WATERLINES

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

protecting coastal communities

STEVE CLARK
Managing Director

Welcome to our latest issue of **Waterlines**

I hope the Christmas and New Year break has been restful and a time with family and friends for as many of us as possible. At the same time, I know that COVID, our opening up and the wave of infections that is currently occurring will continue to impact on our colleagues, friends and families. I know that we all sincerely wish, and are working towards making 2022 a better year for all of us!

While COVID has been the overwhelming issue in the media during 2021, climate change and it's effects is no less important or urgent as an issue to be addressed. While it's impacts are becoming more evident around the globe, and particularly in coastal environments, our work has never been more critical. Profound change, requiring a shift to greener and more sustainable practices that benefit communities and improve our vulnerable planet has never been more urgent.

As we reflect on our year, I would like to extend my sincere appreciation for the daily diligence, dedication, and exceptional professional expertise the Water Technology team demonstrates.

This edition is an example of the team's efforts supporting our clients to address a range of coastal management challenges. You will read how our passionate team have delivered innovative, long-term solutions to protect our coastal communities and to design coastal infrastructure solutions for future generations, including:

- Managing and mitigating against the impacts of coastal erosion
- A seawall upgrade for a port expansion
- Coast Zone Management Planning

Thank you for taking the time to read Waterlines and I'd like to extend good wishes to everyone for 2022! Please do not hesitate to contact me or any of the Water Technology team at any stage if we can be of assistance.

Buffering against storms and rising sea levels

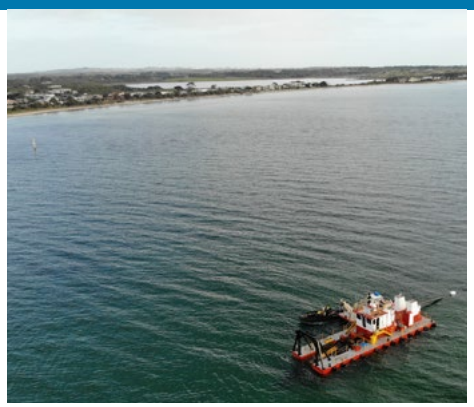
BELLARINE BEACH NOURISHMENT

The North Bellarine beaches are experiencing erosion, impacting the foreshore and recreational assets. This erosion is due to the combination of natural processes, severe storms and rising sea levels attributed to climate change. The Victorian Department of Environment Land and Water Planning (DELWP) commissioned Water Technology to design and provide superintendent services for beach nourishment works along the Bellarine Peninsula. This project is funded by the Victorian Government's $8 million Port Phillip Bay Beaches Renourishment program.

