) | Sensitivity<br>(Figure 29)<br>2100+ (beyond 75 yrs) |
|-----------------------------------------------|---------------------------------------------------|----------------------------------------------------|--------------------------------------------------|-----------------------------------------------------|
|                                               | Sea level rise (from ~1990 baseline)              |                                                    |                                                  |                                                     |
|                                               | 0 to 0.2 m                                        | 0.2 to 0.5 m                                       | 0.5 to 0.8 m                                     | 0.8 to 1.1 m                                        |
| <b>STORM TIDE INUNDATION</b>                  | 1% AEP + 0.2 m SLR                                | 1% AEP + 0.5 m SLR                                 | 1% AEP + 0.8 m SLR                               | 1% AEP + 1.1 m SLR                                  |
| <b>PERMANENT INUNDATION<br/>(TIDAL AREAS)</b> | 0.2 m SLR                                         | 0.47 m SLR                                         | 0.82 m SLR                                       | 0.82 m SLR*                                         |
| <b>EROSION</b>                                | 2 x 1% AEP + 0.0 m SLR                            | 2 x 1% AEP + 0.2 m SLR                             | 2 x 1% AEP + 0.5 m SLR                           | 2 x 1% AEP + 0.8 m SLR                              |

\* Same scenario as long term due to data availability

Attachment 6 provides further mapping of all scenarios used in the risk assessment.



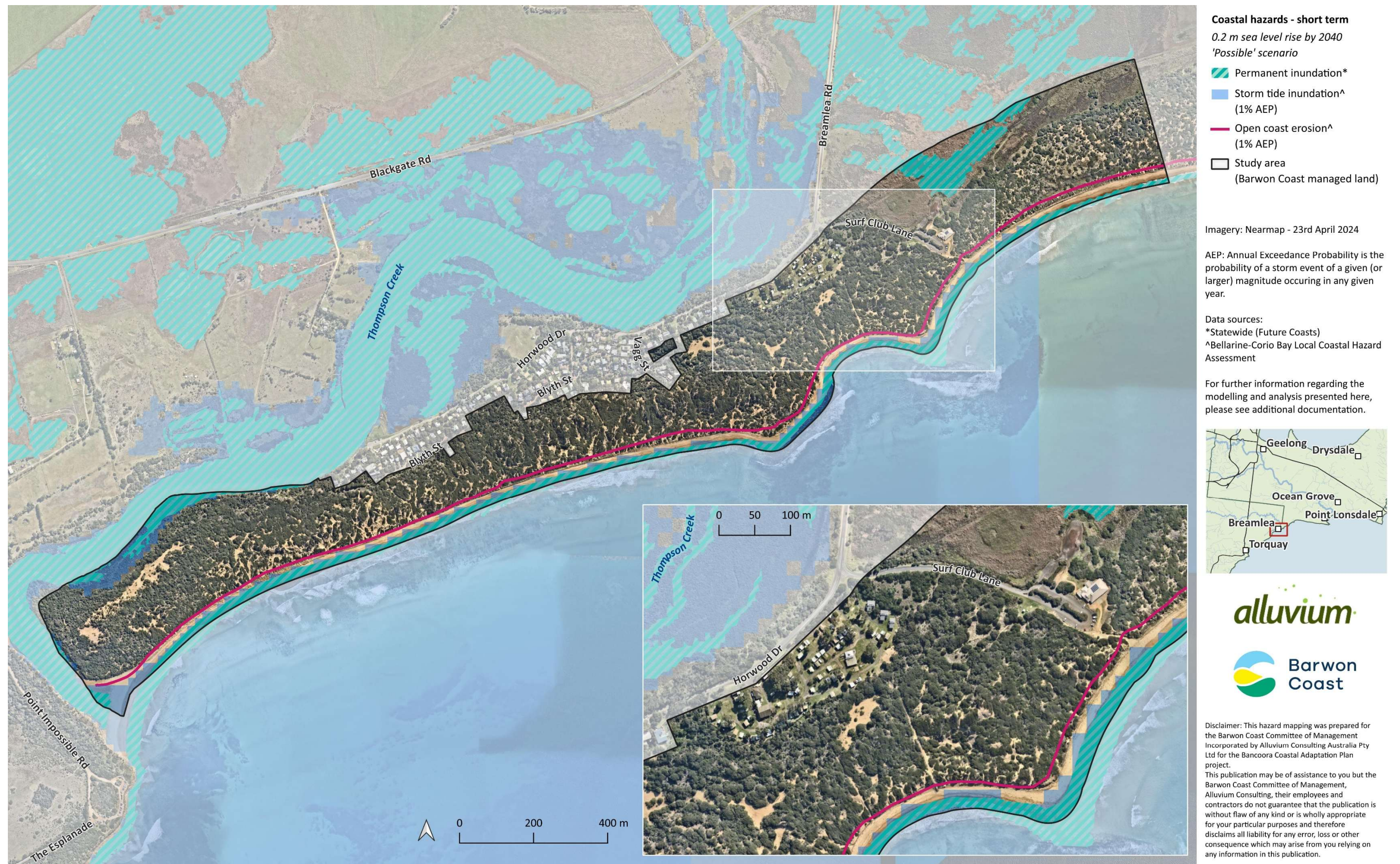


Figure 26. Coastal hazard mapping - short term (0.2 m sea level rise by 2040)



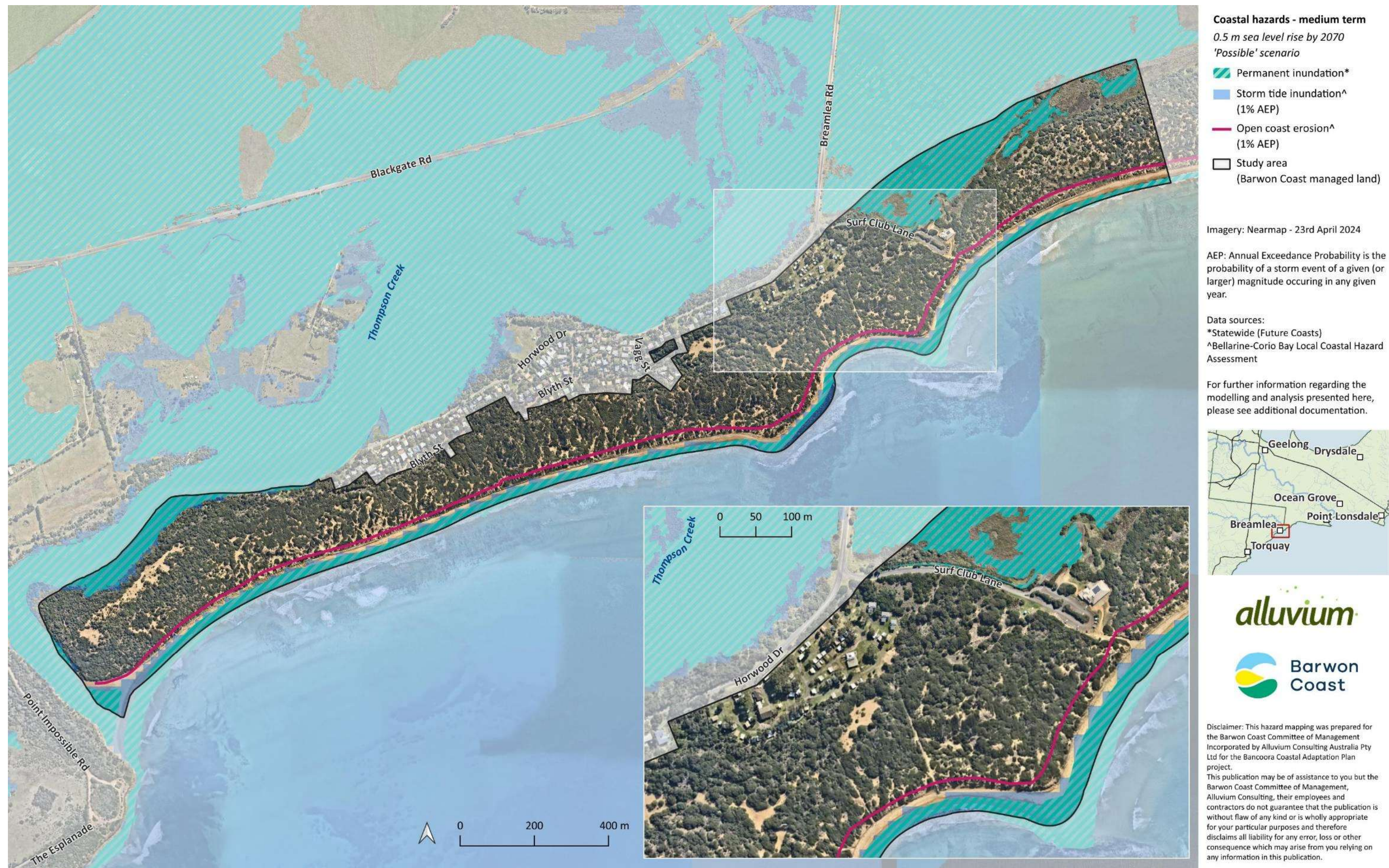
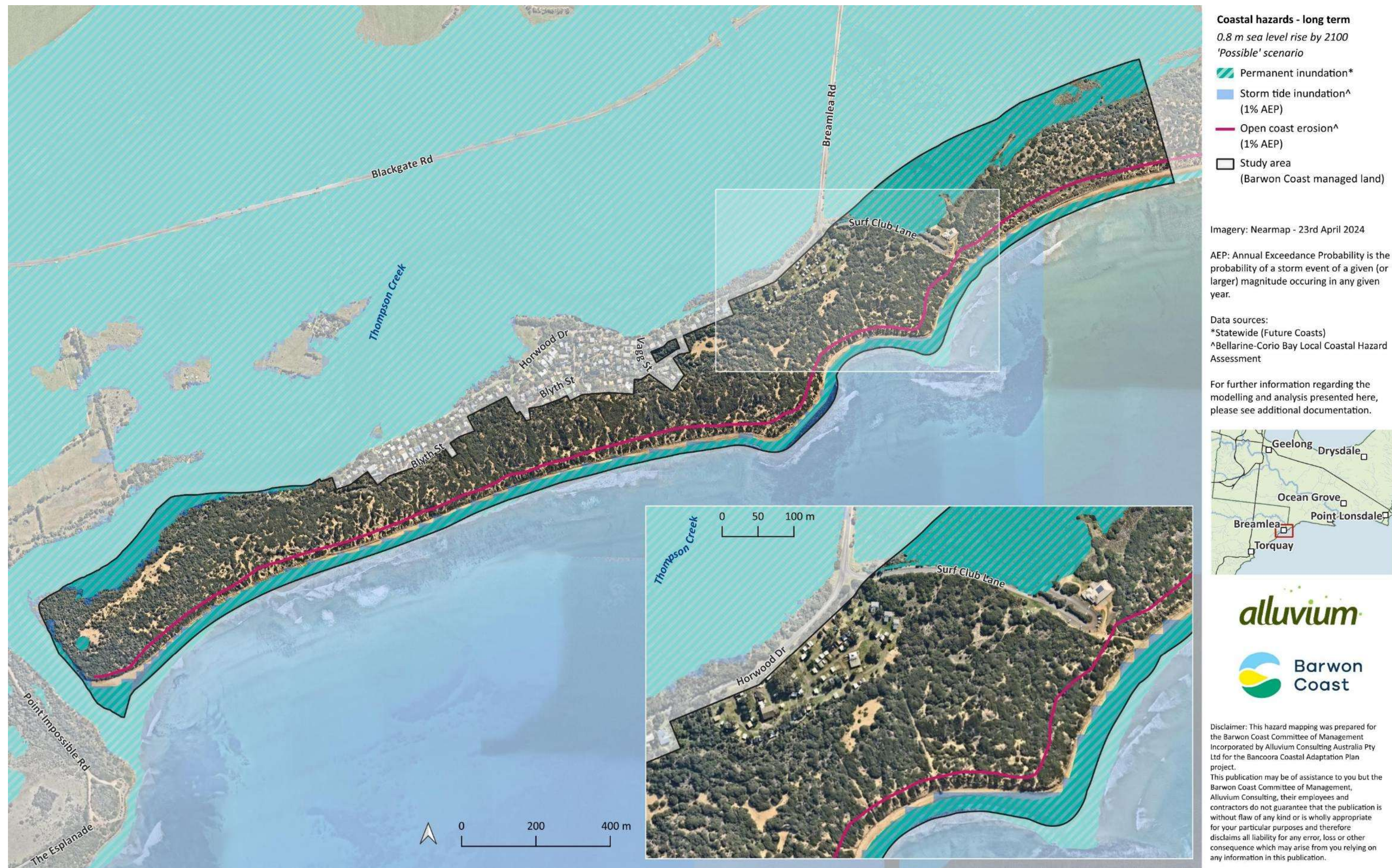


Figure 27. Coastal hazard mapping - medium term (0.5 m sea level rise by 2070)





**Figure 28.** Coastal hazard mapping - long term (0.8 m sea level rise by 2100)



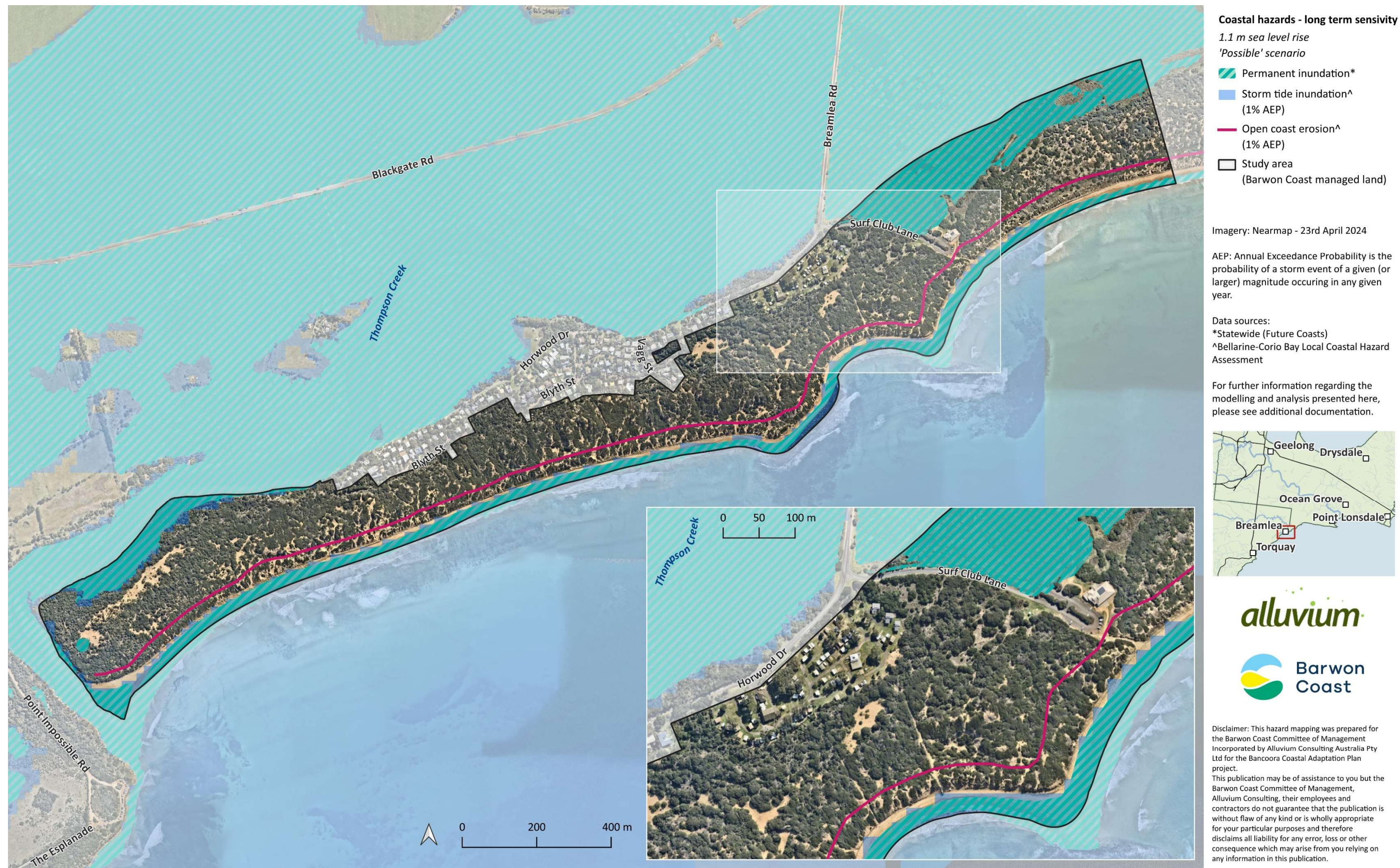


Figure 29. Coastal hazard mapping - long term sensitivity scenario (1.1 m sea level rise)



### Community appreciation of coastal hazards and known vulnerabilities

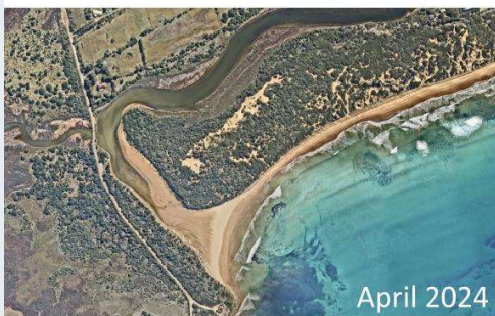
The Breamlea community have observed impacts from coastal hazards and a range of other natural hazards. Through our community survey and interviews, people reflected on some of the changes they had seen, and the impacts flooding and erosion can have on the community:

#### Breamlea Road and access to the town

Breamlea Road was apparently raised in the 1970s due to constant flooding. Prior to this, there were stories of people using boats to access the township. A 2001 flood event (pictured right) shows the road and large areas of the floodplain inundated. Community members and previous studies (Cardno, 2015a) recognise the vulnerability that stems from only one access road into and out of the township.



25th April 2001 Photo credit: Clark Coleman



Thompson Creek estuary 2009 to 2024 comparison

#### Sand movement and estuary dynamics

People also report seeing sand and sediment shifting along the beaches and around the estuary mouth. This includes day to day changes, seasonal movement and erosion following large storm events. Reported storm events included in the 1990s where large amounts of sand was shifted, covering rockpools on Breamlea Beach and a large storm around 2011/12, where the estuary mouth changed position and parts of the estuary mouth eroded (aerial imagery comparison, left).



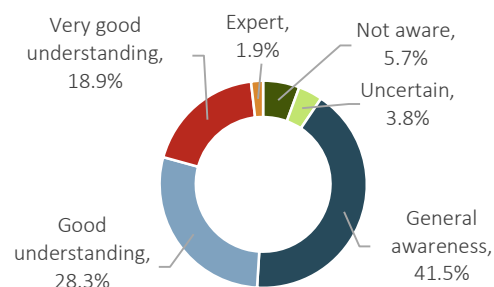
Horwood Drive inundation Photo credit: Phil Thomson

#### Horwood Drive

The community reports relatively frequent inundation of Horwood Drive, which generally coincides with the closure of Thompsons Creek mouth and wet season rainfall.

Through our community survey, nearly half of respondents (49%) felt they had either a good, very good, or expert understanding of coastal hazards (Figure 30), a large proportion (41.5%) felt they had a general awareness of coastal hazards. 9.5% were either not aware, or uncertain.

**Figure 30.** Left: Results of Q9- How would you rate your current understanding of the potential for coastal hazards in the area?



## 4 Vulnerability and risk

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Stage 4</b><br><b>Vulnerability and risk</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Explore place-based coastal hazard vulnerability and risk, to enable strategic consideration of adaptation needs/priorities. |
| The risk and vulnerability assessment examines how coastal processes and resulting hazards in the absence of adaptation (intervention) might change over time. This enables a strategic approach to considering coastal hazard risk and adaptation needs. Bringing together appreciation of the study area's values, vision and objectives (Stage 2) and the findings of coastal hazard exposure (Stage 3), Stage 4 examines hazard risk and vulnerability. This stage asks <i>how might coastal processes impact what we value?</i> |                                                                                                                              |

**Note:** Barwon Coast is responsible for the planning and management of the coastal Crown land at Bancoora Beach and the Breamlea foreshore, therefore the project is primarily focused on these areas of coastal Crown land. Vulnerability and risk assessments, and future adaptation actions and pathways relating to private land are not included in this project.

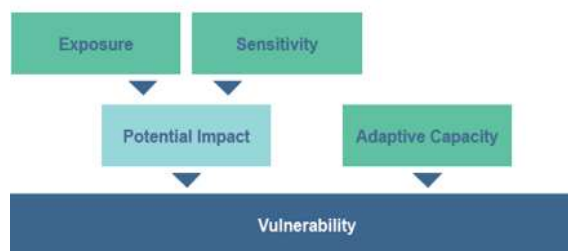
### 4.1 Vulnerability

To set the scene for the risk assessment, we first consider vulnerability. The vulnerability assessment draws on the current understanding of:

- The range of values, uses and infrastructure that are likely to be impacted by coastal hazards, from the short-term to longer-term ( $\geq 0.8$  m SLR)
- How vulnerability may vary across the study area or for certain values, uses or infrastructure.
- Exposure, sensitivity, and adaptive capacity of the area and certain values in relation to coastal hazards and climate change implications
- Discussions with Barwon Coast, the Project Steering Group and the community during the project, also informs the understanding of coastal hazard vulnerability.

Vulnerability assessments are generally at a broader scale and consider areas, communities and cultural, environmental, economic or social systems as a whole.

**Coastal vulnerability** is the susceptibility of people and places along the coast to adverse impacts from coastal hazards. It includes the degree of exposure, and ability to cope with, respond to and adapt to coastal hazards.



**Figure 31.** Elements of coastal vulnerability

Vulnerability is comprised of several elements (Figure 31), defined below.

|                          |                                                                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exposure</b>          | Refers to the degree to which cultural, environmental, economic or social systems are exposed to a given coastal hazard.                                                |
| <b>Sensitivity</b>       | The degree to which systems are affected by or responsive to a given hazard.                                                                                            |
| <b>Potential Impact</b>  | A function of a system's exposure and sensitivity.                                                                                                                      |
| <b>Adaptive capacity</b> | Ability of systems, institutions, humans, and/or natural environments to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. |

Table 16 provides an overview of coastal hazard vulnerability for the Bancoora CAP.



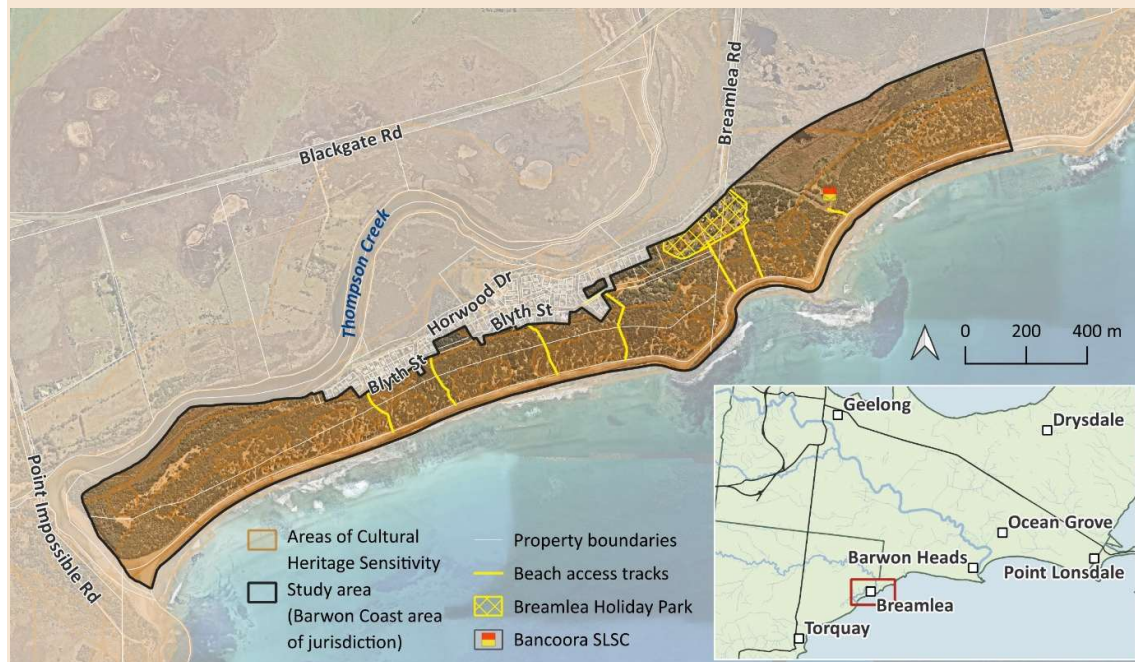
Table 16. High-level coastal hazard vulnerability assessment for the Bancoora CAP.

| Vulnerability criterion |                  | Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Exposure                | Potential impact | <p>The Breamlea and Bancoora coastal areas are prone to inundation and erosion processes, driven by offshore wind and wave climate of the Surf Coast and other drivers including the Thompson Creek estuary and surrounding waterways and floodplains. Predicted changes in climate from short to longer term, including sea level rise of 0.8 m or more are likely to result in a greater area being exposed to inundation and erosion.</p> <p>Storm tide inundation is likely to increase through the Thompson Creek estuary, with likely increasing frequency of inundation and eventual permanent inundation through the estuary floodplain. Inundation exposure is somewhat uncertain with both catchment and estuary processes having a role, but inundation is likely to increase with sea level rise. Open coast erosion is also likely to increase along the beaches and dune systems, with potentially secondary impacts from inundation through erosion and eventual breakthrough of the dune barrier system near the Surf Lifesaving Club. Conceptually, groundwater is likely to become shallower and more saline with sea level rise.</p> |
| Sensitivity             |                  | <p>The increased extents of storm tide and permanent inundation and erosion may have impacts including disruption to beach access assets, SLSC car parking and access, and broader access to and through the township. Natural values, assets and ecosystem services are also likely to be sensitive to the increased extent of saltwater inundation and erosion, along with groundwater intrusion, with potential impacts (permanent change, loss) on high ecological value areas. This includes dunes ecosystems and Thompson Creek estuarine wetlands and saltmarsh communities.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Adaptive capacity       |                  | <p>As a region characterised by natural features and large protected areas, the adaptive capacity of these natural assets and ecosystems is uncertain. The coast, along with access to beaches, water and SLSC facilities play an important role in the liveability and attraction of visitors to the region. Barwon Coast also relies on visitation and a good visitor experience for their operations. Adaptive limitations do exist with the relative isolation of some facilities and the township itself through single route road access.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Potential to benefit    |                  | <p>Barwon Coast and coastal users of these coastal areas are likely to benefit from increased focus on environmental, land use and facility planning associated with mitigating the risk of coastal hazards. Investment into coastal hazard adaptation can enhance natural systems, social and amenity values of the coast, as well as provide risk mitigation.</p> <p>Proactive work on strengthening and protecting natural systems will build natural resilience and assist to maintain the natural values that Breamlea/Bancoora residents and visitors value strongly. Enhancing resilience of natural systems can include reducing stressors (e.g. disturbances through access), supporting specific species/ecosystems (e.g. through revegetation works) and furthering knowledge of response to sea level rise (e.g. further monitoring and studies).</p>                                                                                                                                                                                                                                                                                       |

### Cultural vulnerability and coastal hazards

The Victorian Aboriginal Heritage Register (the Register), or VAHR, established by the *Aboriginal Heritage Act 2006*, is an important administrative tool for the successful management of Aboriginal cultural heritage. The Register holds the records of all known Aboriginal cultural heritage places and objects within Victoria. Aboriginal heritage places and objects are irreplaceable, non-renewable resources and can also include traditional and spiritual sites of significance. These places or objects are normally identified during archaeological surveys and are recorded by Heritage Advisors.

*The entire study area is designated as Areas of Cultural Heritage Sensitivity under the Aboriginal Heritage Regulations 2018 (Figure 32).*



**Figure 32. Areas of Cultural Heritage Sensitivity**

In our risk and vulnerability assessment, we have sought to include appreciation of risk to cultural values. However, spatial data cannot adequately represent these values, as data is either not available or not an appropriate method of representation. A high-level qualitative risk assessment is performed. This risk assessment has been performed by a non-Indigenous assessor and does not reflect the depth of cultural knowledge, lived experience, or culturally informed understanding that a Wadawurrung assessor would bring. Ongoing collaboration with Wadawurrung representatives is essential to ensure that cultural values, significance and perspectives are appropriately interpreted, assessed and incorporated into adaptation planning.

A broad range of undocumented and intangible cultural values also exist across coastal areas. A cultural values assessment (CVA) has been completed by WTOAC. The CVA highlights that all registered Aboriginal Places are under the protection of the *Aboriginal Heritage Act 2006*. Cultural Heritage Management Plans (CHMPs) are necessary around all Aboriginal places or Areas of Cultural Heritage Sensitivity. Dunes are expected to have tangible heritage (i.e. shell middens, artefact scatters, etc.) and are recorded as burial grounds for Wadawurrung people in the past.

Close engagement with WTOAC is needed in understanding both tangible and intangible cultural heritage in adaptation planning and all works in these sensitive areas.



## 4.2 Hazard exposure

Coastal hazard exposure is assessing what things (values, uses and infrastructure) are within hazard prone areas (exposed to inundation, erosion).

### Values, uses and infrastructure

Information and data on values, uses and infrastructure (or 'assets') across the Breamlea and Bancoora coastal zone has been compiled in a spatial Geographical Information Systems (GIS) database. This captures the physical/mapped values or assets that have potential to be exposed to coastal hazards. We note that coastal hazards can also impact on intangible or non-physical values. This database was built from publicly available information, data supplied by Barwon Coast, statewide (Data.vic) sources, City of Greater Geelong Data Exchange, supplementary datasets (e.g. SeaMap), or digitisation of aerial imagery and Before You Dig enquiries. We used this database to explore the likelihood of asset exposure to coastal hazards, and the consequence of that exposure (in relation to risk, detailed below).

For the Bancoora CAP, risk assessment is focussed on the public uses, assets and facilities that Barwon Coast has management responsibilities for, or assets servicing Barwon Coast assets (e.g. road access, water supply). We have not sought to include all assets in these areas, such as decommissioned infrastructure or private assets. Consideration of natural values has been included for Barwon Coast managed land, within the context of the Breamlea/Bancoora coastal ecological systems.

Table 17 details the values, uses and infrastructure (assets) data included in the database. Figure 33 shows some of these values, uses and assets using available spatial data.

**Table 17. Values, uses and infrastructure identified for the Bancoora CAP**

| Theme                                                       | Asset type                                                                                       |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>Wadawurrung cultural heritage and significant places</b> |                                                                                                  |
| Cultural values and significant places                      | Mapped Areas of Cultural Sensitivity                                                             |
|                                                             | Tangible cultural heritage e.g. shell middens                                                    |
|                                                             | Intangible cultural heritage that may be linked to a physical site                               |
| <b>Coastal and marine ecosystems and habitats</b>           |                                                                                                  |
| Beach                                                       | Beach ecosystem                                                                                  |
| Vegetation                                                  | Dune ecosystem including Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC*                   |
|                                                             | Wetland ecosystems including Coastal Saltmarsh/Mangrove Shrubland Mosaic EVC*                    |
|                                                             | Grassland ecosystems                                                                             |
|                                                             | Coastal Alkaline Scrub                                                                           |
| Coastal bird habitat                                        | Other native vegetation                                                                          |
|                                                             | Breeding sites for threatened bird species                                                       |
|                                                             | Feeding sites for threatened bird species                                                        |
| <b>Recreational and tourism uses and facilities</b>         |                                                                                                  |
| Beach recreation and access                                 | Beach activities (walking, relaxing on the sand, playing in the sand, SLSC competitions/patrols) |
|                                                             | Beach access tracks                                                                              |
|                                                             | Beach access stairs                                                                              |
| Breamlea Caravan Park                                       | Breamlea Caravan Park and related facilities                                                     |
| Surf lifesaving club                                        | SLSC building (inc. toilets)                                                                     |
|                                                             | SLSC tower and viewing platform                                                                  |
|                                                             | SLSC car park                                                                                    |
|                                                             | SLSC overflow car park                                                                           |
|                                                             | SLSC beach access track                                                                          |
| <b>Utilities, connection and transport</b>                  |                                                                                                  |
| Road access (servicing public assets / areas)               | Breamlea Road                                                                                    |
|                                                             | Horwood Drive                                                                                    |
|                                                             | Surf Club Lane                                                                                   |
| Water and sewerage infrastructure (servicing public assets) | Water hydrants and fire plugs (in Barwon Coast CoM)                                              |
|                                                             | Water pipes (to/from public assets)                                                              |
|                                                             | Sewer pipes (to/from public assets)                                                              |
|                                                             | Recycled water pipes                                                                             |

\*EVC = Ecological Vegetation Class



**Figure 33.** Mapped coastal values, uses and infrastructure across Breamlea/Bancoora.



## Hazard exposure and likelihood

The purpose of the exposure assessment is to understand the ‘likelihood’ (probability) of values, uses and infrastructure being exposed to coastal hazards. Likelihood generally increases over planning horizons, with sea level rise. Defining coastal hazard likelihoods provides an initial appreciation for vulnerabilities along the coast.

Likelihood ratings for the Bancoora CAP are summarised below (Table 18). These scenarios have been tailored to utilise and account for the best available hazard data for the region, for each hazard type. Likelihood of occurrence of coastal hazards events has been approximated and developed with reference to the VRC guidelines. In coastal hazard mapping in Section 3.7, the “possible” (bolded in Table 18) scenarios are mapped for storm tide inundation, permanent inundation and erosion.

Table 18. Hazard likelihood scenarios

|                                           | Short<br>By 2040 (up to 25 yrs)      | Medium<br>By 2070 (25 to 50 yrs) | Long<br>By 2100 (50 to 75 yrs) | Sensitivity<br>2100+ (beyond 75 yrs) |
|-------------------------------------------|--------------------------------------|----------------------------------|--------------------------------|--------------------------------------|
|                                           | Sea level rise (from ~1990 baseline) |                                  |                                |                                      |
|                                           | 0 to 0.2 m                           | 0.2 to 0.5 m                     | 0.5 to 0.8 m                   | 0.8 to 1.1 m                         |
| <b>STORM TIDE INUNDATION</b>              |                                      |                                  |                                |                                      |
| Likely                                    | 1% AEP + 0.0 m SLR                   | 1% AEP + 0.2 m SLR               | 1% AEP + 0.5 m SLR             | 1% AEP + 0.8 m SLR                   |
| Possible                                  | <b>1% AEP + 0.2 m SLR</b>            | <b>1% AEP + 0.5 m SLR</b>        | <b>1% AEP + 0.8 m SLR</b>      | <b>1% AEP + 1.1 m SLR</b>            |
| Unlikely                                  | 1% AEP + 0.5 m SLR                   | 1% AEP + 0.8 m SLR               | 1% AEP + 1.1 m SLR             | 1% AEP + 1.4 m SLR                   |
| Rare                                      | 1% AEP + 0.2 m SLR                   | 1% AEP + 0.47 m SLR              | 1% AEP + 0.82 m SLR            | No data – use prev.                  |
| <b>PERMANENT INUNDATION (TIDAL AREAS)</b> |                                      |                                  |                                |                                      |
| Likely                                    | 0.0 m SLR                            | 0.2 m SLR                        | 0.47 m SLR                     | 0.82 m SLR                           |
| Possible                                  | <b>0.2 m SLR</b>                     | <b>0.47 m SLR</b>                | <b>0.82 m SLR</b>              | No data – use prev.                  |
| <b>EROSION</b>                            |                                      |                                  |                                |                                      |
| Possible                                  | <b>2 x 1% AEP + 0.0 m SLR</b>        | <b>2 x 1% AEP + 0.2 m SLR</b>    | <b>2 x 1% AEP + 0.5 m SLR</b>  | <b>2 x 1% AEP + 0.8 m SLR</b>        |
| Unlikely                                  | 2 x 1% AEP + 0.2 m SLR               | 2 x 1% AEP + 0.5 m SLR           | 2 x 1% AEP + 0.8 m SLR         | 2 x 1% AEP + 1.1 m SLR               |
| Rare                                      | 2 x 1% AEP + 0.5 m SLR               | 2 x 1% AEP + 0.8 m SLR           | 2 x 1% AEP + 1.1 m SLR         | 2 x 1% AEP + 1.4 m SLR               |
| <b>GROUNDWATER*</b>                       |                                      |                                  |                                |                                      |
| Likely                                    | Shallow extent 0.2 m SLR             | Shallow extent 0.5 m SLR         | Shallow extent 0.8 m SLR       | Shallow extent 1.1 m SLR             |

Green – Bellarine LCHA (hydrodynamic modelling) Red – Future Coasts (static/bathtub modelling)

Blue – PPBCHA Bold – indicates scenarios mapped in Section 3.7. AEP = Annual exceedance probability SLR = Sea level rise

\*Whilst groundwater information is presented here, due to limitations with hazard information, the risk assessment considers groundwater hazards at a more conceptual level.

### Method considerations

Given coastal hazard modelling for a range of AEP scenarios (in addition to a 1% AEP) is not available, a scale of likelihood has been developed by ‘bringing forward’ or ‘pushing back’ different sea level rise scenarios. For example, for the storm tide inundation, medium term (0.2 to 0.5 m SLR) planning horizon:

- a 1% AEP + 0.2 m SLR scenario is used to represent a ‘likely’ scenario,
- a 1% AEP + 0.5 m SLR scenario represents a ‘possible’ scenario (in alignment with the AEP descriptions in the VRC guidance), and
- a 1% AEP + 0.8 m SLR scenario represents an ‘unlikely’ scenario.

Given the more simplistic static approach to storm tide modelling undertaken for the Future Coasts project, this scenario (1% AEP + 0.47 m SLR) is used to represent a ‘rare’ scenario. Given the different modelling methods used, there are also instances where assets are assessed as exposed to permanent inundation but not storm tide inundation. These two hazard types are treated as separate processes in the risk assessment.

**It is acknowledged there are limitations in the applied likelihood scenarios, approximated due to available hazard data. However, assumptions and methods are considered suitable for the purposes of hazard exposure and risk assessment for the Bancoora CAP.**

## Exposure analysis

The exposure analysis combines the mapped coastal hazard extents and the assets database to analysis the values, uses and infrastructure located in identified erosion-prone or inundation areas. Geospatial and aerial imagery assessment has been used to determine for each asset (listed in Table 17) the scenarios at which these assets are exposed to the identified coastal hazard.

Exposure analysis (and subsequent risk assessment) assumes no additional adaptation (intervention) measures to manage and/or mitigate hazard impacts are enacted.

Area/s being exposed to coastal hazards, does not necessarily mean management or action is required. Barwon Coast and other land and asset managers need to look at the values, uses and infrastructure within these areas and implications of any flooding and/or erosion, to inform decisions on how we can respond through adaptation.

The purpose of the exposure assessment is to provide the 'likelihood' component for the risk assessment (described below). This provides the probability of values and assets being exposed to given coastal hazard scenarios, across planning horizons. Defining coastal hazard likelihoods provides an initial appreciation for assets and values vulnerabilities along the coast.

Figure 34 shows an example range of scenarios and relative likelihood of exposure for the medium-term planning horizon. For this given scenario and for each hazard type:

- Storm tide inundation – “Rare” that the car park, overflow car park, Surf Club Lane road and sewer pipes are exposed to storm tide inundation
- Permanent inundation – “Possible” that the car park overflow area will be exposed to permanent inundation
- Open coast erosion – “Possible” the SLSC tower and viewing platform, parts of the beach access, dune vegetation, and beach access stairs would be exposed, “Unlikely” or “Rare” for the full beach access track and further areas of dune vegetation to be exposed to open coast erosion.

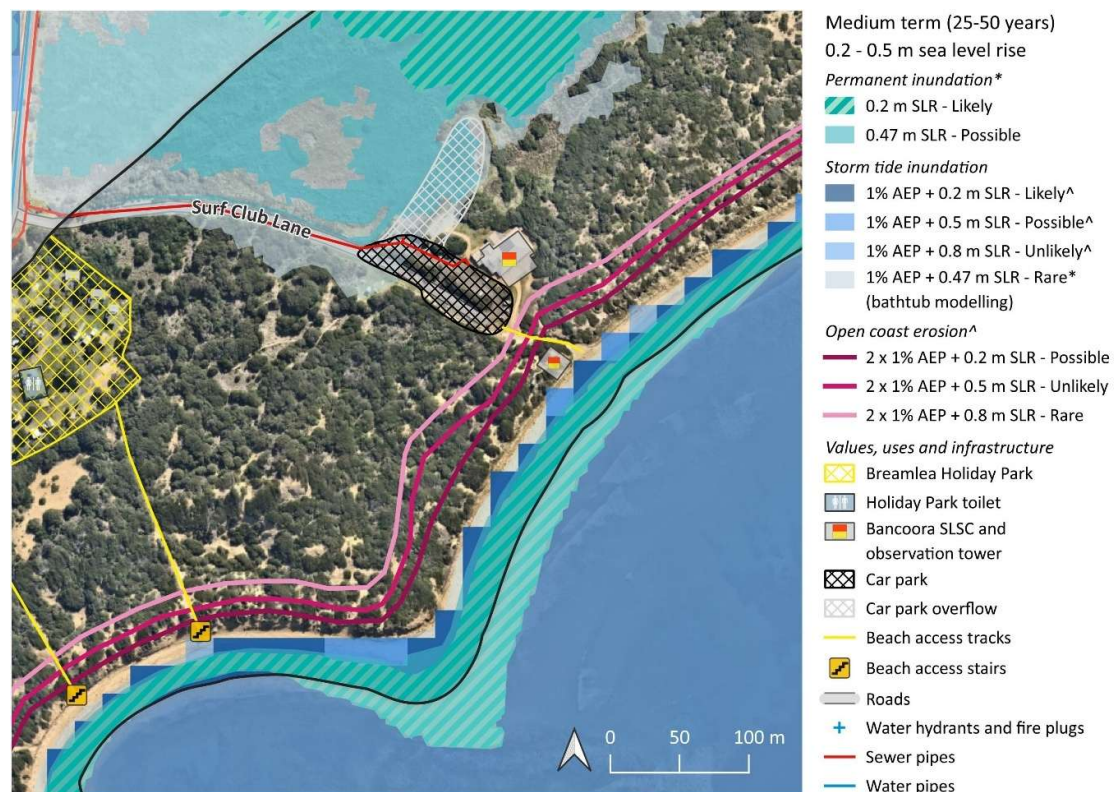


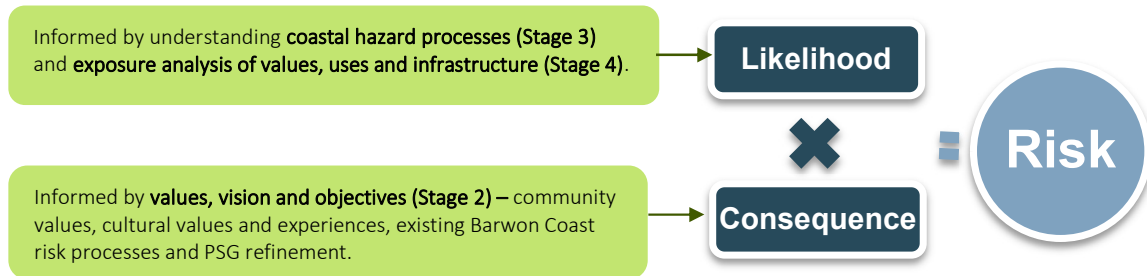
Figure 34. Example exposure analysis



### 4.3 Risk definition and framework

Hazard risk assessment combines likelihood of asset exposure to a hazard event (described above) with the consequence of asset exposure, should that hazard event occur, to assess the overall risk of impact from coastal hazards.

In accordance with AS/NZS ISO 31000:2009, risk is defined as the combination of likelihood of occurrence of an event and the consequence if the event occurs.



**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.

The **consequence** (impact/outcome) of a value or use being exposed to coastal hazard/s considers impacts on various aspects including health and safety; cultural landscapes; the natural environment; public access, use, provision of facilities and services; public property and assets; and financial and corporate elements. Consequence ratings can also vary for hazard types (erosion and inundation) and consider both short and long term impacts.

For the Bancoora CAP, coastal hazards are described in Section 3 as part of coastal hazard exposure understanding, with likelihood of these hazards defined in Section 4.2. Consequence ratings are tailored based on local stakeholder feedback and informed by community values as part of understanding values, objectives and a vision (Stage 2).

Our approach to assessing risk and vulnerability for the Bancoora CAP has taken a leading practice approach, where possible, aligned to Victoria’s Resilient Coast guidelines (DEECA, 2023). This includes:

- Developing tailored consequence categories and assigning a typical consequence of erosion, temporary inundation and permanent inundation to each asset type.
- Developing a tailored risk assessment and risk tolerance categories.
- Assessing risk for place-based values, based on available spatial data (including point, linear and polygon assets), considering the spatial distribution of risk across the study area, hot spot areas, vulnerabilities and potential for cumulative impacts.

This approach enables:

- A strategic risk assessment across the study area for the purposes of adaptation planning
- Assessment of risk for individual assets
- Identification of hot spot areas
- Cumulative impacts to be reviewed at the aggregated scale.

### Consequence categories

To understand the consequence of coastal hazard exposure, a tailored set of consequence categories have been developed and applied to the identified values, uses and infrastructure. These categories have been informed by:

- Existing risk management approaches for Barwon Coast, Victorian State Government and other management agencies.
- Similar assessments for coastal adaptation planning around Australia.
- Appreciation of values and aspirations.
- Feedback from Barwon Coast staff, including risk approach, assigning suitable budgets, levels of tolerance and recovery periods relevant for the region.
- Feedback from the Project Steering Group.

Consequence classifications are general in nature and represent the typical consequence of erosion or inundation impacts on values and asset types. Consequence classifications and definitions (Table 19) are used to assign a consequence rating, with the highest consequence rating adopted across the criteria. Discretion is and should be applied for particular values, uses and infrastructure, considering cumulative or synergistic impacts.

Each of the values, uses and infrastructure identified (Table 17) are assigned a consequence rating for each hazard type (Table 20). Consequence of hazards can vary depending on the hazard type – i.e. an asset experiencing temporary flooding has different impacts to it experiencing erosion. For many assets, erosion has a higher consequence than temporary inundation, as erosion represents a permanent loss of land/asset, which is different to temporary periods of combined storm tide and catchment inundation. For this analysis, the consequence of permanent inundation or areas subject to regular tidal inundation is considered similar to erosion, reflecting a more permanent change/loss.



