2019 Slade Point Local Coastal Plan

Australian Government

National Landcare Programme

Mackay Regional Council

Reef Catchments

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Cover image: Slade Point - Lamberts Beach Lookout. Image provided by Mackay Regional Council.

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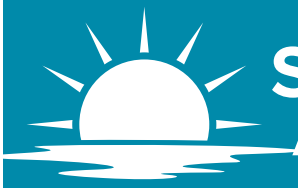
SLADE POINT WAS NAMED BY CAPTAIN JAMES COOK, ***AFTER SIR THOMAS SLADE,*** THE NAVAL ARCHITECT WHO DESIGNED NELSON'S H.M.S. VICTORY

SLADE POINT RESERVE IS ONE OF THE ***LAST REMAINING AREAS*** OF **COASTAL DUNES** AND **PAPER BARK WETLANDS** IN THE MACKAY REGION

LAMBERTS LOOKOUT IS ONE OF THE FEW PLACES IN MACKAY YOU CAN WATCH BOTH A



SUNRISE & A SUNSET

LAMBERTS LOOKOUT PROVIDES UNSPOILED

360° VIEWS

WITH BINOCULARS FOR WHALE WATCHING AND WILDLIFE SPOTTING

LAMBERTS BEACH AND NORTH HARBOUR BEACH ARE ***THE ONLY TWO***

SURF BEACHES IN MACKAY

COASTAL DUNE SYSTEMS PLAY A ***CRUCIAL ROLE*** IN THE ECOSYSTEM. VEGETATION IS CRITICAL TO DUNE FORMATION AND STABILISATION.

TRADITIONAL OWNERS PREVIOUSLY OCCUPIED THE SLADE POINT AREA. ***ITEMS OF CULTURAL SIGNIFICANCE ARE KNOWN TO BE PRESENT IN THE AREA***

RAM CHANDRA PARK IS A **POPULAR RECREATIONAL AREA** FOR

FAMILIES

THE McCREADYS CREEK ESTUARY SUPPORTS MANGROVES THAT PROVIDE

ENVIRONMENTAL SERVICES,

INCLUDING HABITAT FOR JUVENILE FISH, SEDIMENT TRAPPING AND CARBON SEQUESTRATION

PARABOLIC DUNES THAT EXTEND FROM SLADE POINT HEADLAND TO SOUTH HARBOUR BEACH ARE A

RARE AND SIGNIFICANT GEOMORPHIC FEATURE

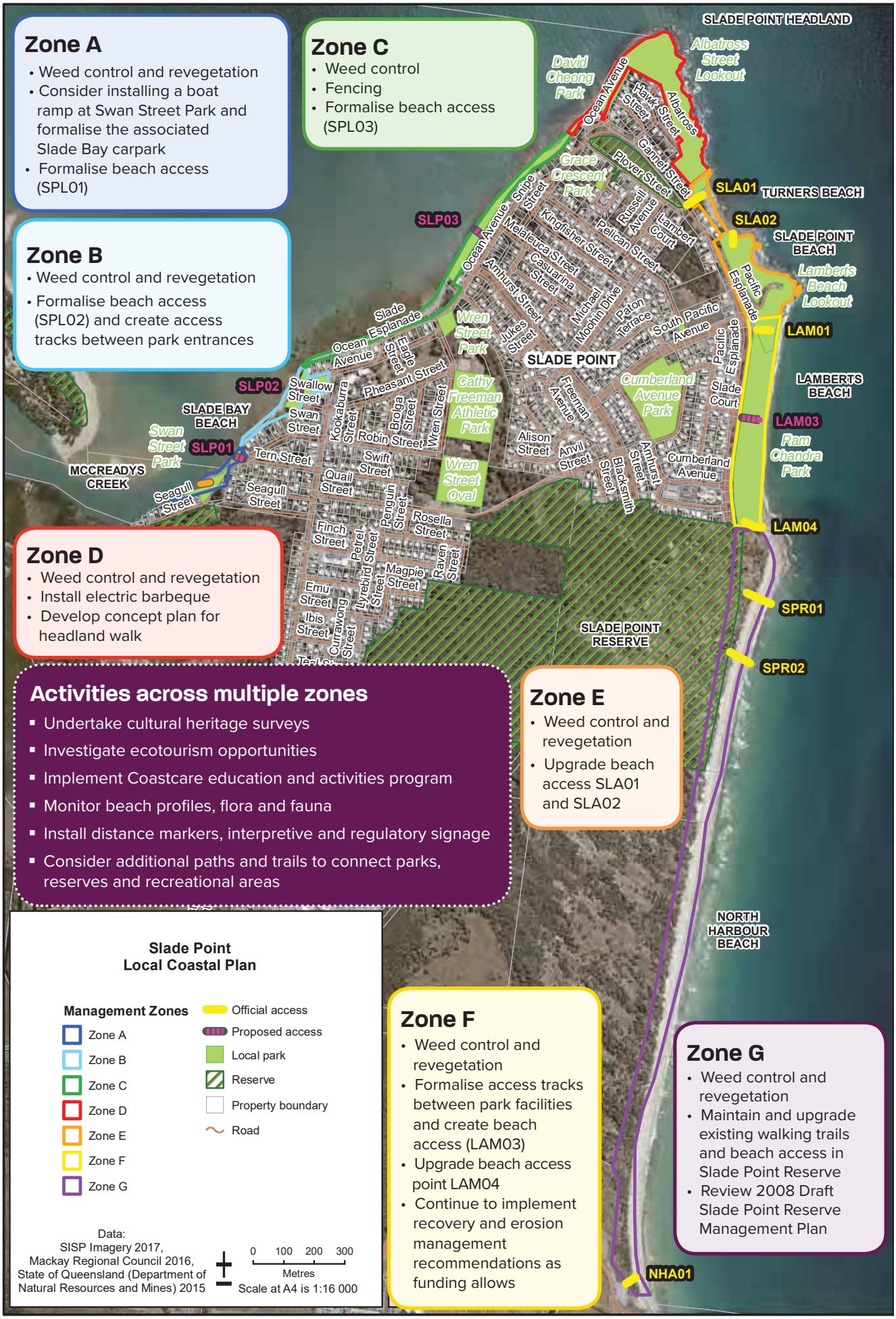


Figure 1: *Visual summary of recommendations.*

1 Executive Summary

Slade Point is a popular recreational area for locals and visitors to our region. Mackay Regional Council (MRC) (hereafter referred to as Council) manages its coastal land at Slade Point through an integrated program of planning, on-ground works, monitoring and community engagement known as the *Coasts and Communities Program*. As part of this program, *Coastal Management Guidelines* (MRC 2012) have been developed to provide a framework for management decisions and activities for coastal land under Council's jurisdiction. Individual Local Coastal Plans, such as this plan for Slade Point, provide site-specific recommendations for individual coastal units.

The *Slade Point Local Coastal Plan* describes the environmental and social values of the coastal unit, as well as the key threats and management issues. Distinct patches of remnant vegetation either side of Slade Point headland support mangrove and salt flat communities, critically endangered beach scrub, paperbark woodland and locally rare tussock grasslands. This diverse composition of ecological communities provides essential habitat for rare and threatened species including the mangrove mouse, coastal sheathtail bat and the northern quoll. Within the coastal unit, the long sandy east facing beaches are known to support shorebird roosting and turtle nesting. Key pressures include the presence of non-native vegetation, the absence of native vegetation, erosion, illegal dumping and climate change. Recommendations to manage these threats include weed control, revegetation, fencing and access management. Social values are also described and opportunities to improve recreational facilities and values have been identified, including additional beach accesses, walking trails, interpretive signage and park infrastructure. The recommended activities will be implemented on a prioritised basis as resources become available.

Community engagement is recognised as a critical part of the success of on-ground works and opportunities for the community to learn about coastal ecosystems and get involved in management activities at Slade Point coastal unit will be provided through the Coastcare program.

The activities recommended in this Local Coastal Plan (Table 2) will help protect and improve the condition of assets in the coastal unit, ensuring that best-practice management principles are implemented and on-ground activities are prioritised and undertaken in a coordinated and strategic way. This plan will help attract additional funding to the region (including from State and Federal sources) to protect coastal resources and improve recreational opportunities for our community.

Key recommendations include:

- Weed control across all zones, targeting major weeds including Guinea grass and lantana.
- Revegetation to assist dune stabilisation and enhance native vegetation cover and connectivity along the coastal corridor.
- Implementing dune rehabilitation strategies to improve the retention of sand along Lamberts Beach, including revegetation to stabilise the dune system.
- Installing regulatory and interpretive signage where appropriate.
- Removing waste and preventing future waste dumping at key sites.
- Repairing beach access points at Turners Beach (SLA01), Slade Point Beach (SLA02), Lamberts Beach (LAM04) and North Harbour Beach (SPR01 and SPR02) and installing additional beach access points along Ocean Avenue (SPL01, SPL02, SPL03) and Lamberts Beach (LAM03).
- Investigating additional recreational opportunities, such as pathways within Swallow Street Park and Ram Chandra Park to direct pedestrians to beach access points.
- Continuing to work with DNRM and NQBP to address common management issues along North Harbour Beach foreshore area, including investigating opportunities to improve and extend walking trails south of Slade Point Reserve to provide for a unique nature trail experience.
- Continuing discussions with relevant government agencies to advocate for boat ramp facilities at Swan Street Park.
- Develop a concept plan for a headland walk between David Cheong Park and Lamberts Beach lookout.

2 Introduction

Council has a major role to play in the management of public coastal lands. Council is responsible for the public land along the coast including Esplanade and Reserves and areas zoned as Open Space. The *Coastal Protection and Management Act 1995* and associated *Queensland Coastal Plan* (DEHP 2013a) underpin coastal management in Queensland and along with multiple other pieces of State and Federal legislation and council's own Local Laws and *Coastal Management Guidelines* (MRC 2012), direct the management of these public coastal areas.

The *Coastal Management Guidelines* (MRC 2012) recognise that the coast is characterised by a diverse range of natural features including: sandy beaches, rocky headlands, rainforest, woodland, grassland, extensive intertidal flats and substantial areas of coastal wetland. The Mackay coastline is a dynamic and forever changing landscape, shaped and formed by a range of factors including: wave action, changing tides, predominant winds and human influences. Mackay also has a large tidal range that exceeds six metres (EPA 2004).

The Mackay region is prone to severe storm events and tropical cyclones that impact coastal areas causing localised erosion. After a storm some areas recover quickly. However, if there is not enough time for adequate recovery before another storm event or if the coastline is a predominantly eroding coast, the impacts of erosion can accumulate altering the shape of the coastline over time.

Management options to improve the resilience of coastal areas to future storm events are available. Maintaining a sufficient buffer of vegetated dune or other coastal ecosystems such as mangroves acts to bind and retain sediment in coastal areas. The *Mackay Coast Study* describes the need to protect coastal areas not only for their importance as assets to tourism and recreation, but also as *the maintenance of wide sandy beaches and well vegetated dune systems provides a natural barrier to storm wave energy and protects inland areas against extreme water levels* (EPA 2004 p.4). Effective coastal management can therefore be viewed as a risk mitigation strategy.

Within the region, development has occurred in some areas that are prone to erosion (EPA 2004). Some areas are already seeing changes in their local coastlines. With future predicted increases in sea level rise and more extreme weather events including cyclones, there is an increasing need to forecast the impact on coastal areas and plan effective, achievable action for protection of coastal values, including:

- The safety and longevity of communities - this includes property, infrastructure and services required for healthy communities.
- Meeting of recreational needs - many locals and visitors utilise coastal areas for activities that add to their health and fitness, provide relaxation and offer opportunities to enjoy nature.
- Continuity of economic services - fisheries and tourism rely heavily on healthy and attractive coastal areas.
- Environmental values – the provision of ecosystem services relies upon healthy coastal vegetation communities and natural environmental processes. Marine turtles and shorebirds require sandy beaches and healthy dune systems for nesting and feeding and many other native flora and fauna require coastal areas for habitat and food.

Adaptation options for coastal areas need to be well considered to ensure the region as a whole is best placed for the future. Maladaptation can occur when proper planning and best science are not incorporated into decision-making processes.

Council manages coastal areas through an integrated program of planning (i.e. Local Coastal Plans (formerly Beach Plans)), on-ground works, monitoring and community engagement known as the *Coasts and Communities Program* (Figure 2). The *Coasts and Communities Program* is a joint initiative of Council and Reef Catchments, funded through Council's *Natural Environment Levy* and the *Australian Government National Landcare Programme*. The aim of the *Coasts and*

Communities Program is to protect coastal ecosystems in the Mackay region and, where opportunities exist, restore these areas to enhance their biodiversity values, whilst allowing for appropriate recreational access and use.

Visit *www.mackay.qld.gov.au/environment/natural_environment/coastal_management* for more information on the program.

Strong emphasis has been on the protection, conservation, rehabilitation and management of the coastal unit and its biological diversity. Actions implemented over past years include:

- Formalisation of car parking at Swallow Street Park.
- Installation of a viewing pavilion, seating and interpretative signage and the provision of small tourist bus and RV campervan parking at Lamberts Beach Lookout.
- Comprehensive community consultation pre and post Tropical Cyclone Debbie including development of *Lamberts Beach: recovery and erosion management* report (Alluvium 2017) and recommendations.
- Rationalisation of access points, improved fencing, sand pushing and dune reprofiling, with a focus on mitigating local erosion issues, improving habitat condition and increasing the resilience of dune systems at Lamberts Beach.
- Installation of new toilet facilities, lifeguard tower and storage container at Lamberts Beach.

The objectives of this Local Coastal Plan are to:

- Identify the values and pressures in the coastal unit.
- Develop strategies to guide the long-term protection of the natural coastal environment of Slade Point.
- Identify recreational opportunities within the coastal unit.

Council is committed to ensuring that communities are well informed throughout the process of Local Coastal Plan development and implementation.

Mackay *Coasts and Communities Program* implementation model

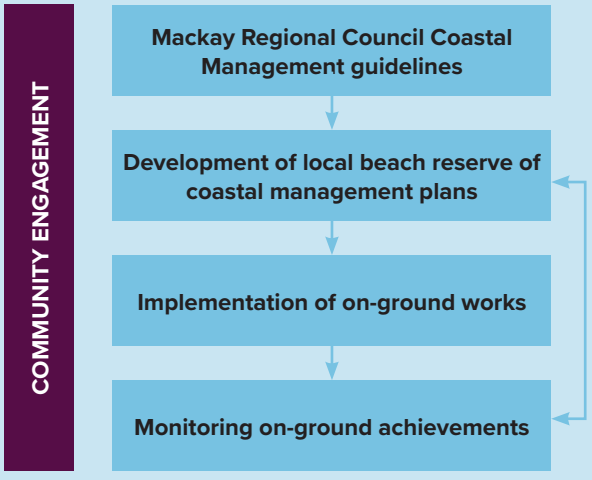


Figure 2 *Mackay Coasts and Communities program Implementation Plan*

2.1 STATUTORY OBLIGATIONS

There are a range of statutes at Regional, State and Federal level that are relevant to, and may guide the management of natural resources and recreation within the Mackay area. These are shown in Figure 3.

FEDERAL GOVERNMENT

- *Biosecurity Act 2015* provides management principles for diseases and pests that may cause harm to human, animal or plant health or the environment, and for other related purposes.
- *Environmental Protection and Biodiversity Conservation Act 1999* provides a high level of protection for Matters of National Environmental Significance (MNES). In particular it provides protection for important populations of migratory species.
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* provides for the preservation and protection of areas and objects in Australia and in Australian waters that are of particular significance to Aboriginals in accordance with Aboriginal tradition.

INTERNATIONAL AGREEMENTS

- *China and Australia Migratory Bird Agreement (CAMBA),* the *Japan and Australia Migratory Bird Agreement (JAMBA),* and the *Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)* provide for conservation of shorebirds (waders) across the migratory flyway for these species.

STATE GOVERNMENT

- *Land Act 1994* provides for the designation of the reserves and assignment of Trustees for the protection of environmentally and culturally valuable and sensitive areas and features.
- *Recreation Areas Management Act 2006* provides for the establishment, maintenance and use of recreation areas; and aims to coordinate, integrate and improve recreational planning, recreational facilities and recreational management for recreation areas.
- *Vegetation Management Act 1999* provides management principles for vegetation within Queensland.
- *Coastal Protection and Management Act 1995 (Coastal Act)* provides a comprehensive framework for the coordinated management of the Queensland Coast, and establishes the Queensland Coastal Plan 2012 as the primary statutory instrument under the Coastal Act.
- *Nature Conservation Act 1992* provides management principles for wildlife within Queensland.
- *Native Title (Queensland) Act 1993* identifies the presence of Native Title over land.
- *Land Protection (Pest and Stock Route Management) Act 2002* provides the regulatory basis for control of pest species. In particular the Act classifies pest species and provides obligations for landholders.
- *Fisheries Act 1994* provides protection for marine plants including mangroves and saltmarshes, and provides the regulatory environment for control of recreational fishing activities.
- *Sustainable Planning Act 2009* provides the regulatory background for the development of planning schemes.
- *Environmental Protection Act 1994* regulates environmentally relevant activities, including release of emissions on land, air or water and noise.
- *Marine Parks Act 2004* regulates use of Marine Park to protect marine environment.
- *Waste Reduction and Recycling Act 2011* provides regulatory regime for management of litter and illegal dumping.
- *Queensland Coastal Plan 2012* provides policy guidance to coastal land managers including best practice coastal management principles which support the development of local management plans.

LOCAL GOVERNMENT

- *Mackay Regional Council Local Law No. 4 (Local Government Controlled Areas, Facilities and Roads) 2011* provides for the management of council controlled lands by enabling the prohibition of vehicle access and protection of vegetation and infrastructure.
- *Mackay Regional Council Local Law No. 2 (Animal Management) 2011* provides for the management of animals in the natural environment, including ensuring that they are under effective control and requiring removal of faeces in a public place.
- *Coastal Management Guidelines 2012* provides a framework for management decisions and activities for land under Mackay Regional Council jurisdiction in the coastal zone.
- *Mackay Regional Council Planning Scheme Open Space Strategy No. 12* outlines Mackay Regional Council's committment to provide a balanced mix of public open space that in turn will provide for a range of active and passive recreational opportunities for the community.
- *Reef Guardian Council program* recognises council's commitment to protect, conserve and enhance the values of the Great Barrier Reef for future generations through effective and responsible land-based management practices. The *Coasts and Communities Program* is a key initiative under this program.

Figure 3: *Regulatory framework*

3 Coastal Unit Description

Slade Point is located approximately eight kilometres north east of the Mackay CBD and includes 6.8km of coastline. The coastal unit stretches from McCreadys Creek Reserve in the north, around Slade Point headland to the east, and continues south along Lamberts Beach and North Harbour Beach, ending north of Mackay's Outer Harbour breakwater (Figure 4).

Prior to European settlement, the Harbour area consisted of a complex mosaic of coastal dune vegetation, freshwater wetlands, estuarine plant communities with patches of rainforest and woodland around rocky outcrops (NQBP 2009). Since settlement, the Slade Point coastline has been developed primarily for urban land use (Short 2000), whilst Port development has occurred at Harbour Beach.

Slade Point can be described as a medium-density residential community with large adjacent areas of Freehold and Reserve tenure. Within the coastal unit, council managed land includes 19.35ha of Reserve and 7.8ha of Esplanade tenure (Figure 5). The estuarine area surrounding McCreadys Creek, Apsley Creek and Vines Creek is zoned as Rural and Open Space reserve and contains a significant area of remnant vegetation (Figure 6). This area is owned and managed by Mackay Regional Council in accordance with the *McCreadys Creek Catchment Management Plan* (MRC 2005). Open Space fringes the coastline as an almost contiguous linear reserve from McCreadys Creek estuary to the southern end of Ram Chandra Park where it joins Slade Point Reserve (SPR). Mackay Regional Council, the Department of Environment and Heritage Protection (DEHP) and the Department of Natural Resources and Mines (DNRM) jointly manage SPR. SPR is a significant ecological feature in the Mackay region containing a diverse range of species and ecological communities within a relatively small area. The reserve supports significant remnant regional ecosystems (RE) once known to be abundant within the lowland areas of the Mackay region (MRC 2008). SPR is located south of Ram Chandra Park, west of North Harbour Beach and north of the Mackay Port Authority Conservation Reserve and the Harbour, and has its own detailed management plan.

The coastal unit is divided into seven zones (Figure 7) based on common management values and issues. Zone A, B and C stretch along Swan Street Park, Swallow Street Park and David Cheong Park respectively. Zone D encompasses the Slade Point headland and includes the Albatross Street Lookout. Zone E begins at the northern extent of Slade Point Beach and extends south to include the Lamberts Beach Lookout. Zone F and G extend along the sandy east facing beaches, where Zone F encompasses Ram Chandra Park and Zone G, North Harbour Beach.