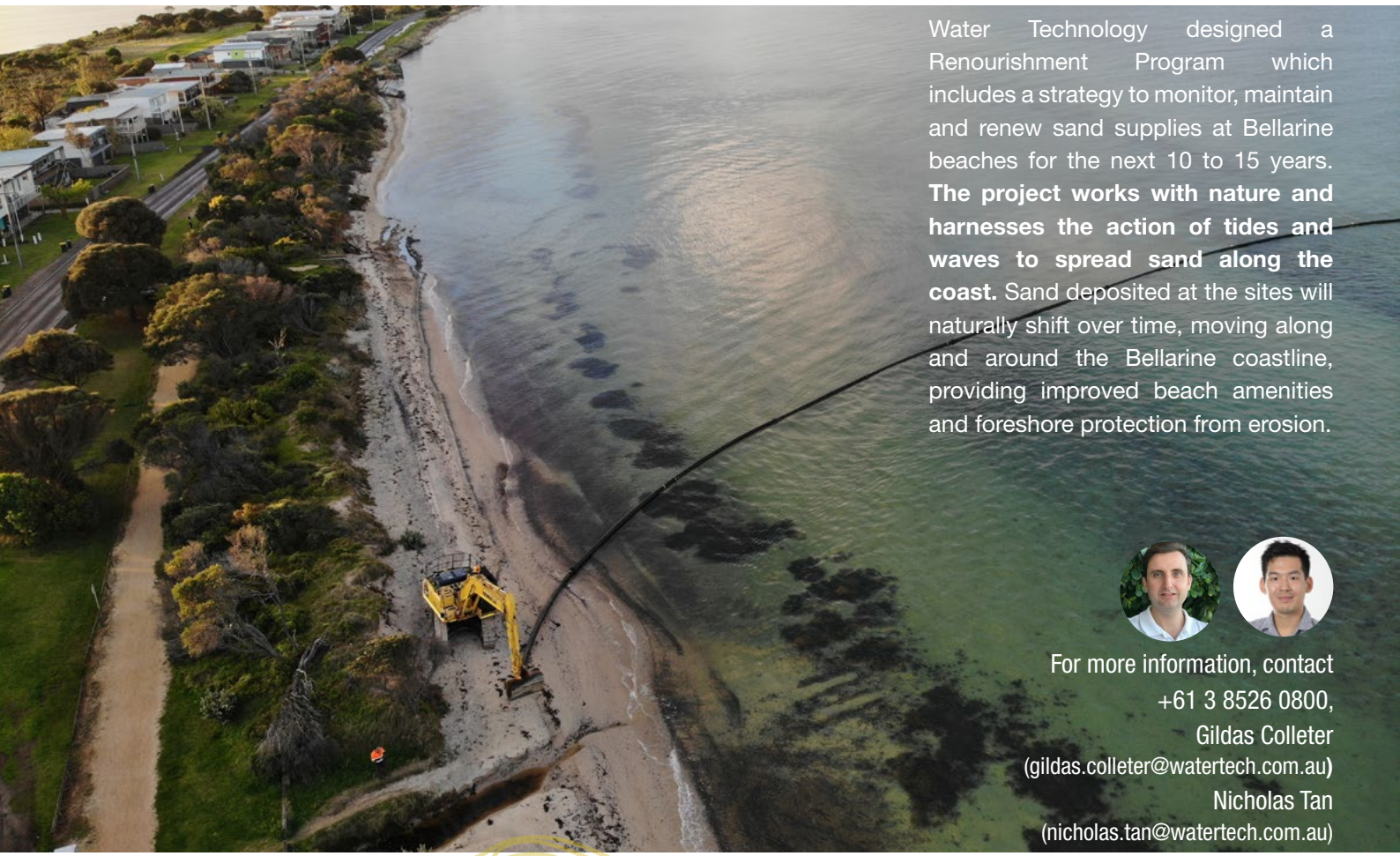
Six Bellarine beaches were selected for renourishment works following an independent assessment of Port Phillip Bay in 2019.

- Anderson Reserve
- Indented Head, Taylor Reserve
- Indented Head, Wrathall Reserve
- St Leonards North
- St Leonards
- St Leonards South

The sand renourishment will immediately buffer storms and rising sea levels, **safeguarding critical assets and infrastructure along the coastline**. Increasing the width of the beaches by approximately 15 metres,



the works will provide up to ten years of protection for these vulnerable sections of the coastline. The new sand will be sourced from coastal sites on the Bellarine Peninsula, where excess sand has built up over the last five years.



Water Technology designed a Renourishment Program which includes a strategy to monitor, maintain and renew sand supplies at Bellarine beaches for the next 10 to 15 years. **The project works with nature and harnesses the action of tides and waves to spread sand along the coast.** Sand deposited at the sites will naturally shift over time, moving along and around the Bellarine coastline, providing improved beach amenities and foreshore protection from erosion.

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Bridgewater Bay
Waterfront Upgrade

Much-needed upgrades at the iconic coastal hamlet at Cape Bridgewater have been eagerly anticipated by the seaside community. They have been on the Council's advocacy list for a decade. The upgrades will ensure access and long term coastal protection and provide critical infrastructure for the burgeoning tourism hotspot.

In early 2020, the Glenelg Shire Council successfully secured $1.5 million from The Victorian Government through the Victorian Building Works package, with the Cape Bridgewater works to form part of the Cape Bridgewater Master Plan Infrastructure Upgrade.

Water Technology was engaged to provide design services for the renewed foreshore amenities at Bridgewater Bay and technical support during the comprehensive stakeholder and community consultation process.

The Infrastructure Upgrade includes:

- The reconstruction of a dilapidated foreshore rockwall to manage beach storm erosion to 2100. The upgraded rockwall incorporates two all-ability access ramps, two vehicle ramps, five access stairs, and sitting platforms.
- A viewing platform above a nearshore limestone reef.
- Restoration of sensitive dunes, sand fencing, revegetation and formal beach entrance points.
- Sealed car parking facilities between the Café and the Surf Life Saving Club and pedestrian linkages along Bridgewater bay beach.

foreshore protection

Water Technology designed the foreshore works to preserve and enhance the outstanding natural attributes of the site.

