FINAL REPORT:

Turkey Beach Shoreline Erosion Management Plan (SEMP)

April 2020

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The project team acknowledges the Bailai, Gurang, Gooreng Gooreng and Taribeland Bunda people as the Traditional Owners of the land. We pay respect to their Elders past, present and emerging, and acknowledge and respect their continuing culture and the contribution they make to the life and protection of this region.

The project team also would like to acknowledge and thank the Turkey Beach community members who attended the community meetings and provided input towards the Shoreline Erosion Management Plan.

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1 Introduction

1.1 Purpose of a SEMP

Coastal zones are naturally dynamic and complex places that are highly valued by the community. Ongoing interactions occur between waves, winds, tides, rivers and the natural environment. Coastal erosion is a natural process that shapes coastlines over long timeframes. However, erosion processes may become problematic when interacting with communities and built infrastructure. The Queensland State Government states that 'Developed areas impacted by erosion require balanced management to protect infrastructure and preserve coastal values and amenity' (DES 2018). A Shoreline Erosion Management Plan (SEMP) provides councils with a framework to proactively plan for the erosion management of their coastline while ensuring natural coastal processes are maintained. A SEMP is informed by strong technical understanding of the coastal processes, values and knowledge of the stakeholders and community and an appreciation of the means, opportunities and resources of the coastal managers to deliver management actions.

The Agnes Water and Seventeen Seventy SEMP is closely aligned with Strategic Goal 2 "Healthy environment, healthy community" in the Gladstone Regional Council Operational Plan. Under this goal is a commitment by Council to take a leadership role in protecting the environment, using resources efficiently and improving the health and safety of the community. In addressing this goal, SEMPs provide direction for the management of key parts of the coastline, and enable efficient use of Council resources in alignment with community values. SEMPs have now been completed for regionally important sections of the coast at Boyne Island and Tannum Sands, Agnes Water and Seventeen Seventy, and Turkey Beach

1.2 SEMP context

This Shoreline Erosion Management Plan (SEMP) has been commissioned by Gladstone Regional Council (GRC) to assist with proactive management the Turkey Beach shoreline. Council has been supported in the SEMP development process by Alluvium Consulting Australia (Alluvium) in partnership with Jeremy Benn Pacific (JBP) and Natural Capital Economics (NCE).

Turkey Beach is located on a low-lying peninsula within Rodds Bay, approximately 70 km south of the city of Gladstone (Figure 1, Figure 2). The settlement is predominantly known as a fishing and holiday village, with a population of approximately 180 permanent residents, increasing to 1,500 during peak holiday periods.

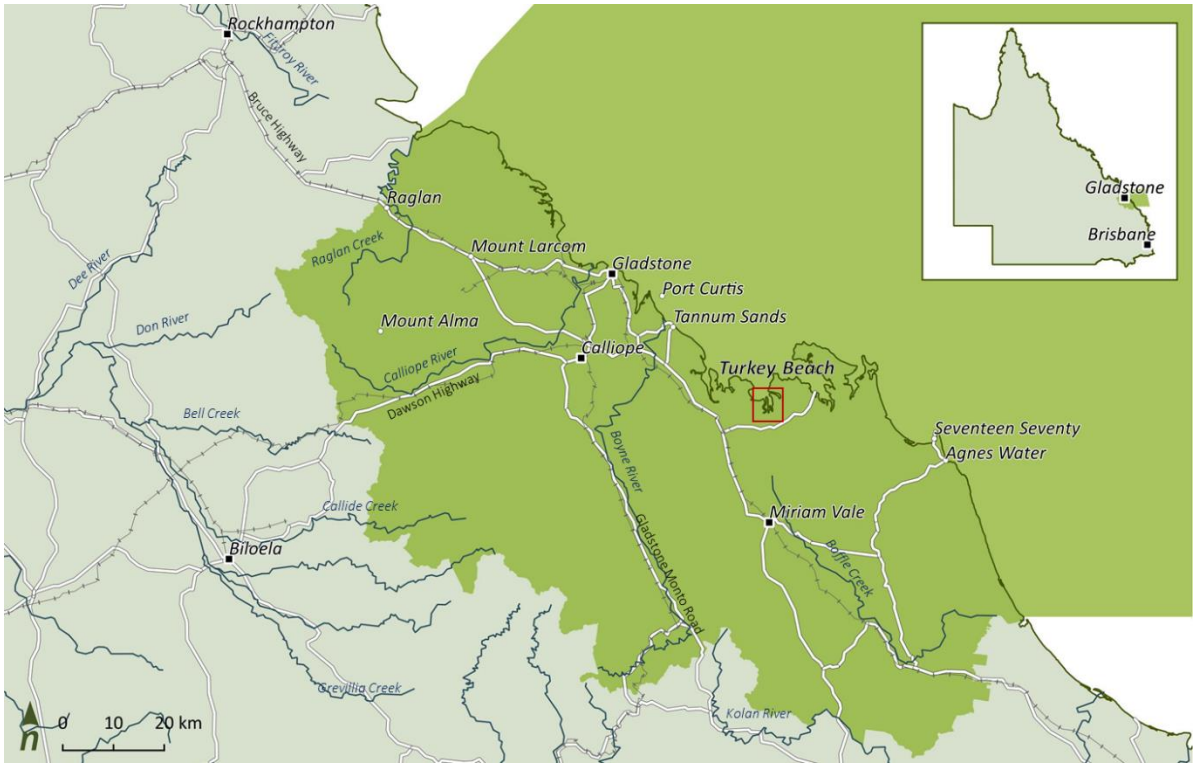


Figure 1. *Study area (shown in red box), Gladstone Regional Council area shown in green*

Figure 2. *Turkey Beach view west along the peninsula* (*https://www.gladstoneregion.info/destinations/gladstone-surrounds/turkey-beach)*

Over recent years, coastal erosion has been an ongoing concern for the Turkey Beach community. The SEMP provides a way forward for Council and the community to proactively manage the shoreline.

Council is also concurrently developing a Coastal Hazard Adaptation Strategy (CHAS) for the region, that will include new technical information relevant to Turkey Beach. The CHAS process will run over 12 months from October 2019 to October 2020 and focuses on long term planning to 2100. The SEMP process has been completed now to ensure Council and the community can have a plan to address immediate issues of concern. The SEMP will be reviewed following completion of the CHAS and new information can be used to refine implementation.

The preparation of the SEMP has been guided by the state guidelines *Preparing a shoreline erosion management plan* (Department of Environmental Science, 2018). The SEMP has been informed by a technical

understanding of coastal processes, as well as the values and knowledge of the stakeholders and community, and an appreciation of the means, opportunities and resources of the coastal managers to deliver management actions. Consideration of the legislative context has also been included (Attachment A). The SEMP development has included consultation with Council, State Government and community stakeholders at the relevant stages of the process.

1.3 Plan structure

This SEMP includes a range of technical studies, engagement activities, and a strategic options assessment, which have informed and shaped the management plan. The Plan is structured as follows:

- **Section 2:** Physical context
    - Landscape setting
    - Coastal processes
    - Trends in shoreline changes
    - Present day shoreline
    - Trajectory of change and management focus
- **Section 3:** Coastal values
    - Environmental, social, economic
    - Community input
- **Section 4:** Management options and suitability
    - Management objectives
    - Options screening
    - Actions
    - Triggers for change
    - Monitoring and evaluation.

Turkey Beach aerial view looking west

2 Physical context

This chapter of the SEMP provides a summary of the landscape setting and geomorphic context for Turkey Beach, coastal processes that shape the landscape, trends in shoreline changes over the years, the current shoreline condition and likely trajectory of change.

2.1 Landscape setting

Rodds Bay extends behind Rodd's Peninsula (Figure 1, Figure 2, Figure 3, Attachment B). The broader coastline to the east and west of the bay is characterised by a complex network of rocky peninsula areas of varying elevations (Figure 5), sandy beach ridge systems and barrier islands, and a network of tidal waterways.

Mangrove islands span the sheltered northern shoreline of Rodds Bay. Turkey Beach is situated on the south-western shoreline, with saltmarsh and mangrove pockets extending along the tidal creek systems. The Turkey Beach rocky peninsula extends north, at relatively low elevation (Figure 5).

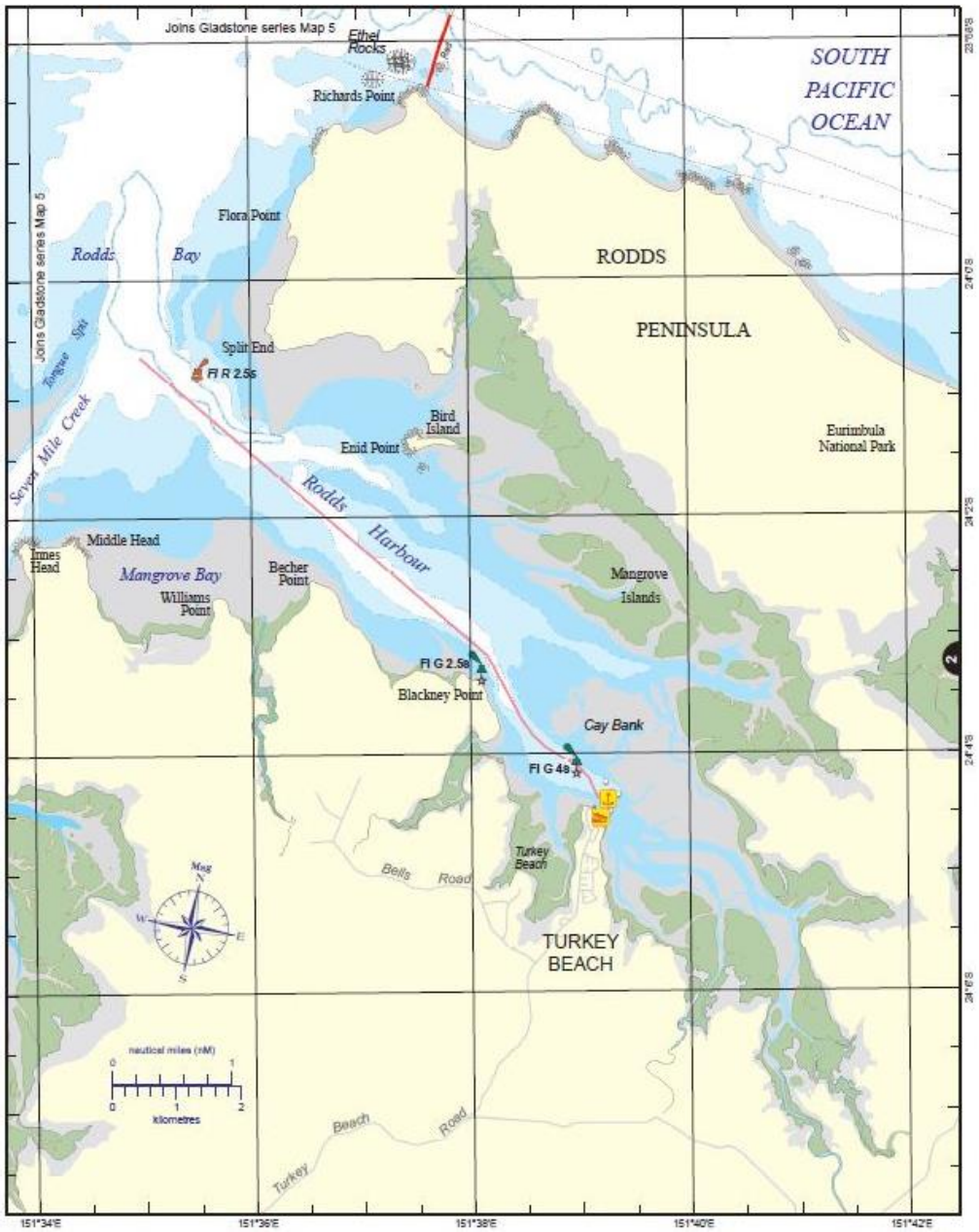


Figure 3. *Turkey Beach navigation chart extract (Maritime Safety Queensland 2014)*

