BRIBIE ISLAND EROSION AND BREAKTHROUGH

Independent expert review pursuant to the Terms of Reference

PART 2 - RECOMMENDED IMMEDIATE OPTIONS

Issues, Options & Actions

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We acknowledge the Traditional Owners throughout Australia and recognise their continuing connection to land, waters, and community. We pay our respect to them and their cultures and to Elders past and present.

ACKNOWLEDGEMENT OF COUNTRY

PREFACE

Part 1 of this report series (Desktop Review) explored the long-standing history and awareness of coastal erosion and the risk of a breakthrough at Bribie Island, as well as the actions proposed, rejected, or taken in anticipation of such an event. It also introduced compounding factors such as climate change and projected sea level rise.

This report, Part 2 (Recommended Immediate Options) shifts the focus to the present, examining the complex conditions that have emerged since the 2022 breakthrough. This section outlines a framework of challenges, aiming for a holistic but accessible understanding that can support broad stakeholder agreement.

Like Part 1, it is intended as a 'progress document' and is considered an options report, not a design report. The recommendations provided are intended to be sufficient to initiate actionable items, which are discussed in greater detail in later chapters.

The issues presented in this report are not exhaustive; they reflect the input and observations gathered to date and will continue to evolve through public consultation and technical review.

As part of the process, this report has been reviewed and informed by a Technical Working Group (TWG) comprised of representatives from relevant government agencies, regulatory bodies, and council officers. While not every comment has resulted in a definitive answer within this stage, every effort has been made to incorporate relevant guidance, provide clarification when needed, and acknowledge areas requiring further investigation. This includes open-ended and essential questions such as: *Who will be responsible for implementing and maintaining the works? How will the proposed solutions be funded and governed?*

These unresolved aspects do not diminish the urgency to act. The purpose of this report is to recommend immediate, low-risk interventions that can begin to relieve pressure on the Pumicestone Passage system, both its ecological functions and the surrounding community, and begin the shift from reactive to proactive adaptation.

In reviewing immediate solutions, we consider the evolution of the site in three phases:

- Pre-Breakthrough #1 (pre-2022)
- Post-Breakthrough #1 (2022-2025)
- Post-Tropical Cyclone Alfred (March 2025)

It is important to acknowledge that even the pre-Breakthrough #1 condition was not an 'ideal' or sustainable long-term state. There were already significant concerns over sea level rise, coastal erosion, and sediment imbalance. This report does not seek to solve all the issues within the system, many of which are deeply interconnected and long-standing. Rather, it aims to focus on what can be achieved immediately to stabilise the system and create space, both environmentally and institutionally, for longer-term planning and more comprehensive solutions.

Our Terms of Reference include "developing urgent recommendations to stabilise the situation for consideration by Government." To achieve this, we undertook a targeted assessment of site conditions using available data (including council plans, technical reports, community-supplied imagery, and on-ground observations). We identified and prioritised key issues, evaluated a range of potential responses, and tested each against criteria including feasibility, constructability, cost, timeframe, environmental constraints, and stakeholder alignment. This report is focused on the recommended approach.

Timing of recommended works is indicative.Normally, a project of this scale and complexity would require significant time and resources for detailed design and modelling. Given the condensed timeframe and urgency, particularly with the next storm season approaching, we've taken a pragmatic, low-risk approach: to reinstate the system to a state like post-Breakthrough #1 (but pre-TC Alfred) as a transitional step.

This is a pilot-style approach: an agile, nature-based intervention designed to be monitored, maintained, and adapted. The goal is to absorb lessons through implementation and use them to inform more robust designs and policies in future phases. The intent is not to stop here, these immediate works must be followed quickly by appropriate longer-term planning, including additional actions/works, as well as optimising management arrangements to ensure forward sustainability.

It is also critical to note our key assumptions:

- These immediate works are not permanent solutions, they are stepping stones to longer-term adaptation
- Works must be actively monitored and managed during and after implementation
- New coordination mechanisms between agencies may be needed to support maintenance and long-term management

We recognise that no single solution will meet all stakeholder expectations or resolve every challenge. The goal of this report is to drive meaningful progress, providing a first step toward longer-term resilience. It aims to balance urgency with caution and aligning near-term action with long-term vision.

To support broader understanding and engagement, we introduce a simplified strategic framework: Transition, Mitigate, Enhance:

- **Transition** reflects a “do nothing” or passive posture
- **Mitigate** aligns with existing Sunshine Coast Regional Council (SCC) strategies such as the Shoreline Erosion Management Plan (SEMP) and Coastal Hazard Adaptation Strategy (CHAS), which favour soft interventions and local adaptation
- **Enhance** involves more direct interventions, such as partial or full island restoration, engineered entrances, and larger-scale infrastructure

Two geographic areas are considered for action:

- **The Island** (historic northern tip of Bribie Island)
- **The Passage** (within the Pumicestone Passage and mainland foreshore, including Golden Beach and Diamond Head)

Actions in one area will invariably influence the other. For example, previous policies of non-intervention on The Island have triggered the need for foreshore works in The Passage. Conversely, appropriate entrance interventions may increase the effectiveness of flood and erosion mitigation tools across the broader system.

In summary, Part 2 marks a shift from understanding to action. It proposes practical steps to reduce system stress while building capacity, technically, environmentally, and institutionally, for the longer-term solutions that must follow.

Figure 1: Two geographic areas defined for action planning - ‘The Island’ and ‘The Passage’

EXECUTIVE SUMMARY

Background

A sequence of significant breaches along northern Bribie Island - Breakthrough #1 (BT#1) in 2022, Breakthrough #2 (BT#2) in March 2025, and the currently forming Breakthrough #3 (BT#3) - has profoundly reshaped the coastal dynamics of the Pumicestone Passage. These events have amplified wave energy, widened tidal channels, and increased exposure of both mainland infrastructure and marine ecosystems to erosion, inundation, and ecological stress. Following Breakthrough #1, mean high-water levels rose by more than 0.23 metres, surpassing the Stage 3 risk threshold established in the Sunshine Coast Council's Coastal Hazard Adaptation Precinct Planning (CHAPP, 2021).

More recently, in the aftermath of Tropical Cyclone Alfred, Council has observed further increases in tidal levels, approaching those of open ocean conditions exceeding the design capacity of the Passage's natural and built systems.

Key Issues

- **Severe Erosion & Sand Redistribution**
  Large-scale sand migration is impacting Golden Beach, Diamond Head, and surrounding ecological zones.
- **Elevated Tidal Inundation & Surge Risk**
  Higher tidal ranges and increased storm vulnerability are threatening low-lying infrastructure.
- **Frontal Dune and Vegetation Loss**
  Dune systems and mangrove buffers are rapidly deteriorating under continued overtopping and erosion.
- **Navigational and Water Quality Challenges**
  Reduced flushing and sediment accumulation are compromising water quality and access, including for emergency services.

Design Philosophy and Strategic Approach

This report identifies pragmatic, low-risk, soft solutions that can be implemented before the next storm season (November 2025), while laying the foundation for longer-term, more engineered interventions. The overarching aim is to reduce imminent risk and buy time for more detailed planning and community engagement on permanent resilience measures.

This approach operates on the assumption that immediate works are not the endpoint, but a first step. These measures will require ongoing monitoring, maintenance, and adaptation, and will only be effective if followed promptly by longer-term strategies.

Key Assumptions

- No single solution will satisfy all stakeholders
  Given the complexity of the site and competing values (ecological, recreational, protective), we acknowledge that consensus on any one approach is unlikely. The proposed actions represent a reasonable and risk-aware balance of immediate needs and feasibility.
- Sand use from the Passage is temporary and must be tracked
  Any material borrowed from within the Passage for immediate works may need to be replenished from offshore sources as part of future management.
- Emergency timeframes will likely bypass normal approval processes
  Works starting by July 2025 are required to meet the November deadline - this will require streamlined or emergency approvals and early coordination.
- These works will need to be managed and maintained
  New models of cross-agency coordination and long-term stewardship will be essential to ensure these interim measures remain effective and integrated with future actions.

Recommended Immediate Actions (To Commence ASAP)

1. Close Breakthroughs #2 and #3
    a. Use local dredged material to reconstruct dunes and form erodible buffer zones, stabilised with vegetation.
2. Buffer the Island Segment Between Breakthrough #1 and Breakthrough #2
    a. Construct a temporary dune barrier to prevent the merging of existing breakthroughs.
3. Construct Inner Sandbank Inside Breakthrough #1
    a. A soft buffer to reduce wave energy entering the Passage and support downstream ecological protection.
4. Dredge Temporary Channel Linking Breakthrough #1 to the North Passage
    a. Restore circulation, enhance water quality, and reuse dredged material for strategic nourishment.

The numbered labels on the figure 2 (right) below correspond directly to the actions listed above.

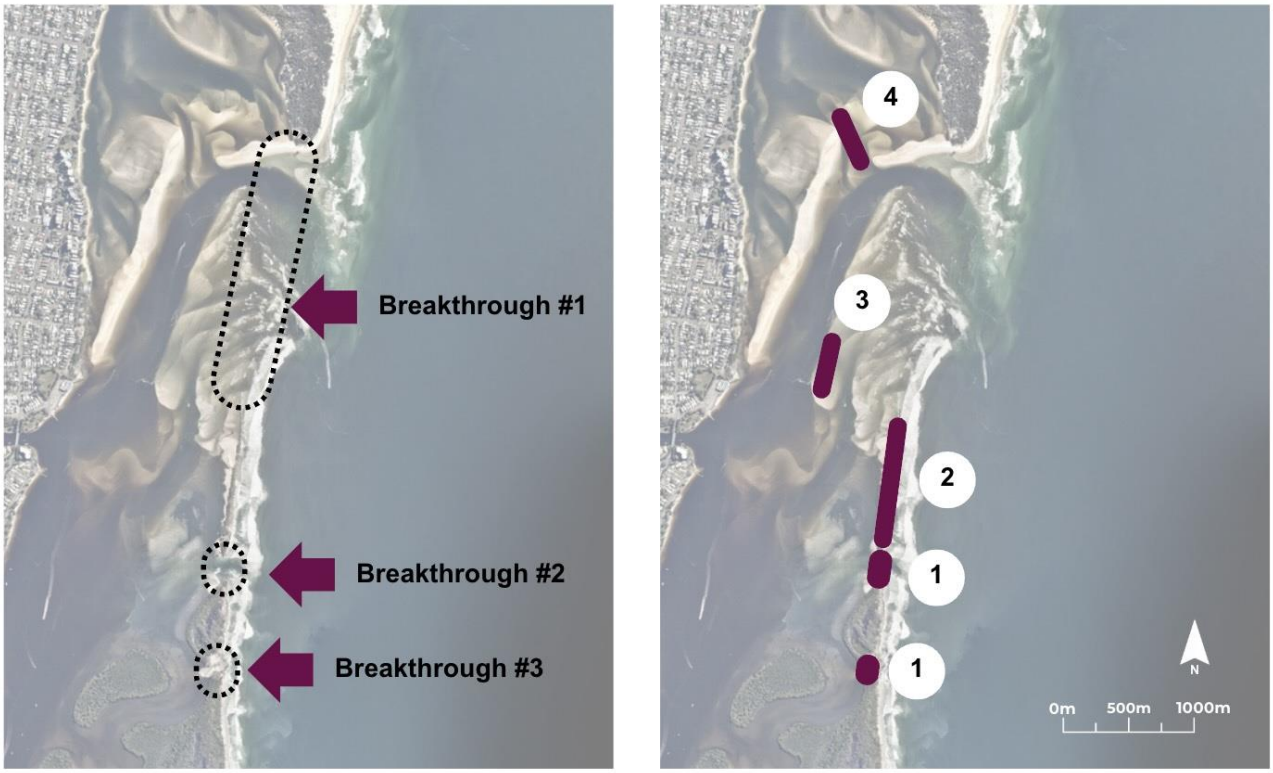

Figure 2 ***Left:*** **Breakthrough locations.** ***Right:*** **Recommended immediate actions for urgent works.**

Indicative Timing

Note these are indicative only and to be developed with suitable contractors.

Table 1: Recommendation Summary

Component	Estimated Duration
Close BT#2 & BT#3 (reinstatement + dune)	3 - 4 months
Island Buffer (BT#1 - BT#2 dune)	2 - 3 months
Inner Sandbank (Behind BT#1)	2 - 3 months
Inner Channel Dredge (Connected to BT#1)	1 - 2 months
Total Estimated Range	**~5+ months**

Timing will be dependent on what works can be done in parallel, however, a minimum duration of 5 months should be assumed. Which means to achieve completion of works by November, commencement of works would be required by July. This is unlikely to be feasible under current conditions (noting that at the time of writing this report it is mid-June), which means timing of all works should be prioritised as per numbering above (noting that the 4th component, while the least 'critical', may provide strategic value as a sand source to support other works).

As this report does not provide detailed design, the recommended works will need to progress in an agile and adaptive manner, most likely involving on-ground coastal engineering input. This approach is typical for 'emergency works', which these urgent recommendations qualify as, given the urgency of completion before the next storm season.

Typically, works proceed on the basis of separate contracts for design and construction, although 'Design and Construct' contracts are not uncommon. A key consideration is how to allocate risk under any contracts. Given the time-sensitive nature of the works, this is particularly critical to ensure delivery proceeds without undue delays. The best outcomes are likely to be achieved through experienced, collaborative project management, delivered by a team with relevant expertise and proven ability to jointly deliver works under challenging circumstances.

An immediate concern is coordination with the Commonwealth regarding Environmental Protection and Biodiversity Conservation Act (EPBC) matters, including, Ramsar wetlands, as well as migratory shorebirds, which typically arrive around August. The recommended Immediate actions have been designed to minimise disturbance and maximise nature positive outcomes by focusing on restoration of the pre-existing coastal dune barrier island (or at least part of it). It is not possible to progress these works without some risks, including to environmental values, however, those values are challenged by the current changed processes, so even a "do nothing" approach presents risks.

Strategic Rationale

This interim soft-engineered solution aims to bring Bribie Island and the Passage back to a post-Breakthrough #1, pre-Tropical Cyclone Alfred state - a condition that, while not ideal, is substantially more stable than the current configuration. This state provides a defensible platform to:

- Reduce imminent threats to public and ecological assets
- Create space for longer-term consultation, design, and approvals
- Minimise design complexity and environmental risk in the short term

Critically, this strategy does not advocate "quick fixes." Instead, it proposes an adaptive, monitored pilot approach, a stopgap that must be followed by investment in robust design, stakeholder alignment, and regulatory planning.

Framing the Path Forward

The immediate need is to restore and buffer the island to its pre-Tropical Cyclone Alfred condition, an achievable benchmark that reduces imminent risk and provides a baseline for more comprehensive future planning. The question for the path forward is:

Do we continue to react to change, or begin to shape it?

This report positions Bribie Island not just as a protected ecological asset, but as a living, natural coastal defence system, worthy of investment, protection, and inclusion in a new generation of integrated, adaptive coastal infrastructure.

1 INTRODUCTION

1.1 Relative to the Terms of Reference

This report has been developed in direct response to the objectives outlined in the Terms of Reference, with a strong focus on identifying and implementing timely, practical actions. Specifically, the report addresses the need for "developing urgent recommendations to stabilise the situation for consideration by Government." Through a comprehensive review of the current physical conditions, environmental vulnerabilities, and community infrastructure risks, this document outlines immediate and staged solutions to mitigate further damage and safeguard key assets.

In parallel, the report investigates "impacts of the breakthroughs on the natural protection of the Pumicestone Passage including residents, businesses, recreational boating, and the Coast Guard." This includes high level review of wave exposure, tidal changes, navigation challenges, and infrastructure erosion, particularly at vulnerable sites such as the Caloundra Power Boat Club and Lions Park.

Finally, the analysis also "considers natural and anthropogenic changes contributing to island erosion across mainland catchment areas and Moreton Bay that affect Bribie Island." This holistic perspective acknowledges the broader system connectivity and the cumulative pressures influencing the island's instability, forming the basis for both immediate recommendations and future adaptive planning strategies.

1.2 Site Information

Bribie Island is a large sand island located off the coast of Queensland, Australia (Figure 3 & Figure 4), forming a natural barrier between the Coral Sea and the Pumicestone Passage. The site of interest specifically refers to the northern spit of Bribie Island and its interface with the mainland at Golden Beach, within the Sunshine Coast Region Local Government Area. This location plays a critical role in the coastal and estuarine dynamics of the northern Pumicestone Passage, which is a tidal waterway extending between Bribie Island and the mainland. The northern end of Pumicestone passage is connected to the ocean. This shallow tidal entrance is generally located at Caloundra Head but migrates southward at times.

The site conditions around Bribie Island, particularly its northern spit and adjacent Pumicestone Passage, are shaped by complex coastal dynamics involving tides, waves, and wind. Since 2022, the site has experienced three major breakthroughs of the Bribie Island northern spit. The first occurred during ex-Tropical Cyclone Seth and significantly increased tidal exchange and wave energy in the passage. More recently, Tropical Cyclone Alfred contributed to additional geomorphic changes, accelerating erosion and contributing to two new breakthroughs, which further reduced tidal attenuation within the passage. These breakthroughs have led to a marked increase in tidal range by as much as 0.46 metres within northern Pumicestone Passage, resulting in tidal conditions more akin to open coast environments. Consequently, increased tidal amplitudes and wave energy are now observed within the passage.

Wave dynamics in the area are equally influential. Offshore from Bribie Island, wave conditions are primarily dictated by east to southeast trade winds, particularly during the April - September period (Figure 5). The significant wave height offshore typically averages around 1.3 metres, though cyclonic activity has generated waves exceeding 8 metres in the past (BMT WBM, 2015). During such events, wave runup has been observed to overtop and erode the narrow dunes of the Bribie Island spit, with the potential to initiate over wash processes and cause mangrove degradation. Inside the Pumicestone Passage, wave energy is generally low due to shallow depths and limited fetch, although locally generated waves (usually below 0.5 m) still contribute to sediment movement along the mainland shorelines (BMT WBM, 2015). Additionally, infragravity (IG) waves have been identified as a critical factor elevating water levels in small creeks during storm events (Figure 6), further complicating hydrodynamic conditions (JBP, 2024).

