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Fraser Coast Shoreline Erosion Management Options Assessment

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Prepared for Fraser Coast Regional Council

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Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 203 Pacific Highway
St Leonards NSW 2065
Australia

Telephone: 02 9496 7700
Facsimile: 02 9439 5170
International: +61 2 9496 7700

sydney@cardno.com.au
www.cardno.com.au

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EXECUTIVE SUMMARY

The Fraser Coast region has a history of shoreline recession and erosion which has been observed by the local community and is also well documented in reports such as the *Hervey Bay Beaches Report* (BPA, 1989) and the *Burnett Mary Coast - Coastline Features and Vulnerability* report (Helman, 2010). The former Hervey Bay City Council previously prepared a *Coastal Protection Strategy* (WBM, 2004) for the Hervey Bay area, that outlined a number of shoreline erosion management activities designed to protect the coast from subsequent erosion. For a number of reasons the former Hervey Bay City Council was unable to implement some of the shoreline erosion management options identified this strategy (see discussion in Lawson *et al.,* 2007).

In 2008 the Fraser Coast Regional Council (FCRC) was created by amalgamating four Local Government Areas (LGAs), including the City of Hervey Bay, City of Maryborough, Divisions 1 and 2 of the Shire of Tiaro, and the Shire of Woocoo. The continuing erosion issues within the new Fraser Coast LGA have resulted in a need to develop consistent policies and options for managing erosion across the entire LGA. The development of a Shoreline Erosion Management Plan (SEMP) is particularly important to guide strategic land use planning and in allocating resources for erosion management initiatives across the LGA in a strategic and appropriate fashion.

This report presents the findings of Stage 2 of the overarching SEMP project, the Options Assessment. Stage 1 involved a Gap Analysis Study (Cardno, 2011), which included scoping some of the activities that have informed Stage 2, or will be required in subsequent activities (see Section 2.1).

Coastal Processes in the Study Area

The Fraser Coast LGA encompasses 112 km of shoreline, from Burrum Heads in the north, to Tinnanbar in the south. Within this extent there are a number of detailed areas of investigation that form the study area (Figures 1.1 and 1.2). To assist management, the study area was divided into five smaller management zones.

The geology of the Fraser Coast region is comprised of a large sedimentary delta system with basalt intrusions that form rocky headlands. The coastal strip was formed as a result of sediment deposition during the last 1.8 million years (BPA, 1989). The major features controlling beach alignment in the northern portion of the study area are rocky outcrops from the Burrum Coal Measures at Point Vernon and Dayman Point (BPA, 1989). These features prevent the northward transport of sand resulting in an inshore sediment deficit west of Point Vernon (Helman, 2010).

The morphology of the coastal zone is shaped by the atmospheric and oceanographic forces that drive sediment transport within this zone. The combination of the sandy sediments of the broader region, regular tidal forcing and sporadic events such as cyclones makes for a dynamic coastal zone within which the mean shoreline position is changing.