The coastal unit contains approximately 13.5ha of remnant coastal vegetation located predominantly within SPR. Remnant vegetation includes a distinct community of *Corymbia tessellaris* +/- *Eucalyptus* open forests adjacent to a community complex of *Casuarina* woodland, rainforest tall shrubland, semi evergreen microphyll vine thicket and tussock grassland on coastal dunes. Coastal development and land modification has resulted in a coastline largely devoid of remnant coastal vegetation (Table 1). Removal of vegetation, as well as the maintenance of parkland settings has restricted reestablishment of native vegetation and allowed for the colonisation and establishment of invasive weed species including lantana *(Lantana camara),* prickly pear *(Opuntia stricta),* century plant *(Agave sp.)* and leucaena *(Leucaena leucocephala).* Common weeds such as Guinea grass *(Megathyrsus maximus)* persist across the coastal unit and heighten the risk of fire in the area.

Two distinctly different beach types occur within the coastal unit and are separated by the rocky headland of Lamberts Beach Lookout. The beaches to the north are over 300m long and are comprised of a distinct rocky gravel and cobble surface. The beaches to the south extend 3.3km and are coarse grained, typical of surf beaches. The east-facing coastline presents a distinct and substantial field of parabolic dunes that extend beyond the coastal unit towards South Harbour Beach. Parabolic dune systems are relatively rare along tropical sections of the Australian coastline and as such, Slade Point presents a unique and valuable geomorphic feature of the Mackay region (Zavadil and Rosengren 2016) (Figure 8).

Historically, Slade Point has been valued for its natural beauty and scenic coastline and the area remains a popular spot for swimming, surfing, fishing and recreational boating opportunities. Several parks within and adjacent to the coastal unit cater for a range of recreational opportunities. Swan Street Park and Swallow Street Park are two local parks that provide a range of facilities including barbeque shelters, picnic tables, seats and water fountains. David Cheong Park and Albatross Street Lookout are linear local parks, and David Cheong Park offers sheltered seating. Ram Chandra Park is a district park that provides a range of additional facilities including toilets, a lifeguard tower and multiple barbeque facilities. Beach showers are located at Swan Street Park and Ram Chandra Park and playground facilities are located both at Swallow Street and Ram Chandra Parks. Several other parks occur within the vicinity of the coastal unit and include Cathy Freeman Athletic Park, Wren Street Park, Grace Crescent Park and Avenue Park (Figure 1).

The Mackay region is inshore from the Great Barrier Reef and activities must comply with the regulatory zoning conditions introduced by the Great Barrier Reef Marine Park Association (GBRMPA) in 2004. Marine Park zoning is an important component of managing marine areas (GBRMPA 2011). The area offshore from Slade Point north and west into Slade Bay is within a Conservation Park (yellow) Zone (Figure 9). The Conservation Park (yellow) Zone allows for increased protection and conservation of areas of the Great Barrier Reef Marine Park, while providing opportunities for reasonable use and enjoyment, including limited extractive use. Low impact activities such as boating, swimming, snorkelling and sailing are permitted. The majority of this zone includes a Whale

Protection Area (blue dashed line). The area inshore of the Marine National Park (blue) Zone boundary (red line) is set aside for port use. Port activities are governed by local, state, national and international requirements and include activities such as dredging and dredge material disposal, waste, pollution and introduced marine pests. The Marine Park is located approximately 5km offshore from Slade Point and is a 'no-take' area. Extractive activities such as fishing or collecting are prohibited however low impact activities such as boating, swimming, snorkelling and sailing are permitted.

For additional details regarding restrictions in the Conservation Park (yellow) Zone, the Whale Protection Area (blue dashed line) and Marine National Park (blue) Zone please visit the GBRMPA website: *www.gbrmpa.gov.au*

Figure 4: *Extent of Slade Point coastal unit.*

Figure 5: *Planning scheme zonation at Slade Point.*

Figure 6: *Land tenure at Slade Point.*

Figure 7: *Coastal management zones at Slade Point.*

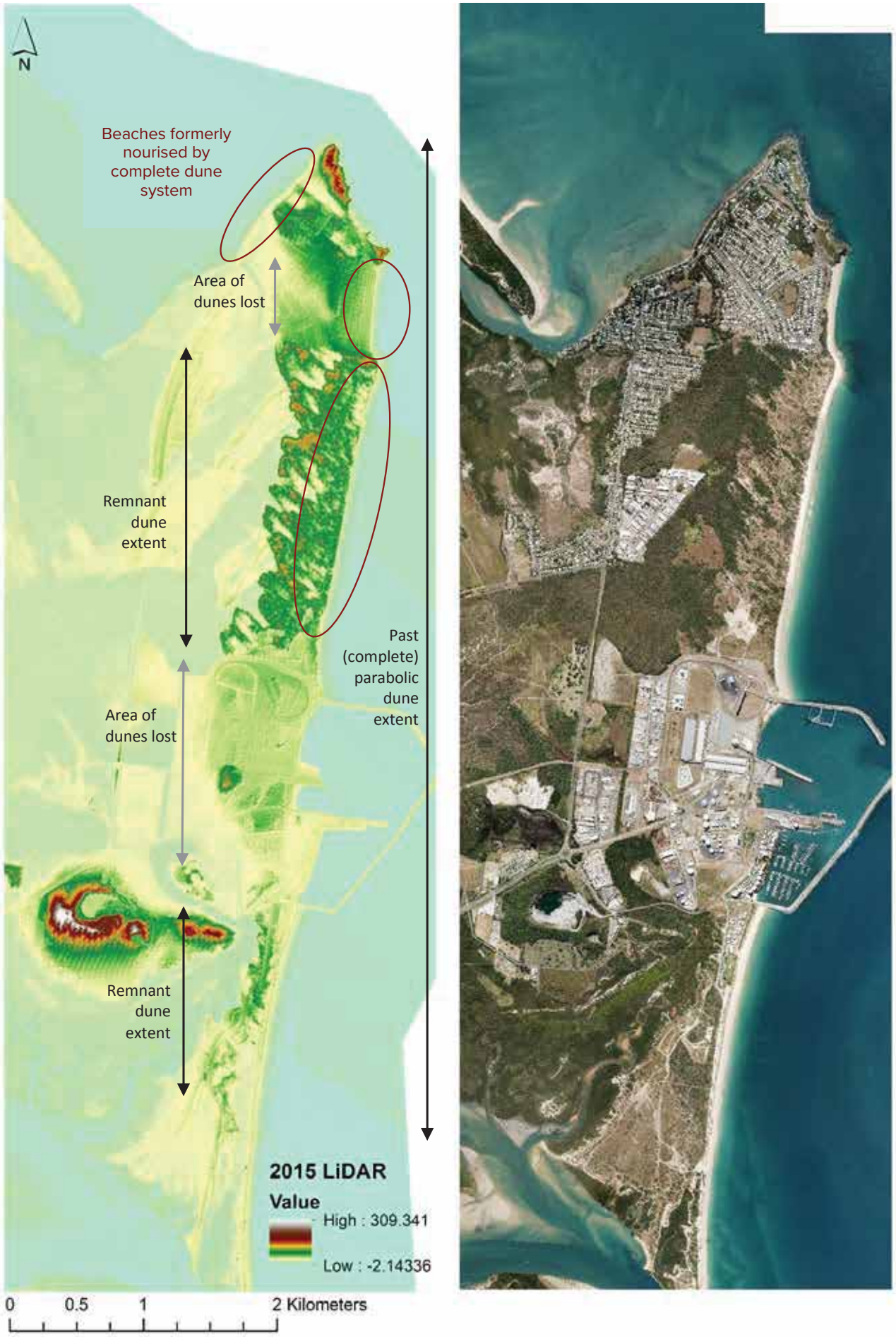


Figure 8: *Slade Bay to South Harbour Beach – 2015 aerial and LiDAR imagery depicting presence of parabolic dune system within the Slade Point coastal unit.*

4 Environmental Values and Management Issues

The Slade Point coastal unit has been extensively modified. Most environmental values including 13.5ha of remnant coastal vegetation and other important habitats such as rocky headlands and coastal zones found in the area are set aside for public Reserve or Esplanade (Figure 4). The ecological communities surrounding Slade Point coastal unit sustain important wildlife populations of Regional, State and National Significance. These vegetation communities are valuable not only in their own right; but as habitat for native fauna. Tracts of remnant vegetation contain significant regional ecosystems that provide important linkages across the landscape. In addition, the ecosystems are important in maintaining natural processes and providing ecosystem services to the local community and region. Carbon storage, water filtration, climate regulation, stabilisation of the shoreline, nutrient cycling and scenic and recreational values constitute just a few examples of the ecosystem services these areas provide to the local community.

This section outlines the distribution and significance of coastal vegetation and wildlife in the Slade Point coastal unit and its environmental values. The major threats and management issues relevant to the environmental values will be discussed, including dune systems and erosion processes.

4.1 VEGETATION

The vegetation component of this plan considers three important facets that define the integrity and condition of vegetation in the coastal unit.

Remnant vegetation is the historical vegetative cover of an area and is captured within official Regional Ecosystem mapping. It includes both woody and non-woody vegetation and is dominated by species characteristic of the vegetation's undisturbed canopy. Remnant vegetation is distinguished by the dominant canopy having greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum (Queensland Government 2016).

Vegetation zonation is the sequence of different vegetation communities or zones that occur along a coastline. The zones reflect changes in the nutrient and moisture content of dune soils, which increase in a landward direction, and changes in the degree of exposure to strong winds, salt spray and sandblast, which decrease in a landward direction (DEHP 2015). When vegetation communities are heavily disturbed, for example by weed encroachment or mowing, vegetation zonation is inhibited.

Non-native vegetation is discussed in terms of the weed species that are present and may require management.

4.1.1 Remnant vegetation

Remnant vegetation is mapped at a scale of 1:100,000 by the Queensland Government for legislative and management purposes (Queensland Government 2016). Regional Ecosystems (RE) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The Regional Ecosystem Description Database describes each RE and list both the Biodiversity Status and the Vegetation Management Class of each (Table 1). The Biodiversity Status is determined based on an assessment of the amount of a RE remaining (as a percentage of its historic range) and its condition and is used to determine the Vegetation Management Class, under the *Vegetation Management Act 1999* (DEHP 2013b). A regional ecosystem is listed as Endangered, Of concern or No concern at Present/Least concern based on these factors. It is important to note that RE mapping provides no indication of the current condition of this vegetation at the local scale.

The importance of coastal vegetation includes, but is not limited to:

- Native dunal vegetation can provide a significant refuge and source of food for local and migratory fauna species.
- Existing native dunal vegetation provides a seed bank for future generations of vegetation, thereby protecting the natural biodiversity of the area.
- Native dunal grasses and groundcover facilitate dune growth by colonising and trapping windblown sand and preventing its escape from the beach system.

In coastal areas, vegetation can be scorched by high temperatures and salt, as well as abraded by windblown sand. Species that can withstand these effects benefit from onshore winds by intercepting wind-borne nutrients from the sea. These nutrients are deposited on the leaves of coastal plants and washed into the sand by the first showers of rain, thereby introducing nutrients to the system and allowing less hardy species to colonise the coastal area (Gold Coast City Council 2007).

In Queensland, approximately 80% of people live on the coast (DEHP 2013a). As a result, remnant coastal vegetation is often fragmented and subject to high levels of disturbance (Caton and Harvey 2010). Coastal development characteristically results in a loss of coastal vegetation, as it often facilitates disturbance throughout the coastal zone through mowing and/or clearing areas of vegetation for recreation. Coastal vegetation remnants, however, remain a critical part of the landscape, providing important ecosystem services, habitat corridors, and recreational values.

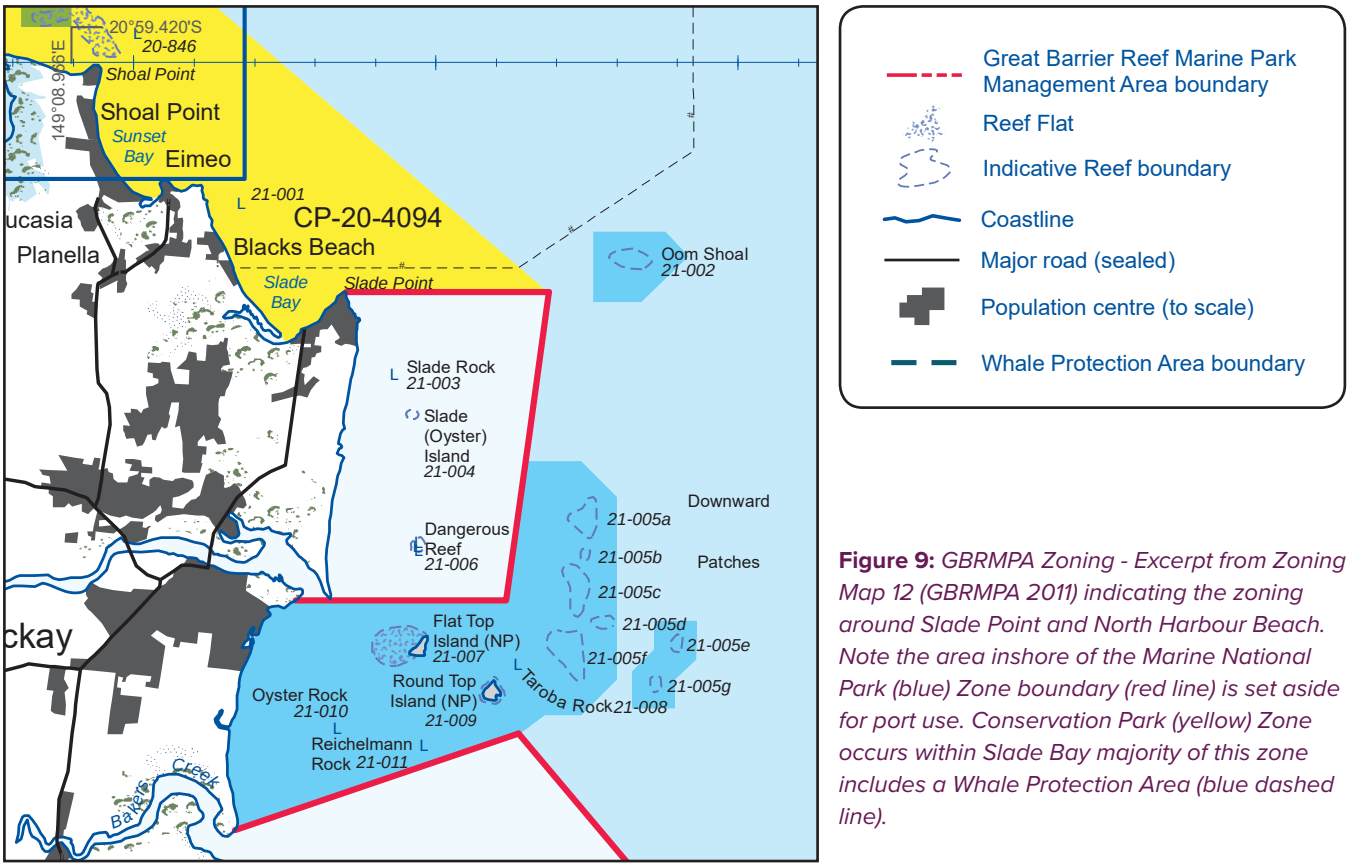


Figure 9: *GBRMPA Zoning - Excerpt from Zoning Map 12 (GBRMPA 2011) indicating the zoning around Slade Point and North Harbour Beach. Note the area inshore of the Marine National Park (blue) Zone boundary (red line) is set aside for port use. Conservation Park (yellow) Zone occurs within Slade Bay majority of this zone includes a Whale Protection Area (blue dashed line).*

Table 1: *Regional Ecosystem (RE) communities at Slade Point.*

Regional Ecosystem (RE)	Short description	Approximate area in hectares (ha) on Reserve and Esplanade tenure	Vegetation Management Act status	Biodiversity status	*Environmental Protection and Biodiversity Conservation Act 1999* status
8.1.1	Mangrove vegetation of marine clay plains and estuaries. Estuarine wetland.	<1ha	No concern at present	No concern at present	n/a
8.2.1	*Casuarina equisetifolia* woodland and/ or sparse herbland to open scrub on foredunes and beaches	10ha	Of concern	Of concern	n/a
8.2.2	Semi-evergreen microphyll vine thicket to vine forest, on coastal dunes		Of concern	Endangered	Critically Endangered
8.2.9	Tussock grassland on coastal dunes		Of concern	Endangered	n/a
8.2.14	*Banksia integrifolia and/or Corymbia tessellaris and/or Acacia disparrima* +/- rainforest spp. tall shrubland, on Holocene parabolic dunes		Of concern	Of concern	n/a
8.12.27b	*Corymbia tessellaris* and/or *Eucalyptus tereticornis +/- C. intermedia +/- C. clarksoniana* open forest with a secondary tree layer of *Livistona decora*, on low hills on Mesozoic to Proterozoic igneous rocks	3ha	Endangered	Endangered	n/a

General principles for the conservation of remnant vegetation include:

- Controlling weeds to allow native species to regenerate.
- Discouraging the dumping of garden and general waste.
- Replanting areas adjoining remnant vegetation patches with native species, to build a buffer between the core vegetation and adjacent land uses.
- Controlling activities such as four-wheel driving, foot and vehicle traffic (Nordstrom *et al.* 2000).

Coastal development and urban expansion has required most of the vegetation within the Slade Point to be classified as non-remnant. Urban residential housing between McCreadys Creek Reserve and Slade Point headland has resulted in an area largely absent of remnant vegetation (Figure 10). Individual stands of native vegetation remain across several of the beaches throughout the coastal unit. Remnants include beach she-oaks (*Casuarina equisetifolia*), beach hibiscus (*Hibiscus tiliaceus*) and various scattered palms (*Pandanus tectorius* and *Livistonia decora*).

Mangroves have established in the northwest facing section of Slade Bay, adjacent to the coastal unit. While offshore vegetation is not within council's land tenure, it is important to recognise that onshore efforts may act to protect or threaten marine vegetation systems, including mangroves and seagrass. The established mangrove community is exposed to inappropriate vehicle and boat access, marine debris, stormwater runoff and recreation activities such as fishing and crabbing. Appropriate management of recreational access and improved stormwater management practices will assist in protecting offshore ecosystems.

The largest portion of remnant vegetation within the coastal unit is located within the foredune swales of North Harbour Beach and is predominantly a community complex of *Casuarina* woodland, rainforest tall shrubland, semi evergreen microphyll vine thicket and tussock grassland on coastal dunes. Within this semi evergreen microphyll vine thickets is listed as critically endangered under the E*nvironmental Protection Biodiversity and Conservation Act 1999* (Table 1). The dominant regional ecosystem within this community complex is tussock grassland on coastal dunes (RE 8.2.9). This vegetation community occurs on large high wind-borne deposits and is very rare. It is the only grassland community on sand dunes in the Central Queensland Coast Bioregion (Queensland Government 2016) and the largest representation of this regional ecosystem occurs at Slade Point (DEHP 2018). RE 8.2.9 is easily damaged by inappropriate fire regimes, weed invasion, vehicle access and uncontrolled pedestrian access. Fire management guidelines for RE 8.2.9 suggest that planned burns only be conducted when rapid regeneration of the grassy layer is expected (DEHP 2018). See Appendix 1 for recommended fire guidelines for each vegetation type within the coastal unit.

North of this community complex, however still within SPR, is a distinct community of *Corymbia tessellaris* +/- *Eucalyptus* open forests (RE 8.12.27b). Three hectares of this ecological community exist within the coastal unit where it is found on the headland at the northern end of SPR. This community is listed as endangered under the *Vegetation Management Act* 1999.

Weed invasion, loss of sand due to inhibited long shore sediment re-nourishment and, as consequence, low native recruitment rates continue to threaten the condition of remnant vegetation along the North Harbour Beach foredune. Cross tenure collaboration and management between different governing entities will better protect the sand dune system and retain the intrinsic value of a natural environment at North Harbour Beach.

Regional Ecosystems found on Council managed land within the coastal unit are further described in Appendix 2.

Opportunities exist to protect and enhance the native vegetation throughout the coastal unit, mostly via weed control and natural vegetation rehabilitation. Vegetation rehabilitation will enhance the complexity of vegetation zonation, increase the environmental value of the area, reduce impacts of artificial lighting on turtle hatchlings and act as a buffer against wind, salt and extreme weather events. Additional native vegetation will also provide habitat for local fauna. In areas where the native vegetation remains largely intact, the approach to be taken will be one of assisted natural regeneration. By controlling weeds and limiting disturbance, natural recruitment of dunal species will occur. Supplementary planting may be undertaken in these areas to enhance vegetation complexity and to replace removed weed species. In areas where natural recruitment is not occurring or where vegetation has been cleared, revegetation should be used as a technique to restore and enhance native vegetation.

Succession planning of old trees in parklands will ensure that the natural and recreational values (shade etc.) of these trees are sustained. Educating residents about tree succession planning would also be beneficial to ensure longevity of tree cover in the area as a whole.

All revegetation activities should be guided by the coastal revegetation principles documented in Appendix 3 and consider appropriate species from the list provided in Appendix 4. The species selected for revegetation at any particular location will ultimately depend on current and pre-clearing regional ecosystem mapping and site specific conditions such as aspect, topography, existing vegetation, soil condition and the availability of appropriate plants. Local experts should be consulted for specific advice regarding unique vegetation communities, where appropriate.