Table 19. Bancoora CAP consequence ratings

|            | Health and safety                                                                                                                                   | Cultural landscapes                                                                                                                                                                                                        | The natural environment                                                                                                                                                                                                                                                                                                                                                                                 | Public access, use, provision of facilities and services                                                                                                                                                                                                 | Property and assets                                                                                                                                       | Financial and corporate                                                                                                                                                                    |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Considers threats to human health and safety.                                                                                                       | Specific consideration of traditional cultural values and the ability to maintain and pass on traditional knowledge and practices to future generations.                                                                   | Considers elements such as regionally significant ecological values and ecosystem services.                                                                                                                                                                                                                                                                                                             | Access to key sites, services and activities underpinning community lifestyle, wellbeing, and culture.                                                                                                                                                   | Damage to public property and infrastructure.                                                                                                             | Considers threats to corporate/business operations and revenue generation.                                                                                                                 |
| Negligible | On-site first aid treatment required by staff, visitor, contractor, or member of the public.                                                        | No impact on places of cultural significance expected                                                                                                                                                                      | Little to no environmental impact(s) on the ecosystem services and natural features of local saline wetlands / estuary, coastal saltmarsh, or dunes.                                                                                                                                                                                                                                                    | Very small, short-term (<5 day) disruption to service delivery, access to key sites/facilities and activities. Numerous alternatives available.                                                                                                          | Minimal damage to Barwon Coast infrastructure with total value <\$20,000                                                                                  | Minimal to no impact on business operations. Loss of revenue <\$20,000/yr                                                                                                                  |
| Minor      | Minor injuries or illness (physical/mental) requiring medical attention by staff, visitor, contractor, or member of the public.                     | Small, contained, and reversible short-term impact on places of cultural significance.<br><br>Full recovery may take less than one year.                                                                                   | Isolated and temporary short-term impact across either saline wetlands / estuary, coastal saltmarsh, or dunes, affecting extent or quality of habitat for local species.<br><br>E.g. Small-scale recovery of depleted or endangered EVCs up to one year.                                                                                                                                                | Small to medium (1-3 week) disruption to service delivery, access to key sites / facilities and activities. Some alternatives available. Some works / repairs required to restore access / services.<br><br>Full recovery may take 6 months to one year. | Minor damage to Barwon Coast infrastructure with total value >\$20,000 but <\$150,000<br><br>Full recovery may take up to one year                        | Minor impact on business operations. Loss of revenue >\$20,000 but <\$100,000/yr<br>E.g. Breamlea Caravan Park not operational for 1-2 days or ~10% sites not operational for a year       |
| Moderate   | Significant injury or illness (physical/mental) requiring in-patient hospitalisation of staff member, visitor, contractor, or member of the public. | Substantial impact on one or more places of cultural significance.<br><br>Full recovery may take more than one year.                                                                                                       | Substantial yet localised impact across either saline wetlands / estuary, coastal saltmarsh, or severe and widespread impact across coastal dunes.<br>E.g. Decline in invertebrate productivity leading to decline in species richness for estuarine waterbodies; shifts towards more salt-tolerant species.<br>Medium scale recovery of endangered EVCs up to 5 years or depleted EVCs up to 10 years. | Substantial (1-2 month) disruption to service delivery, access to key sites/facilities and activities. Works / repairs required to restore access / services.<br><br>Full recovery may take more than one year.                                          | Moderate to major damage to property or infrastructure with total value >\$150,000 but <\$1.5 million.<br><br>Full recovery may take more than one year   | Moderate impact to business operations. Loss of revenue >\$100,000 but <\$250,000/yr<br>E.g. Breamlea Caravan Park not operational for 1-2 months or ~25% sites not operational for a year |
| Major      | Extensive and/or permanent injury or illness (physical/mental) of staff member, visitor, contractor, or member of the public.                       | Severe and widespread semi-permanent impact on one or more places of cultural significance, including loss of land, connection to land and ability to continue traditional practices.<br><br>Recovery may take many years. | Severe and widespread temporary impact across saline wetlands, estuary, coastal saltmarsh, or severe and widespread permanent impact across coastal dunes.<br>E.g. Shifts in species composition, loss of habitat (foraging and roosting) for local and/or threatened species.<br>Large scale recovery of endangered EVCs over 5-10 years or depleted EVCs over 10 years.                               | Severe (3-4-month peak season or full year) disruption to service delivery, access to key sites/facilities and activities. Major works required to restore access/services.<br><br>Full recovery expected to take several years                          | Major damage or loss of property or infrastructure with total value >\$1.5 million but <\$10 million.<br><br>Full recovery expected to take several years | Major impact to business operations. Loss of revenue >\$250,000 but <\$1,000,000/yr<br>E.g. Entire Breamlea Caravan Park not operational for 1 year.                                       |
| Severe     | Single or multiple deaths or severe permanent disability or illness (physical/mental) of staff, visitor, contractor, or member of the public.       | Severe and widespread permanent impact on multiple places of cultural significance, including loss of land, connection to land and ability to continue.<br><br>Recovery unlikely                                           | Severe and widespread, permanent impact across saline wetlands / estuary, coastal saltmarsh, and/or dunes.<br>E.g. Changed habitat from brackish to marine, loss of dune vegetation, loss of habitat for many species, including threatened species.<br>Full recovery unlikely or expected to take >10 years.                                                                                           | Widespread and permanent disruption to service delivery, access to key sites/facilities and activities.<br><br>Full recovery may be unlikely or take many years.                                                                                         | Widespread major damage or loss of property or infrastructure with total value >\$10 million.<br><br>Full recovery may be unlikely or take many years.    | Severe (long term and widespread) impact to business operations. Loss of revenue >\$1,000,000/yr<br>E.g. Entire Breamlea Caravan Park not operational for multiple years.                  |

Table 20. Consequence ratings for values, uses and infrastructure identified for the Bancoora CAP

| Theme                                                 | Asset type                                                                                       | Consequence of exposure |                      |            |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|----------------------|------------|
|                                                       |                                                                                                  | Storm tide inundation   | Permanent inundation | Erosion    |
| Wadawurrung cultural heritage and significant places* |                                                                                                  |                         |                      |            |
| Cultural values and significant places                | Mapped Areas of Cultural Sensitivity                                                             | Negligible              | Moderate             | Moderate   |
|                                                       | Tangible cultural heritage e.g. shell middens                                                    | Minor                   | Major                | Major      |
|                                                       | Intangible cultural heritage that may be linked to a physical site                               | Minor                   | Major                | Major      |
| Coastal and marine ecosystems and habitats            |                                                                                                  |                         |                      |            |
| Beach                                                 | Beach ecosystem                                                                                  | Negligible              | Negligible           | Negligible |
| Vegetation                                            | Dune ecosystem including Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC                    | Minor                   | Moderate             | Moderate   |
|                                                       | Wetland ecosystems including Coastal Saltmarsh/Mangrove Shrubland Mosaic EVC                     | Negligible              | Minor                | Minor      |
|                                                       | Coastal Tussock Grassland EVC                                                                    | Negligible              | Minor                | Minor      |
|                                                       | Other native vegetation                                                                          | Negligible              | Minor                | Minor      |
| Coastal bird habitat                                  | Breeding sites for threatened bird species                                                       | Negligible              | Moderate             | Moderate   |
|                                                       | Feeding sites for threatened bird species                                                        | Negligible              | Minor                | Minor      |
| Recreational and tourism uses and facilities          |                                                                                                  |                         |                      |            |
| Beach recreation and access                           | Beach activities (walking, relaxing on the sand, playing in the sand, SLSC competitions/patrols) | Negligible              | Minor                | Minor      |
|                                                       | Beach access tracks                                                                              | Negligible              | Minor                | Minor      |
|                                                       | Beach access stairs and emergency markers                                                        | Minor                   | Moderate             | Moderate   |
| Breamlea Caravan Park                                 | Breamlea Caravan Park and facilities                                                             | Moderate                | Major                | Major      |
| Surf lifesaving club                                  | SLSC building (inc. toilets)                                                                     | Major                   | Severe               | Severe     |
|                                                       | SLSC tower and viewing platform                                                                  | Moderate                | Major                | Major      |
|                                                       | SLSC car park                                                                                    | Moderate                | Major                | Major      |
|                                                       | SLSC overflow car park                                                                           | Negligible              | Minor                | Minor      |
|                                                       | SLSC beach access track                                                                          | Minor                   | Moderate             | Moderate   |
| Community connection and transport                    |                                                                                                  |                         |                      |            |
| Road access                                           | Breamlea Road access                                                                             | Moderate                | Severe               | Severe     |
|                                                       | Surf Club Lane access                                                                            | Moderate                | Severe               | Severe     |
|                                                       | Horwood Drive access (to/from public assets)                                                     | Moderate                | Severe               | Severe     |
| Utilities and services                                | Water hydrants and fire plugs (in Barwon Coast CoM)                                              | Minor                   | Major                | Major      |
|                                                       | Water pipes (to/from public assets)                                                              | Moderate                | Severe               | Severe     |
|                                                       | Sewer pipes (to/from public assets)                                                              | Moderate                | Severe               | Severe     |
|                                                       | Recycled water pipes                                                                             | Negligible              | Minor                | Minor      |

\*Ratings by a non-Indigenous assessor and do not reflect the depth of cultural knowledge, lived experience, or culturally informed understanding that a Wadawurrung assessor would bring. Ratings may not represent the full suite of coastal hazard impacts on Aboriginal heritage and cultural values.



### Risk assessment matrix and tolerance

Once consequence and likelihood ratings have been determined, a risk matrix is used to assess the overall level of risk for each value or use, under different scenarios. A risk assessment matrix has been tailored for the Bancoora CAP (Table 21). It is informed by existing Barwon Coast risk processes, Statewide risk assessments, guidance, the VRC framework, availability of data representing likelihood, and other leading practice approaches.

**Table 21. Tailored risk matrix for the Bancoora CAP**

|            |          | Consequence |        |          |        |           |
|------------|----------|-------------|--------|----------|--------|-----------|
|            |          | Negligible  | Minor  | Moderate | Major  | Severe    |
| Likelihood | Likely   | Medium      | Medium | High     | High   | Very high |
|            | Possible | Low         | Medium | Medium   | High   | High      |
|            | Unlikely | Low         | Low    | Medium   | Medium | High      |
|            | Rare     | Low         | Low    | Low      | Medium | High      |

Note: We have only included likelihoods of Likely, Possible, Unlikely, and Rare for our risk assessment due to the availability of hazard data for the study area. Not all hazards have representative data for the full suite of likelihood.

Quantifying risk provides a basis to strategically prioritise and manage (mitigate) risk, through an adaptation response. We may be able to ‘cope’ or ‘live with’ a certain level of risk before we reach a ‘trigger’ point where risk reaches unacceptable levels. Consideration of risk tolerance is provided for each risk category (Table 22), as guided by Barwon Coast risk tolerance, State guidance and the VRC framework.

**Table 22. Tailored risk tolerance categories for the Bancoora CAP**

| Risk      | Risk tolerance                                                                                                                                                                                                                | Action required                                                                                                                      |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Very High | A risk that following an understanding of likelihood and consequence, is so high that it warrants that all possible mitigation measures be analysed in order to bring about a reduction in risk. Falls outside risk appetite. | Immediate and/or ongoing actions to avoid or reduce the risk to as low as possible should be undertaken as soon as practicable.      |
| High      | A risk that following an understanding of likelihood and consequence, is so high that it is likely to endanger service delivery and values. May fall outside risk appetite.                                                   | Risk should be reduced, treated, or eliminated through mitigation strategies, where possible, in the short term.                     |
| Medium    | A risk that does not automatically require risk mitigation but rather a cost-benefit analysis is required to determine if treatment is necessary. Risk falls within risk appetite.                                            | Risk should be reduced, treated, or eliminated through mitigation strategies, where possible, in the short to longer term.           |
| Low       | A risk sufficiently low that the risk should be able to be managed via existing controls and normal operating procedures. Well within risk tolerance.                                                                         | Treatment of risk if/when resources are available. Manage and monitor as part of current operations and provide for periodic review. |

## 4.4 Risk assessment outcomes

Risk has been assessed for each planning horizon, coastal hazard type and across different value and asset types, relevant for the Bancoora CAP.

### Risk across the region and asset types

Overall, values, uses and infrastructure across the study area will be at increasing risk of more frequent / permanent inundation and erosion in the medium to long term. There is risk of open coast erosion impacts in the short-term with increasing risk for key values, uses and infrastructure into the long term. While coastal hazard risk is low for some hazards in the short term, proactive adaptation will help mitigate risk into the medium and long term. Table 23 presents a summary of risk ratings across the Breamlea and Bancoora coastal areas for each hazard type.

**Table 23. Bancoora CAP risk profile summary.**

|                              | Short<br>By 2040 (up to 25 yrs)      | Medium<br>By 2070 (25 to 50 yrs) | Long<br>By 2100 (50 to 75 yrs) | Sensitivity<br>2100+ (beyond 75 yrs) |
|------------------------------|--------------------------------------|----------------------------------|--------------------------------|--------------------------------------|
|                              | Sea level rise (from ~1990 baseline) |                                  |                                |                                      |
|                              | 0 to 0.2 m                           | 0.2 to 0.5 m                     | 0.5 to 0.8 m                   | 0.8 to 1.1 m                         |
| <b>STORM TIDE INUNDATION</b> | Low                                  | Low                              | Low*                           | Medium                               |
| <b>PERMANENT INUNDATION</b>  | Low                                  | Medium*                          | High                           | High                                 |
| <b>OPEN COAST EROSION</b>    | Medium*                              | Medium*                          | Medium*                        | High                                 |

\* Select values, uses and infrastructure at higher risk.

### Conceptual understanding of risk for other hazard types

With limited mapped coastal hazard extents, understanding of risk resulting from groundwater and estuary dynamic hazards has been considered at a conceptual/qualitative level. The narrative below describes emerging risks for these hazard types.

#### Groundwater

Across the study area, groundwater is generally brackish with salinity of 1,000 to 3,500 mg/L and only suitable for certain irrigation crops or stock use. Large areas of the Thompson Creek estuary have shallow groundwater where the water table is less than 2 m deep. Rising sea level will see the seawater-groundwater interface move further inland. This is a slow process over decades and results in shallower water tables and increased salinity of groundwater. Given the study area already exhibits shallow groundwater, the risk to values, uses and infrastructure is considered low in the short to medium term. Over longer timeframes shallower water tables and increased salinity could impact on groundwater uses.

#### Estuary dynamics

With uncertainty in the response of estuary systems to a changing climate and sea level rise, the risk associated with these changes is also uncertain. The Bancoora CAP has not sought to determine exact changes resulting from a changing climate to the Thompson Creek estuary and research is still ongoing in this space. Generally it is expected that with sea level rise, inundation across estuaries will increase. This could be associated with increased berm heights (and therefore estuary water levels) and increased storm tide inundation. Values, uses and infrastructure across the Thompson Creek could be exposed to storm tide and increasing permanent inundation through the Thompson estuary. Dynamic estuary movement could also cause erosion of dune habitat and vegetation across the estuary mouth.

#### Storm tide vs. permanent inundation note:

Some areas, values, uses or assets may be shown as being exposed to permanent inundation in the short to long term, but not exposed to storm tide inundation. This is a result of the different data sources used for assessment. While related, these two processes are assessed separately. Each process has a differing consequence of exposure with generally a lower consequence associated with storm tide inundation.

Risk assessment results for individual values, uses and assets are presented for storm tide inundation, permanent inundation and open coast erosion in Table 24, Table 25 and Table 26, respectively, below. These tables show the likelihood of exposure, consequence rating for the asset type, and resultant risk rating.



**Table 24. Risk assessment results for storm tide inundation**

| Values, uses and infrastructure                                                                  | Planning horizon                                                                                                                                                                                                                                                                               |            |      |                          |            |      |                          |            |        |                         |            |        |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|--------------------------|------------|------|--------------------------|------------|--------|-------------------------|------------|--------|
|                                                                                                  | Short                                                                                                                                                                                                                                                                                          |            |      | Medium                   |            |      | Long                     |            |        | Sensitivity             |            |        |
|                                                                                                  | By 2040 (up to 25 years)                                                                                                                                                                                                                                                                       |            |      | By 2070 (25 to 50 years) |            |      | By 2100 (50 to 75 years) |            |        | 2100+ (beyond 75 years) |            |        |
| Sea level rise (from ~1990 baseline)                                                             | 0 to 0.2 m                                                                                                                                                                                                                                                                                     |            |      | 0.2 to 0.5 m             |            |      | 0.5 to 0.8 m             |            |        | 0.8 to 1.1 m            |            |        |
|                                                                                                  | Likelihood                                                                                                                                                                                                                                                                                     | Conseq.    | Risk | Likelihood               | Conseq.    | Risk | Likelihood               | Conseq.    | Risk   | Likelihood              | Conseq.    | Risk   |
| <b>Wadawurrung cultural heritage and significant places</b>                                      |                                                                                                                                                                                                                                                                                                |            |      |                          |            |      |                          |            |        |                         |            |        |
| Mapped Areas of Cultural Sensitivity                                                             | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Tangible cultural heritage e.g. shell middens                                                    | Minimal spatial data used represent these values, as either not available or not an appropriate method of representation. Low risk of storm tide inundation on sites of significance, with temporary impacts to some sites and locations that already experience natural cycles of inundation. |            |      |                          |            |      |                          |            |        |                         |            |        |
| Intangible cultural heritage (linked to physical site)                                           |                                                                                                                                                                                                                                                                                                |            |      |                          |            |      |                          |            |        |                         |            |        |
| <b>Coastal and marine ecosystems and habitats</b>                                                |                                                                                                                                                                                                                                                                                                |            |      |                          |            |      |                          |            |        |                         |            |        |
| Beach ecosystem                                                                                  | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Dune ecosystem<br>including Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC                 |                                                                                                                                                                                                                                                                                                | Minor      |      |                          | Minor      |      |                          | Minor      |        |                         | Minor      |        |
| Wetland ecosystems<br>including Coastal Saltmarsh/Mangrove Shrubland Mosaic EVC                  | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Coastal Tussock Grassland EVC                                                                    | Rare                                                                                                                                                                                                                                                                                           | Negligible | Low  | Rare                     | Negligible | Low  | Rare                     | Negligible | Low    | Unlikely                | Negligible | Low    |
| Other native vegetation                                                                          | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Breeding sites for threatened bird species                                                       | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Feeding sites for threatened bird species                                                        | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| <b>Recreational and tourism uses and facilities</b>                                              |                                                                                                                                                                                                                                                                                                |            |      |                          |            |      |                          |            |        |                         |            |        |
| Beach activities (walking, relaxing on the sand, playing in the sand, SLSC competitions/patrols) | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |
| Beach access tracks                                                                              |                                                                                                                                                                                                                                                                                                | Negligible |      |                          | Negligible |      |                          | Negligible |        |                         | Negligible |        |
| Beach access stairs and emergency markers                                                        |                                                                                                                                                                                                                                                                                                | Minor      |      |                          | Minor      |      |                          | Minor      |        |                         | Minor      |        |
| Breamlea Caravan Park and facilities                                                             |                                                                                                                                                                                                                                                                                                | Moderate   |      |                          | Moderate   |      |                          | Moderate   |        |                         | Moderate   |        |
| SLSC building (inc. toilets)                                                                     |                                                                                                                                                                                                                                                                                                | Major      |      |                          | Major      |      |                          | Major      |        |                         | Major      |        |
| SLSC tower and viewing platform                                                                  |                                                                                                                                                                                                                                                                                                | Moderate   |      |                          | Moderate   |      |                          | Moderate   |        |                         | Moderate   |        |
| SLSC car park                                                                                    | Rare                                                                                                                                                                                                                                                                                           | Moderate   | Low  | Rare                     | Moderate   | Low  | Rare                     | Moderate   | Low    | Unlikely                | Moderate   | Medium |
| SLSC overflow car park                                                                           | Rare                                                                                                                                                                                                                                                                                           | Negligible | Low  | Rare                     | Negligible | Low  | Rare                     | Negligible | Low    | Unlikely                | Negligible | Low    |
| SLSC beach access track                                                                          |                                                                                                                                                                                                                                                                                                | Minor      |      |                          | Minor      |      |                          | Minor      |        |                         | Minor      |        |
| <b>Community connection and transport</b>                                                        |                                                                                                                                                                                                                                                                                                |            |      |                          |            |      |                          |            |        |                         |            |        |
| Breamlea Road access                                                                             | Rare                                                                                                                                                                                                                                                                                           | Moderate   | Low  | Rare                     | Moderate   | Low  | Rare                     | Moderate   | Low    | Unlikely                | Moderate   | Medium |
| Surf Club Lane access                                                                            | Rare                                                                                                                                                                                                                                                                                           | Moderate   | Low  | Rare                     | Moderate   | Low  | Rare                     | Moderate   | Low    | Unlikely                | Moderate   | Medium |
| Horwood Drive access (to/from public assets)                                                     | Rare                                                                                                                                                                                                                                                                                           | Moderate   | Low  | Rare                     | Moderate   | Low  | Unlikely                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| Water hydrants and fire plugs (in Barwon Coast CoM)                                              | Rare                                                                                                                                                                                                                                                                                           | Minor      | Low  | Rare                     | Minor      | Low  | Rare                     | Minor      | Low    | Unlikely                | Minor      | Low    |
| Water pipes (to/from public assets)                                                              | Rare                                                                                                                                                                                                                                                                                           | Minor      | Low  | Rare                     | Minor      | Low  | Rare                     | Minor      | Low    | Unlikely                | Minor      | Low    |
| Sewer pipes (to/from public assets)                                                              | Rare                                                                                                                                                                                                                                                                                           | Minor      | Low  | Rare                     | Minor      | Low  | Rare                     | Minor      | Low    | Unlikely                | Minor      | Low    |
| Recycled water pipes                                                                             | Likely                                                                                                                                                                                                                                                                                         | Negligible | Low  | Likely                   | Negligible | Low  | Likely                   | Negligible | Low    | Likely                  | Negligible | Low    |

Table 25. Risk assessment results for permanent inundation

| Values, uses and infrastructure                                                                  | Planning horizon                                                                                                                                                                                                                                                                                   |            |        |                          |            |        |                          |            |           |                         |            |           |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|--------------------------|------------|--------|--------------------------|------------|-----------|-------------------------|------------|-----------|
|                                                                                                  | Short                                                                                                                                                                                                                                                                                              |            |        | Medium                   |            |        | Long                     |            |           | Sensitivity             |            |           |
|                                                                                                  | By 2040 (up to 25 years)                                                                                                                                                                                                                                                                           |            |        | By 2070 (25 to 50 years) |            |        | By 2100 (50 to 75 years) |            |           | 2100+ (beyond 75 years) |            |           |
| Sea level rise (from ~1990 baseline)                                                             | 0 to 0.2 m                                                                                                                                                                                                                                                                                         |            |        | 0.2 to 0.5 m             |            |        | 0.5 to 0.8 m             |            |           | 0.8 to 1.1 m            |            |           |
|                                                                                                  | Likelihood                                                                                                                                                                                                                                                                                         | Conseq.    | Risk   | Likelihood               | Conseq.    | Risk   | Likelihood               | Conseq.    | Risk      | Likelihood              | Conseq.    | Risk      |
| <b>Wadawurrung cultural heritage and significant places</b>                                      |                                                                                                                                                                                                                                                                                                    |            |        |                          |            |        |                          |            |           |                         |            |           |
| Mapped Areas of Cultural Sensitivity                                                             |                                                                                                                                                                                                                                                                                                    | Moderate   |        |                          | Moderate   |        | Possible                 | Moderate   | Medium    | Likely                  | Moderate   | High      |
| Tangible cultural heritage e.g. shell middens                                                    | Minimal spatial data used represent these values, as either not available or not an appropriate method of representation. Low to medium risk of permanent inundation impacts on sites of significance, with temporarily inundated areas becoming more regularly / permanently inundated over time. |            |        |                          |            |        |                          |            |           |                         |            |           |
| Intangible cultural heritage (linked to physical site)                                           |                                                                                                                                                                                                                                                                                                    |            |        |                          |            |        |                          |            |           |                         |            |           |
| <b>Coastal and marine ecosystems and habitats</b>                                                |                                                                                                                                                                                                                                                                                                    |            |        |                          |            |        |                          |            |           |                         |            |           |
| Beach ecosystem                                                                                  | Likely                                                                                                                                                                                                                                                                                             | Negligible | Low    | Likely                   | Negligible | Low    | Likely                   | Negligible | Low       | Likely                  | Negligible | Low       |
| Dune ecosystem including Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC                    |                                                                                                                                                                                                                                                                                                    | Moderate   |        | Possible                 | Moderate   | Medium | Likely                   | Moderate   | High      | Likely                  | Moderate   | High      |
| Wetland ecosystems including Coastal Saltmarsh/Mangrove Shrubland Mosaic EVC                     | Likely                                                                                                                                                                                                                                                                                             | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |
| Coastal Tussock Grassland EVC                                                                    |                                                                                                                                                                                                                                                                                                    | Minor      |        |                          | Minor      |        | Possible                 | Minor      | Medium    | Likely                  | Minor      | Medium    |
| Other native vegetation                                                                          | Likely                                                                                                                                                                                                                                                                                             | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |
| Breeding sites for threatened bird species                                                       |                                                                                                                                                                                                                                                                                                    | Moderate   |        | Possible                 | Moderate   | Medium | Likely                   | Moderate   | High      | Likely                  | Moderate   | High      |
| Feeding sites for threatened bird species                                                        | Likely                                                                                                                                                                                                                                                                                             | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |
| <b>Recreational and tourism uses and facilities</b>                                              |                                                                                                                                                                                                                                                                                                    |            |        |                          |            |        |                          |            |           |                         |            |           |
| Beach activities (walking, relaxing on the sand, playing in the sand, SLSC competitions/patrols) |                                                                                                                                                                                                                                                                                                    | Minor      |        | Possible                 | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |
| Beach access tracks                                                                              |                                                                                                                                                                                                                                                                                                    | Minor      |        |                          | Minor      |        |                          | Minor      |           |                         | Minor      |           |
| Beach access stairs and emergency markers                                                        |                                                                                                                                                                                                                                                                                                    | Moderate   |        |                          | Moderate   |        |                          | Moderate   |           |                         | Moderate   |           |
| Breamlea Caravan Park and facilities                                                             |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        |                          | Major      |           |                         | Major      |           |
| SLSC building (inc. toilets)                                                                     |                                                                                                                                                                                                                                                                                                    | Severe     |        |                          | Severe     |        |                          | Severe     |           |                         | Severe     |           |
| SLSC tower and viewing platform                                                                  |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        |                          | Major      |           |                         | Major      |           |
| SLSC car park                                                                                    |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        | Possible                 | Major      | High      | Likely                  | Major      | High      |
| SLSC overflow car park                                                                           |                                                                                                                                                                                                                                                                                                    | Minor      |        | Possible                 | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |
| SLSC beach access track                                                                          |                                                                                                                                                                                                                                                                                                    | Moderate   |        |                          | Moderate   |        |                          | Moderate   |           |                         | Moderate   |           |
| <b>Community connection and transport</b>                                                        |                                                                                                                                                                                                                                                                                                    |            |        |                          |            |        |                          |            |           |                         |            |           |
| Breamlea Road access                                                                             |                                                                                                                                                                                                                                                                                                    | Severe     |        |                          | Severe     |        |                          | Severe     |           |                         | Severe     |           |
| Surf Club Lane access                                                                            |                                                                                                                                                                                                                                                                                                    | Severe     |        |                          | Severe     |        | Possible                 | Severe     | High      | Likely                  | Severe     | Very high |
| Horwood Drive access (to/from public assets)                                                     |                                                                                                                                                                                                                                                                                                    | Severe     |        | Possible                 | Severe     | High   | Likely                   | Severe     | Very high | Likely                  | Severe     | Very high |
| Water hydrants and fire plugs (in Barwon Coast CoM)                                              |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        |                          | Major      |           |                         | Major      |           |
| Water pipes (to/from public assets)                                                              |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        |                          | Major      |           |                         | Major      |           |
| Sewer pipes (to/from public assets)                                                              |                                                                                                                                                                                                                                                                                                    | Major      |        |                          | Major      |        | Possible                 | Major      | High      | Likely                  | Major      | High      |
| Recycled water pipes                                                                             | Likely                                                                                                                                                                                                                                                                                             | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium    | Likely                  | Minor      | Medium    |

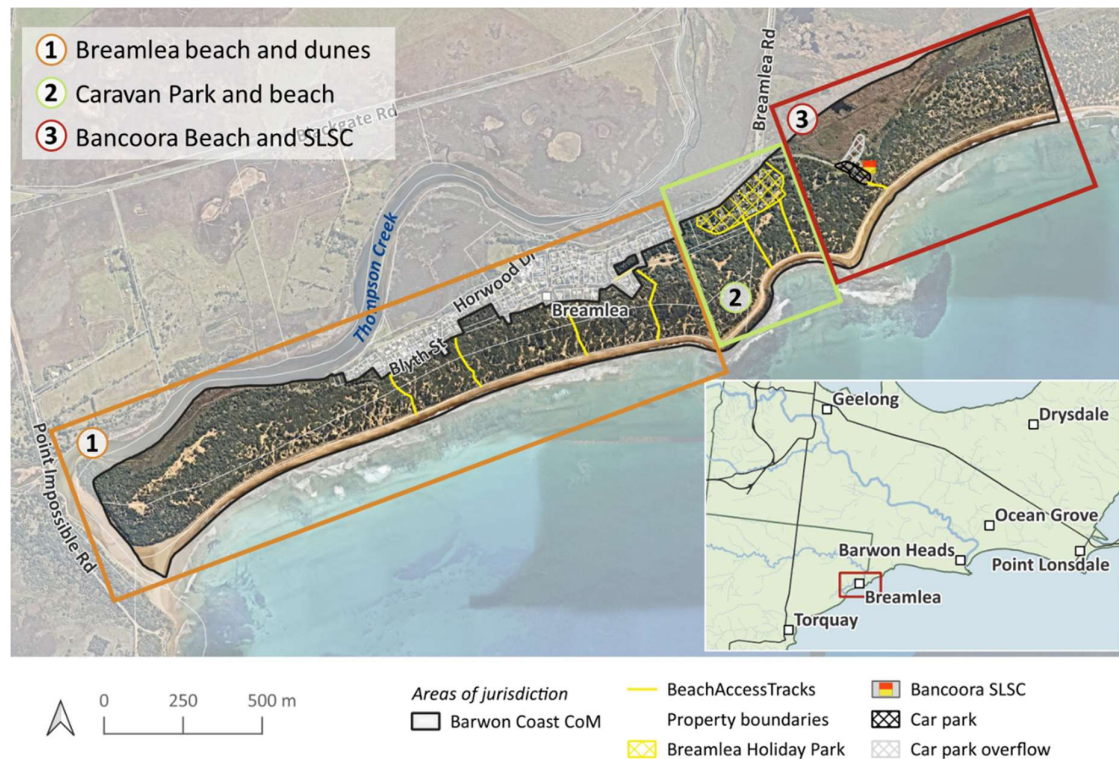
Table 26. Risk assessment results for open coast erosion

| Values, uses and infrastructure                                                                  | Planning horizon                                                                                                                                                                                                                                                                      |            |        |                          |            |        |                          |            |        |                         |            |        |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|--------------------------|------------|--------|--------------------------|------------|--------|-------------------------|------------|--------|
|                                                                                                  | Short                                                                                                                                                                                                                                                                                 |            |        | Medium                   |            |        | Long                     |            |        | Sensitivity             |            |        |
|                                                                                                  | By 2040 (up to 25 years)                                                                                                                                                                                                                                                              |            |        | By 2070 (25 to 50 years) |            |        | By 2100 (50 to 75 years) |            |        | 2100+ (beyond 75 years) |            |        |
| Sea level rise (from ~1990 baseline)                                                             | 0 to 0.2 m                                                                                                                                                                                                                                                                            |            |        | 0.2 to 0.5 m             |            |        | 0.5 to 0.8 m             |            |        | 0.8 to 1.1 m            |            |        |
|                                                                                                  | Likelihood                                                                                                                                                                                                                                                                            | Conseq.    | Risk   | Likelihood               | Conseq.    | Risk   | Likelihood               | Conseq.    | Risk   | Likelihood              | Conseq.    | Risk   |
| <b>Wadawurrung cultural heritage and significant places</b>                                      |                                                                                                                                                                                                                                                                                       |            |        |                          |            |        |                          |            |        |                         |            |        |
| Mapped Areas of Cultural Sensitivity                                                             | Possible                                                                                                                                                                                                                                                                              | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| Tangible cultural heritage e.g. shell middens                                                    | Minimal spatial data used represent these values, as either not available or not an appropriate method of representation. Medium to high risk of erosion impacts on sites of significance, especially in dune ecosystems, with permanent loss of physical sites and access over time. |            |        |                          |            |        |                          |            |        |                         |            |        |
| Intangible cultural heritage (linked to physical site)                                           |                                                                                                                                                                                                                                                                                       |            |        |                          |            |        |                          |            |        |                         |            |        |
| <b>Coastal and marine ecosystems and habitats</b>                                                |                                                                                                                                                                                                                                                                                       |            |        |                          |            |        |                          |            |        |                         |            |        |
| Beach ecosystem                                                                                  | Possible                                                                                                                                                                                                                                                                              | Negligible | Low    | Possible                 | Negligible | Low    | Possible                 | Negligible | Low    | Possible                | Negligible | Low    |
| Dune ecosystem including Coastal Dune Scrub/Coastal Dune Grassland Mosaic EVC                    | Possible                                                                                                                                                                                                                                                                              | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| Wetland ecosystems including Coastal Saltmarsh/Mangrove Shrubland Mosaic EVC                     |                                                                                                                                                                                                                                                                                       | Minor      |        |                          | Minor      |        |                          | Minor      |        |                         | Minor      |        |
| Coastal Tussock Grassland EVC                                                                    | Likely                                                                                                                                                                                                                                                                                | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium | Likely                  | Minor      | Medium |
| Other native vegetation                                                                          |                                                                                                                                                                                                                                                                                       | Minor      |        |                          | Minor      |        |                          | Minor      |        |                         | Minor      |        |
| Breeding sites for threatened bird species                                                       | Possible                                                                                                                                                                                                                                                                              | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| Feeding sites for threatened bird species                                                        |                                                                                                                                                                                                                                                                                       | Minor      |        |                          | Minor      |        |                          | Minor      |        |                         | Minor      |        |
| <b>Recreational and tourism uses and facilities</b>                                              |                                                                                                                                                                                                                                                                                       |            |        |                          |            |        |                          |            |        |                         |            |        |
| Beach activities (walking, relaxing on the sand, playing in the sand, SLSC competitions/patrols) | Possible                                                                                                                                                                                                                                                                              | Minor      | Medium | Possible                 | Minor      | Medium | Possible                 | Minor      | Medium | Possible                | Minor      | Medium |
| Beach access tracks                                                                              | Rare                                                                                                                                                                                                                                                                                  | Minor      | Low    | Unlikely                 | Minor      | Low    | Possible                 | Minor      | Medium | Possible                | Minor      | Medium |
| Beach access stairs and emergency markers                                                        | Possible                                                                                                                                                                                                                                                                              | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| Breamlea Caravan Park and facilities                                                             |                                                                                                                                                                                                                                                                                       | Major      |        |                          | Major      |        |                          | Major      |        |                         | Major      |        |
| SLSC building (inc. toilets)                                                                     |                                                                                                                                                                                                                                                                                       | Severe     |        |                          | Severe     |        |                          | Severe     |        | Unlikely                | Severe     | High   |
| SLSC tower and viewing platform                                                                  | Possible                                                                                                                                                                                                                                                                              | Major      | High   | Possible                 | Major      | High   | Possible                 | Major      | High   | Possible                | Major      | High   |
| SLSC car park                                                                                    |                                                                                                                                                                                                                                                                                       | Major      |        |                          | Major      |        | Rare                     | Major      | Medium | Unlikely                | Major      | Medium |
| SLSC overflow car park                                                                           |                                                                                                                                                                                                                                                                                       | Minor      |        |                          | Minor      |        |                          | Minor      |        |                         | Minor      |        |
| SLSC beach access track                                                                          | Possible                                                                                                                                                                                                                                                                              | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                 | Moderate   | Medium | Possible                | Moderate   | Medium |
| <b>Community connection and transport</b>                                                        |                                                                                                                                                                                                                                                                                       |            |        |                          |            |        |                          |            |        |                         |            |        |
| Breamlea Road access                                                                             |                                                                                                                                                                                                                                                                                       | Severe     |        |                          | Severe     |        |                          | Severe     |        |                         | Severe     |        |
| Surf Club Lane access                                                                            |                                                                                                                                                                                                                                                                                       | Severe     |        |                          | Severe     |        |                          | Severe     |        |                         | Severe     |        |
| Horwood Drive access (to/from public assets)                                                     |                                                                                                                                                                                                                                                                                       | Severe     |        |                          | Severe     |        |                          | Severe     |        |                         | Severe     |        |
| Water hydrants and fire plugs (in Barwon Coast CoM)                                              |                                                                                                                                                                                                                                                                                       | Major      |        |                          | Major      |        |                          | Major      |        |                         | Major      |        |
| Water pipes (to/from public assets)                                                              |                                                                                                                                                                                                                                                                                       | Major      |        |                          | Major      |        |                          | Major      |        |                         | Major      |        |
| Sewer pipes (to/from public assets)                                                              |                                                                                                                                                                                                                                                                                       | Major      |        |                          | Major      |        |                          | Major      |        |                         | Major      |        |
| Recycled water pipes                                                                             | Likely                                                                                                                                                                                                                                                                                | Minor      | Medium | Likely                   | Minor      | Medium | Likely                   | Minor      | Medium | Likely                  | Minor      | Medium |



### Sub-area risk outcomes

For the purposes of adaptation planning, the Breamlea/Bancoora coastal areas have been divided into three sub-areas, these are detailed in Figure 35. For each sub-area the key values, uses and assets are considered and an overall risk rating applied. Appreciation of risk at this more localised level helps to describe the core drivers of risk for each sub-area and adaptation priorities.



**Figure 35.** *Bancoora CAP sub-areas*

As stated above, the focus of the risk assessment and adaptation planning is on Barwon Coast land, assets and infrastructure. Risk ratings across these sub areas encompass the public values, uses and assets in these areas and the public assets servicing these areas (e.g. road access, water and sewer connection).

Risk assessment summaries for the sub-areas are presented below.

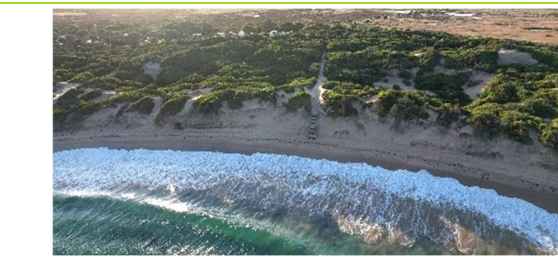


## Risk assessment summary: Breamlea beach and dunes

| Description                                  | Includes Barwon Coast managed land across Breamlea Beach and the dune systems. Key assets include coastal beach and dune vegetation, breeding and feeding sites for threatened birds, beach activities, access tracks, access stairs and emergency markers. Horwood Drive also provides road access to these public areas. Open coast erosion at the beach and inundation from the Thompson Creek estuary drive hazard exposure for this area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                     |                                           |    |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------|--|--------------------------------------|---------------------------------------|-------------------------------------|-------------------------------------------|--|--------------------------------------|--|--|--|--|------------|--------------|--------------|--------------|-----------------------|-----|-----|------|------|----------------------|-----|---------|-------|-------|--------------------|--------|--------|--------|--------|
| Risk profile                                 | <table><tr><th></th><th>Short<br/>By 2040<br/>(up to 25 years)</th><th>Medium<br/>By 2070<br/>(25 to 50 years)</th><th>Long<br/>By 2100<br/>(50 to 75 years)</th><th>Sensitivity<br/>2100+<br/>(beyond 75 years)</th></tr><tr><td></td><td colspan="4">Sea level rise (from ~1990 baseline)</td></tr><tr><td></td><td>0 to 0.2 m</td><td>0.2 to 0.5 m</td><td>0.5 to 0.8 m</td><td>0.8 to 1.1 m</td></tr><tr><td>STORM TIDE INUNDATION</td><td>Low</td><td>Low</td><td>Low*</td><td>Low*</td></tr><tr><td>PERMANENT INUNDATION</td><td>Low</td><td>Medium*</td><td>High*</td><td>High*</td></tr><tr><td>OPEN COAST EROSION</td><td>Medium</td><td>Medium</td><td>Medium</td><td>Medium</td></tr></table> <p>*Higher risk for select assets – increasing inundation of Horwood Drive access</p> <p><b>In the short term (next 25 years)</b><br/>Medium risk of beach and dune erosion associated with large storms. May cause damage to access stairs and loss of dune vegetation, with increasingly steep dune scarps in response to storm events. Storm tide inundation from Thompson Creek is likely across wetland habitats.</p> <p><b>Over the medium to long term (25 to 75+ years)</b><br/>Increasing areas of open coast erosion with impact to beach access tracks and stairs likely into the long term, associated with storm erosion. Increasing inundation risk and potential permanent inundation of some areas, including access to foreshore via Horwood Drive and of beach/dune ecosystem.</p> |                                       |                                     |                                           |                                                                                      |  | Short<br>By 2040<br>(up to 25 years) | Medium<br>By 2070<br>(25 to 50 years) | Long<br>By 2100<br>(50 to 75 years) | Sensitivity<br>2100+<br>(beyond 75 years) |  | Sea level rise (from ~1990 baseline) |  |  |  |  | 0 to 0.2 m | 0.2 to 0.5 m | 0.5 to 0.8 m | 0.8 to 1.1 m | STORM TIDE INUNDATION | Low | Low | Low* | Low* | PERMANENT INUNDATION | Low | Medium* | High* | High* | OPEN COAST EROSION | Medium | Medium | Medium | Medium |
|                                              | Short<br>By 2040<br>(up to 25 years)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Medium<br>By 2070<br>(25 to 50 years) | Long<br>By 2100<br>(50 to 75 years) | Sensitivity<br>2100+<br>(beyond 75 years) |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
|                                              | Sea level rise (from ~1990 baseline)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                       |                                     |                                           |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
|                                              | 0 to 0.2 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.2 to 0.5 m                          | 0.5 to 0.8 m                        | 0.8 to 1.1 m                              |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
| STORM TIDE INUNDATION                        | Low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Low                                   | Low*                                | Low*                                      |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
| PERMANENT INUNDATION                         | Low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Medium*                               | High*                               | High*                                     |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
| OPEN COAST EROSION                           | Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Medium                                | Medium                              | Medium                                    |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
| Barwon Coast values, uses and assets at risk | Key assets at increasing risk of coastal hazards include: <ul style="list-style-type: none"><li>• Beach ecosystem and beach activities.</li><li>• Dune ecosystems and vegetation.</li><li>• Breeding sites for beach nesting birds.</li><li>• Beach access stairs and tracks.</li><li>• Access through Horwood Drive.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |                                     |                                           |  |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |
| Adaptation priorities                        | <ul style="list-style-type: none"><li>• Avoid increasing coastal hazard risk through planning of any future assets / infrastructure outside of known coastal hazard extents.</li><li>• Support nature-based adaptation to allow and support dune, estuary and wetland ecosystems to respond to changing conditions.</li><li>• Explore opportunities for upgrade/redesign of beach access stairs to accommodate hazards, particularly when assets are damaged in storm events (i.e. to ‘build back better’).</li><li>• Ongoing monitoring and collaboration with other agencies, particularly in relation to Horwood Drive access and adaptation planning for the road and related utility assets.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                       |                                     |                                           |                                                                                      |  |                                      |                                       |                                     |                                           |  |                                      |  |  |  |  |            |              |              |              |                       |     |     |      |      |                      |     |         |       |       |                    |        |        |        |        |



## Risk assessment summary: Caravan Park and beach

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |                                              |                                            |                                                  |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------|--------------------------------------------------|
| <b>Description</b>                                  | Includes the Breamlea Caravan Park, related facilities, beach access tracks / stairs and beach and dune environments. Breamlea Road provides access to the Caravan Park, with sewer and water utilities also servicing the park. Beach and dune erosion drive hazard exposure for this area. However, rocky headlands provide some protection. Inundation drives some exposure for roads along Thompson Creek.                                                                                                                                                                                                                                                 |  |                                              |                                            |                                                  |
| <b>Risk profile</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Short</b><br>By 2040<br>(up to 25 years)                                        | <b>Medium</b><br>By 2070<br>(25 to 50 years) | <b>Long</b><br>By 2100<br>(50 to 75 years) | <b>Sensitivity</b><br>2100+<br>(beyond 75 years) |
|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Sea level rise (from ~1990 baseline)                                               |                                              |                                            |                                                  |
|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>0 to 0.2 m</b>                                                                  | <b>0.2 to 0.5 m</b>                          | <b>0.5 to 0.8 m</b>                        | <b>0.8 to 1.1 m</b>                              |
|                                                     | <b>STORM TIDE INUNDATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Low                                                                                | Low                                          | Low                                        | Low*                                             |
|                                                     | <b>PERMANENT INUNDATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Low                                                                                | Low                                          | Low*                                       | Low*                                             |
| <b>Barwon Coast values, uses and assets at risk</b> | <p>Key assets at increasing risk of coastal hazards include:</p> <ul style="list-style-type: none"> <li>• Beach ecosystem and beach activities</li> <li>• Dune ecosystems and vegetation</li> <li>• Beach access stairs and tracks</li> <li>• Access through and utilities along Breamlea Road</li> </ul>                                                                                                                                                                                                                                                                                                                                                      |                                                                                    |                                              |                                            |                                                  |
|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                    |                                              |                                            |                                                  |
| <b>Adaptation focus</b>                             | <ul style="list-style-type: none"> <li>• Avoid increasing coastal hazard risk through planning of any future assets / infrastructure outside of known coastal hazard extents.</li> <li>• Explore opportunities for upgrade/redesign of beach access stairs to accommodate hazards, if assets are damaged in storm events ('build back better').</li> <li>• Continued monitoring of conditions and nature-based methods to strengthen ecological values and improve natural hazard resilience and habitat migration.</li> <li>• Collaborate with other agencies, particularly in adaptation planning for Breamlea Road and related utility services.</li> </ul> |                                                                                    |                                              |                                            |                                                  |



## Risk assessment summary: Bancoora Beach and SLSC

|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                      |                                       |                                     |                                           |                                                                                      |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|-------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------|--|
| Description                                                                                                                                                                                                                                                                                                                                                                                        | Includes Bancoora Beach and the Surf Lifesaving Club building, toilet facilities, car parks, beach access track, SLSC tower, viewing platform, dune vegetation and some wetland saltmarsh vegetation. Breamlea Road and Surf Club Lane provide road access to the Beach and SLSC, along with water and sewerage infrastructure in the road corridor. Both open coast erosion and inundation drive hazard exposure for this area. A dune breakthrough could increase exposure further through time.                                                          |                                      |                                       |                                     |                                           |    |  |
| Risk profile                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Short<br>By 2040<br>(up to 25 years) | Medium<br>By 2070<br>(25 to 50 years) | Long<br>By 2100<br>(50 to 75 years) | Sensitivity<br>2100+<br>(beyond 75 years) |                                                                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Sea level rise (from ~1990 baseline) |                                       |                                     |                                           |                                                                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 to 0.2 m                           | 0.2 to 0.5 m                          | 0.5 to 0.8 m                        | 0.8 to 1.1 m                              |                                                                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                    | STORM TIDE INUNDATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Low                                  | Low                                   | Low                                 | Medium                                    |                                                                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                    | PERMANENT INUNDATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Low                                  | Medium                                | High                                | High*                                     |                                                                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                    | OPEN COAST EROSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Medium*                              | Medium*                               | Medium*                             | High                                      |                                                                                      |  |
| *Higher risk for select assets – very high risk of permanent inundation for Surf Club Lane access, high risk of open coast erosion for SLSC tower and viewing platform.                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                      |                                       |                                     |                                           |                                                                                      |  |
| <b>In the short term (next 25 years)</b><br>Some assets at immediate risk of open coast erosion, including the SLSC tower / viewing platform and beach access. Low risk from inundation hazards, with rare inundation events reaching saltmarsh areas, the overflow car park and Surf Club Lane access.                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                      |                                       |                                     |                                           |                                                                                      |  |
| <b>Over the medium to long term (25 to 75+ years)</b><br>Increasing risk into the medium and long term with high risk of permanent inundation of Surf Club Road access, associated utility connections and car parking areas. Increasing risk of erosion for the SLSC car park and building, with uncertainty in dune response and potential for dune breakthrough at the SLSC beach access track. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                      |                                       |                                     |                                           |                                                                                      |  |
| Barwon Coast values, uses and assets at risk                                                                                                                                                                                                                                                                                                                                                       | Key assets at increasing risk of coastal hazards include: <ul style="list-style-type: none"><li>• SLSC tower and viewing platform</li><li>• SLSC car park and overflow car park</li><li>• Surf lifesaving club building (long term 75+ years)</li><li>• Beach ecosystem (inc. breeding sites for beach nesting birds)</li><li>• Dune ecosystems and vegetation</li><li>• Beach activities, access stairs and tracks</li><li>• Access through and utilities along Breamlea Road and Surf Club Lane.</li></ul>                                                |                                      |                                       |                                     |                                           |  |  |
| Adaptation focus                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"><li>• Immediate adaptation planning for at risk assets (SLSC viewing platform).</li><li>• Proactive planning to reduce risk for other assets (SLSC building, road access, utilities) at-risk into the medium and longer term. Capitalise on the unique opportunity to redesign the SLSC and ensure it accommodates hazard risk for its future design life.</li><li>• Support nature-based resilience across dune and wetland habitats, with monitoring of conditions, particularly potential dune breakthrough.</li></ul> |                                      |                                       |                                     |                                           |                                                                                      |  |

## 4.5 Broader landscape-scale risks and vulnerabilities

Adaptation planning across the township is interconnected and adaptation planning at a broader landscape-scale has implications for Barwon Coast uses, facilities and operations. This section highlights key vulnerabilities and risks associated with Barwon Coast assets and land that are co-dependent or heavily influenced by values, assets, or infrastructure managed by other authorities.