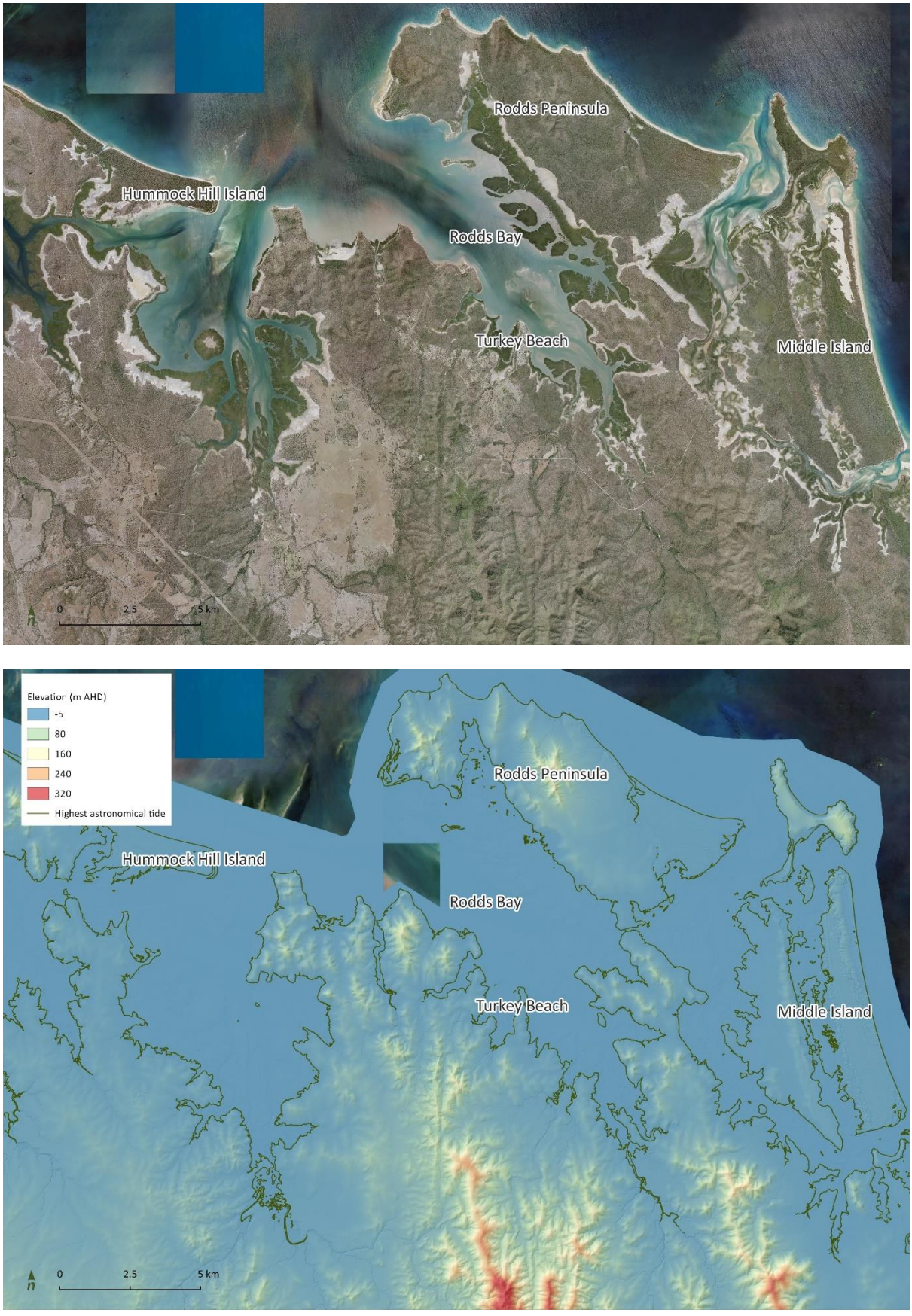


Figure 4. *2017 aerial (top) and elevation (bottom) images of Turkey Beach and surrounding landscape*

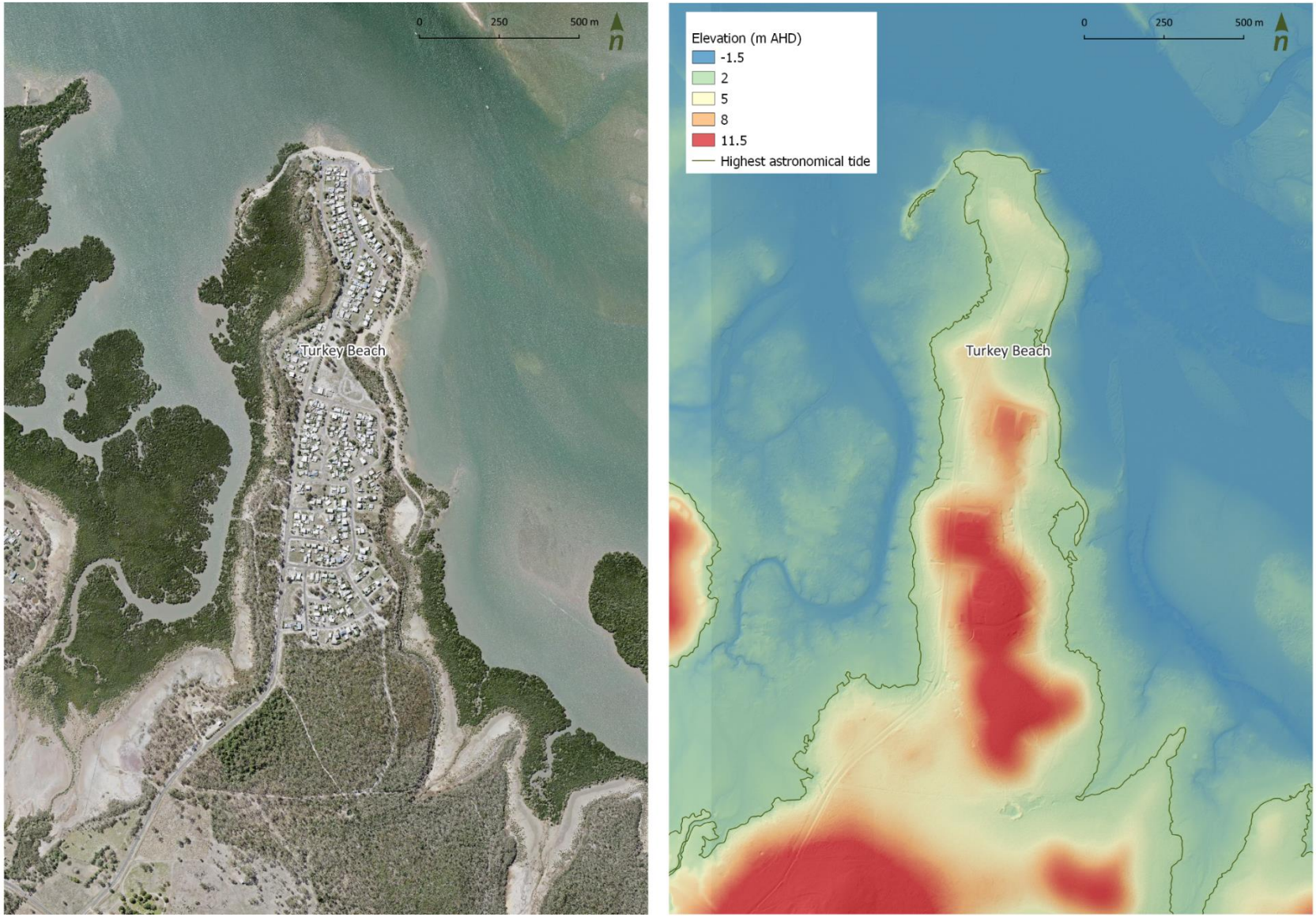


Figure 5. *2009 aerial (left) and elevation (right) images of Turkey Beach and surrounding landscape*

The depositional features of the broader coastline (sandy beach ridge systems and barrier islands between peninsulas) are comprised of marine and fluvial derived deposits of Quaternary age, most likely of Holocene origin (formed within last 6,000 years).

Holocene beach ridges along the depositional coastline tend to be orientated north-northwest (e.g. Middle Island). These beach ridges are composed of fine-grained quartz sands, interspersed with rutile, ilmenite and zircon. Estuarine and deltaic sediments in depositional zones around the tidal creeks include mud, silt and evaporite deposits, and may also contain vegetated black soils.

The Turkey Beach peninsula is underlain by a geological unit known as the Agnes Water Volcanics. This unit is composed of Triassic felsic volcanics, including rhyolite, andesite and trachyte. A sandy shoreline extends around the margins of the bedrock based peninsula, comprised of moderately coarse sands and shell material.

A channel with a depth between 10-20m extends from the entrance to Rodds Harbour to the northern point of Turkey Beach. To the south-west of Turkey Beach the channel becomes shallower, typically less than 5m depth, fringed by intertidal flats around the meandering channel and mangrove stands along the shoreline.

2.2 Coastal processes

Tides

Turkey Beach experiences a semi-diurnal, macro-tidal signature (Figure 6). The tidal plane at the open coastline is found to increase as it propagates across Rodds Bay, with tide levels at Turkey Beach being approximately 0.15 m higher than the open ocean. Tidal planes at the closest tidal gauge, Pancake Creek, are shown in Figure 7. Pancake Creek is located approximately 12 km due east of Turkey Beach near the open coastline.

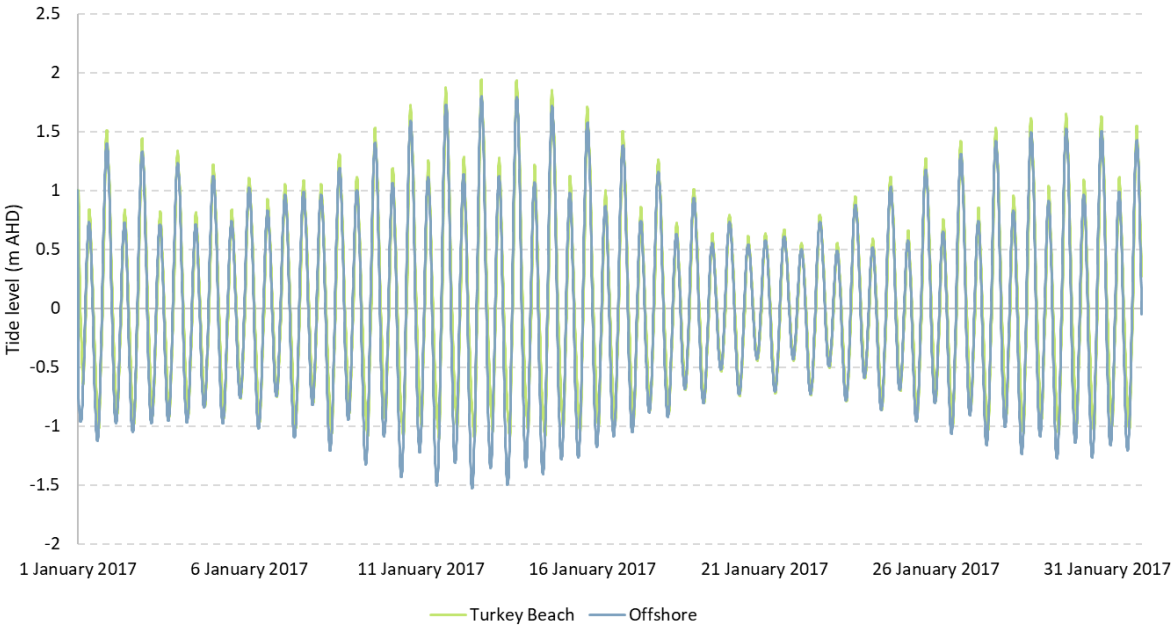


Figure 6. *Tide level simulation within Rodd's Bay (simulated using a Delft3D numerical model, refer to Attachment B for model setup)*

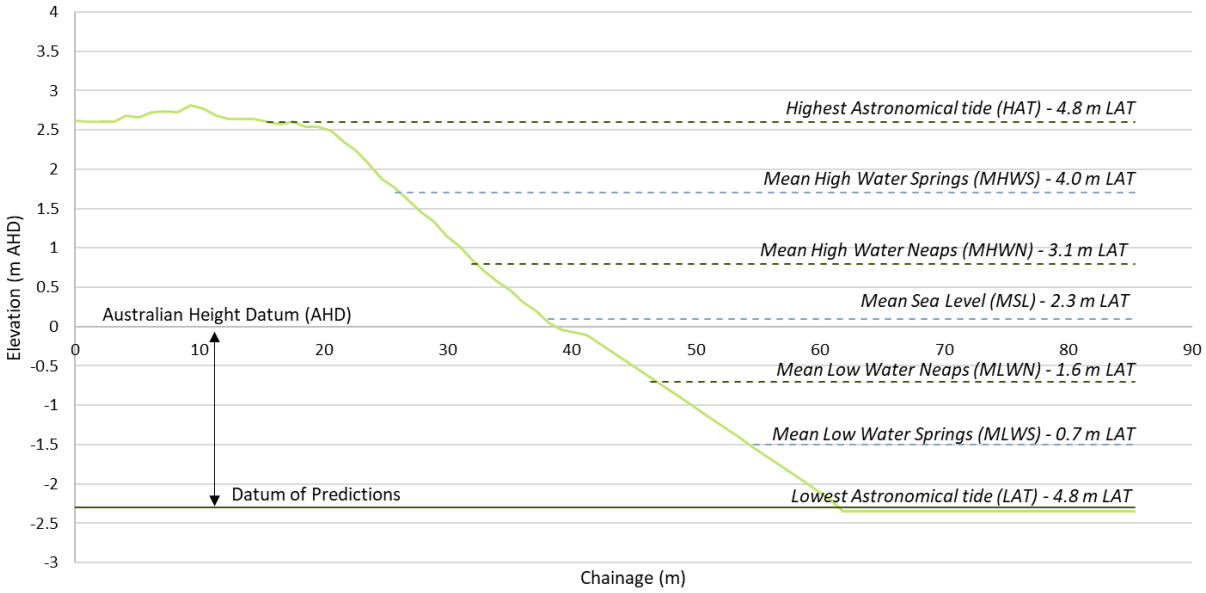


Figure 7. *Tide conditions at Pancake Creek - tide levels shown in Australian Height Datum (AHD) with corresponding Lowest Astronomical Tide (LAT) levels labelled*

Tidal currents

Tidal currents are typically stronger on the south-east flowing flood tide (rising tide) compared to the northward ebb currents (falling tide) (Figure 8). The flood tide currents can reach around 0.5 - 0.6 m/s during neap tides and increase to over 1 m/s during spring tides (Figure 9).