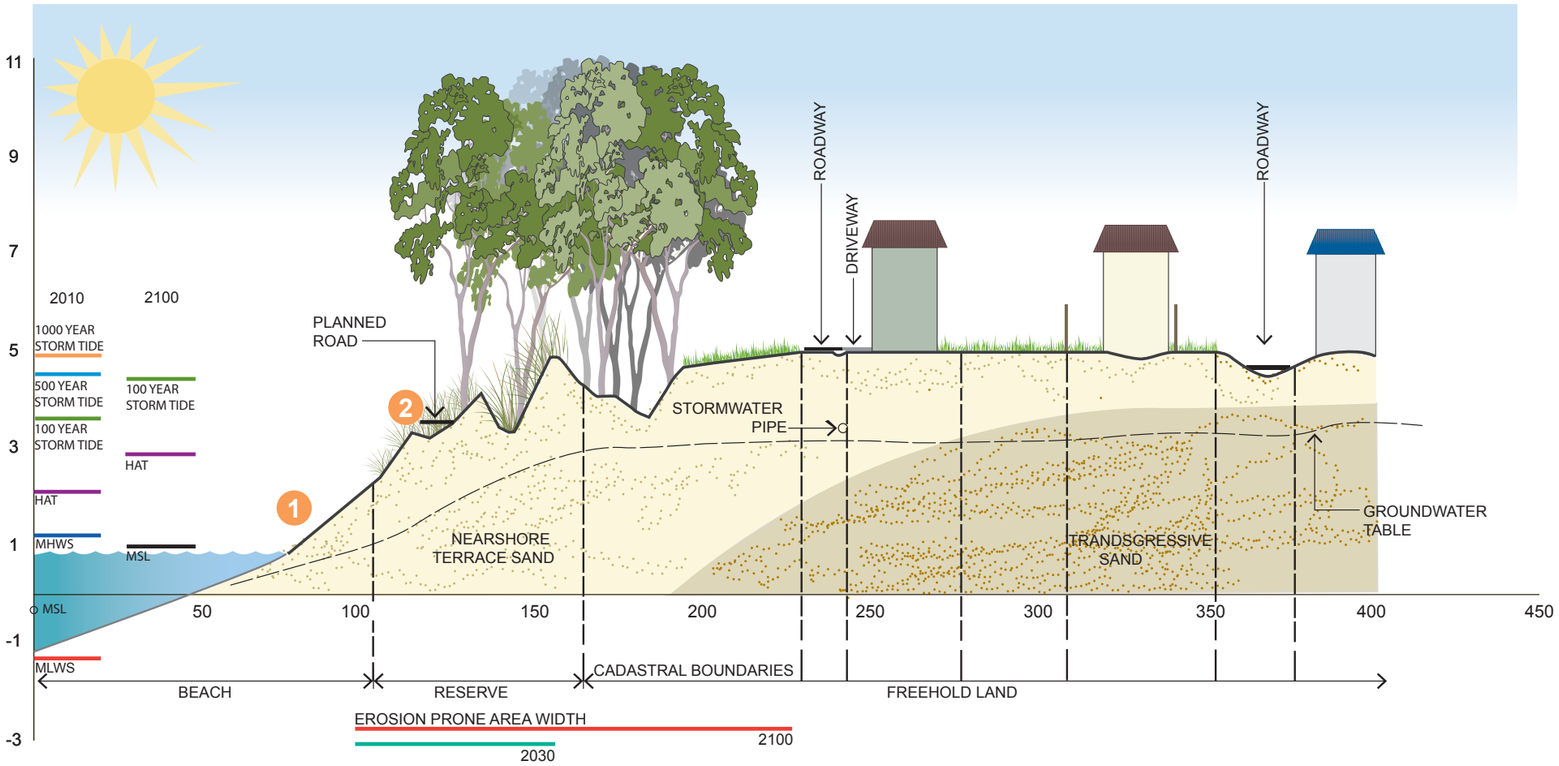
At the last end of the last ice age some 18,000 years before present (b.p.) the ocean water level was approximately 120 m lower than the present level and the shoreline located about 100 km offshore from its present position in Hervey Bay. Between 18,000 and 6,000 years b.p., sea level rose 120 m (Figure 1.3) and the shoreline migrated landward to roughly its current location. The present day sandy coastline of the study area has formed due to accretion since this time (BPA, 1989).

Over the past 6,000 years sea level has remained reasonably steady (Helman, 2010) until more recent times. However, from 1961 to 2003 globally average sea levels rose 1.8 mm/yr, although the rate of rise appears to be increasing, with globally averaged sea levels rising 3.1 mm/yr between 1993 and 2003 (DCC, 2009). In Australia, sea levels increased by an average of about 1.2 mm/yr between 1842 and 2002. This would translate to a significant landward translation of the shoreline due to SLR inundation and shoreline erosion, although there is a high level of uncertainty around the sea level rise (SLR) projections and it will be important to provide for ongoing monitoring and re-assessment of the projections over time.