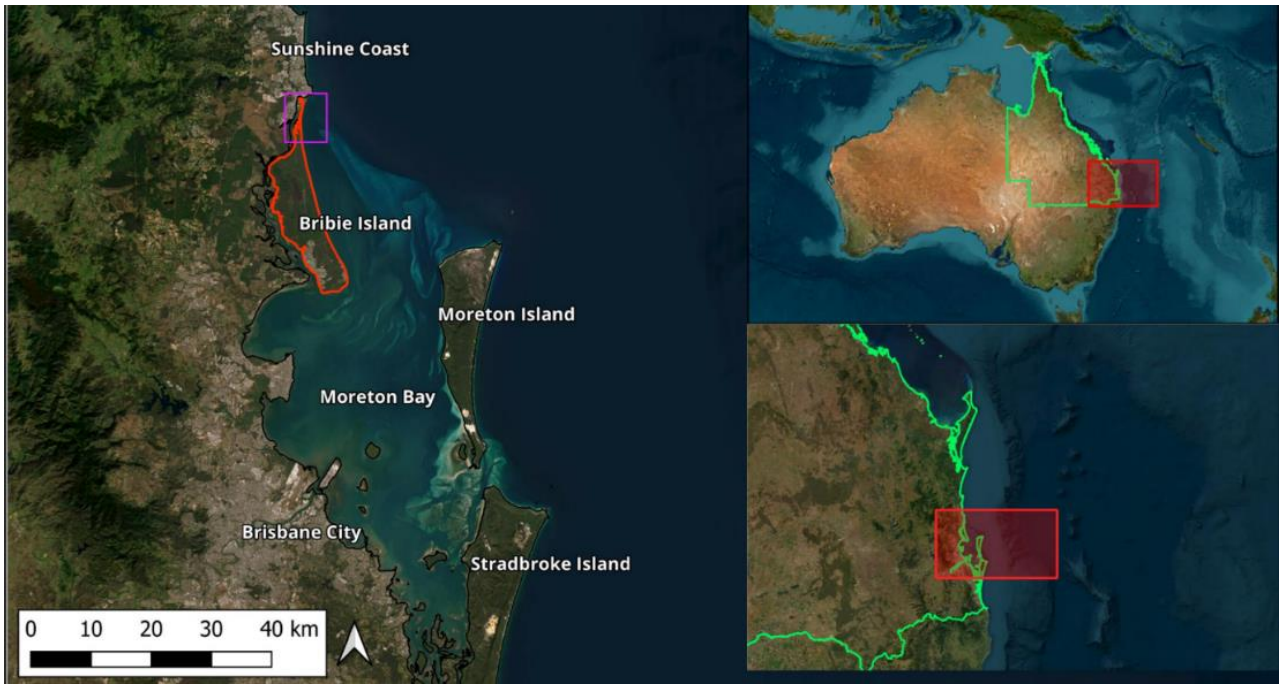

Figure 3: **Aerial image of site (Waterhouse, A., 2023).**

Figure 4: **Aerial image of the site (Waterhouse, A., 2023).**

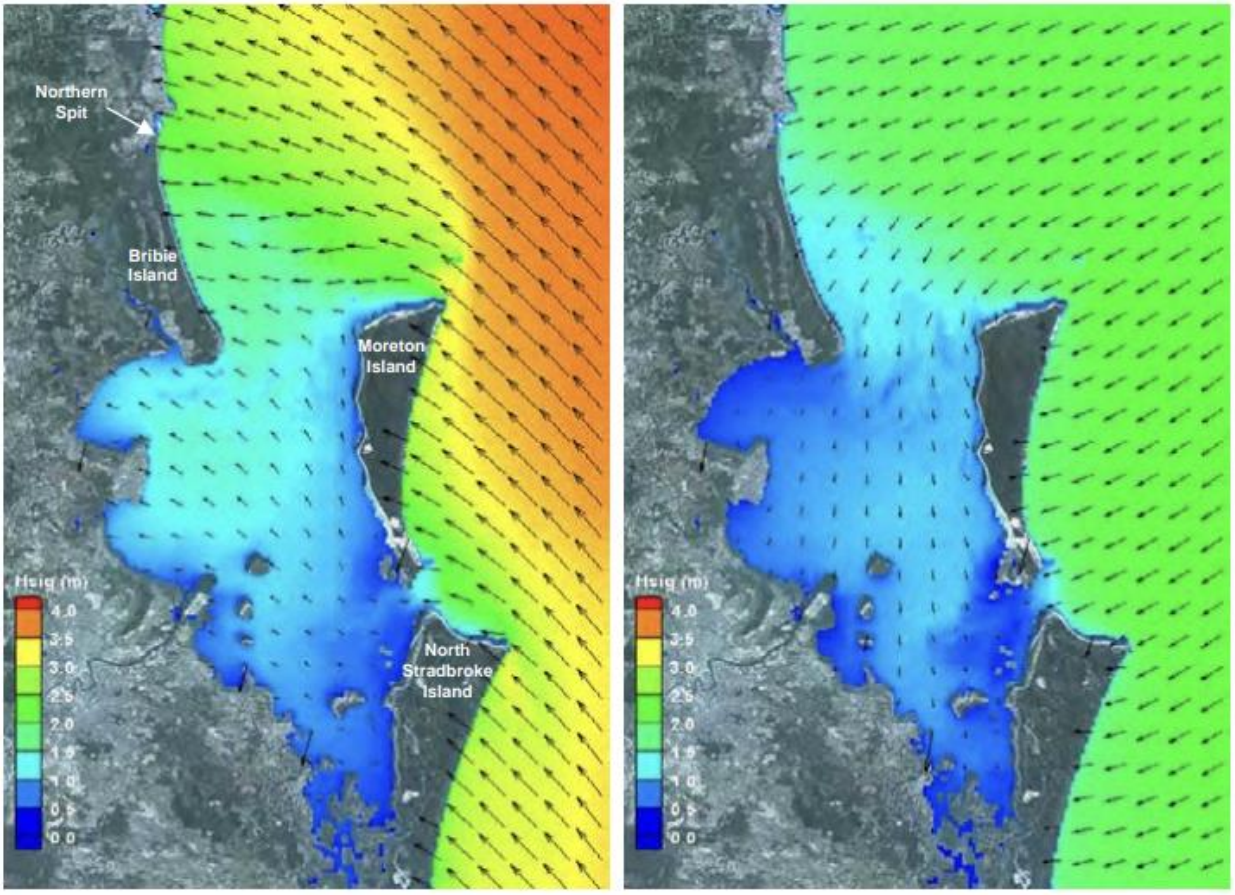

Figure 5: **Site location and regional wave climate (BMT, 2015).**

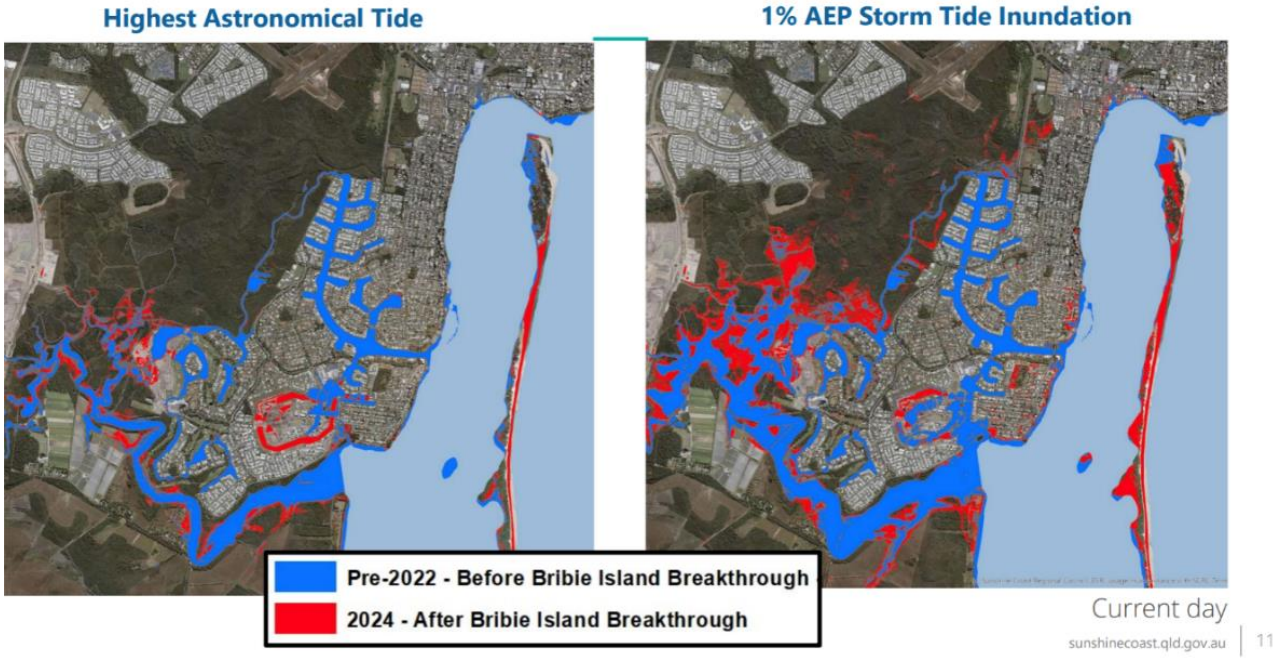

Figure 6: **Inundation conditions worsened following Breakthrough #1 (CHAS, 2025).**

Sediment Quality

The study area predominantly consists of unconsolidated sand but also includes areas of indurated sands like coffee rock. Previous testing has shown low levels of silts and some potential acid sulphate soils (PASS). PASS may also exist at Diamond Head, which could be affected during seawall construction.

The breakthroughs and closures have resulted in large volumes of clean beach sand being washed into the passage. This can be dredged without adverse impacts on water quality.

Dredging and placement of dredged material must be managed under SDAP Module 4 and the Coastal Protection State Planning Regulatory Provision (SPRP) s3.2.6, especially regarding the exposure of PASS and other contaminants.

Because of the possible presence of acid sulphate soils and other contaminants, pre-dredging studies of areas other than recent clean sand deposits are recommended to identify risks. All activities must comply with the Sunshine Coast Planning Scheme 2014, Coastal Protection State Planning Regulatory Provision (SPRP), and State Planning Policy (SPP) interim development assessment provisions for Water Quality.

2 THE SITUATION

2.1 Values of Bribie Island and Pumicestone Passage

The Golden Beach CHAPP by the Sunshine Coast Council identifies a rich set of cultural, environmental, social, economic, and heritage values that define the identity, function, and future vision of the Golden Beach study area. Stretching over 4 km along Pumicestone Passage, the area is historically and ecologically significant, offering critical recreational, community, and environmental services. It supports a variety of water-based activities such as swimming, fishing, and boating, and is central to the lifestyle and tourism economy of the Sunshine Coast.

Environmental values include the area's designation within the Moreton Bay Marine Park and its proximity to Ramsar-listed wetlands, marine plants, seagrass meadows, mangrove habitats, and fish breeding grounds. These systems provide critical biodiversity, water quality, and flood mitigation services, but have already shown signs of stress following the 2023 Bribie Island breakthrough, which has altered coastal processes.

Cultural values are deeply rooted in First Nations connections to land and sea Country. The Kabi Kabi and Jinibara Peoples maintain cultural and legal interests across the region. These rights acknowledge culturally significant places such as middens, fish traps, and sacred trees. The CHAPP supports culturally respectful engagement and integration of free, prior and informed consent (FPIC) into future project planning.

European heritage also plays a role in shaping the area's identity. Key State and local heritage sites, such as the Tripcony Hibiscus Caravan Park, Fort Bribie, Military Jetty, and Norfolk Pines, contribute to the historical landscape and reinforce community attachment to the coastal environment.

Social values include the area's strong community fabric, its foreshore amenities, and local identity as a coastal lifestyle destination. Community engagement conducted through recent Council programs (Healthy Coast Management Plan, Shoreline Erosion Management Plan and Coastal Hazard Adaptation Precinct Planning) highlights public concern about environmental degradation and a desire to protect the natural coastal character. The area is a hub for community recreation including boating and fishing activities, well-loved by both locals and visitors.

Economically, Golden Beach contributes to a broader regional economy heavily reliant on tourism and population growth. The Sunshine Coast attracts over 4.2 million visitors annually, with beaches being the primary attraction. Healthy coastal systems are critical to sustaining tourism, property values, and local employment, while also delivering vital ecosystem services. Prior research (e.g., Blackwell, 2007) suggests the economic value of a single beach visit can range between $4.49 and $22.31, highlighting the monetary worth of maintaining access and amenity.

Importantly, many of these values, particularly environmental and social values, were assessed prior to the Bribie Island breakthrough and are now under increasing pressure. The CHAPP acknowledges that changes to coastal dynamics are already impacting these values, reinforcing the urgency for responsive and forward-looking coastal management.

2.2 The 2022 Bribie Island Breakthrough

2.2.1 The Lead-Up to the Breakthrough

Significant work was undertaken in Part 1 of this report series. It details that the Bribie Island breakthrough was the result of a long history of natural coastal processes, human interventions, and policy decisions. Key contributing factors, as outlined in the 2025 Bribie Island Erosion and Breakthrough Review Part 1, include:

2.2.2 Natural Dynamics and Long-Term Coastal Change:

Bribie Island, like other coastal dune systems, was formed during the Holocene and is subject to ongoing natural changes, including sea-level fluctuations, storm events, and sediment movement.

Long-term degradation of Moreton Bay estuaries over thousands of years was already occurring due to reduced tidal circulation and sediment infill.

The spit was inherently unstable, with past records and studies noting its vulnerability to breaching due to narrowing and erosion.

2.2.3 Historic Warnings and Predictive Studies:

Community and scientific concerns about the potential for a breakthrough were raised as early as the 1960s.

Proposals to stabilise the entrance or address erosion were made but not implemented with potential impediments including cost, jurisdictional issues, and environmental concerns.

A predicted sequence of deterioration was outlined by local stakeholders in 1964, including increasing shoaling, narrowing of the spit, and eventual breakthrough driven by cyclone or flood events.

2.2.4 Storm and Weather Events:

Major cyclones and high rainfall events, notably in 1954 and subsequent decades, significantly accelerated erosion processes.

These events repeatedly shifted the channel alignment and increased pressure on the narrowest section of the spit.

2.2.5 Human Influences and Policy Choices:

Dredging for navigation, upstream land use, and alterations to sediment supply (e.g., removal of mangroves, sand mining applications) within the entire Moreton Bay boundary have contributed to system instability.

Government policy for Bribie Island emphasised minimal intervention in natural coastal processes. This delayed both ‘soft’ (nourishment or dunes) and ‘hard’ engineering responses despite growing evidence of risk.

2.2.6 Physical Geomorphology

The Caloundra Headland forms a sediment transport divide and limited alongshore sediment supply has contributed to the progressive narrowing of the northern Bribie Island spit.

The location of the eventual breakthrough (near the narrowest part of the spit) aligned with long-standing predictions.

In summary, the breakthrough was not a sudden or isolated event, but the culmination of decades of natural erosion, increased storm intensity, limited sediment supply, human activities and deferred intervention. Despite community foresight and technical advice, management actions were largely constrained by policy frameworks favouring non-intervention.

2.2.7 Summary of the Causes of the 2022 Breakthrough

This report focuses on urgent, low-risk, forward-looking solutions to address the impacts of the 2022 Bribie Island breakthrough (and now the 2025 breakthroughs), rather than assigning causes. A study conducted by BMT (BMT, 2023) reviewed the contributing factors to the breakthrough, highlighting that the area is part of a highly complex and interconnected coastal system.

Our Desktop Analysis (Report 1) indicates that this system is even more complex and intricate than acknowledged in some recent assessments. Importantly, this system does not operate in isolation; Bribie Island is linked to the broader Moreton Bay estuarine-marine environment, with its southern outlet at the Gold Coast Seaway. As such, it must be recognised that any natural process or human intervention within this system is likely to influence other parts, with the scale of impact varying.

While the Desktop Analysis provides insight into long-term erosional trends evident in the gradual degradation of the northern spit, this report focuses on the practical and immediate actions needed to mitigate risk and manage change.

In future chapters, we will revisit the findings of the Desktop Analysis to explore more holistic, system-wide solutions for long-term adaptation.

2.2.8 The Breakthrough - A Process Over the Years

As noted in the Desktop Analysis, the initial breakthrough (BT#1) was the result of long-term processes unfolding over many years. For a more recent summary (the last two decades) a visualisation of the changes has been highlighted below. The following image shows the changing width of the island (Breakthrough#1 location) with a general decline over the years until it did breakthrough in 2022.