The design considers the aesthetic and natural textures of the nearby limestone reefs. Consequently, a palette of natural material (limestone, sandstone, bluestone) was employed to control the works' texture and colour.

The coastal works meander along the beach, with several micro embayments located along the seawall. **These embayments promote the restoration of beach vegetation and assist in collecting and managing wind-blown sand.** An interlocked "turtle shell" finish is applied on the seawall to interface with the sandy beach. The parametric placement of sandstone blocks along the viewing platform raises the nearshore limestone platform reefs over the beach. The viewing platform was modularised to facilitate construction and reduce cost.

Glenelg Shire Council engaged Mibus Bros Contractors to undertake and construct the foreshore works. Water Technology is providing superintendent services to deliver a high-quality project for generations of the community to enjoy and love.

Water Technology will also be working with consultancy Urbis to deliver the next stages of the project, which includes the renewal of onshore infrastructures such as shared paths, car parks, and the amenity block's modernisation.

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SHORELINE EROSION AT AMITY POINT
A Complex Challenge

The picturesque township of Amity Point is located at the north-eastern point of North Stradbroke Island, Queensland, Australia. The town's foreshore is subject to a process called retrogressive flow slides, threatening residences and foreshore property. While the cause of these slide events is not well understood, the Amity Point community has been informally managing this erosion threat for years through a system of placing rocks from the local quarry at the foreshore in what is called a Flow Slide Barrier. Whilst not following the same construction and design principles of a normal seawall, over time these works have provided sea wall style protection and effectively protected the foreshore from storm wave action.

Redland City Council engaged Water Technology to undertake a Shoreline Erosion Management Plan (SEMP) that recognised the Flow Slide Barrier as a sufficient coastal protection structure and recommended maintaining the structure. Redland City Council accepted the recommendations and re-engaged Water Technology to scope a strategy for implementation of the SEMP. Consideration was given to the significant complexity around the implementation of the SEMP due to the various land tenures, planning legalities, native title, access and cost implications.

Water Technology developed an Implementation Plan in consultation with all stakeholders, including State, Council and several local residents, that sets out how the SEMP recommendations can be executed. The key aspect that shaped the plan's development was the desire of the large majority of all parties to maintain the ownership and maintenance responsibility of the structure, as was the case in the previous decades. In order to progress with the recommendations of the Implementation Plan, Water Technology and Council are currently working on a Preliminary Approval which will provide the framework for the individual landowners to progress with their Development Applications.

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Coastal Zone MANAGEMENT PLANNING

NSW Coastal Management

There has been a period of significant transformation for coastal and estuary management in New South Wales. With the rollout of the State's new coastal management framework, most Councils across NSW are now embarking upon developing Coastal Management Plans (CMPs) that will lay out how they plan to manage their "coastal zone" for the next decade.

The development of CMPs involves addressing the various risks and pressures facing the coastal zone and harnessing opportunities to protect and enhance the beautiful natural resources of the coast. However, "the coastal zone" is a broad term and covers not just the states 2,000 km of coastline but over 180 estuaries that punctuate the region.

At Water Technology, we have been involved in many CMPs that span both open-coast and estuarine environments. In doing so, we have been able to apply our expertise and insights in some very different and innovative approaches.

Open Coast Hazards

The last few years have been relatively stormy by historical standards – with major coastal erosion events recorded along the coast in 2016, 2020 and 2021. Erosion hotspots like Byron Bay, Wamberal and Collaroy have all felt the pinch, leaving local and State Governments with a renewed emphasis on managing coastal hazards. With future sea-level rise and climate change impacts, it is crucial to start thinking about how we manage our coastline to adapt to current and future hazards.

We recently undertook a study for Shoalhaven City Council (on the south coast), identifying adaptation pathways for some of their "at-risk" coastal infrastructure. This required consideration of erosion mechanisms and coastal sediment transport (we are sand nerds, after all) and included a detailed economic analysis to ensure that decision-making

was backed up by a sound understanding of financial costs and benefits over time. This is particularly important when considering traditional hard protection structures with alternative "nature-based" solutions such as coastal dune management and beach nourishment. We presented our innovative approach to cost-benefit analysis at the NSW Coastal Forum late last year.