4.1.2 Vegetation Zonation

A key feature of dune vegetation is the sequence of different vegetation communities that occur with increasing distance landward. Typically, this involves a gradual transition from bare sand, to ground cover, to open forests or woodlands (DEHP 2015). Zonation processes are those, which facilitate this progression and are discussed in this Local Coastal Plan as recruitment and colonisation. Natural zonation refers to what is effectively a normally behaving ecosystem, where recruitment and colonisation can occur unhindered over natural gradients (Figure 11). Zonation processes are hindered along the sandy foreshore areas of Slade Point as a result of

Figure 10: *Remnant vegetation communities of the Slade Point coastal unit.*

residential development and park maintenance, clearing and weed incursion.

Opportunities to increase vegetation cover across multiple locations within the coastal unit are numerous. Not only would revegetation increase the environmental value of the area, it would also provide shade, increase aesthetics of the local area and provide privacy for residences neighbouring publicly reserved areas.

The Esplanade along Ocean Avenue provides a unique opportunity to enhance connectivity and vegetation cover in the coastal unit. Private properties throughout the northern half of the coastal unit inhibit vegetation zonation. Gardens, houses, rock walls and other types of infrastructure restrict vegetative seed dispersal and other colonising mechanisms.

The rocky substrate of Slade Point Headland and Lamberts Beach Lookout present a naturally restricted ecosystem. Local experts should be consulted to ensure that appropriate weed control techniques are employed to enhance existing remnants such as northern wattle *(Acacia crassicarpa)*.

Open, mowed grassy areas, such as David Cheong Park, Slade Point Beach, Ram Chandra Park and other Open Space areas, further interrupt vegetation dispersal. Revegetation with local native species will increase the natural values of these areas. Slade Point headland presents modified vegetation communities, which are disconnected from remnant vegetation communities. Weed control would enhance the native setting and increase the community value of this area.

The natural vegetation zonation along Lamberts Beach has been interrupted by erosion, informal access and development, whilst at North Harbour Beach natural vegetation zonation processes are interrupted primarily by erosion and competitive weed invasion (Figure 12). The establishment of goat's foot (*Ipomoea pes-caprae)* and she-oaks (*Casuarina equisetifolia*) should be encouraged through selective weed control and improved access management to assist in the natural colonisation and stabilisation dunes (Figure 13). Ram Chandra Park exists as the hind dune of Lamberts Beach and is maintained as Open Space. Mature trees are scattered throughout the southern section of this park and many are showing signs of senescence, storm damage and lack of recruitment. Infill planting in these areas would enhance the natural values of the park, as well as provide habitat for fauna, shade and wind protection. Revegetation efforts need to consider other factors such as recreational uses of the park and soil stabilisation. Recreational use of the southern end of the beach may also increase with the introduction of vegetation and subsequent shade that it provides. Notably, Ram Chandra Park's proximity to SPR presents an opportunity to introduce a buffer between recreation and conservation purposes, thereby build resilience to SPR remnant vegetation communities.

The absence of sand-trapping vegetation causes sand to be lost from the system and the natural, dynamic system of sand movement is therefore disrupted (Gold Coast City Council 2007). Increasing the area of natural coastal vegetation along Ram Chandra Park should be encouraged to allow for migration and increased dune stability. Over time post and rail fencelines should be relocated landward to allow natural regeneration and expansion of coastal vegetation into the mown area. Weed control and rehabilitation activities should be included to improve the dune structure and condition along the length of the beach. Revegetating the dune system in this way will also enhance connectivity, providing corridors for movement of wildlife. This will complement the efforts of the fence along Lamberts Beach to reduce erosion, and increase the aesthetic value of the area.

Surrounding areas including street verges and Freehold Land could be considered as corridors linking high value environmental reserves. A street tree program to increase the number of street trees would benefit the Slade Point area. Road verges are large and increased vegetation cover would provide protection from blown sand, reduce wind intensity through the township and provide a cooling effect with improved shade.

4.1.3 Non-native vegetation

The presence of non-native vegetation can be detrimental to the function of the dunal environment. Non-native vegetation can displace native dunal vegetation due to its ability to grow aggressively, smother native dunal species and compete for available nutrients. Transformative weeds such as Guinea grass (*Megathyrsus maximus*) and lantana (*Lantana camara*) can also increase fuel loading and fire intensity.

It is important to note that while not all weeds require immediate removal due to low impacts on native species, under the *Biosecurity Act 2014*, the council and the local community have a general biosecurity obligation to take reasonable and practicable steps to minimise the risks associated with invasive plants and animals under their control. This legislation was put into force on the 1st July 2016, and changes the classifications of weed species from what has been referred to in earlier Beach Plans. Subsequently, weeds will now be discussed in terms of:

- **Declared weeds** are described as species that have, or could have, serious economic, environmental or social impacts (DAFF 2013). Declared weeds recorded at Slade Point such as lantana (*Lantana camara*), mother-of-millions (*Bryophyllum delagoense)* and prickly pear (*Opuntia stricta and O. monacantha)* require action for removal under the *Land Protection (Pest and Stock Route Management) Act 2002*.

- **Environmental weeds** are described as those that can cause major modifications to natural ecosystem function. These species are capable of outcompeting native vegetation and in some cases, have the potential to increase fuel loads in coastal ecosystems largely sensitive to fire (DAFF 2013a). Environmental weeds for removal at Slade Point include but are not limited to century plant *(Agave sp),* leucaena *(Leucaena leucocephala)*, Guinea grass (*Megathyrsus maximus),* molasses grass *(Melinis minutiflora),* moonlight cactus *(Selenicereus validus)* and pineapple *(Ananas comosus)*.

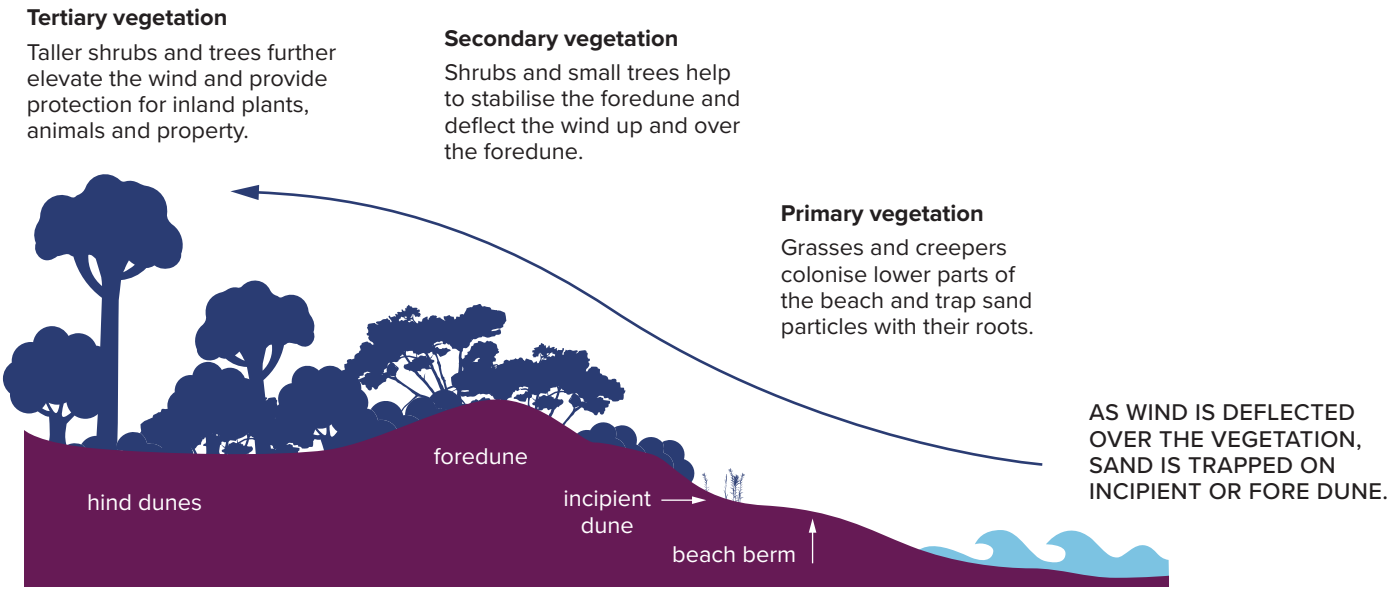


Figure 11: *Role of dune vegetation.*

Figure 12: *Dune vegetation at North Harbour Beach with dense prickly pear (Opuntia sp.) (circled).*

Figure 13: *Goats foot (Ipomoea pes-caprae) and Casuarinas on the Lamberts Beach foredune.*

- **Locally significant weeds** are those that impact natural processes at a local scale. Locally significant weeds within Slade Point include painted spurge *(Euphorbia cyathophora)* and beach evening primrose (*Oenothera drummodii*)). Beach evening primrose (*Oenothera drummodii*) is a new emergent herbaceous species found on the foredune of North Harbour Beach. Its spread to Black Beach suggests that it is a prolific species, able to readily colonise foredune systems.

- **Non transformative/nuisance weeds** are problematic on a local scale and should be managed on a case-by-case basis. A multitude of herbaceous weeds and garden escapees result from the close proximity of coastal Reserve areas to residential zones and include, cobbler's peg *(Bidens alba)*, pink periwinkle *(Catharanthus roseus)*, poinciana *(Delonix regia)*, siratro *(Macroptilium atropurpureum)* and mother-in-law's tongue *(Sanseviera trifasciata).*

Numerous weeds are present throughout the coastal unit and commonly appear along the periphery of remnant vegetation. In accordance with the weed management principles found in Appendix 5, weed control priorities include declared and environmental weed species and those capable of altering habitats or ecosystem function. Problematic weeds such as lantana (*Lantana camara*), leucaena (*Leucaena leucocephala*), beach evening primrose (*Oenothera drummodii*) (Figure 14), prickly pear (*Opuntia stricta and O. monacantha*), Guinea grass (*Megathyrsus maximus*) and molasses grass *(Melinis minutiflora)* are dispersed across all zones. Similarly, nuisance weeds such as cobbler's peg (*Bidens alba*) are also readily distributed across the coastal unit.

Removal of lantana, leucaena and prickly pear should be the focus for initial weed control efforts, as they are transformative weeds that readily colonise disturbed areas; suppressing native plant regeneration and restricting faunal movement. Repeat treatment of saplings will be required until the seed bank is depleted. Guinea grass *(Megathyrus maximus)* and molasses grass *(Melinis minutiflora)* pose a threat to remnant communities as they outcompete native species and increase the fire risk to adjacent fire sensitive remnant vegetation. Removal of Guinea grass *(Megathyrus maximus) and* molasses grass *(Melinis minutiflora)* is a priority around surrounding fire sensitive remnant coastal vegetation communities. Mother-of-millions (*Bryophyllum sp.*) (Figure 15a), century plant (*Agave sp.*) (Figure 15b) and mother-in-law's tongue *(Sanseviera trifasciata)* (Figure 16) often establish as result of waste dumping and readily invade sandy coastal habitats through suckering. Painted spurge (*Euphorbia cyathophora*) should be removed as it is poisonous to humans. High value areas such as around SPR and coastal reserves being encroached upon by residential gardens are key areas to focus weed control and community education programs. Non-native species such as beach evening primrose (*Oenothera drummodii*) occur along the foredune of North Harbour Beach. As a new emergent that has successfully spread with prevailing winds, this weed should be managed as a priority. Simultaneous removal of large tracts of non-native species should be avoided as it may displace native fauna and encourage dune instability.

Council recognises that some community members may value coconuts *(Cocos nucifera)* for their aesthetic appeal. The removal of coconuts from recreational and parkland areas is beyond the scope of this plan. However, adult and juvenile coconuts that occur within areas managed for environmental purposes will be removed in accordance with the coastal weed control principles (Appendix 5). Removal will be undertaken in a staged manner. Coconuts can be a significant risk to pedestrians, increase fire risk and intensity through the accumulation of vegetative waste and smother native vegetation preventing regeneration. It is a common misconception that coconut trees assist foredune stability, however their root system is very shallow and is easily undermined by high waves.

It is recommended that weed management continues throughout the coastal unit and this, together with revegetation activities to replace removed weed species will prevent future weed re-occurance and assist the re-establishment of native vegetation. Opportunities for local community members to get involved in coastal management activities will be provided through the Coastcare program. All revegetation activities should consider the guiding principles documented in Appendix 3.

The removal of non-native species from the coastal unit will improve the condition of native vegetation, enhancing habitat quality and its resilience to natural disturbance whilst also reducing the risk of fire. Using appropriate weed control techniques in a progressive manner as time and resources permit, as per Appendix 5 will assist the rehabilitation of coastal vegetation communities. A list of weed species can be found in Appendix 6.

Most vegetation communities within the coastal unit are regarded as highly sensitive to fire. RE 8.2.9 is the exception as it is known to tolerate moderate winter to late winter and storm burns at 4-6 year intervals where no more that 70% of each patch should be burned in any given year. Planned burns should only be conducted when rapid regeneration of the grassy layer is expected. Use of fire as a vegetation management technique should be carefully planned in consultation with vegetation specialists in accordance with Queensland Fire Emergency Services (QFES) and Rural Fire Services (RFS) policies and procedures. All fire management activities should occur in line with the Clarke Connors Range Fire Management Guidelines in Appendix 1 (Reef Catchments 2009).

4.2 WILDLIFE

Slade Point provides three separate stretches of sandy beach with over 3.3km of potential marine turtle nesting habitat. Records indicate an increase of nestings along Lamberts Beach from one to eight between 2012-2014, and eight to 26 along North Harbour Beach between 2012-2015 (Mackay District Turtle Watch Association 2017, pers comm). Significant challenges for turtle nesting along the Lamberts Beach and North Harbour Beach include a receding shoreline (erosion), residential lights and noise pollution from the road. All sandy beaches in the Mackay region provide potential habitat for marine turtle nesting and turtles are commonly sighted in the area. Green turtles *(Chelonia mydas)* and flatback turtles

Figure 15a: *Mother-of-millions (Bryophyllum sp.) colonising the Slade Point headland south to Turners Beach.*

Figure 14: *Beach evening primrose (Oneothera drummodii) spreading northward along North Harbour Beach. It is suspected that this weed's northward distribution is result of prevailing winds.*

Figure 15b: *Century plant (Agave sp.) and other garden escapees colonising the Slade Point headland south to Turners Beach.*

Figure 16: *Mother-in-law's tongue (Sanseviera triasciata) a garden escapee establishing along Slade Bay Beach.*

(Natator depressus) are listed as vulnerable in State (*Nature Conservation Act 1992*) and Federal (*Environment Protection and Biodiversity Conservation Act 1999*) legislation. Given their status, a *Recovery Plan for Marine Turtles in Australia* has been in place since 2003 and provides an overview of threats and recovery actions required for these species.

Key threats to turtles and their reproductive success are identified as the following:

- Light and noise pollution from nearby houses disorientates hatchlings during their movement to the ocean.
- The presence of dogs and other domestic pets in the area, particularly those not on leashes, pose a number of threats including mortality of hatchlings from predation, exposing clutches through digging and injury to turtles while laying eggs.
- Distribution and type of vegetation (i.e. root system), including excessive shading or lack thereof plays an influential role determining the sex of the hatchling.
- Unofficial tracks through the dune system, where tracks appear brighter than surrounding areas due to light reflection and can disorientate both hatchlings and adults.
- Beach vehicle access, as turtles are not able to penetrate the compacted sand or navigate wheel ruts.

Essential Habitat mapping identifies sites and locations considered to contain important habitat for flora and fauna species of conservation significance. It is only mapped over remnant and regrowth vegetation and is based on either confirmed sightings, records of breeding, known suitable habitat or resources occurring at a location, or habitat that forms part of a potentially important corridor (DEHP 2014).

Essential Habitat for the mangrove mouse (*Xeromys myoides*), which is listed as *Vulnerable* under the *Queensland Nature Conservation Act 1992*, includes the mangrove communities lining McCreadys Creek and Slade Bay (Figure 17). Mature animals appear to utilise taller communities dominated by yellow mangrove (*Ceriops tagal*) and orange mangrove (*Bruguiera spp.*), however juveniles are sometimes located in low forests of yellow mangrove. The quantity and quality of storm water entering the catchment will be of relevance to the health of the mangrove mouse population in Slade Bay and adjoining McCreadys Creek Reserve.

Seagrass, which forms meadows in sheltered coastal waters such as Slade Bay, is an important food source for marine animals including dugongs (*Dugong dugon*g) and marine turtles. Globally significant populations of dugong occur in the Great Barrier Reef region (GBRMPA 2007). Vital ecosystems, in particular McCreadys Creek's vast mangrove systems and seagrass beds, need to be protected as they provide habitat and food resources to an array of species such as fish, marine turtles and dugongs (GBRMPA 2007). The sheltered nature of Slade Bay and its beach suggest the possible establishment of a sea grass belt offshore from the northwestward facing beach. Seagrass has been previously surveyed in a small offshore area on the other side of Slade Bay, but given that the rock wall has been established and the dynamics of the bay have shifted since the last records were collected in 2010, the extent of the seagrass has likely changed. Further surveying could confirm this analysis. Presuming seagrass is present in Slade Bay, it presents vital habitat for a range of marine wildlife including dugongs, juvenile fish and other vertebrates.

The SPR provides a range of ecological communities, which provide a diverse range of habitats. The SPR Management Plan details a cumulative list of fauna surveys and show records of approximately 13 amphibians, 10 mammals, 20 reptiles and over 110 species of birds including the near threatened beach stone curlew (*Esacus magnirostris*) (MRC 2008). The whole Slade Point region is also considered to be potential habitat for the northern quoll (*Dasyurus hallucatus*) (Figure 17).

Currently, the major threats to wildlife along the coastal unit include loss of habitat through development, erosion, weed incursion, infrastructure, feral and domestic animals and artificial lighting. Opportunities exist to install interpretive signage featuring key faunal species and ecosystems (such as beach scrub and mangroves) at high profile locations within the coastal unit, such as along Ram Chandra Park. Signage informs the general public about what they can do to protect significant species and ecosystems. Figure 17 indicates the wildlife values within the Slade Point coastal unit.

4.3 EROSION

4.3.1 Coastal processes and erosion

Slade Point foreshore and a large portion of the broader Mackay region's beaches maintain sand dunes in the coastal unit. Coastal dune systems play a crucial role in facilitating coastal ecosystem processes and in the protection of property in the coastal unit (DERM 2011a). As part of the broader sand movement process, healthy dune systems act to dissipate the kinetic energy of waves, which may otherwise propel into adjacent infrastructure and property. The sand and dunes create friction when waves pass over them, slowing the waves down and dissipating their energy. Healthy coastal dunes help protect coastal infrastructure during intense wind, storm and cyclone events (Figure 18). The dunes also act to replenish the foreshore with sand after major sand-loss events.

However, human induced changes have altered coastal areas and therefore dune formation. For example, the loss of coastal vegetation for Open Space and coastal development reduces the capacity of beaches to catch and trap wind-borne sand grains. Once the protective capacity of the dune system is weakened in this way, coastal erosion can take place, leading to significant damage to landforms and infrastructure via coastal recession.

Planners and coastal residents may have a negative association with erosion and coastal recession, though in many cases it is a natural phenomenon. There are constant interactions between coastal landforms and the ocean, and this creates a dynamic and ever-changing environment. Sandy coastlines migrate landward and seaward in response to natural phases of sand erosion (loss) and accretion (gain). Sand movements can form dunes onshore, sand bars offshore, or instigate beach erosion. All of these movements are governed by wind, waves and tidal activity over varying time scales.

Figure 17: *Slade Point wildlife values.*

Over short time scales there are natural beach fluctuations in response to intense weather activity. For example, during a storm, strong waves carve away sand from the beach and dunes, resulting in escarpments onshore and sand bars offshore. Gradually, sometimes over many years, the sand that was lost offshore is pushed back onshore by gentler high tides (Figure 18). This process is natural and in many cases, cannot be stopped.

However, long-term erosion or accretion is driven by fundamental changes in the dynamics of sand deposition and removal from a beach system. This is an on-going problem, and preventing beach recession would often require continual nourishing. This is illustrated in Figure 18, where too much sand from coastal dunes is lost seaward to allow the dune to be restored to its original state.

Challenges to dune health are often unavoidable in developed areas such as Slade Point. However, intervention and management can help to protect the coastal landforms.

Dunes should be protected where possible by maintaining and enhancing native vegetation. Ground cover, shrub and tree species stabilise dunes with their root systems, and catch wind-borne sand sediments to replenish the dunes and foreshore. The loss of this vegetation can lead to accelerated rates of erosion of the dunes. The natural build-up of sand in frontal dunes needs to be encouraged as a reservoir for sand during periods of wind and wave erosion. Plant communities provide vegetative cover, which stabilises the dune and thus make the system resilient to pressures such as sea level rise, storms, and floods. Supporting vegetation as a surface cover increases dune stability but also biodiversity and ecological function of the dune system (DEHP 2013a). Coastal vegetation is also important in protecting infrastructure and houses, as it slows wind speeds and reduces the amount of salt and sand transported inland.