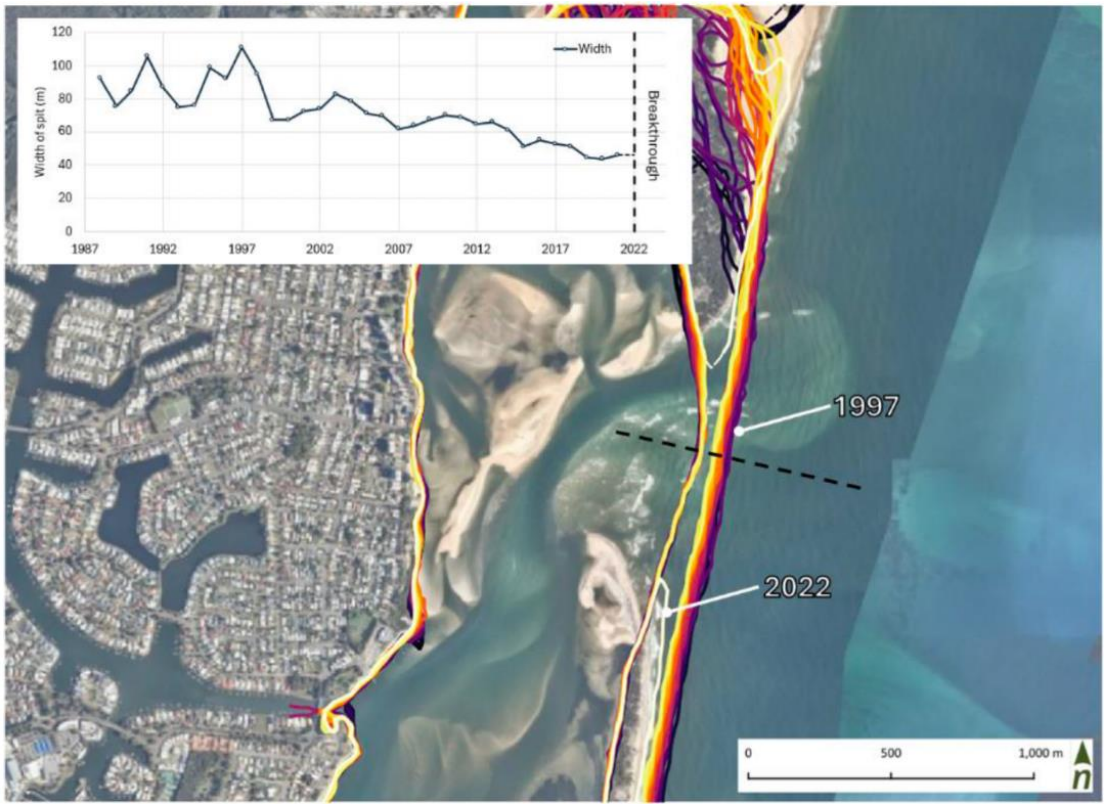

Figure 7: **Mean annual width of the Bribie Island northern spit along the transect (dashed line) from 1988 to the 2022 breakthrough. Adapted from Geoscience Australia DEA Coastlines. Image source: Nearmap 2023 (CHAPP, 2025).**

2.3 Since the Breakthrough 2022

2.3.1 Extract from Golden Beach CHAPP

On 2 January 2022, large waves associated with ex-Tropical Cyclone Seth over-washed the dunes on northern Bribie Island and cut a tidal channel through the narrowest section of the island, creating a new entrance to Pumicestone Passage. Since January 2022, the breakthrough of the island has widened to over 1km and has become the dominant entrance. The previous entrance at Caloundra has since been infilling with sand and is now closed over with a significant sand berm extending from Bribie Island to Bulcock Beach. The formation of a new entrance has opened Pumicestone Passage to ocean waves, increased tidal levels and changed navigational access within Pumicestone Passage. Wood et al. (2023) stated that the key impacts following the breakthrough of Bribie Island have been:

- *Formation of a new entrance 1.4km south of the Caloundra Bar which has increased both tidal range and tide level within Pumicestone Passage.*
- *Infilling of the Caloundra Bar due to the reduction in ebb tide flow and the migration of the ebb tide delta sands into the entrance from wave action.*
- *Formation of a tidal delta at the new entrance with large sand bars. An important part of this process has been the migration of a large volume of sand westward towards Golden Beach.*
- *Increased wave and storm surge penetration from Moreton Bay into Pumicestone Passage which has caused erosion and nuisance flooding along the Golden Beach coast.*

- *Wave penetration into Pumicestone Passage which has caused the loss of extensive seagrass beds by sediment reworking and migration.*

Potential future impacts

The BMT, 2018 report used numerical modelling to assess the potential impacts and changes in coastal processes resulting from a breakthrough at the narrowest section of Bribie Island, focusing on the implications for hydrodynamics, morphology, and the associated risks to coastal and inland areas. This study highlighted the following potential future impacts under a permanent breakthrough scenario:

- *Tidal and Hydrodynamic Changes: The study found alterations in tidal dynamics, including a reduction in tidal range attenuation and changes in water levels that could influence flood hazards across the lower floodplain, particularly affecting communities and assets at Golden Beach. Tidal amplitude over the largest modelled tide at Golden Beach was 89% of that at Mooloolaba.*
- *Wave Exposure: An increase in wave energy entering Pumicestone Passage from offshore, with peak wave heights up to 0.6m near the Lamerough Canal along the mainland shoreline. The sea level rise scenario further suggested an increase in wave energy within Pumicestone Passage, predicting nearshore wave heights generally exceeding 0.5m across the broader Golden Beach shoreline.*
- *Flood Hazard and Coastal Inundation Risk: The likely future scenario suggests that the tidal regime within northern Pumicestone Passage will change due to a combination of changes to the Bribie Island spit morphology and sea level rise. This change is expected to lead to a reduced freeboard at the shoreline and an increase in the risk of coastal inundation for northern Pumicestone Passage mainland communities.*

The findings of the Pumicestone Flood Study emphasise the complex interplay between hydrodynamic and morphological processes in response to a potential coastal breakthrough, highlighting the need for careful consideration of these dynamics in coastal management and planning efforts.

2.4 The Current Situation

The current situation at Bribie Island and Pumicestone Passage is the result of complex, long-term natural processes unfolding over millennia, now intensified by recent physical events. While shaped by broader climatic and geological forces, the immediate triggers of concern are the breakthroughs along northern Bribie Island, which have rapidly accelerated change in the coastal system, refer to 2025). Table and Figure 8. For clarity, we have divided the system into two key zones for further review and summarisation.

The Island

Northern Bribie Island has undergone significant structural change:

- Breakthrough #1, which occurred in January 2022, continues to widen and deepen, becoming the dominant tidal entrance to Pumicestone Passage.
- Breakthrough #2 has since formed and is actively expanding.
- A third potential breakthrough is emerging, with active overwash observed in low-lying areas south of the second breakthrough.
- The remaining section of the island between Breakthroughs #1 and #2 is extremely vulnerable and at risk of full loss in the near term.
- Damage to public assets has already occurred, with risks increasing as the island's natural buffer function is further diminished.

The Passage

Changes within Pumicestone Passage following the breakthroughs are significant:

- The original Caloundra Bar has closed due to the initial breakthrough
- Tidal levels have risen within the channel since the first breakthrough, with associated increases in water levels during high tides and storm events.
- Water circulation and flushing capacity have decreased in the northern area of The Passage, raising concerns about water quality and ecosystem health.
- Wave energy penetration has increased, particularly in areas directly behind the breaches, causing ongoing shoreline erosion, sediment redistribution, and stress to seagrass and mangrove habitats.

Together, these changes reflect a coastal system in rapid transition. While some impacts have been anticipated through long-term planning frameworks, the pace and scale of change now present immediate challenges that must be understood and addressed through a combination of urgent response and long-term adaptation.

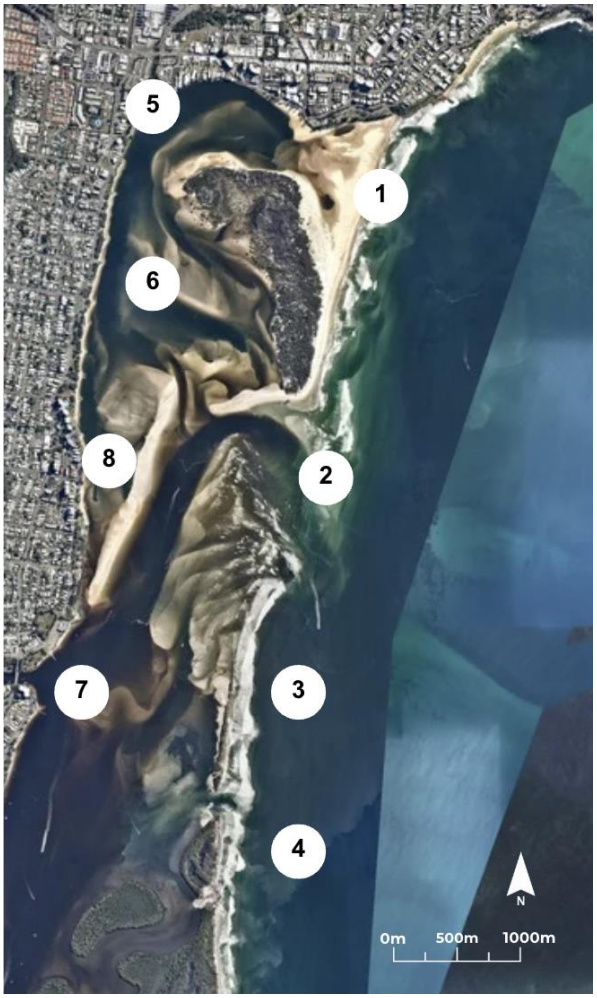

Figure 8: **Aerial image of site, indicating coastal processes occurring currently (Nearmap image, 2025). Table 3: Key to Figure 7 - High level summary of current coastal processes**

Table 2: **High Level Situation Summary**

No.	Situation (High Level Summary)
1	Closure of historic Caloundra Bar
2	Expansion of Breakthrough #1 (from 2022)
3	Erosion and rapid degradation of remaining island
4	Breakthrough #2 is expanding, and Breakthrough #3 is occurring
5	Reduced circulation and flushing of northern The Passage
6	Increased tidal levels withing The Passage
7	Wave energy impacting shoreline
8	Build-up of sand bank (wave break island) behind BT#1

Note: This summary is based on a review of available data and supplemented by accessible online resources and stakeholder observations, it highlights key processes only and is not exhaustive.

2.4.1 The Island (Situation Details)

The island is now a series of smaller islands, highlighted well in the aerial image below from 7th of May 2025.

Figure 9: Bribie Island Breakthrough #1 & #2 on May 7, 2025 (Bluey's Photography Facebook Account, 2025).

2.4.2 Breakthrough #1 Is Expanding

Figure 10: Aerial images of Breakthrough #1 on April 17, 2025 (Nearmap, 2025).

Recent imagery and field observations have confirmed that Breakthrough #1 continues to expand, reinforcing concerns about the stability of northern Bribie Island and the increasing exposure of Pumicestone Passage. The comparison of aerial data between 21st January 2025 (pre-Cyclone Alfred) and the most recent post-cyclone imagery reveals a notable loss of approximately 100 metres of exposed sand at the island's seaward tip, highlighting the dynamic and unstable nature of the breach.

In addition to the direct geomorphic changes, there has been a further loss of approximately 200 metres into the southern vegetated areas, primarily involving the degradation of dune and swale vegetation. Notably, Melaleuca species, which were established along the inside edge of the island tip, have been completely eroded in several locations. Vegetation loss is more pronounced on the seaward side of the breach, suggesting wave-driven erosion as the dominant force, rather than passive inundation or rising water levels.

Over the past several years, the island has shown a long-term vegetation retreat rate of approximately 1 metre per year, based on available imagery and site reports. However, the recent cyclone-induced impacts demonstrate that short-term events can drive far more rapid change, and under current conditions, this rate is accelerating.

The ongoing expansion of Breakthrough #1 is of particular concern because:

- It increases the width and tidal efficiency of the entrance, thereby raising tidal range and wave penetration into the Passage.
- It places additional pressure on the remaining landmass between Breakthroughs #1 and #2, which is already under strain from overtopping and vegetation loss.
- It threatens further degradation of local ecosystems and infrastructure, especially as vegetation buffers and dune structures are removed.

This section of the island has transitioned from a stable vegetated buffer to a rapidly evolving breach zone. If not addressed, the continued enlargement of Breakthrough #1 may soon result in the merging of Breakthroughs #1 and #2, effectively removing the remaining barrier island segment and transforming the coastal dynamics of The Passage.

2.4.3 Breakthrough #2 Has Occurred (and Is Expanding)

Breakthrough #2 formed during Tropical Cyclone Alfred in March 2025, triggered by a convergence of factors including elevated storm surge, extreme wave conditions, and pre-existing degradation of the seaward vegetation line. The area had already been identified as vulnerable due to previous overwash events and progressive vegetation dieback, and Tropical Cyclone Alfred acted as the final catalyst for a full breach.

Since its formation, Breakthrough #2 has rapidly expanded. At the time of this report, the breach measures approximately 150 metres wide, with tidal depths ranging between 2 to 3 metres at high tide. Unlike Breakthrough #1, which developed over time with intermittent sediment deposition and inner bank formation, Breakthrough #2 has remained relatively open and exposed, with little to no inner sandbank formation inside the passage. This absence of an inner depositional buffer significantly increases the exposure of inland areas to direct wave and tidal energy from Moreton Bay. Refer to Figure 11 and Figure 12.

Early observations noted substantial loss of frontal dune sand, much of which appears to have been transported inland into the passage. As the sand eroded, a residual layer of mangrove peat, root systems, and organic substrate remained exposed for a short period, temporarily resisting further erosion. However, this natural barrier ultimately gave way once the underlying sand had been fully displaced, leading to a sudden and rapid expansion of the breach.

Importantly, the substrate behind Breakthrough #2 is notably different from that of Breakthrough #1. Instead of beach-quality sand, the inner zone here consists primarily of fine-grained mangrove silt. This material is significantly more susceptible to resuspension, mobilisation, and long-term degradation. The potential ecological implications are substantial, including the destabilisation of the adjacent mangrove systems and the erosion of critical benthic habitats.

In contrast to Breakthrough #1, which initially evolved with the development of an inner tidal delta that helped modulate wave energy, Breakthrough #2 lacks these sedimentary features. As a result, it represents a more direct and potentially severe conduit for oceanic forces to impact the internal environments of Pumicestone Passage and the sensitive ecological zones to its west.

The continued growth and evolution of Breakthrough #2 demands urgent monitoring and requires early-stage intervention to mitigate the risk of accelerated erosion, habitat loss, and increased hydrodynamic impacts on the mainland foreshore and community infrastructure.

Figure 11: Location of breakthrough sites in relation to sandbanks in The Passage (pre Breakthroughs) (Google Earth aerial, 2018).

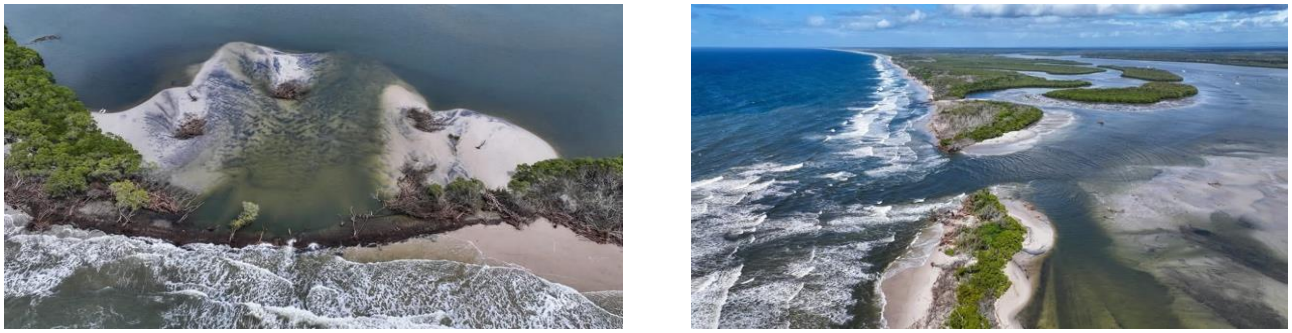

Figure 12: Aerial images of breakthrough. *Left:* March 11, 2025 - During Tropical Cyclone Alfred conditions. *Right:* May 7, 2025 - Fully open channel/bar crossing (Bluey's Photography Facebook Account, 2025).

2.4.4 Public Assets Have Been Damaged

Northern Bribie Island contains very limited public infrastructure, primarily concentrated at Lions Park, which includes a picnic shelter and public toilet facility. During Tropical Cyclone Alfred (March 2025), severe coastal erosion significantly damaged this area. The toilet block and surrounding amenities were rendered unusable, with active erosion continuing to degrade the site condition. Recent images (figure 12) confirm the complete loss of the toilet facility.

Note that all infrastructure at Lions Park, except the concrete tank (which was pumped out and left in-situ, were removed from site by Queensland Parks and Wildlife Service (QPWS) contractors.

In addition to recreational assets, Northern Bribie Island is home to heritage-listed World War II bunkers and gun towers, located further south along the dune system. These historically significant structures have been under threat from ongoing coastal erosion for many years. In 2017, International Coastal Management (ICM)

developed protection designs for the prominent gun tower for Moreton Bay Regional Council, recognising its cultural value and exposure risk. However, implementation of these works was not pursued, primarily due to complexities associated with environmental and heritage approvals.

The rapid progression of erosion following the breakthrough events now places both recreational and heritage assets at greater risk, underlining the need for updated assessments and potential emergency protection measures.

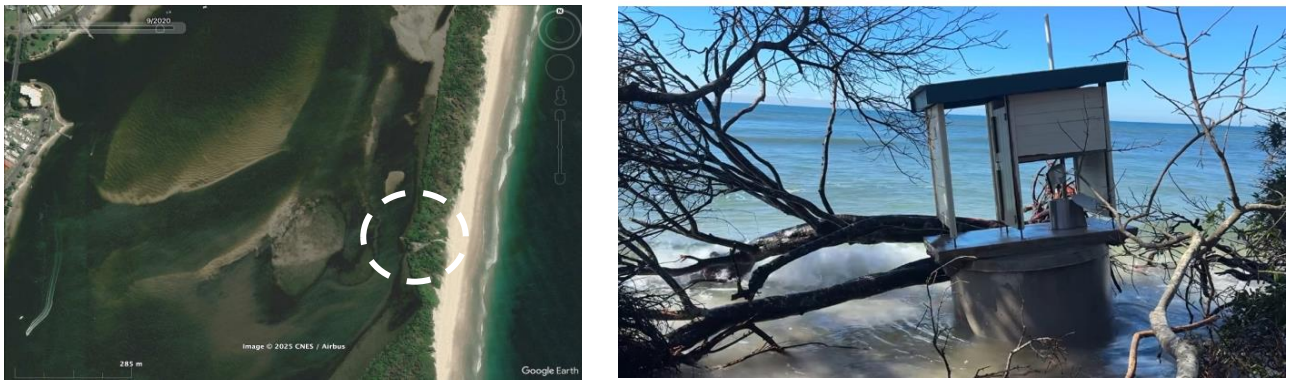

Figure 13: ***Left:*** **Aerial image of the toilet facility (Google Earth, 2025).** ***Right:*** **Loss of the toilet facility at Lions Park on April 29th, 2025 (Caloundra Fishing World Facebook, 2025).**

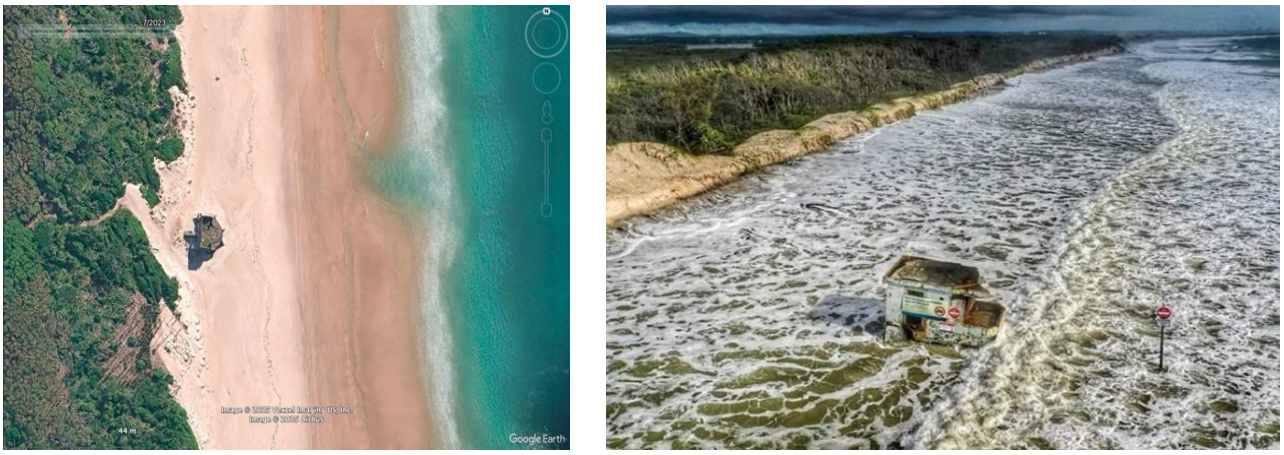

Figure 14: ***Left:*** **Aerial image showing the location of the WWII bunker (Google Earth, 2025).** ***Right:*** **Drone image of WWII bunker taken in 2018 (Bluey's Photography Facebook Account, 2018).**

2.4.5 Weakening of the Remaining Stretch Between #1 and #2

The remaining section of Bribie Island between Breakthrough #1 and Breakthrough #2 is increasingly vulnerable, showing signs of rapid geomorphic change. Once a continuous barrier island, this stretch is progressively transforming into a low-lying sandbank, with vegetation acting as the last line of defence against collapse. However, this vegetation is now visibly stressed due to persistent inundation, and in many areas, is beginning to fail.