We have recently been engaged by Shoalhaven City Council to undertake a CMP for their 165 km of open coastline and are looking forward to helping guide the future of some of the states most breath-taking natural environments.

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Estuary Management

Integrated estuary management requires a "systems" approach that recognises that many risks to estuary health begin upstream across the catchment. Proactive and equitable engagement with stakeholders is crucial to achieving positive outcomes. In practice, this approach involves coordination with many stakeholders of differing roles and responsibilities across the wider catchment.

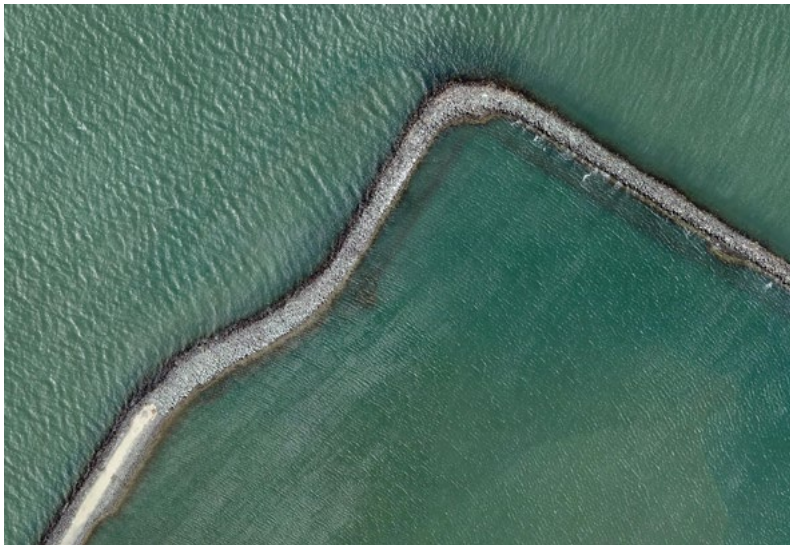
Water Technology's recent work in Coffs Harbour (on the mid-north coast) for the Woolgoolga Region Estuaries CMP is a good example of this approach. With a need to focus on urban, industrial, and agricultural land use impacts – the CMP has involved engagement with the local community, traditional owners' groups, agricultural industry groups, Coffs Harbour City Council, and over ten different state government agencies. Using a highly collaborative approach, the CMP has been an excellent opportunity to improve coordination between stakeholders, and work together to achieve the shared goal of protecting and enhancing our estuaries.

This CMP is due for completion in early 2022 and will provide innovative ways to address estuary health risks, protect the natural environment, and preserve indigenous cultural heritage.

Port of Brisbane

Future Port Expansion Seawall Upgrade

The Future Port Expansion (FPE) rock revetment seawall at the Port of Brisbane was built in 2005 on top of very soft marine clays. The structure was designed to settle over time, and regular top-ups have been required. The first top-up occurred in 2013, with another top-up now needed. Working closely with Golder, a geotechnical consultant, condition and risk assessments were undertaken to understand the current and future risk exposure, followed by repair design.



The condition assessment provided a detailed understanding of the FPE seawall's performance after settlement of up to 3 m. The seawall has undergone significant geometrical changes due to the settlement, reducing the resulting crest width and level. Despite the considerable movement of the seawall due to the settling, the structure is classified as fair to marginal.

The risk assessment focused on the risk from wave overtopping, potentially impacting the structural performance of the FPE seawall, and on wave transmission over the seawall, potentially impacting internal bund walls and fill. The risk assessment was undertaken for present-day through to 2030 to assess when the risk changes to an intolerable level. It was concluded that upgrade works in the form of crest raising were required as soon as possible to minimise potential risks.

The repair design had to consider the change of the FPE seawall from an emergent structure shortly after raising the crest to a partially submerged structure after further settlement had occurred. Most importantly, the repair design had to optimise geotechnical, coastal and constructibility aspects to determine the most efficient design that would provide a design life of approximately ten years or longer. This was achieved by geotechnical and coastal engineers working closely together with Port of Brisbane, and by having early contractor involvement.

Two top-up options have progressed to detailed design. Both options have been presented considering the reduced need for future repairs, calculated cost minimisation and lower risk from a geotechnical stability perspective. The works are currently being tendered, and construction start is envisaged in the coming months.