### Bio-cultural landscape vulnerabilities

Bio-cultural landscapes across Breamlea are vulnerable to coastal hazards because they encompass interconnected natural features, cultural practices and places of deep significance to Wadawurrung Traditional Owners. Coastal hazards can impact tangible cultural sites such as middens, artefact scatters, coastal access, and other significant places.

At the same time, these hazards can threaten intangible cultural values. These include stories, songlines, language associations, practices, and ongoing connections to place. They might rely on the integrity and adaptive capacity of the landscape itself. Impacts on access for cultural use and ceremony, diminish the ability to pass knowledge to future generations, and weaken the continuity of relationships with Country. The WTOAC cultural values study will provide further insights into impacts of coastal hazards on cultural values.

### Road access

Barwon Coast foreshore reserves, the Caravan Park and the SLSC are all accessed through Breamlea Road, Horwood Drive and Surf Club Lane. Road access is at risk from coastal hazards:

- *Breamlea Road* – medium risk of storm tide inundation into the long term (by 2100). As detailed in Section 3.6, Breamlea Road may also act as a levee, limiting inundation east of the road. This levee function needs further investigation to understand risk to the road and adjoining land.
- *Horwood Drive* – high risk of permanent inundation in the medium term (by 2070) and very high risk in the long term (by 2100)
- *Surf Club Lane* – high risk of permanent inundation in the long term (by 2100).

Whilst these roads provide access to Barwon Coast assets, there are broader considerations with these roads also providing access to the township and private properties. Road access is the responsibility of CoGG. Adaptation for these assets will need to occur in tandem with broader township adaptation planning. This planning may influence longevity of the Bancoora SLSC as a recreation node and foreshore/Caravan Park access.

### Water and sewer services

Water and sewer connections service the Caravan Park and SLSC. Water pipes are at low risk of storm tide inundation; however, sewer pipes are at high risk of permanent inundation into the long term (by 2100). Barwon Water manage these assets. The ability of these assets to cope with coastal hazard exposure is uncertain. Collaboration with Barwon Water is needed to understand the resilience of these assets to coastal hazards and risks to servicing of Barwon Coast assets into the future.

### Nature based resilience and habitat migration

While some natural values on Barwon Coast land are at risk of coastal hazards, there are also adjoining habitats at risk. These include the wetland/floodplain ecosystems around the Thompson Creek estuary. Adaptive capacity of these habitats can be low when adjoining land or infrastructure prevents natural migration due to changing conditions. Parks Victoria and Corangamite CMA manage these natural systems.

### Thompson Creek estuary and catchment dynamics

The response of Thompson Creek estuary to sea level rise may also inform further risk understanding for Barwon Coast assets. The adaptive capacity of estuary systems responding to sea level rise is complex. The impact or magnitude of change depends on characteristics of individual estuaries. Management of the estuary is the responsibility of Corangamite CMA and Surf Coast Shire.

## 5 Adaptation pathways and planning

### 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.

Stage 5 identifies, assesses and decides on adaptation options and actions most appropriate for managing current and future coastal hazard risk across the study area. Adaptation is informed by the values, objectives and vision (Stage 2), coastal hazard exposure understanding (Stage 3) and risk and vulnerability assessment (Stage 4). Adaptation involves considering strategic adaptation option, actions and a pathways approach to adaptation. This stage asks *how can we manage and adapt to coastal hazard impacts?*

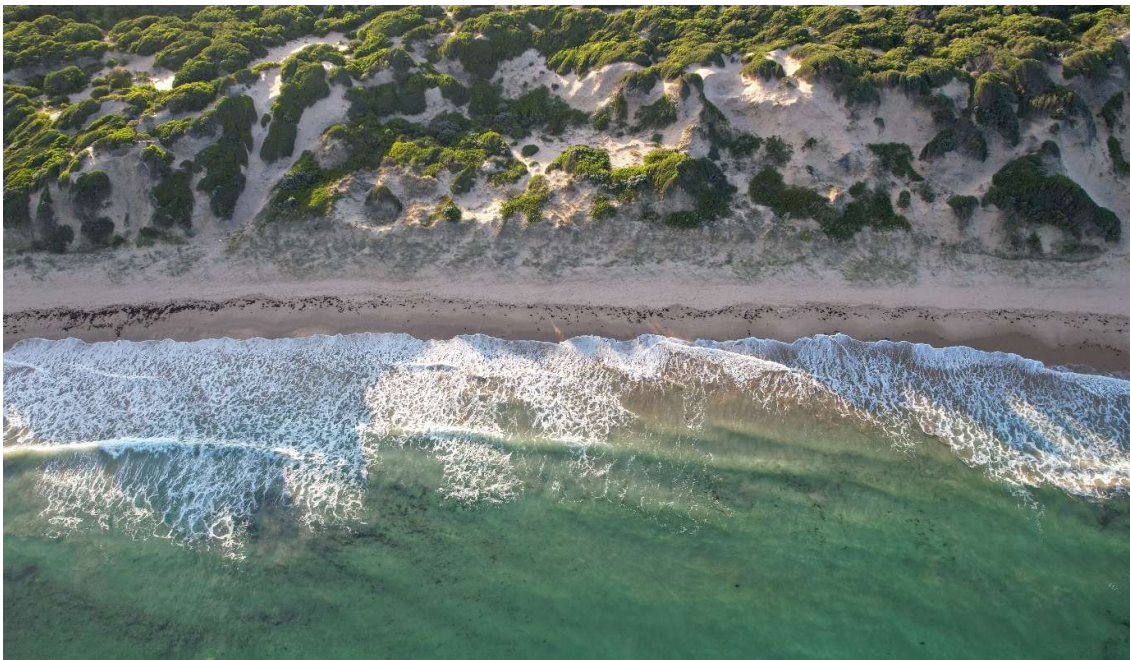
### 5.1 Adaptation approach and policy

Managing emerging coastal hazard risks, requires longer term strategic thinking and adaptive approaches. Understanding local values and risk profiles, including what is at risk (land, values and assets), and how the risk profile is changing over time, can inform our adaptation response.

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

- Assessing the available strategic **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 with 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 long-term management.

These terms are defined further, below.





## Adaptation objectives

Adaptation objectives help guide appropriate adaptation response/s and assess adaptation options and actions. Community perspectives on coastal values through Stage 2 have informed tailored objectives for adaptation across the Bancoora region (see Section 2.8). In line with these values, adaptation objectives are to:

- Look after Wadawurrung cultural heritage and significant places
- Care for coastal and marine ecosystems
- Respect strong and dynamic coastal processes
- Preserve simplicity
- Safeguard recreational and tourism uses of the coast
- Collaborate with and empower community and stakeholders

These values and core objectives for coastal management and adaptation form the basis for considering and assessing the suitability of different coastal hazard adaptation options and actions.

## Adaptation options

Adaptation options are different strategic approaches to managing coastal hazard risk. The Marine and Coastal Policy (2020) refers to six strategic adaptations options, to be considered in the hierarchical order:

|                                             |                                                                                                                                                                                                                                                                           |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Non intervention</b>                  | Allow marine and coastal processes, and the hazards they may pose, to occur.                                                                                                                                                                                              |
| <b>2. Avoid</b>                             | Locate new uses, development and redevelopment away from areas that are or will be negatively impacted by coastal hazards.                                                                                                                                                |
| <b>3. Nature-based methods</b>              | Enhancing or restoring natural features to mitigate coastal hazard risk.                                                                                                                                                                                                  |
| <b>4. Accommodate</b>                       | Structures can be designed to reduce the exposure to, or decrease the impact of, coastal hazard risk, thus 'accommodating' the risk.                                                                                                                                      |
| <b>5. Retreat</b>                           | Existing structures, assets or uses may be decommissioned or relocated away from areas that are, or will be, negatively impacted by coastal hazards.                                                                                                                      |
| <b>6. Protect (major engineering works)</b> | 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. |

## Adaptation actions

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

These can be broadly classified under three key functional (adaptation action) types:

- **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 blue carbon ecosystems / 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.

Adaptation actions are not mutually exclusive, and often a suite of measures is required to effectively manage coastal hazard risk.

## Adaptation pathways

Adaptation pathways are a forward-looking decision-making process used to identify actions for managing changing coastal hazard risk and uncertain climate conditions into the future. Adaptation pathways are made up of a sequence of steps or decision points over time, addressing both present day and future needs. Adaptation options and actions can be built into adaptation pathways, along with triggers for when new decisions or actions may be needed to address hazard risk.

## 5.2 Adaptation objectives

|                              |                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Adaptation objectives</b> | Adaptation objectives help guide appropriate adaptation response/s and assess adaptation options and actions. |
|------------------------------|---------------------------------------------------------------------------------------------------------------|

Stage 2 established coastal values, adaptation objectives and a vision (see Section 2.8). Adaptation objectives help guide appropriate adaptation responses and assess suitable adaptation options and actions. For the Bancoora CAP, adaptation objectives are to:

### **Look after Wadawurrung cultural heritage and significant places**

Collaborate with Wadawurrung Traditional Owners in adaptation to manage both intangible and tangible Wadawurrung cultural heritage and significant places, minimise impacts on Wadawurrung values and support ongoing connection to Sea Country.

### **Care for coastal and marine ecosystems**

Align adaptation outcomes to prioritise nearshore marine, beach, dune, estuarine and saltmarsh ecosystems and threatened species communities. Consider adaptation actions that have the dual function of increasing resilience while supporting restoration of natural spaces.

### **Respect strong and dynamic coastal processes**

Work with and respect the strong natural coastal processes that shape the Breamlea / Bancoora coast, considering nature-based methods that leverage and support the coast's dynamic nature to continue.

### **Preserve simplicity**

Ensure adaptation actions align with the simple and peaceful character of the area, prioritising nature-based methods that both protect and enhance the natural landscape while avoiding inappropriate development or structures.

### **Safeguard recreational and tourism uses of the coast**

Ensure adaptation actions safeguard recreational uses, access and facilities of the coast, including use of and access to sandy beaches, maintaining tourism, visitation and the financial foundation these provide to local coastal management for as long as possible.

### **Collaborate with and empower community and stakeholders**

Knowledge-share and collaborate with stakeholders and community members in adaptation, respecting stakeholder management responsibilities and community connection to place. Empower stakeholders and community through an educational and participatory approach to decision-making for adaptation.

### 5.3 Adaptation options

|                           |                                                                                                                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adaptation options</b> | Adaptation options are different strategic approaches to managing coastal hazard risk. The Marine and Coastal Policy (2020) refers to six strategic adaptations options, to be considered in the hierarchal order. |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 27 provides an overview of adaptation options, their level of alignment with adaptation objectives and initial assessment of suitability at the sub-locations in addressing coastal hazard risk.

**Table 27. Preliminary assessment of adaptation options against values, objectives and suitability at sub-locations.**

|                                      | ●○○                                               |                          |                        | ●●○                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | ●●●                                            |  |  |
|--------------------------------------|---------------------------------------------------|--------------------------|------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------|--|--|
|                                      | Limited alignment with adaptation objectives<br>✕ |                          |                        | Moderate alignment with adaptation objectives<br>~ |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | Good alignment with adaptation objectives<br>✓ |  |  |
|                                      | Not suitable at location                          |                          |                        | May be suitable at location                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | Suitable at location                           |  |  |
| Adaptation option                    | Alignment with objectives                         | Breamlea Beach and dunes | Caravan Park and beach | Bancoora Beach and SLSC                            | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                |  |  |
| 1. Non intervention                  | ●●○                                               | ✕                        | ~                      | ✕                                                  | For some areas of low risk, <b>Non-intervention</b> is appropriate. For some locations, the level of hazard risk is too great for <b>Non-intervention</b> or may only be suitable until certain risk-based triggers are reached.                                                                                                                                                                                                                       |  |                                                |  |  |
| 2. Avoid                             | ●●●                                               | ✓                        | ✓                      | ✓                                                  | Some <b>Avoid</b> actions, such as future planning, will provide some benefit in proactively reduce future exposure of Barwon Coast built assets. <b>Avoid</b> actions are unable to fully mitigate hazard risks for existing assets and values.                                                                                                                                                                                                       |  |                                                |  |  |
| 3. Nature-based methods              | ●●●                                               | ✓                        | ✓                      | ✓                                                  | <b>Nature-based methods</b> are likely to provide some benefit in shorter-term and align strongly with adaptation objectives. However, projected risk for some locations may become too great, especially in medium to longer term. Early implementation of <b>Nature-based methods</b> increases natural resilience over time.                                                                                                                        |  |                                                |  |  |
| 4. Accommodate                       | ●●○                                               | ✓                        | ~                      | ✓                                                  | <b>Accommodate</b> actions may provide some benefit for existing assets and provide opportunity to proactively plan for expected risk increase whilst retaining values, uses and assets. <b>Accommodate</b> actions may only mitigate impacts of a single hazard type (i.e. erosion or inundation). At Bancoora there is a unique opportunity to influence the redesign of the SLSC and ensure it accommodates hazard risk for its future design life. |  |                                                |  |  |
| 5. Retreat                           | ●●○                                               | ~                        | ~                      | ~                                                  | <b>Retreat</b> of at-risk assets may be appropriate through relocation or removal of specific infrastructure in high-risk areas, or where risk cannot be adequately managed otherwise. <b>Retreat</b> can mitigate risks of multiple hazard types into the long term.                                                                                                                                                                                  |  |                                                |  |  |
| 6. Protect (major engineering works) | ●○○                                               | ✕                        | ~                      | ~                                                  | <b>Protect</b> actions are generally not in strong alignment with the adaptation objectives. Selected <b>Protect</b> actions, may mitigate risk for some coastal hazards and protect some high-risk assets, or provide temporary protection whilst other options are planned and implemented. Many <b>Protect</b> actions only mitigate impacts of a single hazard type.                                                                               |  |                                                |  |  |



## 5.4 Adaptation actions

### Adaptation actions

Adaptation actions are the range of tools, decisions and works that can be implemented to create adaptation pathways aligned to the strategic adaptation options. These can be broadly classified under three key functional (adaptation action) types: Land management, planning and design; nature-based; and engineering. Adaptation actions are not mutually exclusive, and often a suite of measures is required to effectively manage coastal hazard risk.

### Available 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. The Victoria's Resilient Coasts - Adaptation Actions Compendium (BMT, 2023) provides an overview of adaptation actions available in adaptation planning. A 'first-pass' pre-screening of all adaptation actions contained in the Compendium is detailed in Attachment 7. This preliminary assessment considers the action effectiveness in reducing hazard risk and overall suitability of the action, in alignment with the physical/environmental setting, values, objectives and vision for Bancoora. Of the actions deemed suitable, further assessment of actions is undertaken through a **multi-criteria analysis**.

### Multi-criteria analysis

Multi-criteria analysis is a decision tool that enables actions to be evaluated based on multiple criteria. This process can assist with shortlisting and selecting adaptation actions. The short-listed adaptation actions are assessed against their alignment with the adaptation objectives (listed above). Actions are also assessed against other functionality, cost and approval criteria.

### Functionality, cost and approvals

In addition to our adaptation objectives, we also need to consider the following criteria:

- **Hazard risk reduction** – the effectiveness of the option in reducing coastal hazard risk
- **Low long-term action cost** – ensuring actions are cost effective over time and deliver coastal hazard risk reduction in the most cost-effective manner.
- **Ease of approvals / policy alignment** – ensuring actions align with the Marine and Coastal Policy, consider the hierarchy of adaptation actions and other considerations that would ease approvals.

The adaptation objectives and additional considerations (above) become the criteria through which we assess adaptation action suitability.

### Establishment and performance over time

When considering assessing adaptation actions and the relative sequencing and timing of implementation we also need to consider:

- **Preparation and planning time** required to undertake the action. All actions have some lead time for planning and establishment before the action is effective in reducing coastal hazard risk.
- **Implementation timing** and considering the suitable time for implementation where the action has time to be planned, prepared and establish before risk increases to intolerable levels.
- **Changing performance over time** as hazard risk increases with rising sea levels, the action ages/requires increased maintenance or reduces in effectiveness over time

The multi-criteria assessment considers the suitability of each action against the objectives and above criteria. Overall suitability is assessed for each sub-area and comment made on the establishment of the action and performance over time. Table 28 outlines the assessment, as follows:

- |    |                                                            |   |                             |
|----|------------------------------------------------------------|---|-----------------------------|
| ✖✖ | Action provides no or very low support for criteria        | ✓ | Suitable at location        |
| ✖  | Action provides low support for criteria                   | ~ | May be suitable at location |
| ○  | Action provides moderate support for criteria or no change | ✖ | Not suitable at location    |
| ✓  | Action provides high support for criteria                  |   |                             |
| ✓✓ | Action provides very high support for criteria             |   |                             |

Table 28. Multi-criteria assessment of adaptation actions for the Bancoora CAP

| Option and action    |                                                                             | Suitability at location |                      |                       | Alignment with objectives                                       |                                        |                                              |                     |                                                      |                                                         | Functionality, cost and approvals |                           |                                      | Comments<br>(action suitability over time)                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|-----------------------------------------------------------------------------|-------------------------|----------------------|-----------------------|-----------------------------------------------------------------|----------------------------------------|----------------------------------------------|---------------------|------------------------------------------------------|---------------------------------------------------------|-----------------------------------|---------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                             | Breamlea Beach          | Caravan Park & beach | Bancoora Beach & SLSC | Look after Wadawurrung cultural heritage and significant places | Care for coastal and marine ecosystems | Respect strong and dynamic coastal processes | Preserve simplicity | Safeguard recreational and tourism uses of the coast | Collaborate with and empower community and stakeholders | Hazard risk reduction             | Low long-term action cost | Ease of approvals / policy alignment |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Non-intervention     | Allow marine and coastal processes, and the hazards they may pose, to occur | ✓*                      | ✓*                   | ✓*                    | ○                                                               | ✓                                      | ✓✓                                           | ✓✓                  | ✗                                                    | ○                                                       | ✗✗                                | ✓✓                        | ✓✓                                   | Does not provide effective hazard risk reduction, but could be suitable in some low-risk locations                                                                                                                                                                                                                                                                                                                                            |
| Avoid                | Controlled access                                                           | ✓                       | ✓                    | ✓                     | ✓✓                                                              | ✓✓                                     | ✓✓                                           | ✓                   | ✗                                                    | ✓                                                       | ✓                                 | ✓✓                        | ✓✓                                   | Effective to reduce beach erosion, but relatively low effectiveness over time with changing conditions. Some impacts to recreational access, increasing in the longer term.                                                                                                                                                                                                                                                                   |
|                      | Development setbacks                                                        | ✓                       | ✓                    | ✓                     | ✓✓                                                              | ✓✓                                     | ✓✓                                           | ✓                   | ○                                                    | ○                                                       | ✓✓                                | ✓                         | ✓✓                                   | Proactive action and important to implement as soon as possible to avoid risk into the future.                                                                                                                                                                                                                                                                                                                                                |
| Nature-based methods | Mangrove forests                                                            | ~                       | ✗                    | ✗                     | ○                                                               | ✓✓                                     | ✓✓                                           | ✓                   | ○                                                    | ✓                                                       | ○                                 | ✓                         | ✓✓                                   | Most nature-based actions generally have low-moderate effectiveness in reducing hazard risk. Actions require longer lead time to allow establishment. However, natural systems can adjust as sea levels rise, providing for longer-term risk mitigation (if natural resilience can keep pace with changing conditions). Actions are potentially suitable for areas of low risk or emerging risk, depending on existing environmental setting. |
|                      | Saltmarsh                                                                   | ~                       | ~                    | ~                     | ○                                                               | ✓✓                                     | ✓✓                                           | ✓                   | ○                                                    | ✓                                                       | ○                                 | ✓                         | ✓✓                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Beach and dune protection / vegetation / management                         | ✓                       | ✓                    | ✓                     | ○                                                               | ✓✓                                     | ✓✓                                           | ✓                   | ○                                                    | ✓✓                                                      | ✓                                 | ✓✓                        | ✓✓                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Use of on-site natural materials                                            | ✓                       | ✓                    | ✓                     | ○                                                               | ✓✓                                     | ✓✓                                           | ✓                   | ○                                                    | ✓                                                       | ○                                 | ✓✓                        | ✓✓                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Wet sand fencing                                                            | ✓                       | ✓                    | ✓                     | ○                                                               | ✓✓                                     | ✓                                            | ✓                   | ○                                                    | ○                                                       | ✓                                 | ✓                         | ✓✓                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Localised beach scraping, dune nourishment, reconstruction <sup>#</sup>     | ✓                       | ✓                    | ✓                     | ✗                                                               | ✓✓                                     | ✓                                            | ✓                   | ✗                                                    | ○                                                       | ✓                                 | ✓                         | ✓✓                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Supported littoral vegetation <sup>#</sup>                                  | ~                       | ~                    | ~                     | ✗                                                               | ✓✓                                     | ✓                                            | ✓                   | ✗                                                    | ✗                                                       | ✓                                 | ○                         | ✓                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Accommodate          | Resilient design / materials in new and retrofitted infrastructure          | ✓                       | ✓                    | ✓                     | ✓                                                               | ✓                                      | ✓                                            | ○                   | ✓✓                                                   | ✗                                                       | ✓✓                                | ✗                         | ✓                                    | Impact on values and effectiveness in reducing hazard risk over time dependent on specific materials, design and asset life. Best implemented when opportunities for asset renewal arise (e.g. SLSC redevelopment, access stair replacement).                                                                                                                                                                                                 |
|                      | Upgrade of drainage network                                                 | ~                       | ~                    | ~                     | ○                                                               | ○                                      | ✓                                            | ○                   | ○                                                    | ✗                                                       | ✓                                 | ✗                         | ✓                                    | Effectiveness in reducing hazard risk over time dependent on local conditions and design. For Bancoora CAP, many actions are the responsibility of other stakeholders, depending on asset management responsibilities.                                                                                                                                                                                                                        |
|                      | Water sensitive urban design                                                | ~                       | ~                    | ~                     | ○                                                               | ○                                      | ✓                                            | ○                   | ○                                                    | ✗                                                       | ✓                                 | ✗                         | ✓                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                      | Road network upgrade                                                        | ~                       | ~                    | ~                     | ○                                                               | ○                                      | ○                                            | ✗                   | ✓                                                    | ○                                                       | ✓✓                                | ✗✗                        |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Retreat              | Removal / relocation of infrastructure                                      | ✓                       | ✓                    | ✓                     | ○                                                               | ✓                                      | ✓                                            | ○                   | ✗✗                                                   | ✗                                                       | ✓✓                                | ○                         | ○                                    | Reduces risk for all hazard types. May require long lead time for planning and engagement. Could be implemented when assets are due for renewal / replacement. Long term effectiveness achieved, once implemented.                                                                                                                                                                                                                            |
| Protect              | Beach nourishment (large scale)                                             | ~                       | ✗                    | ~                     | ✗                                                               | ✗✗                                     | ✗                                            | ○                   | ✗                                                    | ✗✗                                                      | ✓✓                                | ✗✗                        | ✗                                    | Reduces erosion risk only. Reduces in effectiveness over time, dependent on conditions, sand source, volume and frequency. Increasingly expensive over the long term.                                                                                                                                                                                                                                                                         |
|                      | Geobag revetment / wall                                                     | ✗                       | ✗                    | ~                     | ✗                                                               | ✗✗                                     | ✗✗                                           | ✗✗                  | ✗✗                                                   | ✗✗                                                      | ✓✓                                | ✗✗                        | ✗                                    | Can provide erosion risk mitigation protection, but with potential impacts to natural values and processes. Require upgrade/replacement over time.                                                                                                                                                                                                                                                                                            |
|                      | Rock bag revetment / wall                                                   | ✗                       | ✗                    | ~                     | ✗                                                               | ✗✗                                     | ✗✗                                           | ✗✗                  | ✗✗                                                   | ✗✗                                                      | ✓✓                                | ✗✗                        | ✗                                    | Can provide erosion and/or inundation risk mitigation protection, but with potential impacts to natural values and processes. Require upgrade/replacement over time.                                                                                                                                                                                                                                                                          |

\*In low risks areas

<sup>#</sup>May be considered a hybrid engineering and nature-based action, pending detail of the approach



Following sections further consider adaptation actions in the context of:

- Landscape-scale adaptation across Breamlea and Bancoora, involving other agencies (Section 4.5)
- Foundational adaptation actions to support adaptation across Barwon Coast CoM (Section 5.5).
- Specific actions and detailed sub-area adaptation pathways (Section 5.6)

## 5.5 Foundational adaptation actions

Foundational actions are about enhancing the adaptive capacity of Barwon Coast, the Bancoora/Breamlea communities and the way we respond to emerging hazard risk. They aim to provide important knowledge, data, skills and tools to enable adaptation approaches to succeed and continue to evolve and adapt to changing conditions. These actions can be integrated with sub-area-specific actions to improve action outcomes.

Foundational actions are under five key themes:

1. Coastal planning and asset management
2. Collaboration and community stewardship
3. Research and knowledge sharing
4. Monitoring evaluation and review
5. Funding and implementation

Table 29 details these foundational actions. These actions provide strong foundations for strengthening resilience across the Bancoora/Breamlea coast and the success of sub-area-specific initiatives.

**Table 29. Foundational actions to enhance adaptive capacity (priority actions over the next 5-10 years).**

| Theme                                                                  | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F1. Coastal planning and asset management</b>                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Proactive planning to avoid and manage coastal hazard risk             | <p><b>F1.1.</b> Use the Bancoora CAP in Barwon Coast master planning and other asset management planning, to ensure no new sensitive uses, assets or infrastructure are developed in hazard-prone areas.</p> <ul style="list-style-type: none"> <li>• New or upgraded structures must consider avoiding hazard-prone areas and/or ensure structures can adapt to anticipated increase in coastal hazards.</li> <li>• Review existing planned infrastructure upgrades and renewals, and update design requirements, timing and prioritisation to incorporate hazard understanding.</li> <li>• Align with the Siting and Design Guidelines for Structures on the Victorian Coast (DELWP, 2020b).</li> </ul> <p><b>F1.2.</b> Review and embed coastal hazard risk information (across all planning horizons) into asset planning and management. Consider assets at risk to inform appropriate asset management, including:</p> <ul style="list-style-type: none"> <li>• Asset design life, maintenance requirements and outlook with increasing hazard risk.</li> <li>• Asset renewal timeframes and opportunities for enhanced resilient design in asset renewal/replacement.</li> <li>• Potential relocation of existing assets.</li> <li>• Future developments, facility upgrades and other design considerations.</li> </ul> |
| <b>F2. Collaboration and community stewardship</b>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Collaborate with rightsholders, land managers and community to promote | <p><b>F2.1.</b> Continue to advance partnerships and collaboration with Wadawurrung Traditional Owners, to understand their needs, aspirations and involvement in coastal hazard adaptation. Includes identification of cultural values and management of significant sites. Support their ongoing role in caring for Country and informing future adaptation approaches to increase resilience and adaptive capacity for cultural values.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



| Theme                                                                                  | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| holistic care for coastal areas and adaptation to changing conditions                  | <p><b>F2.2.</b> Promote cross-organisational and State information sharing. Advocate for and collaborate with land managers in landscape-scale adaptation planning for Breamlea/Bancoora including:</p> <ul style="list-style-type: none"> <li>• Township adaptation planning and road access (City of Greater Geelong).</li> <li>• Natural system adaptation and Thompson Creek estuary management (Corangamite CMA, Parks Victoria, Surf Coast Shire).</li> <li>• Other utilities and servicing of Barwon Coast land and assets (Barwon Water, other utility providers) .</li> <li>• Incorporate outcomes into adaptation planning for Barwon Coast assets, uses and facilities.</li> </ul> |
|                                                                                        | <p><b>F2.3.</b> Promote dune and vegetation enhancement knowledge building and educational programs. Includes:</p> <ul style="list-style-type: none"> <li>• Supporting volunteers to enhance dunes through on-ground initiatives (action F3.2).</li> <li>• Communication and knowledge building of suitable species and vegetation management methods.</li> <li>• Broad community education on importance of access control.</li> <li>• Promotion of monitoring activities through citizen science programs (action F4.1).</li> </ul>                                                                                                                                                         |
|                                                                                        | <p><b>F2.4.</b> Collaborate with other land managers, local government and emergency agencies to promote local emergency and disaster preparedness advice. Includes reviewing and incorporating coastal hazard risk considerations into Caravan Park and SLSC emergency procedures. Consider early planning for storm events and site-specific vulnerabilities, such as road access and evacuation constraints (i.e. one road access).</p>                                                                                                                                                                                                                                                    |
|                                                                                        | <p><b>F3. Research and knowledge sharing</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Undertake additional investigations and share existing knowledge to support adaptation | <p><b>F3.1.</b> Make the Bancoora CAP publicly available and continue to engage and communicate with the community, Traditional Owners, stakeholders and land managers on plan implementation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                        | <p><b>F3.2.</b> Investigate dune system responses to species replacement (marram grass/tea tree vs. native spinifex) and potential implications for coastal erosion hazards. Based on investigations and research, trial replacement across Bancoora/Breamlea coastal zone and monitor changes to inform broader implementation. Align with Barwon Coast's Biodiversity Strategy and explore collaborations with research and university partners. Undertake dune and vegetation protection, enhancement and management for all existing dune areas, including access control and communication through action F2.3.</p>                                                                      |
|                                                                                        | <p><b>F3.3.</b> Investigate and develop an approach for small-scale sand scraping actions in response to increasing erosion and large storm events. Consider:</p> <ul style="list-style-type: none"> <li>• sand availability, methods of scraping, triggers for implementation</li> <li>• impacts on access and temporary access closure</li> <li>• planning requirements, contractors and logistics</li> <li>• potential impacts on shore-nesting birds and other sensitive ecosystems</li> </ul>                                                                                                                                                                                            |
|                                                                                        | <p><b>F3.4.</b> Advocate for and collaborate with Corangamite CMA for local investigations into:</p> <ul style="list-style-type: none"> <li>• Estuary responses to sea level rise and changing climate and management implications.</li> <li>• Catchment and coincident flooding dynamics and impacts to coastal hazard risk.</li> <li>• Local ecosystem sensitivities / responses to changing coastal hazards and management implications, including exploring opportunities for making space for natural ecosystem migration.</li> <li>• Opportunities for blue carbon habitat restoration and expansion across the Thompson estuary.</li> </ul>                                            |
|                                                                                        | <p><b>F3.5</b> Advocate for and collaborate with City of Greater Geelong for local investigation into the function of Breamlea Road as a levee-type structure, current specifications/maintenance regime and longevity of function in context of coastal hazards.</p>                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Theme                                                                                                 | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                       | <b>F3.6.</b> Guided by Wadawurrung Traditional Owners, investigate and continue to record Wadawurrung cultural heritage, history, values and culturally significant areas. Identify vulnerabilities to changing coastal hazards and management implications.                                                                                                                                                                                                                                                                                            |
| <b>F4. Monitoring evaluation and review</b>                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Monitor changes in coastal hazard risk and effectiveness of adaptation                                | <b>F4.1.</b> Investigate opportunities for improved monitoring initiatives (drone, photo point programs e.g. CoastSnap). Regularly communicate key findings and opportunities for community involvement.                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                       | <b>F4.2.</b> Undertake beach monitoring, particularly following large storm/erosion events and in key locations (Bancoora SLSC beach access) to understand response to storm events. Can include photo point monitoring or elevation, drone and/or beach survey monitoring. Should storm events damage access infrastructure (e.g. stairs), review configuration of access across entire study area, needs for multiple access points, and potential consolidation (removal of access).                                                                 |
|                                                                                                       | <b>F4.3.</b> During development integrate evaluation metrics into implementation planning, including consideration of effectiveness of actions and reporting requirements.                                                                                                                                                                                                                                                                                                                                                                              |
|                                                                                                       | <b>F4.4.</b> Continue to review and update coastal hazard modelling and hazard extents in response to changes, including: <ul style="list-style-type: none"> <li>• New/updated technical information as it becomes available (new hazard studies, updated records / major monitoring findings)</li> <li>• Changes to State policy (e.g. sea level projections, planning requirements, coastal hazard definitions)</li> <li>• Major landscape changes (e.g. following major hazard events, largescale development or other landscape change).</li> </ul> |
| <b>F5. Funding and implementation</b>                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Refining implementation details and supporting implementation through adequate funding and resourcing | <b>F5.1.</b> Develop implementation plan for the Bancoora CAP, including consideration of timing, responsibilities, funding sources and other implementation details. Align with other strategic and operational planning e.g. Masterplan, Coastal and Marine Management Plan (CMMP).                                                                                                                                                                                                                                                                   |
|                                                                                                       | <b>F5.2.</b> Capture potential funding avenues to support implementation of adaptation actions, such as Victoria's Resilient Coast Grants, Coastal Public Access and Risk Grants, Coastal and Marine Management Grants and Coastcare Victoria Community Grants.                                                                                                                                                                                                                                                                                         |
|                                                                                                       | <b>F5.3.</b> Consider resources to facilitate implementation and opportunities for efficient and collaborative implementation with other land managers. Encourage community stewardship, agency co-funding and prioritised implementation to maximise resources.                                                                                                                                                                                                                                                                                        |
|                                                                                                       | <b>F5.4</b> Consult with the community, Traditional Owners, stakeholders and relevant land managers during the planning and implementation of adaptation actions.                                                                                                                                                                                                                                                                                                                                                                                       |

In addition to these foundational actions, specific -place-based actions are built into adaptation pathways for each sub-area, detailed below.

## 5.6 Sub-area adaptation pathways and actions

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adaptation pathways</b> | Adaptation pathways are a forward-looking decision-making process used to identify actions for managing changing coastal hazard risk and uncertain climate conditions into the future. Adaptation pathways are made up of a sequence of steps or decision points over time, addressing both present day and future needs. Adaptation options and actions can be built into adaptation pathways, along with triggers for when new decisions or actions may be needed to address hazard risk. |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Developing adaptation pathways

When developing an approach for managing risk and developing an adaptation plan, at a local scale, we can consider the following (in line with Victorian State Government Policy):

| Adaptation options                          |                                                                                                                                                                                                                                                                           | Developing adaptation pathways                                                           |                                                                                               |                                                                                                                                                                               |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strategic options (in order)                | Definition                                                                                                                                                                                                                                                                | Questions for building an adaptation pathway                                             |                                                                                               | Associated types of adaptation actions                                                                                                                                        |
| <b>1. Non intervention</b>                  | Allow marine and coastal processes, and the hazards they may pose, to occur.                                                                                                                                                                                              | Is non-intervention appropriate?                                                         | For which hazards and risks?<br>For how long?                                                 | <ul style="list-style-type: none"> <li>Land use management</li> <li>Planning and access controls</li> </ul>                                                                   |
| <b>2. Avoid</b>                             | 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?                                                                       | <ul style="list-style-type: none"> <li>Land use management</li> <li>Wetlands and blue carbon ecosystems</li> <li>Beach and dune ecosystems</li> <li>Hybrid methods</li> </ul> |
| <b>3. Nature-based methods</b>              | Enhancing or restoring natural features to mitigate coastal hazard risk.                                                                                                                                                                                                  | Can we pursue a nature-based approach?                                                   | What actions do we include?                                                                   | <ul style="list-style-type: none"> <li>Land use management</li> <li>Resilient design</li> <li>Flood and drainage works</li> <li>Road resilience and design</li> </ul>         |
| <b>4. Accommodate</b>                       | 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?                                                                  | <ul style="list-style-type: none"> <li>Land use management</li> <li>Removal, relocation and/or transition</li> </ul>                                                          |
| <b>5. Retreat</b>                           | 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?                        | <ul style="list-style-type: none"> <li>Nourishment</li> <li>Engineering (seawalls, groynes, etc.)</li> </ul>                                                                  |
| <b>6. Protect (major engineering works)</b> | 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. | Are we not able to reduce risk in any other manner?<br>Do we require a protect approach? | How long will this be feasible for?<br>Will there be unintended consequences on other values? |                                                                                                                                                                               |



## How to interpret the adaptation pathway

Adaptation pathways include a collection and sequencing of adaptation actions for managing coastal hazard risk (erosion, permanent inundation, storm tide inundation). They have been used to examine and communicate a range of site-specific actions and a preferred pathway for each sub-area.

These pathways are adaptive and may be subject to change over time as part of ongoing implementation, monitoring and budget considerations. Key elements of the pathways include (Figure 36):

- Site-specific adaptation actions for each sub-area – capturing current and future actions.
- Broader landscape-scale considerations and actions that may influence the sub-area pathway.
- Sea level rise projections and risk profile over planning horizons.
- Preparation time for planning and assessments required to enable action implementation,
- Triggers to be used to determine a change in response or adaptation pathway.
- Action performance / effectiveness in reducing risk for different hazard types and how that might diminish over time (with changing risk, and reducing performance due to elapsed time / aging measures).

Note that some pathways, triggers and timing is dependent on broader landscape-scale considerations. These are described further in Section 5.7.

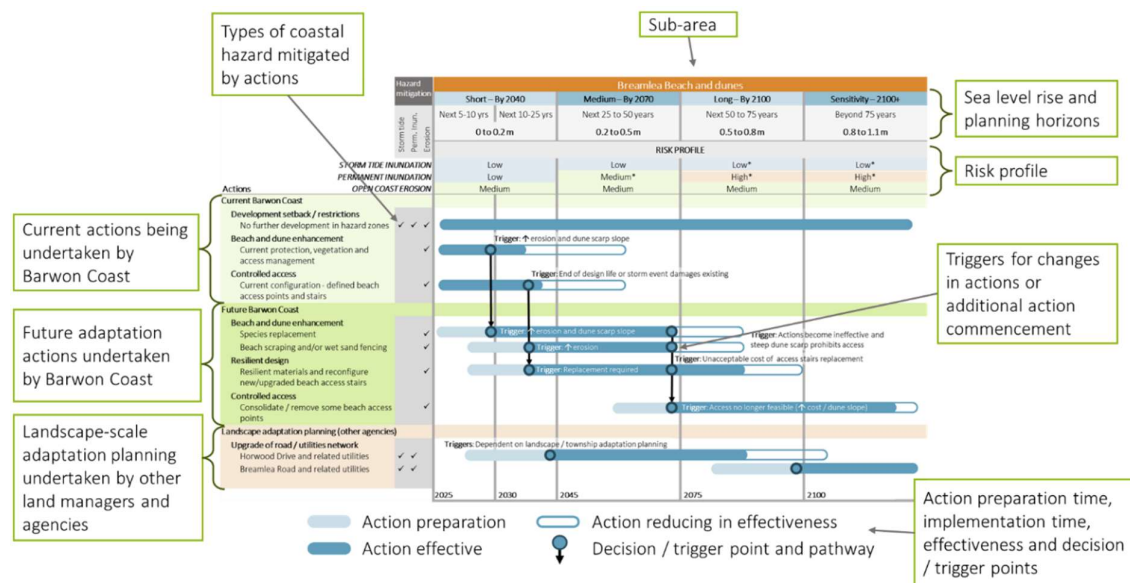


Figure 36. Example adaptation pathways, with core pathway elements labelled

## Potential action timing and triggers

In the pathways and actions tables below, potential timing of action planning and implementation is highlighted. This timing is indicative and actions can be brought forward or pushed back, based on a range of triggers. Key triggers are highlighted in the pathways; however other triggers may include:

- Changing hazard conditions and monitoring outcomes.
- Landscape-scale adaptation planning (see section 5.7).
- Funding opportunities for implementing adaptation or asset renewal.
- State policy changes.

The following sections highlight the potential adaptation actions, key considerations for adaptation, the adaptation pathway and actions, for each sub-area.

### Breamlea Beach and dunes

Adaptation across the Breamlea Beach and dune system will need to consider increasing impacts from both erosion along the beach/dune and inundation from Thompson Creek estuary. Considering the risk outcomes in Section 4.4 and suitable adaptation actions detailed above, Table 30 details potential adaptation actions for Breamlea Beach and dunes to be included in an adaptation pathway.

**Table 30. Potential adaptation actions for Breamlea Beach and dunes.**

| Pathway option              | What actions might this include for the sub-area?                                                                                              | Is this option appropriate, if so when and for how long?                                                                                               | Pathway inclusion |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>Non-intervention</b>     | No new actions to mitigate coastal hazard risk. Continued access and vegetation management.                                                    | Appropriate in the short term for some areas, but further actions needed to mitigate emerging hazard risk.                                             | No                |
| <b>Avoid</b>                | <b>Development setback/restrictions</b> for Barwon Coast assets. No new development in hazard-prone areas.                                     | Appropriate now and into the future to avoid further increases in risk.                                                                                | Yes               |
|                             | <b>Controlled access</b> with defined beach access points and dune protection/fencing to facilitate natural resilience.                        | Appropriate in the short term but may reduce in effectiveness and access stairs may be lost in storm events or as they come to the end of design life. | Yes               |
| <b>Nature-based methods</b> | <b>Beach and dune enhancement</b> including vegetation management, species replacement and/or wet sand fencing to increase natural resilience. | Appropriate now, with enhanced management actions required in the medium term. Effectiveness may decrease as conditions change into the longer term.   | Yes               |
| <b>Accommodate</b>          | <b>Resilient design</b> in new /upgraded access stairs to increase resilience to coastal processes and storm-based erosion.                    | Appropriate in the short-medium term where existing access stairs are nearing end of design life or are damaged in storm events.                       | Yes               |
|                             | <b>Upgrade of road / utilities network</b> including Breamlea Road and Horwood Drive to allow access to the beaches / foreshore.               | Dependent on broader landscape / township adaptation planning in the short to medium term.                                                             | See section 5.7   |
| <b>Retreat</b>              | <b>Controlled access</b> through consolidating or removing some beach access points where coastal conditions restrict access.                  | Appropriate in the medium-long term where changing conditions mean access is infeasible or would require significant investment to retain access.      | Yes               |
|                             | <b>Retreat / removal</b> of all beach access points, meaning no access to beach areas from township.                                           | Not appropriate in short-medium term as does not retain coastal access. Dependent on broader township adaptation planning.                             | No                |
| <b>Protect</b>              | <b>Beach nourishment</b> to provide a sand buffer and retain a sandy beach.                                                                    | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with large-scale nourishment.                       | No                |
|                             | <b>Engineering</b> such as seawalls or groynes to protect dune and/or retain sand on the beach.                                                | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with larger engineering.                            | No                |

Along with the broader adaptation objectives, there are some key considerations for this adaptation pathway:



#### **Cultural values**

The dunes across this area are rich in middens and hold strong Traditional Owner value. Access control on dedicated paths is essential to protect the dune ecosystem and reduce disturbance/erosion of middens. Investigating opportunities for Traditional Owner-led adaptation will help support both tangible (place-specific) and broader bio-cultural values. Adaptation actions could include further research, survey, documenting or salvage of place-specific values such as middens.



#### **Retaining access to a sandy beach for as long as possible**

Residents and visitors utilise this area to access the sandy beach at Breamlea for walking, relaxing, swimming, dog walking and other recreational activities. Access will be increasingly challenging with sea level rise due increasing erosion, steeper dune scarps and coastal hazard impacts on access infrastructure (access pathways and stairs). The adaptation pathway attempts to retain access for as long as possible, noting that with changing conditions, some access points may need to be removed.



#### **Retaining natural values and facilitating dune retreat**

The undeveloped, natural setting of this area is a core value and should be retained in adaptation. Enhancing natural resilience through dune enhancement activities may include access controls, vegetation management and other management measures such as wet sand fencing to support dune dynamics. Across Breamlea, replacement of marram grass and tea tree species to native dune species may assist in decreasing dune slopes and allowing access down a shallower dune scarp. Species replacement will also support other native flora and fauna, habitat, such as Hooded Plover nesting sites.



#### **Interdependencies with broader township planning and road access**

Access to the coast and use of Barwon Coast managed land in this area relies on access to and through the township via Breamlea Road and Horwood Drive. Adaptation planning for these assets and the broader township will guide actions for Barwon Coast managed land and assets (see Section 5.7).