This area is critical. If the land between Breakthroughs #1 and #2 is lost, it would create an uninterrupted opening approximately 2.5 km wide, fully exposing Pumicestone Passage to direct oceanic wave energy and tidal inflows. The full implications of such an opening are expected to result in a marked increase in tidal range, wave penetration, and hydrodynamic forcing throughout the Passage.

Such changes could impact the sensitive environmental values of the region, including wetlands, seagrass meadows, mangrove habitats, and critical estuarine ecosystems.

Figure 15: PPCMB showing oceanfront-exposed vulnerable vegetation on May 6, 2025.

Figure 16: Drone images of the breakthrough. Note the degrading vegetation along the oceanfront, resulting in vegetation loss (right). Once the vegetation is lost, the island transitions into a submerged sand bar (Bluey's Photography Facebook Account, 2025).

2.4.6 Potential for Breakthrough #3 (South of Breakthrough #2)

At the time of writing, signs of a third Breakthrough #3 forming on northern Bribie Island have been identified. Aerial imagery and historical data indicate that this overwash zone has existed since at least 2013, meaning it is not a new phenomenon. However, recent observations show that this section has continued to weaken, with vegetation retreating at an average rate of approximately 1 metre per year.

The area of concern lies immediately adjacent to sensitive mangrove wetlands. Should Breakthrough #3 develop into a fully open channel, it would directly connect offshore oceanic conditions to these wetlands, with the potential to severely alter their ecological function and balance. The fine-grained sediments and delicate vegetation systems of these mangroves are highly vulnerable to changes in salinity, tidal range, and wave action, all of which would likely be amplified by another active breakthrough.

While Breakthrough #3 has not yet fully formed, its progression, especially under further storm or high tide events, poses a significant environmental risk that requires close monitoring and proactive action.

Figure 17: Drone images of Breakthrough #3. *Left:* March 11, 2025. *Right:* May 7, 2025, showing overwash conditions (Bluey's Photography Facebook Account, 2025).

2.5 The Passage (Reviewed)

2.5.1 Increase Tide Levels Since Breakthrough #1

Since Breakthrough #1 (2022), there has been a general increase in tidal levels within The Passage, leading to noticeable changes in the local hydrodynamics. This shift in tidal behaviour has raised concerns regarding its potential long-term impact on coastal stability and infrastructure.

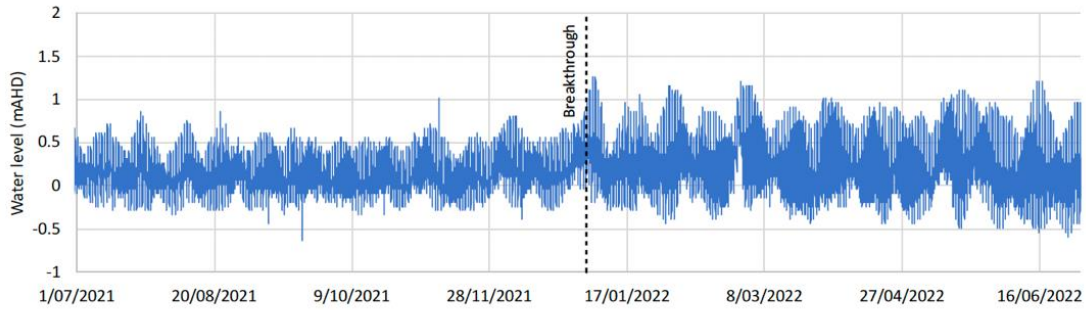

Figure 18: Change in tidal range at Golden beach before and after 2022 breakthrough (CHAPP, 2025).

Information provided by Sunshine Coast Council:

The State re-derived Highest Astronomical Tide levels for Golden Beach following Breakthrough#1 were noted as +1.13mAHD

Storm tide data and tide predictions for Golden Beach monitoring site | Environment, land and water | Queensland Government

Following TC Alfred, peak tides have been exceeding this and now approximate the Caloundra Coast Guard and Mooloolaba Tide Levels (HAT 1.22mAHD).

This means that conditions at Golden Beach are more similar to open coast conditions (not their historical inner waterway conditions) which have been exaggerated by the TC Alfred impacts.

2.5.2 What Does That Mean for Shoreline Structures & Public Assets?

2.5.2.1 The Caloundra Power Boat Club

One of the main concerns regarding tidal changes is the Caloundra Power Boat Club, given its proximity to the shoreline and the potential for increased erosion and flooding.

Council's Local Disaster Management Group (LDMG) moved to 'stand up' on 3rd March, in response to Tropical Cyclone Alfred. The area in front of the Caloundra Power Boat Club was sandbagged 4th-5th March. It's important to note that the works were undertaken by Council under the direction of the Local

Disaster Coordinator (LDC) as emergency works (i.e., it was not a directive of a Council officer, but the LDC, acting in their capacity under a disaster situation).

To support this, sand nourishment is being applied in front of the club to maintain a natural buffer, although it appears that this is not stabilising, requiring ongoing replenishment.

Figure 19: ***Left:*** **Image from a boat during high tide in 2023, level unknown (PPCMB, 2023).** ***Right:*** **Sand nourishment in front of the Caloundra Power Boat Club on May 1, 2025 (RPS, 2025).**

2.5.2.2 Other Assets

Several public assets are located along the Pumicestone Passage, including boat ramps and jetties.

Due to time constraints, a comprehensive review of each asset's functionality, specifically in terms of user safety, stability, and overall condition, has not been included in this report.

It is anticipated that the Sunshine Coast Council is addressing these aspects as part of the next stages of the CHAPP process, though confirmation is still pending. If not, it is strongly recommended that a detailed investigation and condition surveys of these assets be conducted to assess their current state and potential risks.

Figure 20: **Image of the jetty on February 28, 2025 - high tide level reaching the top of the jetty pre-Tropical Cyclone Alfred (Bluey's Photography Facebook Account, 2025).**

2.5.2.2.1 Increased wave exposure on assets

As previously noted regarding the Caloundra Power Boat Club, no significant structural damage occurred as a result of wave action. However, a high-level assessment of wave-induced impacts within the passage indicates that the primary outcome has been sand inundation.

As wave energy moves towards the land, sand is physically pushed ashore, forming a new foreshore. This process, driven by increased wave exposure due to the breakthrough, has led to the redistribution of sediment in the affected areas.

Figure 21: **Image of the boat ramp with sand washing up along the shoreline and covering boat ramp access on April 29, 2025 (Caloundra Fishing World Facebook, 2025)**

Figure 22: ***Left:*** **Image taken on May 7, 2025, along inside of the second breakthrough, showing beach formation on diamond head (Bluey's Photography Facebook Account, 2025).** ***Right:*** **Sand washing over the foot path (PPCMB, 2025).**

Figure 23: ***Left:*** **Sand washing into mangrove ecosystem north of the Caloundra Power Boat Club.** ***Right:*** **Debris washed over the footpath during high tide, south of the Caloundra Power Boat club (Bluey's Photography Facebook Account, 2025).**

2.5.3 Decreased Flushing/Circulation

Water quality in the passage has been identified as a concern since the 1990s, primarily due to outfall sources rather than issues with natural flushing. The decrease in natural flushing capacity has exacerbated the situation.

A recent report from the former Department of Environment and Science (DES 2023) indicates that water quality levels are not currently a significant issue. However, a report submitted to us by PPCMB suggests there may be potential water quality concerns, though this submission has not yet been verified (i.e. we have not taken our own water quality samples and had them tested).

Despite this, it is clear that the decreased flushing in the northern section of the passage has had an impact, and this trend is expected to continue, increasing the likelihood of future water quality problems.

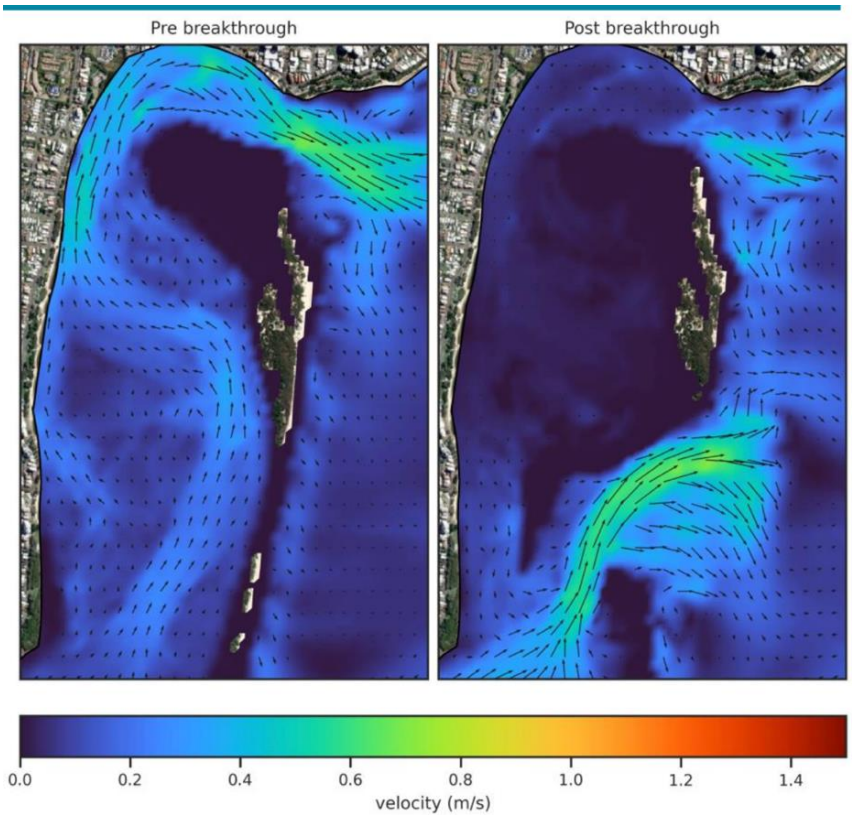

Figure 24: Flow velocity model of the site (Waterhouse, A., 2023).

2.6 Tropical Cyclone Alfred (A Real-World Stress Test for Bribie)

The region has recently gone through a severe weather event (Tropical Cyclone Alfred) which is determined to be a significant storm for the region.

The impacts of Tropical Cyclone Alfred on the Bribie Breakthrough area include, but are not limited to:

- Increased Breakthrough (widening of Breakthrough #1)
- Formation of a second Breakthrough (Breakthrough #2)
- Damage to and loss of public infrastructure on the island (e.g., Lions Park)
- Minor overtopping at Golden Beach and near the Caloundra Power Boat Club
- Minor overtopping at Diamond Head

Figure 25: ICM site visit on March 24, 2025 (two weeks after Tropical Cyclone Alfred).

2.6.1 Existing Action Plans

2.6.1.1 CHAPP Options Analysis - Project Summary

The Sunshine Coast Council (SCC) is conducting the Golden Beach and Caloundra (Bulcock Beach) Coastal Hazard Adaptation Precinct Planning (CHAPP) Options Analysis to assess and compare adaptation and mitigation measures for managing coastal hazards affecting public land and Council-owned infrastructure at Golden Beach.

The project, delivered by Alluvium Group in partnership with Tract, began in February 2024 and is scheduled for completion in October 2026.

Objectives:

- Identify short-term solutions (to 2041) and long-term options adaptable for 2070 and 2100.
- Focus on mitigating risks from beach erosion, dynamic sand movement, tidal inundation, storm tides, and coincident flooding, as previously outlined in the Sunshine Coast CHAS (2021).

While the Department of Environment, Tourism, Science and Innovation (DESI) supports maintaining natural coastal processes, it does not propose direct remedial action for the Bribie Island breakthrough but may respond to its impacts (DES 2023).

Community Involvement

Public engagement is a key component and there will be activities planned for community involvement. The community will help shape values, priorities, and potential adaptation options. Additional details are available in the Communication and Engagement Plan.

2.6.1.2 The Action Plan (BMT, 2015)

The Action Plan (BMT, 2015) identified the most likely breakthrough location at the narrowest section of the Bribie Island spit, *south of Blue Hole and opposite Nelson Street*. It outlines a Three-Stage Strategy to manage risks associated with tidal changes in Pumicestone Passage, triggered by:

1. Beach nourishment needs exceeding 10,000m³/year.
2. Beach nourishment becoming unsustainable.
3. A rise in mean high-water springs or mean sea level >0.2m above 2014 levels.

Trigger 3 signifies unacceptable inundation risk and activates Stage 3, recommending construction of a revetment seawall along the Nelson Street to Bells Creek shoreline to manage tidal regime changes.

The Action Plan determines this to be an unacceptable level of risk and that a revetment seawall be constructed.

Proposed works include:

- Rock revetment extension between *Lamerough Canal and Caloundra Power Boat Club* to protect Council boat ramp facilities.
- Revetment extension/upgrade between *Keith Hill Park and Roy Street*.

The Sunshine Coast CHAS (May 2021) aligned with the Action Plan by adopting the 0.2m tide level increase as a trigger for seawall construction and recommended that 2041 adaptation measures be implemented immediately if a breakthrough occurred.

In January 2022, a breakthrough occurred at the predicted location. Since then, mean high-water levels have risen by 0.23m, exceeding both the Action Plan Stage 3 trigger and CHAS projections, necessitating immediate responses.

Gap analysis findings from the recent working CHAPP:

- Continued beach nourishment without seawall construction is insufficient to manage inundation risk.
- The proposed seawall could be extended north to Nelson Street, linking with foreshore works and incorporating living seawall elements.
- Upgrades should consider stormwater infrastructure, including enhanced backflow prevention.
- The Keith Hill Park to Roy Street seawall could be extended to Bells Creek boat ramp and north to connect with Military Jetty.

3 WHAT ARE THE ISSUES?

3.1 Defining 'Issue'

As part of the Terms of Reference, RPS and ICM have been tasked with determining immediate and urgent solutions and recommendations.

The first step in this process is to define what "urgent/immediate" means in this context.

Coastal hazard response in dynamic environments, such as Bribie Island, requires a tiered and adaptive approach: one that addresses immediate risk, while also setting a pathway toward sustainable long-term resilience. In this chapter, we define and differentiate immediate, short-term, and long-term solutions, and highlight the importance of integrating these perspectives when planning and implementing a coastal hazard adaptation plan.

3.2 Defining "Immediate" or "Urgent"

For the purposes of this chapter, we consider 'immediate' or 'urgent' actions as those that must be undertaken within the timeframe leading up to the next storm season. That is, before November 1, 2025, when Queensland's traditional severe weather season begins (typically concluding on April 30)

This timeframe is not arbitrary. The breakthrough of Bribie Island occurred in early 2023, and over the past two years the Golden Beach area has experienced multiple significant weather events, including a direct cyclone impact. These events have amplified tidal influence and erosion, escalating risk to infrastructure, property, and safety. Delaying action until the next storm season could result in major negative impacts, particularly if further high-energy events coincide with the already-altered coastal system.

In this context, immediate measures are those necessary to prevent acute damage or loss, particularly where:

- Life is under threat
- Essential infrastructure is at risk
- Further delay may lead to compounding issues and significant recovery costs

3.2.1 Immediate Solutions - Urgency and Effectiveness

Immediate solutions are defined by their speed, practicality, and effectiveness in responding to existing or rapidly emerging hazards. These measures are typically enacted when there is a clear and present risk to life, property, or critical infrastructure. In the context of Golden Beach, the January 2022 breakthrough of Bribie Island has already triggered significant tidal regime changes, as noted in the CHAPP report:

"Tidal monitoring… has shown an increase in HAT of 310mm… an increase in mean high-water level of 0.23m… exceeding the trigger level for Stage 3 of the Action Plan."

This shift has redefined what is considered urgent. In such cases, intervention without delay is often necessary - whether it be sand nourishment, interim barriers, or something more substantial. A high-level example might include the reinstatement of part of Bribie Island to slow the altered tidal exchange and mitigate immediate inundation risk.

However, such responses must be understood as temporary stabilisation, not lasting solutions. Without addressing underlying drivers, such as ongoing sea level rise, weakened sediment supply, or human modifications to coastal systems, the same breach or hazard may re-emerge, potentially more aggressively.

3.2.2 Short-Term Solutions - Transitional Adaptation

Short-term solutions in this case can cover planning horizons up to 2041, aligning with the CHAPP's interim planning framework. These solutions build upon immediate actions, offering incremental improvements that manage risk more sustainably and buy time for longer-term planning and approvals. Examples include:

- Interim dune reconstruction or reinforcement.
- Minor relocations of vulnerable infrastructure.
- Modular, scalable coastal structures that can be upgraded over time.