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Mindarie Marina
Improving Breakwater Structure and Sa

Mindarie Marina is 35 km north of Perth, Western Australia. In 2005 the City of Wanneroo took over management responsibility for the Mindarie Breakwater structures. Due to their age and design, the structures presently require significant maintenance, with ongoing issues identified. These affect the condition and functionality of the structures and present a significant public safety issue.

The breakwater structures, consisting of the main breakwater and spur groyne, were constructed in 1988. These structures create calm waters inside the marina for boat launching, mooring and mitigating coastal erosion and flooding hazards to the marine precinct, including parking, roads, pedestrian pathways, residential properties, and the commercial businesses.

The City of Wanneroo commissioned Water Technology to investigate the maintenance options for the Mindarie Breakwater structures that will reduce the likelihood of failure and improve public safety. Options were considered to extend the design life of the breakwater and spur groyne.

To comprehensively address the project priorities, the study was divided into four stages:

Stage 1 included *Data Collection and a Desktop Review* in June 2019. Four detailed condition assessments were undertaken; an above water condition, a below water dive inspection, a hydrographic survey, and a desktop review of geophysical investigations and historic inspections of works.

Stage 2 provided an *Options Assessment and Design Basis* for the breakwater and groyne in November 2019. Calibrated numerical modelling was used to generate the design criteria for each identified breakwater segment concept design. Cost estimates, a multi-criteria analysis, and recommendations for the further design of the preferred options to repair the structural defects were developed and assessed separately for each segment. Structure design continuity and possible benefits from combining repair work for adjacent sections were provided to ensure design continuity.

Stage 3 presented the *Detailed Design* in September 2021. The detailed design incorporated updated wave and water level design conditions using collected metocean data, testing the proposed

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designs via physical modelling to investigate, and optimising key design parameters to increase confidence that the primary design requirements will be satisfied. The findings of an updated geophysical assessment were included in the detailed design. A geotechnical assessment of the proposed design and construction loading, including the placement of armour and use of heavy plant and equipment; incorporate outcomes into the detailed design. A *Risk Assessment* of the final detailed design, including a *Safe Design Report* with a construction risk register, a *Monitoring and Maintenance Plan*, *Cost Estimates* and *Detailed Design Drawings*, and a *Technical Specification for Construction*, round out the Stage 3 deliverables.

Stage 4 will provide the *Tendering and Construction Support* scheduled for the Summer of 2022-23. The design has prioritised works based on the current structure condition and available funding. Construction access is a significant constraint, so the design has focussed on ensuring constructability whilst meeting the aim of reducing the likelihood of failure and improving public safety. The majority of the structure will see an increased crest level and reinstating armour to present-day construction and design practices.

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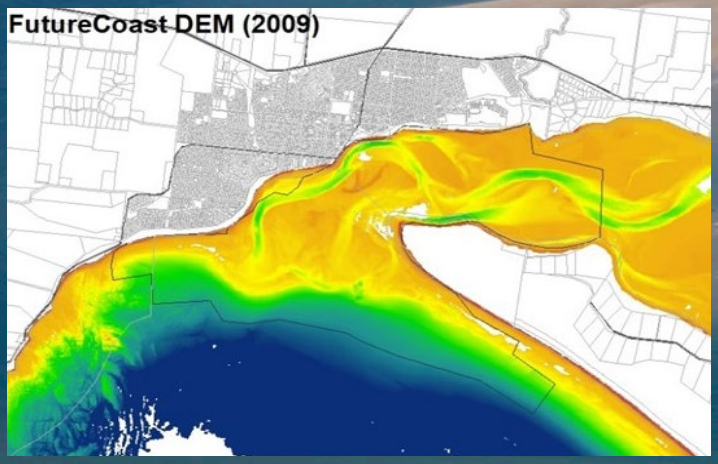
INVERLOCH REGION COASTAL HAZARD ASSESSMENT