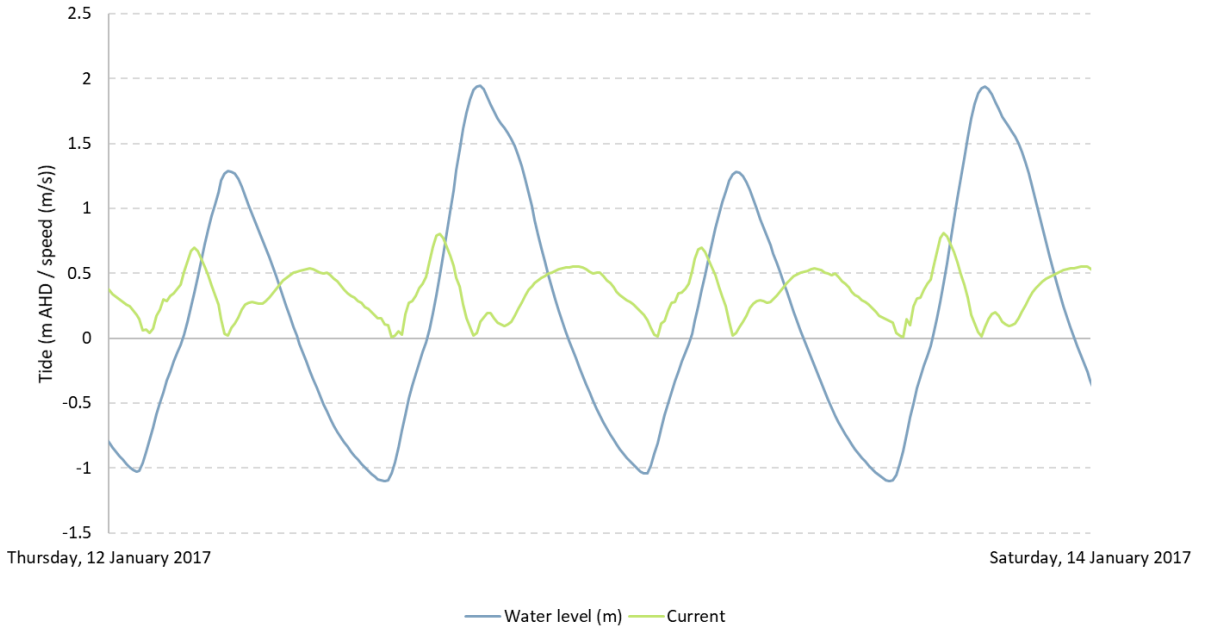


Figure 8. *Tide/current relationship at Turkey Beach*

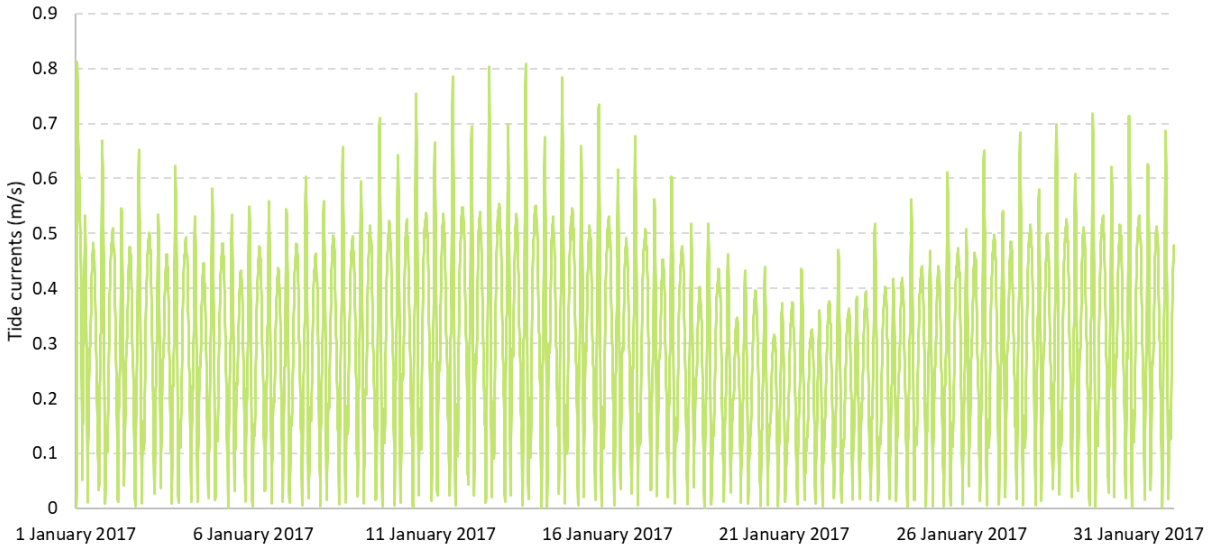


Figure 9. *Modelled tidal currents within the channel to the east of Turkey Beach*

During spring tides these currents are sufficient to drive sediment transport within the Bay. Figure 10 shows modelled tidal current direction and magnitude on the flood tide and the ebb tide.

The northern beach (adjacent to the Esplanade) is prone to strong tidal currents in both directions, with the west and eastern shorelines being more sheltered from tidal currents.

Figure 10. *Modelled tidal patterns around Turkey Beach showing peak flood-tide (Left) and ebb-tide (Right) (white arrows) and overall dominant direction (red arrows)*

Wind

The regional wind climate based on the closest wind station located in Gladstone (48 km north of Turkey Beach) indicates that the dominant wind direction spans between 45°/N to 180°/N (north-east to south-east) (Figure 11).

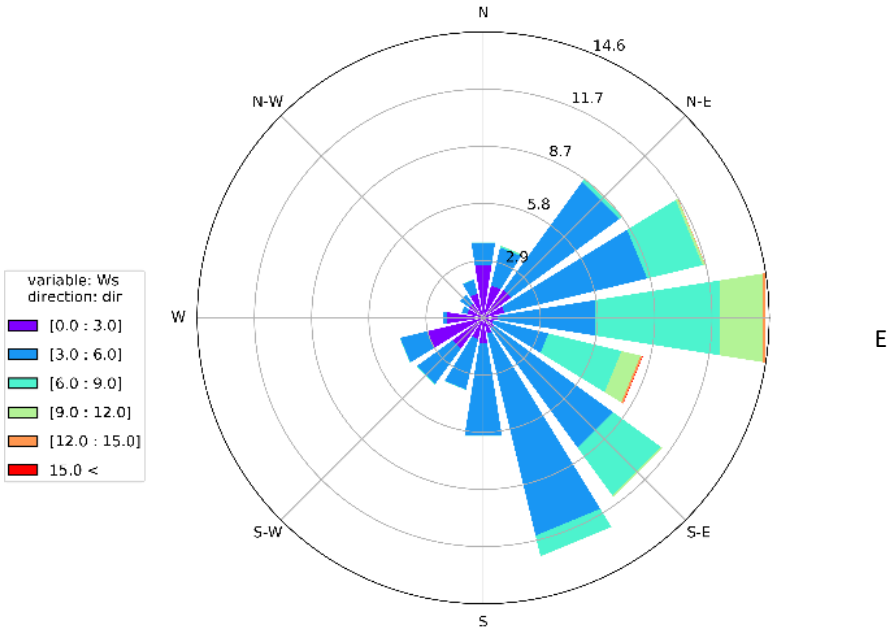


Figure 11. *Wind conditions at Gladstone (the wind rose shows the occurrence of winds strength, direction and frequency of wind)*

Waves and sediment transport

A numerical model (the JBP Beach Evolution Model – JBEM - refer Attachment B) combining the Gladstone wind conditions and the Turkey Beach tidal signature (between 2000 and 2017) was developed to investigate nearshore wave processes (with depth limited wave calculations) and longshore sediment transport.

Modelled prevailing wave conditions (shown in Figure 12) are north-east to east at the northern facing shoreline (left image) and north-east to south-east along the eastern facing shoreline (right image).

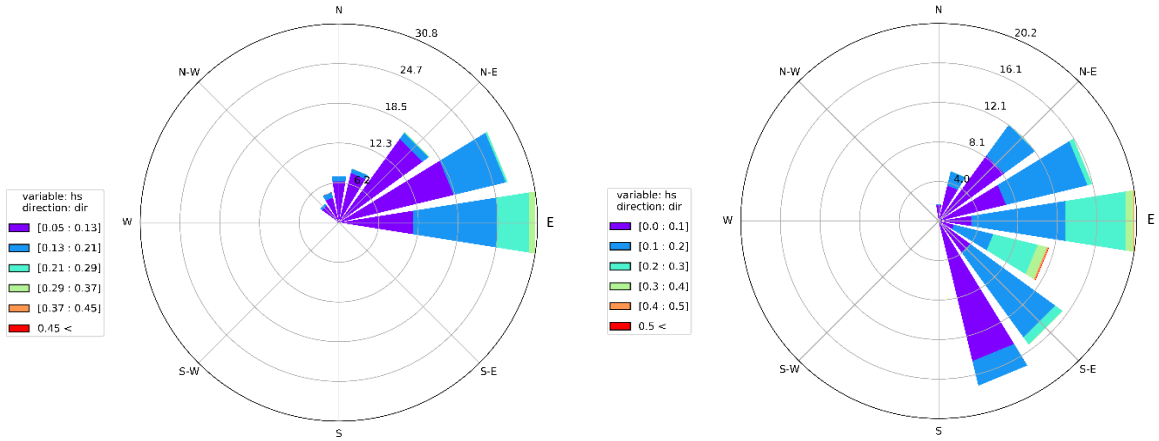


Figure 12. *Modelled wave conditions at northern beach (left) and eastern Turkey Beach (right).*

Modelled longshore sediment transport rates at the northern-facing and eastern-facing shorelines at Turkey Beach between 2000 and 2017, based on dominant tide and wind-generated wave sediment pathways, are shown in Figure 13. Longshore transport refers to the cumulative movement of beach and nearshore sand parallel to the shore by the combined action of tides, wind, and waves and the shore-parallel currents produced by them. These forces usually result in an almost continuous movement of sand either in suspension or in bedload flows.

Figure 13. *Longshore sediment transport pathways under tides and wind-waves, and modelled volumes*

Along the northern-facing shoreline the modelled potential Longshore Sediment Transport (LST) indicates a dominant westerly transport. This is driven by prevailing winds. The potential rate of transport is less than 70 m^3/year, which is relatively low. However, the rate may be exacerbated by cross-shore sediment transport and aeolian (wind-driven) sand loss.

A divergent sediment regime occurs along the eastern-facing shoreline due to the strong easterly winds and the curved coastline. Potential LST is approximately 170 m^3/year in a northerly direction and approximately 50 m^3/year in a southerly direction. This rate is likely to be reduced by the presence of mangroves and vegetation along parts of the shoreline.

Overall, the sediment transport rates along the north and east shorelines of Turkey Beach are relatively low. Periods of sediment movement and erosion are likely to be episodic / driven by storm events such as TC Debbie in March 2017. The elevated water levels and wave energy during storm events will contribute to sand loss, particularly at the exposed northern beach.

2.3 Erosion Prone Area

The Queensland State Government defines Erosion Prone Areas (EPA) for the Queensland Coastline (Department of Environment and Science, 2016). The EPA indicates areas that may be prone to coastal erosion processes by 2100. This includes open coast erosion and tidal inundation due to sea level rise.

The EPA extent for the Turkey Beach peninsula includes areas likely to be exposed to tidal inundation by 2100, represented by the combined mapping of Highest Astronomical Tide (HAT) plus 0.8 m sea level rise, and a HAT plus 40 m (horizontal) default zone. The majority of the township is outside of the 2100 EPA, however the shorelines, open space areas and some limited residential areas on the margins are likely to be exposed to increasing tidal areas in the absence of intervention. Longer term adaptation options are considered in the Coastal Hazard Adaptation Strategy currently being developed by Council. For the SEMP process, the EPA assists to highlight areas that may be increasingly prone to the emerging coastal hazards from present day to 2100. Notable areas include the northern point and sections of the eastern shoreline (Figure 14).