Short-term measures must strike a delicate balance between speed of delivery and environmental or planning compliance. They often serve as a test bed for adaptive techniques, allowing monitoring, community engagement, and refinement before committing to more permanent interventions.

3.2.3 Long-Term Solutions - Resilience and Transformation

Long-term solutions are developed with future planning horizons in mind - 2041, 2070, and beyond - and focus on building resilience to cumulative and irreversible change, including sea level rise and intensified storm patterns. These strategies are typically more complex, capital-intensive, and subject to higher levels of governance and environmental evaluation.

However, long-term solutions should not be delayed until those future years. On the contrary, their design and staged implementation can and should begin now, to ensure infrastructure and adaptation measures are in place and functioning well before the impacts they are designed to manage reach critical thresholds. Early action also allows for integration with immediate and short-term works, ensuring coherence across scales and reducing overall cost and risk through planned phasing.

For Bribie Island, long-term thinking invites consideration of whether simple reinstatement is sufficient, or whether a more resilient system, potentially involving artificial headlands and reefs, coastal realignment, or hybrid infrastructure, should be pursued from the outset. These solutions may challenge existing planning frameworks and approval pathways, but they offer the greatest opportunity for durable, adaptive protection.

3.2.4 Integrating Timescales for Smart Coastal Management

Effectively managing coastal hazards requires integrated thinking across timescales. Immediate actions are critical to protect life and infrastructure in the face of imminent risk, but these actions must be designed to support or evolve into longer-term strategies. Similarly, long-term solutions must not be deferred until 2041 or 2070. Rather, they can be initiated now, ensuring communities are prepared in advance, not just reacting to future thresholds when they arrive.

As the project progresses, future chapters in this report series will continue to explore this spectrum - challenging assumptions, identifying trade-offs, and proposing actionable, scalable strategies that balance the need for speed with the demand for lasting resilience.

3.3 The Issues List

Note that there is likely an infinite list of “issues”, and what constitutes as a ‘issue’ will vary depending on individual perspectives and context. However, for the purposes of finding immediate/urgent solutions, we have highlighted initial key, overarching issues in ‘Table 1’. This list may evolve or expand during or after community consultation. At this stage, the issues are numbered for reference, but they are not ranked in any particular order.

Table 3: Issue List

No.	Category	Issues	Review/Discussion
1.	Sand Migration (Erosion & Accretion)	Large-scale sand migration has been ongoing since the initial breakthrough (BT#1) over two years ago. This includes significant accretion that has blocked the historic Caloundra Bar and opened multiple new channels, as well as persistent erosion along the coastal frontage. The redistribution of sand along the shoreline and within the passage is altering navigability, ecological zones, and foreshore stability.	The prolonged changes in sand movement are altering the morphology of the coast. If not managed, continued erosion could threaten infrastructure, public access, and ecological assets such as mangroves and seagrass meadows.
2.	Tides	The breakthrough has altered the tidal regime in Pumicestone Passage, leading to higher high tides and greater tidal variation. These changes have also reduced the natural flushing capacity of (part of) the system, which may affect water quality, nutrient dispersion, and ecological health, it has also increased flushing in other areas. Fluctuations in tidal dynamics are being observed along the shoreline, contributing to instability and stress on estuarine ecosystems.	Rising tidal levels increase the risk of inundation for adjacent low-lying properties and public infrastructure. There is conflicting information about water quality, with some data suggesting potential health risks. These uncertainties hinder decision-making for urgent mitigation. In addition, the reduced flushing could lead to algal blooms and degradation of aquatic habitats. A detailed review of hydrodynamics and a feasibility study for improvements to the Pelican Waters channel weir are recommended.
3.	Waves	Wave energy is now entering Pumicestone Passage through newly formed breaks, especially BT#1 and BT#2. Golden Beach was not historically exposed to such wave conditions and lacks the design resilience to withstand them. The widening of BT#1 increases vulnerability to storm surges and wave penetration into developed areas. Wave energy is being dissipated in some areas by the build-up of sand banks within the Passage.	Wave exposure is increasing the potential for sudden erosion and infrastructure damage. While Cyclone Alfred in 2025 did not cause catastrophic failure, the storm highlighted vulnerable areas such as near the Caloundra Power Boat Club. Continued widening of the breaches could elevate future risks.
4.	Environmental Values	Critical ecological assets are under pressure. Mangroves and wetlands behind BT#2, seagrass beds inside BT#1, and various marine and bird habitats are at risk from erosion, sedimentation, and hydrodynamic change. Wildlife displacement, including potentially isolated terrestrial fauna, has been observed.	Environmental degradation could be long-lasting and complex to reverse. Seagrass and mangrove systems provide essential ecosystem services including fish habitat, carbon storage, and shoreline stability. Ongoing disruption could trigger biodiversity loss and degrade the resilience of the coastal environment.
5.	Structures & Assets	Public structures such as jetties and boat ramps are experiencing higher levels of inundation and sand encroachment. Sediment movement linked to both BT#1 and BT#2 is changing access and usability, particularly during high tides. Storm water drains within The Passage are facing blockages due to sand inundation.	While major infrastructure damage has not yet occurred, escalating pressures could impact service levels and public safety. Proactive asset condition surveys and resilience upgrades are recommended to avoid costly emergency repairs.
6.	Navigational Access	Navigational access through BT#1 is now highly dynamic, presenting hazards for recreational and emergency marine vessels. The Caloundra Sailing Club and Coast Guard have reported operational limitations, and natural debris from the degrading island flora has compounded navigational challenges. Navigation aid closest to BT#1 has been lost.	Although natural variability in channel form is expected in coastal systems, the current configuration is reducing safety and reliability for key marine users (Coast Guard). This could limit emergency response capabilities and community recreation. Targeted intervention may be required.
7.	Recreational Use	Recreational use patterns are changing due to concerns over water quality and increased wave energy. There is uncertainty around the accuracy and transparency of water quality data, and anecdotal reports suggest shifts in boating behaviour.	Perceptions of poor water quality and increased risk are likely to reduce public enjoyment and safety. This may affect tourism, community health, and public confidence. Reliable monitoring and public communication are essential.
8.	Cultural Values	The changing coastal landscape is affecting community connection to place, including disruption of long-standing use of the passage and Bribie Island for recreation, ceremony, and cultural practices. Indigenous heritage values may also be at risk.	There is limited qualitative data available to fully assess cultural impacts. Community engagement and Traditional Owner consultation are critical to identifying heritage risks and developing culturally respectful adaptation strategies. This will be covered in following reports.

3.4 Constraints (Environmental & Legislative)

3.4.1 Planning Framework Summary

The planning and environmental context governing Golden Beach is highly complex and multi-layered, involving intersecting national, state, and local frameworks. These regulatory instruments set out detailed zoning, environmental protections, hazard overlays, and development conditions, all of which inform and constrain long-term planning for the area. However, in this chapter of the report series, while we acknowledge the importance of these frameworks, our primary focus is on immediate and urgent hazard mitigation actions - treating them more as emergency works rather than conventional development projects subject to extended assessment timelines.

At the local level, the Sunshine Coast Planning Scheme 2014 applies a wide range of zoning designations and overlay codes across the Golden Beach study area. These include flood hazard overlays, heritage protections, biodiversity and wetland overlays, and planning codes tied to scenic amenity and land stability. Although Council is currently drafting a new Planning Scheme (submitted to the State Government for review in December 2023), the CHAPP report notes that:

"Planning considerations are to be revisited as the draft planning scheme continues through the preparation and adoption phases."

Further complicating the planning landscape are overlapping state and federal obligations. At the national level, the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) identifies Matters of National Environmental Significance (MNES) relevant to the area, including RAMSAR wetlands, threatened and migratory species, and marine turtle habitat. Any works determined to significantly impact these values must be referred to the Commonwealth for assessment as a "controlled action," which may trigger the need for a full Environmental Impact Statement (EIS).

Additionally, land and cultural heritage claims under the Native Title Act 1993 and Aboriginal and Torres Strait Islander Heritage Protection Act 1984 apply to areas within the study site, involving the Kabi Kabi and Jinibara Peoples. This requires careful engagement and compliance in areas affected by current or potential claims.

The state planning framework introduces further layers of approval and potential referrals. These include triggers under the State Planning Policy, which identifies significant ecological values (e.g. koala habitat, wetlands, declared fish habitat areas), natural hazards (e.g. erosion-prone areas, bushfire risk, storm tide inundation zones), and infrastructure corridors. Additional legislative instruments, such as the Coastal Protection and Management Act 1995, Environmental Protection Act 1994, Fisheries Act 1994, Marine Parks Act 2004, and Planning Act 2016, apply to specific types of work, especially those involving tidal areas, dredging, or marine vegetation.

Despite these constraints, the CHAPP Options Analysis project emphasises the urgency of proactive, flexible responses in hazard-prone areas. It highlights that:

"Golden Beach is likely to be increasingly exposed to beach erosion and dynamic sand movements… Low-lying areas may also be increasingly exposed to tidal inundation, storm tide inundation and coincident flooding."

Moreover, the CHAPP notes that some state planning frameworks have not yet been updated to reflect the Bribie Island Breakthrough of January 2022, suggesting a time lag between environmental change and formal planning controls:

"Due to statutory constraints… the State Planning Framework has not been updated to reflect the Bribie Island breakthrough."

In light of these complexities, this report adopts a risk- and outcome-based approach. While we recognise the importance of aligning with legislative requirements, our emphasis is on implementing practical, time-sensitive interventions that address realised and immediate risks - especially where mean high-water levels have already exceeded planned thresholds, and existing infrastructure and community assets are at risk. Detailed environmental and statutory assessments will be required as part of future works, particularly as the CHAPP moves into project design and delivery stages. However, this report prioritises the articulation of near-term adaptive responses, reflecting the dynamic and urgent nature of the coastal hazard landscape now confronting the area.

3.5 High Level Issue Review

While it is acknowledged that the list of potential issues is extensive and subjective - varying with individual perspectives and lived experiences - this report identifies several key, overarching concerns that require urgent attention. These include dynamic sand migration, leading to erosion and accretion across multiple zones; increased tidal levels and wave exposure in the Pumicestone Passage; environmental degradation, particularly to seagrass beds, mangroves, and fish habitats; and impacts to infrastructure, such as jetties, boat ramps, and navigation channels.

The changing coastal environment is also disrupting cultural values, public safety, and recreational use, with rising concern over water quality and habitat loss. Importantly, the compounding effect of two active breakthrough channels (BT#1 and BT#2) introduces heightened uncertainty around future coastal behaviour. As these conditions evolve, community concern is growing, driven by a lack of clarity around what can or will be done. While this chapter outlines a snapshot of known issues to guide immediate responses, it is expected that further community engagement will expand or refine this list, especially as values, priorities, and on-ground conditions continue to shift.

4 WHAT COULD BE DONE?

4.1 What's the Approach?

When considering the future of Bribie Island and its surrounding communities, there are essentially two paths forward. The first is to do nothing, to allow nature to take its course without intervention. The second is to take action, which can range from small-scale, temporary works to large-scale, long-term interventions.

Action can be a one-time solution or an ongoing, adaptive approach. Each path has implications for the social, environmental, and economic values of the region. In the face of accelerating climate impacts, increased coastal development, and rapidly shifting natural dynamics, the decision to act, or not, will shape the future resilience of this coastline.

4.1.1 Do Nothing: "Let Nature Take its Course" Approach

The do-nothing approach has been a common stance in many parts of New South Wales, where the default position often leaves communities and assets at the mercy of coastal change. A clear example of this can be seen at Wamberal, where homes were severely threatened by erosion as early as 1978. Fast forward to 2025, and similar images still emerge, with properties and infrastructure again facing collapse. These repeated events highlight the reality that while natural systems are dynamic, the risks from doing nothing are compounding. Erosion is not just a one-off event; it is persistent and worsening due to a combination of natural variability and human influence. Without action, damage continues, uncertainty grows, and opportunities for proactive, managed outcomes are lost.

Figure 26: ***Left:*** **Wamberal 1978 erosion (Wamberal Net, 2025).** ***Right:*** **Wamberal 2025 beach erosion (Daily Telegraph, 2025).**

4.1.2 The "Take Action" Approach

By contrast, taking proactive action can build resilience and secure long-term benefits. For example, the Gold Coast provides a compelling case study. In 1967, cyclones caused widespread devastation to the region's coastline, stripping beaches and threatening infrastructure. In contrast, during Tropical Cyclone Alfred in 2025, although isolated impacts were recorded, much of the Gold Coast remained stable and resilient, with the coastal dunes acting as a natural buffer protecting both community assets and the local economy.

Notably, much of the coastline's terminal seawall (the last line of defence) remained buried and unseen, showcasing the effectiveness of these natural systems.

Tourism returned almost immediately, emphasising the success of decades of proactive investment in coastal management. Key to this success was the implementation of pilot projects, the trialling of innovative solutions, and continuous monitoring and adaptation. Many of these pioneering strategies, now globally recognised, were initiated by Angus Jackson, founder of International Coastal Management (ICM), during his tenure as Head of the Coastal and Waterways Department at Gold Coast City Council in the 1970s and 80s. This approach shows that with vision, leadership, and a willingness to learn, coastlines can be not only

protected but enhanced for future generations. It is noted that the Gold Coast is not a 'perfect' solution, yet it highlights the nature of taking action, monitoring, learning, adapting and progressing in the coastal resilience approach.

Figure 27: ***Left:*** **Gold Coast Cyclone 1967 (ICM Archives).** ***Right:*** **Gold Coast April 2025, post Tropical Cyclone Alfred (ICM, 2025).**

It should be noted the Sunshine Coast has also been proactive in coastal management practices in many locations over the years and therefore has a precedent for acting. The above-mentioned Gold Coast example is for reference only as it is relevant to the latest impacts of Tropical Cyclone Alfred (of which this report has been triggered by). It is not the intent of the design approach to re-create the Gold Coast, only the proactive management approach using innovative solutions.

4.2 Where Are We Heading?

This report focuses on identifying and recommending urgent actions to address the immediate risks and challenges following recent breakthroughs on Bribie Island. While the priority is on short-term, implementable solutions, we also recognise the value in aligning these actions with broader long-term goals wherever possible. Establishing this connection will not only maximise the benefit of near-term interventions but also help lay the foundation for a more resilient and adaptive future. At a high level, the longer-term vision that these immediate actions aim to support includes:

- **Stabilising and managing tidal regimes,** ideally returning water levels within Pumicestone Passage to conditions closer to those experienced before the initial Breakthrough, while also improving long-term resilience to increasing tides.
- **Ensuring the safe and functional use of the waterways**, particularly for recreation, navigation, and emergency access.
- **Increasing the resilience of the passage environment**, supporting ecological health, water quality, and biodiversity.
- **Reinforcing the resilience of the island coastline**, reducing erosion and safeguarding public and private assets.

4.2.1 High Level Options Review

To achieve the longer-term objectives outlined above, a range of potential options will need to be assessed in greater detail. These will form the foundation of future reports in this series, with consideration given to feasibility, cost, environmental impact, and stakeholder alignment. Drawing on our extensive experience delivering similar coastal resilience projects nationally and internationally, we recognise that there is insufficient time within this immediate phase to fully analyse and design long-term interventions.

The table that follows presents a preliminary list of potential approaches for discussion purposes only. Each option has its own benefits and trade-offs, and none should be considered definitive at this stage. In future reports, we will examine these in greater depth, including costings, risk profiles, and maintenance implications to support more informed decision-making.

Table 4: Potential Long-term Options List

No.	Potential Solution	Purpose
1	**Multipurpose Artificial Reef**	Designed to reduce wave energy reaching the narrow section of Bribie Island, helping to protect the remaining dune and vegetation line. Additionally, it promotes nearshore sand accumulation - functioning similarly to a submerged groyne - while enhancing habitat diversity and providing recreational opportunities such as diving, fishing, and surfing.
2	**Artificial Headland**	Supports the upper beach and helps retain nourishment placed as part of a dune buffer system. These headlands slow longshore sediment transport, increasing the lifespan of the nourished beach. They also provide additional space for dune vegetation establishment and natural resilience.
3	**Terminal (Buried) Wall under vegetated dunes**	Acts as a concealed final line of defence, intended to reduce the risk of complete island failure. Unlike urban seawalls, this solution allows for some overtopping, acknowledging the natural landscape behind it. Inspired by the Gold Coast A-line but adapted for a lower-risk, environmental context.
4	**Widened island inner bank with oyster reefs and mangrove rehabilitation**	By redistributing sand from the northern island tip, a broader, more stable berm can be constructed to support mangrove growth. The addition of oyster reefs helps guide water flow, stabilise sediments, and enhance ecological resilience.
5	**'Soft' groynes for entrance stabilisation (both sides of entrance bar)**	Using low-impact, geotextile-based groynes to guide sediment transport and improve entrance stability on both sides of the re-opened Caloundra Bar. Similar to approaches used at Maroochydore River, this solution is adaptable and minimises environmental disruption.
6	**Re-opening the old Caloundra Bar**	This would require a significant dredging and nourishment campaign.
7	**Small sand inlet pump station**	A small-scale sand bypass system, akin to the Noosa River Inlet pump, could be used to manage sand buildup in the entrance and redistribute material to high-need zones like the outer beach. This improves long-term entrance stability and helps maintain channel function.
8	**Shifting main channel (offset from Golden Beach)**	Re-aligning the main channel further offshore from Golden Beach would reduce direct tidal and wave energy on the mainland foreshore, allowing for natural beach widening and the creation of a broader dune buffer.
9	**Increase sand and dune buffer along Golden Beach**	This approach enhances the resilience of beachfronts by enabling space for dune restoration, reducing erosion pressure, and improving long-term coastal stability. It also provides greater flexibility for future adaptation and protection strategies along the urban interface. It may be done in conjunction with plans to build seawalls along this shoreline which could be buried.
10	**Weir Improvement/Upgrades**	Enhancing the capacity of the existing weir system may help manage the increased tidal ranges observed since the breakthrough events. By better regulating water flow and levels, this option could support improved water quality, flood resilience, and system-wide hydrodynamic balance. Note: this element has been flagged for consideration going forward and is not a design recommendation.

Figure 28 Potential future options using different elements from the 'toolkit' (ICM, 2025).

Note that the options outlined here are not the only potential future solutions. A wide range of approaches may be viable, and it is expected that community consultation and feedback will play a critical role in shaping the next stages of planning and design.