These actions and considerations are detailed in the adaptation pathway (Figure 37) and adaptation actions (Table 31). This pathway includes:

- **In the short-term (next 5 to 10 years)**
  - Continue planning controls, dune protection and access control.
  - Plan, implement and monitor dune species replacement.
  - Plan and investigate sand scraping and/or wet sand fencing, and beach access stair replacement.
  - Continue collaborating with CoGG on Horwood Drive inundation (see Section 5.7).
- **In the short-term (10 to 25 years)**
  - Implement sand scraping and/or wet sand fencing (if feasible), in response to storm erosion.
  - Reconfigure and resilient design of beach access stairs, as they come to the end of their design life or are impacted by storm events.
- **In the medium-term (25 to 50 years)**
  - Implement landscape-scale planning with other agencies to address Horwood Drive inundation.
  - Investigate beach access and plan for consolidation / removal of some access points.
- **In the long term (50+ years)**
  - Implement landscape-scale planning with other agencies to address broader township access through Breamlea Road (see Section 5.7).



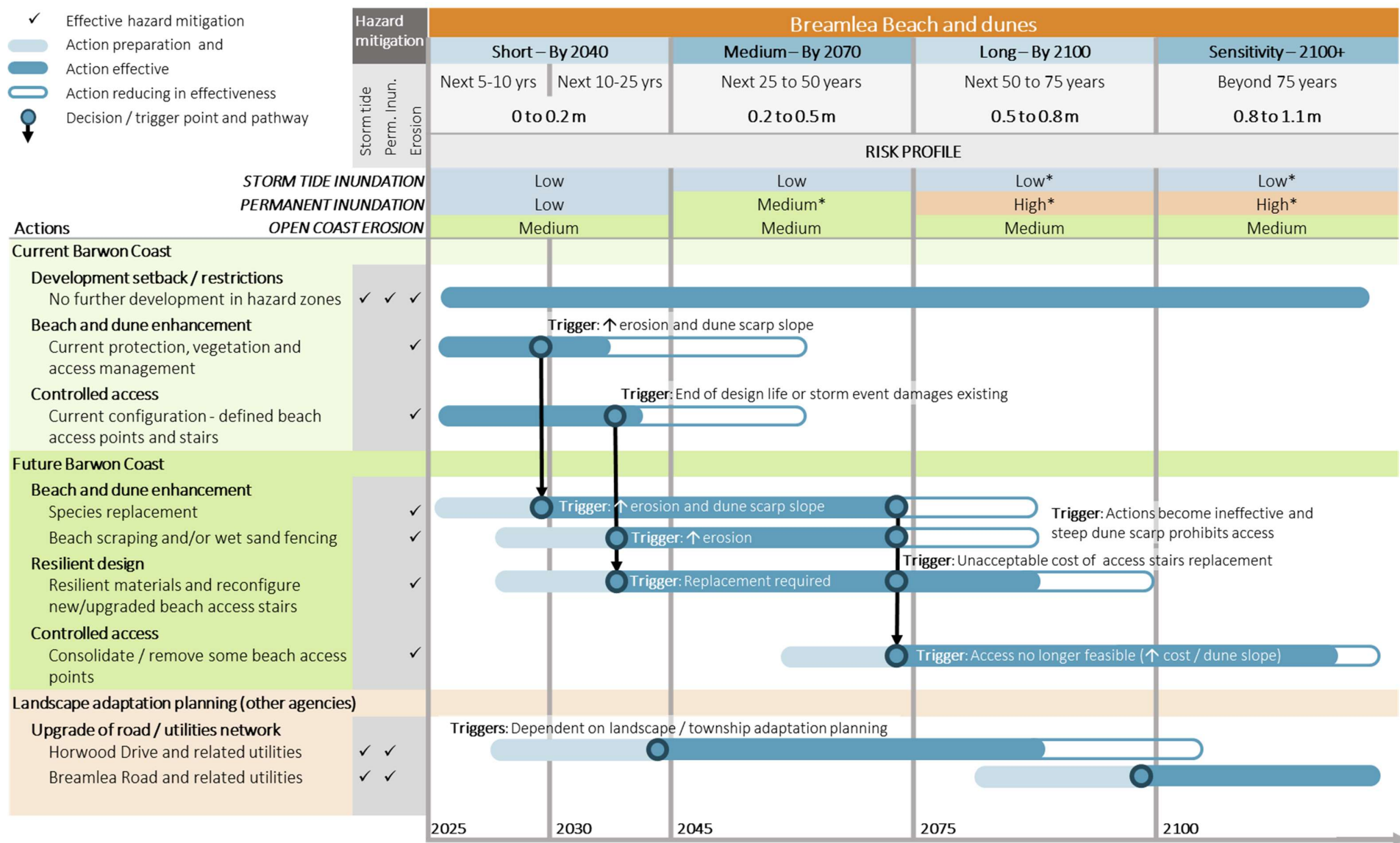


Figure 37. Adaptation pathway for Breamlea Beach and dunes.

Table 31. Adaptation actions for Breamlea Beach and dunes.

| Action                                                                                          | Detail                                                                                                                                                                                                                                                                                                                                                                      | Potential timing            |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Current Barwon Coast actions</b>                                                             |                                                                                                                                                                                                                                                                                                                                                                             |                             |
| <b>Development setback / restrictions</b><br>No further development in hazard zones             | <b>BR 1.1</b> As Foundational action F1.1, ensure no new assets or infrastructure are developed in hazard-prone areas.                                                                                                                                                                                                                                                      | Now and ongoing             |
| <b>Beach and dune enhancement</b><br>Current protection, vegetation and access management       | <b>BR 1.2</b> Continue current vegetation management, weed control and revegetation efforts.                                                                                                                                                                                                                                                                                | Now and ongoing             |
| <b>Controlled access</b><br>Current configuration - defined beach access points                 | <b>BR 1.3</b> Continue current access management practices including defined access points and fencing to protect dune habitat areas.                                                                                                                                                                                                                                       | Now and ongoing             |
| <b>Future Barwon Coast actions</b>                                                              |                                                                                                                                                                                                                                                                                                                                                                             |                             |
| <b>Beach and dune enhancement</b><br>Species replacement                                        | <b>BR 2.1</b> As Foundational action F3.2, increase dune enhancement through further revegetation and control/investigate species replacement of marram grass to native species to encourage reduced dune slope. Monitor outcomes of species replacement over time.                                                                                                         | Next 5-10 years and ongoing |
| Beach scraping and/or wet sand fencing                                                          | <b>BR 2.2</b> As Foundational action F3.3, investigate and implement sand scraping following storm events to maintain safe access. Consider establishing wet sand fencing to support natural resilience, maintain access and a sandy beach. Investigate potential impacts to ecological values (e.g. Hooded Plover nesting).                                                | 10+ years                   |
| <b>Resilient design</b><br>Resilient materials and reconfigure new/upgraded beach access stairs | <b>BR 2.3</b> As access stair infrastructure reaches end of design life, or if damaged in storms, replace with resilient designs. Can include: <ul style="list-style-type: none"> <li>• resilient materials,</li> <li>• reconfigured access parallel to coast, rather than perpendicular, and/or</li> <li>• deeper piles and stairs to accommodate beach change.</li> </ul> | 20-50 years                 |
| <b>Controlled access</b><br>Consolidate / remove some beach access points                       | <b>BR 2.4</b> Where changing conditions cause access to be prohibitive (due to cost of asset replacement or increasing dune slopes) remove some access points. Consider broader configuration of beach access and needs across entire landscape.                                                                                                                            | 50+ years                   |

### Caravan Park and beach

Adaptation across the Caravan Park and beach will need to consider increasing impacts from both erosion along the beach/dune and inundation from Thompson Creek estuary. Considering the risk outcomes in Section 4.4 and suitable adaptation actions detailed above, Table 32 details potential adaptation actions for the Caravan Park and beach area to be included in an adaptation pathway. While a lower risk, the adaptation pathway for the Caravan Park area is similar to that of the Breamlea Beach and dunes to manage risk and maintain visitation along the beach and dunes neighbouring the Carvan Park for as long as possible.

**Table 32. Potential adaptation actions for the Caravan Park and beach.**

| Pathway option              | What actions might this include for the sub-area?                                                                                              | Is this option appropriate, if so when and for how long?                                                                                                          | Pathway inclusion        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Non-intervention</b>     | No new actions to mitigate coastal hazard risk.                                                                                                | Appropriate in the short to medium term with only low risk for many assets.                                                                                       | Yes – for low-risk areas |
| <b>Avoid</b>                | <b>Development setback/restrictions</b> for Barwon Coast assets. No new development in hazard-prone areas.                                     | Appropriate now and into the future to avoid further increases in risk.                                                                                           | Yes                      |
|                             | <b>Controlled access</b> with defined beach access points and dune protection/fencing to facilitate natural resilience.                        | Appropriate in the short term but may reduce in effectiveness and access stairs may be lost in storm events or as they come to the end of design life.            | Yes                      |
| <b>Nature-based methods</b> | <b>Beach and dune enhancement</b> including vegetation management, species replacement and/or wet sand fencing to increase natural resilience. | Appropriate now, with enhanced management actions required in the medium term. Effectiveness may decrease as conditions change into the longer term.              | Yes                      |
| <b>Accommodate</b>          | <b>Resilient design</b> in new /upgraded access stairs to increase resilience to coastal processes and storm-based erosion.                    | Appropriate in the short-medium term where existing access stairs are nearing end of design life or are damaged in storm events.                                  | Yes                      |
|                             | <b>Upgrade of road / utilities network</b> including Horwood Drive to allow access to the Caravan Park and sewer services.                     | Dependent on broader landscape / township adaptation planning in the medium to long term.                                                                         | See section 5.7          |
| <b>Retreat</b>              | <b>Controlled access</b> through consolidating or removing some beach access points where coastal conditions restrict access.                  | Appropriate in the medium to long term where changing conditions mean access is infeasible or would require significant investment to retain access.              | Yes                      |
|                             | <b>Retreat / removal</b> of all beach access points, meaning no access to beach areas from Caravan Park.                                       | Not appropriate in short-medium term as does not retain coastal access and would severely impact Caravan Park. Dependent on broader township adaptation planning. | No                       |
| <b>Protect</b>              | <b>Beach nourishment</b> to provide a sand buffer and retain a sandy beach.                                                                    | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with large-scale nourishment.                                  | No                       |
|                             | <b>Engineering</b> such as seawalls or groynes to protect dune and/or retain sand on the beach.                                                | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with larger engineering.                                       | No                       |



Along with the broader adaptation objectives, there are some key considerations for this adaptation pathway:



#### **Cultural values**

The dunes across this area are rich in middens and hold strong Traditional Owner value. Given the high visitation from the caravan park, access control on dedicated paths is essential to protect the dune ecosystem and reduce disturbance/erosion of middens. Investigating opportunities for Traditional Owner-led adaptation will help support both tangible (place-specific) and broader bio-cultural values. Adaptation actions could include further research, survey, documenting or salvage of place-specific values such as middens.



#### **Retaining tourism value and access to a sandy beach for as long as possible**

The Breamlea Holiday Park relies on access to the sandy beach as a key drawcard for visitors and permit holders. Access to sandy beaches from the caravan park will be increasingly challenging with sea level rise due to a steeper dune scarp and coastal hazard impacts on access infrastructure (access pathways and stairs). The beach directly accessed through the caravan park is surrounded by rocky reefs and headlands. It may be more sheltered from waves/storms than Breamlea and Bancoora Beaches, with reduced erosion impacts. The pathway attempts to retain access for as long as possible, noting that with changing conditions, some access points may need to be reconfigured or removed. Evaluating access needs following storm events and beach response to sea level rise will be important in informing the timing of future impacts, access configuration and adaptation actions.



#### **Retaining natural values**

The low-key, natural setting of the Caravan Park area is a core value and should be retained for as long as possible in adaptation. Enhancing natural resilience through dune enhancement activities may include access controls, vegetation management and other management measures such as wet sand fencing to support dune dynamics. Across Breamlea, replacement of marram grass and tea tree species to native dune species may assist in decreasing dune slopes and allowing access down a shallower dune scarp. Species replacement will also support other native flora and fauna, habitat, such as Hooded Plover nesting sites.



#### **Interdependencies with broader township planning and road access**

Access to and servicing of the Caravan Park relies on access to the township via Breamlea Road and sewerage utilities. Adaptation planning for these assets and the broader township will guide actions for Barwon Coast managed land and assets (see Section 5.7).

These actions and considerations are detailed in the adaptation pathway (Figure 38) and adaptation actions (Table 33). This pathway includes:

- **In the short-term (next 5 to 25 years)**
  - Continue planning controls, dune protection and access control.
- **In the medium-term (25 to 50 years)**
  - Plan and implement (if suitable) species replacement and dune enhancement activities.
  - Landscape-scale planning with other agencies to address increasing risk to Barwon Water sewerage utilities servicing the Caravan Park.
- **In the long-term (50+ years)**
  - Plan for and implement beach scraping and access stair reconfiguration, in response to storm events.
  - If access / cost of management is no longer feasible, investigate removal of access.

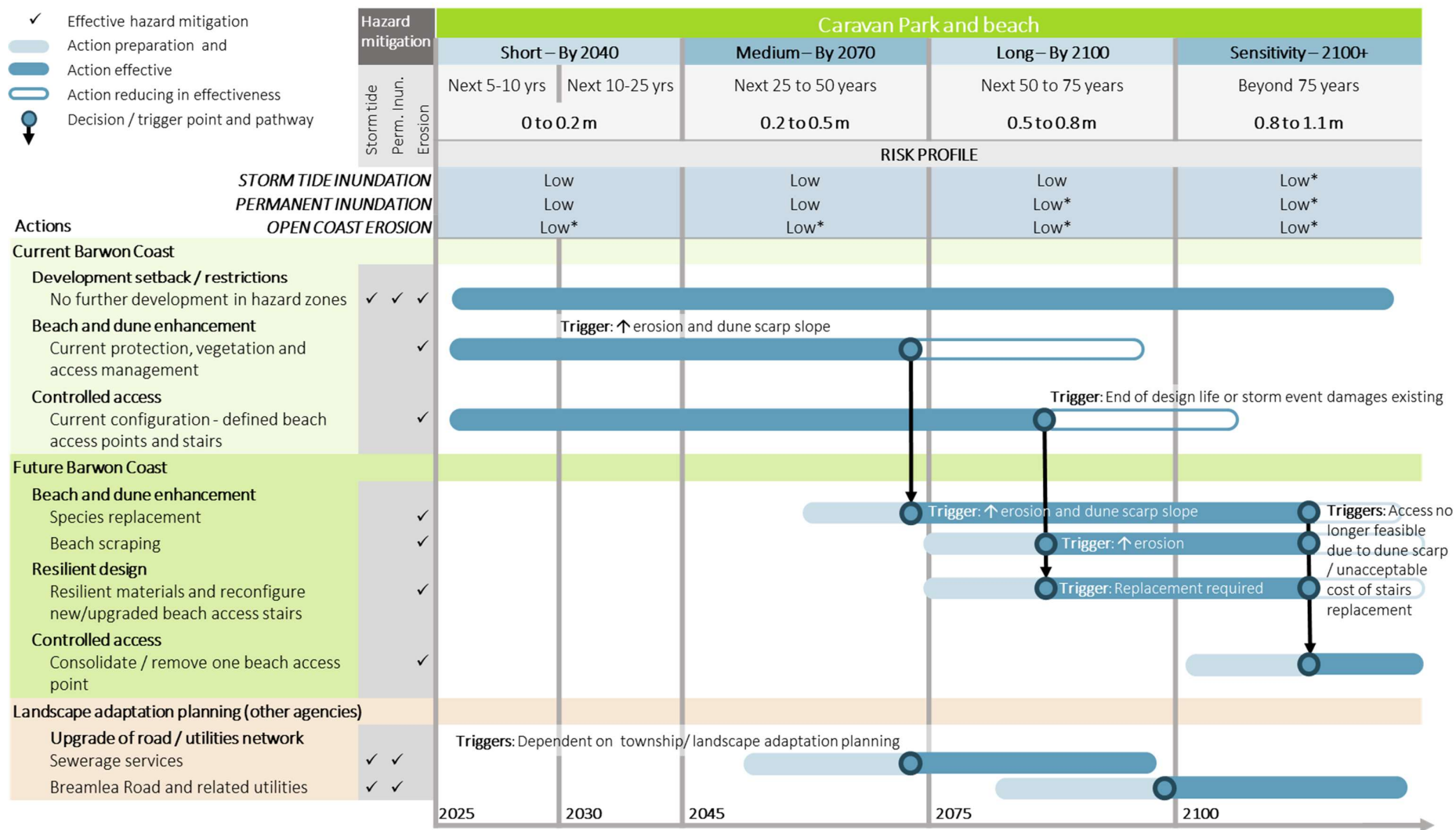


Figure 38. Adaptation pathway for the Caravan Park and beach.

Table 33. Adaptation actions for Caravan Park and beach.

| Action                                                                                          | Detail                                                                                                                                                                                                                                                                                                                                                                      | Potential timing |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>Current Barwon Coast actions</b>                                                             |                                                                                                                                                                                                                                                                                                                                                                             |                  |
| <b>Development setback / restrictions</b><br>No further development in hazard zones             | <b>CA 1.1</b> As Foundational action F1.1, ensure no new assets or infrastructure are developed in hazard-prone areas.                                                                                                                                                                                                                                                      | Now and ongoing  |
| <b>Beach and dune enhancement</b><br>Current protection, vegetation and access management       | <b>CA 1.2</b> Continue current vegetation management, weed control and revegetation efforts.                                                                                                                                                                                                                                                                                | Now and ongoing  |
| <b>Controlled access</b><br>Current configuration - defined beach access points                 | <b>CA 1.3</b> Continue current access management practices including defined access points and fencing to protect dune habitat areas.                                                                                                                                                                                                                                       | Now and ongoing  |
| <b>Future Barwon Coast actions</b>                                                              |                                                                                                                                                                                                                                                                                                                                                                             |                  |
| <b>Beach and dune enhancement</b><br>Species replacement                                        | <b>CA 2.1</b> Increase dune enhancement through further revegetation and control/investigate species replacement of marram grass to native species to encourage reduced dune slope. Monitor outcomes of species replacement over time.                                                                                                                                      | 20+ years        |
| Beach scraping                                                                                  | <b>CA 2.2</b> As Foundational action F3.3, investigate and implement sand scraping following storm events to maintain safe access. Investigate potential impacts to ecological values (e.g. Hooded Plover nesting).                                                                                                                                                         | 50+ years        |
| <b>Resilient design</b><br>Resilient materials and reconfigure new/upgraded beach access stairs | <b>CA 2.3</b> As access stair infrastructure reaches end of design life, or if damaged in storms, replace with resilient designs. Can include: <ul style="list-style-type: none"> <li>• resilient materials,</li> <li>• reconfigured access parallel to coast, rather than perpendicular, and/or</li> <li>• deeper piles and stairs to accommodate beach change.</li> </ul> | 50+ years        |
| <b>Controlled access</b><br>Consolidate / remove one beach access point                         | <b>CA 2.4</b> Where changing conditions cause access to be prohibitive (due to cost of asset replacement or increasing dune slopes) remove one or both access points. Consider broader configuration of beach access to/from the Caravan Park.                                                                                                                              | 75+ years        |



## Bancoora Beach and SLSC

Adaptation across Bancoora Beach and the SLSC will need to consider increasing impacts from both erosion along the beach/dune and inundation from Thompson Creek estuary. Considering the risk outcomes in Section 4.4 and suitable adaptation actions detailed above, Table 34 details potential adaptation actions for Bancoora Beach and SLSC to be included in an adaptation pathway.

**Table 34. Potential adaptation actions for Bancoora Beach and SLSC.**

| Pathway option              | What actions might this include for the sub-area?                                                                                                                                | Is this option appropriate, if so when and for how long?                                                                                                      | Pathway inclusion            |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| <b>Non-intervention</b>     | No new actions to mitigate coastal hazard risk.                                                                                                                                  | Appropriate in the short to medium term with only low risk for many assets.                                                                                   | No                           |
| <b>Avoid</b>                | <b>Development setback/restrictions</b> for Barwon Coast assets. No new development in hazard-prone areas.                                                                       | Appropriate now and into the future to avoid further increases in risk.                                                                                       | Yes                          |
|                             | <b>Controlled access</b> with defined beach access point and dune protection/fencing to facilitate natural resilience.                                                           | Appropriate in the short term but may reduce in effectiveness and access pathway may become location for dune breakthrough.                                   | Yes                          |
| <b>Nature-based methods</b> | <b>Beach and dune enhancement</b> including vegetation management, small-scale sand scraping, species replacement and/or wet sand fencing to increase natural resilience.        | Appropriate now, with enhanced management actions required in the medium term. Effectiveness may decrease as conditions change into the longer term.          | Yes                          |
| <b>Accommodate</b>          | <b>Resilient design</b> in new/upgraded infrastructure (SLSC redevelopment and associated assets) to increase resilience to coastal processes, flooding and storm-based erosion. | Appropriate in the short term where SLSC redevelopment is occurring. Long term resilience, dependent on design configuration, materials used and design life. | Yes                          |
|                             | <b>Upgrade of road / utilities network</b> including Breamlea Road and Surf Club Lane to allow access to the SLSC and sewer services.                                            | Dependent on broader landscape / township adaptation planning into medium-long term.                                                                          | See section 5.7              |
| <b>Retreat</b>              | <b>Controlled access</b> through beach access reconfiguration and overflow car park access controls, where conditions restrict access.                                           | Appropriate in the short-medium term where changing conditions mean access is infeasible or would require significant investment to retain access.            | Yes                          |
|                             | <b>Retreat / removal</b> of SLSC tower and potential resilient redesign of viewing platform structure.                                                                           | Appropriate in the short term to reduce immediate hazard risks.                                                                                               | Yes                          |
|                             | <b>Retreat / removal</b> of Surf lifesaving club building and facilities.                                                                                                        | Not appropriate in short-medium term as does not retain recreational values. Dependent on conditions and dune breakthrough into the longer term.              | Yes – as alternative pathway |
| <b>Protect</b>              | <b>Beach nourishment</b> (larger scale) to provide a sand buffer and retain a sandy beach.                                                                                       | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with large-scale nourishment.                              | No                           |
|                             | <b>Engineering</b> such as seawalls or groynes to protect dune and/or retain sand on the beach.                                                                                  | Not appropriate due to high impact on values, impacts to coastal dynamics and high cost associated with larger engineering.                                   | No                           |

Along with the broader adaptation objectives, there are some key considerations for this adaptation pathway:



#### **Cultural values**

The dunes across this area are rich in middens and hold strong Traditional Owner value. Given the high visitation around the SLSC and to the Caravan Park, access control on dedicated paths is essential to protect the dune ecosystem and reduce disturbance/erosion of middens. Investigating opportunities for Traditional Owner-led adaptation will help support both tangible (place-specific) and broader bio-cultural values. Adaptation actions could include further research, survey, documenting or salvage of place-specific values such as middens.



#### **Retaining access to a sandy beach and delaying dune breakthrough for as long as possible**

The recreation node relies on access to the sandy beach as a key drawcard for visitors. The access track near the SLSC is a low point in the barrier dune and therefore exposed to potential breakthrough / overtopping. Cardno (2015) suggested the access track area could erode to 4 m deeper than current elevations with >0.5 m sea level rise likely to erode the dune sufficiently for a 1% AEP storm tide event to overwash the access track. The adaptation pathway aims to retain access and delay dune breakthrough for as long as possible, noting that with changing conditions, a breakthrough and additional inundation of the area could occur.



#### **Surf lifesaving club services and facilities**

The SLSC and its facilities are important in ensuring swimmer safety, as a social meeting point and community service. Retaining surf lifesaving services for as long as possible is important. Various SLSC facilities have varying levels of emerging risk, with the SLSC tower at immediate risk, the overflow car park at risk in the medium-term, and Surf Club Lane, the remaining car park, and potentially the SLSC building itself at risk in the longer term. Adaptation actions must retain essential SLSC services and address emerging risk across these assets.

##### ***Siting and design of surf lifesaving club***

With proposed surf lifesaving club redevelopment, there is a unique opportunity to enhance the siting and design of new infrastructure to avoid and accommodate coastal hazards. The design must ensure that structures can adapt to anticipated increases in coastal hazards including sea level rise over the structure's intended lifespan. Further guidance on siting and design requirements is detailed in the Siting and design guidelines for structures on the Victorian Coast (DELWP, 2020b).



#### **Retaining natural values and facilitating dune retreat**

The undeveloped, natural setting of this area is a core value and should be retained in adaptation. Enhancing natural resilience through dune enhancement activities may include strengthening access controls, vegetation management and other management measures such as wet sand fencing and sand scraping to manage dune dynamics. Migration of wetland habitats could be facilitated to the north of the SLSC and guided by broader landscape adaptation planning.



#### **Interdependencies with broader township planning and road access**

Bancoora Beach and the SLSC as a key recreation node relies on access through Surf Club Lane and Breamlea Road. Adaptation planning for road access and the broader township will guide actions for Barwon Coast managed land and assets in the sub-area. In the longer term land managers and rightsholders may need to consider the longevity of the SLSC as a recreation node, with increasing access challenges and potential for a dune breakthrough in the vicinity (see Section 5.7).

These actions and considerations are detailed in the adaptation pathway (Figure 39) and adaptation actions (Table 35). This pathway includes:

- **In the short-term (next 5 to 10 years)**
  - Continue planning controls, dune protection and access control.
  - Plan, implement and monitor dune species replacement.
  - Investigate and implement wet sand fencing.
  - Redevelop SLSC to include resilient design and materials of building, strengthened access controls through the beach. access and overflow car park.
  - Consult with community as part of review of SLSC tower, including resilient re-design and siting of the viewing platform.
- **In the short-term (10 to 25 years)**
  - Plan for and implement drainage upgrades for the SLSC car park
  - Landscape-scale planning with other agencies to address Surf Club Lane inundation.
- **In the medium-term (25 to 50 years)**
  - Monitor, plan and implement beach scraping and dune reconstruction to minimise risk of dune breakthrough.
  - Reconfigure the SLSC car park to address inundation risks.
- **In the long term (50+ years)**
  - As the SLSC reaches end of design life, plan for and implement either:
    - Redesign with resilient design and materials to suit conditions.
    - Removal of SLSC building and relocation of facilities elsewhere.
  - Landscape-scale planning with other agencies to address broader township access through Breamlea Road.



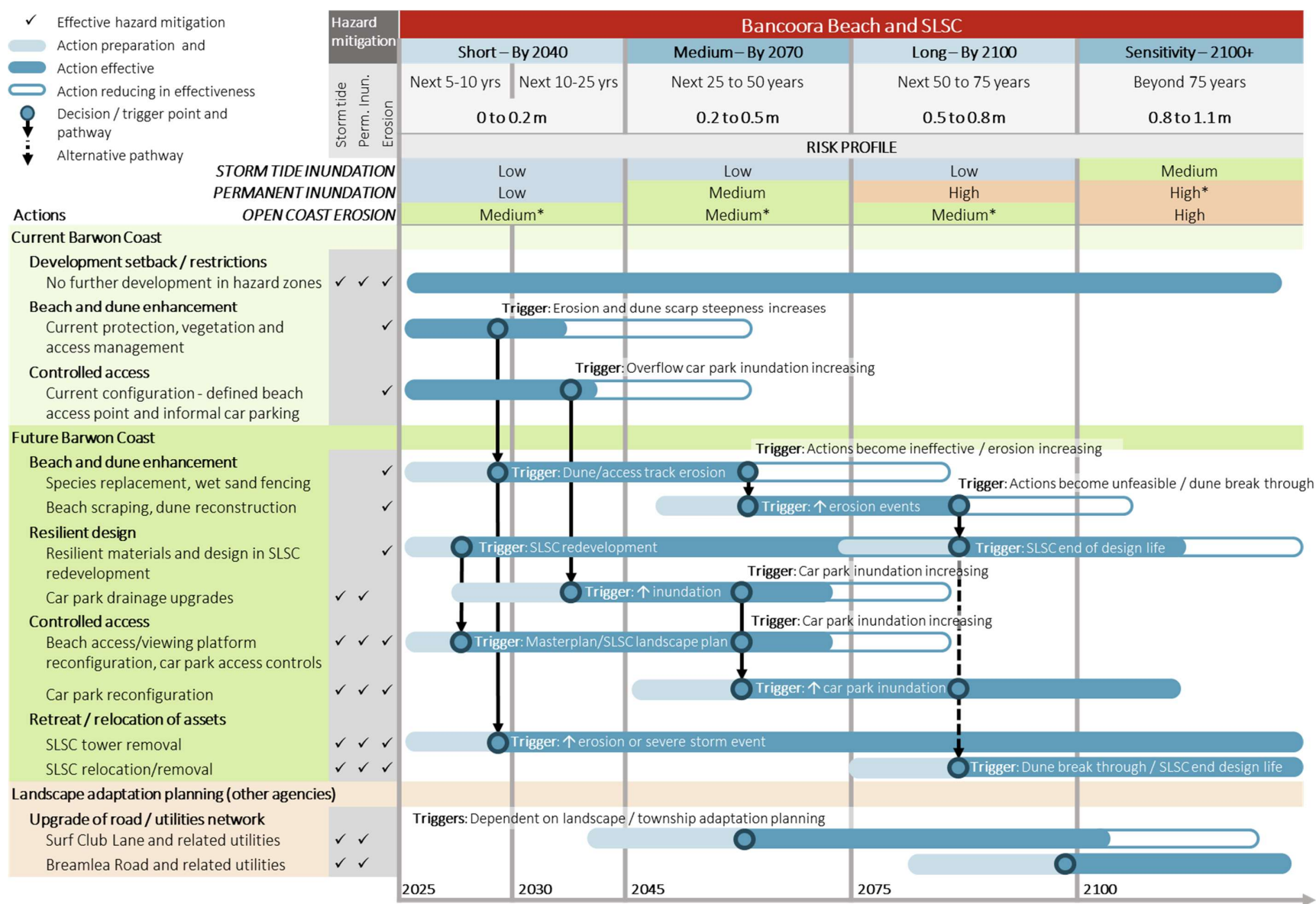


Figure 39. Adaptation pathway for Bancoora Beach and SLSC.

Table 35. Adaptation actions for Bancoora Beach and SLSC.

| Action                                                                                         | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Potential timing                |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| <b>Current Barwon Coast actions</b>                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| <b>Development setback / restrictions</b><br>No further development in hazard zones            | <b>BA1.1</b> As Foundational action F1.1 and in Barwon Coast master planning, CMMP and other asset management planning, ensure no new assets or infrastructure is developed in hazard-prone areas. Includes no increase in SLSC footprint.                                                                                                                                                                                                                                                                                                                  | Now and ongoing                 |
| <b>Beach and dune enhancement</b><br>Current protection, vegetation and access management      | <b>BA1.2</b> Continue current vegetation management, weed control and revegetation efforts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Now and ongoing                 |
| <b>Controlled access</b><br>Current configuration - defined beach access point and car parking | <b>BA1.3</b> Continue current access management practices including defined access point and fencing to protect dune habitat areas.                                                                                                                                                                                                                                                                                                                                                                                                                         | Now and ongoing                 |
| <b>Future Barwon Coast actions</b>                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| <b>Beach and dune enhancement</b>                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| Species replacement, and wet sand fencing                                                      | <b>BA2.1</b> As Foundational action F3.2, increase dune enhancement through further revegetation and control/investigate species replacement of marram grass to native species to encourage reduced dune slope. Monitor outcomes of species replacement over time. Investigate wet sand fencing to support natural resilience, maintain access and a sandy beach. Investigate potential impacts to ecological values (e.g. Hooded Plover nesting).                                                                                                          | 5-10 years                      |
| Beach scraping, dune reconstruction                                                            | <b>BA2.2</b> As Foundational action F3.3, investigate and implement sand scraping following storm events to maintain safe access. Implement localised sand scraping and dune reconstruction to reduce risk of dune breakthrough, enhance natural recovery following storms and maintain access.                                                                                                                                                                                                                                                             | 20+ years, monitoring dependent |
| <b>Resilient design</b>                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| Resilient materials and design in SLSC redevelopment                                           | <b>BA2.3</b> Redesign surf lifesaving club building with resilient materials and design to accommodate coastal hazard risk. Design for 30-year design life.                                                                                                                                                                                                                                                                                                                                                                                                 | 5-10 years                      |
| Car park drainage upgrades                                                                     | <b>BA2.4</b> Upgrade car park drainage (including Surf Club Lane, as required) to mitigate flooding risk. Consider permanent closure of overflow car park.                                                                                                                                                                                                                                                                                                                                                                                                  | 10-25 years                     |
| <b>Controlled access</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| Beach access reconfiguration and overflow car park access controls                             | <b>BA2.5</b> In SLSC redevelopment, realign beach access to be more resilient to erosion processes, consider: <ul style="list-style-type: none"> <li>Alignment of beach access to be diagonal to coast, rather than perpendicular</li> <li>Formalise beach access to reduce erosion impacts from foot traffic</li> <li>Implement access controls (fencing, bollards and gates) for overflow car park to restrict access to wetland environments and during time of overflow car park inundation. Increase car park closure as conditions change.</li> </ul> | 5-10 years                      |
| Car park reconfiguration                                                                       | <b>BA2.6</b> Reconfigure SLSC car park to reduce coastal hazard impacts. May include reduction in car parking spots and transition of overflow car park to wetland habitat.                                                                                                                                                                                                                                                                                                                                                                                 | 25-50 years                     |

| Action                                | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Potential timing |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>Retreat / relocation of assets</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |
| SLSC tower                            | <b>BA2.7</b> At the end of life, remove SLSC tower and revise siting and redesign viewing platform. Includes: <ul style="list-style-type: none"> <li>• Removal of SLSC built infrastructure</li> <li>• Restoration of dune ecosystem through planting and protection</li> <li>• Consider alternative viewing platform structure with resilient design and revised siting to conditions; or</li> <li>• Consider SLSC observation needs and moveable towers / trailers</li> </ul> | 5-10 years       |
| SLSC relocation / removal             | <b>BA2.8</b> Based on erosion and dune breakthrough monitoring, consider options to relocate SLSC, in alignment with broader township adaptation planning. Consider alternative locations, SLSC building removal, and requirements of SLSC service.                                                                                                                                                                                                                             | 25-50 years      |



## 5.7 Landscape-scale adaptation

Some coastal impacts will affect areas outside Barwon Coast's land, especially places we rely on for access and services. This means we also need to plan at a broader landscape or township scale. That includes considering how cultural landscapes, the township itself (including private property access), the Thompson Estuary, rural lands, local roads, and essential utilities might be affected as sea levels rise, and what actions will be needed.

Table 36 outlines landscape scale priorities that Barwon Coast will need to work with other agencies to address.

**Table 36. Landscape-scale adaptation priorities**

| Landscape-scale adaptation priority                                                                                                                                                                                                                                                                     | Interactions / co-dependencies                                                                                                                                                                                                                                     | Agencies/ rightsholders involved                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Cultural values and landscapes</b><br>Adaptation planning for cultural values (tangible and intangible). Potential actions could include recording and documenting sites and stories and/or relocation/ preservation of artefacts and physical values.                                               | <ul style="list-style-type: none"> <li>Traditional Owner connection to Country</li> <li>Cultural landscapes including land and sea country</li> <li>Visitor experience and storytelling</li> </ul>                                                                 | Wadawurrung<br>Traditional Owners<br>Aboriginal Corporation                                         |
| <b>Township-scale adaptation planning</b><br>Broader adaptation planning for all assets, values and uses across the Breamlea and Bancoora landscape, including public and private property and assets.                                                                                                  | <ul style="list-style-type: none"> <li>Future of the Breamlea township and community needs for Barwon Coast services/assets</li> <li>Broader planning scheme and development controls</li> </ul>                                                                   | City of Greater Geelong<br>All other Rightsholders and stakeholders                                 |
| <b>Transport and utility networks</b><br>Adaptation planning, related to above, for key access roads and utilities servicing the township. This includes Breamlea Road as the primary access to/from the township, Horwood Drive as access to foreshore areas and Surf Club Lane as access to the SLSC. | <ul style="list-style-type: none"> <li>Township access and longevity of township as a coastal destination</li> <li>Utility servicing of Barwon Coast assets</li> <li>Access to key Barwon Coast facilities including the Caravan Park and SLSC.</li> </ul>         | City of Greater Geelong<br>Barwon Water<br>Other Rightsholders, utility providers, and stakeholders |
| <b>Nature-based resilience and habitat migration</b><br>Further assessments and adaptation planning for natural systems including migration of wetland/floodplain habitats around the Thompson Creek estuary and dune system response to sea level rise.                                                | <ul style="list-style-type: none"> <li>Opportunities for habitat expansion/retreat onto Barwon Coast managed land.</li> <li>Complementary actions to support nature-based landscape-scale adaptation</li> </ul>                                                    | Parks Victoria<br>Corangamite CMA<br>Other Rightsholders and stakeholders                           |
| <b>Thompson Creek estuary response to sea level rise</b><br>Further investigations into responses of Thompsons Creek estuary mouth to rising sea level including likely changes in estuary opening/closure regime and implications for flood extents / frequency.                                       | <ul style="list-style-type: none"> <li>Interactions of catchment-driven and coastal flooding, implications for hazard extents / exposure</li> <li>Subsequent management interventions (if any) and implications for hazard risk to Barwon Coast assets.</li> </ul> | Corangamite CMA<br>Surf Coast Shire<br>Other Rightsholders and stakeholders                         |

## Landscape-scale actions

Based on the risk assessment findings (Stage 4), an indicative pathway is detailed in Figure 40. This pathway is dependent on other rightsholders and managing agencies, but indicates approximate timing and preparation required for decision-making. Actions to progress this pathway are detailed in Table 37. Note that these actions are for Barwon Coast to support other rightsholders and agencies in their progression of adaptation planning. Specific actions and timing will be dependent on individual rightsholder and agency priorities.

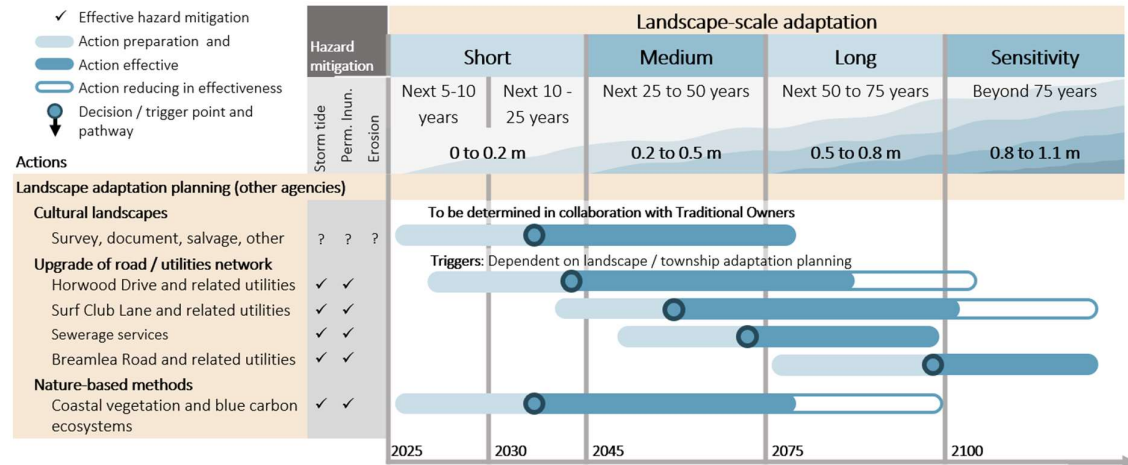


Figure 40. Pathway for landscape-scale adaptation actions.

Table 37. Actions to progress landscape-scale adaptation.

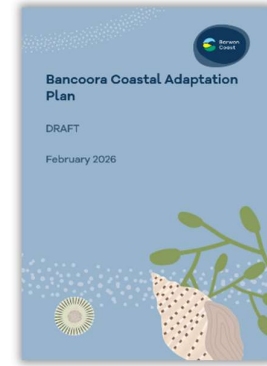
| Action                                                    | Detail                                                                                                                                                                                                                                                                                                                                                                                                                    | Potential timing |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>Landscape adaptation planning priorities</b>           |                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| <b>Cultural landscapes</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| Survey, document, salvage, other                          | <b>LA1.1</b> Partner with WTOAC to investigate opportunities to address coastal hazard risk on cultural landscapes, values and connection to Country. Seek guidance from and support WTOAC to implement adaptation actions, which could include further research, survey, documenting or salvaging artefacts/physical values, and/or management of significant sites, supporting their ongoing role in caring for Country | Now and ongoing  |
| <b>Upgrade of road / utilities network</b>                |                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| Horwood Drive and related utilities                       | <b>LA1.2</b> Support City of Greater Geelong in broader township adaptation planning and planning for Horwood Drive access. Consider implications for Barwon Coast assets, land and uses.                                                                                                                                                                                                                                 | 10-25 years      |
| Surf Club Lane and related utilities                      | <b>LA1.3</b> Support City of Greater Geelong in broader township adaptation planning and planning for Surf Club Lane access. Consider longevity of the area as a recreation node and long term access requirements.                                                                                                                                                                                                       | 25-50 years      |
| Sewerage services (and additional utilities, as required) | <b>LA1.4</b> Support Barwon Water (and other utility providers) in adaptation planning for sewerage, water and other services. Consider implications for servicing of the Caravan Park.                                                                                                                                                                                                                                   | 25-50 years      |
| Breamlea Road and related utilities                       | <b>LA1.5</b> Support City of Greater Geelong in broader township adaptation planning and planning for Breamlea Road access. Consider implications for Barwon Coast assets, land and uses.                                                                                                                                                                                                                                 | 50 years         |
| <b>Nature based methods</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| Coastal vegetation and blue carbon ecosystems             | <b>LA1.6</b> Support Parks Victoria and Corangamite CMA in broader habitat adaptation planning. Consider implications for Barwon Coast assets, land and uses and opportunities for land use transition.                                                                                                                                                                                                                   | 10-25 years      |

## 6 Summary and next steps

### The Bancoora CAP summary document

This technical document summarises the work undertaken in developing the Bancoora CAP for Stages 1-5 of the VRC framework. Stage 6 of the framework is to develop the Coastal Adaptation Plan (CAP) and confirm implementation details.

Alluvium assisted Barwon Coast with the development of a public-facing summary document – The Bancoora Coastal Adaptation Plan. This document was endorsed by the Barwon Coast Committee of Management and released for public comment in March 2026 and finalised and approved in July 2026.

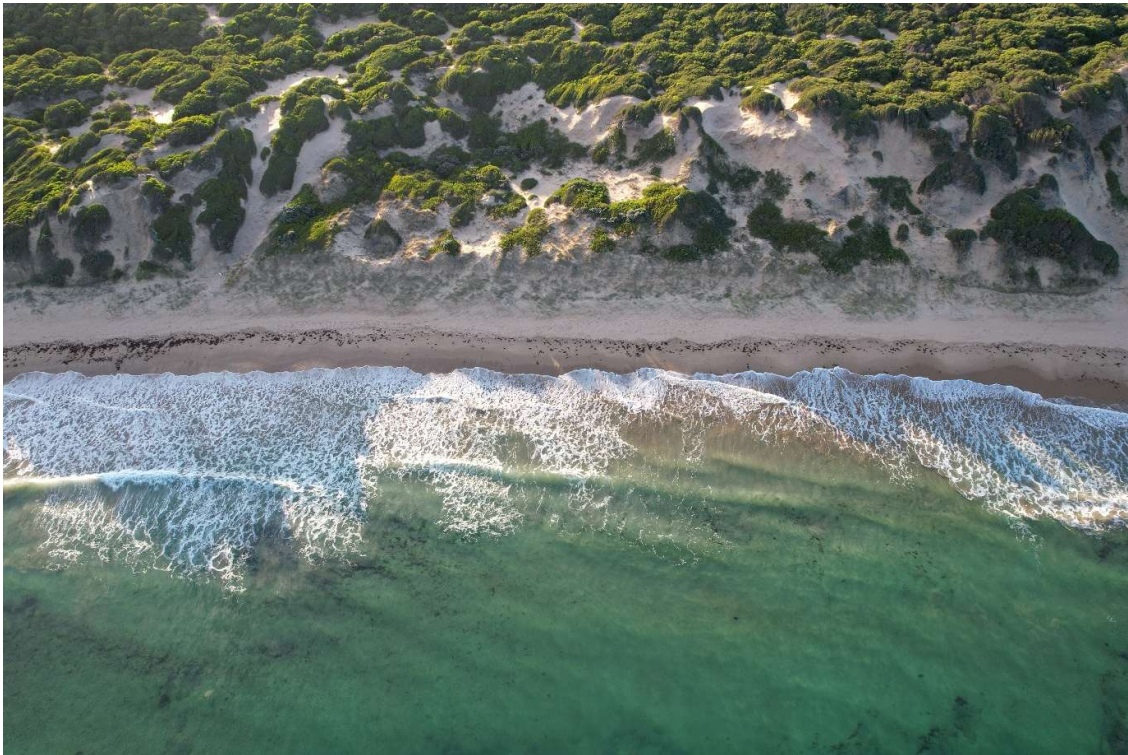


### Successful implementation

Adaptation planning and its implementation is a shared responsibility between Barwon Coast and a wide range of rightsholders, stakeholders and the community. Each will have specific roles and responsibilities in planning and delivering actions to increase the resilience of the region. Clearly defining these will be key. Collaboration between agencies will also be essential.

Adaptation requires commitment from Barwon Coast and other relevant agencies to prioritise coastal hazard management and ensure its integration with other plans and strategies. Some adaptation actions will likely be delivered via a range of existing Barwon Coast mechanisms (where possible). This includes the asset management plans, risk management, coastal and marine planning, masterplanning, annual capital works program, and other stakeholder plans, as well as business-as-usual operations for Barwon Coast. Other actions may require the development of new initiatives and processes.

Implementing adaptation will also include elements of monitoring, evaluation, review, and improvement, to be applied using an adaptive management approach, ensuring tracking, accountability and improvement of the hazard management.





### Next steps

The Bancoora CAP provides a range of technical and strategic outputs. The next stages of the VRC framework including confirming the plan for action, commencing implementation and ensuring ongoing monitoring and review (Table 38). For Barwon Coast, this may include:

- Developing an implementation plan and/or embed CAP actions into other strategic planning documents (e.g. CMMP, Master Planning), including adequate funding, resourcing, and monitoring protocols.
- Confirming foundational and sub-area actions and determining a process for collaborating with Traditional Owners, other managing authorities and the community to progress these actions.
- Refining landscape-scale adaptation and implications for Barwon Coast management responsibilities.