A conceptual model showing a cross section of the shoreline illustrates some of these different processes (Figure E.1). The present day (2010) and projected future water levels are shown on the left, along with some approximate storm tide levels. The projected 2030 and 2100 Erosion Prone Areas (EPAs) are marked on the horizontal axis. It is apparent that the projected SLR of 0.8 m by 2100 will result in a significant increase in both day to day water levels and those that occur during extreme events. The rising sea level will also lead to rising groundwater levels in the coastal floodplains, with consequences for surface drainage. The projected rise in mean sea level to 2100 will also result in a landward translation of the shoreline and Erosion Prone Area.

The historical placement of fixed cadastral boundaries in that portion of the coastal zone now known to be susceptible to shoreline erosion, has led to a situation in which substantial portions of the developed coastline are under threat from shoreline erosion.

Coastal protection works have been constructed in a number of locations where development is at risk from shoreline erosion in the present day. A previous condition assessment of those structures located in the Hervey Bay area Coastal Engineering Solutions (1999) found that a number of the existing coastal protection works were in poor condition, and several were failing. There are coastal protection works in place at four locations in the Great Sandy Strait area, and of these two are in poor condition. A number of less formal coastal protection works have also been implemented, particularly at Poona. It is anticipated that most of these types of works would likely have limited success in arresting shoreline erosion, and as they are generally low profile, it is reasonable to assume that they would not provide much protection (particularly from overtopping) during a storm event or cyclone.