Future long-term strategies could include scenarios such as retaining the Breakthrough #1 bar entrance where it is, keeping the northern end of Bribie Island closed/attached to Caloundra and creating a 'wave break island' or series of inner sandbank islands for example.

These and other alternatives will be explored in a future report in this series. The purpose of flagging these possibilities at this stage is to prompt early dialogue about what may be achievable and desirable, helping to shape the direction of future design development based on shared values and informed discussion.

5 WHAT COULD WE ACTION NOW?

Working with the constraints of time (before next storm season), resource limitations (procurement) and permitting challenges, it is essential to determine what can be done in the 'immediate' timeframe to achieve the goals.

5.1 What Are the Goals of These Immediate Solutions?

As discussed in the previous section we derived some longer-term, high-level goals. We understand that to achieve these goals, significant works (and time) will be required and therefore this report aims to focus on the immediate. What can we achieve in the immediate timeframe to:

- Reduce negative impacts on The Passage foreshore and assets (public and private)
- Improve water quality and safe navigation
- Buy time to learn from the immediate solutions to inform longer-term solution

The last point highlighting the re-occurring theme of a pilot approach. Acting in a relatively low risk approach to develop the solutions as they proceed, monitoring and maintaining them to inform the longer-term outcomes will be the best approach to this situation.

We recognise that coastal management involves complex trade-offs, and that stakeholders may hold differing views on what should be prioritised. Our approach to identifying solutions has been pragmatic and informed, with the understanding that not all concerns can be addressed immediately or to the full satisfaction of every party.

5.1.1 Limitations of Design and Recommendations

Due to time constraints, the following recommendations are presented at a concept design level only. Their purpose is to provide real solutions that could be implemented, with the understanding that detailed implementation planning is still to come. The rationale behind each approach has been documented as thoroughly as possible within the available timeframe.

Additional information, such as up-to-date surveys will be required (noting that conditions of the site are continually changing). Further investigation into constructability, procurement and associated costs will also be required, along with engagement with relevant agencies.

5.1.2 Focus on Golden Beach and Diamond Head Foreshore or the Island?

Recent feedback from the TWG raised concerns about the need for focus on Golden Beach and Diamond Head, particularly in relation to sand over wash into public areas and elevated tidal levels. It's been acknowledged that SCC is progressing both short- and long-term planning for seawalls in this area and that our intention is not to disturb this process for immediate works.

Most community concerns relate to two key symptoms:

- Sand wash into public open spaces (particularly following high tides and wave action)
- Increased tidal levels within Pumicestone Passage in general

When responding to complex coastal issues like this, there are generally two approaches:

- Address the symptoms - mitigate the local impact
- Address the cause - reduce the source of the issue

5.1.2.1 The Cause/Trigger - The Immediate Benchmark (TC Alfred)

"The cause" in this case is highly complex (refer to Report 1 – for the desktop analysis of this site's very long history). The "cause" can also be relevant to time. Depending on how far back in history you look, there is an array of different potential "causes" or triggers.

To design and approve a suitable 'long term' solution in a matter of weeks (the allowable time of this report) that tackles the long history of triggers is unrealistic. Therefore, we are looking at realistic "immediate" trigger

point in time. TC-Alfred is the most obvious significant trigger point for the cause of recent symptoms, as described by the following:

Elevated Tidal Levels

It has been established that tidal ranges within the Passage increased following the Bribie Island breakthroughs after Tropical Cyclone Alfred. While tides were already elevated post-Breakthrough #1, the additional breaches have worsened the situation. Reinstating the island to a pre-Tropical Cyclone Alfred condition would likely help reduce current tidal levels, returning the system to a more stable (though still undesirable) state.

Increased Wave Action and Sand Over wash

Similarly, wave energy impacting the foreshore at Diamond Head and Golden Beach has increased since Tropical Cyclone Alfred, resulting in sand being pushed into public areas. By restoring Bribie Island's physical form to its pre-Tropical Cyclone Alfred configuration, this wave energy exposure is expected to reduce, thereby minimising further overwash events.

Ultimately, if we can return the state to a pre-Tropical Cyclone Alfred condition, we know that conditions will be improved, although not 'ideal', these immediate works will get the process started towards the longer-term goals.

5.1.2.2 Urgency and Interim Measures

This report has aimed to identify and prioritise immediate risks to infrastructure, safety, and community assets. What is considered "urgent" will differ depending on local values and lived experiences.

5.2 Recommendation 1 - Close Breakthroughs #2 and #3

5.2.1 Why?

The risks associated with these breakthroughs have been discussed earlier and are considered urgent, particularly in the context of completing works before the next storm season.

Since the formation of these breakthroughs, tidal and wave conditions within The Passage have changed significantly. Inner tide levels along Golden Beach now resemble those of the open coast, and a significant amount of wave energy is entering The Passage as a result.

5.2.2 What?

In practical terms, Breakthroughs #2 and #3 need to be plugged and sealed to reinstate Bribie Island to its pre-Tropical Cyclone Alfred condition. This will help restore some of the island's former protective function and reduce the impacts currently observed in Pumicestone Passage.

To close and stabilise these openings, sand will need to be pumped and placed into the active channels, essentially rebuilding the dune barrier across each breach

However, because several weeks of tidal flow have already occurred through these breakthroughs, the seabed on both the ocean and passage sides, has likely adjusted to function as active tidal channels. This means that simply filling the breaches is not enough; the newly reinstated landform will remain vulnerable to continued scour and re-erosion from these adapted flow paths.

As a result, additional protection measures will be required on both the coastal (eastern) and passage (western) sides of the filled areas to ensure their stability and functionality. Alternative supporting measures were reviewed in earlier versions of this report and refined based on feedback received from technical reviewers.

The final recommendations emphasise actions on the coastal side, where the risk of higher impact and exposure is most significant. They also adopt 'soft' approaches, thereby minimising the potential impacts of interventions by aligning outcomes to pre-existing natural conditions. Incorporating more engineered elements would potentially increase reliability, however, design and materials requirements would add complexities that may frustrate timely delivery of these urgent recommendations.

5.2.3 How?

Initial, high-level investigations indicate that approximately 100,000m3 of sand would be required to infill the two breakthroughs (BT#2 and BT#3), allowing for some losses during the filling process (numbers to be confirmed at time of works as the situation is changing).

This raises a critical question: where will the sand come from?

Several options have been considered:

- Offshore sources: Offshore sources are being investigated as part of the CHAPP and will likely be integrated into long term solutions. Offshore sources are not apparently readily available without investigation and negotiations. They should, however, be considered as potential sources for immediate works (if time and sourcing allow however, it seems unlikely within the timeframe).
- Inshore sources (within The Passage): These areas also present challenges, including potential impacts on coastal stability. Additionally, some regions within the passage are identified as having acid sulphate potential and seagrass, complicating extraction efforts. Removing sand within The Passage will also have impacts on hydraulic processes and needs to be considered.

For immediate/urgent works, the following sand sources have been identified as the most feasible due to their availability and proximity to the proposed sites. Note that offshore sand source investigations will continue. Note that the sand targeted for immediate works is aimed at being the least impactful to coastal processes and is not meant to be a standalone series of works. Ie. Sand that might be moved for immediate works could be considered potentially 'borrowed' and will need to be monitored going forward to maintain a hydraulic balance requiring maintenance.

5.2.3.1 Potential - Remove Sand from the Old Caloundra Bar Entrance

A promising option is the old bar/entrance way, which has naturally filled in with good-quality beach sand over time. This could serve as a valuable source of 'suitable' beach sand (subject to analysis).

Without 'breaking open' the old Caloundra Bar and further changing the hydrodynamics, initial review shows that by removing an area (red triangle in Figure 49, left) by approximately 1m would maintain the sand level at Mean High Water Springs, meaning it would remain dry beach for much of the day. This area would produce approximately 100,000m3 of sand volume.

Targeted dredging of only removing 1m of sand depth is likely to have less impact than dredging deeper holes, though this approach requires a more refined dredging methodology, including continuous monitoring and evaluation.

5.2.3.2 Potential - Remove Sand from Within the Passage

A significant amount of sand has naturally washed into the passage from the island itself (red marker in Figure 49, right). Could this sand be used? In theory, yes, but careful investigation is needed to assess how the sand has moved and mixed with existing substrates, particularly in relation to seagrass habitats and acid sulphate soils. Extracting this sand without disrupting these delicate ecosystems will require a careful, targeted approach, but could likely be done with precision dredging.

Similar to the discussion above regarding the old bar entrance delta, we have nominally allowed for removal of 1m of material across the area indicated in the Figure below. This would produce approximately 150,000m3 of sand.

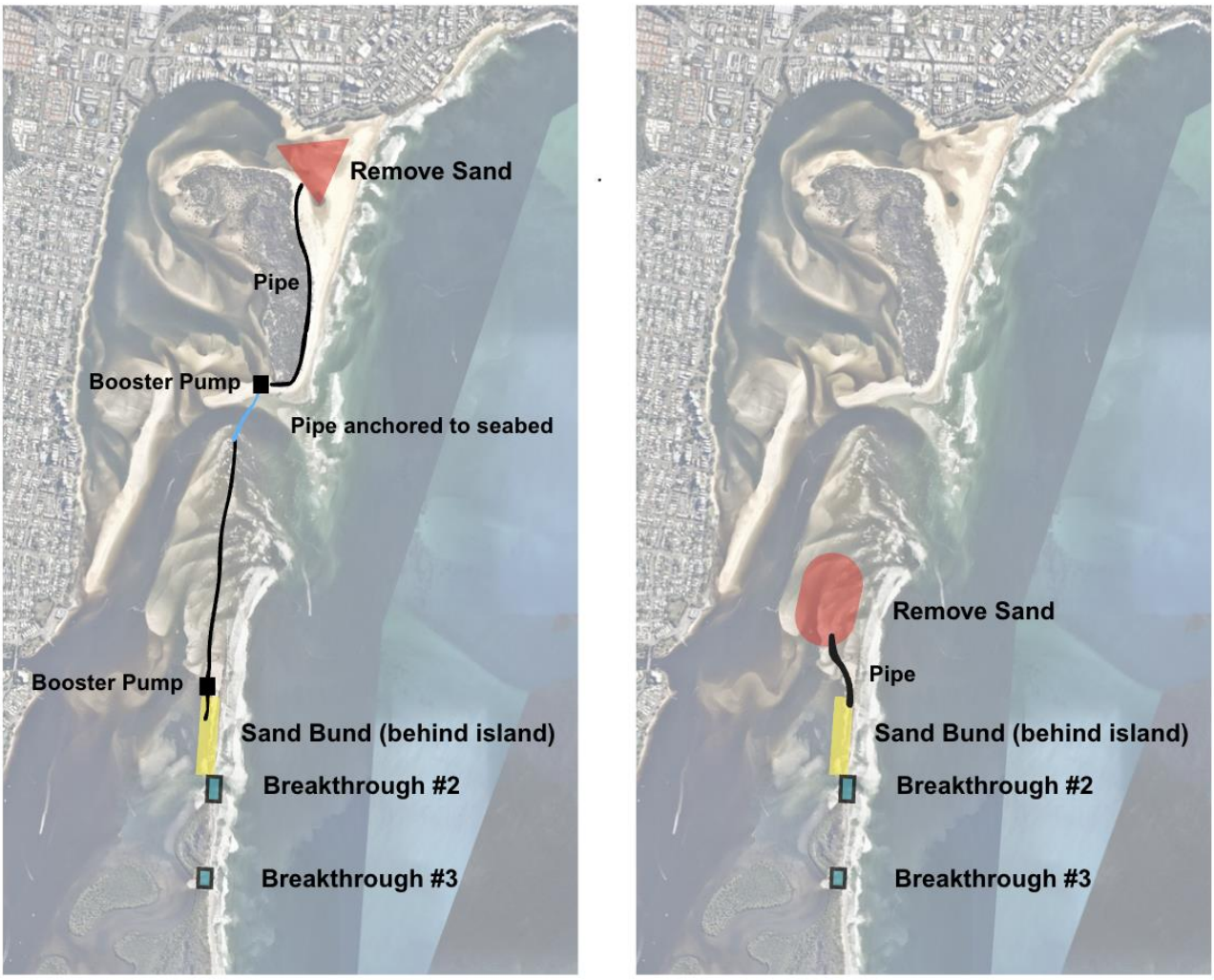

Figure 29: ***Left:*** **Indicative plan view of a temporary pumping system, shifting sand from old bar entrance to new breakthroughs.** ***Right:*** **Potentially sourcing sand from within The Passage to 'close' the new breakthroughs (ICM, 2025).**

An additional option would be to remove more sand from the old Caloundra Bar by moving deeper into the Passage and extending the depth of the cut towards reinstating a channel. Any such works should proceed so as to avoid causing the bar to 'break open'. Opening the Old Caloundra Bar while the other breakthroughs exist is not recommended.

This could mean removing the extra 150,000m3 from the northern area of the inner Caloundra Bar instead of behind the remaining island. As this is a pilot approach, the best way to proceed would be to monitor how the dredging is going relative to the stability of the Caloundra Bar, with the intent to remove sand without weakening the bar and causing a breakthrough.

A high-level review of the approaches pros and cons is highlighted in the following table. Note that this list is not exhaustive and has focused on key elements for consideration.

Table 5: Pros and Cons of Sand Source Areas

Approach	Pros	Cons
Remove from Old Caloundra Bar	• Should be good quality, clean sand • Sand built up over time so is in theory 'in excess' • Not in environmentally sensitive zone for approval purposes	• Long distance from breakthroughs #2 & #3, requiring pipe crossing of existing bar (BT#1). • Risk of pipe damage and will need to be anchored to allow access through bar (BT#1) • Risk of weakening the old Caloundra Bar build up, and being a breakthrough in next storm season - creating tidal issues
Remove from inside island (The Passage)	• Proximity to issue area means easier, cheaper and less risk for construction • No disruption to the existing bar crossing with pipe	• Sand has potentially mixed with inner seagrass beds (hence suggested removal on 1m of sand only) • Potentially disrupts the hydraulic efficiency of the sand bank (note that there is the build-up of the pronounced sand bank along the Golden Beach foreshore inside of BT#1 which is providing good foreshore protection)

Pilot Approach:

A common thread through this report is the pilot approach. Getting started and adapting as required. Further discussions with local contractors are required to work out the best logistics for efficient sand transport and works. It should be noted that conditions on the site are changing and realistically will need to be assessed as the works proceed with decisions made on-site as to whether the works can be done in a safe a manageable manner.

5.2.3.3 Determine Suitable Design Level (Acceptable Level of Failure)

Figure 31 represents the existing seabed and dune profile near the recent breakthrough event, which the transect line location can be seen in Figure 30. The current cross section shows significant erosive damage to the island, with large amounts of debris and vegetation lying across the eastern side of the island. Tide heights are indicated, and with wave setup, a 50-year storm event (JBP, 2024) can be illustrated showing significant over washing of the island, causing erosion and considerable damage to the vegetation. This will have effects on the western side of the island (Pumicestone Passage), including Golden Beach.

Figure 32 shows the current cross-section of Breakthrough #2 (approximation), which indicates seabed and the relevant storm tide level of +2.19 m AHD. This low and flat profile poses a significant risk of storm tide ingress, particularly during high-energy events such as the 50-year storm.

Figure 30: Survey transect (post TC Alfred) - near Breakthrough #2 (Drone Survey by Elysia Andrews, Queensland Government Hydraulics Laboratory)

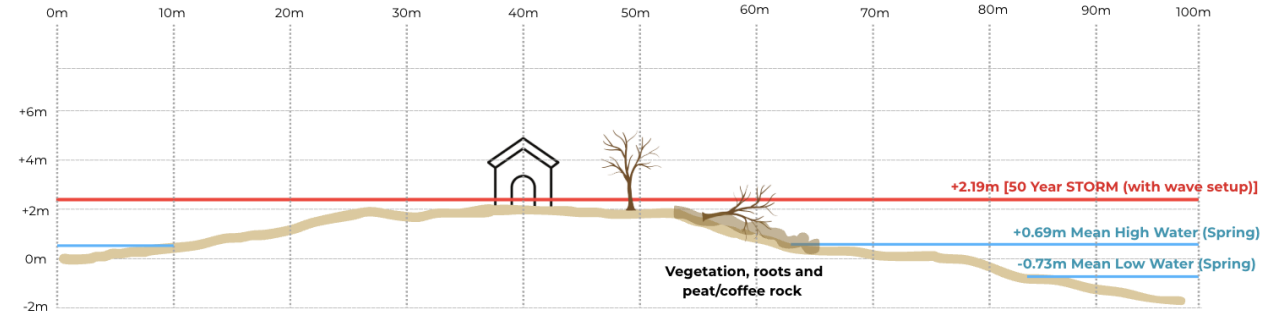

Figure 31: Typical cross-section near Breakthrough #2, providing current beach slope, with relative MLWS, MHWS and a 50-year ARI event.

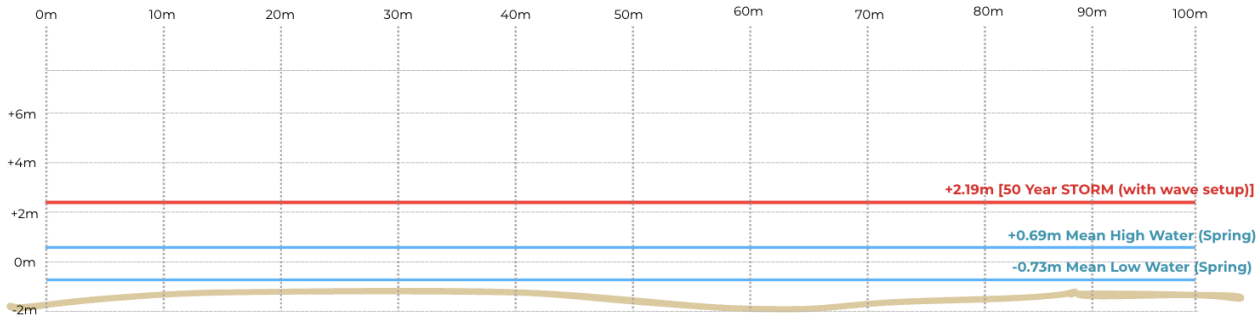

Figure 32: Typical cross-section of Breakthrough #2 (approximate), showing current sea-bed level, with relative MLWS, MHWS and a 50-year ARI event.

