

The Cape to Cape Resilience Plan will enable management agencies and communities to proactively manage coastal hazard impacts and increase resilience for coastal areas from Cape Paterson to Cape Liptrap.

Developed over 2 years, stakeholders and communities actively collaborated to create the plan, which provides a roadmap to build resilience across communities and adapt to coastal hazards both now and into the future.

The Resilience Plan aims to:

- Inform future decisions regarding the protection and management of our coast and foreshore
- Inform future land use planning
- Guide management of public utilities / facilities
- Guide the management of areas of environmental and cultural significance
- · Safeguard our coastal values and lifestyle
- Foster collaboration and shared care of our coastline.

Developing the Resilience Plan included:



Understanding **community values and vision** for the future, including cultural values, through extensive engagement.

Understanding **coastal processes** that have shaped the coastline in the past, and what they may look like in the future.



Identifying coastal hazard areas through a **Coastal Hazard Assessment (CHA).**

Understanding **vulnerabilities and risks** to assets, including an **economic base case**.

The plan is a product of the **Inverloch Regional and Strategic Partnership (RaSP).** Established in 2020, the RaSP brings together Traditional Owners and nine agencies with roles in managing the region's coastal and foreshore values, assets and infrastructure.

Approach

The *Marine and Coastal Act 2018*, related Policy, and guiding principles informed development of the plan. The <u>Victoria's Resilient Coast – Adapting for 2100+</u> framework also provided a staged approach for coastal hazard risk management and adaptation.



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





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A plan shaped by community values

Community values, partnerships, and engagement form core components of resilience planning under the framework. The development of the plan has focussed around ten key community values:



Water quality that is safe and reliable for human consumption, recreational use, healthy ecosystems and primary industry

These values have been embedded in all stages of the technical work, informing plan and action development.



The changing coastal landscape

The coastline between Cape Paterson and Cape Liptrap has formed over millions of years. Tectonic movements, wind and wave energy, catchment runoff, sand movement and varying sea levels have all shaped the coast we see today.

These unique landscapes are valued for their ecosystems and habitats, recreational and social value, culturally significant stories, sites and values, and as a driver for economic development of the region. The proximity to the coast and natural beauty of the region makes it a desirable place to live, work and visit.

Coastal hazards

When natural coastal processes impact on the things we love and value in coastal areas, they become coastal hazards.

Coastal hazards considered in adaptation planning for the Cape to Cape region include:

Coastal erosion

Including sand/sediment loss on sandy shores, cliff collapse or slumping



Storm tide inundation

Temporary flooding from the sea and rainfall (catchment)



Permanent inundation

Increasing tidal areas



Groundwater intrusion

Rising water tables and increased salinity



We consider these hazards under varying sea level rise conditions into the future:

| Sea level rise | Indicative horizon | Description | |
|----------------------|-----------------------|-------------|--|
| Mean sea level (MSL) | Present day | Base line | |
| MSL +0.2 m | 2040 | Short term | |
| MSL +0.5 m | 2070 | Medium term | |
| MSL +0.8 m | 2100 | Long term | |
| MSL +1.1 m | 2100 | Sensitivity | |
| MSL +1.4 m | 2100 | scenarios | |

Coastal hazard modelling and mapping

New coastal models (computer-based) were developed to estimate current and future erosion, sea level rise and storm tide inundation hazards for the Cape to Cape region.

Aligning with best practice coastal hazard adaptation studies, a series of scenarios were modelled which incorporated a range of:

- Planning horizons (sea level rise scenarios).
- Coastal hazard 'events' (probabilities).
- Urban and catchment (rainfall) flow events.
- Erosion rates (recent, rapid and longer term).

Different combinations of these variables are used to reflect local current and future conditions that may be experienced across the region.

These scenarios are modelled and **coastal hazard extents** are mapped.



Coastal hazard maps. Source: DEECA

Check out the hazard layers at: mapshare.vic.gov.au/coastkit

Coastal hazard impacts

Once we know the areas likely to be exposed to coastal hazards, we can assess the vulnerabilities and risk for the values, uses and infrastructure in those areas.

We assessed:

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Beach and foreshore assets - Access, stairs, boardwalks, protection structures, beaches

Planning scheme - Zones and overlays

Buildings and facilities - Building footprints (public and private), SLSC, amenities, shelters, park and street furniture

Transport infrastructure - Roads, bridges, crossing, paths and trails

Other infrastructure and utilities - Water, sewer, electricity, telecoms, gas pipelines

Land use, environmental and cultural - Dune system, vegetation, habitat, ecosystems, sensitive sites, cultural areas

Extensive spatial analysis was undertaken to assess which assets (or portions of assets) are exposed to the mapped coastal hazard scenarios.