**Table 38. VRC stages and stage purpose.**

| VRC stage                                                                                                                    | Purpose                                                                                                                                                                            | Status            |                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------|
|  <b>1. Scoping and preparation</b>          | Provide a foundation for adaptation planning aligned to best practice guidance.                                                                                                    | ✓ Complete        | <b>Embedded throughout:</b><br>Traditional Owner knowledge, rights and assertions |
|  <b>2. Value, vision and objectives</b>     | Ensure adaptation planning is underpinned by regional and place-based values.                                                                                                      | ✓ Complete        |                                                                                   |
|  <b>3. Coastal hazard exposure</b>          | Assess coastal hazard exposure, including scenarios that enable best practice approaches to assessing current and emerging risk.                                                   | ✓ Complete        |                                                                                   |
|  <b>4. Vulnerability and risk</b>           | Explore place-based coastal hazard vulnerability and risk, to enable strategic consideration of adaptation needs/priorities                                                        | ✓ Complete        |                                                                                   |
|  <b>5. Adaptation actions and pathways</b> | 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.  | ✓ Complete        | Partnerships and a collaborative process                                          |
|  <b>6. Plan and implement</b>             | Confirm the plan of action for coastal hazard risk management and adaptation and commence implementation.                                                                          | 🕒 To be commenced | Engagement and communication                                                      |
|  <b>7. Ongoing monitoring and review</b>  | Ensure coastal hazard risk management and adaptation is accompanied by ongoing monitoring and evaluation process that enables effective implementation, learnings and improvement. | 🕒 To be commenced |                                                                                   |

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## Glossary

| Term                              | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Annual Exceedance Probability     | 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.                                                                                                                                                                                                                                                                                             |
| Bathymetry                        | Elevations of a surface underwater, e.g. seabed elevations                                                                                                                                                                                                                                                                                                                                                                                  |
| Coastal compartment               | A segment of coast defined by similar sediment transport processes at a local scale, including within the nearshore areas (just seaward of the shoreline). Compartment boundaries delineate the extent of the compartment.                                                                                                                                                                                                                  |
| 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 erosion                   | Short-term erosion (storm bite): Erosion that occurs on a short term basis, often during a storm. The shoreline and beach then gradually regains sediment (rebuilds) in calmer conditions.<br><br>Long-term erosion (recession or retreat): Continuous movement of the shoreline position in a landward direction, occurring either gradually over many years, or when the shoreline does not recover following a short term erosion event. |
| Event                             | Where weather conditions affecting a specific place are notably different from typical, day-to-day conditions normally experienced at that location (for example, a storm event).                                                                                                                                                                                                                                                           |
| Hydrodynamic                      | 'Hydrodynamics' is the study of the flow and movement of water, including forces that drive its motion. Hydrodynamic modelling includes forces generated by tides, wind and waves.                                                                                                                                                                                                                                                          |
| Inundation                        | Also known as flooding, where water covers land that is normally dry.<br><br>In the context of this project, the flooding is via water from sea (rather than rivers and rain). Inundation modelling considers where water is or flows to, accounting for many processes. These include rainfall, tides, storm surge, overtopping and wave runup and setup.                                                                                  |
| Overtopping                       | When water from the sea or ocean washes over the top of natural or manmade features (e.g., beaches, sand dunes, cliffs, seawalls)                                                                                                                                                                                                                                                                                                           |
| Permanent inundation              | Regular flooding as part of the local tidal cycle, rather than storms and weather conditions. With sea level rise, previously dry land is becoming impacted by the tides.                                                                                                                                                                                                                                                                   |
| Planning horizon                  | An indicative timeframe by which we expect a projected sea level rise scenario to occur. The Marine and Coastal Policy requires us to plan for sea level rise of not less than 0.8 metres by 2100.                                                                                                                                                                                                                                          |
| Storm tide (temporary) inundation | Temporary flooding by sea water of low-lying coastal land from a locally elevated sea level (storm tide).                                                                                                                                                                                                                                                                                                                                   |
| Tides                             | Tides are the rise and fall of sea level. Tides vary from daily cycles to those associated with climate, weather and sun and moon positions. 'Storm tides' are a combination of normal (expected) tides, storm surge, wave setup and runup.                                                                                                                                                                                                 |
| Tidal range                       | The difference between the water level at high tide and the previous or following low tide water level.                                                                                                                                                                                                                                                                                                                                     |
| Tidal plane                       | A reference elevation for defined tide heights. There are many different tidal planes which include Highest Astronomical Tide (HAT), Lowest Astronomical Tide (LAT), Mean High Water Springs (MHWS), Mean Low Water Neaps (MLWN) and Mean Sea Level (MSL),                                                                                                                                                                                  |
| Topography                        | Elevations of a surface                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Significant wave height           | The average height of the highest one-third of waves in a given period.                                                                                                                                                                                                                                                                                                                                                                     |

| Term             | Definition                                                                                                                                                                                                                                                                                             |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Static model     | A static (sometimes called a ‘bathtub’) model is quite simplistic, based on water levels and ground surface elevations. This method fills the sea like a bathtub when you add water. Lower parts (low-lying coastal land) fill up first, then higher parts, until water levels reach the design level. |
| Sand scarping    | The mechanical movements or ‘pushing’ of sand from the lower part of the beach to the upper beach/dune or redistributing sand build-up from undesirable areas. This mimics natural beach recovery and helps to accelerate dune rebuilding after storm-based erosion.                                   |
| Storm tide       | The total elevated sea height at the coast during a storm, combining storm surge and the predicted tide height.                                                                                                                                                                                        |
| Storm surge      | Storm surge is a local, abnormal rise in sea level above normal (expected) levels. Water levels change due to low air pressure associated with storms.                                                                                                                                                 |
| Wave attenuation | The reduction in wave energy as it travels through an area. Waves can be attenuated (reduce in energy) when passing through rough surfaces, structures, vegetation or other obstacles.                                                                                                                 |
| Wave refraction  | The change in direction of waves as they move around a structure, headland or other obstacle.                                                                                                                                                                                                          |

## Acronyms

| Term    | Definition                                            |
|---------|-------------------------------------------------------|
| AEP     | Annual Exceedance Probability                         |
| AHD     | Australian Height Datum                               |
| BW      | Barwon Water                                          |
| CAP     | Coastal Adaptation Plan                               |
| CCMA    | Corangamite Catchment Management Authority            |
| CMMP    | Coastal and Marine Management Plan                    |
| CoGG    | City of Greater Geelong                               |
| CoM     | Committee of Management                               |
| DEECA   | Department of Energy, Environment and Climate Action  |
| ENSO    | El Niño Southern Oscillation                          |
| GORCAPA | Great Ocean Road Coast and Parks Authority            |
| HAT     | Highest Astronomical Tide                             |
| IPCC    | Intergovernmental Panel on Climate Change             |
| LAT     | Lowest Astronomical Tide                              |
| MSL     | Mean Sea Level                                        |
| PV      | Parks Victoria                                        |
| SAM     | Southern Annular Mode                                 |
| SCSC    | Surf Coast Shire Council                              |
| SLR     | Sea Level Rise                                        |
| SLSC    | Surf Lifesaving Club                                  |
| VMaCC   | Victorian Marine and Coastal Council                  |
| VRC     | Victoria's Resilient Coast – Adapting for 2100+       |
| WTOAC   | Wadawurrung Traditional Owners Aboriginal Corporation |



## Figures

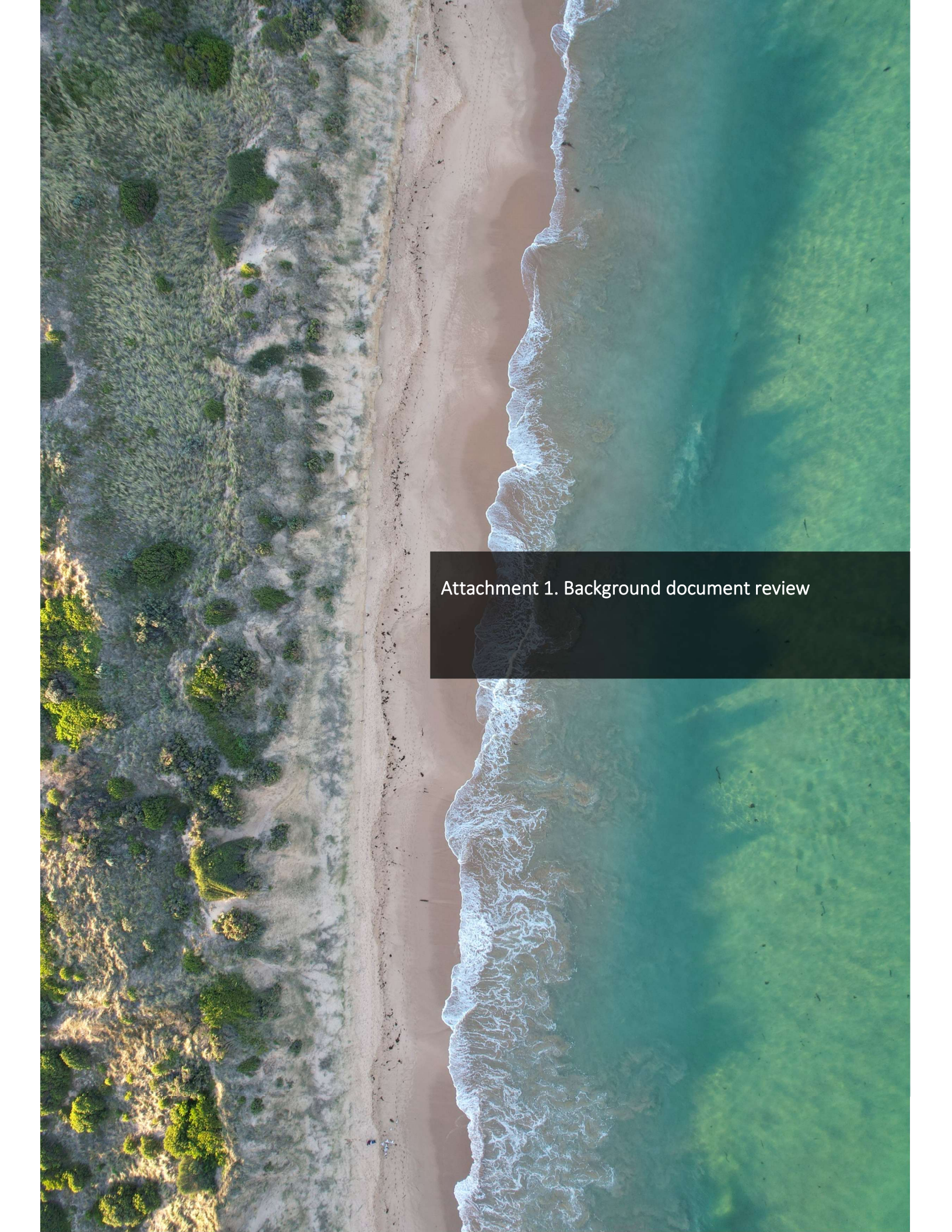
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An aerial photograph of a coastal landscape. The top half of the image shows a wide, light-colored sandy beach. To the left of the beach is a dense area of green vegetation, including shrubs and grasses. The bottom half of the image shows the ocean, with a clear turquoise color and visible white foam from waves breaking near the shore. A dark, semi-transparent rectangular box is overlaid on the right side of the image, containing white text.

## Attachment 1. Background document review



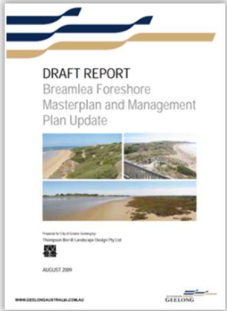
## STUDY AREA and IMMEDIATELY ADJACENT

| Document                                                                                                                                                                   | Summary of the document                                                                                                                                           | Objectives, goals or recommendations that align with coastal adaptation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| <p><i>Annual Report 2022-23</i><br/>(Barwon Coast Committee of Management Inc. 2022)</p>  | <p>A report detailing the growth and strategic planning development for the 2022-23 financial year reporting period for Barwon Coast Committee of Management.</p> | <p>Key areas of focus for Barwon Coast:</p> <ul style="list-style-type: none"> <li>• Planning – inclusive of a CMMP and precinct master plans</li> <li>• Protecting and enhancing the natural environment and cultural values</li> <li>• Public access, use and provision of facilities</li> <li>• Accommodation</li> <li>• Communications and community engagement <ul style="list-style-type: none"> <li>○ Note: Positive working relationships have been developed with the Bancoora Surf Life Saving Club (SLSC), and Breamlea volunteer groups: CoastCare, Friends of the Hooded Plover and Community Garden.</li> <li>○ Note: A community survey was conducted for the resident and visiting communities at Breamlea and Bancoora over the 2022/23 summer, providing great insight into the issues of concern and visitation demographics.</li> </ul> </li> <li>• Commercial leases and licences (of the Crown land reserves managed by Barwon Coast – predominately to sporting clubs and SLSCs)</li> </ul> | <p><u>Cultural</u>: Barwon Coast are very proud of the close working relationship they have with WTOAC. This includes monthly meetings working with WTOAC on achieving shared actions in their Healthy Country Plan, Paleert Tjaara Dja.</p> <p><u>Economic</u>: financial viability of Barwon Coast is through the operation of three accommodation parks: Barwon Heads, Riverview Family, and Breamlea Caravan Parks as well as the seasonal Riverside Camp Ground. Income generated from the parks plus leases and licences funds all of Barwon Coast’s coastal management operations. Breamlea Caravan Park was a highlight, with full year revenue of \$711k, a 30%+ increase on previous results.</p> <p><u>Climate change / coastal processes</u>: Adapting and responding to a changing climate will continue to provide challenges for the protection of our dunes, their valued floristic and faunal communities; and the maintenance of infrastructure, in particular beach accesses and coastal protective assets. The most obvious impacts are storm surge events, and less obvious are increasing sea levels; changes to weather patterns including changes to temperature and rainfall ranges. These provide real threats to the biodiversity and the physical extent of the slender coastal reserves managed by Barwon Coast.</p> <p><u>Social</u>: ensuring equity of coastal access in a context of increasing demand for camping, caravanning and accommodation, especially during the peak period.</p> <p><u>Environmental</u>: The Natural Resource Management team implements a continuing works program to address pest plant threats and protect vulnerable species observed throughout the dune system. Additionally, the value of fauna is a focus to guide resource allocation and extending education outreach activity into the community.</p> |

## STUDY AREA and IMMEDIATELY ADJACENT

| Document                                                                                                                                                                    | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Objectives, goals or recommendations that align with coastal adaptation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <p><i>Coastal and Marine Management Plan (CMMP) 2020-2025</i><br/>(Barwon Coast 2020)</p>  | <p>The CMMP is the key strategic document for Barwon Coast, providing the foundation for planning and operations over the next five-year period (2020–2025) and guidance in forming and observing longer- term vision. It informs the development and revision of supporting plans and documents, including precinct master plans, vegetation management plans, and other issues-based plans. It will also help to set priorities for annual budgets.</p> <p>It has three management themes:</p> <ol style="list-style-type: none"> <li>1) Natural and cultural values,</li> <li>2) Planning and integration, and</li> <li>3) Use and enjoy sustainably</li> </ol> <p>With ten-year objectives, five-year outcomes, and strategic actions provided for each theme.</p> <p>It provides specific values, priorities, actions, and master plan drawings for six precincts across BC's management area, as well as accommodation services - this information is planned to be developed into dedicate 'Precinct Master Plans' in the future.</p> <p>At the time of writing, the Breamlea Foreshore Reserve was not yet under BC management and therefore is not included within this CMMP.</p> | <p>This CMMP has a focus on:</p> <ul style="list-style-type: none"> <li>• Meeting the demands of increased visitation due to population growth</li> <li>• Planning for the increasing effects of climate change</li> <li>• Programs to care for, rehabilitate and protect natural habitats and biodiversity</li> <li>• Recognising the rights, aspirations and knowledge of Traditional Owners</li> <li>• Increasing community, Traditional Owner and stakeholder participation in coastal and marine management.</li> <li>• Ensuring an integrated approach to coastal and marine management in partnership with adjacent land and water management</li> <li>• Ensuring Barwon Coast's financial viability.</li> </ul> | <p><u>Cultural</u>: Barwon Coast acknowledges the long and deep connections between the coast and the Traditional Owners and will continue to work collaboratively to care for the coast for its cultural significance and to promote awareness of cultural values. Wadawurrung Cultural Heritage sites are under threat from human and environmental impacts. Securing their long-term future is seen as a priority. Barwon Coast acknowledges post European settlement heritage and will continue to care for and respect sites of significance and promote awareness of these cultural values</p> <p><u>Economic</u>: Financial sustainability - Barwon Coast ensures that it remains financially viable and maintains adequate revenues to meet its management needs. Caravan occupancy is a key element of revenue.</p> <p><u>Social</u>: public amenities and facilities (safe and accessible public shelters, toilets, picnic settings, life-saving buildings, pathways and trails), land and water-based recreation, aesthetic values, safety, isolation and a sense of place.</p> <p><u>Environmental</u>:<br/>The protection and restoration of the natural environment of the marine and coast is Barwon Coast's highest priority. Community also value protection and enhancement of natural environments, vegetation and fauna, landscape, water quality. Native vegetation communities, the endangered Hooded Plover, the fragile dune, estuarine and marine environments were also identified as being valued by the community.</p> <p><u>Climate change</u>: Barwon Coast proactively identifies and prepares adaptation plans in response to climate change and its potential impacts including inundation, erosion, heat, fire, rain and storms. Climate change impacts including storm surge, erosion and flooding are recognised by community as a key challenge. Barwon Coast is committed to a collaborative approach involving communities and agencies in adaptation planning and response. Decision making about coastal adaptation options will consider the potential impacts if no action is taken as well as the costs, benefits and risks of any proposed options.</p> |

# STUDY AREA and IMMEDIATELY ADJACENT

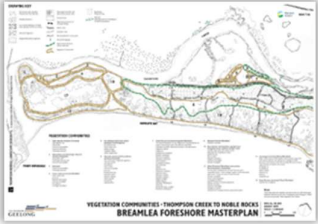
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| <p><i>Breamlea Foreshore Masterplan and Management Plan 2009 Update</i><br/>(Thompson Berrill Landscape Design for City of Greater Geelong 2009)</p>  | <p>The Plan provides updated management guidelines and recommendations for the City of Greater Geelong to guide an integrated approach for the Breamlea reserve. Its development was guided by a project steering group comprised of representatives from CoGG, DES, Parks Vic, CCMA, Breamlea Progress Assoc., Breamlea Coast Action, Bancoora SLSC, Wathaurong Cooperative, Barwon Water and Breamlea Caravan Park. It describes the existing conditions of the site (geology, geomorphology, coastal processes, flora and fauna, and cultural heritage) as well as issues and recommendations for seven subareas of the Breamlea reserve, as well as traffic management.</p> <p>The Plan ends with implementation recommendations/actions, prioritised by timeframe, and categorised by 4 themes:</p> <ol style="list-style-type: none"> <li>1. environment (climate change and coastal processes, significant fauna protection, vegetation management, stormwater management),</li> <li>2. recreation (across the study area, and for 3 key subareas),</li> <li>3. infrastructure and traffic management (including fire risk),</li> <li>4. cultural heritage.</li> </ol> | <p><u>Key objectives:</u></p> <ul style="list-style-type: none"> <li>• To re-confirm the community's vision and values for the reserve</li> <li>• To update the Management Plan based on these, and a plan for the continued improvement of the recreational, environmental and visual amenity</li> <li>• To review existing infrastructure and provide recommendations for improvement and ongoing maintenance</li> <li>• To review existing pedestrian and vehicle links and investigate opportunities for further improvement</li> <li>• To protect the integrity of sites of historical and cultural value significance</li> <li>• To review provision of recreational infrastructure</li> </ul> | <p><u>Cultural:</u> Breamlea's Aboriginal cultural heritage is highly significant; for example, it has one of the highest densities of middens along the central west coast. The diverse range of foods available within the study area prior to European settlement indicate that this region would have highly valued and cared for by Wadawurrung peoples. This diversity is due to the variety of ecological zones present at Breamlea: dunes, the ocean, the tidal creek, basalt rock platforms, and wetlands/saltmarshes.</p> <p><u>Environmental:</u> Community strongly supports protection of environmental values associated with flora and fauna of the area. For example, highly valued saltmarsh vegetation communities and the associated faunal species, e.g. EPBC Act listed, orange-bellied parrot. Highly valued remnant Moonah trees, FFG Act listed (62% on private property, only 4% with limited regenerative capacity). Highly valued Hooded Plover habitat at Breamlea beach, FFG Act listed. There is recognition that Breamlea is an area of extreme fire risk, and that prescribed burns are required for fuel reduction.</p> <p><u>Social:</u> Breamlea is a popular location for fishing and also used for boating and kayaking along Thompson Creek. A surf school operates at Bancoora Beach, in addition to the activities of the Bancoora SLSC.</p> <p><u>Coastal processes:</u> recognition of coastal processes, e.g. as the front face of the dunes is undergoing continual change as a result of wave and wind action, it is to be expected that any steps or structures will require maintenance and replacement periodically.</p> <p><u>Economic:</u> the Breamlea caravan park is an important economic asset, with the only commercial shop in Breamlea the general store/post office within the caravan park. Recognition that the park's facilities no longer meet contemporary standards and value their upgrade/replacement.</p> |



## STUDY AREA and IMMEDIATELY ADJACENT

| Document                                                                                                                                                                           | Summary of the document                                                                                                                                                                                                                                                                                                                                                                           | Objectives, goals or recommendations that align with coastal adaptation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <p><i>Breamlea Foreshore masterplan: Noble Rocks to Black Rocks (draft for comment) 2009</i></p>  | <p>Draft masterplan for Noble Rocks to Black Rocks, includes actions for Bancoora Beach, management of township vegetation / traffic / waste, signage, and notes on community consultation and climate change / coastal processes.</p> <p>The design and management objectives are from the 'Recommendations' section of the <i>Breamlea Foreshore masterplan and Management Plan Update</i>.</p> | <p><u>Design objectives:</u></p> <ul style="list-style-type: none"> <li>• Achieve a balance between recreation facilities and natural environmental values</li> <li>• Protect existing environmental and cultural heritage values</li> <li>• Maintain primary visitor facilities at Bancoora Beach to reduce the impact of vehicular traffic through the local township</li> <li>• Retain existing recreation passive facilities in the two reserves and minimise their visual impact on the surrounding saltmarsh</li> <li>• Snively design and locate interpretive signage to inform visitors and the local community of the unique environmental values</li> </ul> <p><u>Management objectives:</u></p> <ul style="list-style-type: none"> <li>• Manage the section of coast between Point Impossible and Scott Street as a conservation zone, discouraging formal public access and undertaking weed control to preserve unique environmental and cultural values</li> <li>• Manage Bancoora Beach car park and surrounds as the key visitor destination point for the town</li> <li>• Actively restrict access to existing designated beach access routes into the dunes between Bancoora Beach and Black Rocks and manage primarily for conservation values to minimise impact on cultural heritage sites</li> <li>• Restrict public vehicle and horse access to the beach and dune environment</li> <li>• Continue to protect the high conservation values of Thompson Creek and the saltmarsh communities</li> </ul> | <p><u>Cultural and environmental</u> values held strongly by the community at Breamlea – new residents are supplied with information packs regarding these values, while awareness and education programs on these values to be run out of the facilities at the Breamlea caravan park are desired by the community.</p> <p><u>Environmental:</u></p> <p>Fire Management is a strong focus of the Breamlea community, yet it is balance against environmental values, where fuel reduction, weed control and vegetation management works are to consider:</p> <ul style="list-style-type: none"> <li>• Protection of remnant Moonah woodland</li> <li>• Improvement to indigenous ground layer biodiversity, following removal of coast tea tree and coast wattle</li> <li>• Staging to minimise impacts on habitat and landscape amenity</li> </ul> <p>Social: all-abilities beach access is valued e.g. installation of board-and-chain on soft sand, wheelchair access to SLSC toilets.</p> <p><u>Climate change/coastal processes:</u> desire to ensure that future infrastructure design and management at Breamlea considers the impacts of climate change, including:</p> <ul style="list-style-type: none"> <li>• Ensuring that design and location of approvals consider SLR, especially along Thompson Creek</li> <li>• Monitoring coastal erosion and accretion and reviewing the location of beach access points / infrastructure to minimise ongoing maintenance / replacement costs</li> <li>• Monitoring vegetation communities and changes in habitat for rare and threatened flora and fauna</li> <li>• Ensuring building design, vegetation and emergency management practices consider increasing bushfire risk</li> </ul> |

# STUDY AREA and IMMEDIATELY ADJACENT

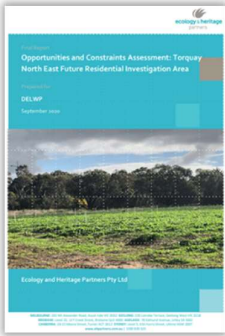
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| <p><i>Breamlea Foreshore masterplan: Vegetation communities 2009 (City of Greater Geelong 2009)</i></p>                                                                                                                                              | <p>Maps of vegetation communities, digitally reproduced from the 1999 Breamlea Foreshore masterplan, with Moonah survey work completed by Mark Trengove in 2004 incorporated. Included in the 2009 update to the Breamlea Foreshore masterplan.</p>                                                                                                                                                                                                            | <p>A general priority is to control coast tea tree and coast wattle, particularly north of Bancoora.</p> | <p><u>Ecological</u> - Vegetation communities documented in study area:</p> <ul style="list-style-type: none"> <li>• Variety of grasslands, sedgelands, and herbfields</li> <li>• Saltmarsh</li> <li>• Teatree-dominated degraded woodland (within the caravan park) – the planted eucalyptus species (e.g. some native to WA) require monitoring to see if they become naturalised; investigate a gradual replacement program.</li> <li>• Remnant moonah woodland</li> <li>• Mixed grassland/shrubland – relatively free of coast tea tree and reasonable diverse; some localised erosion, mostly associated with tracks</li> <li>• Dune system, dominated by coast tea tree, coast wattle and bare sand – includes steep areas with active erosion; relatively free of significant weeds</li> </ul>                                                                                                                                                                                         |
| <p><i>Breamlea Caravan Park masterplan 2017 (City of Greater Geelong 2017)</i></p>  <p><i>Breamlea Holiday Park information leaflet (Barwon Coast 2022)</i></p>  | <p>The masterplan for the Breamlea Caravan Park that provides management direction until 2022. In addition to specifics for caravan park management, the masterplan includes information on vegetation management and cultural heritage values.</p> <p>Leaflet contains a map of caravan park sites for visitors and a page of caravan park information, including rules in place within the caravan park, as well as information about the Bancoora SLSC.</p> | <p>NA.</p>                                                                                               | <p><u>Cultural heritage</u>: Breamlea is an area of high cultural heritage significance, with more than 60 Aboriginal archaeological sites within a 2 km radius of the caravan park.</p> <p><u>Ecological</u>: Existing large eucalypts contribute to landscape character and amenity of the caravan park; however these trees are not local to Breamlea. The plan directs for a staged tree replacement using a mix of local species.</p> <p><u>Social</u>:</p> <ul style="list-style-type: none"> <li>• the caravan park offers recreational facilities (playground, beach volleyball basketball, recreation room) and amenities (barbecue areas), in addition to accommodation, both 12-month permits and casual stays, to visitors who value being close to the water, in a bush environment.</li> <li>• a sense of calmness, safety and amenity – there is no need to rush in Breamlea (vehicle speed restrictions in the caravan park and the township reflect these values)</li> </ul> |

## STUDY AREA and IMMEDIATELY ADJACENT

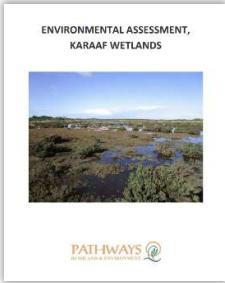
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| <p><i>Bancoora Beach Precinct plan concept 2020</i><br/>(City of Greater Geelong 2020)</p>  | <p>Draft masterplan for the Bancoora Beach precinct, includes actions primarily for the Bancoora Surf Life Saving Club (SLSC) and carpark, as well as the Surf Club Lane access road to the SLSC, and the beach access point from the SLSC.</p> | <p><u>Key Objectives:</u></p> <ul style="list-style-type: none"> <li>• Ensure future provision of recreation infrastructure in the coastal environment is sustainable and sensitive to environmental needs and not excessive to local community and visitor requirements.</li> <li>• Ensure that emergency management measures are developed to meet current and future use.</li> <li>• Promote understanding of the unique natural dynamic system and the actions individuals can undertake to assist in protection of the environment.</li> <li>• Recognise and protect unique cultural values of the area.</li> </ul> | <p><u>Cultural heritage:</u> The diverse ecology of the area had provided Wadawurrung people with a wide range of food resources for thousands of years. There are desires to improve protection and awareness of cultural heritage, such as through preparation of a Cultural Heritage Management Plan in consultation with WTOAC, which may include interpretation opportunities to increase visitor understanding and awareness of cultural heritage at Bancoora and Breamlea.</p> <p><u>Ecological:</u> The precinct directly adjoins the Breamlea Flora and Fauna Reserve and provides habitat for rare and threatened birds including Orange Bellied Parrot, Hooded Plover and sensitive Coastal Saltmarsh, Moonah Woodland and Dune Scrub vegetation. Value significant vegetation and habitat value, desire to have protection through 'no go areas'/fencing and signage.</p> <p><u>Social:</u></p> <ul style="list-style-type: none"> <li>• Recreation: the Bancoora beach has long been popular with local surfers, swimmers, walkers, dog walkers and naturalists.</li> <li>• Visitors: it is the closest beach to new residential development areas at Armstrong Creek and there has been a significant rise in beach visitor numbers over the past two years. There's a need to ensure facilities are appropriate for needs of increasing visitor numbers (e.g. prevent vehicle incursion into wetland areas adjacent to overflow carpark)</li> <li>• Tranquil, quiet and safe atmosphere: value slow vehicle speeds, security lighting, beach safety and surveillance</li> </ul> <p>Some <u>community comments</u> on the plan concept:</p> <ul style="list-style-type: none"> <li>• "Protection of the dunes on Bancoora Beach is a high priority."</li> <li>• "Would like to see an interpretive facility outlining the environmental values of Bancoora and information on Hooded Plover conservation."</li> <li>• "Future buildings need to be sympathetic to the natural environment not objectionable."</li> <li>• "There should be no increase to the environmental footprint from changes to the Surf Club or car park."</li> <li>• "Would like to see refurbishment of the existing Surf Club, including better shower and toilet facilities."</li> </ul> |



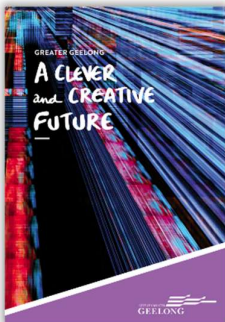
# STUDY AREA and IMMEDIATELY ADJACENT

| Document                                                                                                                                                                                                                                          | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Objectives, goals or recommendations that align with coastal adaptation | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <p><i>Opportunities and Constraints Assessment: Torquay North-East Future Residential Investigation Area 2020</i><br/>(Ecology and Heritage Partners. 2020)</p>  | <p>An ecological assessment undertaken to determine opportunities and constraints for the suitability for the Torquay North-East Future Residential Investigation Area for future development. The assessment findings were to inform a required Statement of Planning Policy for the Surf Coast Distinctive Area and Landscape (DAL), declared such in 2019.</p> <p>The assessment included the Breamlea Flora and Fauna Reserve and Karaaf wetlands in its study area. It provided notes on the general extent and condition of vegetation, as well as any potential habitat for significant fauna species and any observed impacts to the reserve, relating to stormwater overflow, from neighbouring developments.</p> | <p>NA.</p>                                                              | <p><u>Environmental:</u></p> <ul style="list-style-type: none"> <li>• The purpose of the Breamlea Flora and Fauna Reserve is for the preservation of native plant species.</li> <li>• The Reserve is a large, open reserve dominated by Coastal Saltmarsh (EVC 9) (bioregional conservation status of endangered). Beaded Glasswort is one of the major plants in this saltmarsh environment, which plays an important role as feeding habitat for the nationally significant, Orange-bellied Parrot</li> <li>• The Reserve comprises a large open dune system that is vegetated with coastal grassland and shrubland vegetation, providing habitat for many bird species, including the threatened Hooded Plover.</li> <li>• Permanent saline wetlands (the Karaaf Wetlands) are also present within the reserve.</li> </ul> <p><u>Cultural:</u></p> <ul style="list-style-type: none"> <li>• The Reserve is an area of cultural heritage sensitivity, known to contain, or is likely to contain Aboriginal cultural heritage places and objects.</li> <li>• The coastal areas along the shorelines of the Reserve would have provided important resources for Aboriginal people, including fish and shellfish, particularly given the shelter offered by the high cliff faces along the coast.</li> <li>• The reserve is believed to be where the escaped convict, William Buckley, camped and lived with the Wathaurong people.</li> </ul> |

STUDY AREA and IMMEDIATELY ADJACENT

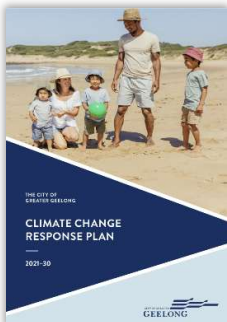
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| <p><i>Environmental Assessment, Karaaf Wetlands</i><br/>(Pathways Bushland and Environment 2022)</p>  | <p>The purpose of this assessment was to determine the current extent and quality of existing vegetation at The Karaaf and identify the impacts resulting from stormwater flows from the western outlets connected to residential development.</p> | <p>NA.</p>                                                              | <p>88 locally indigenous plant taxa and 91 introduced taxa were recorded from the Karaaf Wetlands. The greater majority of the introduced species are restricted to the drier areas, fringing the saltmarsh system. Most of the saltmarsh which has not been affected by stormwater inputs is relatively weed free, especially in the areas subject to tidal inundation.</p> <p>The Bellarine Glasswort <i>Tecticornia</i> sp. (Connewarre) is only known from hypersaline saltmarsh vegetation of western Port Phillip Bay and the Bellarine Peninsula. This relatively recently recognised species does not yet have a formal conservation status but would meet the requirements for listing under the Flora and Fauna Guarantee as at least 'endangered'. The Karaaf is a stronghold for this species, where it is the dominant species of low, hypersaline saltmarsh shrubland.</p> |

# CITY OF GREATER GEELONG

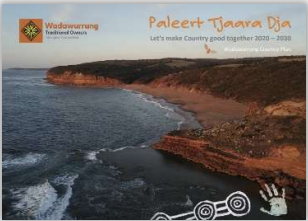
| Document                                                                                                                                                                                    | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                            | Values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| <p><i>Our Community Plan 2021-25</i><br/>(City of Greater Geelong 2021)</p>                                | <p>This plan is a key strategic document that ensures the Council stays current and responsive to the region's evolving priorities and opportunities. It tells the community what councillors are aiming to achieve during their four-year term.</p> <p>The region's long-term vision and values were established in 2017 as part of the Council's clever and creative 30-year plan for the community, and they remain the Council's 'north star' today.</p>                                                       | <p>The plan identifies four strategic directions that Council will focus their efforts on over the next four years, always moving towards the 30-year vision:</p> <ol style="list-style-type: none"> <li>1. Healthy, caring and inclusive community</li> <li>2. Sustainable growth and environment</li> <li>3. Strong local economy</li> <li>4. High-performing Council and organisation.</li> </ol> | <p>Sustainability is a key principle underpinning this plan. Sustainability refers to a continual way of thinking that focuses on the best outcomes for people, the environment and the economy – both now and in the future. It also means demonstrating leadership, supporting sustainable choices for industry and the community, as well as tracking Council progress and reporting annually against global reporting standards.</p> <p>Strategic direction and outcomes with particular relevance to coastal hazard management include:</p> <ul style="list-style-type: none"> <li>• Sustainable growth and environment:</li> <li>• We protect and restore our natural environment</li> <li>• Greater Geelong has quality, vibrant public spaces</li> </ul> |
| <p><i>A Clever and Creative Future: 30-year community vision</i><br/>(City of Greater Geelong 2017)</p>  | <p>From September 2016 to May 2017, over 16,000 people told Council what they value about the region, how they rate it against the recognised elements of a successful community, and shared ideas about how to address challenges now and in the future.</p> <p>The diversity of the people involved and their commitment and passion for Greater Geelong makes this document a strong and durable platform to guide future decision-makers, establish their planning requirements and hold them accountable.</p> | <p>The community's 30-year clever and creative vision: "By 2047, Greater Geelong will be internationally recognised as a clever and creative city region that is forward looking, enterprising and adaptive, and cares for its people and environment."</p>                                                                                                                                          | <p>Features nine community aspirations:</p> <ol style="list-style-type: none"> <li>1. A prosperous economy that supports jobs and education opportunities</li> <li>2. A leader in developing and adopting technology</li> <li>3. Creativity drives culture</li> <li>4. A fast, reliable and connected transport network</li> <li>5. A destination that attracts local and international visitors</li> <li>6. People feel safe wherever they are</li> <li>7. An inclusive, diverse, healthy and socially connected community</li> <li>8. Sustainable development that supports population growth and protects the natural environment</li> <li>9. Development and implementation of sustainable solutions</li> </ol>                                              |



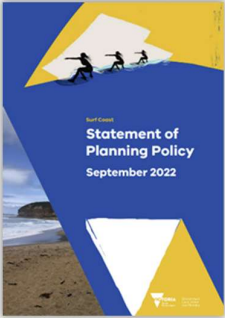
# CITY OF GREATER GEELONG

| Document                                                                                                                                                                | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Values                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| <p><i>Climate Change Response Plan 2021-30</i><br/>(City of Greater Geelong 2021)</p>  | <p>This plan is a roadmap to reduce greenhouse gas emissions across the municipality and make the Geelong city-region more resilient to climate impacts.</p> <p>The plan identifies what actions we need to take, not the operational details of how Council might implement those actions. It is intended that residents, businesses and organisations will use the plan for guidance and act within their spheres of control and influence.</p>                                                                       | <p>The Council has a goal of net zero emissions Greater Geelong-wide by 2035.</p> <p>Relevant actions:</p> <ul style="list-style-type: none"> <li>Investigate the establishment of a Regional Adaptation Strategic Partnership to improve our understanding of coastal processes in particular coastal erosion by 2022</li> <li>Develop coastal adaptation plans by 2024 that identify the adaptation pathways and responses for priority coastal hazard sites along the Bellarine Peninsula, Corio Bay and outer coast</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>The environment and climate change are a significant priority for residents and stakeholders and they're looking to Council for leadership on these issues.</p> <p>Sea level rise and higher-intensity coastal storms are recognised as critical risks to the Geelong region posed by climate change and likely to damage natural and constructed coastal assets</p>                                                               |
| <p><i>Environment Strategy 2020-30</i><br/>(City of Greater Geelong 2021)</p>         | <p>The purpose of The City of Greater Geelong Environment Strategy 2020–30 is to define and communicate how the City of Greater Geelong will protect and improve the region's environment.</p> <p>The strategy is designed to guide planning, decision-making and actions for the next ten years. The focus of effort will be to improve the health of local environment, reducing the Council's environmental footprint and simultaneously striving to protect the lifestyle all residents and visitors all enjoy.</p> | <p>Relevant goals and principles:</p> <p><i>Goal 1 Become A Zero-Emission, Climate-Ready City And Region</i></p> <ul style="list-style-type: none"> <li>Principle 1.4 increased awareness and understanding of climate change impacts.</li> <li>Principle 1.5 Build climate change adaptation into decision-making.</li> <li>Principle 1.6 Increase collaborative climate change responses.</li> </ul> <p><i>Goal 2 Create Greener Community Spaces</i></p> <ul style="list-style-type: none"> <li>Principle 2.2 Increase adoption of nature-based, green-blue infrastructure solutions.</li> <li>Principle 2.3 Connect people to nature.</li> </ul> <p><i>Goal 4 Protect, Enhance And Restore Our Region's Biodiversity</i></p> <ul style="list-style-type: none"> <li>Principle 4.1 Collaborate with the Wadawurrung Traditional Owners to connect culture and biodiversity.</li> <li>Principle 4.2 Protect and enhance indigenous biodiversity.</li> <li>Principle 4.4 Adaptive management approach to biodiversity conservation.</li> <li>Principle 4.5 Build community knowledge, engagement and partnerships.</li> </ul> | <p>During the engagement for the 30-year clever and creative vision, the community reported the natural environment as one of the features they most valued about the region.</p> <p>The region features diverse urban, rural and coastal environments, with large areas dedicated to the conservation of remnant indigenous vegetation, and flora and fauna species of international, national, state and regional significance.</p> |

## BROADER REGION AND NEIGHBOURING MANAGERS

| Document                                                                                                                                                                                                                                      | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| <p><i>Paleert Tjaara Dja (Let's make country good together) Country Plan 2020-2030</i><br/>(Wadawurrung Traditional Owners Aboriginal Corporation 2020)</p>  | <p>The <i>Paleert Tjaara Dja</i> (Let's make country good together) Country Plan 2020-2030 presents a collective vision and direction for the future of Wadawurrung people and Country.</p> <p>The ultimate vision of the Plan is: <i>Wurrurrwilwa gupma bengadak Wadawurrung wurring-wurring baap dja</i> – All people working together to make Wadawurrung Country and Culture strong.</p> <p>It illustrates what is threatening the health of Wadawurrung Country and people, and priority work areas to address these threats. It serves as a guide for building Wadawurrung cultural heritage management and broader aspirations, including the Wadawurrung Land and Sea Management Program.</p> | <p>The Plan presents nine values and goals that detail what is notably important. Three programs and 18 strategies provide focus areas to reduce the 16 threats identified and improve the health of values.</p> <p>Relevant strategies and related goals include:</p> <p><b><i>Wurrurrwilwa Wadawurrung Corporation - Strengthening Wadawurrung Corporation</i></b> key goals:</p> <ul style="list-style-type: none"> <li>By 2021 the WTOAC Healthy Country and Culture Committee is guiding projects</li> <li>By 2027 WTOAC is known and being engaged by 60% of our stakeholders in any decisions to do with cultural and environmental management in our Country.</li> <li>By 2030, we have healthy relationships and partnerships supported by agreements with 60% of our priority stakeholders</li> </ul> <p><b><i>Gobata Dja baap Ngubiyt - Taking Care of Country and Waters</i></b></p> <ul style="list-style-type: none"> <li>By 2021, our Caring for Country Team is established</li> <li>By 2024, cultural heritage values along our coastal country are assessed.</li> <li>By 2027, Cultural Heritage Plans or Agreements are in place to guide the protection of priority cultural places.</li> <li>By 2029 20,000 ha (10%) of crown land that are special places to Wadawurrung peoples are in Wadawurrung management.</li> </ul> | <p>Key values identified in the Country Plan that relate to <u>environmental</u> and <u>cultural</u> and <u>social</u> values include those of:</p> <ul style="list-style-type: none"> <li>Coastal Country and Warre (Sea Country). <i>“Our links to coastal and sea Country are vital! They continue to be a place where we can swim, fish, harvest and connect, a safe place to revive and partake in our living culture.”</i> (Melinda Kennedy)</li> <li>Yulluk (Waterways, rivers, estuaries and wetlands)</li> <li>Native animals</li> <li>Bush tucker, medicines and resources</li> <li>Wadawurrung cultural sites and places</li> <li>Wadawurrung culture and people</li> </ul> <p><u>Economic values</u> identified include Wadawurrung enterprise and employment.</p> <p><u>Climate change</u>: sea level rise, rising sea temperatures, drought, bushfires, and windfarm locations are key threats identified in the Country Plan.</p> |

# BROADER REGION AND NEIGHBOURING MANAGERS

| Document                                                                                                                                                              | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p><i>Surf Coast Statement of Planning Policy September 2022 (DELWP, 2022b)</i></p>  | <p>Parts of the Surf Coast Shire and the City of Greater Geelong were declared a distinctive area and landscape under section 46AO of the <i>Planning and Environment Act 1987</i> (the Act) in 2019. Under the Act, the Minister for Planning must prepare a Statement of Planning Policy for a declared area, the purpose of which is to create a framework to guide future use and development of land within the declared area to ensure protection and conservation of its distinctive attributes.</p> | <p>Key objectives include:</p> <ul style="list-style-type: none"> <li>To conserve, strengthen and promote the declared area's Wadawurrung living cultural heritage values and partner with the Wadawurrung to care for Country.</li> <li>To conserve and improve the significant environmental, ecological and biodiversity attributes of the declared area.</li> <li>To conserve and enhance the declared area's significant landscapes.</li> <li>To support the resilience of the declared area by taking sustained measures to achieve a net-zero emissions future, reduce greenhouse gas emissions, mitigate climate change and natural hazard risks and adapt to their impacts.</li> <li>To support a diverse socially and environmentally responsible economy that protects and promotes the declared area's landscape significance, environment and biodiversity, Wadawurrung living cultural and historic heritage values.</li> <li>To plan and manage the sustainable development of settlements in the declared area consistent with the protection of the area's landscape significance, environment and biodiversity, Wadawurrung living cultural and historic heritage values and consistent with the unique character, role and function of each settlement.</li> </ul> | <p>Attributes qualifying Surf Coast declared area as a distinctive area and landscape:</p> <p><i>Outstanding environmental significance:</i></p> <p>a) Creeks, wetlands, saltmarshes, woodlands and beaches in the area provide habitat for numerous state and national threatened species.</p> <p>(b) Areas of biodiversity significance include...Karaaf Wetlands, Breamlea Flora and Fauna Reserve, Thompson Creek...</p> <p><i>Heritage and cultural significance:</i></p> <p>(a) The area has extensive heritage and cultural value including areas of Wadawurrung heritage significance, renowned surfing locations and shipwrecks along the coastline.</p> <p>(b) Coastal areas and waterways contain significant Wadawurrung heritage value and are gathering places for the Wadawurrung people</p> <p>State-significant landscape: Torquay Coast, Coastal Saltmarsh and Woodland - Coastal Saltmarshes: a flat, marshy landscape centred on the Thompson Creek estuary and wetlands. This area is set behind high dunes and takes in the hamlet of Breamlea.</p> |