5.2.3.4 Recommended Approach - Reinstate and 'Buffer'

The proposed immediate approach is to build up the island level to its 'pre-breakthrough' condition. Essentially reinstating the dune system across breakthrough #2 (Figure 33) which aims to re-establish a physical barrier between the Pumicestone Passage and the open ocean. This would involve placing a significant volume of sand via dredging to recreate the historical beach and dune profile, restoring natural topography that previously offered some resistance to wave energy, tidal exchange, and storm surge.

However, this reinstated landform remains highly vulnerable in the short to medium term. Firstly, while the sand may be shaped to match historical dune elevations, the elevation still lies close to or below the projected storm tide level (+2.19 m AHD with wave setup). This means even a moderately severe storm could overtop or breach the newly formed dune before it becomes stable. Secondly, the freshly dredged sand will be loose and unconsolidated, lacking the natural compaction that develops over time. Without vegetation such as spinifex or coastal grasses, there is no root structure to anchor the sand, making it extremely susceptible to erosion from wind, waves, and overwash.

To improve the short-term resilience of this restoration effort, it is critical that the reinstated dune is quickly stabilised through vegetation planting and allowed time to consolidate naturally. Engineering options such as temporary geotextile or rock containment and sand fencing were considered to support initial stability while the dune system matures. However, due to limitations in time for design and approvals, while also taking feedback from environmental agencies, a purely 'soft' approach is recommended.

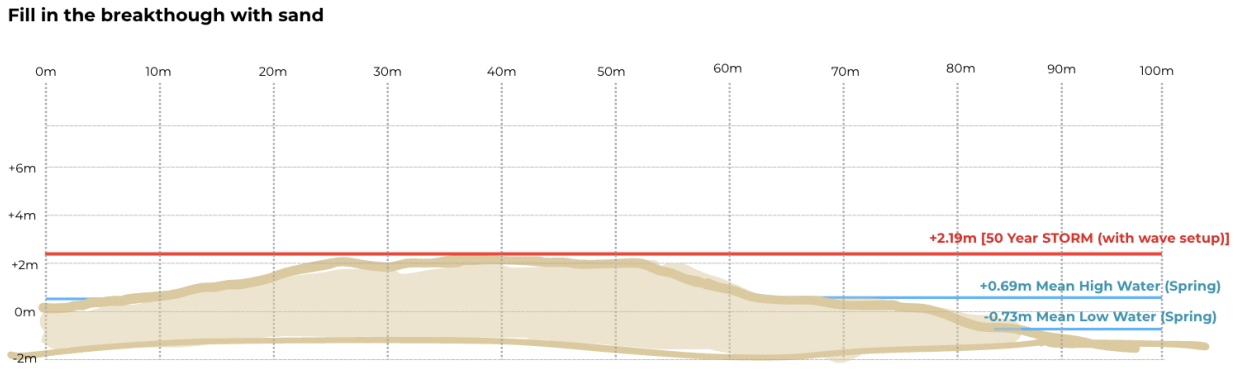

Figure 33: Step 1: Fill in the breakthrough with sand - use dredge to pump sand to stockpile. Use bulldozers to push sand across the breakthrough and close the gap. Reinstate to existing height to match the rest of the remaining island strip

Survey analysis comparing pre- and post-Tropical Cyclone Alfred dune profiles shows that dunes with crest levels below +3 m AHD were overtopped during the event, while dunes at or above +5 m AHD withstood wave impacts. Even at these higher elevations, approximately 65 m²/m of sand volume was lost during the storm. To replicate that level of resilience, a sacrificial dune of +5 m AHD crest height and approximately 65 m²/m cross-sectional volume is recommended as a minimum to withstand the next storm season, plus some additional volume for 'typical' conditions.

While the dune is expected to erode under storm conditions, its purpose is to act as a buffer, absorbing wave energy and protecting the reinstated landform behind it. This option provides interim protection and buys time for adaptive management, without triggering complex construction or approvals processes associated with harder engineering interventions. A conceptual cross-section is provided below.

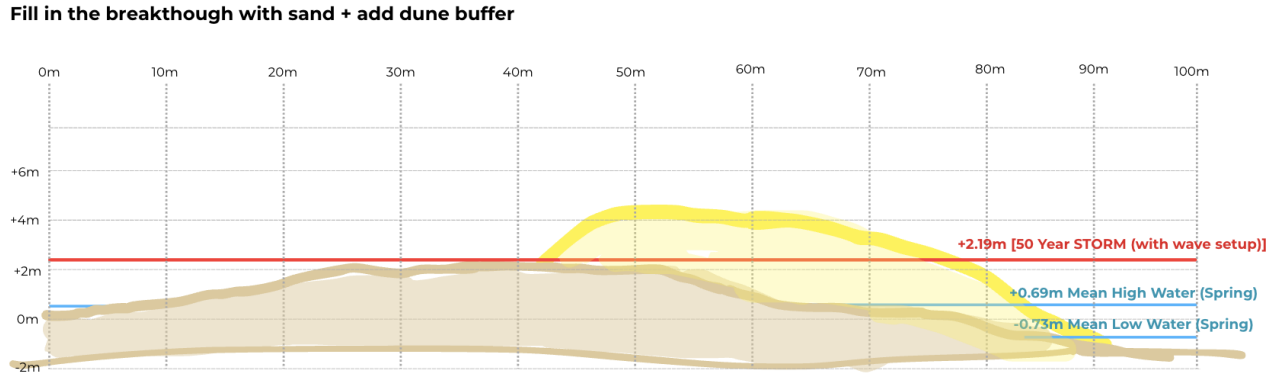

Figure 34: Step 2: Add the required mass nourishment along the eastern side of island to act as buffer from storm erosion scarp.

Note that conceptually the sections are shown as 'steps', to highlight the difference between simply reinstating the sand that was there, and placing additional sand, however, the works would be done at the same time as one 'solution'.

It is expected that this nourishment works could be completed in roughly 3-4 months (within the necessary timeframe for next storm season).

5.2.4 Pros and Cons

A high-level review of the approach pros and cons is highlighted in the following table. Note that this list is not exhaustive and has focused on key elements for consideration.

Table 6: Pros and Cons of Approach

Approach	Pros	Cons
Reinstate with Dune 'Buffer'	• No 'structures' means softer approach and 'easier' for approvals • No risk of 'damage' to structures for maintenance	• No structures mean a higher chance of sand being 'lost' to erosion and littoral drift • Without structures, dunes are susceptible to erosion. If greater storm conditions than TC Alfred are faced, additional maintenance nourishment would be required

5.3 Recommendation 2 - Protect the Remaining Island (Between BT#1 and BT#2)

5.3.1 Why?

The remaining stretch of island between Breakthrough #1 and Breakthrough #2 is rapidly degrading, with vegetation loss accelerating since Tropical Cyclone Alfred. This vegetation has acted as the final line of defence. Once it is lost, the island has been observed to retreat quickly, with sediment washing into the passage and forming an expanding sand bank.

Importantly, public assets at Lions Park, located within this vulnerable section, have already sustained damage, including the toilet block and picnic facilities, which have been rendered unusable and removed. Without intervention, this remaining section of island may be lost entirely, potentially leading to significant changes in coastal processes and further infrastructure risk on The Passage foreshore.

Introducing protective measures in front of the vegetation could help slow the degradation, retain the island's form for longer, and buy time for more comprehensive future planning.

Figure 35: Aerial image of debris, vegetation and potential peat/coffee rock along 'edge' of existing island (Drone Survey by Elysia Andrews, Queensland Government Hydraulics Laboratory).

5.3.2 What?

This chapter outlines the priority actions required to reduce short-term risk, stabilise vulnerable areas, and lay the foundation for longer-term resilience planning. However, it is important to acknowledge the significant challenges associated with implementing protective works, particularly along the island's edge. This zone is physically inconsistent, littered with debris and peat/coffee rock, and may contain Acid Sulphate Soils. These conditions will make any kind of structural intervention difficult, costly, and likely to require substantial site preparation, including clearing and stabilisation.

In addition, the natural surface levels along much of this stretch of island are low-lying and prone to inundation during storm events, as seen recently during Tropical Cyclone Alfred. These realities must be factored into all response planning. As such, the proposed short-term actions are framed with an emphasis

on low-impact, practical measures that can offer immediate protection or time buffers, while avoiding the pitfalls of premature or unfeasible construction.

5.3.3 How?

Figure 36 illustrates the remaining island section between breakthroughs #1 and #2, highlighting the critical need for mass sand nourishment along the ocean-facing front. Based on the storm erosion scarp left by Tropical Cyclone Alfred, we now have a clear understanding of the minimum dune volume and profile required to withstand another intense storm season. The current landform, while supported in part by vegetation, roots, and underlying peat or coffee rock, remains highly vulnerable due to its limited width and low elevation on the seaward side, especially where the terrain dips below the critical +2.19 m AHD storm tide level (with wave setup).

To protect this narrow island segment from further breach or overtopping, a targeted sand buffer must be placed in front of the vegetated core, as shown in yellow. This nourishment would act as a sacrificial buffer, absorbing storm wave energy and preventing direct attack on the vegetated ridge and underlying substrate. Without this proactive intervention, the next storm season could lead to a complete collapse of this remaining island segment, connecting the existing breakthroughs and severely compromising coastal protection for the mainland.

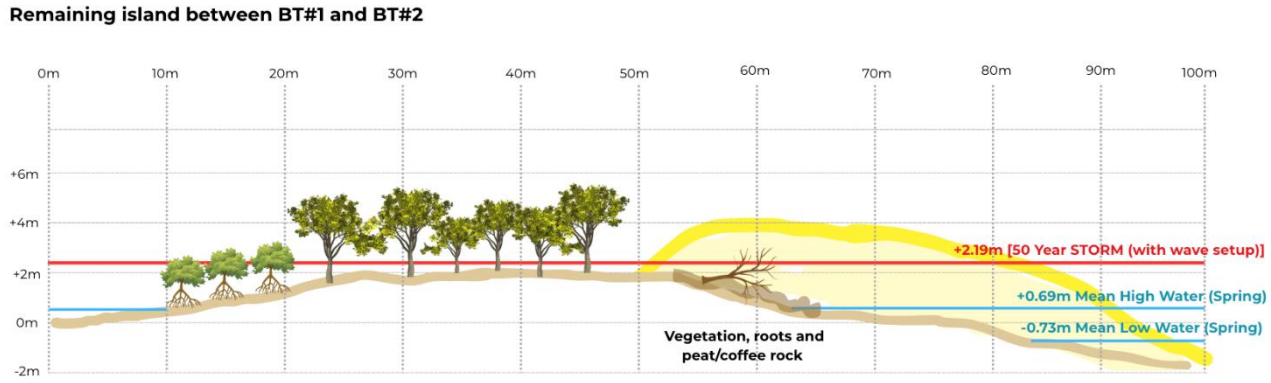

Figure 36: Typical cross-section between breakthrough #1 & #2, and the required mass nourishment along the eastern side of island to act as a buffer from storm erosion.

5.3.4 Pros and Cons

A high-level review of the pros and cons is provided in the following table. Note that this list is not exhaustive and has focused on key elements for consideration.

Table 7: Pros and Cons of Approach

Approach	Pros	Cons
Add Dune 'Buffer'	• No 'structures' means softer approach and 'easier' for approvals • No structures means no risk of 'damage' to structures for maintenance	• No structures means that higher chance of sand being 'lost' to erosion and littoral drift • Without structures, dunes are susceptible to erosion. If greater storm conditions than TC Alfred are faced, additional maintenance nourishment would be required • Chance that additional sand washes in and 'smothers' existing vegetation

5.4 Recommendation 3 - Wave Protection for The Foreshore Inside of Breakthrough #1

5.4.1 Why?

Even if the recommended measures such as closing Breakthroughs #2 and #3 and buffering the remaining island section are successfully implemented, a critical exposure point will remain at Breakthrough #1. This gap continues to allow significant wave energy to enter the Passage, directly impacting the foreshore behind Breakthrough #1 without the natural sand bank 'wave buffer'.

This increased wave activity is redistributing sand from north to south along the foreshore. This area is currently subject to ongoing maintenance, with sand regularly shifted back in front of the club, only for it to wash back down shortly after, creating a repetitive and unsustainable cycle.

This area is particularly susceptible during high tide or storm events. Addressing this exposure is required to reduce risk to public infrastructure and maintain functionality of critical access points.

5.4.2 What?

Inner Sand Bank (Pilot Trial):

This option involves constructing a sand bank inside the existing island tip, using a pilot-scale design to test wave attenuation benefits. The final crest height would be determined based on available material and cost constraints; however, the higher the bank - ideally above Mean High Water (MHW) - the better its protective function. Due to its position within the sheltered inner bar, this bank could be trialled without additional armouring, as wave energy and sediment loss risks are expected to be lower in this location.

5.4.3 How?

This area is highly dynamic and will require on-site decision-making to determine the appropriate sand volume at the time of construction. However, the expected volume is comparable to that required for reinstating and buffering Breakthroughs #1 and #3 - approximately 100,000m³. This material could be sourced from either of the previously identified locations.

Use of the internal sand source (vs the bar delta) would effectively shift that existing footprint to the proposed sand bank, with the relocated material placed to provide increased elevation and improve its performance as a wavebreak for areas of the foreshore that remain exposed from BT#1.. This sandbank could nominally follow the alignment of the FHA boundary, piloting a potentially longer-term strategy. The suggested location of this sandbank is shown in the recommendations chapter, Figure 38.

5.4.4 Pros and Cons

A high-level review of the pros and cons is provided in the following table. Note that this list is not exhaustive and has focused on key elements for consideration.

Table 8: Pros and Cons of Foreshore Protection behind BT#1

Approach	Pros	Cons
Inner sand bank (pilot trial)	• Provides shorebird habitat inside channel • Soft solution only on the edge/outside of environmentally sensitive borderline makes for 'easier' approvals • May temporarily reduce wave impacts inside of BT#1	• Sand bank subject to natural process and may wash into the existing channel over time, will require maintenance • Requires additional sand shifting within The Passage which will take sand from another location

5.5 Recommendation 4 - Improve Northern Passage Circulation

5.5.1 Why?

Water quality within the Pumicestone Passage has been a subject of discussion since at least the 1990s, with flushing and tidal exchange repeatedly highlighted as key to maintaining ecological health. Since the 2022 breakthrough of Bribie Island, however, the natural closure of the Caloundra Old Bar has caused a substantial reduction in water circulation in the northern reaches of the passage. This has not only raised environmental concerns, particularly regarding stagnant water and potential ecological degradation, but has also created access issues for local users, including the Caloundra Sailing Club and Coast Guard, who rely on navigable channels for safe operations.

As a result, improving tidal flow and restoring circulation in this part of the passage is considered an important short- to medium-term priority. This could support both water quality outcomes and recreational and emergency service access, while also offering co-benefits for broader estuarine resilience

5.5.2 What?

Improving circulation within the northern section of the Pumicestone Passage can be achieved through several strategies, the most notable being either reopening the Caloundra Bar or creating a new internal channel linking the Passage to Breakthrough #1, as proposed in the above concept. While reopening the Caloundra Bar could restore traditional tidal exchange patterns, this may result in broader changes to local hydrodynamics and would require extensive assessment and approvals. To minimise such impacts, the preferred approach is to progress the concept modelled solution, a 17,000 m³ dredged channel that reconnects the northern passage to Breakthrough #1.

This proposed channel offers the dual benefit of improved flushing while avoiding major changes to coastal dynamics. Importantly, the dredged material could be repurposed to support nearby resilience initiatives, such as dune restoration or nearshore stabilisation works, optimising resources across the broader emergency works program. Assuming the use of a cutter suction dredge, mobilisation costs could be shared with these other projects. Given the likelihood that the channel may naturally infill over time, further investigation should explore cost-effective maintenance options, such as re-mobilising the dredge periodically or installing a small slurry pump system to sustain the opening.

5.5.3 How?

Improving flushing and access was considered in the Waterhouse (2023) report, which determined suitable (concept) channels, their respective dredge volume and assumed infill rates as per the following:

Figure 37: Aerial image of Bribie Island, indicating the three northern channel options previously considered by MSQ in a modelling investigation detailing the capital dredge volumes required and the predicted sedimentation rates (Waterhouse, A., 2023).

Table 9: Sand Volumes (m3) of Bribie Bar East/West and Golden Beach

Channel Location	Dredge Volume	Sedimentation (6 months)
Bribie Bar East/West	17,000m3	Up to 57%
Golden Beach	77,200m3	Up to 49%

5.5.4 Pros and Cons

A high-level review of the approaches pros and cons is highlighted in the following table. Note that this list is not exhaustive and has focused on key elements for consideration.

Table 10: Pros and Cons of Dredging the Channel

Approach	Pros	Cons
Dredge channel	• Potential increase in northern Passage flushing • Temporary improved access to the bar (BT#1) from the northern end of The Passage • Use of dredged material for other immediate works (or other)	• Requires maintenance dredging beyond existing dredge approval permit levels

6 OTHER GENERAL CONSIDERATIONS

6.1 Highlighted Gaps

Not considered in this immediate solution recommendations report are a couple of critical factors that are beyond the scope of our Terms of Reference but will be up for discussion, these include but are not limited to:

1. Financing - how will the project(s) be funded
2. Responsibility and Maintenance - who will be responsible for maintenance and ongoing minoring
3. Constructability - this options report has covered only the high-level design and has not detailed the design or methodology. This will require further analysis and collaboration with contractors however, the following assumptions have been made for consideration
    a. High strength silt curtains would be essential for all dredging and nourishment works
    b. Minimising impact during the construction process which includes logistics of getting machinery to the site and creation of temporary access ways that would be required by a barge (access and landing areas)
    c. It is important to note there are several other construction constraints, such as shorebird migration season and limited working windows as the storm season approaches. While some work may continue into the storm season, this is only feasible until conditions become unsafe - reinforcing the need to complete as much as possible beforehand
    d. A detailed methodology statement
    e. Costs and volumes in our recommendations are high level based on available information and may increase based on urgency and development of the design on site. A better approach to budgeting would be to allow for on-site decision making with a flexible budget

It is expected that as this process and series of reports progress, additional questions and uncertainties will continue to emerge.