Coastal hazard risk is assessed based on the:



Likelihood (probability/chance) of exposure to coastal hazards *and*

Consequence (impact) of exposure

Likelihood is estimated for each hazard scenario that was considered, based on the probability of occurrence.

Consequence is determined through a tailored rating of impact. This rating considering community and cultural values, existing risk management approaches, similar assessments nationwide, and RaSP partner input.

Assessing risk and vulnerabilities across the region informs where action may be required to reduce risk to acceptable levels.

| Risk | Action required |
|-------------|---|
| High | Immediate and/or ongoing action required to treat, eliminate, or reduce risk. |
| Significant | Short term action required to treat, eliminate, or reduce risk. |
| Medium | Short to longer term action required to treat, eliminate, or reduce risk. |
| Low | Manage and monitor the risk as part of current operations, provide for periodic maintenance/review. |

The Project also included economic analysis to assess the economic cost of non-intervention (business as usual or doing nothing differently) and a range of case studies to further investigate:



- The value of Inverloch Surf Beach.
- Ecosystem services from blue carbon.
- Access impacts including Cape Paterson-Inverloch Road (Bunurong Road) and Venus Bay-Inverloch Road.



Adapting to coastal hazard risk

The Marine and Coastal Policy 2020 reframed the management of coastal hazards in Victoria, enabling a sustainable and holistic approach to benefit Victoria's coastline in the long term. Under the policy, adaptation options are considered in order of:

1. Non-intervention



Allow marine and coastal processes, and the hazards they may pose, to occur.

redevelopment away from

Enhancing or restoring natural

Structures can be designed to

reduce the exposure to, or decrease the impact of,

coastal hazard risk, thus

'accommodating' the risk.

Existing structures, assets or uses may be decommissioned

or relocated away from areas that are, or will be, negatively

impacted by coastal hazards.

features to mitigate coastal

hazard risk. Includes dune and vegetation enhancement

areas that are or will be

negatively impacted by

Locate new uses,

development and

coastal hazards.

and small scale

renourishment.

2. Avoid



3. Nature-based



4. Accommodate

5. Retreat



6. Protect (major engineering)



Existing physical barriers are enhanced, or new ones constructed, to mitigate the impact of coastal hazards. Includes engineered structures (groynes, seawalls, breakwaters) and major dune and beach renourishment.

Assessment of adaptation options has been guided by:

- The Victorian Marine and Coastal Policy
- Appreciation of risk across locations and emerging risk through time
- Economic assessment and case studies
- Detailed coastal modelling of engineering solutions
- Community and stakeholder perspectives

Actions and pathways

Implementing these options includes many adaptation actions. These actions can be broadly classified into:

- Land management, planning and design
- Nature-based
- Engineering

Detailed decisions about the implementation and timing of actions will be made in line with the normal government policy and budget processes.

Adaptation pathways

Adaptation actions are not mutually exclusive. Often, we require a suite of measures to effectively manage coastal hazard risk. Tailored adaptation pathways provide a roadmap of adaptation actions from present day to 2100+. This approach allows us to:

- Plan strategically for the long term.
- Consider multiple potential futures.
- Avoid short-term actions that may lead to poor adaptation outcomes.

Adaptation pathways include:

- Clear action sequencing, providing confidence to take short-term action.
- Lead times required for further investigations, design and approvals.
- Changing feasibility of actions over time.
- Trigger points when a different action is required.



The actions for the Resilience Plan have three themes:

 Foundational actions Provide strong foundations

Provide strong foundations for strengthening community resilience and success of regional and location-specific initiatives

Regional actions

have relevance across the whole Cape to Cape region (and potentially beyond)

Location-specific actions provide detailed actions for location-specific management. They are dependent on local hazard drivers, values and assets at risk, and environmental processes.

Foundational actions

Foundational actions are about enhancing the adaptive capacity of Cape to Cape stakeholders and 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 regional and locationspecific actions to improve action outcomes.

Foundational actions in the Plan include:



Actively engaging and empowering the community to build coastal hazard resilience.



Facilitating knowledge sharing and education on hazards and adaptation.



Monitoring changes in coastal hazard risk and effectiveness of adaptation.



Boosting collaborative research opportunities and undertaking additional investigations to support adaptation.