Figure 14. *State Erosion Prone Area*

2.4 Trends in shoreline change

Macro changes
The shoreline of Turkey Beach peninsula has remained relatively stable over recent decades, including pre- and post-residential settlement (Figure 15).

Observations from the historical aerial imagery spanning 1959 to 2017 include:

- Minimal change in overall shoreline position over this time
- Minimal (no discernible) change in the distribution and extent of mangrove communities around the peninsula
- Similar patterns in offshore sediment bars and deposits over the decades
- No major losses or gains of sediment in particular locations along the peninsula
- Some minor changes in shoreline position and vegetation extents evident along the northern and eastern shorelines.

Figure 15. *Historical aerial imagery (1959 to 2017)*

Shoreline movements

The Digital Shoreline Analysis System (DSAS) for ArcGIS was used to identify finer scale historical shoreline changes and trends (see Attachment C for details). Key observations include (refer Figure 16):

- **Western shoreline:** No discernible change along the western shoreline position since 1959.
- **Northern point:** Accretion along central parts of the northern shoreline - this is likely linked to human influences such as the establishment of the Esplanade Road (early 70s) and sand scraping undertaken in early 2017 (discussed in Section 2.5). Limited areas to the east and west sides of the northern shoreline may have experienced some minor recession (up to 10 m). The toilet block was removed and relocated due to erosion several years ago. The west side is in the lee of the boat ramp which intercepts some of the longshore sediment transport (stops it moving around to the northern shoreline).
- **Eastern shoreline:** Accretion south of the boat ramp in the order of 5 – 20 m (linked to interception of longshore sediment transport), and limited areas that may have experienced minor recession (5-10m).

In areas that have experienced recession, the End Point Rate of change (over 1959 – 2017) is relatively low, in the order of 20 cm/yr. Linear Regression Rates of change are also relatively low, in the order of -0.2m to +0.3m per year. Attachment C provides additional detail on rates of change along the full Turkey Beach shoreline.

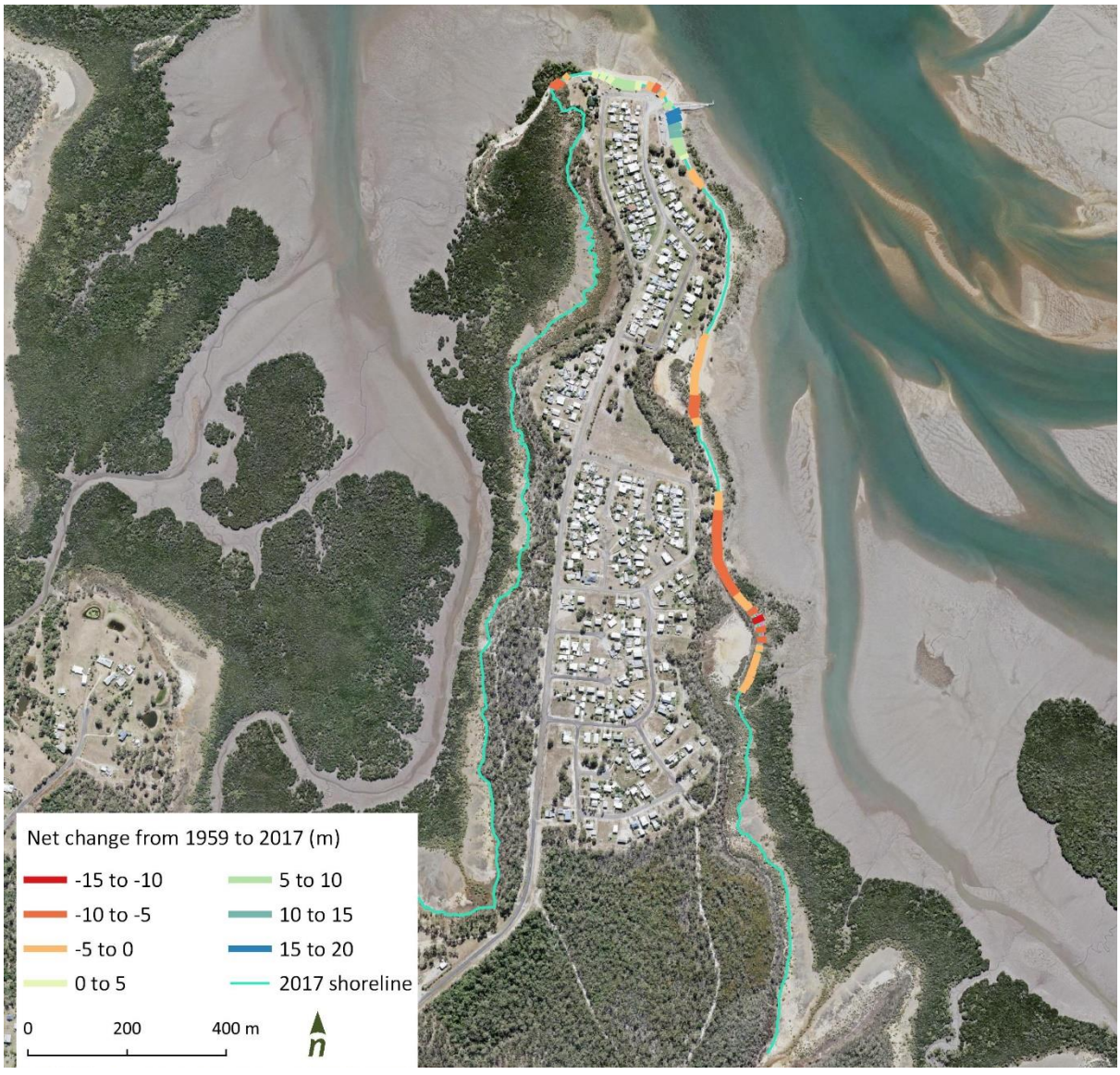


Figure 16. *Net shoreline movement from 1959 to 2017 (m) – seaward accretion (+ change) or landward recession (-ve change) measured from transects spaced at 20 m intervals along the shoreline*

2.5 Present day shoreline

Key observations of the present day shoreline, including management challenges and actions over recent years, include the following. Additional site-specific notes are included in Attachment D.

Western shoreline

The western shoreline is a sheltered environment lined with extensive mangrove communities. A tidal channel runs parallel to the shoreline, however there are no formal boat access points. Some informal access to the channel occurs, with associated local disturbance to the sandy shoreline and vegetation communities. The mangroves provide protection to the shoreline from wind and wave energy.

Figure 17. *Western shoreline – tidal channel*

Northern point

The northern point is a relatively exposed section of coast, influenced by strong tidal currents and prevailing easterly winds (refer Section 2.2). This is the main recreational zone for Turkey Beach, including an informal swimming enclosure (not approved or managed by Council), boat ramp, war memorial, car parking, amenities block and picnic area (e.g. Figure 2, Figure 18).

Figure 18. *Northern point shoreline recreation area (Source: Google maps – Brian Clarke Oct 2019)*

Since settlement (early 1970s) there has been relatively open access from the Esplanade Road and car park to the beach and water, and limited vegetation in the near shore and backshore areas (refer Figure 15).

Mangroves are present only to the far western side of the point, along with some informal rock protection work (where minor recession has occurred – refer Section 2.4) (Figure 19).

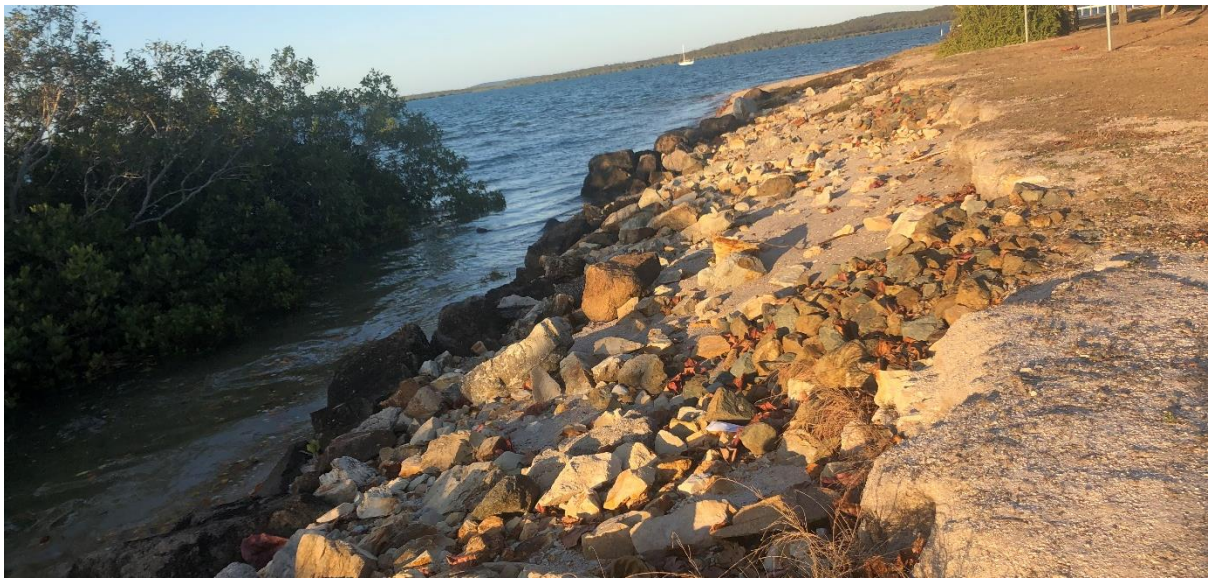


Figure 19. *Northern point shoreline – informal rock protection at far western side of the point*

Minor erosion is also observed on the lee (north) side of the boat ramp (where minor recession has occurred – refer Section 2.4). The position of the boat ramp intercepts the northerly sediment transport, resulting in a build up of sand on the southern side of the ramp, and less sand reaching the north point shoreline. The lee (north) side of the boat ramp is also used for informal boat access.

Figure 20. *Northern point shoreline - Lee (north) side of the boat ramp*

Erosion of the coarse sandy shoreline occurs periodically after storm events, and there is minimal dune re-building / recovery observed between events. As of August 2019 an erosion scarp along most of the beach length was observed, at approximately 0.2 m high. Also visible offshore is a sandbar, running parallel to the shoreline. Eroded sand along this reach is transported to the west (driven by tides and easterly winds – refer Section 2.2), moving around the point and extending the north-west sand bar offshore.

Figure 21. *Northern point shoreline – erosion scarp behind swimming enclosure*

Beach nourishment via sand scarping was undertaken in August 2017 following erosion during Severe Tropical Cyclone (STC) Debbie in March 2017. Photos of the site condition pre-STC Debbie, post STC-Debbie, post beach nourishment and during the field visit are shown in Figure 22. These photos indicate an erosion scarp prior to STC Debbie, which was exacerbated following STC Debbie. Sand scraping was undertaken in August 2017, in the order of up to 5,000m^3 to restore and smooth the beach profile.

Figure 22. *Northern point shoreline - Beach profile in front of the boat ramp carpark located on The Esplanade, Turkey Beach – pre and post nourishment (All photos except current condition supplied by GRC)*

The majority of the nourished volume has since been eroded, with the current conditions (as of June 2019) appearing similar to pre-STC Debbie.

Factors likely to be exacerbating erosion of the northern point shoreline include the presence of the boat ramp (intercepting longshore sediment transport to the point), and regular disturbance of the sands along the beach, including the informal boat access to the north of the boat ramp.

Foot and vehicle access occurs regularly along this section of the shoreline, causing regular turning over of the coarse sandy beach materials. In the absence of disturbance, sandy beach materials will 'self armour', meaning the finer materials will settle to the base, and coarser materials will then provide a protective layer on the surface that provides increased natural resistance to erosion. Disturbance to this armouring process increases the risk of erosion during small and large events.

Eastern shoreline

The eastern shoreline extending south from the boat ramp is characterised by a sandy shoreline and intertidal rock and mud flats (Figure 30). Mangroves extend along much of the shoreline, although less dense than the western shoreline communities, and provide some protection from wind and wave energy.

Figure 23. *Eastern shoreline – south of the boat ramp (Source: https://www.realestate.com.au/property-residential+land-qld-turkey+beach-201378922)*

A small erosion scarp (0.2 m) is present in some areas behind the mangroves that aligns with observed shoreline recession (refer Section 2.4). Stormwater runoff drains to the beach (e.g. Bell Street drain, Figure 24). Timber bollards and signage indicating tidal influences and soft sands have been established to deter vehicle access in some areas (Figure 25).

Coastal erosion and recession on the eastern shoreline is not currently impacting residential areas or key infrastructure, however erosion from vehicle access is reported to be contributing to localised inundation for some properties on Bell Street.

Loss of mangrove and fringing vegetation extent and density is likely to be the key factor that may exacerbate future erosion along this section of shoreline. Tidal areas may also begin to encroach on some parts of the residential areas along the eastern shoreline in the coming years.