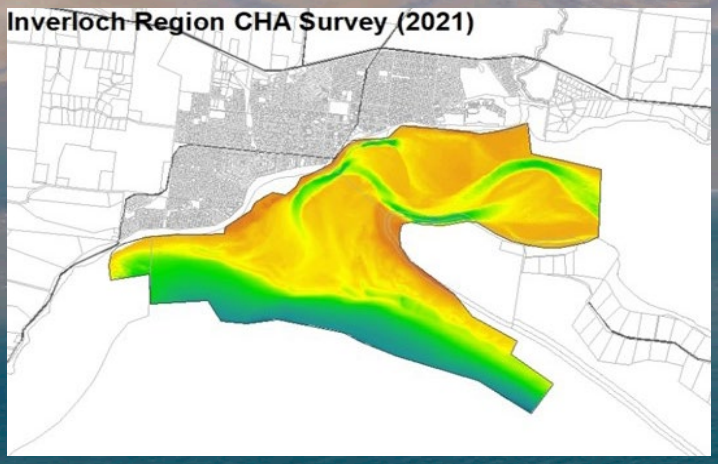
Causes and Risks of Erosion

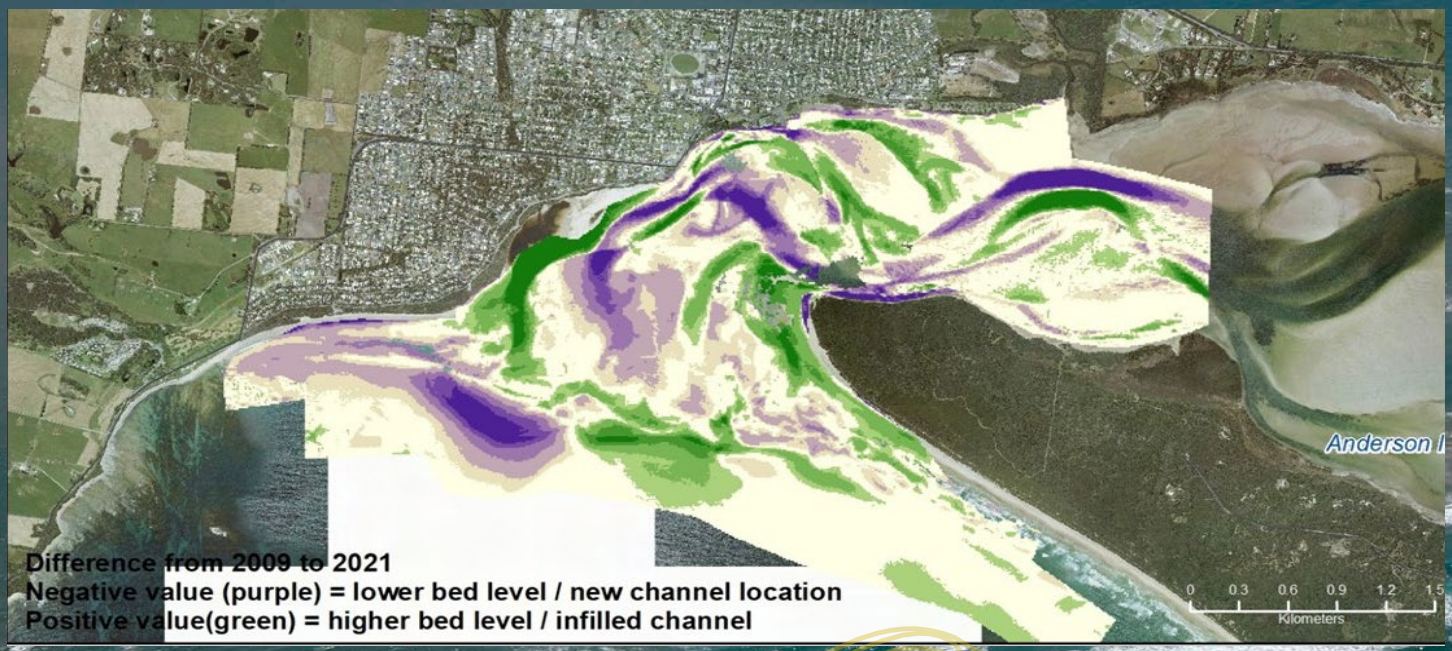
Water Technology has been working with the Victorian Department of Environment, Land, Water and Planning to undertake a Coastal Hazard Assessment (CHA) for the coastline between Cape Paterson and Cape Liptrap in South Gippsland, Victoria.. The CHA is a key piece of work for the Cape to Cape Regional and Strategic Partnership (RaSP), investigating the coastal environment and providing understanding to the causes and risks associated with the erosion at Inverloch both now and into the future.