Investigating mechanisms, seeking and applying for funding to support implementation of the Plan.



Regional actions

Regional actions have relevance across the whole Cape to Cape region (and potentially beyond). Regional actions look to provide a broader process, method or framework via which many location-specific actions can be achieved.

Some regional actions have specific relevance at particular locations. Implementation of these regional actions helps to coordinate and drive more specific, location-based actions.

Regional actions in the Plan include:



Planning updates to avoid current and future risk, including land use and emergency response planning



Dune, vegetation and ecosystem management and enhancement.



Small-scale, moving to larger scale dune and beach renourishment including identifying sand sources and triggers for nourishment.



Identifying blue carbon opportunities that could enhance ecosystem services.



Planned management approach for culturally significant sites and places.



Redesign and upgrades of infrastructure, including road and utility network and building resilience of private assets.



Developing an approach to planned relocation of both public and private built assets and transition of land uses.



Regional maintenance of coastal protection structures and investigation to support largescale sand sourcing and nourishment.

Location-specific actions

The Cape to Cape study area has been divided into four reporting regions:

- 1. Cape Paterson-Inverloch Road (Bunurong Road)
- 2. Inverloch Surf Beach
- 3. Inverloch (within Anderson Inlet)
- 4. Venus Bay and Tarwin Lower

In addition to the foundational and regional actions, different locations require site-specific adaptation responses to manage localised risk.

Providing location-specific management, these actions are dependent on local hazard drivers (i.e. erosion or inundation), values and assets at risk, and environmental processes.

Cape Paterson-Inverloch Road (Bunurong Road)

Cape Paterson-Inverloch Road is the primary thoroughfare connecting the Inverloch and Cape Paterson townships. The road is an important asset providing scenic views of the sandy coves, rock platforms and cliffs, and access to pocket beaches for visitors to explore. Many utilities and services also run along the road. This region will be impacted by erosion and storm tide inundation, with exposure and risk likely to increase into the future.

Cape Paterson-Inverloch Road (Bunurong Road) coastal hazard risk profile:

| SLR | 0.0 m | 0.2 m | 0.5 m | 0.8 m |
|----------------------|---------|-------|-------|-------|
| Indicative time | Present | 2040 | 2070 | 2100 |
| Erosion | Med* | Med | Sign* | Sign |
| Storm tide | Med* | Med* | Med | Med |
| Permanent inundation | Low | Low | Low | Low |

*At some locations within the reporting area.

The preferred pathway for Cape Paterson-Inverloch Road involves accommodating risk, then retreating into the future.*





Considerations for this pathway include:

- Retains sandy beach and natural amenity good ØÅ alignment with community values.
- Requires retreat mechanism/strategy tini) development.
- Maintains localised access to key assets and attractions.



No longer a full coastal route from Inverloch to Cape Paterson, but potential opportunity for cycling or walking trails in transition periods.

Adaptation approach must integrate works for road and wastewater networks.

Immediate actions to implement this pathway include:



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Developing a targeted retreat response. Includes triggers and approach for utilities, roads, wastewater services and private properties.



Minimising dune disturbance and enhancing vegetation and habitat connectivity through allowing space for ecosystem transition.



- Reviewing at-risk infrastructure and embedding coastal risk information in asset management.
- Upgrading key assets to accommodate risk in the short term, while a retreat approach is developed.

Maintaining existing coastal hazard protection structures, while retreat approach is developed.

Inverloch Surf Beach

Renowned for its natural amenities and coastal seascapes, Inverloch Surf Beach is a major tourist destination, drawing in beach users, avid surfers and holidaymakers during peak summer seasons. It supports a range of recreational values such as swimming, surfing, boogie boarding, relaxing, walking and bird watching.

The Surf Beach is exposed to high energy open ocean south-westerly and south-easterly swells originating from Bass Strait. This region will be impacted by erosion and storm tide inundation. These combined hazards mean risk is likely to increase significantly.

Inverloch Surf Beach coastal hazard risk profile:

| SLR | 0.0 m | 0.2 m | 0.5 m | 0.8 m |
|-------------------------|---------|-------|-------|-------|
| Indicative time | Present | 2040 | 2070 | 2100 |
| Erosion | Med* | Med* | Sign* | High |
| Storm tide | Low | Med* | Med | Med |
| Permanent inundation | Low | Low | Low | Low |

*At some locations within the reporting area.