Damage to dunal vegetation in the Mackay region often occurs through pedestrian and vehicle traffic, and acts of vandalism. Intentional removal of coastal dune vegetation, as well as inappropriate pedestrian and vehicle access, displaces sand, and where it continuously occurs, can lead to localised eroded areas. Clearly established pathways to the foreshore can help to mitigate the threat of people and vehicles destroying dunal vegetation by funneling activity to a small number of well-maintained pathways. To prevent the degradation of dune systems and for public safety, it is important for users to stay on designated tracks. A range of consultation and education opportunities should be provided to the local community to mitigate damage to dunal vegetation.

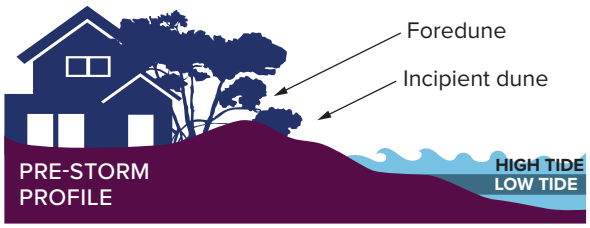
Another major threat to the natural function of dunes is hard infrastructure (e.g. seawalls) (Figure 19). Often these structures are built in the attempt to protect property from shoreline recession. Seawalls and other hard structures reflect wave energy onto other areas, rather than gradually dissipate the energy like dunes do. This leads to scouring around the edges and in front of seawalls, and accelerates the loss of sand on the surrounding beach.

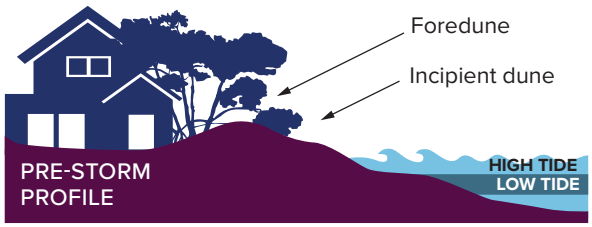
Ensuring that erosion prone areas (Figure 20) remain free of hard infrastructure and are well covered by native vegetation allows natural processes to occur unhindered. This provides the best opportunity for managing shoreline erosion and retaining environmental values (EPA 2004). Where infrastructure is installed, such as seawalls, the amount of sand that is lost seaward is much greater than the natural amount, thereby accelerating erosion and beach recession. A report called *Lamberts Beach: recovery and erosion management* was developed by Alluvium in November 2017. The report reviewed local coastal influences against observations and recommended a suite of works over three distinct stages. Initial works have been progressed and included immediate post cyclone recovery works to restore the foredune to pre-cyclone conditions. The report suggests that the Mackay Coastal Hazard Adaptation Strategy (CHAS) process consider long-term adaptation planning for Lamberts Beach and the wider coastline (Alluvium 2017).

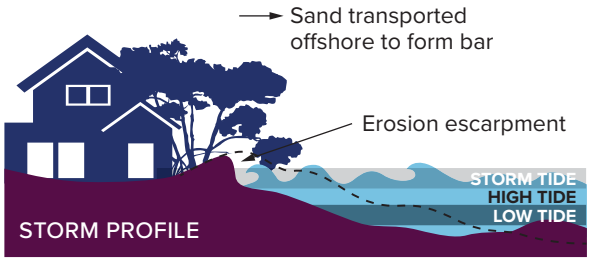
Human changes (i.e. coastal development) have also shaped the beach. The sandy beach of Lamberts Beach foreshore has in the past shown a concerning degree of shoreline erosion. This section describes the geomorphology and processes shaping the Slade Point coastal area, the threats and management considerations.

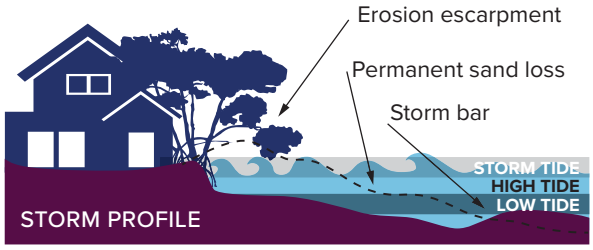
4.3.2 Landscape context

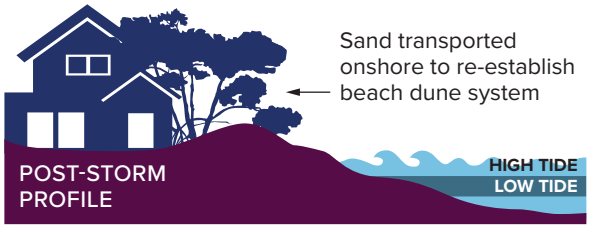
Prior to the construction of Mackay Harbour, Harbour Beach formed a linear beach system from Slade Point to East Point. The beach is exposed to a predominantly southeast wave climate and is characterised by strong nearshore tidal currents flowing northerly on the ebb and southerly on the flood. A

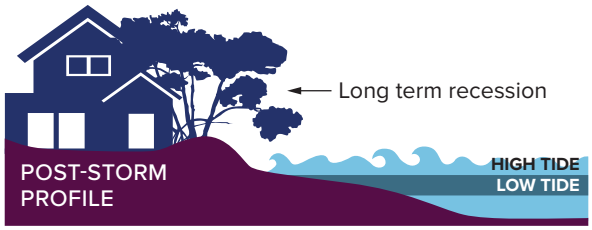












Beach erosion/accretion cycle showing no permanent sand loss or coastline retreat *(Source: DERM).*

Long term beach recession showing profile displaced landward due to permanent sand loss *(Source: DERM).*

Figure 18: *Beach erosion.*

Figure 19: *Rock wall along Slade Bay Beach.*

Figure 20: *Slade Point erosion prone area.*

stronger tidal flow in the direction of the ebb in conjunction with the prevailing wave climate, results in a net sediment transport towards the north (Figure 21) (EPA 2004).

Human activity has had a major impact on landscape form along the Mackay coastline, particularly by altering sediment supply and distribution (Alluvium 2017). Residential development at Slade Point headland and Lamberts Beach as well as the construction and subsequent extension of Mackay Harbour provide important context to understanding the shoreline erosion dynamics across the coastal unit.

The western shoreline of Slade Point (within Slade Bay) is comprised of a rocky platform overlain with sand and mud. A number of private landholders have constructed low rock walls along the western shoreline of Slade Point to protect their properties against episodic erosion (Figure 19). Sandy beaches are unlikely to ever establish along the length of their rock walls due to the reflective nature of these structures. A stand of mangroves has grown approximately halfway along the shoreline near the mouth of McCreadys Creek. The mangroves are occasionally smothered by the passage of a sand shoal, resulting in short term dieback (EPA 2004).

The eastern side of Slade Point headland consists of rocky outcrops within an embayment. Turners Beach and Slade Point Beach exists as low volume sandy beaches that present a distinct rocky gravel and cobble surface perched on a rocky platform. Residential development on the headland has reduced the overall supply of overland sand to the western coastline.

Slade Point residential area was developed between 1972 and 1977 (Alluvium 2017) (Figure 22). Prior to development, Slade Point was part of a parabolic dune system that extended along Harbour Beach toward the headland (Figure 8). Parabolic dunes build up on elevated areas, are u-shaped, concave and are orientated towards the dominant wind direction (in this case southeast). The parabolic dune system of Harbour Beach provided an important backshore sand source to the adjacent beaches, including the major wind-borne sand supply across the headland to Slade Bay. Development of the Slade Point headland and Lamberts Beach residential area involved significant modification of the dunes, ground leveling and placement of fill material (including silts, clays, gravels) to create the residential zone and the foreshore area of Lamberts Beach (Alluvium 2017). As a result, from around 1972 onwards the shoreline has been a highly modified environment and Lamberts Beach is effectively a created foreshore and beach environment that has since been susceptible to erosion (Alluvium 2017).

The establishment and progressive enlargement of the harbour has interrupted the northward longshore sand supply north of the harbour (EPA 2004) (Figure 21). The southern breakwater extends across the full width of the nearshore zone and acts as a near complete barrier to the northward transport of sand. Hydrographic survey data within the *Mackay Coast Study* demonstrates an erosion trend in the centre of the northern section of North Harbour Beach (MAC134) and Lamberts Beach (MAC137) (Figure 23) (EPA 2004). The survey suggests that the blocking effect of the harbour and the extraction of sand results in continual downdrift erosion.

Slade Point is highly valued by the community as a popular surf beach and recreational parkland. Visitation to the area is also increasing with the recent establishment of the whale watching platform and lookout on the headland at the northern extent of the beach. There is a strong desire across both council and community stakeholders to recover and maintain its iconic sandy beaches. Shoreline position changes and the volume of sand lost from the beach during Tropical Cyclone Debbie is further addressed in *Lamberts Beach: recovery and erosion management* (Alluvium 2017).

4.3.3 Sediment transport pathways

Sediment dynamics along the Mackay coastline are complex, driven by interactions between local topography, wind regime, wave energy, a large tidal range, fluvial processes and land use. The coastal zone is relatively exposed to the prevailing wave climate and is characterised by strong nearshore tidal currents and a prevailing south-east wave climate which results in a net sediment transport towards the north (Figure 21) (EPA 2004).

The majority of the sediment transport across Slade Bay is along the outer margin of the tidal flats, influenced by the predominant southeast wave climate (EPA 2004). The net northward sediment transport episodically bypasses Slade Point headland where it is dispersed into two distinct pathways – west across the intertidal flats of Slade Bay and northwest to a nearshore sand shoal system east of Blacks Beach. The channel of McCreadys Creek further separates the sediment transport across Slade Bay. Fluctuations in the alignment of McCreadys Creek and the variable sand supply around Slade Point headland cause shoreline movements along this section. The presence of the mangroves indicates that this section is relatively sheltered from wave energy and ebb tidal flow from McCreadys Creek. It appears that the embayment has reached an approximate equilibrium and there is no clear evidence indicating a recent erosion trend (EPA 2004).

Turners Beach and Slade Point Beach are small pocket beaches perched on the rocky platform at the base of the eastern side of the headland. As the potential longshore sediment transport rate is much higher than the actual supply of sediment at this location, each beach generally comprises mixed gravel and cobble material with some sand. Before the establishment of residential subdivisions on Slade Point, it is likely that an aeolian (wind-borne) transport of sand was sourced overland from Lamberts Beach to Slade Point Beach. This sand was probably also a source of supply to Slade Bay which has now been eliminated. Low sand supply is exacerbated by the general erosion trend along North Harbour Beach and Lamberts Beach caused by the blocking effect of the harbour walls. Furthermore loss of the dunes for residential development has resulted in a loss of sand supply to the associated beach systems (i.e. Black Beach).

North of the Pioneer River, wave energy becomes dominant, producing steeper and varied beach morphology quite different from the broad tidal flats of the coastline to the south Pioneer River. Lamberts Beach is a relatively exposed, high-energy section of the Mackay coastline sustained by the throughput of longshore sediment transport (EPA 2004).

It is separated from North Harbour Beach by a small bedrock outcrop that intrudes into the longshore sediment transport flow, resulting in the creation of an occasional shallow shoal at the southern end of the beach. A slightly higher energy regime is experienced at Lamberts Beach when compared with North Harbour Beach. As a consequence, Lamberts Beach tends to be steeper and has a generally coarser median grain-size. A coastline model was applied to Lamberts Beach to simulate the movement of the average position of the shoreline in response to changes in the longshore sediment transport. The simulation was run for a 50-year period assuming no sand placement occurs north of the harbour. The model predicted a recession in the order of 35m at the centre of Lamberts Beach (MAC137) (Figure 23) (EPA 2004). The model was also applied to North Harbour Beach under the same simulation parameters. The model predicted a recession in order of 80m at the centre of North Harbour Beach (MAC134) (Figure 23) (EPA 2004).

The southern breakwater extends across the full width of the nearshore zone and acts as a near complete barrier to the northward transport of sand (Figure 21). A small rate of sediment transport has the potential to naturally bypass the southern breakwater, however bypass rates are considerably lower that the transport rates that had occurred along the beach pre harbour construction (EPA 2004). Tidal flow characteristics and wave conditions are also considerably affected by the breakwater. Tidal flows north of the harbour wall are accelerated and diverted offshore. The harbour walls significantly shelter the

Figure 21: *Mackay coastline aerial (DEHP 2015) - Harbour Beach South to Slade Bay – Indicative longshore sediment transport noted by arrows - after EPA (2004).*

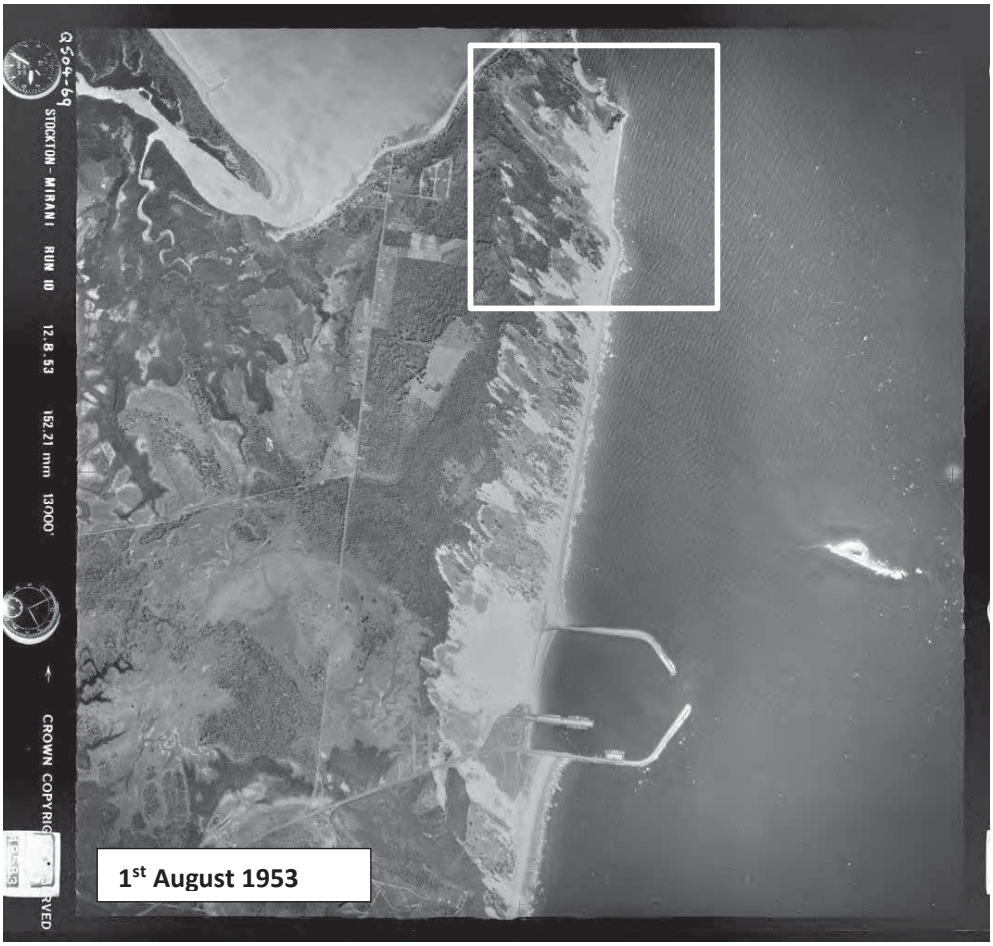


Figure 22: *Historical aerial imagery of Lamberts Beach and surrounding coastline.*

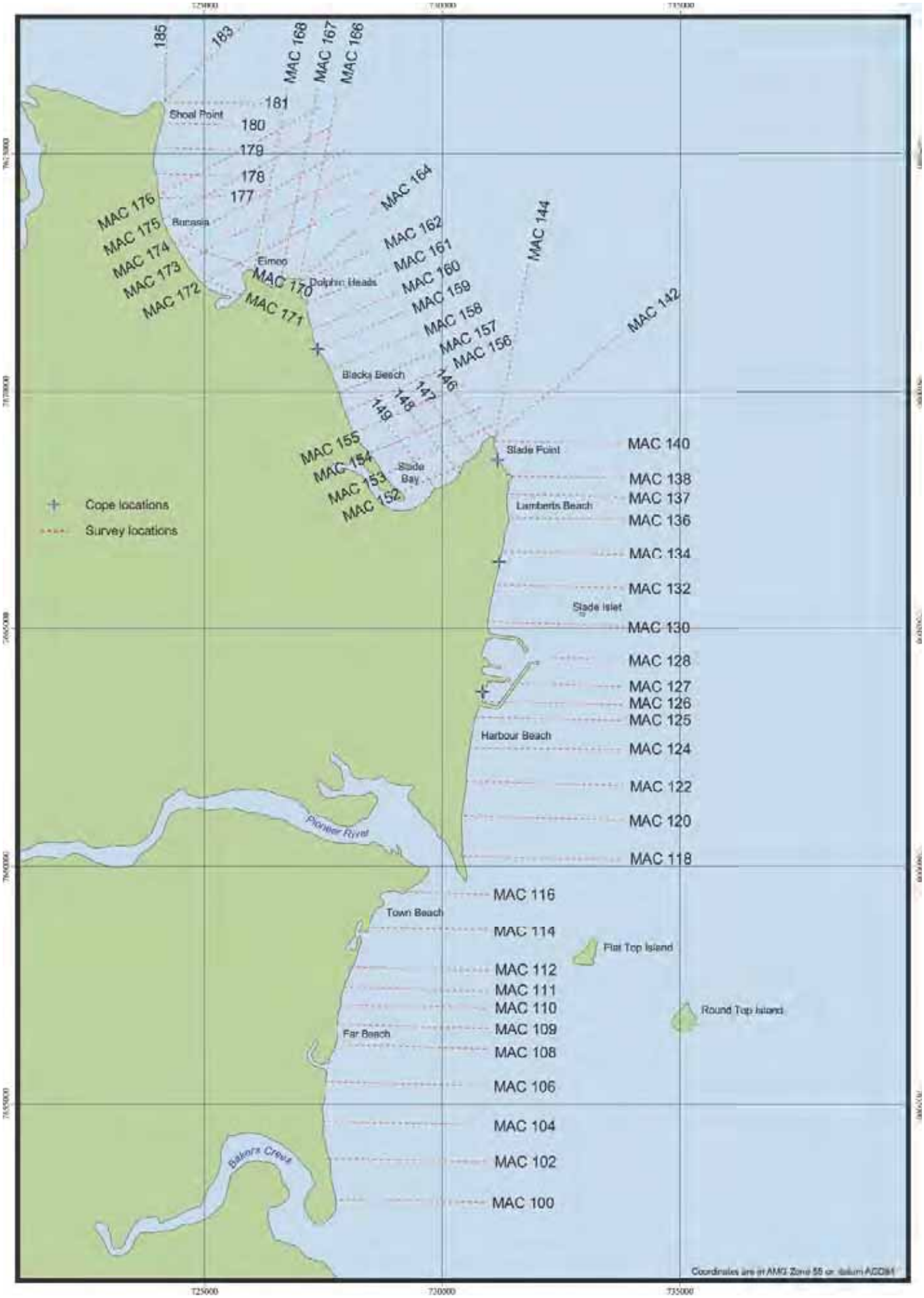


Figure 23: *Location of Beach Protection Authority beach profiles surveys conducted in 1971, 1977, 1978, 1979, 1981, 1986, 1992 and 1997 (EPA 2004).*

beaches immediately adjacent from wave conditions which in effect results in the accumulation of sediment immediately north of the harbour wall. Between 1968 and 1988 the Mackay Port Authority's capital dredging works introduced significant quantities of dredged sand on the beach north of the harbour (EPA 2004). The majority of this has since moved northward but some can be seen to remain immediately north of the harbour wall in the deposition zone. Survey data and aerial photographs show a small trend of beach accretion for up to approximately 1km north of the breakwater (EPA 2004).

4.3.4 Sediment supply and trajectory

The continuous supply of sand from the Pioneer River entrance and the regular onshore winds has combined to generate extensive sand dune formations, which in turn provided historical sediment supply to Slade Point and associated beaches. Construction of the harbour and the establishment of Slade Point as a residential zone have interrupted sediment pathways and reduced this supply significantly. 50 year period coastline model simulations (assuming no sand placement occurs north of the harbour) predicted a recession in order of 35m at Lamberts Beach (MAC137) and 80m at North Harbour Beach (MAC134) (Figure 23) (EPA 2004).

Overall, the net long-term trajectory of sediment supply to the Mackay coastline is likely to be one of reduced supply (Alluvium 2016), which will likely cause beach recessions over the long term. However, further investigation would be required to quantify the trajectory of the sediment budget, and could be combined with a regional study on long term sediment supply for the Mackay coastline.

4.3.5 Shoreline observations

The Lamberts Beach shoreline was inspected in July 2016 as part of a geomorphic review of several beaches in the region. At the time of inspection, recent erosion from Tropical Cyclone Dylan (2014) was observed, with a relatively steep scarp line present. A selection of pre Tropical Cyclone Debbie images of the beach and additional detail on the condition of the beach pre-cyclone (July 2016) is provided in the geomorphic review by Alluvium (2016) (Figure 24).