Figure 24. *Eastern shoreline - stormwater drainage at the northern section of beach at Bell Street*

Figure 25. *Eastern shoreline – timber bollards*

2.6 Trajectory of change and management focus

Prevailing coastal processes combined with anthropogenic impacts (ie. vehicle access, pedestrian access, stormwater) will continue to drive episodes of erosion along the Turkey Beach shoreline over the coming decades, mainly impacting the northern point and eastern shorelines.

With a changing climate and projected sea level rise, the area prone to erosion and tidal inundation, and the magnitude of erosion in storm events, is expected to increase.

The majority of Turkey Beach is well positioned (at elevation, set back from the shoreline) to avoid extensive erosion impacts on residential areas and key infrastructure. However, there are some residential areas already being impacted during high tide events and storm surges (ie. Bell Street). Erosion will continue to have an impact on shoreline amenity, recreation and other social and economic values for the town and region.

The management focus for the SEMP includes to:

- Part A - Minimise erosion along western and eastern shorelines

  This can primarily be achieved through the protection of existing mangrove and foreshore vegetation communities that provide protection to the west and east shorelines from erosion processes (wind and wave energy).

- Part B - Minimise erosion from the northern point shoreline

  This will require active management of the sandy shoreline to retain, and periodically restore sand to this location.

The overall intent of actions associated with Part A and Part B of the SEMP is to manage erosion in a way that maximises social, economic and environmental benefits for the community.

Mangroves at Bowton St

3 Coastal values

Turkey Beach holds significant environmental, social and economic values to the Gladstone Region, including the Traditional owners, the communities that reside there, and visitors. This section provides a summary of key values to protect / consider in the management of shoreline erosion processes.

3.1 Environmental values

The Turkey Beach peninsula is located within the Rodd's Bay estuary and is surrounded by an abundance of vegetation and native wildlife habitat that is of state and national significance (Figure 26).

Figure 26. *State mapped environmental values of Turkey Beach (MSES – Matters of State and Environmental Significance)*

3.2 Cultural values

The Bailai, Gurang, Gooreng Gooreng and Taribeland Bunda People are the Traditional Owners within the Gladstone Region. The coastal region of the Gladstone LGA, including Turkey Beach, holds significant value to the Traditional Owners. Indigenous cultural identity is intrinsically linked to the condition of the natural components of the region (GBRMPA 2019). The Native Title hold within Turkey Beach is shown in Figure 27.

Figure 27. *Native title boundaries within Turkey Beach*

3.3 Economic values

The main industry in Turkey Beach is tourism, with a particular focus on fishing, crabbing and boating. The main tourism drawcards in town include the boat ramp and the annual Turkey Beach Tractor Bash (Figure 28).

This contributes to the broader tourism industry of the Gladstone Region. During the 2017/18 financial year, the total value added to the Gladstone Region economy from tourism was $87.6 million (NIEIR 2018). International tourists accounted for 20 % of the total number of visitors.

Figure 28. *Advertising poster for the 2019 Tractor Bash*

3.4 Community input – workshop 1

A stakeholder workshop was held on the 26th August 2019 at the Turkey Beach Community Hall. The purpose of the meeting was to:

- Provide an overview of the project, the purpose of a Shoreline Erosion Management Plan and coastal policy setting
- Provide an introduction to coastal processes and erosion, including interactions with the shoreline and built structures and ecosystems, and factors that lead to erosion and inundation (tides, storm surges, waves, overtopping) (Figure 29)
- Gather history, insights and perspectives of the local community in relation to shoreline erosion management.

During the stakeholder meeting a timeline of events significant to coastal management and development was established (Figure 30) and significant assets, values and issues relating to coastal management were identified (Table 1).

Figure 29. *Discussing coastal processes and identifying values and issues along the Turkey Beach shoreline*

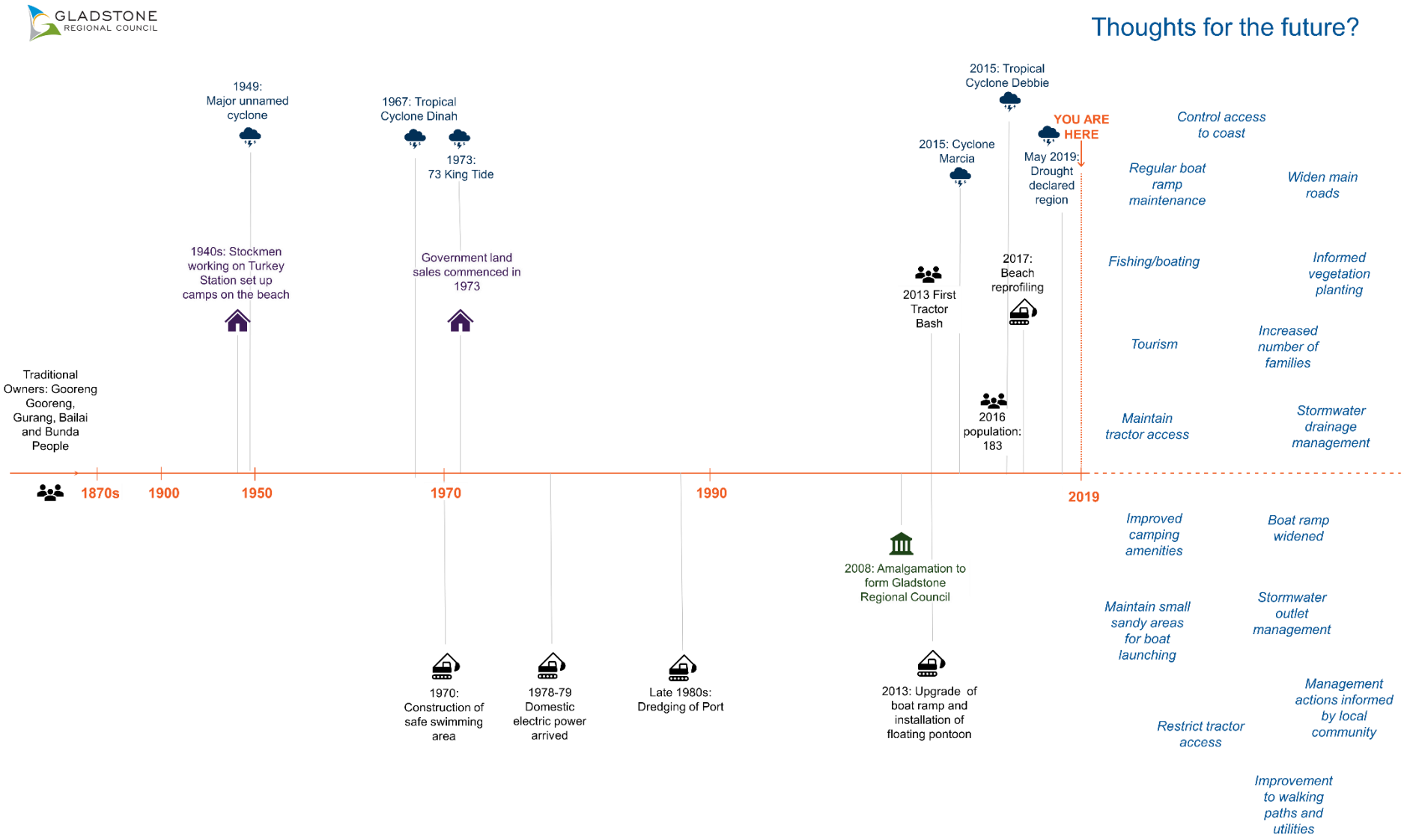
The values and desired outcomes identified by the community are factored into the objectives for management for the SEMP (Section 4.1). The intent of the SEMP is to ensure that options proposed for managing erosion at Turkey Beach are consistent with the values and desired outcomes of the community and key stakeholders.

Table 1. Assets/values of the Turkey Beach coastline, main issues of concern, desired outcomes

Assets/values	
	Recreational fishing
	Boat ramp (including safe access and egress under all tidal conditions)
	Sandy beaches (for both boat launch and recreational use)
	Flora and fauna (terrestrial and aquatic), in particular EPBC listed flora and fauna (e.g. dugongs)
	Recreational access, aesthetics and facilities

Current issues
• Boat ramp can be a safety issue when slippery • Long wait times on ramp during busy periods • Illegal rubbish dumping in the tidal zone • Tractor/vehicle access in inappropriate areas contributing to coastal erosion and vegetation damage (including mangroves) • Tidal inundation (height and duration of high tides increasing) • Shoreline erosion • Erosion at stormwater outlet

Desired outcomes
• Maintain fishing and boat access • Protect and enhance habitat • Maintain tourism • Maintain sense of pride in community • Protect mudflats and sea grass meadows • Protect and enhance habitat and remnant vegetation • Maintain aesthetics and recreation value (including swimming access) • Ensure a diversity of vegetation • Protect nursery habitat for fish • Protect vegetation buffer against coastal erosion • Protect infrastructure (swimming enclosure) and water quality for swimming • Protect infrastructure such as walkways, amenity blocks and shade structures • Protect foreshore



We would like to acknowledge the Traditional Owners of the Port Curtis Coral Coast region, the Gooreng Gooreng, Gurang, Bailai and Bunda People, and pay our respect to their past, present and future custodianship and involvement in the management of the region.

Figure 30. *Turkey Beach - timeline of past events and thoughts for the future - compiled by community stakeholders (August 2019)*

4 Management options and suitability

As noted previously (Section 2.6), two focus areas are defined for this SEMP:

- Part A - Minimise erosion along western and eastern shorelines
- Part B - Minimise erosion from the northern point shoreline

The overall intent of actions associated with Part A and Part B of the SEMP is to manage erosion in a way that maximises social, economic and environmental benefits for the community.

4.1 Part A – Western and eastern shorelines

The primary action to assist with minimising erosion along the western and eastern shorelines is the protection, and enhancement, of existing mangrove and foreshore vegetation communities. Mangroves and foreshore vegetation provide protection to the shoreline from erosion processes (wind and wave energy), and encourage the deposition of sediments.

Protection and enhancement of mangrove communities is also in accord with all desired outcomes raised by the community in relation to protection of habitats as well as providing protection to infrastructure.

Two priority actions are identified to protect and enhance mangroves and foreshore vegetation communities, as follows.

Action 1 – Complete a foreshore access plan in partnership with the community
Minimising foot and vehicle disturbance to the western and eastern shoreline areas is a priority action to protect and enhance mangrove and foreshore vegetation communities. In particular, this is important in areas with establishing and / or rejuvenating mangrove communities.

This can be achieved through providing signage and bollards in sensitive areas (as has already been established in some locations), while still providing access at designated points (to ensure access is provided for). Priority areas are those where shoreline recession has been identified (refer Figure 16). Indicative zones and priority areas for assisting / maintaining vegetation establishment are highlighted in Figure 31.

A plan to define agreed beach access points and designated boat ramps/boat access (including formalisation or changes to boat access points over sand along the beach) can be completed in consultation with the community as part of the SEMP implementation. This will also inform / link to the current boat ramp strategy being developed by Council for asset planning purposes. A shift of the existing informal boat access from the north of the main boat ramp to the south side (where sand is building up rather than eroding) should be considered as part of the access plan.

Action 2 – Review alternative stormwater management options
Stormwater runoff has potential to generate localised scour along the shoreline, exacerbate inundation extents and impact on foreshore vegetation communities. Impacts have been observed and reported by the community at a number of locations along the shoreline (including Bell Street).

A review of alternative stormwater management options at Turkey Beach can assist to identify feasible changes to existing alignments and outfalls to mitigate impacts on the coastline form and vegetation communities.

Figure 31. *SEMP – Part A – Western and eastern shorelines – minimal disturbance zones (orange) where foot and vehicle disturbance should be limited to defined locations - and priority sites (purple) where access should be restricted if feasible*

4.2 Part B - Northern point shoreline

Maintaining a sandy shoreline along the northern point of Turkey Beach is a desired outcome of the community, and contributes to a range of social, amenity and recreational values of the site and linked economic value to the region. Given the current site context and coastal processes, the northern point shoreline will require active management to mitigate erosion, retain and restore sand to this location.

Options

There are a range of shoreline erosion management options applied in different contexts across Australia and abroad, however preferred options vary depending on site context and stakeholder preferences.