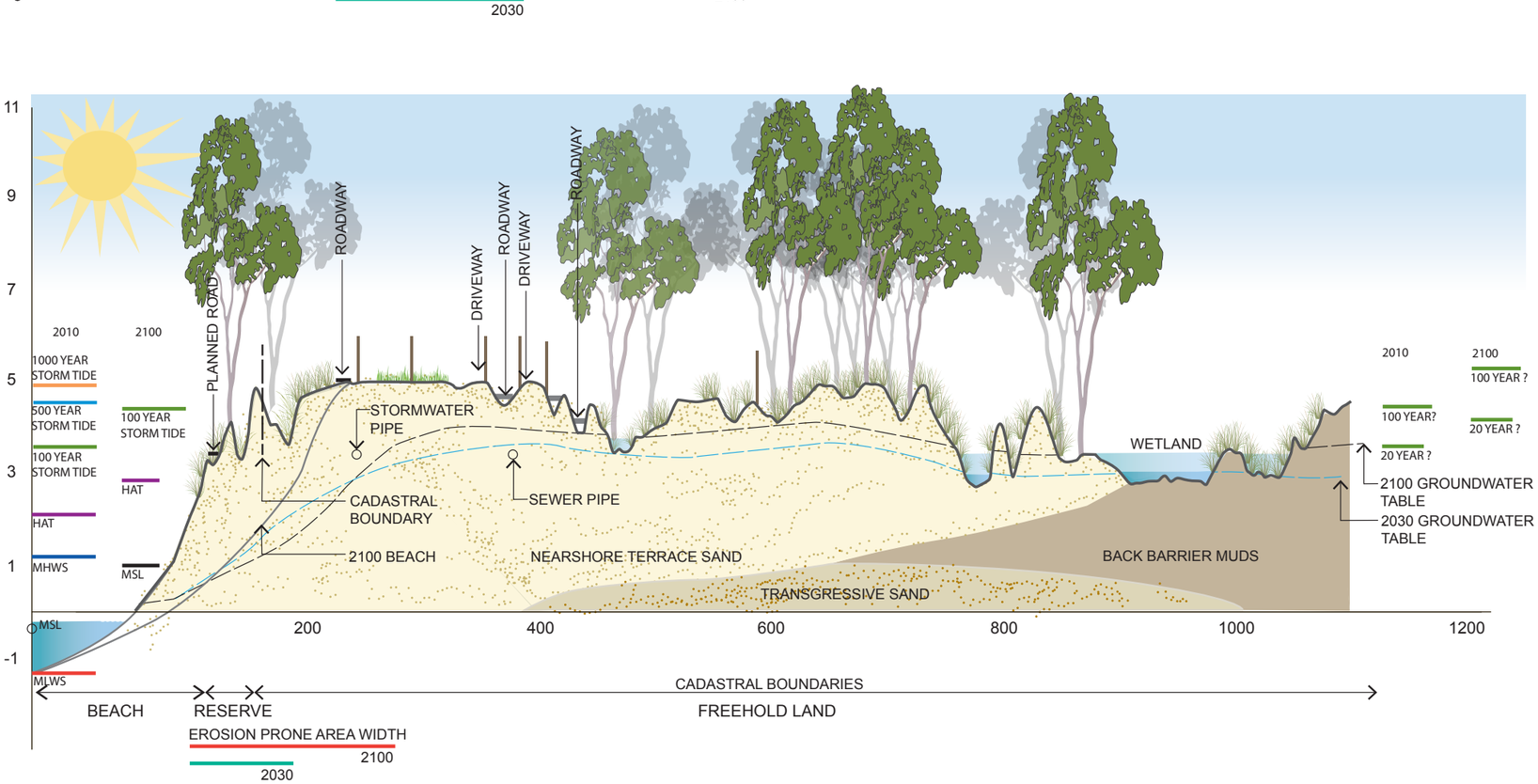


FIGURE E.1: CONCEPTUAL MODEL OF SHORELINE PROCESSES

LOW PROFILE BEACH

VEGETATED LOW FOREDUNE

Study Approach

When scoping the methodology for the development of an SEMP for the new Fraser Coast LGA in 2009, FCRC sought to adopt an approach that would minimise the risk of these issues outlined above arising again. After reviewing the literature, FCRC prepared the initial scope of works for this project based on the methodology presented in the United Kingdom's Department of Environment, Food and Rural Affairs (DEFRA) *Shoreline Management Plan Guidance* manual (DEFRA, 2006). FCRC were of the view that the DEFRA approach went beyond the requirements for preparing SEMPs under the old Queensland Coastal Plan (QCP) as DEFRA's approach adopts a more rigorous program of consultation and participation by the key stakeholders and the community. Cardno was engaged by FCRC to prepare a SEMP for the Fraser Coast LGA in accordance with these guidelines

In March 2011, and subsequent to commencement of the project, the Queensland Government released the updated QCP and companion documents, including the *State Planning Policy for Coastal Protection Guideline* (DERM, 2011c) which provides updated guidance on the approach to preparing SEMPs. A review of the new SEMP guidelines conducted by Cardno confirmed that the Fraser Coast SEMP project was largely compliant with the new SEMP guidelines, but that some modification of the existing project methodology would be required to ensure compliance with the new guidelines.

Consequently, an effort has been made to adopt a methodology for preparing the Fraser Coast SEMP that meets the requirements of the QCP, but also incorporates those elements of the DEFRA guidelines that add value to the SEMP process. The study approach has included:

- A review of coastal processes in the study area and calculation of EPA widths for the 2030, 2050, 2070 and 2100 planning horizons;
- An assessment of the potential constraints and opportunities on shoreline management including:
  - The current statutory framework that prohibits the implementation of certain options in specific locations, and
  - The values and uses of the study area, which may be either positively or negatively impacted by the adoption of a particular management approach; and
- Qualitative and quantitative assessments of risk to the values and uses of the Fraser Coast shoreline from erosion.

A management framework consisting of broad management policies and more detailed site-specific management options has been developed for the Fraser Coast LGA based on the outcomes of these assessments.

Section 2 of this report includes a more detailed overview of the study approach.

Analysis of Constraints and Opportunities

The current legislative framework imposes constraints on coastal management that effectively force the SEMP to adopt certain management policies and options. Where multiple pieces of legislation apply to a

single stretch of coastline the potential constraints are confounded by inter-departmental jurisdiction issues. For some locations in the study area, the current legislation prevents implementation of any options on state land within the coastal zone, thereby preventing FCRC from adopting a policy of *Holding the (Shore) Line* at its present location (i.e. by constructing coastal protection works). Under this scenario, ongoing landward translation of the shoreline will ultimately impinge on freehold property boundaries at which time the legislative constraints would no longer apply and implementation of coastal protection works would likely have more success. The loss of the public open space and recreational amenity, public access to the shoreline, and associated decline in revenue from tourism and other coastally dependent commercial activities, are likely to result in significant social, economic and environmental costs.