Alluvium again attended the site on 22 June 2017 post TC Debbie. Field observations confirm the presence of an eroding scarp extending north from the harbour at the base of the dunes, as well as an eroding scarp at Lamberts Beach and Slade Point Beaches. Focusing on Lamberts Beach, the post-cyclone position of the shoreline was mapped and photos and observations were recorded along the complete length of Lamberts Beach. The main observations of shoreline change post Tropical Cyclone Debbie included scour of a large volume of sand from the upper beach in front of a steep scarp line, which was 2–3m + high and near vertical in places (Figure 24). Moreover retreat of the scarp line was evident at several locations as impacting park infrastructure and amenities. Fill material was also exposed (Alluvium 2017).

4.3.6 Shoreline Changes

A range of data on shoreline position is available from 1972 to 2017. The majority of the Lamberts Beach shoreline (500–600m) has experienced recession in the order of 20–25m since 1977 (Figure 25). The exception to this is the very southerly extent of the beach in the sheltered area before the rocky outcrop. Major shoreline retreats were experienced in 1982, 1998, 2010 and 2015. Several meters of retreat of the main scarp line occurred between 2015 and 2017 as result of Tropical Cyclone Debbie (Alluvium 2017).

Comparison of 2009 and 2015 aerial imagery confirms recent shoreline recession in the order of 10–15m has occurred at both Slade Point Beach and Lamberts Beach (Figure 26a and b, Figure 27). With a loss of both wind-borne and longshore sediment supply, continued shoreline retrogradation at Lamberts Beach and Slade Point Beach is likely. The volume of sand scoured from the scarp line and upper beach during Tropical Cyclone Debbie has been at 10,500m^3 (Alluvium 2017). Futhermore, it is estimated that in the order of 65,500m^3 of sand has been eroded from Lamberts Beach over the last 10 years, where 10,500m^3 was associated with Tropical Cyclone Debbie and 55,000m^3 was associated in previous storm events (within last 10 years) (Alluvium 2017).

Observations from Alluvium's 2016 study have shown retrogradation in the order of 10 – 15m within the last six years (however there may have been periods of accretion over that time). It is considered likely that only a limited quantity of sand supplied to Turners Beach and Slade Point Beach will

now be transported around the headland into Slade Bay and beyond. Cross-shore sediment transport is likely to dominate at these beaches, and therefore sand renourishment would be a reasonably effective management strategy to assist with maintaining the beach in the short term (Alluvium 2016).

Comparison of 2009 and 2015 aerial imagery confirms recent shoreline recession in the order of 8–15m, and up to 20m in some locations, along North Harbour Beach (Figure 28). With a loss of longshore sediment supply, the shoreline at North Harbour Beach is likely to further recede into the parabolic dunes. In the absence of intervention, there will likely be a continued recession of North Harbour Beach until a dynamic equilibrium is reached with the current cross-shore and longshore transport conditions (Alluvium 2016).

Remnant vegetation has been largely removed and consequently weakened the parabolic dune system. The narrow buffer zone and clearing of native vegetation for parklands and development along the beachfront, drives this problem. As a result, the dune system of Turners Beach, Slade Point Beach and Lamberts Beach has decreased resilience and capability to withstand natural forces, in particular extreme events. Disturbance of the dune system by pedestrian access should be minimised to increase vegetation cover to stabilise the system. In order to best facilitate the growth of native dunal vegetation, it is important to control weeds, undertake revegetation and manage access across all foredunes within the coastal unit. Management of pest plants and pedestrian access is particularly important where the natural system is weakened or exposed to high pressures, such as those associated with residential development and recreational use. Weed control will need to be on-going in order to prevent re-establishment. Revegetation using local native species within the Reserve boundary would also assist in the function and maintenance of the dune structure into the future.

It is important for pedestrians to stay on designated tracks in order to reduce the widespread impact of pedestrian traffic.

Recreational activities/ facilities such as walking tracks and picnic facilities should be located outside of the erosion prone area and inside the landward dunal areas (Figure 20) (DERM 2011b).

In consideration of climate change forecasts it is evident that development has occurred within the erosion prone area along the Slade Point coastal unit (Figure 20). The retention and maintenance of the Reserves in this area is important to prevent threats to private property and infrastructure, by creating a buffer between erosion scarps and property.

The volume of sand intercepted compared with that bypassing the harbour wall is not known. A more detailed investigation of the longshore and cross-shore sediment transport would assist with improving predictions of coastline recession, and inform management options, in particular if there is a need to pursue artificial bypassing of the harbour. Immediate post cyclone recovery works have occurred in line with Alluvium's (2017) recommendations. Limited sand scraping from the intertidal zone to the base of the scarp and minor reshaping of the scarp crest is being undertaken post Tropical Cyclone Debbie to address public safety risks and improve the aesthetics of the area. Post and rail fencing has also been installed to reduce the widespread impact of pedestrian traffic on the foredune and has been complemented by revegetation (Figure 29a and 29b).

A 45-70m artificially placed sand buffer is to be constructed along 590m of the existing dune in 2019. The dune will be planted with appropriate indigenous vegetation to trap sand and facilitate dune advancement towards the sea. Beach renourisnment works have been funded by the Queensland Government and the Commonwealth-State Natural Disaster Relief and Recovery Arrangements (NDRRA).

Future management considerations including the monitoring of sand budgets to determine future management intervention requirements are described in the Alluvium report - *Lamberts Beach: recovery and erosion management (2017)*.

Figure 24: *Lamberts Beach scarp line June 2016 (left) and July 2017 post TC Debbie (right).*

Figure 25: *Comparison of indicative shoreline positions from 1972 to 2017. Note change reflects only the visible difference in the mature vegetation/scarp line from aerial imagery. Change does not reflect the volume of sediment lost from the toe of the scarp line and frontal dunes as observed on the ground in June 2017 inspections. The 1977 shoreline position represents the shoreline once development of the area was completed, and is the benchmark for assessing subsequent shoreline change and erosion rates. At the closest point, there is around 50m from the scarp line to the last road access.*

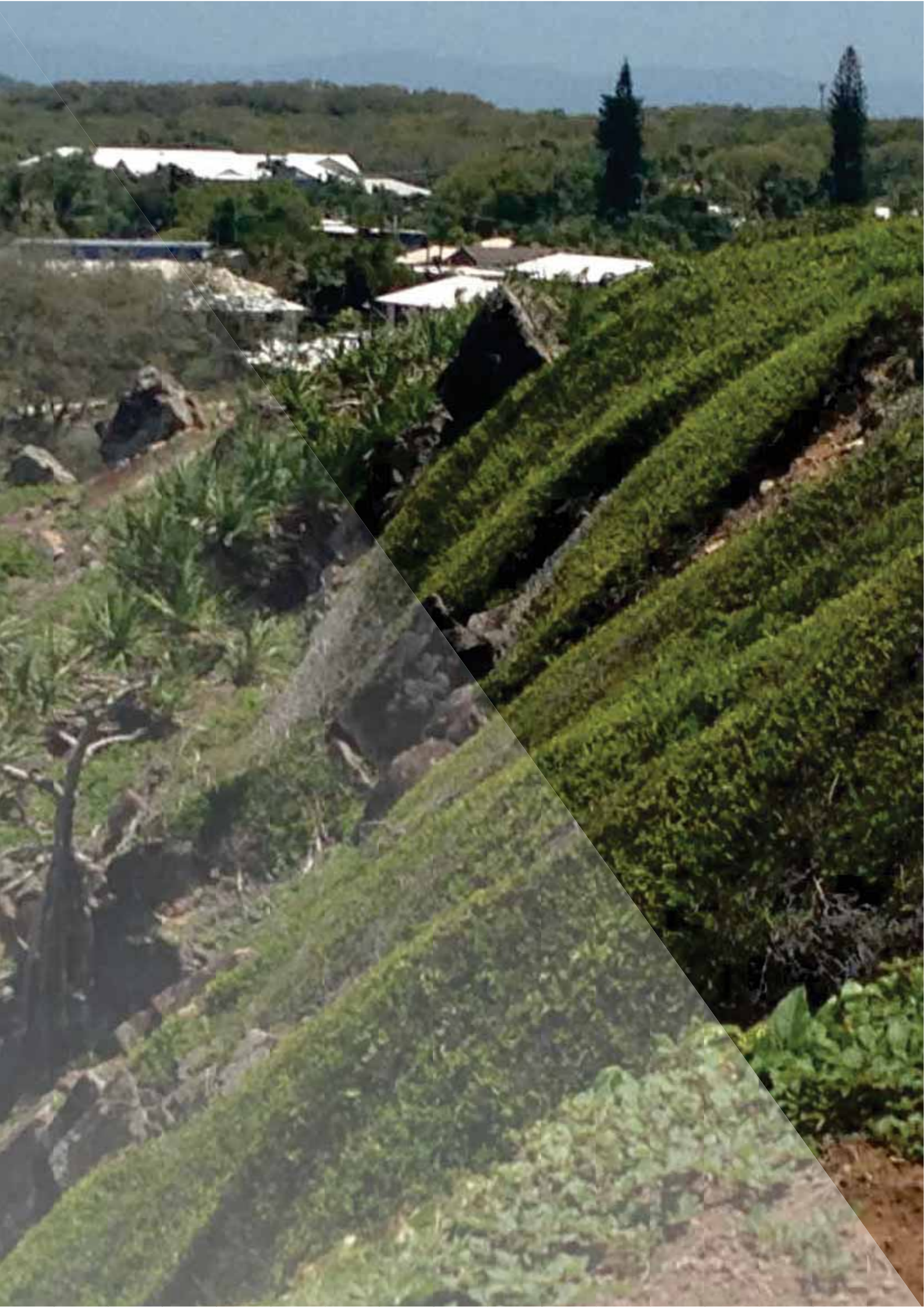
Figure 26a and 26b: *Slade Point beach – aerial imagery 2009 (left) and 2015 (right) indicating shoreline has receded in the order of 10 – 15m (at location indicated in red box).*

Figure 27: *Lamberts Beach aerial imagery – 2009 (left) and 2015 (right) indicating recent shoreline retreat in the order of 5-15m. Red line indicates 2009 approximate shoreline position.*

Figure 28: *North Harbour Beach– aerial imagery 2009 (left) and 2015 (right) indicating shoreline recession in the order of 8–15m and up to 20m in some locations. Red line indicates approximate 2009 shoreline position.*

Figure 29a: *Scarp reshaping post Tropical Cyclone Debbie as a first response.*

Figure 29b: *Colonisation of native goats foot (Ipomoea pes-caprae) on re-shaped scarp (right).*



5 Social Values and Management Issues

This section provides an assessment of the social values, such as cultural values and recreational opportunities and facilities offer by the coastal unit. The focus lies on a sustainable approach to explore recreational opportunities while conserving the natural environmental values of the area. Provision of adequate facilities that cater for a range of interests and abilities is also an important consideration of this plan.

Slade Point is located north of the Mackay Harbour about a 10 minute drive north of Mackay CBD. In addition to scenic vistas, Slade Point provides numerous local, district and conservation parks that encourage a diverse range of recreational activities such as surfing and whale watching, as well as providing large areas suitable for gatherings between friends and family.

5.1 CULTURAL HERITAGE

The Traditional Owners of the Mackay region are the Yuwibara people. A large part of the Slade Point area, before development, was comprised of estuarine and palustrine wetlands which were popular hunting and camping sites for Indigenous people of the land. Traditional Owners used these wetlands and the coastal area for hunting, gathering and other cultural purposes. As such the restoration of natural areas remains of significance to Traditional Owners (Tonga 2016 pers. comm, 2 Feb). Shell middens have been found on the Slade Point headland (Mooney 2016 pers. comm, 8-9 Feb) and McCreadys Creek is reported to contain remnants of a fishtrap/ weir (DATSIP 2016).

Additional surveys of the area by Traditional Owners may reveal further sites or items of cultural significance. In order to do so, it is suggested that Traditional Owners are employed to document findings and outline clear management objectives for preserving the cultural heritage in the area.

5.2 RECREATIONAL OPPORTUNITIES

Recreational sites are important as they provide a range of social benefits including opportunities for active and passive recreation, tourism, education and social activities. They also support community wellbeing and provide opportunities for improving general health through outdoor recreation. Additionally, through signage and interpretation, there is an opportunity to raise awareness of local wildlife and educate people about the natural coastal processes and vegetation that support these species. Council's *Mackay Region Planning Scheme* (MRC 2017) outlines council's vision to provide a balanced mix of public Open Space that in turn will provide for a range of active and passive recreational opportunities for the community. Open Space is set aside for recreational and non-recreational activities. Active and passive recreational opportunities are provided to meet the needs of the community, whereas non-recreational Open Space areas are provided for the protection of natural areas, (including environmentally significant vegetation, wildlife habitat areas, waterways, and wetlands) and for the use of land for utilities and storm water management (MRC 2016). In order to develop an integrated and comprehensive Local Coastal Plan, it is important to consider public use and future opportunities that balance the environmental conservation and recreational needs of this coastal unit.

The *Mackay Region Planning Scheme* (MRC 2017) was considered when assessing the coastal unit for possible recreational and conservation based recommendations, including the risks recreation may pose to local wildlife and native vegetation. Environmental sustainability is prioritised in line with the *Coastal Management Guidelines* (MRC 2012), with consideration for providing a range of recreational opportunities in order to meet needs of the broader Slade Point and Mackay community. Council's *Open Space Schedule (SC6.16)* (MRC 2018) seeks to achieve recreational diversity and effective distribution of recreational areas, and to create an interactive interface between the environment and the community, and establish a network of Open Space areas accessible to everyone. This Local Coastal Plan seeks to align this policy, community needs and environmental conservation.

Slade Point is a medium density residential community, highly valued by locals and visitors for its scenic vistas and diverse recreational opportunities. The long sandy expanses at Lamberts Beach and North Harbour Beach facilitates outdoor activities, where locals and visitors can enjoy the environment and its natural assets. A variety of birds can be observed along the beach and scenic views of islands can be admired from the headland. Locals and tourists enjoy Slade Point for its recreational opportunities as well as its close proximity to Mackay CBD.

The Slade Point Park Precinct area encompasses 21.3ha of Open Space and provides a range of recreation parks suitably distributed across the precinct to accommodate Open Space provision for the Slade Point community members and its visitors. Recreational Parks are classified into local, district, regional, sport and linear parks to set desired service standards, including allowable features and maintenance. In accordance with MRC's *Open Space Schedule (SC6.16)* all recreational parks within this coastal unit provide a garbage bin, drinking water, lighting, shaded seating and play and landscape features offering safe community access and recreational use.

Within the coastal unit there are six recreational parks and one non-recreational park. Swan Street Park, Swallow Street Park, David Cheong Park, Albatross Street Lookout and Lamberts Beach Lookout are each designed to accommodate short (<3hr) stays, providing sufficient area to accommodate seating, informal and active play and other landscape features. Each park features at least 100m^2 of open grassed area to allow informal active recreation. Ram Chandra Park is a district park

and as such is designed to encourage longer stay through the provision of additional sheltered seating and formal picnic facilities (including electric barbeques), larger active play areas (including playground equipment), public toilets and car parking facilities. Under MRC's *Open Space Schedule (SC6.16*), district parks are required to set aside a minimum area of 3,000m^2 of open grassed area to encourage informal active recreation and organized social interactions in an outdoor setting (MRC 2016). Both park classifications are required to provide shaded bench seating connected via pathways, where 50% of the pathway should achieve shaded tree cover. The remaining park within the Slade Point coastal unit is SPR. This non-recreational park is set aside for the protection of natural areas (i.e. environmentally significant vegetation, wildlife habitat areas).

Swan Street Park and Swallow Street Park are small local parks located east of McCreadys Creek Reserve (Figure 30). Swan Street Park provides a garbage bin, a drinking fountain, sheltered seating and a picnic table and electric barbeque (Figure 31). Prior to 2011, Swan Street Park provided informal boat access to McCreadys Creek, however the ladder was damaged during Tropical Cyclone Yasi and consequently decommissioned. Boat ramp upgrades are planned and prioritised across the region using consultation feedback and information from the *Recreational Boating Facilities Demand Forecasting Study 2011* (DTMR 2018). To date the Swan Street boat ramp has not been considered as a priority for the state. In light of the Department of Transport and Main Road's (DTMR) prioritisation process, council has undertaken a feasilbity investigation to determine the most appropriate location of the ramp and has progressed development approvals. Council will continue to advocate for boat ramp facilities at Swan Street Park on behalf of the Slade Point community.

Swallow Street Park provides a garbage bin, drinking fountain, playground, sheltered seating, picnic table, an electric barbeque and designated car parking (Figure 32 and 33). Swallow Street Park significantly exceeds the minimum open grassed area required to accommodate informal active recreation. It is therefore recommended that a shaded pedestrian pathway be established from the designated car parking area to a beach access point. Establishment of the path and low tide access point (SLP02) will reduce multiple access locations, improve public safety and increase the provision of shade, shelter, connectivity and habitat for native animals along the coastal corridor. Establishment of an additional low tide beach access point (SLPO3) along Ocean Avenue would provide an alternative safe access that builds upon the native coastal corridors.

David Cheong Park (Figure 34) is managed as an open grass area with minimal recreational facilities including sheltered seating and a picnic table. Combined with the offer of ample street-side parking, additional investment into park facilities, for example an electric barbeque, could be easily justified as a means to increase park visitation, considerate of the attractive views provided at the headland (i.e. Slade Bay and Keswick Island). An infrequently used unofficial boat ramp is located within the park adjacent to Hawk Street. The installation of a boat ramp at Swan Street would deter vehicles from illegally accessing the ramp to launch their vessels. As David Cheong Park exceeds its open grassed area requirement (i.e. 100m^2), it is recommended that the park be revegetated with local natives to not only increase the provision of shade, shelter, connectivity and habitat for native animals along the coastal corridor, but to also reduce the maintenance required to regularly mow this park.

Similar to David Cheong Park, Albatross Street Lookout provides scenic views across Slade Bay and Brampton Island (Figure 36). Park infrastructure is scarce however appropriate for this hidden park. Sheltered seating could be installed to increase the use of this park. On the most part, invasive weeds dominate Slade Point headland. Exposure to prevailing winds and its steep terrain makes the Slade Point headland difficult to rehabilitate. Garden escapees and transformative weeds should be prioritised to reduce spread, competition and encourage native regeneration. Despite the terrain, an informal access track has been established that traverses the headland travels south behind the residential houses and ends at Turners Beach. This access track could be considered for formalisation, however as the terrain is challenging and the prevailing wind conditions would restrict access during times of inclement weather, substantial capital would be required to create an access track that complies with pedestrian access safety standards. It is recommended that a concept plan with cost estimates be produced to allow the feasibility of this project to be considered.

The Gannet Street Walkway (SLA01) provides a closed canopy walkway remnant of its former vegetation community, beach scrub. The understory however is dominated by a monoculture of mother-of-millions (*Bryophyllum sp.*) and green waste dumping. Landholder education along with programmed weed control, revegetation, waste removal and the replacement of eroded beach access point SLA01 would considerably improve this beach access track. Similarly, the beach access point at the southern end of Turners Beach (SLA02) requires replacement as it too is undermined.

Lamberts Beach Lookout (Figure 35 and 37) is a landmark pavilion that offers two dedicated viewing areas with seating and interpretative signage. The upper level provides 360 degree views of Slade Point and its coastline and is equipped with binoculars for whale watching and other wildlife spotting. Onsite parking has been improved to provide designated car parking facilities for small tourist buses and campervans and also includes a disabled parking bay. The headland contains a range of environmental weeds, which due to the terrain and exposure to prevailing winds are difficult to manage. Garden escapees and tranformatives weeds, particularly those whose seeds are readily windborne, should be prioritised to reduce spread, competition and encourage native regeneration.

Ram Chandra Park is a popular recreational area and provides a beach shower, four sheltered picnic areas with electric barbeques, seating, toilets and a lifeguard tower (Figure 38). A large open grassed area is set aside for informal activity, significantly beyond that of the minimum requirements of a district park. Recent sand renourishment activities, including sand scraping to reform Lamberts Beach foredune and the installation of a post and rail fence has allowed colonisation of pioneer native plants (Figure 29b). Encouraging vegetation establishment and spread will facilitate dune growth, improve dune stability and encourage further plant recruitment. It is strongly recommended that signage be installed at regular intervals along the post and rail fence to direct pedestrian towards formal beach access points. Key messages that simply demonstrate the current vulnerability of the dune; the requirement for vegetation colonisation to stabilise the structure, and the consequence of ongoing interference through ongoing pedestrian use, should be employed to curb access patterns of beach goers. To facilitate access management, it is recommended that at least one new beach access point (LAMO3) be established between LAM01 and LAM04 to promote use of formal beach access points. An access point should be located near the lifeguard tower to assist lifeguard access onto the beach. It is also recommended several shaded pedestrian pathways be established within the park to direct pedestrian traffic between centralised park facilities (i.e. toilet, life guard tower and playground equipment) and beach access points. Natural recruitment should be encouraged throughout the park to restore natural zonation, reduce wind speeds, increase natural shade and provide habitat for local fauna. Fencing would assist vegetation regeneration allowing adequate protection for young trees to mature. Weed control and infill planting along the scarp, in select locations across the foredune and within the park would also assist vegetation establishment and foredune stabilistation.