## BROADER REGION AND NEIGHBOURING MANAGERS

| Document                                                                                                                                                                                                               | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Values and aspirations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <p><i>Corangamite Regional Catchment Strategy (2021) website</i></p> <p><i>(Corangamite Catchment Management Authority 2021)</i></p>  | <p>A high-level blueprint for catchment health. It provides a strategic, integrated framework for natural resource management in the Corangamite Catchment Management Authority's region of Victoria. It is the basis for the development of action plans through its Priority Directions for each theme:</p> <ol style="list-style-type: none"> <li>1) Water (inc. water ways, wetlands, estuaries, groundwater)</li> <li>2) Biodiversity (inc. native vegetation and habitats, native fauna)</li> <li>3) Land</li> <li>4) Coast and marine (inc. coast and marine environments)</li> <li>5) Communities (inc. Traditional Owners, regional communities)</li> </ol> <p>In addition to these over-arching priority directions, the RCS also provide more detailed assessments and direction for specific local areas, including the Bellarine and Surf Coast (inclusive of the Breamlea Foreshore Reserve), for each theme. This includes:</p> <ul style="list-style-type: none"> <li>• assessment of current conditions and trends</li> <li>• major threats and drivers of change</li> <li>• 6-year priority directions, inc. identified collaborators, including Barwon Coast</li> <li>• 6-year outcomes</li> </ul> | <p>The following priority directions have been developed to deliver the 6-year outcomes identified for the over-arching Coast and Marine Theme, developed through community consultation:</p> <ul style="list-style-type: none"> <li>• Build research and knowledge, including Traditional Owner knowledge of coastal / marine systems and threatening processes to inform adaptive management and mitigation (as Lead)</li> <li>• Manage upstream impacts to mitigate impacts on the coastal and marine environments (as Lead)</li> <li>• Regularly monitor the quality of the coastal environment to establish a baseline, identify change, and actively manage issues as they arise (as Collaborator)</li> <li>• Explore carbon sequestration opportunities to deliver both climate and catchment/biodiversity benefits (as Lead)</li> <li>• Support Original Custodians (Traditional Owners) to manage the marine and coastal environment and to share cultural knowledge (as Lead)</li> <li>• Participate in the development and implementation of a process for the provision of coastal erosion advice for long term planning, management and adaptation (as Collaborator)</li> <li>• Ensure planning for development considers, minimises and where possible avoids adversely impacting waterways, salt marsh vegetation, coastal sand dunes and beaches (as Collaborator)</li> </ul> | <p>Through a consideration of the 6-year priority directions and outcomes for eh Bellarine and Surf Coast area, the following values were identified:</p> <p><u>Environmental</u>: habitat for threatened and culturally significant local species are a priority of the CMA; proactive management of the catchment and the coast by all stakeholders is valued to achieve continued improvement in the health and resilience of the region's highly valued coastal and marine environment.</p> <p><u>Cultural</u>: enduring partnerships with the Wadawurrung people to:</p> <ol style="list-style-type: none"> <li>1) acknowledge and enhance Wadawurrung values of natural assets;</li> <li>2) ensure the Wadawurrung people have a strong say in management of natural assets;</li> <li>3) identify and implement appropriate mechanisms for sharing Wadawurrung stories and history; and,</li> <li>4) identify and implement opportunities for Wadawurrung people to own and manage water on their country</li> </ol> <p><u>Climate change</u>: Explore carbon sequestration opportunities to deliver both climate and catchment/biodiversity benefits. Engage with the community on the need to mitigate and adapt to climate change and its impacts. Develop and implement a process for the provision of coastal erosion advice for long term planning, management and adaptation.</p> |

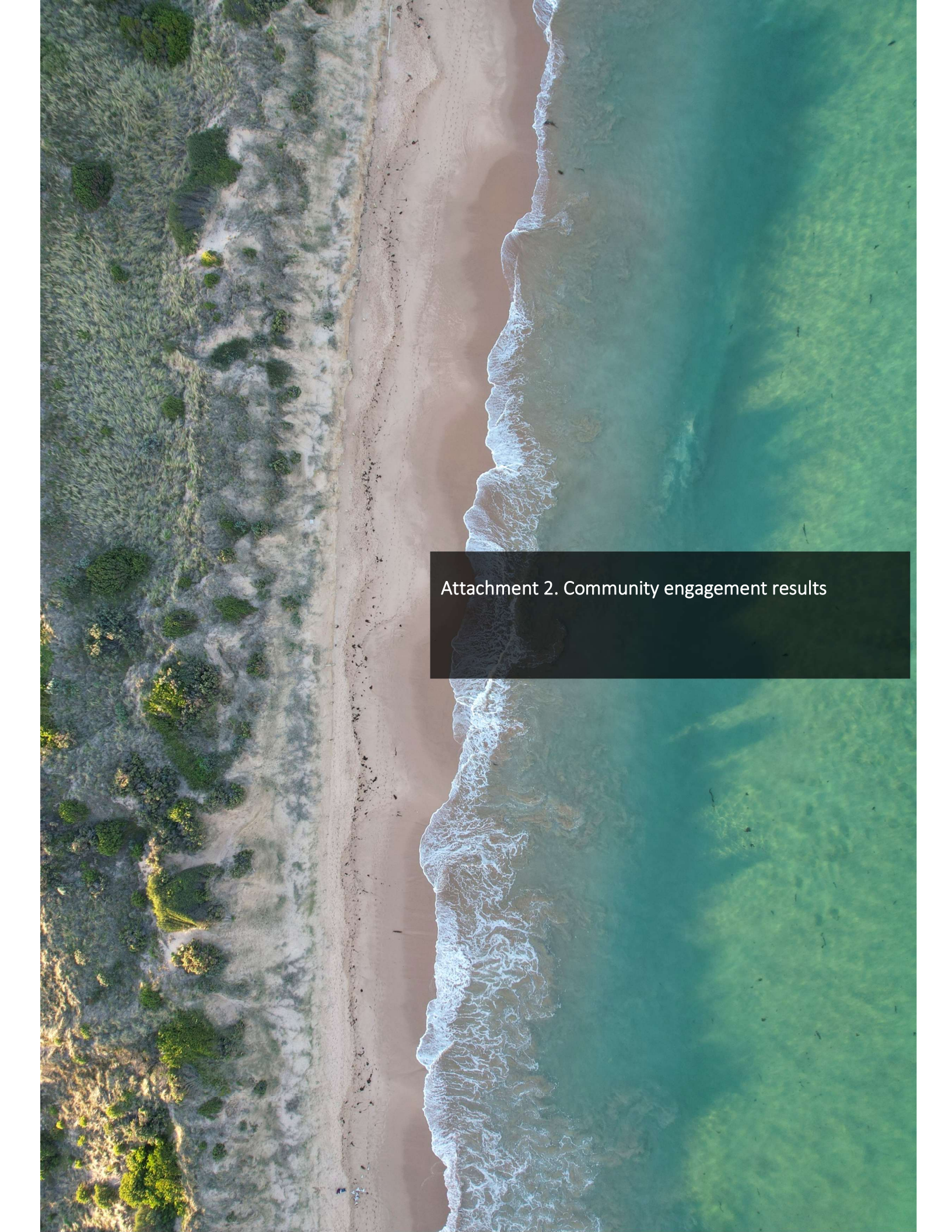
## BROADER REGION AND NEIGHBOURING MANAGERS

| Document                                                                                                                                                                                                                                                                           | Summary of the document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Values and aspirations |
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| <p><i>Visitor Economy Master Plan for the Great Ocean Road Region 2021-2030: Rebuilding a stronger and more robust and balanced visitor economy (Great Ocean Road Regional Tourism 2021)</i></p>  | <p>This plan, written by the Great Ocean Road Regional Tourism Board, provides a strategic framework and roadmap to guide the regional visitor economy recovery from the COVID-19 pandemic to 2024 and ensure renewed strong sector growth from 2024 to 2030. The region cover stretches <b>from the Surf Coast Shire to Glenelg Shire</b> (Torquay to past Portland).</p> <p>It does this by emphasising responsible, sustainable and resilient policies that balance social, economic, environmental and cultural outcomes.</p>     | <p><b>Environment objectives:</b></p> <ul style="list-style-type: none"> <li>- Improved public land management</li> <li>- Managed visitation at natural attractions</li> <li>- Develop dispersed sites and infrastructure</li> <li>- Mitigate the effects of climate change</li> <li>- Increase transport and access options to reduce heavy reliance on motor vehicles</li> <li>- Establish an Environment and Community Development Fund - visitor contribution</li> </ul> <p><b>Environmental priorities:</b></p> <ul style="list-style-type: none"> <li>- All developments (public and private) to be required to restore/regenerate natural landscapes</li> <li>- Establish and market "Volunteer Environmental Tourism" projects</li> <li>- A global leader in regional climate change mitigation and responsible tourism practice</li> </ul> <p>Recognise Traditional Owners and support development of Indigenous cultural experiences</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |
| <p><i>Great Ocean Road Coast &amp; Parks Authority: Annual Report 2022-23 (Great Ocean Road Coast and Parks Authority 2022)</i></p>                                                              | <p>The second Annual Report by the Great Ocean Road Coast and Parks Authority (The Authority), the first to cover a full year of operations.</p> <p>The report details the Authority's progress in the following areas: management of the Great Ocean Road environs through embedding cultural competency and self-determination, protecting the marine, coast and parks environments, enabling engaged and active communities, creating sustainable and regenerative visitor experiences, and ensuring financial sustainability.</p> | <p>Among the key focal areas for the Authority in 2021-22 and 2022-23 were:</p> <ol style="list-style-type: none"> <li>1 Environment and Coastal Operations: <ol style="list-style-type: none"> <li>a. The Coastal Reserves Team manages critical coastal and visitor infrastructure across the region.</li> <li>b. The Conservation Team work closely with dedicated environmental volunteers and Traditional Owner groups to protect and manage the iconic coastal Crown land and marine waters.</li> <li>c. Projects and initiatives delivered include various land transfers, facility and signage upgrades, safety campaigns, and coastal protection upgrades and repairs.</li> </ol> </li> <li>2 Strategy, Engagement and Transformation: <ol style="list-style-type: none"> <li>a. This team drive purposeful strategic planning and business improvements required to transition to a standalone coast and parks manager.</li> <li>b. This team's work includes developing the first Five Year Business Strategy and Community Engagement Strategy to guide engagement with 21 discreet communities and Traditional Owners</li> </ol> </li> <li>3 Tourism Operations: <ol style="list-style-type: none"> <li>a. The Authority manages eight caravan parks, which generate the majority of its revenue (\$21.2 million in 2022-23), reinvesting this money in the Authority's operations</li> <li>b. The Authority also issues permits and licences for foreshore activities and tour operators dependent on the coastal environment.</li> </ol> </li> </ol> |                        |

# BROADER REGION AND NEIGHBOURING MANAGERS

| Document                                                                                                                                                                                                          | Summary of the document                                                                                                                                                                                                                                                                                                                                                                             | Key/relevant objectives, goals or recommendations that align with the CHA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Values and aspirations |
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| <p><b>Coast and Marine Management Plan 2020-25 – Torquay to Lorne</b></p> <p><i>(Great Ocean Road Coast Committee 2020)</i></p>  | <p>This CMMP aligns directly with, and builds upon, the objectives and actions in the 2018 Great Ocean Road Action Plan.</p> <p>Prepared by the GOR Coast Committee, it will allow GORCAPA to undertake critical business-as usual operations, and broader strategic actions during the transition between management authorities. It covers the stretch of coast from <b>Torquay to Lorne</b>.</p> | <p>The priorities of the plan, as formulated from community consultation, include:</p> <ol style="list-style-type: none"> <li>1. <b>Protect the natural environment:</b> Continuously identified as the number one priority for GORCC. Strong support to increase weed control, protect wildlife, cross-tenure management and maintain undeveloped, natural areas.</li> <li>2. <b>Increase education:</b> Increase awareness of Aboriginal, cultural and environmental values of the coast, and increase education and enforcement of anti-social behaviour associated with dogs, litter and nude beaches.</li> <li>3. <b>Address climate change:</b> Improve monitoring and adaptation measures including revegetation and avoiding development and use in priority areas.</li> <li>4. <b>Support sustainable visitation:</b> Work with partner agencies and authorities to strategically plan and manage impacts from population and tourism growth.</li> <li>5. <b>Maintain and improve infrastructure:</b> Improve existing infrastructure, including amenity blocks and playgrounds, to meet the demands of increased visitation and use.</li> </ol> <p><b>Consultation:</b> The conversation with the Authority's community, stakeholder and partner agencies will continue through the development of all major infrastructure projects and master plans. The Authority continues to engage and consult with these groups to inform their planning and decision-making.</p> |                        |



An aerial photograph of a coastline. The top half of the image shows a sandy beach with some small figures of people. To the left of the beach is a strip of land with green, low-lying vegetation. The bottom half of the image shows the ocean with white-capped waves breaking onto the shore. The water is a deep blue-green color.

## Attachment 2. Community engagement results



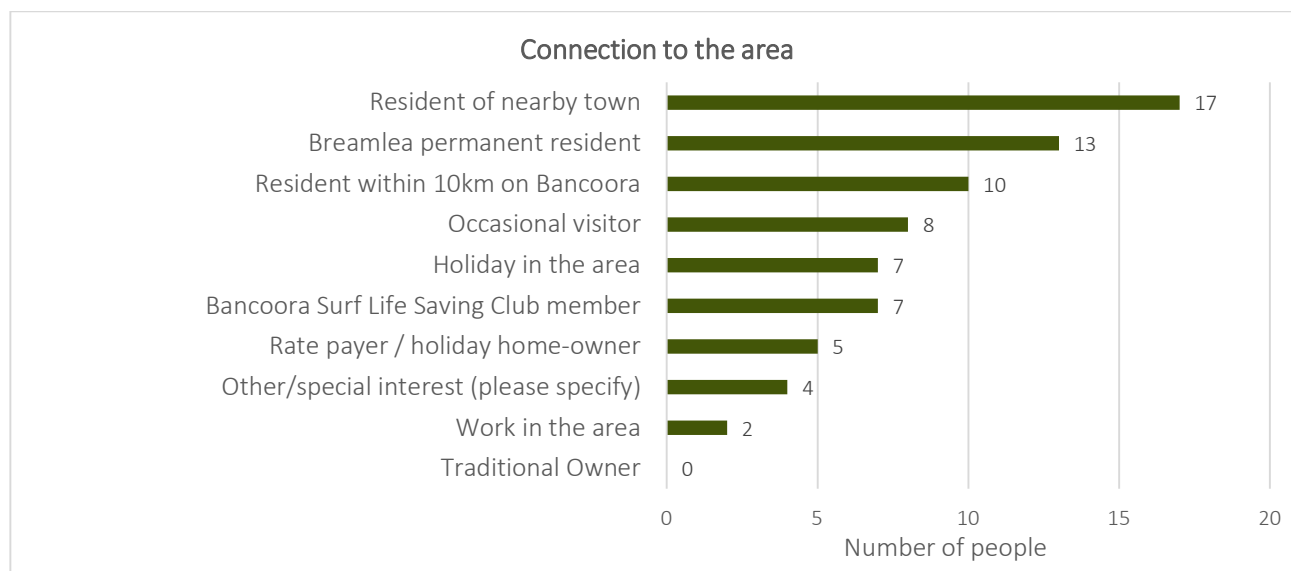
## Community engagement results

From August to October 2024, an online community values survey was available on the Barwon Coast Committee of Management's website. The survey was undertaken by 56 people and was intended to inform development of stage 2 (values, aspirations and vision) of the Bancoora Coastal Adaptation Plan. The results of each survey question are included below.

In addition, five targeted interviews were held with long-term residents and/or members of local community groups: Breamlea CoastCare, Breamlea Community Association, and the Bancoora Surf Life Saving Club. Key findings from these interviews have been incorporated into the results and analysis of survey questions 6, 11, and 12 and included below.

### Q1: How would you describe your connection to the area

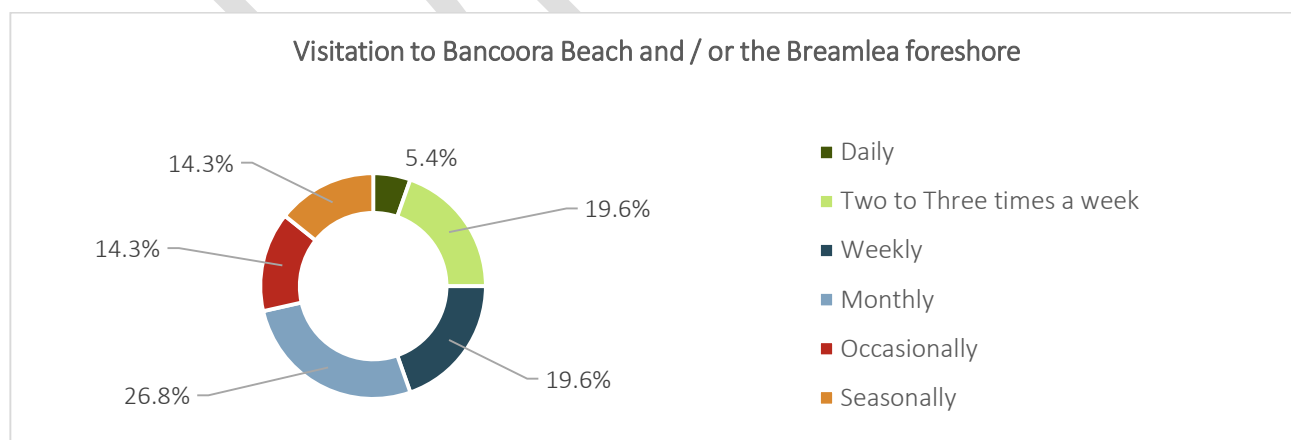
The majority of respondents (71%) had a close connection to the area, being either a resident of Breamlea, a resident of a nearby town, and/or a resident within 10 km.



**Figure 1.** Results of Q1: How would you describe your connection to the area.

### Q2: On average, how often do you visit Bancoora Beach and/or the Breamlea foreshore?

Nearly half of all respondents (45%) were frequent visitors to Bancoora Beach and/or the Breamlea foreshore.



**Figure 2.** Results of Q2: On average, how often do you visit Bancoora Beach and/or the Breamlea foreshore?

Q3: What are five words that come to mind when visiting the Bancoora Beach or the Breamlea foreshore?

The results of Q3 were collated into a word cloud, where the size of each word represents the frequency that it was mentioned across all responses (Figure 3).



**Figure 3.** Word cloud showing the results of Q3: What are five words that come to mind when visiting the Bancoora Beach or the Breamlea foreshore?



These results were then categorised into eight themes and an individual word cloud created for each theme (Figure 4). These themes included: Beach and Recreation, Peaceful and Quiet, Beautiful and Invigorating, Community and Family, Nature and Biodiversity, First Nations Culture, Access and Facilities, and Dynamic and Wild.

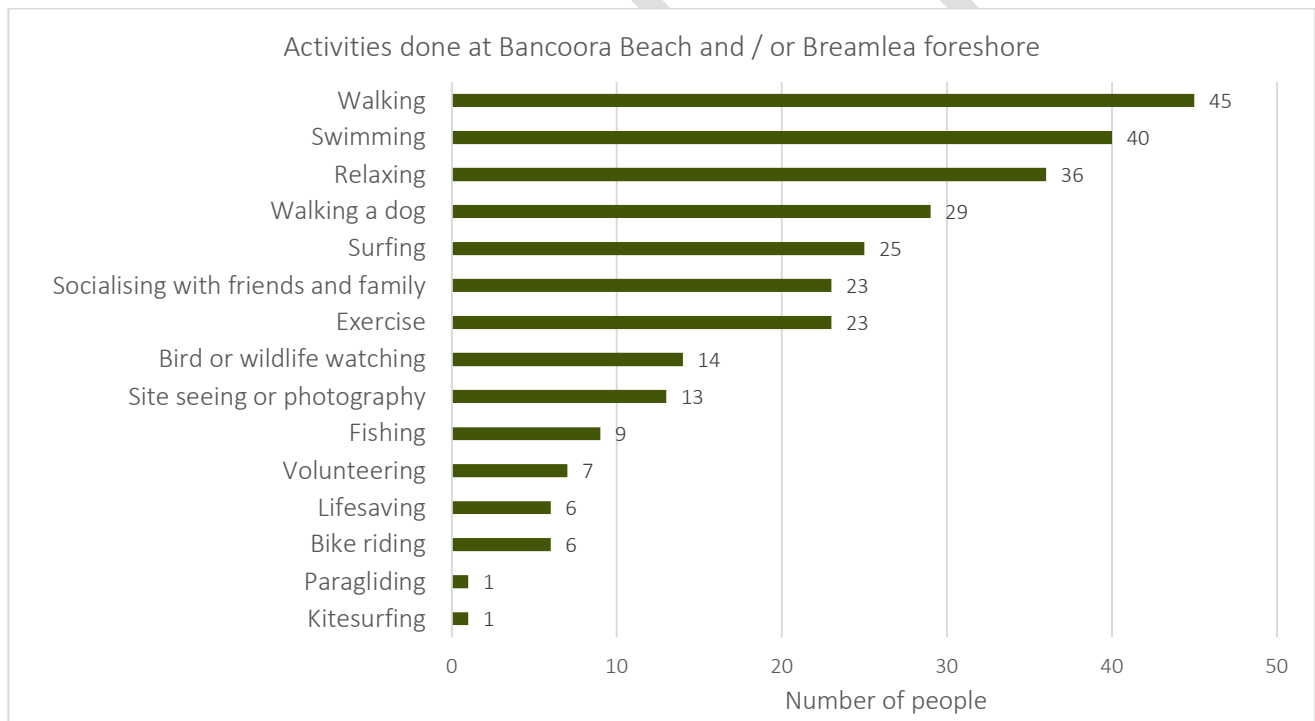




**Figure 4.** Individual word clouds demonstrating the emergent themes from the results of Q3: What are five words that come to mind when visiting the Bancoora Beach or the Breamlea foreshore?

Q4: What activities do you do when visiting Bancoora Beach or the Breamlea foreshore?

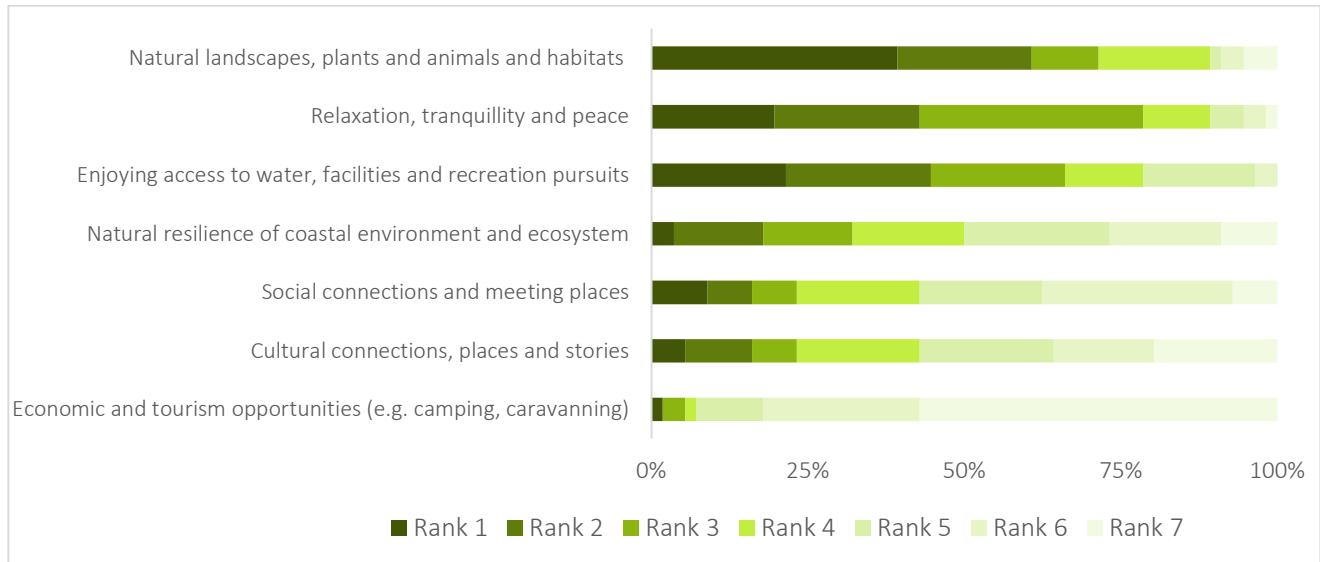
Walking was the most commonly performed activity (80% of all respondents) in the area, with other ‘passive’ forms of recreation (relaxing – 64%, walking a dog – 51%, socialising with friends and family – 41%) also very common (Figure 5). Swimming was the most popular ‘active’ activity (71%), followed by surfing (45%) and exercise (41%).



**Figure 5.** Results of Q4: What activities do you do when visiting Bancoora Beach or the Breamlea foreshore?

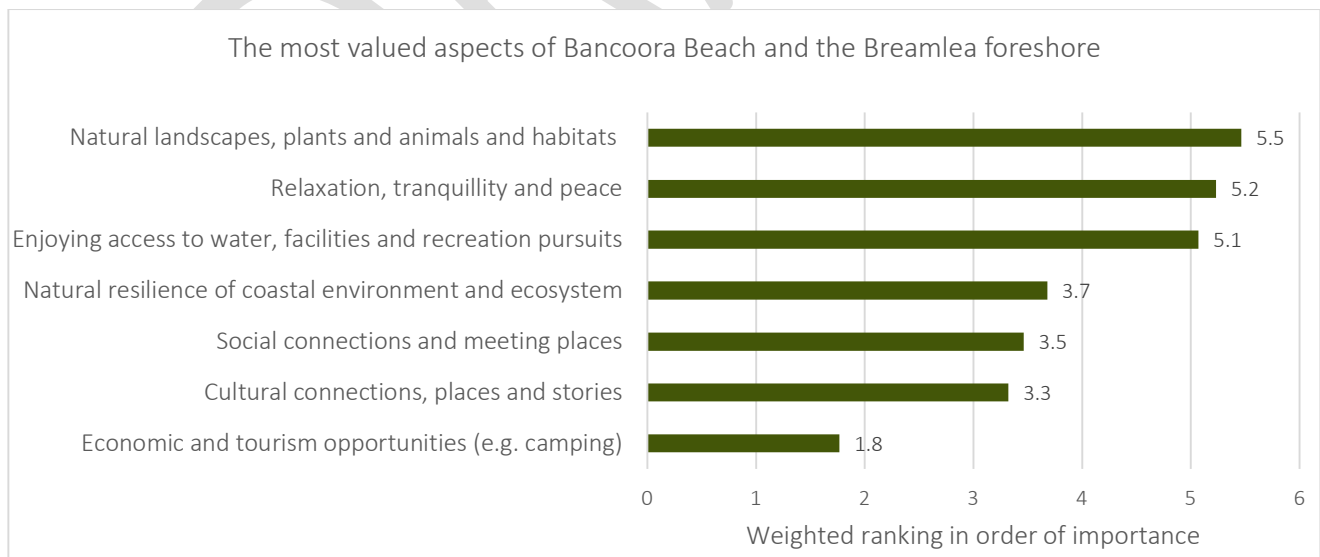
*Q5: What do you value most about Bancoora Beach and the Breamlea foreshore? With 1 being the most important to you.*

Figure 6 shows the breakdown of Q5 results, in which the percentage of each rank received by each value is shown. *Natural landscapes, plants and animals and habitats* was ranked 1 by the largest number of people, followed by *Enjoying access to water and facilities and recreation pursuits* and *Relaxation, tranquillity and peace*. This graph shows individual ranks, whereas a weighted average score for the same question is presented below.



**Figure 6.** Breakdown of results for Q5: What do you value most about Bancoora Beach and the Breamlea foreshore? With 1 being the most important to you, in which the percentage of each rank received by each value is shown.

Figure 7 shows the results of Q5 as a weighted average, where a value ranked 1 by a respondent receives the largest weighting and a value ranked 7 receives the lowest weighting. These weightings were summed for all respondents to give a ranked list of values in order of importance. *Natural landscapes, plants and animals and habitats*, was ranked the most important overall, while *Relaxation, tranquillity and peace* and *Enjoying access to water and facilities and recreation pursuits* were also highly ranked.



**Figure 7.** Results of Q5: What do you value most about Bancoora Beach and the Breamlea foreshore? With 1 being the most important to you, with importance represented as a weighted average.



*Q6: Is there anything else that is important to you?*

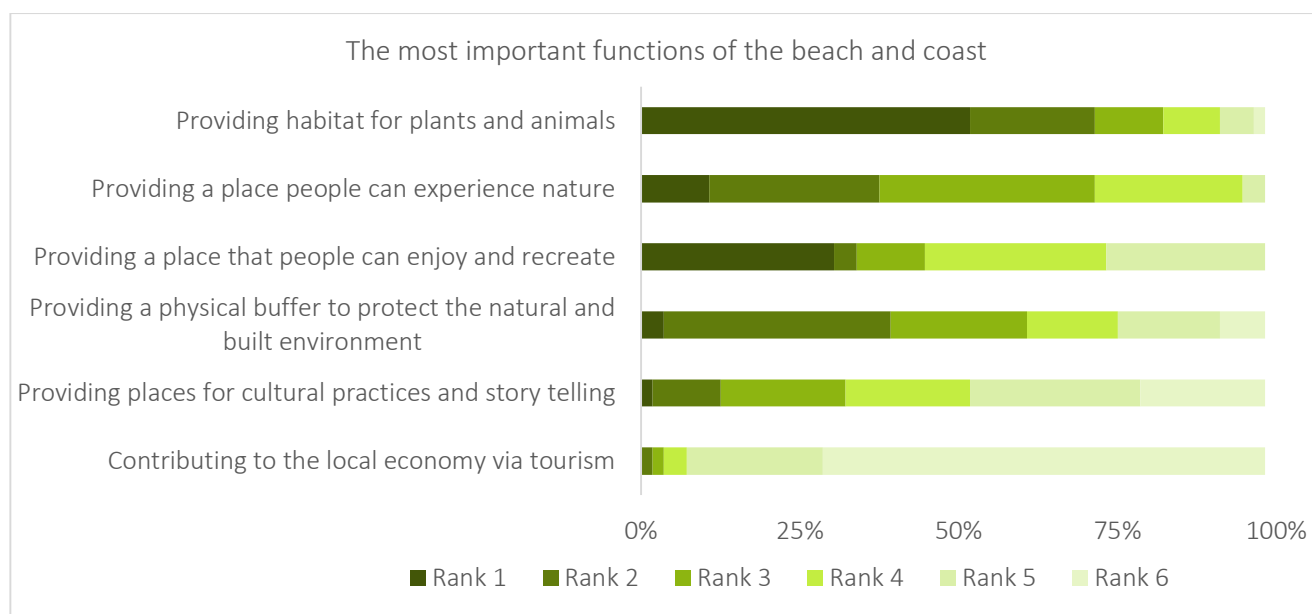
Table 1 shows the summary analysis of the long-form answers received for Q6, isolating eight key values that emerged from the results. Note, this summary analysis includes content from the targeted interviews analysis (rows: Environmental, Social, Cultural).

**Table 1. Results of Q6: Is there anything else that is important to you?**

| Value                                                           | Detail                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Prioritising protection of the natural environment</b>       | Appreciation for the unique landscape with many distinct zones: wetlands, saltmarsh, estuary, dunes, beach. Increasing appreciation for biodiversity of wetlands, not seen merely as “swamps”.                                                                                                                                                                                                                                                                 |
|                                                                 | Desire to protect natural values, ecosystems, wildlife and their habitats (marine and terrestrial); “Breamlea is a village in the dunes – residents are custodians”                                                                                                                                                                                                                                                                                            |
|                                                                 | Dunes and vegetation are highly valued, but there’s concern about their current state. The dunes’ vegetation has shifted from sparse to dense, affecting natural sand movement.                                                                                                                                                                                                                                                                                |
|                                                                 | Concern for increasing pressures from urban sprawl and increased population on the natural environment, e.g. parking in protected areas, high-speed traffic moving through wetland areas, increase in freshwater in the wetlands with increased urban stormwater and less frequent estuary openings. Have observed changes in birdlife, decline in certain wildlife (e.g. frogs, mosquitos, Bogong moths), and increase in invasive freshwater plants (Typha). |
|                                                                 | Preference for minimal commercial development to retain the natural, unspoiled environment.                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Community connection and tradition</b>                       | Importance of family and community connections to the area, with many users having longstanding relationships.                                                                                                                                                                                                                                                                                                                                                 |
|                                                                 | Value placed on the small, intimate nature of the caravan park, with opposition to large commercial interests.                                                                                                                                                                                                                                                                                                                                                 |
|                                                                 | SLSC and Breamlea community are somewhat separate communities. Strong sense of community respectively.                                                                                                                                                                                                                                                                                                                                                         |
| <b>Cultural and historical significance</b>                     | Awareness of Aboriginal cultural values and a need to respect and protect cultural heritage, e.g. extensive middens in the dunes.                                                                                                                                                                                                                                                                                                                              |
|                                                                 | Appreciation for the heritage of the area.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Quietness and isolation</b>                                  | Appreciation for the quiet, isolated, and uncrowded nature of Breamlea and Bancoora Beach, particularly for relaxation and reflection.                                                                                                                                                                                                                                                                                                                         |
|                                                                 | Desire to maintain peacefulness, with emphasis on limited noise and restrictions on intrusive activities (e.g. jet skis).                                                                                                                                                                                                                                                                                                                                      |
| <b>Accessibility, safety and fit-for-purpose infrastructure</b> | Importance of accessible and fit-for-purpose facilities and infrastructure, such as roads and the surf lifesaving club.                                                                                                                                                                                                                                                                                                                                        |
|                                                                 | Safety of the area, with illegal campfires increasing risk of bushfires and emergency egress routes often congested with parked cars during the busy months.                                                                                                                                                                                                                                                                                                   |
|                                                                 | Concerns about current parking restrictions / distance from beach access points, carpark condition, and the limited amount of parking, especially during busy months.                                                                                                                                                                                                                                                                                          |
| <b>Dog-friendliness and responsible dog ownership</b>           | High value placed on dog-friendly access for a portion of the beach while emphasising responsible dog ownership.                                                                                                                                                                                                                                                                                                                                               |
|                                                                 | Concerns about dog waste and its impact on beach users.                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Recreational use and community activities</b>                | Enjoyment of recreational activities offered by the area, such as walking, swimming, surfing, kitesurfing, beach launches and landings for boating, estuary for fishing.                                                                                                                                                                                                                                                                                       |
|                                                                 | Surf lifesaving club viewed as vital for safety and community enjoyment. There’s shifting demographics in the club, with Armstrong Creek residents now making up a large portion of membership and the Nippers program being very successful.                                                                                                                                                                                                                  |
| <b>Simplicity and Limited Development</b>                       | Strong preference for keeping the area simple and not developing it further – strong desire to “keep it as it is”.                                                                                                                                                                                                                                                                                                                                             |
|                                                                 | Emphasis on maintaining a small-town, relaxed feel with minimal commercial and structural changes.                                                                                                                                                                                                                                                                                                                                                             |

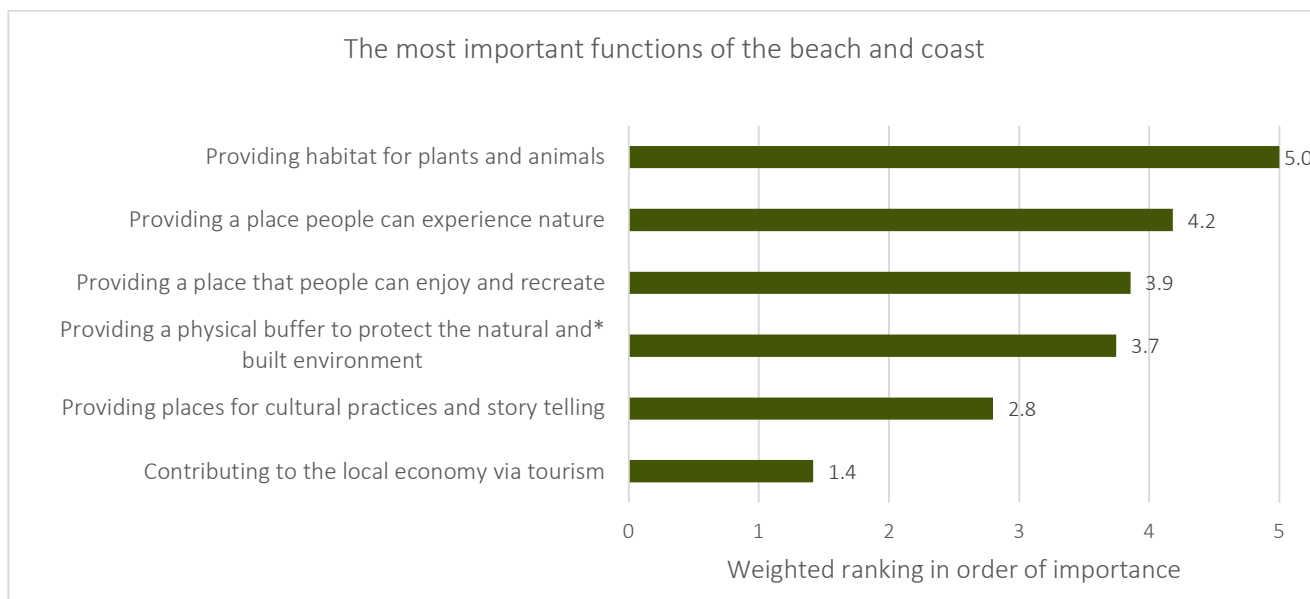
*Q7: What do you think the most important functions of the beach and coast? With 1 being the most important to you*

Figure 8 shows the results of Q7, in which the percentage of each rank received by each function is shown. 52% of respondents ranked *Providing habitat for plants and animals* as the most important (rank 1) function. A weighted average representation of the results is presented below.



**Figure 8.** Results of Q7: What do you think the most important functions of the beach and coast? With 1 being the most important to you, in which the percentage of each rank received by each value is shown.

Figure 9 shows the results of Q7 as a weighted average, where a function ranked 1 by a respondent receives the largest weighting and a function ranked 7 receives the lowest weighting. These weightings were summed for all respondents to give a ranked list of beach and coast function in order of importance. *Providing habitat for plants and animals*, was ranked the most important overall, while *Providing a place people can experience nature*, *Providing a place people can enjoy and recreate* and *Providing a physical buffer to protect the natural and built environment* were also highly ranked.



**Figure 9.** Results of Q7: What do you think the most important functions of the beach and coast? With 1 being the most important to you, with importance represented as a weighted average.

Q8: What other functions do you think are most important?

Table 2 shows the summary analysis of the long-form answers received for Q8. Many of these additional comments fit within the functions presented above.

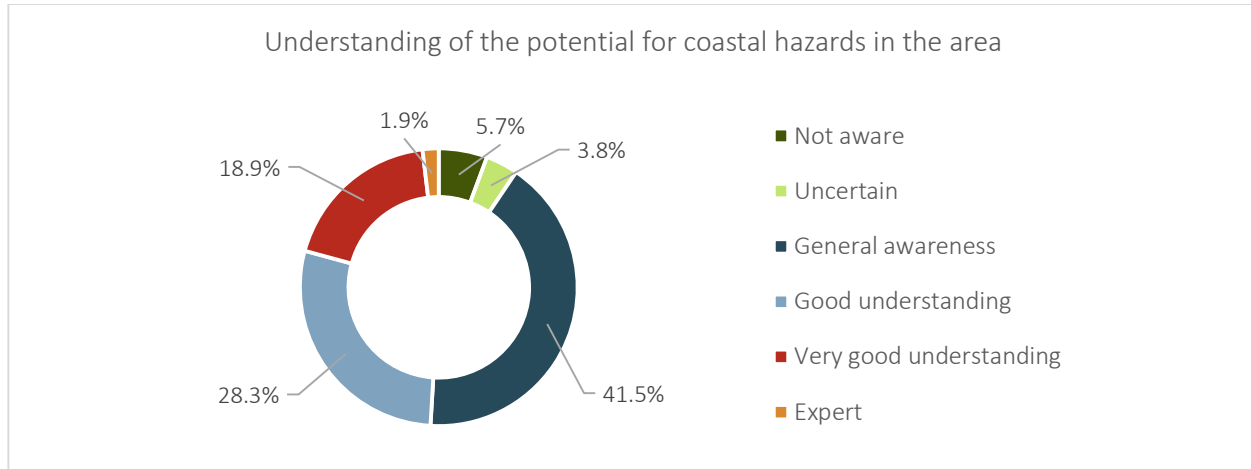
**Table 2. Results of Q8: What other functions do you think are most important?**

| Function                                            | Detail                                                                                                                                                                                          |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Protective function of the natural landscape</b> | Appreciation for the beach and dunes as an important protective barrier for inland areas e.g. protection from tides, erosion and wind.                                                          |
|                                                     | Strong emphasis on minimal human influence and preservation of natural landscapes to continue to perform this function, particularly dunes and wetlands e.g. allowing for natural dune movement |
| <b>Health and well-being benefits</b>               | The easily accessible beach and foreshore provides easy access to nature, with benefits for health and well-being, including mental health.                                                     |
|                                                     | The area is a source of calm and tranquillity, with high scenic values,                                                                                                                         |
| <b>Ecological and habitat functions</b>             | The area is a haven for local wildlife, providing a range of ecosystems and habitat types (sandy beach, vegetated dunes, estuary, wetlands, salt marsh)                                         |
| <b>Recreational activities</b>                      | Key recreational uses include surfing, fishing, swimming, boating, and other water-based activities.                                                                                            |
| <b>Educational subject</b>                          | Provides an accessible and friendly space to learn about safety around water, especially for families and young people.                                                                         |
|                                                     | Illustrates the importance of understanding and respecting natural changes in the environment, such as tidal shifts and dune migration.                                                         |
| <b>Local community gatherings</b>                   | The beach serves as a meeting place for residents and caravan park locals.                                                                                                                      |
|                                                     | Social gatherings and events at the SLSC and caravan park (e.g., surf lifesaving club events, karaoke nights) foster community connections.                                                     |

Q9: How would you rate your current understanding of the potential for coastal hazards in the area?



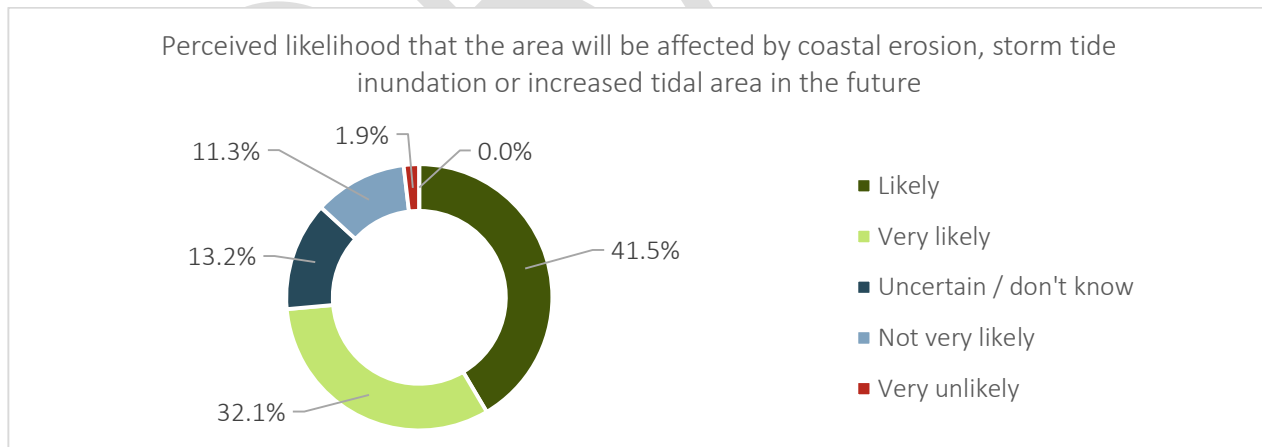
A large proportion of respondents (41.5%) felt they had a general awareness of coastal hazards, while nearly half of respondents (49%) felt they had either a good, very good, or expert understanding of coastal hazards (Figure 10).



**Figure 10.** Results of Q9: How would you rate your current understanding of the potential for coastal hazards in the area?

Q10: How likely do you think that the area will be affected by coastal erosion, storm tide inundation or increased tidal area in the future?

The majority of respondents (74%) perceived the likelihood of the area being affected by coastal hazards as either likely or very likely (Figure 11).



**Figure 11.** Results of Q10: How likely do you think that the area will be affected by coastal erosion, storm tide inundation or increased tidal area in the future?

*Q11: Do you have any past experiences of coastal hazards at Bancoora Beach or the Breamlea foreshore? Experiences could include significant events or changes to the coast you've observed over time, details on how this impacted you and/or your use of the coast.*

Table 3 shows the summary analysis of the long-form answers received for Q11, categorising the key hazard experiences that were reported by respondents. Note, this summary analysis includes content from the targeted interviews analysis (row: Coastal hazards).

**Table 3. Results of Q11: Do you have any past experiences of coastal hazards at Bancoora Beach or the Breamlea foreshore?**

| <b>Hazard experience</b>                                             | <b>Detail</b>                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Dune erosion, sand movement and decreasing beach width</i></b> | Erosion of dunes, with exposure and loss of cultural heritage material, such as middens. Increased risk of dune collapse.                                                                                                                                             |
|                                                                      | Impacts of windblown sand blocking beach access e.g. rarely at SLSC, and more commonly covering lower sections of beach staircases.                                                                                                                                   |
|                                                                      | Observed vegetation loss due to dune erosion and uncontrolled pedestrian traffic.                                                                                                                                                                                     |
|                                                                      | Significant increase in dune size and changes in shape - now steeper and more prone to erosion; used to be sparsely vegetated, prior to interventions and revegetation e.g. with marram grass.                                                                        |
|                                                                      | A major storm in the 1990s drastically shifted sand, permanently altering the beach and covering previous rock pools.                                                                                                                                                 |
| <b><i>High tides and storm impacts</i></b>                           | High tides impacting beach access, creating steep drop-offs at access points, and leaving a smaller area of 'dry beach', especially in autumn. This is impacting paragliders who utilise this section of beach to get airborne and walkers.                           |
|                                                                      | March/April king tides force SLSC volunteers to retreat up the beach, limiting their ability to patrol directly on the beach.                                                                                                                                         |
|                                                                      | Storm surges and big swells contributing to erosion, sand shifts, and altering rips, swells, and coastal dynamics; A large storm around 2011/2012 washed away dune at the southeast corner of the estuary, leaving a steep dune face that hasn't naturally recovered. |
|                                                                      | A large flood event of 25 April 2001, combined with a storm surge, had large impacts.                                                                                                                                                                                 |
|                                                                      | Large accumulations of seaweed after storms, sometimes causing odours.                                                                                                                                                                                                |
| <b><i>Estuary closures and flooding</i></b>                          | Thompson Creek estuary is frequently closed, causing stagnant wetlands and occasional flooding at Horwood Drive; there's a belief that construction of the Black Rock Sewer pipe may have contributed to more frequent closures.                                      |
|                                                                      | Longtime residents recall Thompson Creek as an always fast and deep flowing tidal estuary, with the wetlands drying out between wet periods.                                                                                                                          |
|                                                                      | Breamlea Road was raised in the 1970s due to constant flooding                                                                                                                                                                                                        |
|                                                                      | Loss of creek flow observed over the years, impacting the wetland ecosystem.                                                                                                                                                                                          |
| <b><i>Population growth and increased visitation pressure</i></b>    | Notable rise in nearby population, particularly at Armstrong Creek, leading to more visitors, parking congestion, and increased foot traffic.                                                                                                                         |
|                                                                      | Concerns about how more people recreating may exacerbate pressures on the coast.                                                                                                                                                                                      |
| <b><i>Dynamic coastal landscape</i></b>                              | Long-term users notice the coast naturally changing over time, with shifting tides, sand, and vegetation appearing as part of a dynamic landscape and with periodic recovery after extreme weather and tides.                                                         |
|                                                                      | Local understanding of natural sand movement patterns, where sand traditionally shifts with the seasons (moving up with summer onshore winds, and back down with winter offshore winds).                                                                              |
| <b><i>Invasive species and habitat loss</i></b>                      | Increased presence of weeds (e.g. English ivy, bridal creeper, dandelions, pea vines, willow wattle, tea tree) affecting native vegetation.                                                                                                                           |
|                                                                      | Observations of local wildlife habitat loss due to erosion and human traffic.                                                                                                                                                                                         |
| <b><i>Future infrastructure challenges</i></b>                       | The SLSC has not faced significant threats from coastal hazards yet but is thinking 10-20 years ahead. The club is currently protected by a single dune.                                                                                                              |
|                                                                      | Hard engineering solutions like groynes or rock walls are not preferred, and there's concern about future retreat options due to the limited area available to retreat to.                                                                                            |

Q12: Do you have any ideas or suggestions on how coastal areas could be made more resilient over time, and help retain what you value about the coast?