A range of values and uses associated with the Fraser Coast coastline was identified and includes:

- Different types of land use and land tenure ranging from freehold residential areas, to leasehold lands and commercial areas;
- A number of different services and utilities that comprise the critical infrastructure needed to support the community and local businesses;
- A range of environmental features that are significant at the regional, State, national and international scales;
- Cultural heritage sites and items, and traditional resource uses;
- The landscape features and shoreline character that contribute to the high visual amenity of the coastal zone;
- Public open space areas and associated facilities, bathing reserves and beaches that are important for recreational access and amenity; and
- Tourism and other commercial activities that contribute to the regional and State economies.

There is a strong community desire to protect these values and uses from shoreline erosion. This will, however, require careful consideration of a suitable shoreline management approach so as to not compromise the values which are the target of the protection.

Risk Assessment Outcomes

Risk assessments were undertaken to provide an indicator of both the present-day level of risk from shoreline erosion, and how the level of risk changes over time. The level of risk was found to vary when comparing erosion from storm events (which can occur at any time) and long term erosion (which occurs gradually). In the short term, storm erosion dominates the risk profile, while long term erosion dominates the risk profile for the longer planning horizons.

Those areas subject to higher levels of existing/short term risk from shoreline erosion include Management Zones 1 (Burrum Heads to Eli Waters) and 3 (Pialba to Urangan). Management Zone 3 is subject to the highest overall level of risk due to its vulnerability to shoreline erosion and the concentration of development in this area. This concentration of assets and facilities gives rise to a considerable level of risk to public safety, critical infrastructure, foreshore parks, freehold land and commercial activities within this area.

In the absence of future coastal protection the potential cost of shoreline erosion to the community is estimated to be significant, based solely on the present value of built assets likely to be lost. This assessment does not include any indirect economic impacts, or the loss of ecological resources located in the Erosion Prone Areas.

Management Framework

A series of management objectives were developed that seek to maintain the values and uses of the study area, consistent with the guiding principles for coastal management outlined in the QCP and SPP for Coastal Protection (see Section 7.1). The objectives represent 'desired outcomes' from the SEMP, and are also used as criteria in the options assessment.

Management policies and options were developed that seek to reduce the level of risk from shoreline erosion. The overarching management policies apply to the 2030 (operational) and 2100 (strategic planning) horizons. For all Management Zones (except Zone 2 – Point Vernon), the preferred management policy to 2030 is to *Hold the Line* (i.e. implement coastal protection works) where development is currently at risk. In Management Zone 2 the level of risk from erosion is generally low and a preferred policy is of *No Active Intervention* is preferred. A policy of *Managed Realignment* (i.e. hold the line at the private property boundary) was also considered for each Zone.

In order to manage the future risk from shoreline erosion, a number of more general management options have also been considered.

A total of 62 management options were subjected to a cost:benefit analysis to assess their relative merits in relation to the management objectives. Of the 62 management options, 15 were not considered technically feasible and 9 were not permissible under the current legislative framework. The remaining 38 management options were ranked on the basis of the cost:benefit index. The preliminary estimates of capital and ongoing costs over a 20 year period of implementation are well in excess of FCRC's existing budget for coastal protection works, and other sources of funding will need to be considered.

The options rankings derived from the cost:benefit assessment are to be used by FCRC to select a sub-set of preferred management options. It is acknowledged, however, that other factors may influence the process of selecting preferred options, such as political pressure, community pressure or funding limitations. These preferred management options will be considered for adoption as management actions in the SEMP.