SPR provides protection and conservation of the natural area and landscape character and is set aside for natural resource management. The reserve is not primarily designed for active recreational use, however consideration should be made to promote connectivity between Ram Chandra Park, SPR and the Mackay Port Authority Conservation Reserve in accordance with the suggestions contained with the *Slade Point Reserve Management Plan* (MRC 2008). It is recommended that the two plans integrate management objectives to align conservation measures and co-management arrangements. An opportunity exists to collaborate with NQBP to maintain and where appropriate extend upon walking trails to provide a unique and safe nature trail experience close to the Mackay CBD.

An opportunity exists to improve connectivity and provide active recreation opportunities between all seven parks within the Slade Point Park District through the provision of distance/direction markers across the network of parks within the Slade Point Park Precinct.

Figure 30: *Swan Street Park and Swallow Street Park recreation and assets.*

Figure 31: *Sheltered picnic table and electric barbeque at Swan Street Park.*

Figure 32: *Playground, sheltered electric barbeque and picnic tables at Swallow Street Park.*

Figure 33: *Allocated parking area for Swallow Street visitors.*

Figure 34: *David Cheong Park and Albatross Street Lookout recreation and assets.*

Figure 35: *Lamberts Beach Lookout, Cumberland Avenue Park and Ram Chandra Park recreation and assets.*

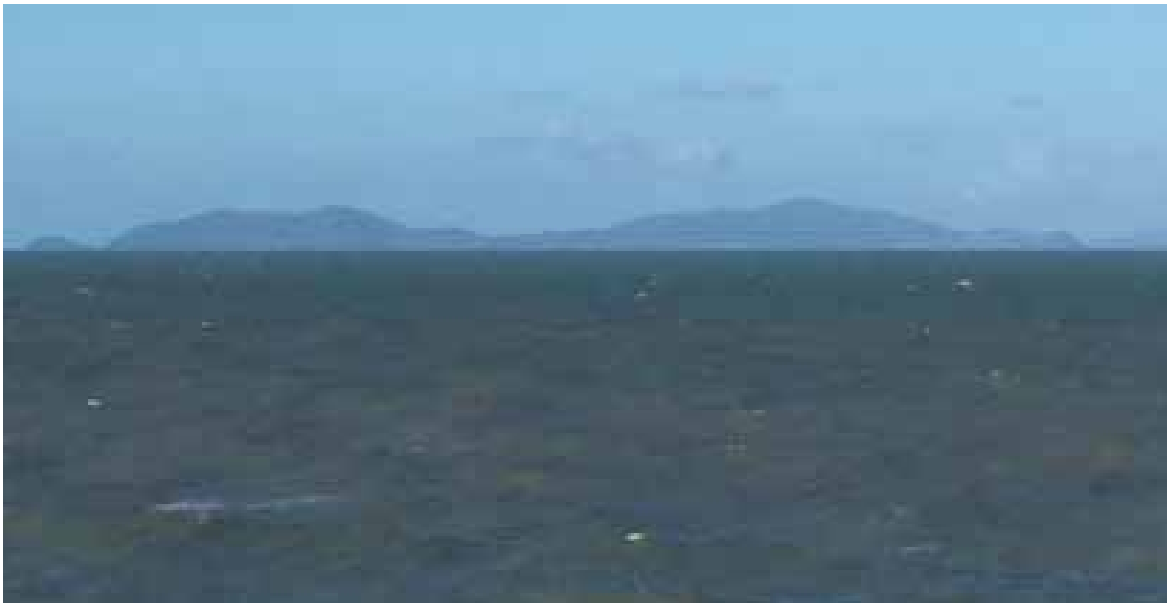


Figure 36: *Brampton Island seen in the distance from the sheltered picnic table located at the end of David Cheong Park.*

Figure 37: *Pavillion at Lamberts Beach Lookout.*

Figure 38: *Park facilities at Ram Chandra Park, Lamberts Beach.*

5.3 PUBLIC ACCESS

To prevent the degradation of dune systems and for public safety, it is important for users to stay on designated access tracks. Pedestrian and vehicle traffic displaces sand, and where it continually occurs, can lead to localised erosion. Recreational activities/facilities (i.e. walking tracks, picnic facilities etc.) where possible, should only be located outside of the erosion prone area and inside the landward dunal areas (DERM 2011b).

Access to the beaches is predominantly pedestrian, via official beach access tracks or unofficial or private tracks. There are seven official beach access points across the coastal unit (SLA01, SLA02, LAM01, LAM04, SPR01, SPR02, NHA01) (Figure 39) and entrance stairs to the once was swim enclosure (Figure 40). Two official access points are being undermined by erosion and should be considered for upgrade (SLA01 and SLA02) (Figure 41a). Moreover beach access track LAM04 should also be considered for upgrade to mitigate irregular disturbance and reduce weed incursion (Figure 41b).

An opportunity exists to install an interpretive signed trail extending from Albatross Street Lookout to Lamberts Beach through to SPR and would provide a unique recreational destination for locals and visitors alike. Moreover the existing tracks and access points within SPR are in disrepair. In some instances sand movement has forced the fence to slump onto the beach (Figure 42 and 43). The fence and associated access points could be transformed into a scenic bushwalking trail, extending the proposed trail from Ram Chandra Park. Improved infrastructure, increased vegetation management and the installation of distance bollards or similar is recommended to discourage the creation of unofficial access tracks. This work would need to occur in partnership and with approval from NQBP and state government agencies.

Fence realignment should be considered in areas prone to erosion, such as Lamberts Beach, to allow native plant recolonisation, provide for vegetation zonation and increase the buffer zone between mixed land use. Any fence realignment should incorporate existing native mature trees and allow for existing juvenile recruits to assist vegetation regeneration.

Several unofficial pedestrian access points exist throughout the coastal unit and many are unsafe for use. Numerous unofficial access points exist along Ocean Avenue and Turners Beach, leading from homes straight onto the beach (Figure 44). Regular disturbance contributes to sand compaction and limits vegetation recruitment and should be discouraged through the installation of post and rail fencing and signage (regulatory and informative). Additional low tide beach access points should be installed along Swan Street (SLP01), in Swallow Street Park (SLP02), from Ocean Avenue (SLP03) and along Lamberts Beach (LAMO3) to allow for regular and safe pedestrian access. Well-placed official formalised tracks should be created to provide the most direct route to beaches thereby limiting the necessity for the public to create informal access points.

The post and rail fenceline along Ocean Avenue and Slade Esplanade needs to be improved to prevent green and general waste dumping.

Plans for the creation of a boat ramp at Swan Street Park remain unfunded. When funds become available, it is recommended that the boat ramp design consider appropriate recreational park embellishments such as a toilet, lighting and interpretative signage. Provision of an official boat ramp in the area will reduce the prevalence of unofficial launching areas such as the ramp at David Cheong Park (Figure 45).

Figure 39: *Slade Point beach access points and recreational areas.*

Figure 40: *Entrance stairs which lead to a historical swimming enclosure which was once located on Ocean Avenue.*

Figure 41a: *SLA01, one of two beach access points undermined by erosion.*

Figure 41b: *Upgrading would prevent erosion and weed incursion.*

Figure 42: *Fence line along scarp of North Harbour Beach (within Slade Point Reserve).*

Figure 43: *North Harbour Beach access points (SPR01 and SPR02 featured) require remediation.*

Figure 44: *Unofficial tracks occur across Slade Point headland.*

Figure 45: *Unofficial boat ramp access within David Cheong Park.*

Figure 46: *Signage within Slade Point Reserve requires updating.*

5.4 SIGNAGE

Signage provides educational and interpretive opportunities for visitors and increases the value that locals place on the natural environment. Signs can highlight areas of high value, provide information about current projects and advise of site-specific restrictions or hazards. Beach access signage is present at the landward and seaward end of each beach access track throughout the coastal unit. It is recommended that signage be regularly audited and updated where required to ensure consistency and accuracy (Figure 46).

There is scope for the installation of new signage detailing the importance of coastal vegetation in reducing erosion. This would be best situated near revegetation sites to further dissuade its removal or destruction via education and awareness raising. Additional interpretive signs could be provided to educate visitors about dune health and function, important or unique native species and communities including marine turtles, and critically endangered beach scrub. Similarly, signage reflecting the cultural history of the area could enhance visitor experience and ensure that the importance of cultural heritage is reflected and appreciated by locals and visitors.

Updating, repairing and installing new signs throughout the coastal unit, in particular, near beach access points or sheltered seating and picnic areas is recommended.

5.5 ECONOMIC VALUES

Beaches are important economic assets as well as natural resources, as they provide services to people and property that have an economic value, including reduced storm damage, together with recreational and tourism opportunities (Strong 2005).

The tourism industry is important for the Australian economy, comprising approximately three per cent of gross domestic product in 2014-15 (Productivity Commission 2015).

Australia's tourism industry is dominated by the natural environment, with national parks and protected areas forming the basis of nature-based tourism experiences (Weaver et al. 1999). Beaches are the most popular coastal attractions for visitors, providing opportunities for a range of activities including bushwalking, whale watching and fishing (Clarke and Johnston 2017).

Beach visitors generate income for the local economy through their expenditure. Spending by tourists is a component of the economic activity across a variety of sectors including accommodation, cafes and restaurants, transport and storage, retail trade, cultural and recreational services and education (Pambudi et al. 2009). Income generated by the coastal tourism sector is highly dependent on the quality and extent of beach systems (Jones and Phillips 2007).

Ecotourism is a significant and growing sector of the tourism industry, and provides a way to reconcile tourism and conservation (Weaver 2001). By marketing natural values, ecotourism can maintain the aesthetic appeal of coastal tourist areas while deriving economic value, and simultaneously produce environmental benefits (Clarke and Johnson 2017).

Beach and dune environments are among the most valuable natural habitats on the coast, providing environmental services, landscape values and habitat for marine and terrestrial plants and animals which can serve to attract tourists as well as provide amenity for local residents (James 2000). The costs associated with recreational and tourist usage of beaches includes the cost of infrastructure provision and maintenance.

Beaches provide goods and services to many stakeholders, with a range of market and non-market values which can be worth millions of dollars per year. The way people value the natural environment however can vary. Value can be associated with direct uses, such as fisheries or tourism, as well as indirect uses, such as mangroves providing nursery habitat for juvenile fish species. Indirect uses are usually found outside the market place and are effectively unpriced. Determining the full value of a natural asset is challenging and often overlooked, however if no monetary value is placed on environmental goods and services there is a risk that they will be perceived as having no value (zero worth) and may be vulnerable to exploitation (Kirkpatrick 2011).

Coastal resources in the Mackay region are highly sought after for competing uses including residential, commercial, tourism and recreation. Effective management is required to ensure that the natural values and attributes of the coast are preserved while economic development and population growth are accommodated (EPA 2004).

Climate change is likely to have a range of direct and indirect economic impacts on recreation and tourism in coastal areas. Local and state governments will need to invest in natural assets to ensure the continuation of a strong tourism culture and investigate opportunities to diversify the tourism image for beach-focused destinations while balancing the value of natural coastal assets against trade-offs for other uses such as industry and development (Kirkpatrick 2011).

5.6 WASTE DUMPING AND LITTER

Green and general waste has aesthetic, social and conservation repercussions. Litter and green waste reduce the visual appeal of beaches, present health threats to visitors (e.g. toxic waste, glass and sharps etc.) and compromise vegetation condition. Green waste, such as palm fronds and lawn cuttings smother large sections of ground cover vegetation throughout the coastal unit. Plastics and other general waste often wash out to sea, presenting dangers for marine wildlife including birds, fish, sharks, turtles and marine mammals. Marine debris may lead to drowning, or cause injury or death through entanglement and internal injuries, or from starvation following ingestion.

Green waste, general waste and marine debris were found throughout the coastal unit with particular hot spots located along Ocean Avenue and Gannet Street walkway (SLA01) (Figure 47). Additional bins, community education and regular clean ups would reduce waste dumping in these areas. In particular, future occurrences of illegal waste disposal adjacent to Blackwood Street could be managed through improved post and rail fencing (Figure 48 and 49).

Introduction of Gross Pollutant Traps (GPTs) in key locations within the coastal unit, closer to the source of the contaminant, would reduce deposition of litter derived from stormwater drains into waterways and the marine environment (Figure 50a and 50b).

Appropriate regulatory signage and a public education and awareness program on the values of coastal unit and impacts of waste dumping should complement other management actions.

Figure 47: *Green waste adjacent to residences along Gannet Street walkway (SLA01).*

Figure 48: *Green waste dumped adjacent to Blackwood Street.*

Figure 49: *Loose configuration of post and rail fencing fails to inhibit green waste dumping.*

Figure 50a and 50b: *Stormwater drain on the southern end of Lamberts Beach could be fitted with a gross pollutant trap to reduce pollutants entering the local marine environment.*

6 Climate Change and Management Issues

Climate change is the term used to describe long-term changes in global weather patterns, and the gradual increase in mean global temperature. There is strong evidence that suggests that the gradual warming trend over the last fifty years has been driven largely by human activity, for example, the burning of fossil fuels, deforestation and intensification of agriculture (The Royal Society 2010). Climate change is having, and will continue to have, significant impacts on lives and ecosystems on which we depend.

Coastal areas are highly exposed to climate change with sea level rise being one of the greatest threats. The best known model relating shoreline retreat due to an increase in local sea level is that proposed by Per Bruun (1962) (Figure 51).

Projected sea level rise (0.8m by 2100) is expected to increase erosion and damage property and infrastructure (DERM 2011b). The response of Australian coastal ecosystems and landforms to climate change will vary, but most are expected to involve shoreline recession, vertical accretion of sand, increased saline inundation of wetlands, and the modification and southward shift of habitat (Australian Government 2013). Additionally, many intertidal ecosystems such as mangroves, seagrass and tidal flat communities will decline.

Key climate change messages for the wet tropics Natural Resource Management cluster, that encompasses the Mackay region, are displayed in Figure 52 (Abbs, D. *et al.* 2015). Current predictions suggest that much of the dune system will be inundated by 2100 (Queensland Government 2011). Maintaining and improving the condition of a buffer area of coastal vegetation, where possible, will provide the best opportunity to build resilience into these ecosystems to cope with changes into the future. *Mackay, Whitsunday and Isaac Climate Sustainability Plan 2016-2020* contains forecasts local to the Mackay region.

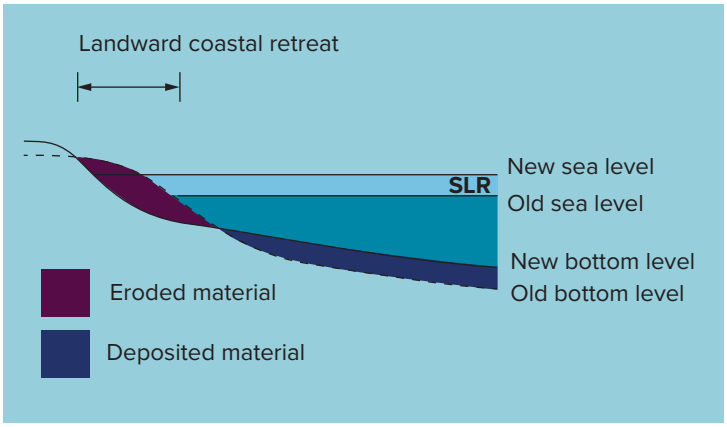


Figure 51: *The Bruun Rule showing erosion of the upper beach and offshore deposition under sea level rise (SLR) sea level rise. Source; DERM.*

Figure 52 also highlights other key changes associated with climate change, such as increased temperatures and more severe tropical storms.

Beaches in the Slade Point coastal unit are vulnerable to erosion from storm tide inundation and permanent inundation as a result of expected sea level rise. Figure 20 uses the prescribed estimation (0.8 m by 2100) to model what the coastline will look like, and currently predicts that much of the dune system will be inundated by this time (DERM 2011b). Current king tides reach the base of the rock walls facing Slade Bay. Maintaining and improving the condition of a buffer zone of coastal vegetation, where possible, will provide the best opportunity to build resilience into these ecosystems to cope with changes into the future. Revegetation of the Slade Point coastal strip will also enhance the ability of flora and fauna to migrate southward by creating a habitat corridor, which facilitates the movement of species much more effectively in response to climate change.

Increased storm intensity predicted with climate change makes stabilising coastal strips in front of infrastructure important for risk mitigation. The use of vegetation is important to bind sediments together and reduce sediment loss. The degraded dune system along Lamberts Beach currently has little capacity to be resilient to storm events and therefore requires revegetation and improved access points to keep pedestrians off fragile dune areas.

In order to protect the tidal flat communities that extend west of the coastal unit (Figure 53), adjacent land should remain free of development and infrastructure to allow for migration of these communities as sea level changes occur. These are highly sensitive areas that should be fenced to restrict vehicle and pedestrian access. Sea level rise will also likely cause the spread of McCreadys Creek into low lying coastal residential areas surrounding Swan Street and Swallow Street Parks as well as bisect Slade Point in a north south direction along the stormwater channels that exists to the east of Cathy Freeman Athletic Park and Wren Street Park. The influx of water from the creeks and stormwater channels adds an additional consideration to the rising sea levels when determining options for protecting or retreating from rising waters.

Retreat is likely to be required in the longer term in some places. Rising sea levels will also see the loss of habitats such as mangroves that are not provided space to retreat landward. This will be the case for most of the mangroves around Slade Point facing into Slade Bay. Due to their position (in most cases in front of rock walls or other infrastructure) their retreat is unlikely to be provisioned for. The loss of this important habitat and fish nursery ground may

KEY MESSAGES FOR THE WET TROPICS

Average temperature will continue to increase in all seasons.

More hot days and warm spells.

Changes to rainfall possible but unclear.

Increased intensity of extreme daily rainfall events.

Mean sea level will continue to rise. Height of extreme sea-level events will also increase.

Fewer but more intense tropical cyclones.

On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

Figure 52: *Key climate change messages for the wet tropics Natural Resource Management (NRM) cluster (Source: Abbs, D. et al., 2015).*

have impacts on local fisheries and the populations of reef fish utilising the mangroves.

The challenge for future planning will be to identify suitable ecological retreat zones for developed sections of coastlines to accommodate climate change processes and preserve unique habitat in specific geographic regions. For example, it may be important to limit development around estuary areas and coastal wetlands and waterways, in order to preserve a zone to accommodate ecological retreat. Adaptation planning is recommended to ensure that this is comprehensively considered to mitigate risk to social and environmental values in the area.

Residents of the coast are already familiar with the risks of living close to the ocean, such as storm surges, cyclones and erosion. However, the intensity of these threats is expected to increase with a warming global climate, so it is important to understand and prepare for this. Reducing environmental pressures will increase the resilience of coastal ecosystems, thereby increasing the likelihood of their persistence into the future.

Figure 53: *Tidal flats located within McCreadys Creek.*

7 Recommended Activities

Table 2: *Recommended activities for the Slade Point Local Coastal Plan*

RECOMMENDED ACTIVITIES	
Zone A | Swan St Park (1ha)	
1	**Vegetation management**
	1.1 Control major target weed species including Guinea grass.
	1.2 Supplement removed weed species with native vegetation, particularly along the frontal dune.
	1.3 Rehabilitate cleared areas and bare patches such as mown areas. Revegetate areas surrounding the existing car park to enhance the estuarine environment and enhance shade, shelter and habitat for native animals along the coastal corridor.
	1.4 Monitor and manage other problematic weed species including residential garden escapees.
2	**Recreational opportunities**
	2.1 Work with partners to install a boat ramp and create formalised designated parking spots to alleviate congestion in busy times.
	2.2 Install interpretive signage where appropriate to highlight biodiversity values.
3	**Access management**
	3.1 Install a beach access point along Swan Street (SLP01).
	3.2 Install distance/direction markers where required to facilitate pedestrian travel between local parks.
4	**Waste management**
	4.1 Remove waste and regulate hot spot locations with signage.
Zone B | Swallow St Park (1.5ha)	
5	**Vegetation management**
	5.1 Control major target weed species including Guinea grass.
	5.2 Supplement removed weed species with native vegetation, particularly along the frontal dune.
	5.3 Undertake revegetation throughout the zone (foreshore and roadsides) to increase connectivity and habitat for native animals along the coastal corridor and provide shade for recreation.
	5.4 Monitor and manage other problematic weed species including, but not limited to residential garden escapees.
6	**Access management**
	6.1 Install a beach access point at the end of this pathway within Swallow Street Park (SLP02) and create pathway links to connect the access point to frequently used entrances.
	6.2 Install distance/direction markers where required to facilitate pedestrian travel between local parks.
7	**Waste management**
	7.1 Remove waste and regulate hot spot locations with signage.
Zone C | Slade Esplanade and Ocean Avenue (3.5ha)	
8	**Vegetation management**
	8.1 Control major target weed species including Guinea grass.
	8.2 Monitor and where suitable, manage other problematic weed species including, but not limited to residential garden escapees.