Seawall / revetment Typically made of rock, concrete, geo-fabric bags or wood, seawalls provide an artificial barrier to erosive processes and protect the coastal assets behind them. They can be either exposed or buried and generally require extensive excavation. A seawall also has limited ability to dissipate energy and generally results in accelerated scour of sand from the base of the wall. Less formal revetments can also be implemented through placement of rock or geo-bags.	 
Groynes Built perpendicular to the coast, groynes can be constructed from a variety of materials, including rock, geo-bags, concrete or wood. Groynes assist with sand retention in areas prone to longshore drift. Sediment is captured on the updrift side, while erosion generally occurs on the downdrift side. Groynes can be formally engineered with excavation, or less formally constructed. They can vary in length, dependent on the sediment transport environment at the site and level of protection required. In some cases, groynes can also be orientated to provide a barrier to wave energy.	  
Breakwater Constructed offshore and generally parallel to the shore, breakwaters dissipate wave energy prior to impacting the beach. Breakwaters are generally constructed of rock or concrete and can be partially or entirely submerged.	
Artificial reef Similar to a breakwater, an artificial reef also reduces the wave energy impacting on the beach. Artificial reefs often have greater habitat value and encourage marine life to establish, mimicking natural reef systems.	
Sand nourishment Sand can be sourced from offshore through dredging or other sources and can be imported or sprayed onto the beach to increase the volume of sand on the beach. Sand can be nourished utilising an external sand source (e.g. river mouth or offshore deposits), or sand scraping can be used to redistribute sand already on the beach. Sand can be shaped to provide a dune system that is stabilised with fencing and vegetation.	 
Vegetation establishment Native coastal vegetation can be sourced and planted to provide stability to a newly established sand dune. This can be through direct seeding or the planting of established vegetation to diffuse wind and wave action and allow for sand retention. Revegetation species will be dependent on the coastal environment, level of protection and salinity.	

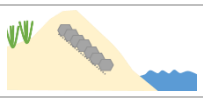
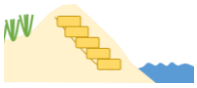
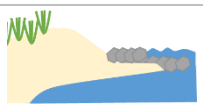
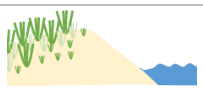
Screening criteria
A set of criteria were developed for the initial screening of management options. These criteria were informed by stakeholder discussions and input (Section 3.4), and an understanding of the short and long term needs and constraints at Turkey Beach.

Suitable options for erosion management of the northern point should:

- Be in accord with QLD State Government policy for coastal management
- Meet necessary planning approvals requirements for the site setting
- Be feasible for available budgets and funding sources
- Be in accord with community expectations - The option should align with expectation of local community stakeholders. This includes the values of the site and desired outcomes from management actions.
- Enable prompt action.

Options screening
An initial screening of the range of options against the criteria is provided in Table 2.

Table 2. Options assessment summary

			Be in accord with State planning policy	Meet planning approvals requirements	Be feasible within budgets and funding sources	Be in accord with community expectations	Enable prompt action
Formal seawall	Rock						
	Geobag						
Formal groyne	Rock						
	Geobag						
Breakwater							
Artificial reef							
Sand nourishment							
Revegetation							

Best meets criteria
May meet criteria
Unlikely to meet criteria

With Marine Park protected areas offshore (including Dugong habitat) it is unlikely that structures that extend offshore (groynes, breakwaters, artificial reefs) would be considered suitable for the site / obtain necessary planning approvals. The impact of these options in terms of construction and maintenance disturbance is also inconsistent with community values and desire for habitat protection. The cost of these options is also likely to be prohibitive.

Seawall structures are supported by State policy as a last line of defence, when other management options are not viable. A last line of defence typically relates to the protection of critical assets that cannot be readily relocated (e.g. last access road). For the northern point of Turkey Beach, there are other management options available to manage the natural coastal processes, and it is unlikely that a seawall structure would be approved at this time. Triggers can be put in place to indicate when, in the future, a seawall may become appropriate if a road or critical asset is likely to be impacted by erosion.

The combined options of beach nourishment and revegetation best meet the screening criteria and are the preferred actions for erosion management along the northern point.

Action 3 – Beach nourishment and revegetation design and implementation plan
Beach nourishment can be implemented through either sand scraping from the adjacent intertidal zone (as was previously completed in 2017 after cyclone Debbie) or south of the boat ramp, or by importing new sand volumes. The preferred approach depends on required volumes and sediment sizes, and budget/feasibility.

Placement approach 1: Beach nourishment via sand scraping / local sources can be achieved with a self-assessible permit up to a volume of 5,000 m^3. It was estimated that in the order of this volume was placed in August 2017 post cyclone Debbie, and has now been largely eroded. A regular program of sand scraping (of up to 5,000 m^3) will likely be required, typically every 3 – 5 years, to maintain the sandy shoreline. The benefit of this approach is that it is relatively inexpensive (hire of excavator), and easy to implement. However, the main disadvantage is the regular disturbance to the beach and intertidal zone, disturbing the sand armour layer and potential limitation to vegetation establishment.

Some sand can be moved from south of the boat ramp to the north (restore the longshore drift), however this alone will not provide the full volume required. A combined shift of sand from the intertidal zone and south of the boat ramp is likely to be the most feasible approach in practice.

Cost estimates for sand scraping are primarily associated with contract fees for operation of an excavator. Cost estimates using a contractor are in the order of \$10 / m^3 plus mobilisation and de-mobilisation costs. An indicative cost associated with a first round of scraping up to 5,000 m^3 is in the order of \$50,000 - \$60,000. Revegetation (for indicative area of 2,000 m^2 - Figure 32) cost will be additional to this, with a mid-range estimate in the order of \$72,000. Total cost of initial sand scraping/placement and vegetation establishment is in the order of \$120,000 - \$130,000 (with indicative 3 – 5 year longevity for placed sand).

Placement approach 2: Beach nourishment using off-site (imported) sand sources is a more expensive exercise, and requires an approvals process, however has the benefit of providing a net gain of sand to the site, and sediment sizes can be selected to suit a design profile.

A program of beach nourishment in the order of 5,000 – 10,000 m^3 every 10 years can provide a more stable beach profile for the longer period. A coarser sediment layer can be graded into the imported to material to increase resistance to erosion. Minimising disturbance to the beach where possible, and encouraging vegetation establishment along the dune areas to catch wind-blown sand and further build the dune area, will also assist long term retention of the placed sand. Unit cost rates for beach nourishment and revegetation are provided in Revegetation (for indicative area of 2,000 m^2 - Figure 32) cost will be additional to this, with a mid-range estimate in the order of \$72,000.

Estimated costs for placement approaches 1 and 2 are indicative only, and dependent on detailed design of volumes and confirmation of unit rates appropriate to the location.

Table 3.

Based on concept nourishment volumes in the order of 5,000 m^3 to 10,000 m^3, mid-range cost of nourishment works may be in the order of $250,000 to $500,000 (respectively) (for 5 – 10 year longevity of placed sand). Revegetation (for indicative area of 2,000 m^2 - Figure 32) cost will be additional to this, with a mid-range estimate in the order of $72,000.

Estimated costs for placement approaches 1 and 2 are indicative only, and dependent on detailed design of volumes and confirmation of unit rates appropriate to the location.

Table 3. Unit costs (range)

Option	Unit costs			Notes
	Low	Medium	High	
Sand renourishment from external sources (per m^3)	$40	$50	$70	Includes cartage to remote area and placement to design profile.
Revegetation (per m^2)	$25	$36	$54	Includes once-off establishment of planting media and planting and initial maintenance of an appropriate species such as sand spinifex (Spinifex sericeous). Ongoing maintenance costs are embedded in existing Council maintenance costs.

Sources: Alluvium (2019) Building a Resilient Coast for the Douglas Shire, Dan Ware and Zsuzsa Banhalmi-Zakar (2017) Funding coastal protection in a changing climate: Lessons from three projects in Australia.

Beach nourishment from an external source is the preferred approach to nourishment at the northern point, providing greater longevity and social, economic and environmental benefit for the site. However it may be more practical for Council, in the short term, to undertake a first nourishment via sand scarping/local sand sources.

The treatment area and sand volumes estimated for nourishment along the northern shoreline are indicative only, and based on estimated sand volumes that will have longevity at the site and provide protection to the backshore environment from erosion events (i.e. the placed sand is eroded, not the shoreline where assets are located). Alternatively, more localised areas of sand scraping / pushing can be undertaken around the priority areas only (e.g. swimming enclosure, toilet block) as has been previously completed in the past. However smaller sand volumes and treatment areas are likely to be eroded more quickly (possibly annually), and the shoreline will remain vulnerable to major erosion in large events.

Figure 32. *SEMP Part B – northern point – beach nourishment and revegetation – indicative nourishment area (4,000 - 5,000 m^2) and vegetation area (2,000m^2)*

For non-self assessible nourishment, a detailed design for the beach nourishment, including sand source and sizing, volume and design profile is required to confirm specifications and construction costs (detailed design cost estimate $20 - $25k), and obtain necessary State approvals.

Revegetation includes opportunities to re-establish Mangrove communities as well as shoreline / dune vegetation species appropriate to the site, including low-lying grasses and ground cover species.

Overall placement approach, volume, frequency, sand source, and detailed design (if required) can be confirmed in a beach nourishment and revegetation design and implementation plan for the northern shoreline of Turkey Beach.

Consideration of managed access across the northern shoreline should also form part of the nourishment and revegetation implementation plan, to maximise longevity of nourishment works. This will also link into the access plan for the eastern and western shorelines.

4.3 Community input – workshop 2

A follow up workshop was held 17th December 2019 in Turkey Beach (Figure 33). The purpose of the meeting was to:

- Present the findings of the technical assessment
- Canvass any further insights and perspectives of the local community in relation to shoreline erosion management
- Outline the approach to the selection of the management options, including constraints
- Present and gather feedback on the recommended management actions

The comments raised and Alluvium/GRC responses are presented in Attachment E. The main comments surrounding the options presented included:

- General support for vehicle/boat launch access control

- Majority support revegetation and signage/education options
- Minority concern over management recommendations not including hard structures to limit further beach erosion

Figure 33. *Community meeting at Turkey Beach 17/12/2019*

4.4 Implementation and review

The recommended management actions of this SEMP for implementation, monitoring and review are summarised in Table 4.

Table 4. Actions summary

Action	Description	Timing	Cost*
Action 1 – Complete a foreshore access plan in partnership with the community	Minimise foot and vehicle disturbance to the western and eastern shoreline areas to protect and enhance mangrove and fringing vegetation communities, as per Part A recommendations (Figure 31) The Plan will define agreed beach access points/restrictions and designated boat ramps/boat access in partnership with the community.	End of 2020/21 FY	Council run (N/A) Conslutant support (if applicable) $15,000 - $20,000.
Action 2 – Review alternative stormwater management options	Review alternative stormwater management options at Turkey Beach to identify feasible changes to existing alignments and outfalls to mitigate impacts on the coastline form and vegetation communities.	End of 2020/21 FY	Council run (N/A) Consultant support (if applicable) $15,000 - $30,000.
Action 3 – Beach nourishment and revegetation design and implementation plan	Confirm overall placement approach, volume, frequency, sand source, and detailed design (if required) of beach nourishment for the northern shoreline of Turkey Beach - informed by the concept specifications in Part B recommendations (Figure 32). The Plan to also include: - Consideration of managed access across the northern shoreline to maximise longevity of nourishment works	End of 2020/21 FY	Consultant support (if required) - overall Implementation Plan ($10,000 - $15,000) Beach nourisment detailed design (if applicable) ($20,000 - $25,000).

Action	Description	Timing	Cost*
	- Revegetation of dune/backshore areas (low ground cover / shrubs as appropriate) - Monitoring and evaluation actions.		
Action 5 – Implement nourishment and vegetation works	As per arrangement determined in Action 3.	End of 2020/21 FY	Cost dependant on Implementation Plan and design – ranging up to $500,000 for beach noruishment that povides up to 10 years of foresore protection.
Action 4 – Implement monitoring	Monitoring to include: - Establishment of monitoring points (photo and depth markers) for monthly beach profile monitoring - Establish other required monitoring identified by Action 3.	End of 2020/21 FY	Council/community led (N/A) Consultal support (if applicable) ($5,000 - $10,000) for set up.
	- Annual and event-based review of shoreline profile change - Annual update of triggers for a SEMP review or change in management.	Annual	Consultant support if applicable ($5,000) – review and summary memo.
Action 5 – SEMP review, evaluation and update	A review of the SEMP every 5 years to confirm and update the plan.	5 years (or earlier if triggered)	Consultant support ($5,00 - $10,000)
	Triggers for an earlier review include: - Loss of >50% of placed sand within 2 years or 1 event – triggering review of SEMP and sand volumes - Erosion of shoreline to within 15m of critical asset/s (last access road, essential services), triggering the need to review the SEMP and management options, including investigating the feasibility of additional protection measures.		

*Indicative costs only and dependant on desired scope of works

War memorial along The Esplanade

5 References

Department of Environmental Science (2016), *Erosion prone area series,* retrieved from http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={52B4C820-488C-4B91-B31D-E1CBA02076F1}

Department of Environmental Science (2018), *Preparing a shoreline erosion management plan,* retrieved from https://www.qld.gov.au/__data/assets/pdf_file/0011/107300/gl-cd-preparing-a-shoreline-erosion-management-plan.pdf

Great Barrier Reef Marine Park Authority (GBRMPA) (2019), *Great Barrier Reef Outlook Report 2019,* GBRMPA, Townsville, retrieved from http://elibrary.gbrmpa.gov.au/jspui/handle/11017/3474

Griffith University Centre for Coastal Management (GU) and GHD (2012). *Coastal Hazard Adaptation Options: A Compendium for Queensland Coastal Councils*.