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GLOSSARY & ABBREVIATIONS

Accretion	A net long-term seaward movement of the average shoreline position caused by a net deposition of sediments. Accretion can be the result of local sediment transport processes.
Adaptation	Adjustment in natural or human systems in response to actual or expected stressors. This involves taking steps to reduce the exposure to risk or vulnerability of that stressor.
AHD	Australian Height Datum
ARI	Average Recurrence Interval
Beach	The area of unconsolidated material between the lowest tidal limit and the highest level reached by wave action.
Beach nourishment	The supply of sediment by mechanical means to supplement sand on an existing beach or to build up an eroded beach.
Beach scraping	Involves re-shaping of the beach profile in a particular location by mechanically moving sand from the lower beach face to the upper beach face. Also known as assisted beach recovery.
Climate Change	A change in the state of the global climate induced by anthropogenic change to the atmospheric content of greenhouse gases and that persists for an extended period, typically decades or longer (DERM, 2011a).
Coastal-dependent Development	Development that requires access to tidal waters to function. Coastal-dependent development may include but is not limited to maritime development including ports, harbours and navigation channels, aquaculture involving marine species, desalinisation plants, tidal generators, erosion control structures and beach nourishment. To remove any doubt, residential development in any form is not coastal-dependent development (DERM, 2011a). This term has also been used in this report to refer to activities such as tourism and bathing reserves, which are effectively coastal-dependent activities.
Coastal Hazard	Coastal erosion and storm tide inundation, or permanent inundation due to sea level rise (DERM, 2011a).
Coastal Hazard Adaptation Strategy	Identifies and assesses areas at risk from coastal hazards, outlines mitigation measures that will be undertaken to facilitate development in hazard areas where the identified risks will effectively be addressed (DERM, 2011a); as required under the QCP.
Coastal Hazard Area	The area that is at risk from storm tide inundation, coastal erosion, or permanent inundation due to sea level rise.
Coastal Protection Work	Any permanent or periodic work undertaken primarily to protect coastal assets from coastal processes.
Coastal Zone	As defined under the *Coastal Protection and Management Act 1995*; encompasses coastal waters and all areas to the landward side of coastal waters in which there are physical features, ecological or natural processes or human activities that affect, or potentially affect, the coast or coastal resources.
Critical infrastructure	Infrastructure that is critical for the functioning of a society and economy. This includes power, water, health, communications systems, banking and food supply chains.
CSG	Client Steering Group
Cultural Resources of the Coastal Zone	The places or objects that have anthropological, archaeological, historical, scientific, spiritual, visual or sociological significance or value, including such significance or value under Aboriginal tradition or Island custom (DERM, 2011a).
DAFF	Queensland Department of Agriculture. Fisheries and Forestry
DCCEE	Commonwealth Department of Climate Change and Energy Efficiency

DEEDI	Former Queensland Department of Employment, Economic Development and Innovation, now known as DAFF
DEFRA	United Kingdom Department of Environment, Food and Rural Affairs
Demonstrated Need (for coastal protection work)	Means evidence has been provided including arguments and reasoning to prove the case that: a) retreat is not a feasible option; and b) there are no alternative solutions to the erosion problem; and c) there is a necessity to undertake works to prevent a foreseeable risk of coastal erosion damaging permanent structures that are i) utilised by persons on an on-going basis; or ii) causing safety hazards that cannot be remediated using any other means (e.g. closing or re-routing walking tracks). Source: DERM, 2011a
DERM	Former Queensland Department of Environment and Resource Management, now known as DEHP
DEHP	Queensland Department of Environment and Heritage Protection
DTMR	Queensland Department of Transport and Main Roads
Dune management	The general term describing all activities associated with the restoration and maintenance of the role and values of beach dune systems. Dune management activities and techniques include planning, dune re-construction, revegetation, dune protection, dune maintenance and often community involvement.
Ecological Values	The intrinsic natural qualities, characteristics or worth attributable to an ecosystem (DERM, 2011a).
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (DERM, 2011a).
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999
EPAs	Erosion Prone Areas Erosion as defined under the *Coastal Protection and Management Act 1995*, refers to an area declared to be prone to erosion under section 70(1) of the Act.
Erosion scarp	See Escarpment.
Escarpment	The landward limit of erosion in the dune system. At the end of a storm the scarp may be nearly vertical; as it dries out the scarp slumps to a typical slope of 1 vertical:1.5 horizontal. Also known as the 'scarp', 'dune scarp' and 'backbeach erosion'.
ESD	Ecologically Sustainable Development
ESG	Extended Steering Group
FCRC	Fraser Coast Regional Council
Feasible	Capable of being done, effected or accomplished in consideration of the short or long-term costs to an individual or a community or in consideration of the likely success or failure of the action (DERM, 2011a).
FTE	Full time equivalent; a measure of full time employees.
GIS	Geographic Information System
HAT	Highest Astronomical Tide; the highest sea level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions (DERM, 2011a).
Hazard	A situation with the potential to result in harm. A hazard does not necessarily lead to harm (DEFRA, 2006).