Table 2: *Recommended activities for the Slade Point Local Coastal Plan*

9	**Access management**	
	9.1	Undertake fence improvements along Slade Esplanade and Ocean Avenue to reduce green waste dumping and inappropriate parking.
	9.2	Install a beach access point (SLP03) along Ocean Avenue from the easement located south west of Melaleuca Street.
	9.3	Install distance/direction markers where required to facilitate pedestrian travel between local parks.
10	**Waste management**	
	10.1	Remove waste and regulate hot spot locations with signage.
Zone D | Slade Point headland (6ha)		
11	**Vegetation management**	
	11.1	Control major target weed species including Guinea grass, leucaena, painted spurge, prickly pear, century plant and mother-in-law's tongue.
	11.2	Undertake revegetation with native plants across David Cheong Park.
	11.3	Facilitate native vegetation regeneration throughout the reserve through strategic weed management.
	11.4	Control weeds on and around well used areas such as informal access tracks until such time that their use (closure or formalisation) is determined.
	11.5	Monitor and manage other problematic weed species including, but not limited to residential garden escapees.
	11.6	Maintain a firebreak between Albatross Street Lookout and Turners Beach.
12	**Recreational opportunities**	
	12.1	Install an electric barbeque at David Cheong Park.
13	**Access management**	
	13.1	Consider formalising the informal walkway leading from David Cheong Park to Albatross Street Lookout. Develop a concept plan with cost estimates for a headland walking track.
	13.2	Delineate the Asset Protection Zone (APZ) and conservation area through the installation of post and rail fencelines.
	13.3	Install distance/direction markers where required to facilitate pedestrian travel between local parks.
	13.4	Install a fenceline along the road frontage of Albatross Street Park.
	13.5	Undertake fence improvements along Ocean Avenue at David Cheong Park.
	13.6	Once boat ramp facilities are completed at Swan Street Park, close the unofficial boat launching point at David Cheong Park.
Zone E | The Bays (Turners Bay and Slade Point Beach) (5ha)		
14	**Vegetation management**	
	14.1	Control major target weed species including mother of millions, prickly pear, century plant, painted spurge and pink periwinkle.
	14.2	Supplement removed weed species with native vegetation, particular along Gannet Street Walkway (SLA01).
	14.3	Facilitate native vegetation regeneration throughout the zone through strategic weed management.
	14.4	Control weeds on and around well used areas such as informal access tracks. Closure or formalisation of these tracks will minimise weed control efforts. Revegetation may be required to infill gaps if natural regeneration is not sufficient.
	14.5	Monitor and where suitable, manage other problematic weed species including, but not limited to residential garden escapees

Table 2: *Recommended activities for the Slade Point Local Coastal Plan*

15	**Recreational opportunities**	
	15.1	Install educational signage to advertise the unique geological features of the area, include the gravel and cobble beaches and adjacent parabolic dunes.
16	**Access management**	
	16.1	Repair the Gannet Street Walkway and beach access point (SLA01) and install appropriate drainage to mitigate erosion.
	16.2	Repair beach access point (SLA02).
	16.3	Delineate Reserve and Freehold tenure though the installation of post and rail fencelines.
	16.4	Install distance/direction markers where required to facilitate pedestrian travel between local parks.
Zone F | Lamberts Beach (Ram Chandra Park) (6.5ha)		
17	**Vegetation management**	
	17.1	Control major target weed species including Guinea grass and prickly pear.
	17.2	Undertake revegetation throughout the zone (foreshore and roadsides) to increase connectivity and habitat for native animals along the coastal corridor and provide shade
18	**Recreational opportunities**	
	18.1	Consider the establishment of a multi-use path within Ram Chandra Park to link park facilities to beach access points. Accompany the installation of access points with revegetation.
	18.2	Install a beach access point (LAM03) near the lifeguard tower and consider whether additional access points are required.
	18.3	Formalise the beach access track at the southern end of Lamberts Beach (LAM04). Investigate opportunities to make LAM04 an all abilities beach access point.
	18.4	Install distance/direction markers where required to facilitate pedestrian travel between local parks.
19	**Erosion management**	
	19.1	Implement recommendations as described in *Lamberts Beach: recovery and erosion management* (Alluvium 2017).
Zone G | North Harbour Beach (19ha)		
20	**Vegetation management**	
	20.1	Control major target weed species including: lantana, Guinea grass, pink periwinkle, prickly pear, Singapore daisy and beach evening primrose through cross tenure collaboration between SPR trustees and NQBP. A key focus area for weed control is the dune system along North Harbour Beach.
	20.2	Supplement removed weed species with native vegetation, particularly along the frontal dune.
	20.3	Facilitate native vegetation regeneration throughout the zone through strategic weed management.
	20.4	Control weeds on and around well used areas including highly dispersive weeds such as cobbler's peg and Seaforth burr.
	20.5	Monitor and manage other problematic weed species including, but not limited to red natal grass, tridax daisy, prickly starwort, common guava, Chinese burr, blue couch, stylo, molasses grass, corky passion vine, passionflower, thatch grass, snake weed, couch grass, siratro, painted spurge, sensitive weed and *Solanum* sp.
21	**Access management**	
	21.1	Reinstate walking trail infrastructure within SPR and onto North Harbour Beach.
	21.1	Repair and formalise beach access points SPR01 and SPR02.
	21.2	Consider extending the path to beach access point NHA01.

22	**Conservation management**	
	22.1	Review the *Draft Slade Point Reserve Management Plan (2008-2018)*.
	22.2	Undertake detailed monitoring of the unique parabolic dune system along North Harbour Beach and in agreement with NQBP, develop an application to the Department of Environment Heritage Protection (DEHPa) to list the parabolic dunes unique to the Slade Point region as a site of geological/geomorphological significance.
	22.3	Revisit the *Land Use Plan - Port of Mackay* (2009) and reconfigure access (both public beach access and road access) to protect features of National Heritage Value (i.e. vegetation communities and its associated geological values within the Mackay Port Authority Conservation Reserve). Renegotiate Slade Point Planning Scheme Zonation (2013) to include appropriate measures to protect land use of the Special Activities (Port).

Other activities across multiple zones		
23	**Cultural heritage**	
	23.1	Engage Traditional Owners to undertake cultural heritage surveys of the area to outline clear management objectives for the preservation of cultural heritage within the coastal unit.
24	**Signage**	
	24.1	Audit all beach access signs across the coastal unit and update or install: ▪ Signage at the landward end of each beach access point that clearly identifies the beach access number, restricted activities, hazards present and provides information on the appropriate first aid treatment for marine stingers. ▪ Beach access numbering signage at the seaward end of each beach access point.
	24.2	Install pathway linkage signage that describes pathway routes and beach access tracks and include measured walking distances where appropriate.
	24.3	Accompany rehabilitation areas with signage (both regulatory and informative).
25	**Waste management**	
	25.1	Inform residents of appropriate waste disposal methods. Follow up with education, regulation and enforcement activities.
	25.2	Educate the community on the impacts of waste on native vegetation, dune health, and wildlife.
	25.3	Assess stormwater outlets and consider installation of Gross Pollutant Traps on stormwater drains close to the source of contaminants.
26	**Tourism**	
	26.1	Investigate opportunities for increased tourism visitation to the area.
27	**Education**	
	27.1	Partner with Coastcare and others to deliver education programs about: ▪ Local weed species and the use of local native species in residential gardens. ▪ Garden waste and general waste disposal. ▪ Responsible pet ownership and how to protect native wildlife.
28	**Monitoring**	
	28.1	Undertake beach profile monitoring and monitor sea level rise to guide future coastal planning and works.
	28.2	Consider a regional study on the long-term sediment (sand) supply for the Mackay coastline.
	28.3	Monitor, or in partnership with others, facilitate the monitoring of shorebirds and turtles.

Table 2: *Recommended activities for the Slade Point Local Coastal Plan*

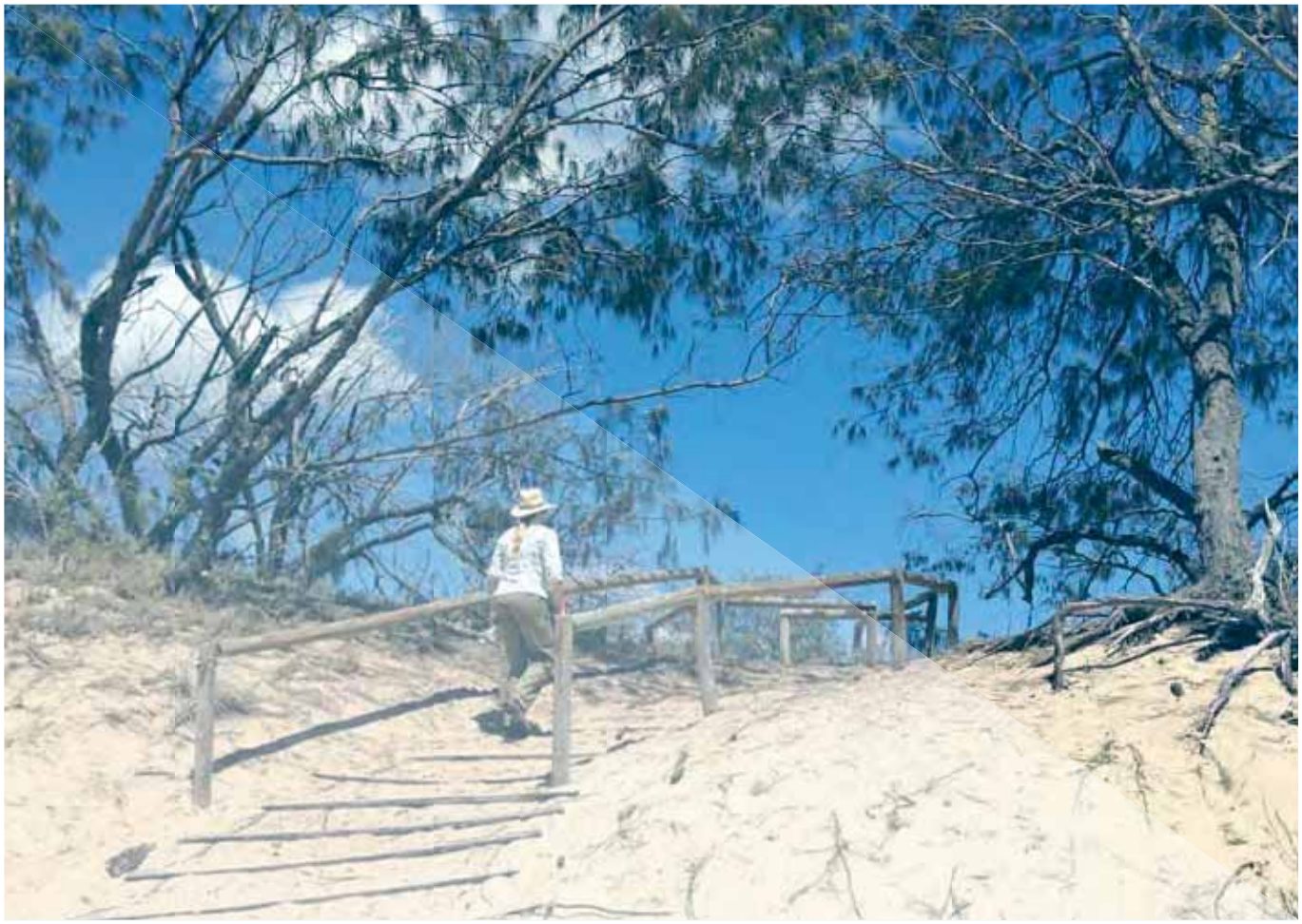
29	**Climate change**	
	29.1	Consider how to manage future predicted reduction in coastal land to retain buffer above the high tide mark (e.g. rolling boundaries).
	29.2	Plan for retreat as required.
	29.3	Review existing revegetation list to ensure that species reflect diversity of all Regional Ecosystems present in coastal unit and in preparation for future predicted climates.
30	**Legislation and local laws**	
	30.1	Use available legislation to protect existing native vegetation on Esplanade and Reserve tenure as required.
	30.2	Using existing laws, undertake enforcements and compliance activities across the area, particularly relating to unrestrained dogs and motor vehicles in park and beach areas.
	30.3	Review and update this document in line with changing legislation.
31	**Community involvement**	
	31.1	Provide opportunities for community members to be involved in coastal management activities at formal Coastcare events.
32	**Enhancement of surrounding areas**	
	32.1	Implement a tree succession plan across the length of the coastal unit.
	32.2	Implement a roadside vegetation program to increase the amount of street trees along roads.
	32.3	Vegetation screening of sewage and other utility substations will enhance the intrinsic beauty and subsequent value of the area.
33	**Access management**	
	33.1	Install regulatory signage to protect shorebird and potential marine turtle populations.
	33.2	Consider pathway linkages and/or distance/direction markers to improve connectivity between parks.
34	**Vegetation maintenance**	
	34.1	Continue to protect and enhance vegetated dune systems.
	34.2	Work with freehold property owners to facilitate protection and appropriate management of significant native vegetation on private land.

8 Implementation and review

The implementation of the *Slade Point Local Coastal Plan* will occur on a prioritised basis as resources become available. In addition to council's Natural Environmental staff and Natural Environment Levy funding, multiple external opportunities for funding and resources to assist in the implementation of the Local Coast Plan exist. These include:

- Federal Government grant opportunities.
- State Government grant opportunities.
- Corporate grant opportunities.
- Regional Natural Resource Management (NRM) group (Reef Catchments Mackay Whitsunday Isaac) partnerships.
- Specialist organisations (such as the Mackay and District Turtle Watch Association, Birdlife Mackay, and Queensland Wader Study Group).
- Local community groups.
- Local community volunteers as part of the Coastcare program.

A formal review of the *Slade Point Local Coastal Plan* should take place every five years as feasible. However, Council may seek to update the Plan at any stage based on the results of monitoring programs, and in line with further protecting the natural environment values of the area.



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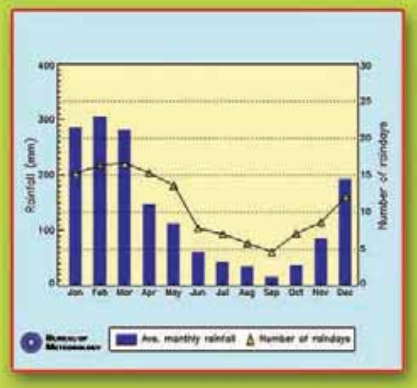
Fire Management Guidelines for Central Queensland Coast

Mangroves and Estuarine Wetlands

Landscape 1

Mangroves, saltmarsh, saltwater couch, areas of saltpan and fringing melaleuca forests and pandanus.



The Clarke Connors Range
bushfire consortium

1

Introduction

Reef Catchments and the Clarke Connors Range Bushfire Consortium

Reef Catchments is a community based, not-for-profit organization that has a proven track record in advancing natural resource management in the Mackay-Whitsunday Region. Reef Catchments works seamlessly across the private and all levels of the public sectors to deliver the results where they matter. For more information andcontact details visit the website www.reefcatchments.com.au

The Bushfire Consortium was formed to begin reducing the threat of inappropriate fire on the outstanding natural and economic values of the Clarke-Connors Range on the Central Queensland coast. This area experiences an extremely variable climate and satellite imaging illustrates that numerous large and intense dry season wildfires have occurred over the last 10 years. The concern is that a drier and hotter climate may further increase the incidence of these fires with consequent environmental and economic impacts. Rural communities recognise the magnitude of these fires, and their effects on life, property, productivity, and the environment. However, the wider community has not had access to good information on appropriate fire management practices until now.

Reef Catchments, in partnership with Volunteer Rural Fire Brigades, Government and non-Government landholders, and the Queensland Fire and Rescue Service, has taken up the challenge of providing the best information available on fire management and planning in the region. These Fire Management Guidelines are the culmination of extensive discussions with experienced members of Volunteer Rural Fire Brigades and other respected fire managers and fire scientists.

These Guidelines are one of the products of the Bushfire Consortium and are intended to be used by Volunteer Rural Fire Brigades and landholders who are on the front line in managing fire in rural communities. They are intended to be used to help land managers plan hazard reduction burning, and in undertaking planned burns for improved production and conservation outcomes.

Using these guidelines

These Fire Management Guidelines have been developed for 12 landscape types in the Mackay Whitsunday region. These landscape types are composed of vegetation types that require similar fire prescriptions.

Four important factors to consider when planning for fire management are:

1. Fire Frequency - how often should an area be burnt.
2. Fire intensity - how hot does the fire need to be.
3. Season - what time of year will usually provide the desired conditions for a planned burn;
4. Burning mosaic - the percentage of ground cover remaining unburnt after a fire.

Other important factors to consider are fuel loads, wind speed, humidity, fuel curing, slope and aspect.

These guidelines are not intended to account for all circumstances. Seasonal, yearly and even daily conditions can vary dramatically. Plan ahead to carry out burns when conditions are suitable and always obtain and adhere to conditions of a permit from your fire warden.

Green - Under most circumstances the number of years between burns should fall within the GREEN range. This range is generally considered appropriate for fire hazard management, production and conservation outcomes.

Orange - Under some circumstances there may be a need for more or less frequent fire but this should fall within the ORANGE range. Generally, this would occur as a 'one off' e.g. two fires in 3 years to reduce a lantana infestation.

Red - Generally, it would be considered undesirable for fire frequency to fall within the RED range. For example these long periods of time between fires would result in undesired vegetation thickening and loss of pasture productivity.

Note. Defining frequency by 'Years' can be misleading e.g. in times of drought or particularly high rainfall. Some fire managers prefer using 'average years.' (defined by having received +/- 20% of the local average annual rainfall by May).

Green - Under most circumstances the desired conditions will be available within the GREEN range of months.

Orange - Desired fire conditions will sometimes fall within the ORANGE range of months and/or the specific requirements for a particular burn will differ in a particular circumstance e.g. Storm burning requires relatively high soil moisture.

Red - Under most circumstances, conditions within the RED range of months would result in damaging fire and/or fire that is difficult to control.

Patchy fuels produced by mosaic burns can be very effective in reducing the intensity and spread of wildfire without risking the complete loss of pasture grasses, loss of soil and nutrients, weed infestations or environmental damage that sometimes result from complete removal of the ground layer from large areas.

Different fire intensities perform different land management tasks as described within the guidelines.

LOW intensity fire is < 1m in height.

MODERATE intensity fire is < 2m in height.

HIGH intensity fire is > 2m in height.

The Clarke-Connors Range Bushfire Consortium is a Reef Catchments initiative with funding support from the Australian Governments Caring for Our Country and Queensland Governments Blueprint for the Bush.

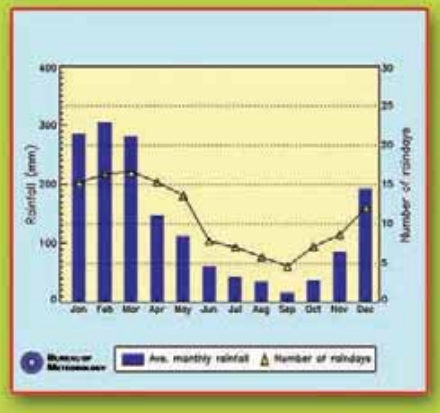
The Clarke Connors Range bushfire consortium

Mangroves and Estuarine Wetlands

Landscape 1

BURNING IS GENERALLY NOT RECOMMENDED IN THIS LANDSCAPE

Mangroves, saltmarsh, saltwater couch, areas of saltpan and fringing melaleuca forests and pandanus.



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Hazard Reduction

Saltmarsh and saltwater couch grasslands are regularly inundated by high tides which maintain high soil moisture and ensure continual green growth throughout the year. Because of this these areas rarely represent a fire hazard risk. Risk is further minimised by the fact that the grasslands rarely accumulate large amounts of fuels and tend to be broken up by patches of saline clay and sparse saltmarsh.

The native ground cover within fringing melaleuca woodland and forests is also saltwater couch and this does not representahigh fire hazard. However, in many areas Guinea grass and other exotic grasses have invaded and these can accumulate high fuel loads that pose a fire risk in the dry season. Guinea grass and many other exotic grasses tend to quickly increase their biomass after fire, often reaching a similar fuel load in as little as one season. The most effective long-term fire hazard reduction strategy is to remove these grasses using herbicide such as glyphosate.

Production

Because of high salt levels in the soil, weed infestations are rarely a problem in saltwater couch grasslands and burning for weed control does not need to be undertaken. Saltwater couch is a perennial grass and pasture condition is strongly dependant on normal tidal cycles. Fire does not improve productivity and indeed, fire can lead to loss of important nutrients. Saltmarsh and saltwater couch grasslands are an important food source, and refuge for juvenile fish. There is strong evidence that juvenile fish feed heavily in these areas on high tides. A decrease in biomass through removal by fire, or overgrazing, may have a significant impact on coastal fisheries production.

Conservation

Apart from their values to coastal fisheries, mangroves, saltmarsh and saltwater couch grasslands provide essential habitat for a range of conservation dependant species. Minimising fire and other disturbance within these areas provides significant positive benefits for migratory and resident shorebirds, seabirds and the threatened mangrove mouse.

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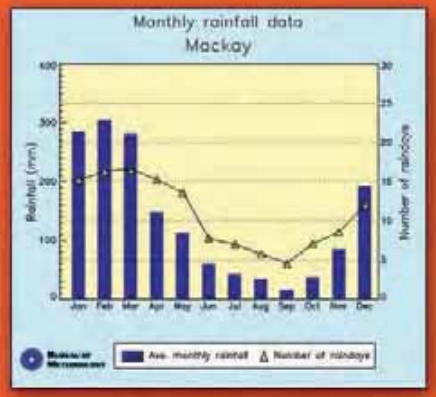
Beaches and foreshores

Landscape 2

THIS LANDSCAPE IS EXTREMELY FIRE SENSITIVE - NO BURNING

Coastal she-oak & beach scrub (rainforest) in protected areas.