The preferred pathway involves nature-based methods, then protection through sand buffers, then retreating into the future in some locations.*





Considerations for this pathway include:

- Allows community to retain a sandy beach and 9 natural amenity for as long as possible.
- Requires retreat mechanism / strategy Í development.
- Allows natural processes and retains natural setting QP and appeal of the Surf Beach.



Less impacts on surrounding marine and coastal environments by not using large, engineered structures.

Immediate actions to implement this pathway include:



Developing a targeted retreat response. Includes triggers and approach for surf life saving club, utilities, roads, and private properties.



Minimising dune disturbance and enhancing vegetation and habitat connectivity through allowing space for ecosystem transition.



Medium-scale, moving to larger scale sand renourishment to enhance dunes and protect infrastructure (roads, SLSC, assets).



Utilising nature-based approaches to recognise and protect cultural values and heritage sites.



Reviewing at-risk infrastructure and embedding coastal risk information in asset management.



Investigating waterway dynamics and drainage options at Wreck Creek to manage flooding risk.



Maintaining existing coastal hazard protection structures (geobag wall) in the short term, while retreat approach is developed.



Inverloch township (within Anderson Inlet)

The Inverloch township is situated within Anderson Inlet, Victoria's largest open barrier estuary. The landscape across the Inlet varies and encompasses sand beaches, engineered coasts, mangrove and saltmarsh communities. The area is valued for varied recreational beach and water activities.

This region will primarily be impacted by storm tide and permanent inundation, with small areas of the foreshore also likely to be impacted by erosion. Channel migration will likely drive some erosion inside the inlet.

Inverloch township coastal hazard risk profile:

| SLR | 0.0 m | 0.2 m | 0.5 m | 0.8 m |
|----------------------|---------|-------|-------|-------|
| Indicative time | Present | 2040 | 2070 | 2100 |
| Erosion | Med* | Med* | Med* | Sign |
| Storm tide | Low | Med* | Med | Med |
| Permanent inundation | Low | Med* | Med* | Sign* |

*At some locations within the reporting area.

The preferred pathways are split into:

- Natural areas within Anderson Inlet (including creeks)
- Holiday Parks / foreshore camping area
- Pymble Avenue picnic/barbecue area, dog beach.

Preferred pathways for Inverloch township (within Anderson Inlet):



Considerations for these pathways include:

- Retains natural setting and increases natural buffer / resilience by making space for nature- good alignment with community values.
 Avoids future risk through improved planning and development controls that consider coastal hazards.
 Requires retreat mechanism/strategy development.
 Maintains local facilities (picnic areas and holiday parks) for as long as possible.
- Adap
 utility

Adaptation approach must integrate works for road, utility networks, holiday parks and private properties.

triggers, approvals and funding.

| Now Natural areas within Andersons Inlet (incl. creeks) | Holiday Park Now NATURE-BASED and | Pymble Avenue picnic and barbecue area/ Dog Beach | |
|--|--|---|--|
| NATURE-BASED transitioning to RETREAT Trigger reached | ACCOMMODATE expanding to, then transitioning to RETREAT | NATURE-BASED with ACCOMMODATE (asset raising /resilience) and RETREAT* then transitioning to RETREAT | |
| (local) | OR/ Trigger reached | Foreshore enhancement | |
| Immediate actions to implement these | Immediate actions to implement these | Now /access control | |
| Enhancing ecosystem connectivity and allowing transition by making space for nature. Includes coastal wetland areas and Ayr, Screw and Pound creeks. | Establishing a continuous vegetation buffer and minimising foreshore disturbance through formal access points, controls and fencing. | Retreat targeted built assets including shelter and temporary rock bag wall >0.2 m SLR (by 2040) OR/ Trigger reached >0.5 m SLR (by 2070) OR/ Trigger reached | |
| Facilitating saltmarsh and mangrove protection and enhancement. | Upgrading key assets (including roads and utilities) to accommodate | Immediate actions to implement these pathways include: | |
| Developing long-term plan for transition of rural areas at risk of inundation to wetland ecosystems. | Advocating/promoting resilient home upgrades and design for private properties, the Holiday Park and foreshore camping built assets. Developing a planned retreat response for the Holiday Park / foreshore camping and its services. Includes triggers, approvals and funding. | Establishing a continuous vegetation buffer and minimising foreshore disturbance through formal access points, controls and fencing. Upgrading key assets (including roads, utilities and boat ramp) to accommodate risk in the short term, while a retreat approach is developed. Developing a planned retreat response for the temporary rock bag wall, timber seawall and at risk assts (including conducted) | |

Venus Bay and Tarwin Lower

The region supports extensive freshwater, estuarine and coastal habitats across Anderson Inlet and the Tarwin River. This region also covers the large dune barrier system along Venus Bay and Cape Liptrap Coastal Park. The natural environment is a big drawcard for living in these communities.