HES	High Ecological Significance
Hold the Line Policy	Prevent the shoreline erosion from occurring by maintaining the shoreline as close to its current average position as possible.
Inundation	An overflow of water or an expanse of water submerging land (DEFRA, 2006).
IPCC	Intergovernmental Panel on Climate Change
LGA	Local Government Area
Managed Realignment Policy	A combination of managed retreat and hold the line policies, whereby a certain amount of natural shoreline erosion is allowed until it reaches a certain location at which the hold the line policy is recommended.
Managed Retreat Policy	Allow natural shoreline erosion to occur, but reduce the level of risk by relocating any critical infrastructure or other assets from the erosion prone area prior to the erosion occurring.
Management	Includes actions required to protect, conserve or rehabilitate coastal resources and to achieve ecologically sustainable development (DERM, 2011a).
Management Zones	Used to define a length of shoreline and hinterland area with similar characteristics in terms of coastal processes and assets at risk.
Material	Dredged material or material excavated from land including mud, sand, gravel, clay and earth (DERM, 2011a).
MHWS	Mean High Water Spring
Mitigation	Measures taken to avoid or alleviate the impact of an event or process.
NES	Matters of National Environmental Significance - Defines triggers for EPBC Act.
No Active Intervention Policy	Allow natural erosion processes to occur while accepting losses of assets; assumes that defences are no longer maintained and will fail over time Also referred to as "do nothing".
Open Space and Recreation Facilities	Outdoor facilities that are capable of sustaining a defined storm tide inundation event without significant damage. Such facilities include but are not limited to those associated with the outdoor sport and recreation and park uses of the Queensland planning provisions (DERM, 2011a).
PIP	Priority Infrastructure Plan
Planning Controls Policy	Land use planning and development controls that seek to reduce the risk from erosion by either preventing or limiting development within the EPA, or by specifying the type of permissible development (e.g. structures that may be more easily relocated if required). No structural works are involved in this policy.
Preferred Policy	The policy that best meets the objectives of the SEMP.
QCP	*Queensland Coastal Plan* (DERM, 2011a)
Sediment transport	The process whereby sediment is moved on/offshore and/or alongshore by wave, current and wind action.
SEMP	Shoreline Erosion Management Plan
Shoreline recession	A net long-term landward movement of the shoreline caused by a net loss in the sediment budget. Recession can be the result of local sediment transport processes and/or sea level rise.
SLR	Sea Level Rise
SP Act	Queensland *Sustainable Planning Act* 2009
SPP	State Planning Policy
Storm bite	The removal of sand from the beach due to wave attack during storms.

Storm surge	The increase in coastal water level caused by the effects of storms. Storm surge consists of two components: the increase in water level caused by the reduction in barometric pressure (barometric set-up) and the increase in water level caused by the action of wind blowing over the sea surface (wind set-up).
Threatened Species	Any species of wildlife indigenous to Australia that is declared under the *Nature Conservation Act 1992* as extinct in the wild, endangered or vulnerable wildlife (DERM, 2011a). Also relates to threatened species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Vulnerability	The degree to which a system is susceptible to, or unable to cope with, adverse effects of, for example, shoreline erosion.