Table 4 shows the summary analysis of the long-form answers received for Q12, isolating the key themes for resilience that emerged from the results. Note, this summary analysis includes content from the targeted interviews analysis (row: Other).

**Table 4. Results to Q12: Do you have any ideas or suggestions on how coastal areas could be made more resilient over time, and help retain what you value about the coast?**

| Resilience ideas                                                        | Detail                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Nature-based methods for ecosystem and erosion protection</i></b> | Focus on dune protection and stabilisation, using fencing and natural plantings to manage erosion, such as native and indigenous grasses, shrubs, and trees.                                                                                                                |
|                                                                         | Calls for additional boardwalks and walking trails to prevent environmental damage from foot traffic.                                                                                                                                                                       |
|                                                                         | Consider further nature-based solutions / green infrastructure rather than hard infrastructure where possible - a handful of suggestions to consider strengthening levies and consider rock barriers (e.g. as at Ocean Grove) to protect from king tides.                   |
|                                                                         | Intensify weed management and protect habitats of species like Hooded Plover.                                                                                                                                                                                               |
| <b><i>Revise estuary management</i></b>                                 | Request for CMAs to revisit their estuary opening guidance and consider prioritising environmental protection over human infrastructure needs.                                                                                                                              |
|                                                                         | Number of suggestions to open the estuary more frequently, noting it remained open more often from the 1960s to the 1980s.                                                                                                                                                  |
|                                                                         | Investigate and address Thompson Creek flow issues, such as tidal flow disruptions in the salt marsh area and increased stormwater entering from urban development upstream.                                                                                                |
| <b><i>Infrastructure and access control</i></b>                         | Maintain paths and controlled access to prevent further dune degradation. When drop offs are created, use equipment (e.g. tractors) to maintain access points.                                                                                                              |
|                                                                         | Address parking challenges arising from increased visitation, including visitor intrusion into sensitive areas and congested emergency access routes. Consider pros and cons of sealing the SLSC car park. Suggestions for shuttle buses on busy days to reduce congestion. |
|                                                                         | Consider options for a new SLSC observation tower that is resilient to coastal hazards yet can provide essential utilities (water, power).                                                                                                                                  |
| <b><i>Broader community engagement and education</i></b>                | Engage local community in restoration efforts through working bees and environmental care projects.                                                                                                                                                                         |
|                                                                         | Promote education to new users of the area to foster appreciation for the environment, including the importance of the area's natural environment for supporting recreational uses and its distinct ecological values - "it's not just a beach"                             |
|                                                                         | Support community efforts towards climate change mitigation.                                                                                                                                                                                                                |
| <b><i>On-ground management presence and enforcement</i></b>             | Current signage is outdated or damaged (e.g. previous City of Greater Geelong signage to be removed, out-of-date information on signage). Seasonal signs for dog regulations would be beneficial to reflect the area's needs accurately.                                    |
|                                                                         | Suggestion for greater on-ground Ranger presence (e.g. from Barwon Coast) to monitor and manage enforcement of regulations.                                                                                                                                                 |
|                                                                         | Need for stronger measures to manage illegal campfires due to bushfire risk.                                                                                                                                                                                                |
|                                                                         | Enforce dog controls, such as leashes in designated areas and cleaning up after dogs, to protect wildlife and reduce disturbance.                                                                                                                                           |
|                                                                         | Increase compliance efforts to balanced passive recreation with active use to ensure equity for all beachgoers                                                                                                                                                              |
| <b><i>Preserving simplicity and limiting development</i></b>            | Avoid large-scale tourism or commercial developments to retain the natural, quiet character of the area.                                                                                                                                                                    |
|                                                                         | Maintain simple upgrades only where needed, such as waste management and minimal infrastructure improvements.                                                                                                                                                               |



|  |                                                                                                                                    |
|--|------------------------------------------------------------------------------------------------------------------------------------|
|  | Ensure any long-term adaptation keeps the area as authentic as possible, balancing preservation with necessary adaptation actions. |
|  | Consider possible eventual retreat, inspired by approaches like the Inverloch Coastal Adaptation Plan.                             |

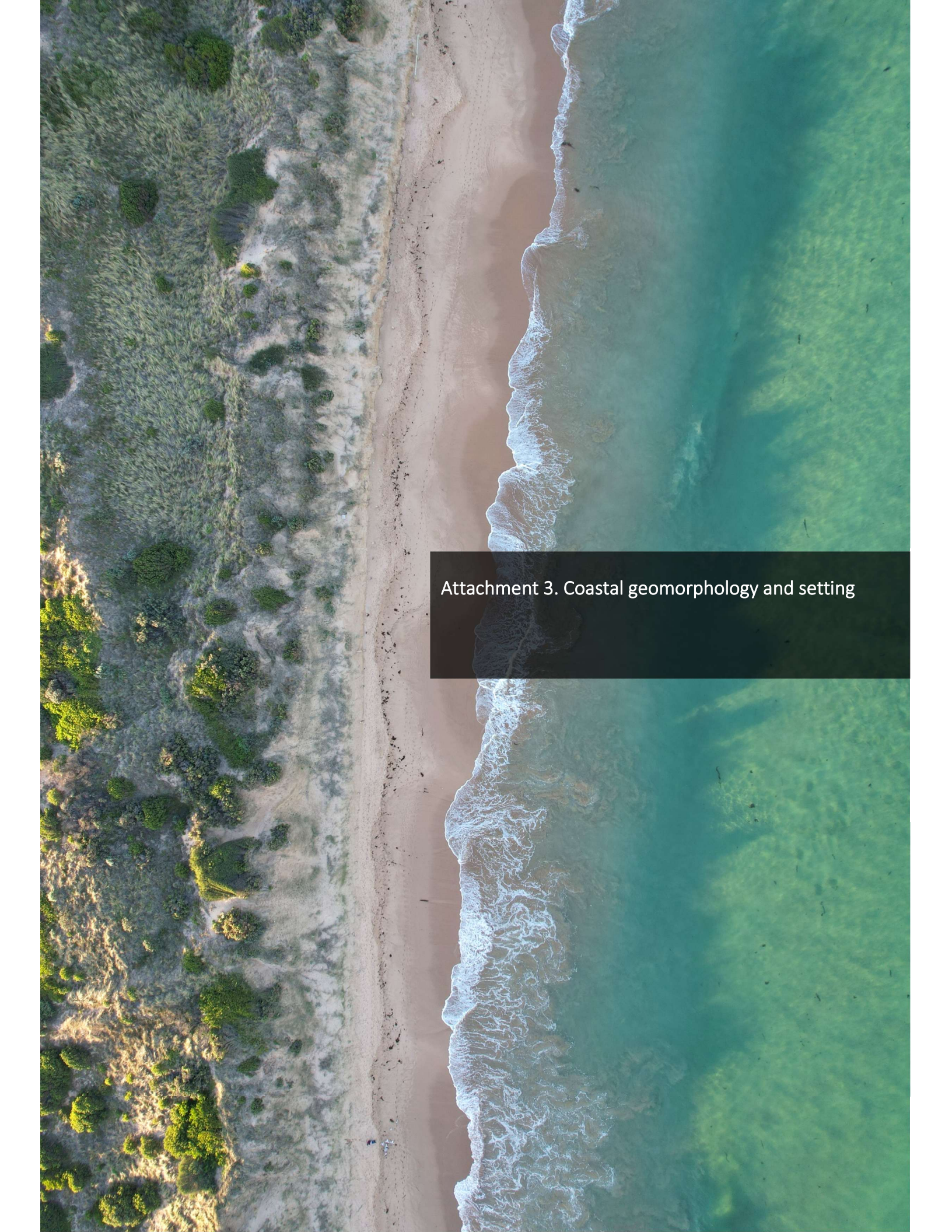
Q13: Are there any other comments that you'd like to share?

Table 5 shows the summary analysis of the long-form answers received for Q13, summarising the main points that emerged from the last comments offered by respondents.

**Table 5. Results to Q13: Are there any other comments that you'd like to share?**

| <b>Further comments</b>                                     | <b>Detail</b>                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Bushfire risk</i></b>                                 | Coastal scrub buildup has increased bushfire risks.                                                                                                                                                                                                                       |
|                                                             | Illegally parked cars often obstruct emergency vehicle access during high-use periods, underscoring the need for strict parking enforcement.                                                                                                                              |
| <b><i>Community appreciation and involvement</i></b>        | Positive feedback for Barwon Coast's maintenance and conservation efforts, with users encouraging continued work to keep the area clean and safe - "It is obvious Barwon Coast cares deeply for the coastal environment it cares for. Keep up the great work!!"           |
|                                                             | Please be mindful of involving community in discussions on implementing new restrictions on uses in the area, e.g. changes to caravan park regulations such as limiting number of cars or non-family members per site, and separation between permanent and casual sites. |
|                                                             | Emphasise the importance of community engagement and communication in planning and regulations.                                                                                                                                                                           |
| <b><i>Emergency and safety measures</i></b>                 | Requests to reinstate yellow emergency beach markers to aid in locating and accessing beach areas in emergencies.                                                                                                                                                         |
| <b><i>Concerns over carrying capacity of the area</i></b>   | Concerns that increasing visitation pressure from increasing nearby populations will exceed the carrying capacity of the area, with suggestions to divert crowds to already developed beaches.                                                                            |
| <b><i>Management suggestions for parking and access</i></b> | Calls for additional boardwalks and walking trails to prevent environmental damage from foot traffic.                                                                                                                                                                     |



An aerial photograph of a coastal landscape. The top half of the image shows a wide, sandy beach with some small rocks and debris. To the left of the beach is a dense area of green vegetation, including shrubs and grasses. The bottom half of the image shows the ocean with clear, turquoise water and white, foamy waves breaking along the shoreline. The overall scene is a natural, coastal environment.

### Attachment 3. Coastal geomorphology and setting



## Coastal geomorphology and setting

This attachment provides further information about the coastal geomorphology and landscape setting of the study area.

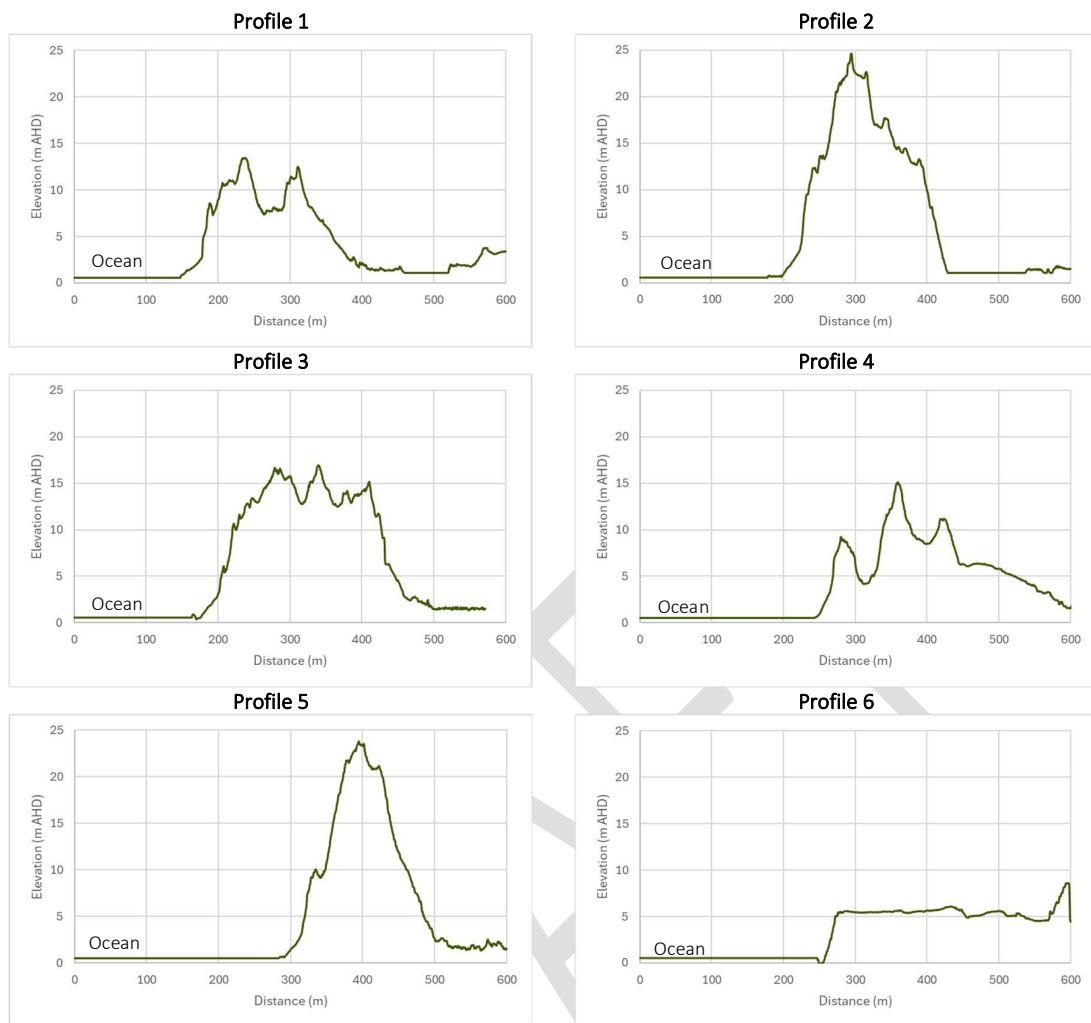
### Landforms and elevation

Figure 12 shows the changes in elevation across the study area. There is an extensive area of low-lying floodplain surrounding Thompson Creek, with the barrier dune system separating this from the open ocean. Low-lying wetland areas extend across the Thompson Creek estuary through to where the geology changes to basalt and the land elevation becomes higher towards Black Rocks.

Figure 13 shows the cross profiles through the dune system and coast, along the profiles shown in Figure 12.



**Figure 12.** Elevation (LiDAR) across the Breamlea and Bancoora area. Source: 2020-21 Golden Plains Area LiDAR. Profiles shown in Figure 13.



**Figure 13.** Elevation profiles (from Figure 12) seaward to inland. Source: 2020-21 Golden Plains Area LiDAR



## Sediment transport

Sandy beaches are inherently dynamic environments which shift their morphology in response to variations in wave, wind and tidal currents. The movement of sediment can be in the longshore direction and can also be in the offshore/onshore direction (cross shore). In general, sandy beaches and their foreshore alignment and profile oscillate between periods of erosion and accretion. Erosion tends to occur under energetic storm conditions, where waves, winds and currents are strong enough to move sand offshore. Sand is then gradually returned to the beach by waves and tides during subsequent calmer periods. Beach erosion is typically characterised in two main categories:

1. **Short-term erosion** - high waves and elevated water levels induce cross-shore transport resulting in sand being eroded from the upper beach and deposited in the nearshore zone. This sand typically moves back onshore gradually under the influences of smaller waves following the storm.
2. **Long-term shoreline movement** - changes or imbalances in the overall sediment budget can lead to gradual erosion or accretion of the foreshore and changes in coastal alignment. Such shoreline movement typically occurs because of variations in the rate of sand transport along the shoreline and/or changes in the supply of sand, either driven by waves (longshore currents) or tidal currents.

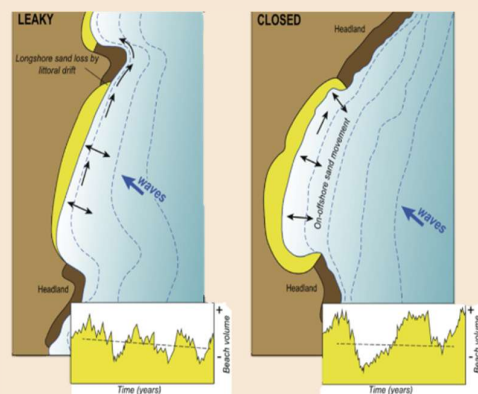
As our climate changes, storm events are becoming more frequent and intense, meaning more sand is being lost offshore and there is less time for a beach to recover. This results in long-term erosion/recession of the beach. Both the short-term erosion (storm bite) and longer-term recession of the coast can impact on assets and values at the coast.



Across the study region, net transport is in an easterly direction. Liu and McCarroll (2023) estimate longshore sediment transport rates across the Point Impossible and Ocean Grove areas to be in the order of 250,000-300,000 m<sup>3</sup>/year. As part of the Bellarine LCHA, Cardno (2015a) estimate net sediment transport to be in the order of ~560,000 m<sup>3</sup>/year. These rates represent an annual mean rate and longshore sediment transport could be quite different when an extreme storm occurs. Geological controls such as natural rocky outcrops, headlands and artificial structures also influence longshore sediment transport.

### Geological controls

Geological controls such as headlands, rock platforms, rock structures, reefs and bedrock are a primary boundary condition known to moderate sediment transport and influence beach morphology (size and shape). The beach profile is geologically constrained and partially controlled by underlying geology. Due to positioning between rocky headlands, Breamlea and Bancoora beaches are situated within a semi-closed sediment compartment. This means the sediment transport operates between the headlands, with small volumes of sediment coming from cross-shore and small volumes being lost alongshore (Thom *et al.*, 2018).



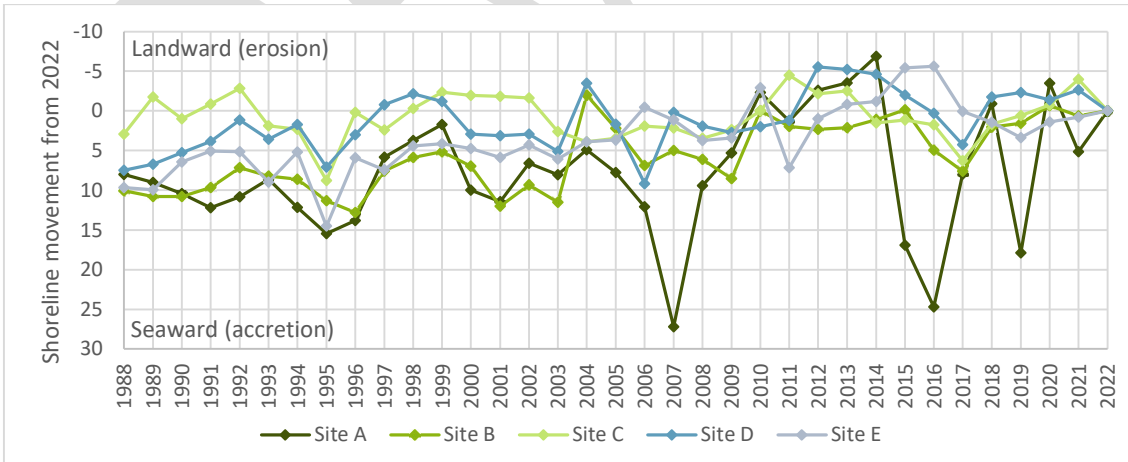
**Figure 14.** Conceptual diagram of 'leaky' and 'closed' compartments (Thom *et al.*, 2018).

A historical review of shoreline changes from 1988 to 2022, has been undertaken across the Breamlea and Bancoora coast using the DEA coastlines tool kit.<sup>1</sup> DEA coastlines uses LANDSAT aerial images to validate a shoreline position in time (using the average tidal position for a given day to represent the shoreline). Once validated, an annual median shoreline position is drawn, representing the median or ‘most representative’ position of the shoreline at approximately mean sea level tide (0 m Above Mean Sea Level) for a given year. Each year’s shoreline is then used to calculate an average rate of coastal change (m/year), where the most recent annual shoreline is used as a baseline for measuring rates of change (Figure 15).



**Figure 15.** Rates of shoreline change from 1988-2022 – Source: DEA Coastlines

The relative positions of the shoreline in relation to the 2022 shoreline has been extracted for five sites A-E (Figure 16). This shows the variability of the shoreline on an annual basis. This method does not reflect short-term shoreline variability, e.g. low and high tide, seasonal effects, or short-lived influences of individual storms.



**Figure 16.** Relative position of shorelines from 1988 to 2022 in relation to 2022 shoreline. Source: DEA coastlines

These observations can be summarised in Table 6 where it is evident that for middle sections of Breamlea Beach and for Bancoora Beach (Sites B, D and E), the shoreline has retreated 0.2-0.3 m/yr on average since 1988. These shorelines can also see variation between years of up to +/-10 m. Whilst the shoreline has fluctuated

<sup>1</sup> Bishop-Taylor, R., Nanson, R., Sagar, S., Lymburner, L. (2021). Mapping Australia’s dynamic coastline at mean sea level using three decades of Landsat imagery. Remote Sensing of Environment, 267, 112734. Available: <https://doi.org/10.1016/j.rse.2021.112734>.

between growth and retreat over time near the Thompson Creek estuary (Site A), the net shoreline movement has remained stable over this time. The west end of Bancoora Beach, near the SLSC access point (Site D) sees less variation year to year and a net stable shoreline from 1988 to 2022.

**Table 6.** Shoreline information for select sites, detailed in Figure 15. Source: DEA Coastlines

| Site                                                     | Most seaward year | Most landward year | Maximum change between years | Rate       |
|----------------------------------------------------------|-------------------|--------------------|------------------------------|------------|
| A East Breamlea Beach, west of Thomson Creek estuary     | 2007              | 2014               | +23.79 m / -21.4 m           | Net stable |
| B Middle Breamlea Beach just west of 50W access point    | 1996              | 2004               | +5 m / -13.5 m               | -0.3 m/yr  |
| C West Breamlea beach, between 49W and 48W access points | 1995              | 2011               | +6.5 m / -8.6 m              | Net stable |
| D West Bancoora beach, just east of SLSC access point    | 2006              | 2012               | +7.5 m / -9 m                | -0.2 m/yr  |
| E East Bancoora Beach                                    | 1995              | 2016               | +10 m / -8.6 m               | -0.3 m/yr  |

### Estuary dynamics

Thompson Creek is a Type B ICOLL (McSweeney *et al.*, 2017). These types of ICOLLs have a narrow to moderately wide entrance channel (75 – 300 m), a uniform channel width in lower reaches, high sedimentary infilling. Through the study area, it is a low energy waterway that meanders through the very low-lying and very flat floodplain hinterland, behind the main township and dune system. The Thompson Creek Estuary has a catchment area of nearly 28 km<sup>2</sup> and is approximately 5.5km in length.

To the west of the creek entrance there is a large area of saline wetland habitat fed by the creek through a culvert under the road. The inner bends of the creek are armoured with low rock retaining-wall structures. These are in place for erosion control along the creek and to minimise any further movements of the channel and will not protect against inundation.

There is no preferred state for an estuary, as both open and closed states are a part of the estuary cycle. These conditions can influence food and habitat availability, water quality, and the estuary appearance (e.g. stagnant water) and odour (e.g. rotting plants). Artificial estuary openings are considered as a management option when high water levels have a significant impact on the environmental, social and economic values of the estuary. For example, when floodplain inundation threatens human assets (e.g. boardwalks, roads, private property) and productive use of the surrounding land (agricultural use).

There are several risks associated with artificial entrance opening including loss of oxygenated surface water, impacts to vegetation, fish kills, poor water quality and unsuccessful opening (i.e. the estuary closes again soon after). Estuary managers (in this case the Corangamite CMA) will carefully consider the risks associated with artificial estuary openings.



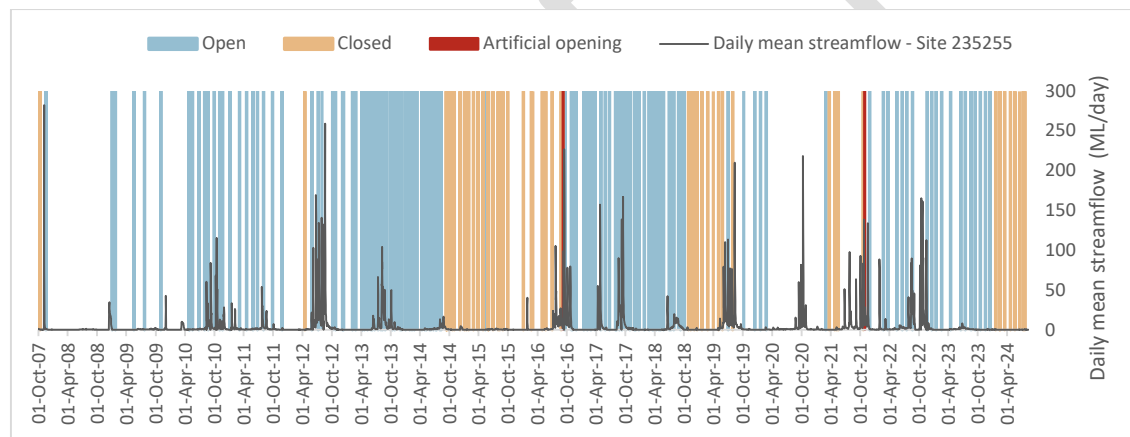


EstuaryWatch mouth condition assessments have been conducted irregularly from 2001 to 2009. Monthly regular assessments commenced in 2010. The assessments indicate that the estuary is mostly tidal dominated and occasionally closes to the ocean. Mouth closures were recorded in October 2007, April 2012, from September 2014 to September 2016, from October 2018 to May 2019, in July 2019, from March to October 2021 and most recently from January 2024 (Figure 17). The entrance was artificially opened in September 2016 and October 2021. Short closures and openings may have occurred between the monthly assessments.

During monitoring times, the water level within the estuary ranged from approximately 200mm below the AHD gauge board in November 2016 to 1.67 AHD in July 2019.

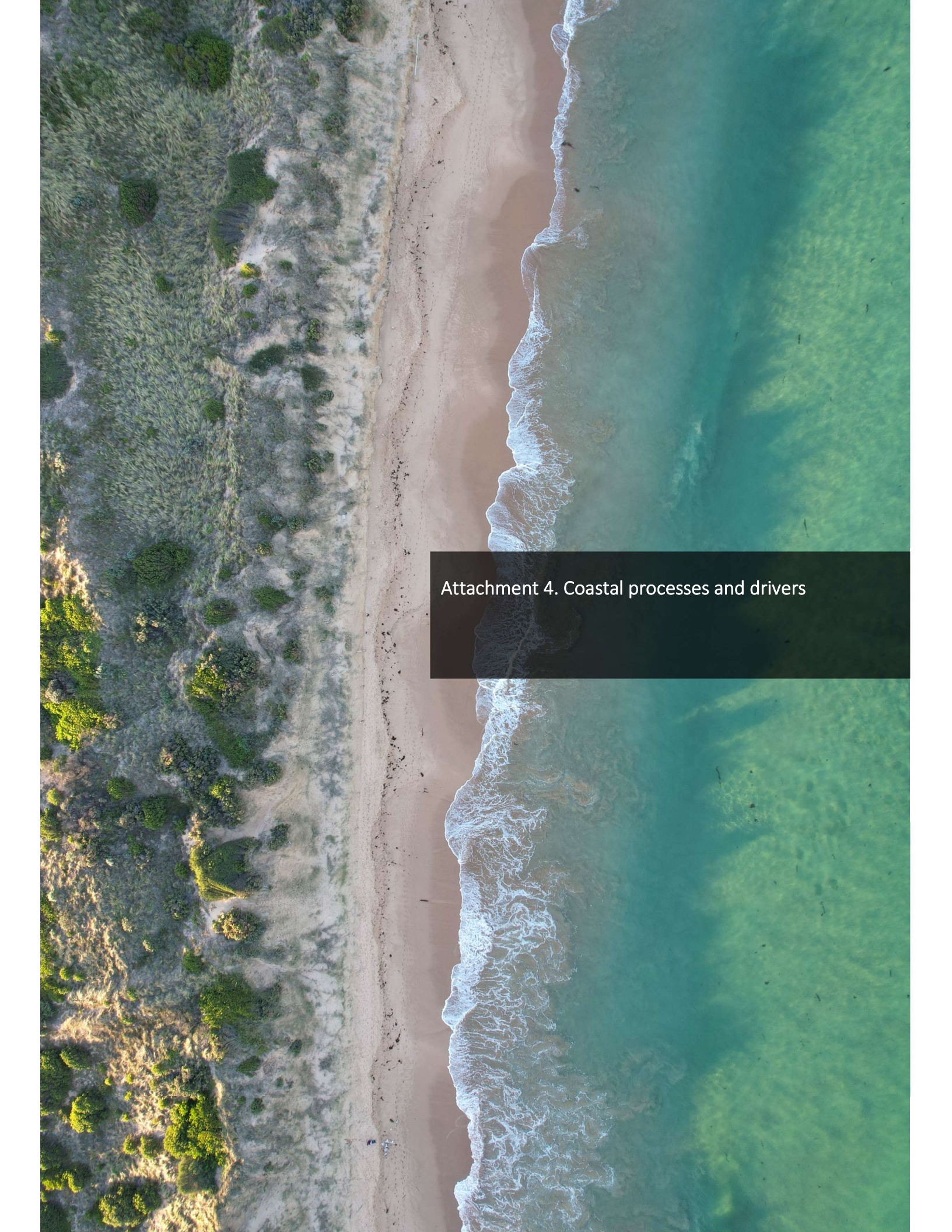
The water level within the estuary fluctuates depending on tidal influences and river flow, at times of estuary closure and no river flow over summer the water level lowers due to evaporation. This results in an increase in salinity in the estuary and a hypersaline environment. The large spread of the estuary wetland system and shallow depth of the estuary also contribute to this. Outside of these times the estuary is mostly brackish with a short period of near freshwater at times of increased river flows during winter and spring. Mild stratification was only evident during times of increased freshwater flows in winter.

Nearer the estuary mouth the salinity commonly represented that of sea water due to good tidal exchange. Stratification is only evident at this site at times of increased river flow. When the estuary mouth is open and there is good tidal exchange oxygen levels are mostly maintained in the healthy range.



**Figure 17.** Mouth condition assessments for the Thompson Estuary 2007-2024, sourced from EstuaryWatch site TPMC. Blank spaces indicate no condition assessment information available.



An aerial photograph of a coastal landscape. The top half of the image shows a wide, sandy beach with gentle waves washing onto it. The water is a clear, light blue-green color. The bottom half of the image shows a dune area covered in dense, low-lying green vegetation. A dark, semi-transparent rectangular box is overlaid on the right side of the image, containing white text.

## Attachment 4. Coastal processes and drivers



## Coastal processes and drivers

Further information on climate drivers and coastal processes is provided below. This compliments Section **Error! Reference source not found.** of the main report.

### Astronomical tide

Astronomical tides are the tidal water levels that result from Earth's rotation and gravitational effects of the Earth, sun and moon. Understanding these tidal ranges helps us understand the range of water levels expected under 'normal' conditions (i.e. not in storm events).

The tides along the Surf Coast follow a semi-diurnal pattern, that is, the region experiences two high and two low tides each day. Tidal planes specified in Table 7. The tidal plane information is sourced from AusTide (2021) for the Lorne (Port 60790) tide gauge and Vic Tides (2023) for the Port Phillip Heads (Point Lonsdale) tide gauge. The tides along the Surf Coast are influenced by the region's geographical features and these features can affect the amplitude and timing of tides, leading to localised variations in tidal patterns.

**Table 7. Tidal planes at Lorne and Port Phillip Heads (m AHD\*)**

| Tidal plane                     | Lorne | Port Phillip Heads (Point Lonsdale) |
|---------------------------------|-------|-------------------------------------|
| Highest Astronomical Tide (HAT) | 1.3   | 0.95                                |
| Mean High Water Springs (MHWS)  | 0.8   | 0.62                                |
| Mean High Water Neap (MHWN)     | 0.4   | 0.36                                |
| Mean Sea Level (MSL)            | 0.0   | 0.0                                 |
| Mean Low Water Neap (MLWN)      | -0.4  | -0.27                               |
| Mean Low Water Spring (MLWS)    | -0.8  | -0.53                               |
| Lowest Astronomical Tide (LAT)  | -1.5  | -1.35                               |

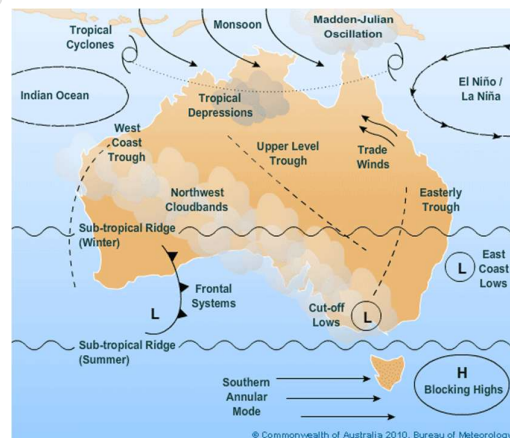
\*AHD refers to the Australian Height Datum. This datum was established in 1971 by assigning the mean sea level for 1966-1968

Water levels in the study area will also be affected by longer-term coastal processes that occur over timescales ranging from weeks to seasons, to decades. These processes include regional atmospheric and oceanographic processes such as the climate drivers and storm tide events, discussed below, and long-term mean sea level rise due to climate change, discussed in Section **Error! Reference source not found.**

### Climate drivers

Weather fronts travelling from west to east, most frequent during the winter months, are the main cause of elevated sea levels along Victoria's southern coast. Broadly, the central open coast of Victoria receives persistent high-energy west and south-westerly waves originating from the Southern Ocean. The Southern Ocean is one of the highest energy coasts globally, swell waves generated in the Southern Ocean are highly variable and travel long distances passing through Bass Strait and interacting with the Victorian coast (McSweeney, 2019).

Natural variability in climate drivers also affects weather patterns from year to year. This influences the year-to-year frequency of extreme sea levels.



**Figure 18. Climate drivers across Australia**



Along the south coast of Australia, major climate drivers that cause multi-year variability include:

#### **The Southern Annual Mode (SAM)**

SAM refers to the north/south movement of the strong westerly winds, storm systems and cold fronts that move from west to east. In the positive phase of SAM, the mid-latitude westerly wind belt together with storm surge-producing frontal systems shifts poleward (south), while in the negative phase they shift equatorward (north). Each SAM event, both positive and negative, tends to last for around ten days to two weeks. The time frame between positive and negative events is quite random but typically range from a week to a few months.

#### **El Niño Southern Oscillation (ENSO)**

ENSO is the extensive warming of the central and eastern tropical Pacific Ocean which leads to a major shift in weather patterns across the Pacific and around Australia's coast. Along the southeastern coast of Australia, the effect of ENSO on sea levels is minor compared to its effect along the northern and western coast. Recent work as part of the Port Phillip Bay Coastal Hazard Assessment (PPBCHA) found there was a weak connection between the transport caused by waves and currents between ENSO modes (El Niño and La Niña events).

#### **Changes to SAM and ENSO events under global warming**

SAM is expected to become more positive on average, with the potential for more high-pressure systems along the Victorian coast and further anticlockwise rotation of wave direction. The frequency of extreme La Niña events is also predicted to increase across the next century as the climate warms. A combination of the southward movement of the westerly wind belt (associated with positive SAM events) and more frequent La Niña events, may result in an increase in easterly trading winds approaching the Victorian coast and an increase in erosion and westward sediment transport at Breamlea and Bancoora.

#### **Wind and wave climate**

As detailed in Cardno (2015a), Bass Strait and Port Phillip Bay lie on the boundary between the westerly-wind belt of the southern hemisphere and the subtropical trade-wind belt. The trade-wind belt moves southward in summer with the thermal equator and the belt of variable winds also moving further south. This means the paths of pressure systems across Australia are further south in summer. As the land areas heat and become low-pressure areas, winds near the earth's surface blow mainly from sea to land (onshore). Conversely, in winter, the land is covered by high pressure, and the winds blow mainly outward from land to sea (offshore).

For the study area, this means that in winter (June to August), the most prevalent winds are northerlies; while in summer (December to February) southerly winds (mainly south east to south westerly) are prevalent. Spring and autumn represent a transition between the two dominant seasons and the wind patterns are a mixture of the summer and winter patterns.

The closest wind stations to the site are Aireys Inlet and Point Wilson (Figure 21). Available historical wind data (from ~1990 to 2023) for these stations (Figure 20) shows this trend. From this data, it is also evident that mean wind speeds are generally higher in winter and spring months ((July to October) and that wind speeds are generally higher in the afternoon (3pm), compared to the morning (9am).



*Wave refraction around headlands and rocky outcrops at Stingray Bay and Breamlea Beach.*

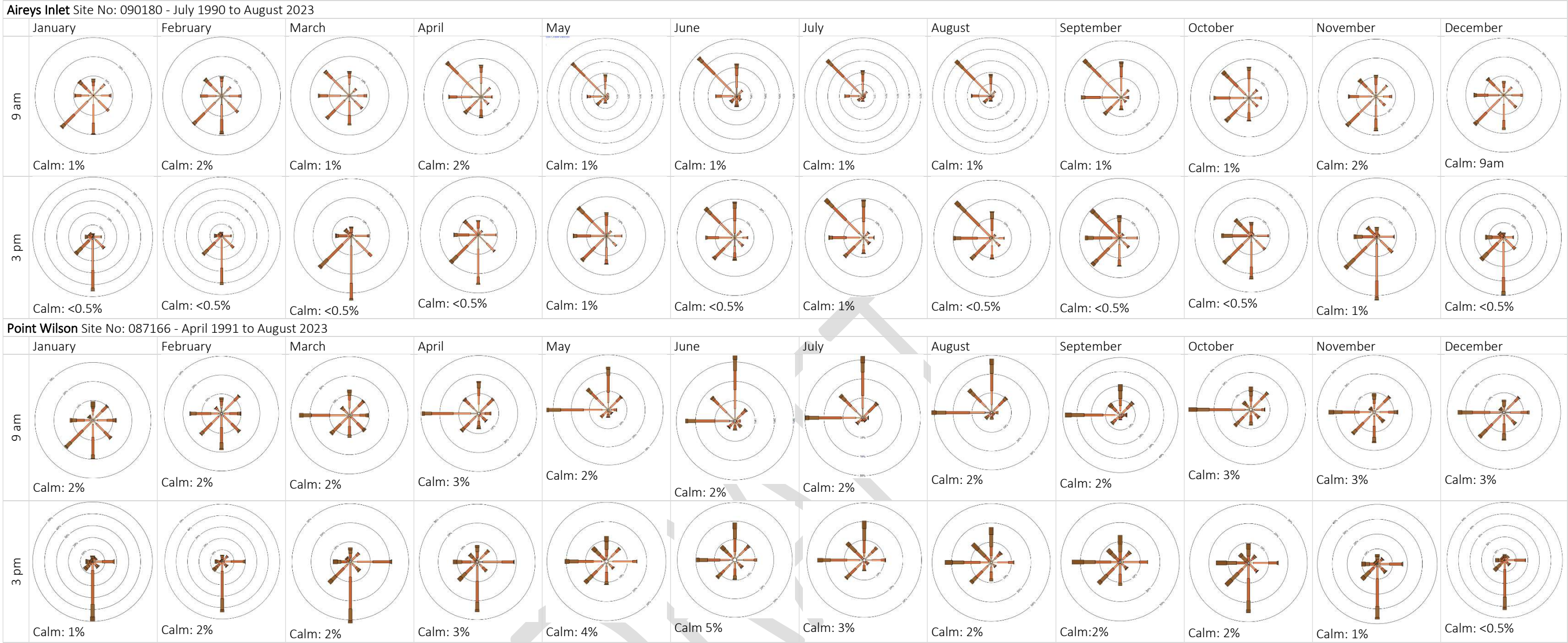
McInnes *et al.* (2011) studied the waves and extreme water levels for the Great Ocean Road region. They found that while the predicted largest significant wave heights in deep water offshore from the coast are from the south-west, these large waves are significantly refracted before they reach the surf coast. This means that waves from the south-west are not necessarily the largest waves reaching the coast. The largest waves reaching the coast tend to be from the south to east, which have smaller offshore wave heights, but can propagate towards the coast with significantly less attenuation due to wave refraction.

Figure 19 summarises these wave sources. At Breamlea and Bancoora, The wave conditions are swell dominated, and the shoreline is afforded some protection from the dominant south-westerly swells due to Point Impossible (west of the Thompson Creek entrance) and the orientation of the shoreline. Sand movement along the beaches and onshore sand movement is controlled by all waves that reach the coast (the overall wave climate), not just larger waves.

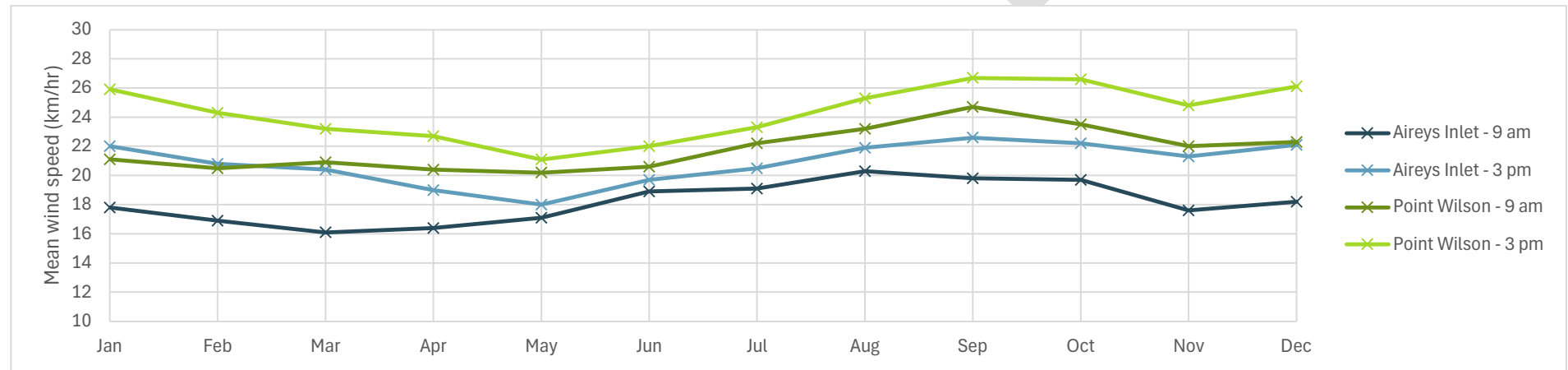
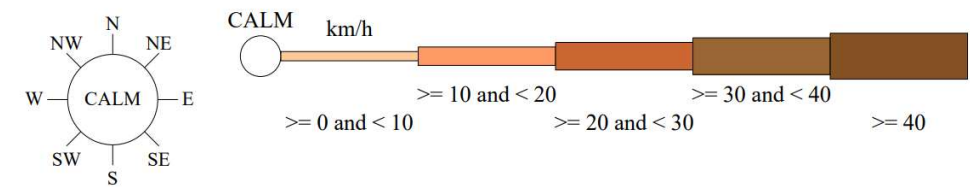


**Figure 19.** Wave sources and directions affecting the Surf Coast. Source: Water Technology (2018).





**Figure 20.** Above: Monthly averaged wind roses for Aireys Inlet and Point Wilson.



**Figure 22.** Mean monthly wind speeds for Aireys Inlet and Point Wilson.



**Figure 21.** Wind station locations





Attachment 5. Coastal hazard data – further information



## Bellarine Peninsula – Corio Bay Local Coastal Hazard Assessment

### Storm tide inundation

Through the Bellarine Peninsula - Corio Bay Local Coastal Hazard Assessment (Bellarine LCHA), storm tide inundation was modelled for the Breamlea / Thompson Creek system. For the eastern area from Bancoora Beach / Black Rocks to the Barwon River estuary no inundation modelling was completed as there was deemed to be minimal risk of inundation.

The assessment utilised hydrodynamic (SOBEK) modelling. This dynamic modelling simulates the movement of water through the environment by accounting for the flow paths, friction of various surfaces and the time variation of sea-level and river flows. The Breamlea area was considered to be of high priority for higher resolution modelling. Key model parameters for the Bellarine LCHA are detailed in Table 8.

**Table 8. Key model parameters for the Bellarine LCHA modelling**

| Model parameter                                 | Description                                                                                                                                                                                                                                                                                                                |         |           |           |           |           |           |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|-----------|-----------|-----------|-----------|
| Grid size                                       | 20 m grid size                                                                                                                                                                                                                                                                                                             |         |           |           |           |           |           |
| Bathymetry                                      | Laser Airborne Depth Sounding (LADS), collected in 2009 / 2010 with horizontal accuracy of +/- 1.62 m, and vertical accuracy is +/- 0.26 m                                                                                                                                                                                 |         |           |           |           |           |           |
| Topography                                      | Light Detection and Ranging (LiDAR), collected in 2007 with horizontal accuracy of +/- 35 cm, and vertical accuracy +/- 10 cm                                                                                                                                                                                              |         |           |           |           |           |           |
| Structures                                      | Key development features such as roads, levees and shore protection structures were checked to ensure they were picked up as topographic features and were refined where necessary.                                                                                                                                        |         |           |           |           |           |           |
| Culverts                                        | Culverts were incorporated into the model beneath the road in two locations where Blackgate Road crosses Thompson Creek; and near the intersection of Blackgate and Breamlea Roads. Four culverts were also identified along the boundary between Thompson Creek and the local properties and incorporated into the model. |         |           |           |           |           |           |
| Tidal boundary                                  | Applied at the mouth of the Thompson Creek                                                                                                                                                                                                                                                                                 |         |           |           |           |           |           |
| Event probabilities                             | 1% AEP incorporating combined effects of waves and storm tide                                                                                                                                                                                                                                                              |         |           |           |           |           |           |
| Significant wave height ( $H_s$ )               | 4.1 to 4.4 m                                                                                                                                                                                                                                                                                                               |         |           |           |           |           |           |
| Adopted storm tide levels for the Breamlea area | Sea level rise                                                                                                                                                                                                                                                                                                             | 0 m SLR | 0.2 m SLR | 0.5 m SLR | 0.8 m SLR | 1.1 m SLR | 1.4 m SLR |
|                                                 | Storm-tide level (m AHD)                                                                                                                                                                                                                                                                                                   | 1.75    | 1.95      | 2.25      | 2.55      | 2.85      | 3.15      |

### Catchment flows and coincident inundation

From the Bellarine LCHA reporting, it is assumed that storm tide inundation modelling does not account for the combined effects of catchment (rainfall) flooding. For the coastal hazard (inundation) extent from flooding to be increased (from coastal inundation alone), the catchment flows would need to occur simultaneously (coincide) with the peak tide and storm-surge levels.