The area is exposed to inundation hazards, with risk likely to increase into the future. Erosion is likely to impact the open coast dunes/beaches (which provide some natural buffer) and small areas of Inlet coastline.

Farmland and saltmarsh areas surrounding Anderson Inlet are likely to be more regularly or permanently inundated. Some estuarine vegetation communities have capacity to naturally migrate inland, where physical barriers (levees, roads) do not limit migration.

Venus Bay and Tarwin Lower coastal hazard risk profile:

| SLR | 0.0 m | 0.2 m | 0.5 m | 0.8 m |
|----------------------|---------|-------|-------|-------|
| Indicative time | Present | 2040 | 2070 | 2100 |
| Erosion | Low | Low | Med | Med |
| Storm tide | Med | Med | Sign | Sign |
| Permanent inundation | Med | Med | Sign | Sign |

The preferred pathway involves nature-based methods and accommodating risk, with some protection, then retreating in some locations, in the future.





Considerations for this pathway include:

Allows natural migration of important coastal and estuarine ecosystems Requires further planning and investigations for × YX X road network and options for raising, protecting or rerouting the road. B Maintains access to coastal communities for as long as possible.



Immediate actions to implement this pathway include:

Minimising dune disturbance and enhancing saltmarsh and mangrove habitat connectivity through allowing space for ecosystem transition.

Accommodating risk through road and utility upgrades to allow services to continue.

Developing a tailored planned retreat approach for inundation-prone private assets (land and built).

Developing a targeted retreat response (including triggers and approach) to redesign the Inverloch-Venus Bay Road network (north of Tarwin Lower).

Undertaking additional flooding assessments across Anderson Inlet and the Tarwin River to determine potential action impacts on hydrology.

Protecting road access through a raised road and armoured levee for Inverloch-Venus Bay Road (between Tarwin Lower and Venus Bay).





Implementing the Plan

The Cape to Cape Resilience Plan will be implemented through a range of mechanisms including:



An effective Monitoring, Evaluation, Reporting and Improvement (MERI) approach, to enable adaptive management and continual learning and improvement.

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Embedding outcomes and actions from the Resilience Plan into existing processes and activities of each RaSP agency.



Implementing new initiatives from the Resilience Plan.



Collaborating and coordinating with RaSP members on action delivery.



Collaborating with State Government and advocating for collaborative delivery of actions and policy to support action delivery.

An Implementation Plan has been developed in collaboration with the RaSP agencies. Outlining the operational application of the Resilience Plan, it provides detail on the responsible, delivery and supporting partners for each action.

Detailed decisions about the implementation and timing of actions will be made in line with the normal government policy and budget processes.

Monitoring, evaluation, reporting and improvement



Monitoring will include both monitoring of physical changes on the coast and plan implementation. This might include funds expended, actions implemented, levels of engagement or benefits/outcomes delivered.



Evaluation of the Plan will consider its impact, effectiveness, appropriateness, efficiency and legacy. Evaluation metrics, which may be based on monitoring data, will be used to evaluate the plan and may trigger a review.



Reporting on overarching Plan implementation will be DEECA's responsibility. This includes annual reporting on the Resilience Plan actions and other reporting metrics. Individual organisations will report on actions through their own internal processes.



Improvement of the Plan will be undertaken through a review every 5 years or when a review trigger occurs. This review will consider the successes of the Plan implementation and opportunities for improvement. This review may be in response to changing physical conditions, changes in policy, new information/data and/or changes to stakeholders and community governance and perceptions/tolerance of risk.

Next steps

This Resilience Plan represents the start of an ongoing process of planned adaptation over time. All stakeholders and community members, including residents, visitors, and workers in the region, share the responsibility of adapting to coastal hazards.

This Plan marks the initial stage of an ongoing process of planned adaptation. Adaptation pathways will be continuously refined, updated, and implemented as new information, knowledge, and community aspirations emerge.

Adaptation pathways will be continually informed by stakeholder and community input and ideas, new knowledge and monitoring the effectiveness of actions.





We acknowledge Victorian Traditional Owners and their Elders past and present as the original custodians of Victoria's land and waters and commit to genuinely partnering with them and Victoria's Aboriginal community to progress their aspirations.



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