6.2 Technical Working Group Input - General Themes

We acknowledge that this process has been undertaken within a compressed timeframe, and that our agile approach, developing this report in parallel with ongoing site assessments and TWG engagement, has limited the window for detailed input from stakeholders. In the interest of transparency, feedback on the draft report has been summarised into key thematic areas, reflecting the collaborative but time-sensitive nature of this working process.

- Question State's position on 'natural process'
- Cost – who to cover? (capital vs. Maintenance)
- Protect the Caloundra Power Boat Club – mentioned perception of addressing one area (inside of Breakthrough #1)
- Concern of taking sand from within The Passage to reinstate the breakthroughs. Consider offshore sources.
- Request more information – more pros and cons of options
- Timeline within next storm season – potentially difficult
- 'Soft options' preferred– nourishment – for approval pathways
- Explore more options for Golden Beach
- More detail on design and costing

7 IMMEDIATE RECOMMENDATIONS

Based on the current findings, stakeholder inputs, and assessment of immediate solutions, the following actions are recommended as priorities to support immediate hazard mitigation and inform sustainable, adaptive coastal management strategies for the Bribie Island and Pumicestone Passage region.

7.1 Recommended Design Approach

Given the urgent nature of the situation and the constraints imposed by time, environment, and approvals, several design approaches were considered as part of this report. The aim was to identify practical, low-risk options that can be implemented ahead of the next storm season, while laying the groundwork for longer-term, more robust solutions.

Immediate Objectives

- Mitigate ongoing damage to foreshore assets and infrastructure (public and private) within Pumicestone Passage
- Improve water quality and navigational safety
- Provide interim protection while longer-term strategies are developed and assessed

Recommended Immediate Actions

We recommend a soft, nature-based intervention consisting of:

1. Closure of Breakthroughs #2 and #3 (reinstate and add dune 'buffer') with vegetation (potentially dune fencing)
2. Buffering of the island segment between Breakthrough #2 and Breakthrough #1 (with dune 'buffer')
3. Construction of an inner sandbank inside Breakthrough #1 to reduce wave energy entering the Passage
4. Creating temporary channel and maintaining it from Breakthrough #1 to the Northern end of the passage

The numbered labels on the figure (*right*) below correspond directly to the actions listed above.

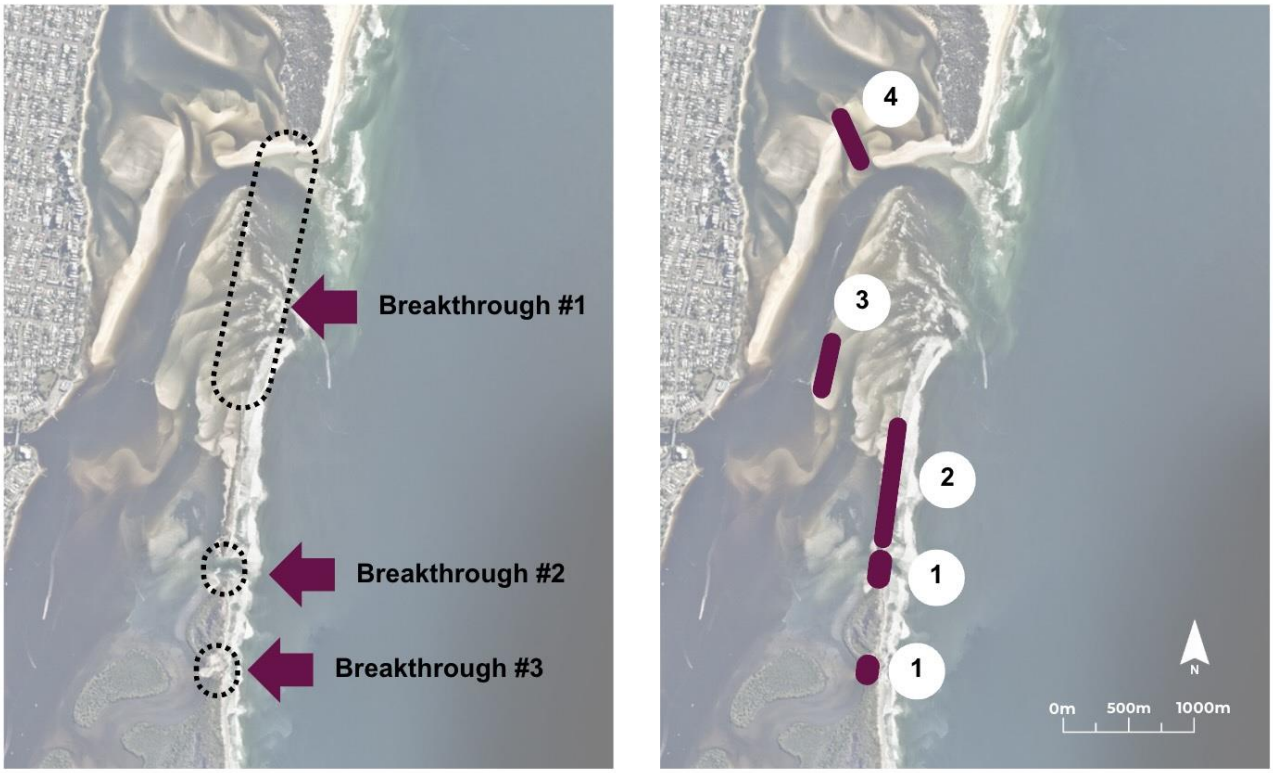

Figure 38: ***Left:*** **Breakthrough locations.** ***Right:*** **Recommended immediate actions for urgent works.**

These works would be completed using sand sourced from within the Passage without engineered structures at this stage. This approach offers the following benefits:

- Low design and construction risk, given that similar conditions existed pre-Cyclone Alfred
- Increased likelihood of environmental approval due to the nature-based methodology
- Feasible within tight timeframes, aiming for completion before the 2025–26 storm season

Key Assumptions

- Sand taken from the Passage may be treated as a temporary borrow, to be potentially replenished from offshore sources as part of future long-term solutions (to be determined)
- The works are adaptive and monitored, allowing adjustments during implementation and maintenance phases
- This approach is a transitional measure, restoring the system to a post-Breakthrough #1 (but pre-TC Alfred) state - an interim condition that is not ideal, but less damaging than the current one

Strategic Rationale

This design path balances urgency with caution. It recognises that:

- There is no perfect solution that meets all stakeholder expectations immediately
- A soft-engineered interim state can help relieve environmental and community pressure
- Longer-term, more engineered solutions potentially involving the full reinstatement of Bribie Island can be developed with adequate consultation, design rigour, and policy alignment
- This middle-ground strategy is intended to stabilise the system, reduce further damage, and buy critical time for the development of comprehensive resilience solutions, to be explored in the next phase of stakeholder engagement and technical investigations.

Table 11: Recommendation Summary

Approach	Approx Construction Time
Reinstate BT#2 & BT#3 and Sacrificial Dune	3-4 months
Sacrificial Dune between BT#2 and BT#1	2-3 months
Build inner sand bank (inside BT#1)	2-3 months
Dredging of inner channel to BT#1	1-2 months

Timing will be dependent on what works can be done in parallel, however, a minimum duration of 5 months should be assumed. Which means to achieve completion of works by November, commencement of works would be required by July. This is unlikely to be feasible under current conditions (noting that at the time of this report it is mid-June), which means timing of all works should be prioritised as per numbering above (noting that #4 while the least 'critical', it may provide strategic value as a sand source to support other works).

7.2 Immediate Priorities

Based on the recommended design approach the following priorities have been derived.

7.2.1 Survey of the Area

Commission an updated, high-resolution survey of Breakthrough #2 and the suspected emerging Breakthrough #3 to confirm extent, rates of change, and priority risk areas for targeted response.

This should include both aerial and bathymetric data to inform design tolerances.

7.2.2 Detailed Design for Immediate Solutions

Finalise detailed designs and methodologies for agreed-upon emergency and pilot-scale works. This will allow rapid engagement with suppliers and contractors.

7.2.3 Procurement and Mobilisation

Commence procurement processes for construction contractors, allowing for staged delivery and flexibility for weather and site changes.

Consider combining with other proposed interventions to reduce mobilisation costs (e.g., shared dredging equipment for dune creation and channel improvement).

7.2.4 Engage Environmental Departments

Engage with departments to evaluate opportunities for oyster reef restoration as a longer-term nature-based solution to improve water quality, stabilise sediments, and build ecological resilience in the Passage.

7.2.5 Investigate Channel Weir Adaptation

Explore and design modifications to the Pelican Waters channel weir to accommodate the observed increase in tidal range since Breakthrough #1, improving tidal flow and mitigating upstream flooding risk.

7.2.6 Review Dredging Constraints

Assess existing legislative or policy limitations that restrict dredging to 10,000-40,000m³ and investigate feasibility of revised thresholds to support both short-term interventions and longer-term sediment management.

This review should consider both environmental thresholds and operational needs.

7.2.7 Develop a Strategic Material Reuse and Sand Budget Plan

Identify and formalise sources of sand (e.g., from Breakthrough #1, inner Passage buildup, or potential offshore sources) and develop protocols for environmentally sensitive relocation to support dune and berm creation, breakwaters, and channel maintenance.

7.2.8 Secure Funding Pathways

Commence grant applications and seek alignment with State/Federal programs for both immediate works and long-term management.

8 CONCLUSION

The recommendations outlined in this report are designed to respond directly to the urgent risks presented by Tropical Cyclone Alfred, while also creating a pathway for longer-term resilience planning. At the heart of this strategy is a measured reinstatement of Bribie Island's form to its pre-Cyclone Alfred condition, a state that, while not ideal, provided a relatively stable and manageable system compared to the post-cyclone configuration we now face.

This reinstatement, coupled with strategic buffering (e.g. added dune volume), is intended to buy time ahead of the next storm season. It reduces the risk of further breakthroughs and gives engineers, planners, and decision-makers the opportunity to develop more durable, longer-term strategies without the pressure of an active, escalating emergency.

Given the compressed timeframe, works should be completed before the 2025–26 storm season, therefore normal approval and design pathways are not feasible. Emergency planning provisions, fast-tracked procurement, and pilot-scale flexibility are therefore essential. Without this expedited approach, there is a high likelihood that significant assets, infrastructure, and environmental values will face renewed damage.

Reinstatement vs. Strategic Enhancement

A central idea in this planning process is the distinction between restoration for stability and transformation for resilience.

Reinstating Breakthrough #2 and Breakthrough #3 with additional buffering is a pragmatic, low-risk response. It leverages existing understanding of pre-Alfred conditions and can be implemented quickly with minimal design.

However, the opportunity exists to use this reinstatement period to lay the groundwork for more robust, forward-looking enhancements.

Take for example the remaining island section between Breakthrough #1 and Breakthrough #2. Simply stabilising the current vegetation may delay loss, but it remains highly vulnerable to the next moderate storm event. A more strategic approach would involve constructing protective features in the nearshore zone, enhancing dune volume, or integrating nature-based solutions like oyster reefs and mangrove fringes.

Framing the Path Forward

Our immediate goal is clear:

Restore and buffer the island to its pre-Alfred condition, an achievable benchmark that reduces risk and provides a baseline for more ambitious future planning.

But the real question is:

Do we continue to react to change, or begin to shape it?

In 1971, Australia was the first country to join the Ramsar Convention on wetlands. The Convention, which applies to this area, defines 'wise use' as: "sustainable utilisation [of wetlands] for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem." The 1997 Commonwealth National Wetland Policy provides that management decisions include due consideration of ecological, economic and social values and in accordance with the precautionary principle and that a response to threats of serious damage should not be postponed due to a lack of full scientific certainty.

This report positions Bribie Island not just as a protected ecological asset, but as a living, natural coastal defence system - worthy of 'wise use', including investment, stewardship, and inclusion in a new generation of integrated, adaptive coastal infrastructure.

Appendix A – Terms of Reference

Bribie Island Erosion and Breakthrough Review

Terms of reference – April 2025

Background

Ongoing erosion, has severely narrowed the width of the northern tip of Bribie Island, creating several weak points. In 2022, large waves cut a new channel through the weakest part of the northern tip of Bribie Island opposite Nelson Street, Golden Beach. This channel rapidly widened and became a new opening to the ocean. Soon after, the original Caloundra Bar closed over. This body of water has constrained the Caloundra Coast Guard, preventing access to the southern passage and open ocean.

Further severe weather caused by Tropical Cyclone Alfred in 2025 has further widened the 2022 breakthrough and caused more damage, including extensive erosion to the foredune at Lions Park. This event also created a second breakthrough south of Lions Park. These events have heightened residents' and businesses' concerns about future risk and impacts, given the Northern tip of Bribie Island has traditionally shielded Caloundra from effects of severe weather.

The Queensland Government committed to conducting an expert, independent review to investigate ongoing erosion, previous break through events and the impacts these have had on Bribie Island. Immediate and long-term recommendations will be developed and consultation with the Local Government, community organisations and local community will occur to assure that their concerns have been heard and are being actioned.

Scope

Issues and areas expected to be included in the review include, but are not limited to:

- Developing urgent recommendations to stabilise the situation for consideration by Government
- Undertaking a desktop review of previous reports and studies relating to the cause and impacts of the long-term erosion of the island and the breakthroughs in 2022 and 2025
- Identifying causes for the ongoing erosion of the island and subsequent wash overs and breakthroughs
- Identifying impacts of the breakthroughs on the natural protection of Caloundra including residents, business, recreational boating, and the Coast Guard.
- Assessing the impact of dredging and shipping channel operations in Moreton Bay that affect Bribie Island including on sand migration.
- Considering natural and anthropogenic changes contributing to island erosion across mainland catchment areas and Moreton Bay that affect Bribie Island.
- Developing long term recommendations to reduce risk of further damage, including to mainland foreshore, infrastructure, and waterways, preserve Bribie Island and maintain navigation through Pumicestone Passage
- Undertaking consultation with Local Government, Federal Government and the local community on short- and longer-term solutions.
- Any other relevant matters the independent reviewer considers appropriate to the review

Report

The output from the review is the final report. The report will include review of existing analysis, outcomes of consultation and short- and long-term recommendations. The review report will be compiled for submission to the Deputy Premier, Minister for State Development, Infrastructure and Planning and Minister for Industrial Relations. A critical element of the scope is that recommendations for immediate action can be made prior to the completion of the final report. Following approval, the final summary report may be published.

Public engagement

Community consultation will ensure transparency and that community views are representative of the local population. This will include a project webpage for written submissions and locally led community forums.

Appendix B – Authors and Contributors

Authors

An audience deserves to know something about the author. This review is the product of a team ('we') represented by two companies, RPS and ICM. RPS was founded in 1970 by a passionate team of academics in Oxfordshire, United Kingdom, and has been operating in the Australia Asia Pacific region since 2003. RPS is part of Tetra Tech Inc, which was founded in 1966 to provide engineering services for waterways, harbours, and coastal areas in the United States. Tetra Tech operations are global and include ~30k employees, however, this review is largely the independent voice of one RPS employee, Brian McRae.

Brian's relevant experience to contribute to this review includes three decades managing coastal and environmental matters in California (Los Angeles, including initiatives related to the L.A. River and the Santa Monica Bay), New South Wales (Sydney's Northern Beaches) and Queensland (including managing the Gold Coast Seaway, Sand bypass system, and navigational channel network), as well as involvement throughout his career in disaster management. His perspective includes training as a naturalist, biologist, environmental planner, and public sector manager. He attributes key achievements in his career to a passion for improving 'systems', including the complex dynamics between ecosystems, governance, economy and, importantly, relationships.

RPS supported Brian with his contributions to this review in a number of ways. Notable support was provided by Brad Williams, Practice Leader - Place (Sunshine Coast), who contributed insight regarding local community dynamics and context. He brings more than 28 years' experience as an urban planner and development consultant, and a deep appreciation of the Sunshine Coast community and environs. His key experience and abilities stem from his direction of large master planned communities, complex urban development projects, emerging regional communities and the drafting of statutory planning instruments.

ICM originated on the Gold Coast and earned global recognition for leading approaches to coastal resilience that rely on nature-based engineering solutions. As a Gold Coast City Council engineer in the 1980s, ICM founder Angus Jackson contributed to the pioneering of this approach, which is founded on Queensland Government investigations in the 1970s ('Delft report') pursuant to coastal storm damages. The Gold Coast Seaway, the GC and Tweed sand bypass systems, and the management of the Gold Coast shoreline originate from this early initiative. ICM has a strong history of innovation in coastal and waterfront design and delivery of cost-effective solutions globally.

Aaron Salyer, Director and Coastal Engineer, partnered with Brian to direct this project, and led the efforts of the team from International Coastal Management (ICM). Aaron's focus is on leading efforts to protect and restore coastal ecosystems, and in particular enhancing community resilience to ocean hazards. Through innovative engineering, he aims to implement nature-based solutions that promote multifaceted benefits. His goal is to foster a profound shift in how society values and interacts with coastal environments, promoting sustainable development and marine conservation worldwide. Aaron is also an expert panellist for the United Nations Ocean Decade.

Contributors

The Department of State Development, Infrastructure and Planning provided invaluable assistance to facilitate the delivery of this review, including supporting RPS/ICM throughout to successfully apply an agile delivery methodology, including organising a Queensland Government Technical Working Group (**TWG**). A separate working group of Sunshine Coast Council officers with relevant subject matter expertise was formed and operated in parallel with the QG TWG. Both groups assisted with the identification of relevant sources, and through reviewing and commenting on draft outputs. Agencies represented include:

- Department of State Development Infrastructure and Planning
- Department of Premier and Cabinet
- Queensland Treasury
- Department of Environment, Tourism, Science and Industry
- Department of Primary Industries
- Department of Resources, Mining, Manufacturing and Regional Development
- Department of Transport and Main Roads, Maritime Safety Queensland
- Queensland Police, Marine Rescue Queensland
- Queensland Reconstruction Authority
- Sunshine Coast Council

Appendix C – Source list

We acknowledge the significant work undertaken by Sunshine Coast Council (SCC) in the preparation of planning, development, and reporting for this area. While we have referenced several of these documents throughout this report, we note that many are interrelated, some informing or supporting others. Readers seeking a deeper understanding of these documents are encouraged to consult them directly as standalone resources. It is also important to highlight that our first report in this series, the Desktop Analysis, provides a more comprehensive review of past work and should be considered the primary reference point for background and context. In contrast, this current report is focused specifically on solutions and immediate actions.

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