National Institute of Economic and Industry Research (NIEIR) (2018) Gladstone Regional Council economic profile, viewed 12 July 2019 https://economy.id.com.au/gladstone/value%20add%20by%20industry

Oyedotun, T. D. T. (2014) Shoreline geometry: DSAS as a tool for historical trend analysis. *Geomorphological Techniques*, Chap. 3, Sec. 2.2

State of Queensland, 1959, 1975 and 1993, aerial photography accesses from: qimagery.information.qld.gov.au/

Attachment A
Legislative context

Legislative context

Coastal management in Queensland is bound by a raft of international, Commonwealth, State and local legislation. The legislation results in a complex structure of rights and responsibilities, particularly surrounding implementation of coastal works. Key legislation relevant to coastal planning within the Gladstone Regional Council LGA is outlined in Figure 34. Any proposed management options will comply with all relevant legislation.

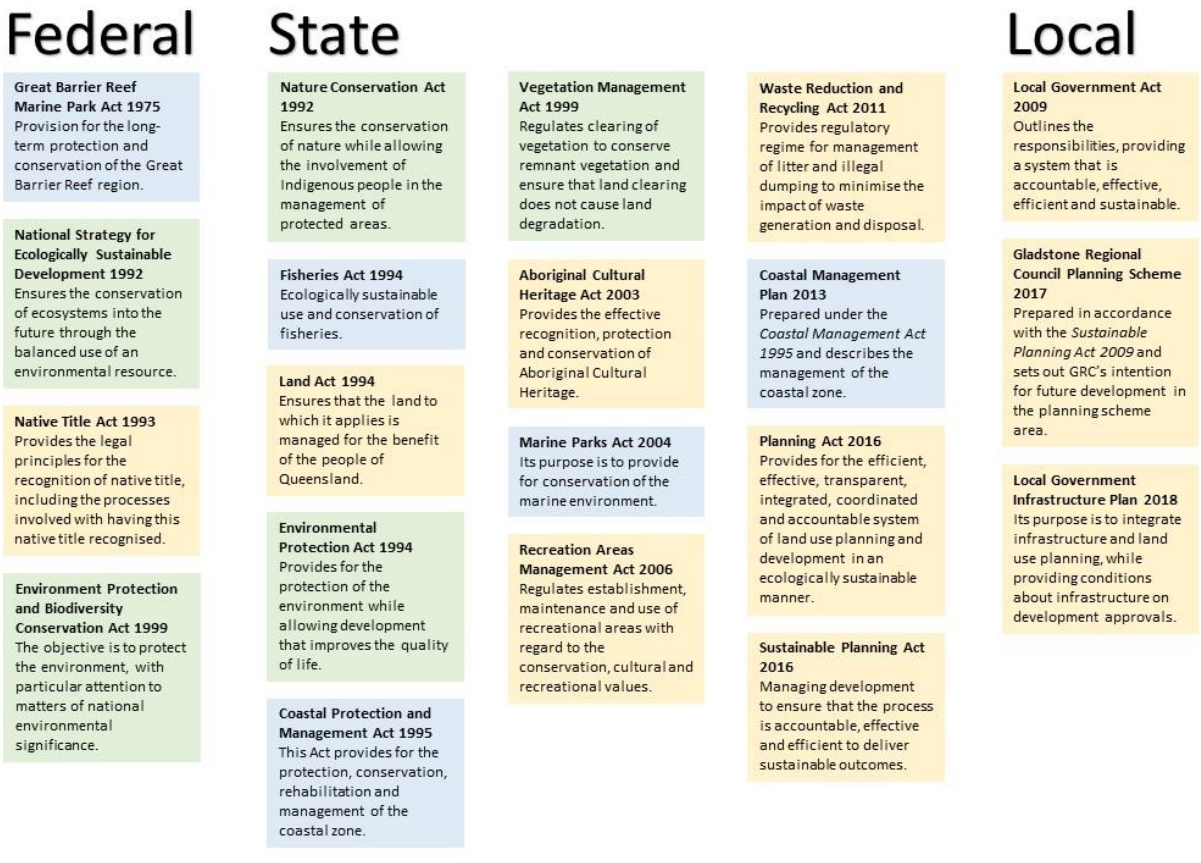


Figure 34. *Summary of the legislation relevant to the Turkey Beach SEMP. (Yellow boxes represent land tenure, title and commercial use plans or Acts, blue boxes represent waterway and coastal plans or Acts, Green boxes represent land, climate, environment and wildlife reforms or plans.*

Approvals processes that may be required for coastal management actions are noted in Table 5.

Table 5. Summary of the approval process for the potential management options (adapted from GU & GHD 2012)

Legislation	Beach nourishment	Revegetation	Buried seawall	Groyne
Coastal Protection and Management Act 1995	✓	✓	✓	✓
Sustainable Planning Act 2016	✓	✓	✓	✓
Fisheries Act 1994	✓	✗	✗	✓
Vegetation Management 1999	✗	✓	✓	✓
Queensland Marine Parks Act 2004	✓	✗	✗	✓
Great Barrier Reef Marine Park Act 1975	✓	✗	✗	✓
Native Title Act 1993	✓	✓	✗	✓

Attachment B
Model information

Model development

Delft3D numerical model development

Model development

Numerical modelling has been undertaken using Delft3D, an integrated model capable of estimating tides, extreme water levels, currents, cyclones and wave conditions. It is an open-source model . As schematised in Figure A1, several modules of Delft3D can be used within modelling scenarios. For this assessment of coastal processes, the Delft3D-FLOW module was used for hydrodynamic calculations (tides, currents, winds).

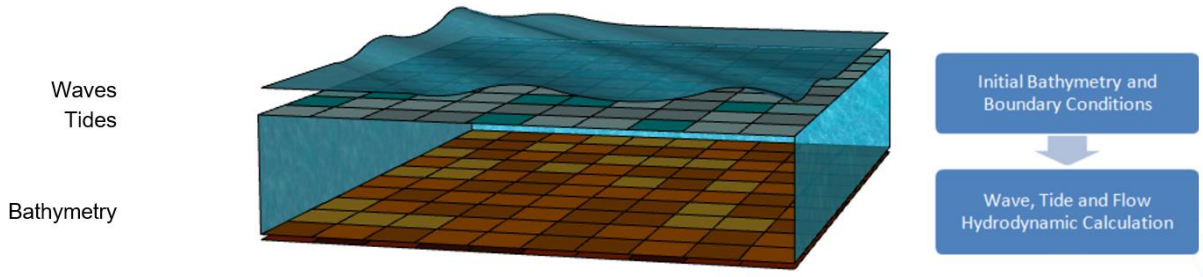


Figure A1. *Delft3D hydrodynamic and wave calculations.*

Modelling extent

The spatial domain of the model spans Rodds Bay. It extends across the 7km mouth of the bay and continues around 15km to the inland estuary.

The model was constructed using a curvilinear computational grid with a varying spatial resolution. This approach allows for large spacing between grid points in the offshore region where a detailed representation of the deep bathymetry is unnecessary, and more detailed information in the nearshore region. The model has a grid size of around 125m x 125m along the outer boundary, and a nearshore minimum grid boundary resolution of 35m x 35m adjacent to Turkey Beach.

Bathymetry

The bathymetry grid was constructed for each model domain based on several sources of data.

- Offshore data is based on the GBR30 dataset. This is a mosaic of high-density multi-beam data, high-density single-beam data or best scale charted data.
- Above mean sea level, the QLD LiDAR dataset has been used.

This data was processed and merged over the Delft3D grid. Once merged, the grid was inspected to ensure that the locations where datasets intersected did not contain abnormal changes in bathymetry, which could distort coastal processes. Any gaps in the bathymetry were smoothed and averaged with the adjacent grid cell.

Boundary conditions

Tidal conditions throughout the model have been based on tidal harmonics. These were extracted from the TPXO (v7.2) global tidal harmonics database. A double spring-neap tidal cycle was run (spring-neap-spring-neap) to reflect January 2017.

JBP Beach Evolution Model

The JBP Beach Evolution Model (JBEM) considers fetch-limited wave growth as described by Hasselmann[1], depth limitation, tidal interactions and wave breaking based on the Nelson Criterion (1994)[2]. Beach evolution is then modelled for the upper beach using the Kamphuis[3] sediment transport calculations, which builds on to commonly used formulae such as the CERC[4] equation, however includes the effects of particle diameter, bed slope and wave period.

1 Shoreline Protection Manual (1984). Volume 1. Chapter VI: Wave forecasting for shallow water. Page 3-55.

2 Nelson, R.C., 1994, "Depth limited design wave heights in very flat regions", Coastal Engineering, vol. 23, no. 1-2, pp. 43-59

3 Kamphuis, J.W. 1991. Alongshore sediment transport rate. Journal of Waterway, Port, Coastal and Ocean Engineering, Vol. 117, 624-640

4 USACE, 1984, Shore Protection Manual, CO. Eng. Res. Centre, US Army Corps of Engineers, Vicksburg, MS, USA

Attachment C
Historical shoreline trends analysis

Historical shoreline trends analysis

Method

Historical images, digitised shorelines, and the Digital Shoreline Analysis System (DSAS) for ArcGIS were used to identify historical shoreline changes and trends along the Turkey Beach coastline. The images were provided by GRC or downloaded from the QImagery website.

Four images spanning 1959 to 2017 were sourced for the analysis from the following sets:

- Gladstone – Whole Region 2017 (resolution: 20cm) Source: GRC
- Miriam Vale 1993 (scale 1:25,000) Source: State of Queensland, 1993
- Rodds Harbour 1975 (scale 1:12,000) Source: State of Queensland, 1975
- Bustard Bay 1959 (scale 1:23,800) Source: State of Queensland, 1959

With the exception of 2017, the images for all years required georeferencing. Shorelines were then digitised immediately seaward of the vegetation line or of any grassed dune areas distinguishable in the historical images. A baseline was drawn along the coast, approximately 50 m inland of the shorelines, as a baseline for casting transects across the digitised shorelines.

Transects were cast and statistics were calculated using the DSAS add-in (version 4.3) to ESRI ArcGIS Desktop (version 10.0). Transects were cast at a spacing of 20 m along the coast with statistical analysis included the change in distances over time, the End Point Rate (EPR) and Linear Regression Rate (LRR).

Limitations

While the method is useful in determining approximate rates of recession or accretion there are some limitations. The calculated measures of change, as provided by DSAS, are only as reliable as the accuracy associated with the source materials (quality and coverage of aerial imagery), whereby mapping errors generally increase in older data (Oyedotun 2014). Precise shoreline positions are typically difficult to determine from aerial imagery alone and accuracy is often limited by the imagery resolution and georeferencing. This is particularly relevant when assessing relatively small changes in shoreline position.

Results are considered indicative and transect results are used collectively to understand the general nature of changes along the shoreline over time, and not as specific measures of change for any given transect. The results provide a means to identify trends, the nature of changes along the shoreline over time, and particular areas of interest for management.

Shoreline change

The EPR and LRR results from the digital shoreline assessment (Figure 35) show shoreline recession as negative values (red transects) while positive values (green transects) represent shoreline accretion. The results for the 1959 to 2017 period indicate the most significant changes in shoreline position are along the eastern and northern extents of the headland. Approximately 1.2 km of shoreline that has experienced some degree of change of the last 60 years.