For the nearby Barwon River, analysis of storm tide (coastal) flooding and catchment (rainfall) flooding indicated there is no correlation in the long-term records. This means that for most catchments along the Bellarine Peninsula, short duration storms (up to ~6 hours) are likely to be the storms that produce the highest rainfall/runoff. These are generally thunderstorm type events that are not associated with high storm-surge levels. The likelihood of a 1% AEP catchment (rainfall) event occurring simultaneously with a 1% AEP storm tide event was deemed to be very low. For the Barwon River, the LCHA modelled a 10% AEP catchment flow event coinciding with a 1% AEP coastal (storm tide) inundation event.

The Bellarine LCHA also assessed the duration of inundation. This mapping is presented in Figure 24 and shows the duration for which inundation is greater than 30 cm for a 1% AEP event with 0.8 m SLR.

### Permanent inundation

Whilst the Bellarine LCHA did assess permanent inundation for some areas. No mapped extents or data was available for the study area.

### Erosion

Coastal erosion was assessed through the Bellarine LCHA. This was primarily a desktop study, with limited field investigations. Beach profiles utilised were derived from 2007 LiDAR and may not account for changes in landforms, structures and other developments or change in shoreline position from this time.

As a sandy open coast environment, four factors were considered in the defined hazard extents (Table 9). These factors are combined and translated into a horizontal distance of shoreline recession, applied for various sea level rise scenarios. To allow for spatial analysis these erosion set back lines were transformed to polygons.

**Table 9. Factors in determining open coast erosion hazard extents for the Bellarine LCHA.**

| Factor                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Short-term / storm bite erosion | Accounts for open coast storm demand. Consistent with other studies across Victoria, two back-to-back 1% AEP storm events are used in the defined erosion hazard area. This factor was modelling using LITPROF and checked against SBEACH for eight profiles between Thompson Creek and Blue Rocks. Wave heights varied between 4.13 m and 4.44 m across the shoreline profiles. The design storm (applied twice) combined these wave heights and water levels detailed in Table 8.<br>Modelling also considers: <ul style="list-style-type: none"> <li>• Orientation of beach to dominant wave direction</li> <li>• Wave climate and water levels</li> <li>• The bathymetry – deepness, profile, nearshore reefs or strata</li> <li>• Sediment grain size</li> </ul> |
| Long term recession rates       | Accounts for longer term sediment loss due to ongoing coastal processes. This factor was determined through historic aerial photography analysis (from 1944 to 2001), but generally was found to be minimal and generally, no rate of long-term recession has been factored into the hazard calculations for the open coast.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Recession due to sea level rise | Accounts for shoreline recession due to the effects of sea level rise. This factor was calculated using empirical calculations (the Bruun Rule) for open coast environments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Slope adjustment                | A factor to account for slope stability and reduced foundation capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

At the time of assessment, there was a lack of beach profile data available for the study area (and Victoria, more broadly). Profiles were taken from LiDAR data flown in 2007. There is uncertainty associated with this in that morphological change to landforms may have occurred since this date, either through human intervention (roads, structures etc.) or natural change (shoreline retreat/advance, etc.). The Bellarine LCHA recommended monitoring (profile surveys) for Bancoora Beach to inform more detailed assessments in the future.

The erosion hazard extents are determined at points along the cross-shore profiles, these are spaced intermittently, and lines between each profile are shaped to follow the topography where possible. Erosion hazard extents between profile locations may be over or under estimated. The profiles for Breamlea and Bancoora beaches are generally in sandy portions of the beach. It is assumed that rocky headlands across the study area will have greater resistance and erosion extents around these features may be overestimated.

A generally conservative approach was taken to determining the erosion hazard extent incorporating two back-to-back 1% AEP events. This scenario is less likely to occur than a single 1% AEP event.



The probability of a 1% AEP wind/wave scenario and a 1% AEP storm tide level scenario were determined independently. These were then brought together to determine a 1% AEP event. The likelihood of the two extremes occurring at the same time is very low, far in excess of an event that would be statistically likely to occur with a 1% annual probability.

Cardno (2015a) and (2015b) provide full modelling methodology reporting.

DRAFT



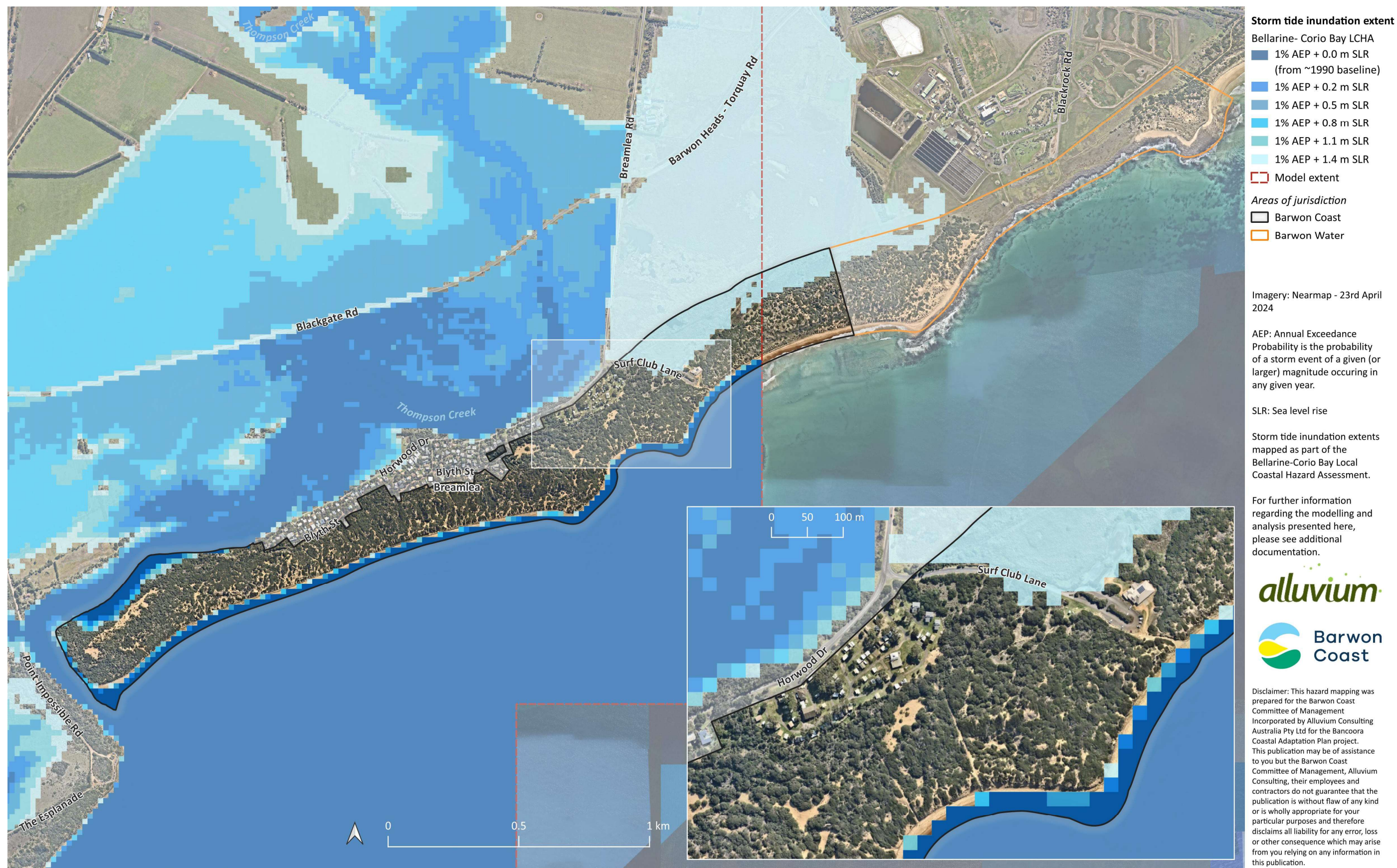
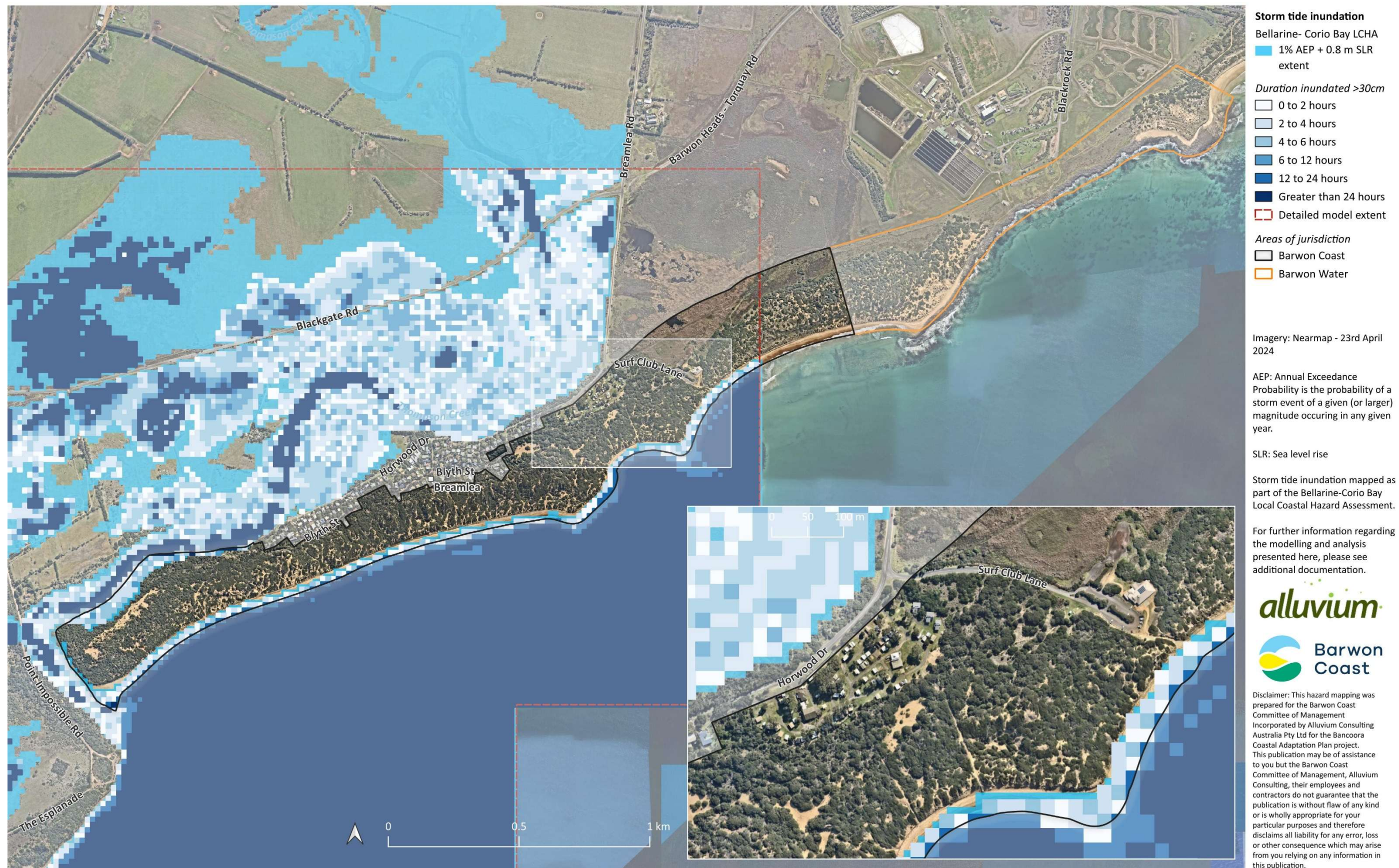


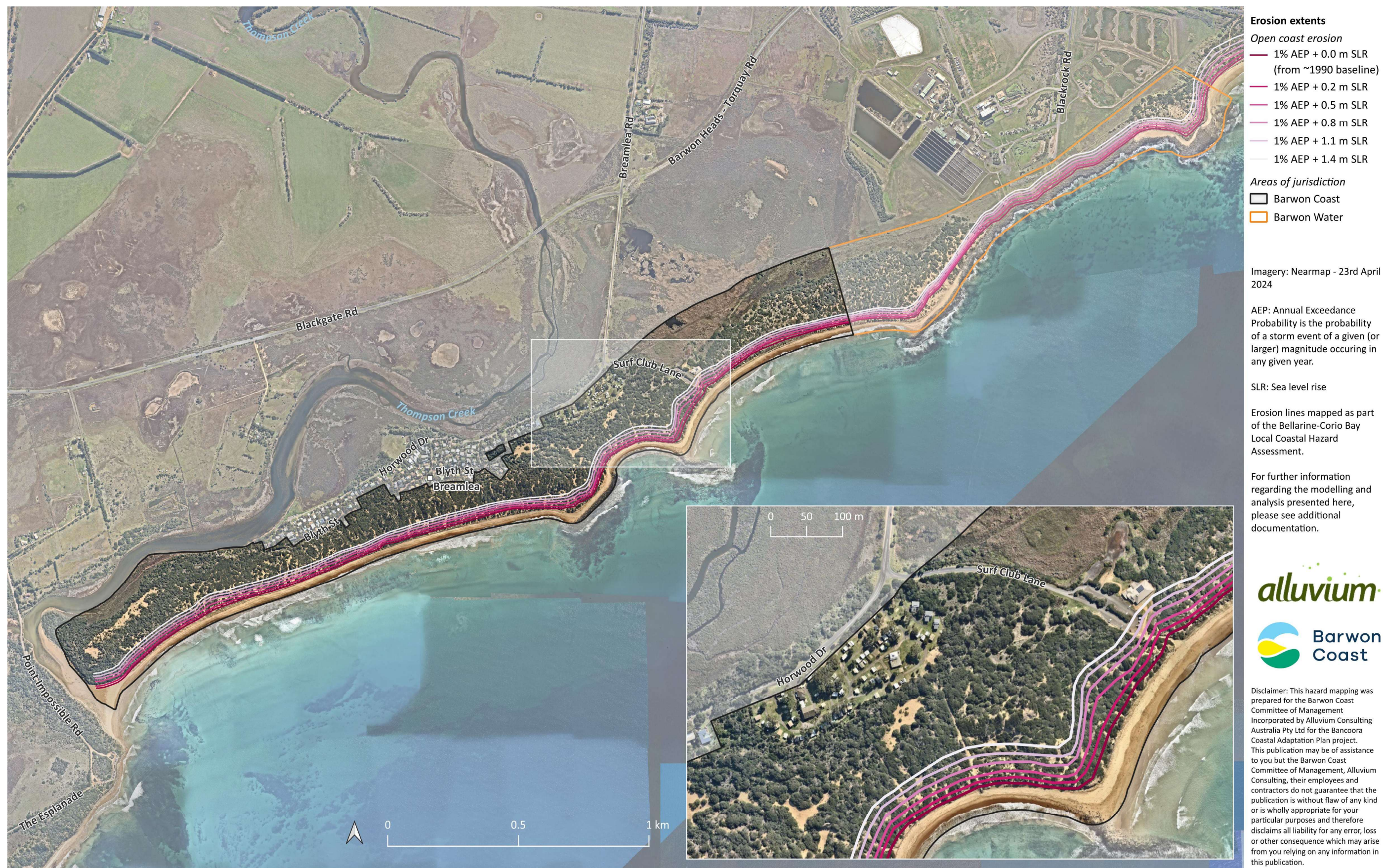
Figure 23. 1% AEP storm tide inundation extent mapping (0.0 m SLR to 1.4 m SLR) – Bellarine-Corio Bay LCHA





**Figure 24.** 1% AEP storm tide inundation duration (0.8 m SLR scenario) – Bellarine-Corio Bay LCHA





**Figure 25.** Open coast erosion extent mapping (0.0 m SLR to 1.4 m SLR) – Bellarine-Corio Bay LCHA



## Future Coasts

Limited reporting is available for the Statewide Future Coasts datasets. It is understood that the approach for determining storm tide and permanent inundation is reported in McInnes *et al.* (2011). The mapping presented represent the Victorian Coastal Inundation Dataset (<https://discover.data.vic.gov.au/dataset/victorian-coastal-inundation>).

The Future Coasts inundation modelling uses simple bathtub models to examine increasing water levels. They combine local tides with sea level rise projections. The permanent inundation is representative of high tide + SLR scenarios. Assessment involved the use of sea level rise scenarios implicit in the IPCC's A1F1 emissions scenario as a basis for CSIRO modelling of projected sea levels and associated flood risk for Victoria's coast

The storm tide inundation was modelled to represent a 1% AEP storm tide event. This used the same projected SLR increases plus an added wind forcing factor. For 2009 this was a 0% forcing, 2040 was 6% (on the 20cm), 2070 was 13% and 2100 was 19% plus the 82cm SLR level.

A 'bathtub' or 'bucket-fill' concept is quite simplistic, based on water levels and ground surface elevations. This method looks at the sea like a bathtub and fills up in the same way a bath does when you add water. Lower parts (i.e. low-lying coastal land) fills up first, then higher parts, until water levels reach the design level.

Inundation and estimated extents for the region have been estimated based on the best available "present day" ground and seabed elevations (topography and bathymetry) at the time of the hazard assessment (2009). These present-day elevations are used all scenarios, short term through to long term. No landform/morphological change has been incorporated into future hazard extent projections.

Note, the statewide Future Coasts datasets have not been edited to remove anomalies such as disconnected flood areas. The extents are based on topographic data captured in 2008/09. In some areas significant modification to the landscape may have occurred since this time (human-induced and/or natural process).





**Figure 26.** Permanent inundation (tidal areas) extent mapping (0.0 m SLR to 0.8 m SLR) - Futures Coasts (Victorian Coastal Inundation Dataset)





**Figure 27.** Storm tide inundation extent mapping (0.0 m SLR to 0.8 m SLR) - Futures Coasts (Victorian Coastal Inundation Dataset)



## Port Phillip Bay Local Coastal Hazard Assessment

### Groundwater

Erosion and inundation studies as part of the Port Phillip Bay Coastal Hazard Assessment (PPBCHA) do not extend to the Breamlea area. However, conceptual modelling of groundwater systems in the region did extend into the broader Barwon coast region. McInnes *et al.* (2022) provides full reporting of PPBCHA groundwater assessment methodology.

As part of the PPBCHA, a method to approximate how changing conditions, including sea level rise, might affect watertable depths and the groundwater system was used. The models and assessments were based on previous research, data and information, including:

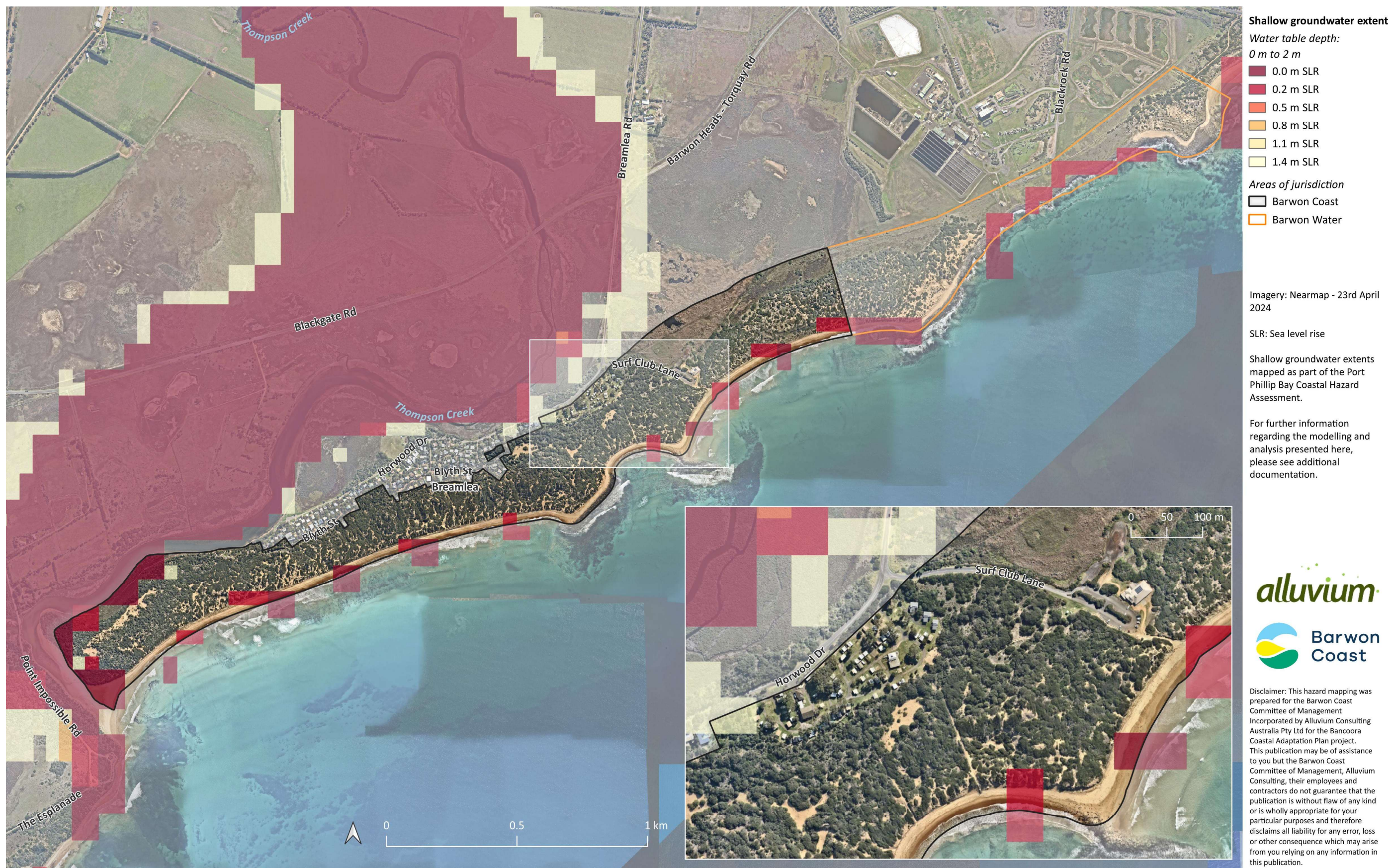
- Previous visualisations, such as the Visualising Victoria's Groundwater (VVG) portal
- Monitoring data from groundwater bores
- Geological surveys
- Studies undertaken for major infrastructure projects and other stakeholder databases

The assessment focussed on understanding where the depth to the watertable is likely to change due to sea level rise. Groundwater depths were classified as:

| Watertable depth | Description                 |
|------------------|-----------------------------|
| Sea              | Surface water               |
| Shallow          | Up to 2 metres deep         |
| Intermediate     | Between 2 and 5 metres deep |
| Deep             | Greater than 2 metres deep  |

In this assessment, the extent of a shallow watertable is seen as the groundwater hazard extent. I.e. the areas where shallow groundwater is present, may present a hazard to the values, uses and enjoyment of the coast. Groundwater hazard mapping shows where shallow groundwater increases due to sea level rise. Groundwater systems can be very slow to respond to change, so some changes to shallow groundwater could take decades.







An aerial photograph of a coastal landscape. The top half of the image shows a wide, sandy beach with gentle waves washing onto it. To the left of the beach is a dune area covered in low-lying, green and brown vegetation. The bottom half of the image shows the ocean with more turbulent waves breaking, creating white foam. The water is a deep blue-green color. A black rectangular box with white text is overlaid on the right side of the image, partially covering the beach and the ocean.

Attachment 6. Coastal hazard mapping – all likelihood scenarios



## Coastal hazard mapping – all likelihoods scenarios

Likelihood ratings for the Bancoora CAP are summarised below (Table 10). Figure 29, Figure 30, Figure 31, and Figure 32 show these scenarios for each planning horizon.

Table 10. Hazard likelihood scenarios

|                                           | Short<br>Up to 25 years | Medium<br>25 to 50 years | Long<br>50 to 75 years | Sensitivity<br>beyond 75 years |
|-------------------------------------------|-------------------------|--------------------------|------------------------|--------------------------------|
|                                           | 0 to 0.2 m              | 0.2 to 0.5 m             | 0.5 to 0.8 m           | 0.8 to 1.1 m                   |
| <b>STORM TIDE INUNDATION</b>              |                         |                          |                        |                                |
| Likely                                    | 1% AEP + 0.0 m SLR      | 1% AEP + 0.2 m SLR       | 1% AEP + 0.5 m SLR     | 1% AEP + 0.8 m SLR             |
| Possible                                  | 1% AEP + 0.2 m SLR      | 1% AEP + 0.5 m SLR       | 1% AEP + 0.8 m SLR     | 1% AEP + 1.1 m SLR             |
| Unlikely                                  | 1% AEP + 0.5 m SLR      | 1% AEP + 0.8 m SLR       | 1% AEP + 1.1 m SLR     | 1% AEP + 1.4 m SLR             |
| Rare                                      | 1% AEP + 0.2 m SLR      | 1% AEP + 0.47 m SLR      | 1% AEP + 0.82 m SLR    | No data – use prev.            |
| <b>PERMANENT INUNDATION (TIDAL AREAS)</b> |                         |                          |                        |                                |
| Likely                                    | 0.0 m SLR               | 0.2 m SLR                | 0.47 m SLR             | 0.82 m SLR                     |
| Possible                                  | 0.2 m SLR               | 0.47 m SLR               | 0.82 m SLR             | No data – use prev.            |
| <b>EROSION</b>                            |                         |                          |                        |                                |
| Possible                                  | 2 x 1% AEP + 0.0 m SLR  | 2 x 1% AEP + 0.2 m SLR   | 2 x 1% AEP + 0.5 m SLR | 2 x 1% AEP + 0.8 m SLR         |
| Unlikely                                  | 2 x 1% AEP + 0.2 m SLR  | 2 x 1% AEP + 0.5 m SLR   | 2 x 1% AEP + 0.8 m SLR | 2 x 1% AEP + 1.1 m SLR         |
| Rare                                      | 2 x 1% AEP + 0.5 m SLR  | 2 x 1% AEP + 0.8 m SLR   | 2 x 1% AEP + 1.1 m SLR | 2 x 1% AEP + 1.4 m SLR         |

Green – Bellarine LCHA (hydrodynamic modelling) Red – Future Coasts (static/bathtub modelling)

AEP = Annual exceedance probability SLR = Sea level rise



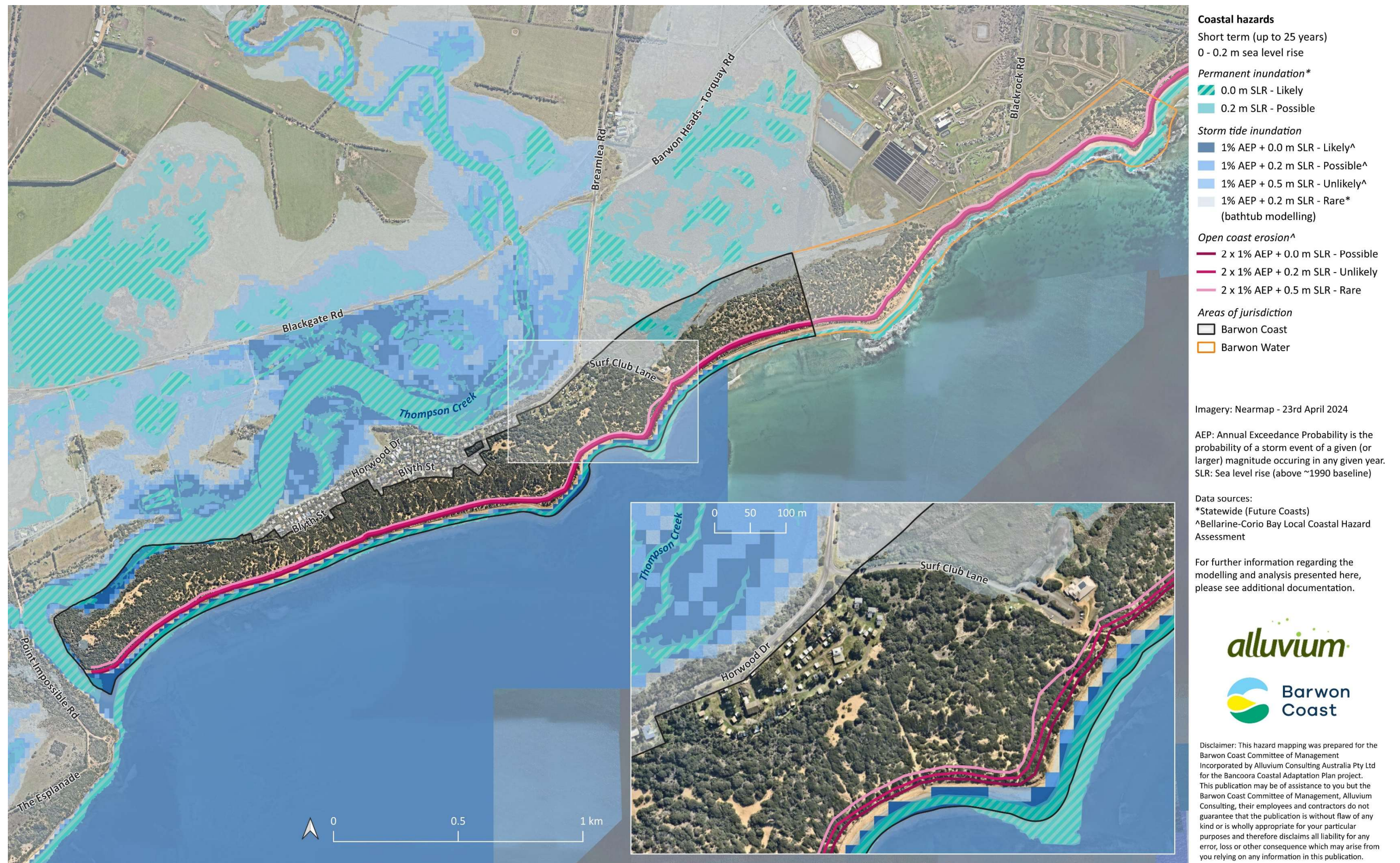


Figure 29. Coastal hazard mapping - short term (up to 25 years) 0 - 0.2 m sea level rise



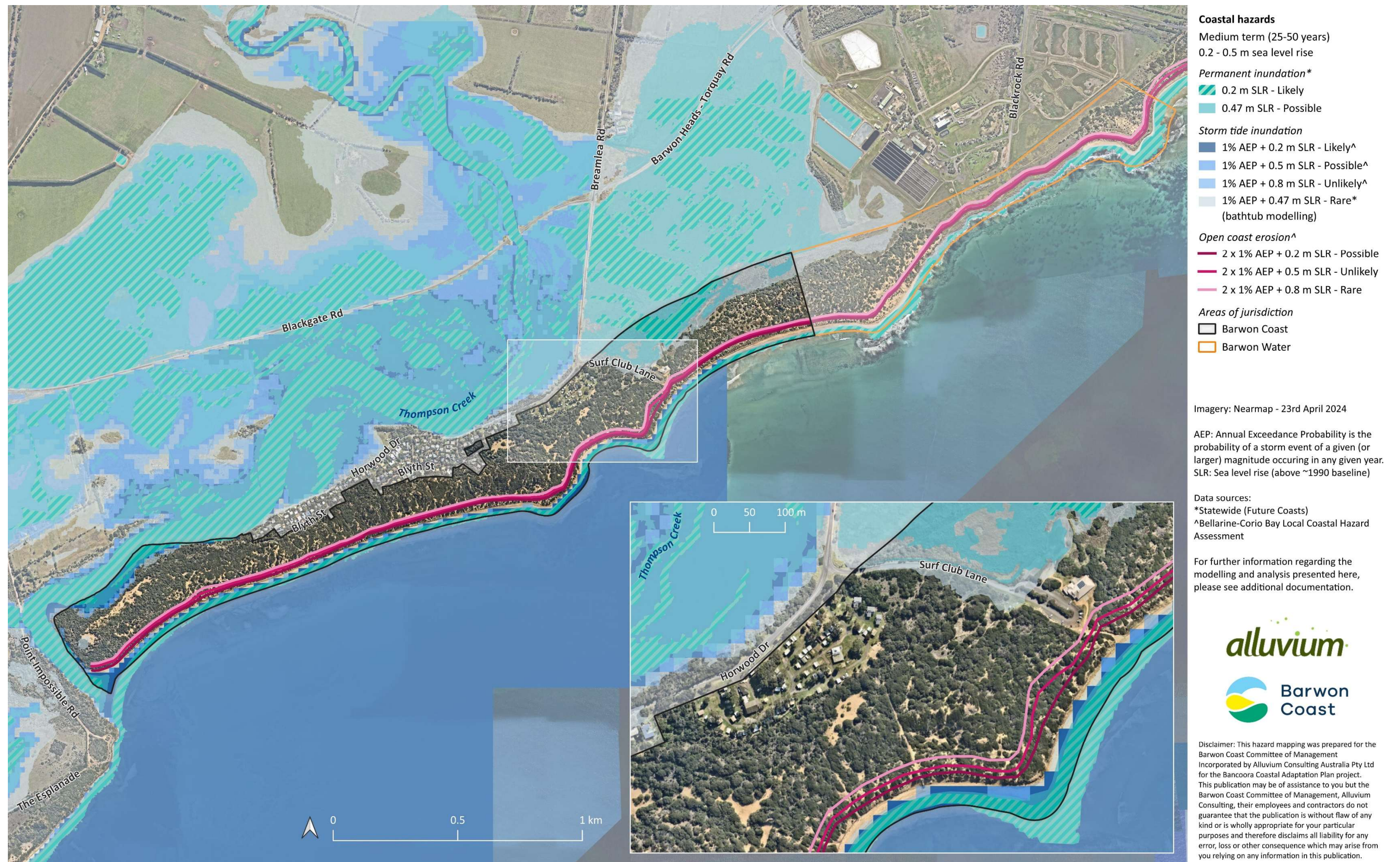


Figure 30. Coastal hazard mapping - medium term (25-50 years) 0.2 - 0.5 m sea level rise



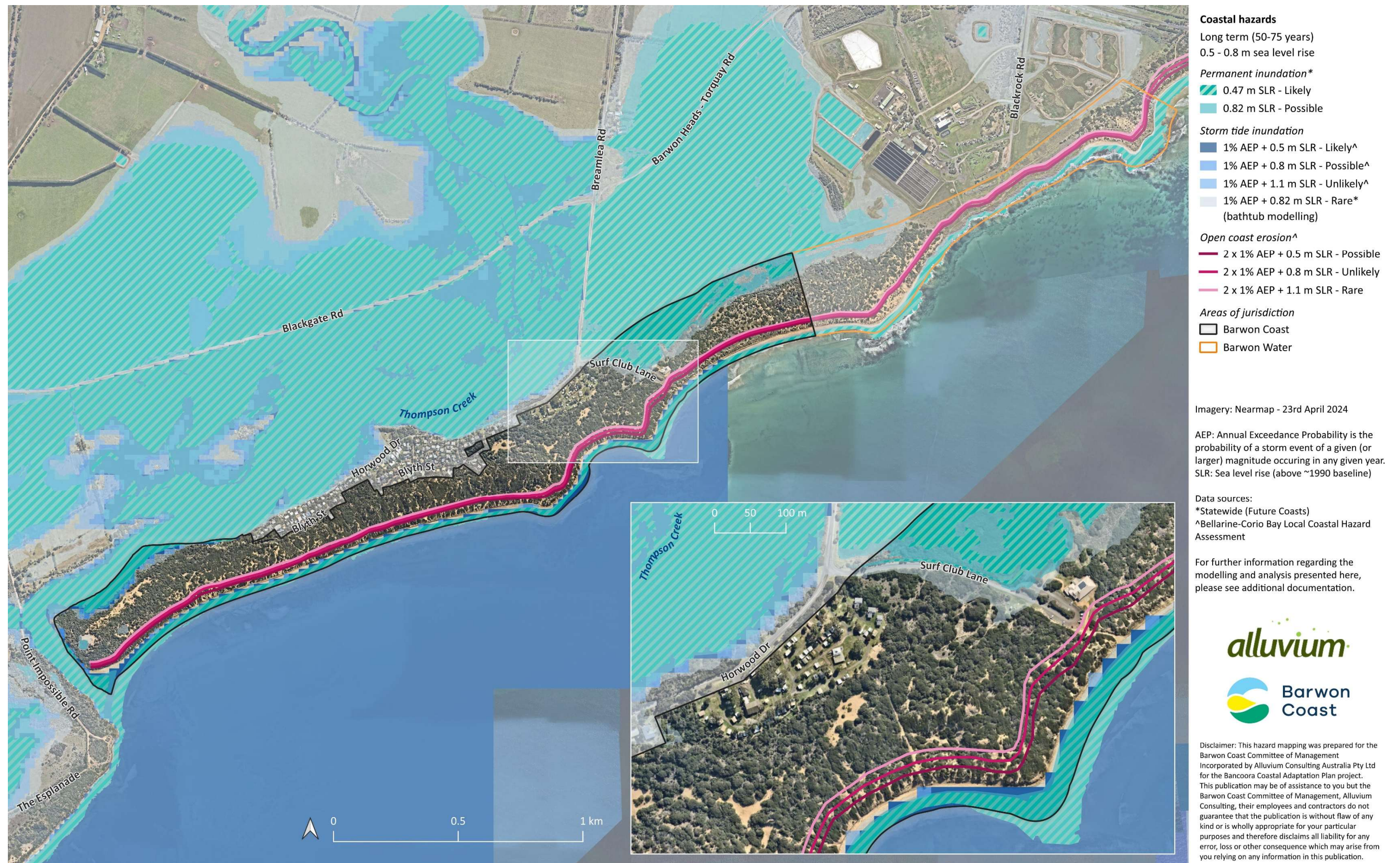


Figure 31. Coastal hazard mapping - long term (50-75 years) 0.5 - 0.8 m sea level rise



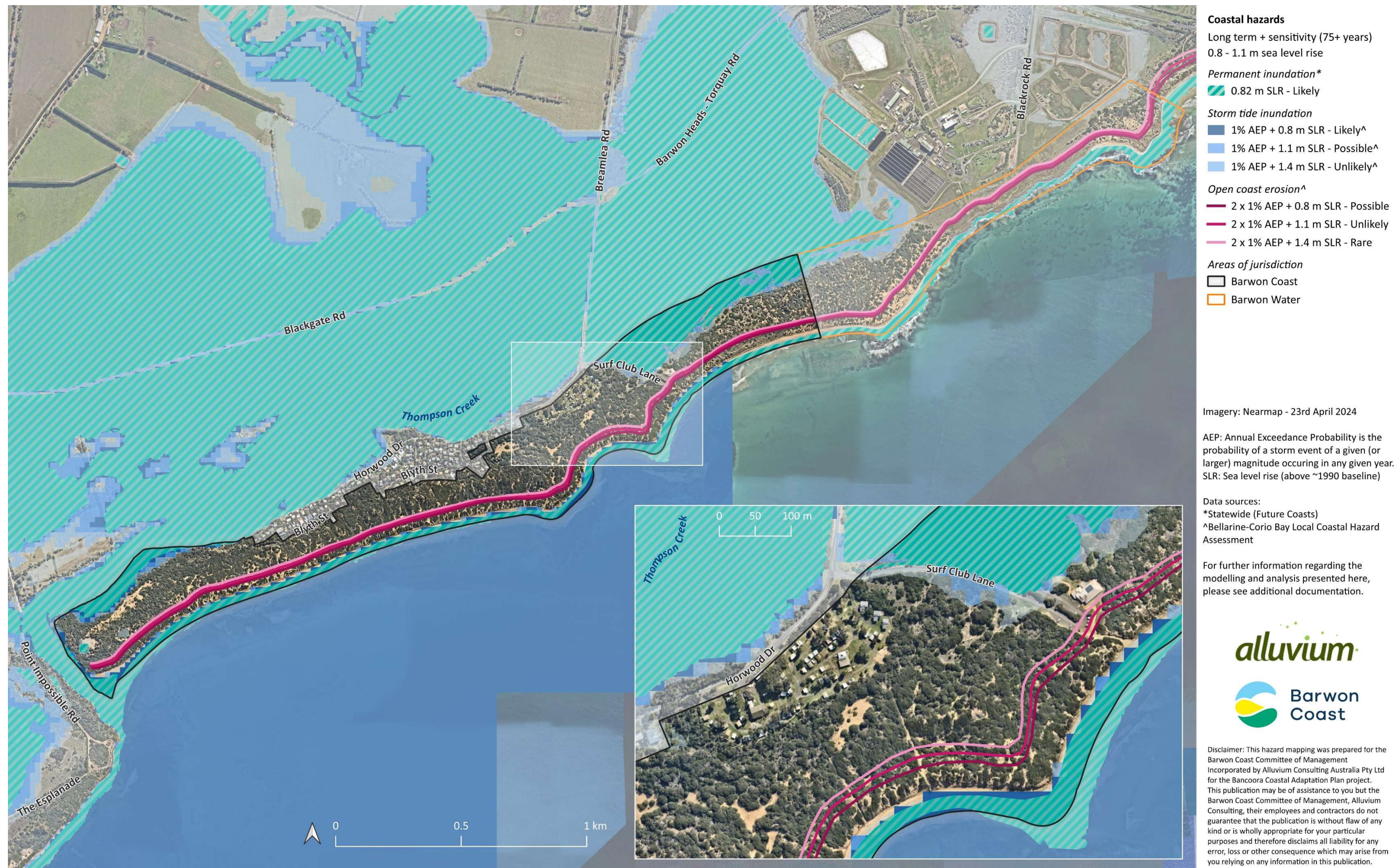


Figure 32. Coastal hazard mapping - long term sensitivity (75+ years) 0.8 – 1.1 m sea level rise





Attachment 7. Adaptation actions pre-screening



## Adaptation actions screening

Table 11 provides preliminary screening of all adaptation actions contained in the Victoria's Resilient Coasts - Adaptation Actions Compendium (BMT, 2023) for consideration. This preliminary screening considers action effectiveness in reducing hazard risk and overall suitability of the action, in alignment with the physical/environmental setting, values, objectives and vision for Bancoora. While Barwon Coast's role in some actions is limited, some actions may be considered as a priority for advocacy with other agencies.

**Table 11. Preliminary assessment of action suitability for further assessment in Bancoora CAP.**

| Effective hazard risk reduction <div></div>   |                                                              | Potential hazard risk reduction <div></div>      |                      | No hazard risk reduction <div></div> |                    |
|-----------------------------------------------|--------------------------------------------------------------|--------------------------------------------------|----------------------|--------------------------------------|--------------------|
| Suitable for further assessment <div></div>   |                                                              | May be suitable as advocacy priority <div></div> |                      | Not suitable in Bancoora CAP         |                    |
| Functional Type                               | Action                                                       | Hazard type                                      |                      |                                      | Open coast erosion |
|                                               |                                                              | Storm tide inundation                            | Permanent inundation |                                      |                    |
| Land management, planning and design          |                                                              |                                                  |                      |                                      |                    |
| Land use                                      | Land acquisition, swap, leaseback                            | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Controlled access                                            | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Planning scheme zone change                                  | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Planning overlays                                            | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Rolling easements                                            | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Removal/relocation of infrastructure                         | <div></div>                                      | <div></div>          | <div></div>                          |                    |
| Resilient Design / Development                | Development setbacks                                         | <div></div>                                      | <div></div>          | <div></div>                          |                    |
|                                               | Resilient design/materials in new/retrofitted infrastructure | <div></div>                                      | <div></div>          | <div></div>                          |                    |
| Cultural landscapes                           | Survey, document, salvage, other*                            | <div></div>                                      | <div></div>          | <div></div>                          |                    |
| Nature Based                                  |                                                              |                                                  |                      |                                      |                    |
| Coastal vegetation and blue carbon ecosystems | Mangrove forests                                             | <div></div>                                      |                      |                                      | <div></div>        |
|                                               | Seagrass meadows                                             |                                                  |                      |                                      | <div></div>        |
|                                               | Saltmarsh                                                    | <div></div>                                      |                      |                                      | <div></div>        |
|                                               | Kelp forests                                                 | <div></div>                                      |                      |                                      | <div></div>        |
| Beach and dune ecosystems                     | Beach and dune protection / vegetation / management          | <div></div>                                      |                      |                                      | <div></div>        |
|                                               | Use of on-site natural materials                             |                                                  |                      |                                      | <div></div>        |
|                                               | Wet sand fencing                                             |                                                  |                      |                                      | <div></div>        |
|                                               | Supported littoral vegetation#                               | <div></div>                                      |                      |                                      | <div></div>        |
| Engineering                                   |                                                              |                                                  |                      |                                      |                    |
| Nourishment#                                  | Localised beach scraping/dune nourishment/reconstruction     |                                                  |                      |                                      | <div></div>        |
|                                               | Beach nourishment                                            | <div></div>                                      |                      |                                      | <div></div>        |
|                                               | Sand by-pass system                                          |                                                  |                      |                                      | <div></div>        |
| Reefs                                         | Shellfish reefs#                                             | <div></div>                                      |                      |                                      | <div></div>        |
| Dredging                                      | Management of channels/dynamics (configuration dredging)     | <div></div>                                      |                      |                                      | <div></div>        |
| Seawalls                                      | Vertical seawalls                                            | <div></div>                                      | <div></div>          |                                      | <div></div>        |
|                                               | Eco-engineering of hard surfaces                             | <div></div>                                      | <div></div>          |                                      | <div></div>        |
|                                               | Rock revetments                                              | <div></div>                                      |                      |                                      | <div></div>        |
|                                               | Geobag revetment / wall                                      |                                                  |                      |                                      | <div></div>        |
|                                               | Rock bag revetment / wall                                    |                                                  |                      |                                      | <div></div>        |
| Groynes                                       | Groynes (rock, geobag, other)                                |                                                  |                      |                                      | <div></div>        |
| Breakwaters                                   | Breakwaters                                                  | <div></div>                                      |                      |                                      | <div></div>        |
| Flood / tidal barriers                        | Levees / dykes                                               | <div></div>                                      | <div></div>          |                                      |                    |
|                                               | Tidal /surge barriers                                        | <div></div>                                      |                      |                                      |                    |
|                                               | Tidal valves on stormwater system                            | <div></div>                                      | <div></div>          |                                      |                    |
|                                               | Saline groundwater intrusion barrier                         |                                                  |                      |                                      |                    |
| Drainage network                              | Upgrade of drainage network                                  | <div></div>                                      | <div></div>          |                                      |                    |
|                                               | Water sensitive urban design                                 | <div></div>                                      | <div></div>          |                                      |                    |
| Road network                                  | Upgrade of road network                                      | <div></div>                                      | <div></div>          |                                      |                    |

\*As led by Traditional Owners

<sup>#</sup>May be considered a hybrid engineering and nature-based action, pending detail of the approach

~ Breamlea Road may act as levee type structure; road upgrades are not within Barwon Coasts' management remit and may be considered as an advocacy for other land managers