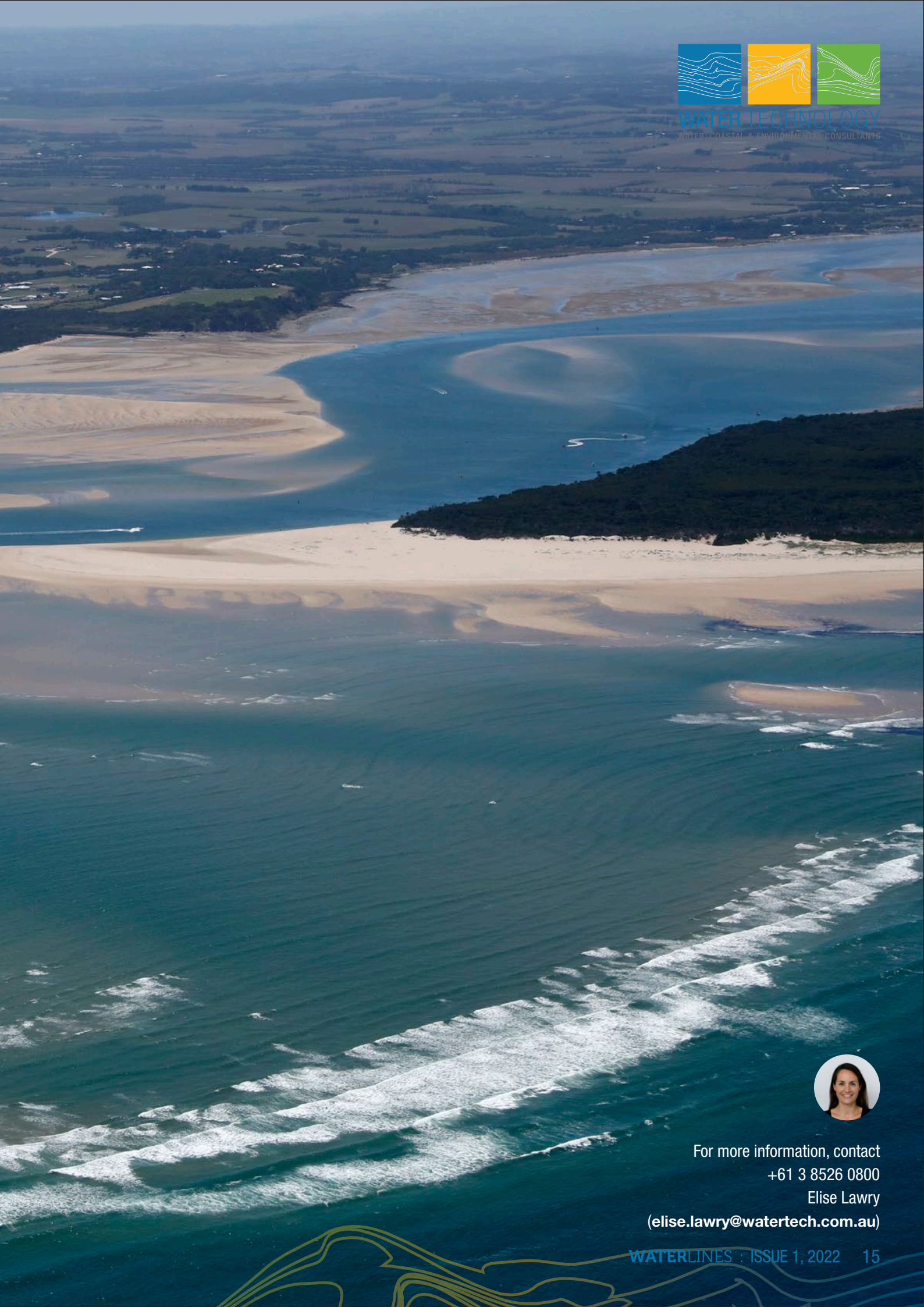
The project, which has included the capture of bathymetric survey through the complex entrance to Anderson Inlet, measurement of tides at Inverloch and Tarwin Lower amongst a raft of other data capture, is well into the assessment of coastal drivers along the shoreline. A recent presentation to the community provided an update of progress and a snapshot of some of the early findings, including net sediment transport along the open beaches and discussion of changing weather patterns and their potential impact on coastal sediments and estuarine configuration.

With numerical models crunching simulations assessing storm tide inundation, erosion setback and sediment dynamics through the entrance, we look forward to delivering more understanding to the RaSP in the coming months.









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