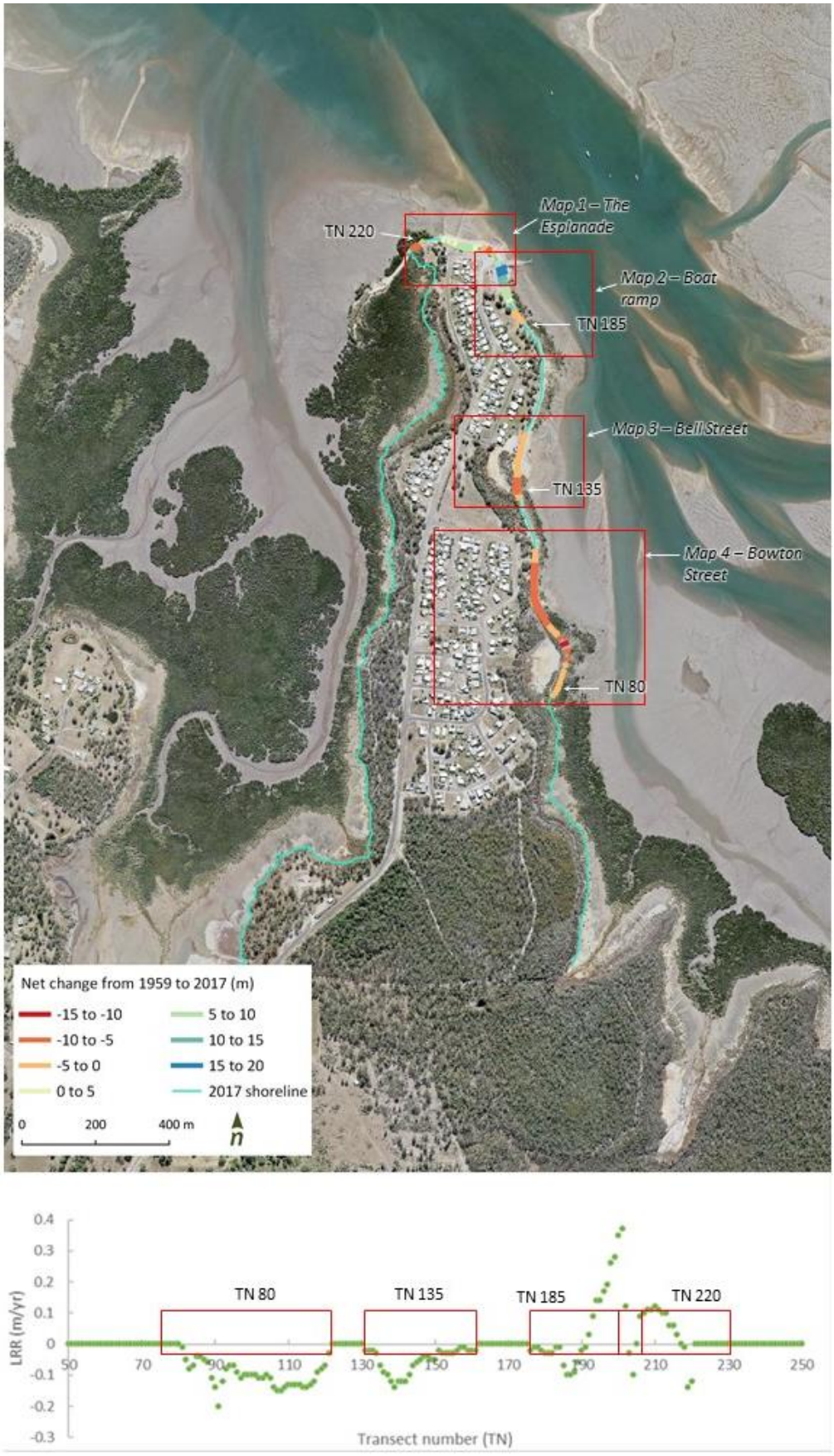


Figure 35. *DSAS transects for Turkey Beach showing End Point Rate (EPR) and Linear Regression Rate (LRR). Red boxes highlight the historic aerial imagery comparison map extents.*

Minor shoreline change was identified in four key areas along the Turkey Beach coastline. The shoreline dynamics at these locations are summarised below, and presented in site photos (Figure 41) and maps of historic shoreline positions (Figure 36 to Figure 39).

Map 1 – The Esplanade (Figure 36***)***

- DSAS indicates shoreline recession at the north western extent of the spit with an EPR of approximately - 0.14 m/yr. Some informal rock armouring is in place immediately to the east.
- Shoreline accretion through central section of the beach with an EPR of 0.12 m/yr. This is likely to be influenced by the development of The Esplanade road reserve and beach nourishment in 2017.
- Shoreline recession of the north eastern extent of the spit, behind the swimming enclosure, with an EPR of approximately - 0.1m/yr.

Map 2 – Boat ramp (Figure 37***)***

- DSAS results show significant shoreline accretion with an EPR of approximately 0.3m/yr. This is likely linked to the construction of the boat ramp (late 1970s) and the addition of a carpark post 1993, where the boat ramp now intercepts the northward transport of sand.
- Minor shoreline recession (or loss of terrestrial vegetation) south of the boat ramp car park in front of Hancock Street residence. EPR rate of approximately -0.07 m/yr.

Map 3 – Bell Street (Figure 38***)***

- Minor shoreline recession in front of properties at the southern end of Bell Street, also corresponding to a reduction in shoreline vegetation since 1959 due to clearing and development.

Map 4 – Bowton Street (Figure 39***)***

- Minor shoreline recession indicated by DSAS but difficult to determine precise shoreline positions due to image quality. Unlikely to be significant or ongoing shoreline recession. Also corresponds to a reduction in mangrove density particularly in front of Bowton Street.

Figure 36. *Historic aerial imagery comparison and shoreline position for Map 1 – The Esplanade*.

Figure 37. *Historic aerial imagery comparison and shoreline position for Map 2 – Boat ramp.*

Figure 38. *Historic aerial imagery comparison and shoreline position for Map 3 – Bell Street.*

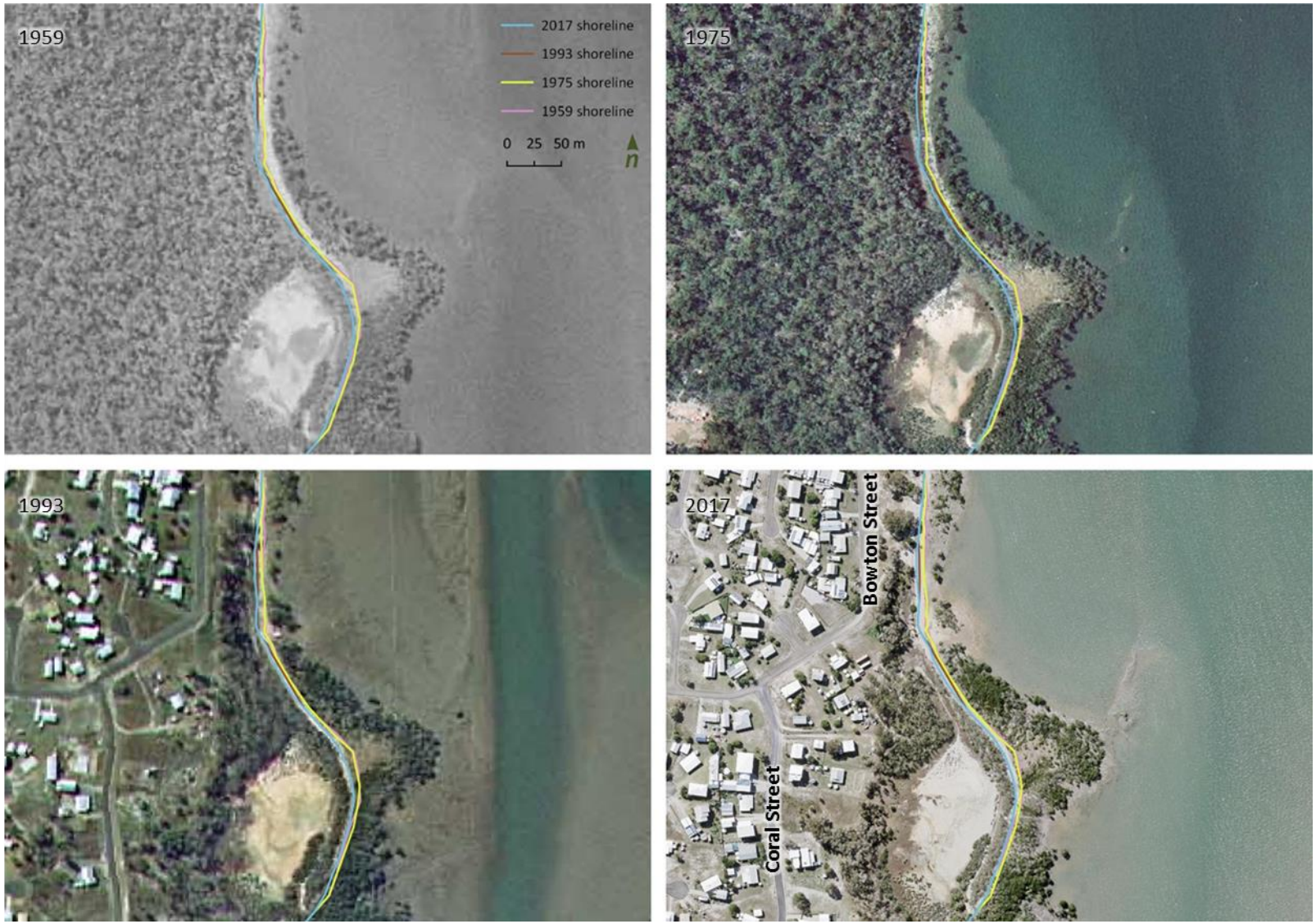


Figure 39. *Historic aerial imagery comparison and shoreline position for Map 4 – Bowton Street*

Attachment D
Site condition observations August 2019

Site condition observations

Field assessments at Turkey Beach were carried out by Alluvium, JBP and GRC on 7th June 2019 and Alluvium and GRC on 26th August 2019. A locality map with road names is shown in Figure 40. Key observations from the site inspections are presented in Figure 41 and summarised in Table 6 to Table 7.

Figure 40. *Locality map with road names*

Table 6. Summary of present shoreline and infrastructure / asset condition adjacent to Turkey Beach Esplanade

Adjacent to The Esplanade	
Existing condition • Relatively steep beach with limited vegetation along northern-facing shoreline • Scarp present along majority of length of beach, approximately 0.2 m high	**Coastal management and engineering** • Evidence of previous rock protection at western end of beach • Visible offshore bar parallel to the beach • No clear sediment transport direction
Infrastructure / assets • Toilet block • War memorial (non-Council asset)	

Table 7. Summary of present shoreline and infrastructure / asset condition at Turkey Beach swimming enclosure and boat ramp

Turkey Beach swimming enclosure and boat ramp	
Existing condition • Shallow beach gradient with evidence of sediment loss	**Coastal management and engineering** • Rock revetment covered by sandy beach
Infrastructure / assets • Boat ramp • Swimming enclosure (non-Council asset) • Road, shelter and bollards landward of beach	

Table 8. Summary of present shoreline and infrastructure / asset condition at Bell Street, Turkey Beach

Bell Street, Turkey Beach	
Existing condition • Low-lying foreshore reserve with minimal berm • Foreshore receding and scarp behind mangroves ~0.2 m, visible until Brown Street • Watermark (leaves) in clear banks on beach • Stormwater discharges onto the beach • Visible bedrock • Roots of trees exposed	**Coastal management and engineering** • Mangrove and mudflat in front of the beach
Infrastructure / assets • Tidal areas encroaching on property boundaries	

Table 9. Summary of present shoreline and infrastructure / asset condition at Bowton Street, Turkey Beach

Bowton Street, Turkey Beach	
Existing condition • Mangrove and mudflat • Stormwater discharge south of Bowton Street • Tidal influenced • Some scarping ~0.1 m	**Coastal management and engineering** • Signage regarding tidal inundation and soft sands to deter vehicle access
Infrastructure / assets • Some timber fencing as part of mangrove and vegetation management	

Figure 41. *Summary of key site inspection observations*

Attachment E
Workshop 2 responses

Community comment	Alluvium/GRC response
Concern over lack of evidence of sea level rise (in reference to state mapped coastal hazard layers). Particularly at a local scale within Turkey Beach.	Acknowledge there may be limited local data/present day evidence but general scientific consensus is that we need to be accounting for this in our planning and State Policies require this. Council is proactively planning in this space, so they can be prepared if it occurs, rather than be reactive.
Influence of the boat ramp on coastal processes (particularly since the upgrade). Concern it is acting like a groyne, with evidence of eddy currents resulting in scouring and coastal erosion (specific example cited of notable scour hole).	We have found limited information around the design process (it is a TMR asset). Acknowledged that structure is potentially impacting sediment transport.
General support for vehicle/boat launch access control: • Suggestion to close of some accesses (some minor support for closing all informal accesses) • Suggestion to formalise some accesses with timber and chains	Undertook a mapping exercise to understand preferred access points.
Boat ramp has 3 tonne weight limit therefore larger boats require launching access at adjacent beach area.	Acknowledged that without upgrade to existing boat ramp closure to this informal access would not be in line with community values.
Several further erosion hotspots identified.	Acknowledged and located on map.
Frustration surrounding time it takes to get response/action from Council and concern that this will happen with the SEMP actions.	SEMP process helps to provide the pathway to ensure council have the appropriate planning tools, steps and funding mechanisms in place. Cited example of Boyne Island/Tannum Sands.
Majority support revegetation and signage/education options. • Concern over damage/illegal clearing of existing vegetation • Discussed species selection (including ensuring views are maintained, otherwise may lead to illegal clearing) • Support for increased understanding around impacts of certain activities (e.g. 4wds on beach getting bogged and causing damage) • Perception that visitors are unaware of local surrounds and conditions and environmental sensitivities	Acknowledged.
Minority concern over management recommendations not including hard structures to limit further beach erosion.	Reiterated point that current State Policies will inhibit approval for the construction of hard structures for this particular erosion problem, given it is not a critical asset.