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Hazard Reduction

Coast she-oak and beach scrub habitats are fire sensitive and will be killed or severely degraded by even low intensity fire.

The native ground cover within beach scrubs and coastal foreshores does not accumulate large amounts of fuel and does not represent a high fire hazard. However, infestations of exotic grasses and weeds can significantly increase hazardous fuels, especially along disturbed edges of this landscape.

Hazard reduction burning is generally not suitable in coastal areas as Guinea grass and other fire loving grasses quickly increase their biomass after fire, often reaching a similar fuel load in as little as one season.

An effective long-term strategy is the use of registered herbicide to reduce fuel hazards where required. Apply when grasses are actively growing, preferably prior to dry season. .

Production

Many remaining areas of beach scrub are islands in a sea of cleared land, and much remaining foreshore vegetation is the only buffer between the land and the sea.

Undisturbed foreshores and beach scrubs are fairly resistant to weed invasions, however smaller patches and disturbed areas are more prone to weed invasions and associated fire risk.

Disturbance caused by stock trampling and the presence of feral pigs can encourage spread of lantana and other weeds into otherwise intact areas. Management of stock access and provision of shade and watering points away from beach scrub and foreshores will reduce the impacts of disturbance in the long term.

Reducing weed impacts by means other than fire around buffers and in degraded areas will protect, and facilitate recovery of, these sensitive coastal areas.

Conservation

Fire is a key threat to remaining areas of beach scrub (rainforest on sand dunes) - a critically endangered ecological community under the National Environment Protection and Biodiversity Conservation Act (1999). Beach scrubs and foreshores are key habitats for many rare and threatened plants and animals and migratory birds. Foreshores are breeding sites for marine turtles and shorebirds such as the beach stone- curlew (pictured above).

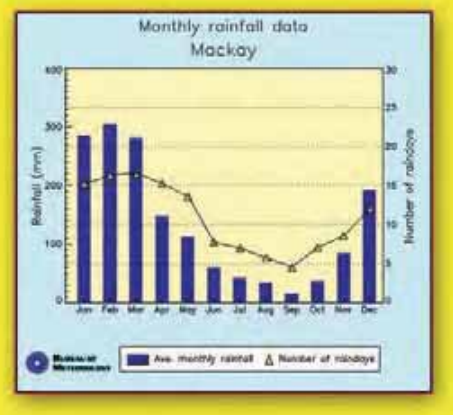
Disturbance of these habitats, commonly due to arson; clearing/mowing of undergrowth; stock trampling; 4WD and pedestrian tracks, leads to weed invasions and increased fire risk. Weed management, rather than fire management, should be used to protect and rehabilitate remaining areas.

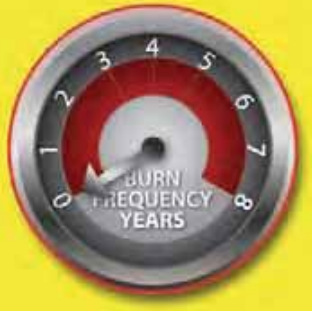
Very careful use of fire in adjacent fire prone landscapes is required; check that these is little to no scorch into beach scrubs and foreshores as an indicator of successful fire management.

Hind Dunes

Landscape 3

Mixed vegetation on hind dunes (behind main beach and foreshore areas) including; Moreton Bay ash, acacia, coastal banksia, paperbarks, bloodwoods, black she-oak, peppermint and stringy barks & grasslands on sand dunes





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Hazard Reduction

Burning is not generally recommended in coastal dune systems and adjacent buffer zone unless for rehabilitation or protection purposes in special circumstances.

Exotic grass infestations such as Guinea grass are common along the edges of coastal dune vegetation. Many introduced grass are favoured by disturbance and rapidly re-grow after fire, often accumulating similar fuel loads in as little as one season.

Landowners in some built up areas may desire protection burning to reduce hazards. Fire should only be used to gain initial control of weedy areas as part of a long term weed management strategy. Burn with low intensity fire; ensure good soil moisture is present (e.g. after 50mm of rain) no more than once every 3-5 years. Avoid regular or repeated burning and do not burn in dry conditions when risk is high.

Management of exotic grasses and other weeds is best achieved by using a registered herbicide when the plant is actively growing. Guinea grass is easily killed after fire with minimal herbicide use.

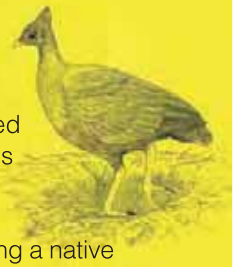
Production

Clearing and introduction of exotic pasture species coupled with impacts of stock can severely impact on fragile dune systems. Exotic species can out-competenatives in disturbed areas and alter natural fire regimes

Open dune grasslands supporting native grasses such as black spear grass would tolerate a low intensity fire every 3-7 years. Planned burns should only be conducted when rapid regeneration of the grassy layer is expected; burn with good soil moisture and where there is a good chance of follow up rain. Avoid regular or repeated burning as loss of groundcover and soil nutrients will encourage weeds and less favourable grasses.

Disturbance of ground layer leads to weed invasions and loss of native grasses. Minimise disturbance from stock trampling and manage weeds using other methods than fire.

Conservation



Lack of knowledge of this ecosystem and its need for fire is a major obstacle to effective fire management. In general, fire should only be applied for regeneration of native grasses and canopy trees and responses carefully monitored.

Fire management could be trialled in areas supporting a native grass ground layer. A low intensity fire no more than once every 3-7 years with good soil moisture is advised. Indicators of successful fire managementinclude: germination of canopy tree species; maintaining native grass density; fauna abundance; and reducing exotic grass dominance.

Many areas supporting beach scrub pioneer species in the understorey will naturally revert to beach scrub; actively exclude fire from these areas.

Coastal landscapes support a diverse range of plants and animals and their habitats are vulnerable to disturbance. Reducing disturbance and managing weeds rather than fire will protect coastal habitats and wildlife such as the orange footed scrub fowl (pictured above).

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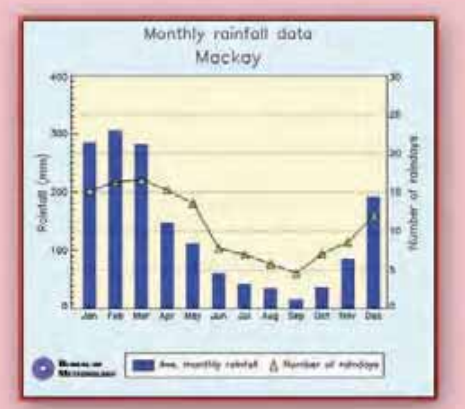
Eucalypt forest and woodlands on hill slopes, ranges and ridges

Landscape 9

Variable woodlands to open forests of ironbark, Moreton Bay ash, bloodwoods, poplar gum, blue gum, yellow stringybark, brushbox, white mahogany, lemon scented gum, depending on altitude and exposure.



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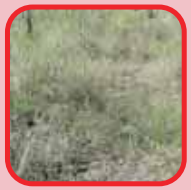
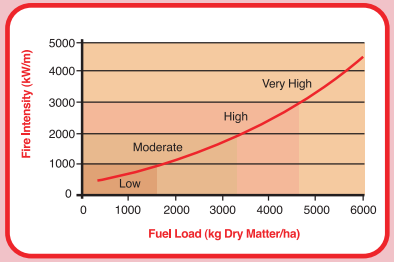
1000 kg / ha

2000 kg / ha



3000 kg / ha

4000 kg / ha



Fuel Load
(kg Dry Matter/ha)

Hazard Reduction

Fire intensity, and therefore risk, increases as the dry season progresses when fuel and soil moisture is low. Conversely, fires in the early dry and wet seasons are usually of lower intensity and more patchy.

Guinea grass and other fire-favoured introduced grasses rapidly colonise burned or otherwise disturbed areas, often reaching very high fuel loads in as little as one season. Because of its superior adaptation to fire, guinea grass will out-compete native and desirable species if burnt too regularly or in dry conditions, and spread into new sites.

To reduce the severity of wildfires and the threat they pose to life and property:

- Coordinate controlled burns with neighbours to manage fuel hazards and maintain a mosaic of different ages of vegetation in the landscape;
- Aim to burn 20-40% of a patch or property in a year. Remaining grassy patches can be re-lit or sprayed in protection zones post-fire;
- Vary the timing and frequency of burning & burn with good soil moisture. Burning is generally not advised between September & December unless after rain with a high chance of follow up rain;
- Observe response of vegetation and fuel load accumulation and adapt management if needed;
- Construct and maintain strategic fire breaks in populated areas or 'hot spots', potentially across several properties.

Production

Burning season and years between burns will vary depending on seasonal climatic conditions, grazing pressure, the type of eucalypt community and whether country has a grassy or denser shrub understorey. Varying the season, intensity and area burnt will create a mosaic of habitats; whereas too frequent fire (annual or every second year) reduces understorey and has serious impacts on soil health and long term sustainability.

A fire after 50mm or more of rain (or first storms) every 3 to 5 years (longer in dryer and/or steeper and/or heavily grazed country) will maintain a good balance of trees and grass. A dense shrub layer or thicker regrowth may increase with longer intervals.

For effective control of woody regrowth and dense shrub layer the undergrowth, fuel loads of at least 1,500 kg/ha are required. Tree and shrubs below approximately 2m high will be suppressed with a moderate intensity fire; however control of regrowth greater than 2m will be difficult as greater fuel loads are required and most eucalypts will re-sprout after fire.

Care must be taken to protect adjacent rainforest and creek edges from hot fires. Igniting along rainforest edges and allowing fire to burn downhill will reduce intensity and resulting damage to fire sensitive vegetation.

Country may need to be de-stocked prior to a burn to allow fuels to accumulate. Wet season spelling after fire will promote native grasses and diversity in ground cover.

Conservation

Planned burning in this landscape should aim to promote patchy fires to ensure a mosaic of different vegetation types and time since fire across the landscape. Rangelands are prone to widespread intense fires in the dry season which is a key threat to biodiversity.

Fire too regularly leads to a loss of vegetation cover and directly threatens yellow-bellied glider, rufous owl and glossy back cockatoo habitat and the mature hollow bearing eucalypts they depend on. Rocky outcrops in the forest are essential habitat for the endangered northern quoll. Do not burn between mid-September and mid-December when juvenile quolls are most vulnerable to fire.

In potential or known quoll habitat, small scale patch burns of 17ha or less are best - burn with good soil moisture or just after the wet season when the ground, leaf litter & vegetation are still very wet. Burn around every 5-7 years and leave some areas unburnt for 7 years or longer, especially in years after a hot fire has occurred. Controlling weeds (especially lantana), woody regrowth and rainforest invasion is a major focus of planned burning in most areas. Dense areas of lantana may require well planned hotter fires to reduce infestations. Frost or herbicide spray before a burn can cure fuels and give better control.

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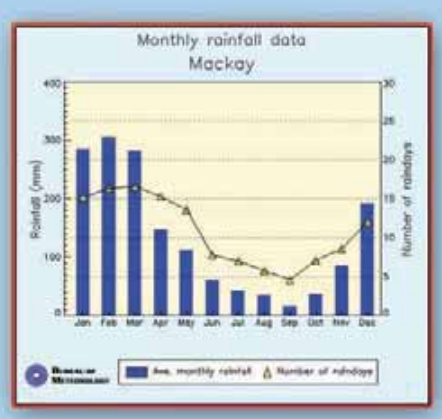
Island and rocky headland landscapes

Landscape 12

Grassy headlands to acacia and brushbox and ironbark forest-shrubland, blue gum and poplar gum woodlands (including hybrids), Moreton Bay ash and blue gum woodland with a dense understorey of vine forest species.



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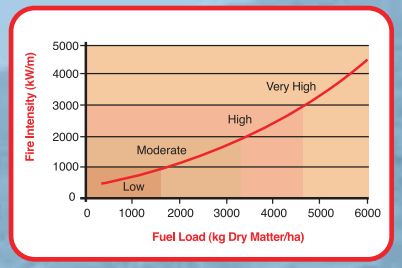
1000 kg / ha

2000 kg / ha

3000 kg / ha

4000 kg / ha



Fuel Load (kg Dry Matter/ha)

Hazard Reduction

Island woodlands and coastal headlands can be infested with introduced grasses and lantana which promote hotter fire are rapidly regrow after fire. In general, it is the more disturbed areas impacted by weeds. Disturbance can be from repeated fires in the past.

Control of weeds and exotic grasses by means other than fire may be preferred in areas surrounding campgrounds, island leases and picnic areas.

Where hazard reduction burning is required, fuel loads of 1500kg/ha are adequate to ensure fire intensity is low to moderate. Greater fuel loads will increase fire intensity and the chance of fire spreading.

On the mainland, four wheel drive tracks and other areas of high visitation are a conduit for introducing weeds which can pose a fire risk to surrounding areas.

Conservation

Some areas of open grassland are being invaded by woodland or vine forest pioneers whilst other areas remain as open grasslands. Research is needed to determine the role of fire in maintaining vegetation types to determine optimum fire regimes.

Dense thickets of swizzle bush (Timonius timon) are replacing grasslands in some areas. Swizzle bush flowers and fruits between July & November, and could be set back if burnt at during this time. Hotter fires may be needed to reduce woody vegetation and maintain an open canopy, requiring fuel loads of 2000-3000 kg/ha.

Maintain extent and area of grasslands, where they remain by trialling burning every 2-3 years with a low-moderate intensity fire; retain at least 50% unburnt. Monitor vegetation and adapt management depending on response to fire regime.

Lantana can be managed by fire in the same way as other woody vegetation. Suitable fuel loads must be available, between 2000-3000 kg/ha, to reduce infestations. Slow burning moderate intensity fire can suppress lantana as it damages the root and lower stem zone.

RE 8.1.1 describes the mangrove community that is establishing northwest of Swallow Street Park and dominates the McCreadys Creek estuarine environment. This ecosystem is clearly distinguished by its dominance of mangrove tree and shrub species (EPA 2004), which thrive in the in muddy, saline, intertidal areas, common to the estuary and can form different compositional communities depending on their position in relation to tidal channels and frequency and abundance of freshwater flushes. This mangrove vegetation is exposed to marine debris, disturbance due to alteration of adjacent ecosystems (e.g. rock wall) and stormwater runoff. Recreation activities such as fishing/crabbing also influence the health of this ecosystem. While offshore vegetation is not within council land tenure, it is important to consider the influence of onshore activities. Appropriate management of recreational access and improved stormwater management practices will assist in protecting these offshore ecosystems. Interpretive signage would assist in the prevention of illegal waste dumping experienced in adjacent vegetation. Generally, this ecosystem is resilient to weed invasion due to its saline growing conditions however lantana (*Lantana camara)* occasionally encroaches in less saline areas. Depending on their position in relation to tidal channels and the amount of freshwater received; the mangroves can form a variety of different compositional communities. At the seaward edge RE 8.1.1 *Rhizophora* species dominate, whereas white mangrove (*Avicennia marina*), blind-your-eye mangrove (*Excoecaria agallocha*), puzzle nut mangrove (*Xylocarpus moluccensis*), black mangrove (*Lumnitzera racemosa*), yellow mangrove (*Ceriops species*), myrtle mangrove (*Osbornia octodonta*) and other predominant species (*Bruguiera* and *Rhizophora* species) are more likely to occur on the landward side. Mangrove communities are vital breeding grounds for a diverse range of species including invertebrates, crocodiles and reef fish species and are therefore both culturally and biotically significant ecosystems. Mangroves are highly fire sensitive and therefore can be put at risk when flammable vegetation such as grassy weed infestations are present in adjacent areas. Fire Management Guidelines for Regional Ecosystems within the Slade Point coastal unit area can be found within the Clarke Connors Ranges Fire Management Guidelines (Reef Catchments 2009).

RE 8.2.1 describes *Casuarina equisetifolia* woodland and/or sparse herbland to open scrub on foredunes and beaches and is easily recognisable along the foredune of North Harbour Beach. It can be distinguished from all other regional ecosystems as it is predominantly distributed along the foredunes and typically comprised of species such as coastal she-oak (*Casuarina equisetifolia*) and ground cover species such as beach spinifex (*Spinifex sericeus*), beach bean (*Canavalia rosea*), goats foot (*Ipomoea pes-caprae*) and birds beak grass (*Thuarea involuta*). Common species in the canopy or lower tree and shrub layers include: tulip tree (*Thespesia populnea*), silver bean (*Sophora tomentosa*), beach pandan (*Pandanus tectorius*), beach hibiscus (*Hibiscus sp.)*, soapy ash (*Alphitonia excelsa*), flintwood (*Geijera salicifolia*) and gray nicker nut (*Caesalpinia bonduc*). Shrub layers often include: coastal vitex (*Vitex trifolia*), coastal lollybush (*Clerodendron inerme*), tuckeroo (*Cupaniopsis anacardioides*), forest indigo (*Indigofera pratensis*), beach berry bush (*Colubrina asiatica*), and octopus bush (*Argusia argentea*). Vegetation within this community is usually zoned according to tidal inundation/exposure with the herbaceous communities closest to the sea and the open forest to woodland communities furthest landward. Disturbance can result in erosion and weed invasion, where problematic weeds include: Mossman River grass (*Cenchrus echinatus*), red natal grass (*Melinis repens*), lantana (*Lantana camara*), tridax daisy

(*Tridax procumbens*), prickly starwort (*Salsola australis*), Guinea grass (*Megathyrsus maximus*), pink periwinkle (*Catharanthus roseus*) and prickly pear (*Opuntia stricta*). Species within this RE are fire sensitive and the removal of ground layer vegetation often results in infestation of pest species such as Guinea grass (*Megathyrsus maximus*), red natal grass (*Melinis repens*) and other weed species, which intensify fire risk.

RE 8.2.2 describes a semi-evergreen microphyll vine thicket to vine forest on coastal dunes. This vegetation community is known to stabilise sand dunes and can protect coastal communities and inland vegetation from storm surges. Up to 1 ha of this critical endangered beach scrub exists within the coastal unit within SPR and is fragmented from surrounding beach scrub occurrences (i.e. small lots along Gannet Street). It is threatened by encroachment (i.e. mowing) and weed infestations. Reserve tenure supports the protection of this ecosystem from threats associated with coastal development and recreational use. The height of the canopy varies between 1-25 m and is dependent on the level of exposure to external factors such as salt laden winds. RE 8.2.2 canopy consists primarily of rainforest species on coastal dunes with trees such as red condoo (*Mimusops elengi*), tuckeroo (*Cupaniopsis anacardioides*), and in some places, brown tulip oak (*Argyrodendron polyandrum*), scaly ebony (*Diospyros geminata*), yellow tulipwood (*Drypetes deplanchei*), droopy leaf (*Aglaia elaeagnoidea*), canary beech (*Polyalthia nitidissima*), scaly ash (*Ganophyllum falcatum*), yellow boxwood (*Planchonella pohlmaniana*), mongo (*Sersalisia sericea*) and peanut tree (*Sterculia quadrifida*). A low tree or shrub layer and the ground layer is present but sparse. Vines such as burney vine (*Trophis scandens*), native jasmine (*Jasminum didymium*) and smooth water vine (*Cissus oblonga*) are common and epiphytes such as the golden orchid (*Dendrobium discolour*) are also found within the tree branches. Many plants found within this ecosystem will return after fire (i.e. rainforest pioneers), however the ecosystem is highly fire sensitive and should not be burned. Weeds alter the structure of the ecosystem and add to the fuel load, which translates to a greater risk of additional fire and high intensity fire. Disturbance by fire promotes weed infestation including by Guinea grass (*Megathyrsus maximus*). Reconsideration of tenures of freehold land that includes this critically endangered ecosystem to ensure adequate protection is recommended. Problem weeds include: include: lantana (*Lantana camara*), pink periwinkle (*Catharanthus roseus*), Seaforth burr (*Cenchrus echinatus*), corky passionflower (*Passiflora suberosa*), tridax daisy (*tridax procumbens*) and common guava (*Psidium guajava*).

RE 8.2.9 describes Tussock grassland on coastal dunes and is the only grassland regional ecosystem on sand dunes in the Central Queensland Coast bioregion. The largest representation of this regional ecosystem occurs within Slade Point. This grassland community is very sensitive to erosion and threats include weed invasion, urban development and uncontrolled pedestrian traffic. The community is dominated by giant spear grass (*Heteropogon triticeus*) and/or blady grass (*Imperata cylindrica*) and/or kangaroo grass (*Themeda triandra*) open tussock grassland to closed tussock grassland. Common subdominant grasses may include coastal love grass (*Eragrostis interrupta*), black spear grass (*Heteropogon contortus*), wanderrie grass (*Eriachne triodioides)*, tall kerosene grass (*Aristida holathera var. holathera*), barbed wire grass (*Cymbopogon refractus*) and black-seed grass (*Alloteropsis semialata*). Several herbs and sedges many be associated with this community and can include woolly glycine (*Glycine tomentella*), love vine (*Cassytha filiformis*), two joint desmodium (*Aphyllodium biarticulatum*), tarvine (*Boerhavia spp*), scurvy weed (*Commelina ensifolia*), old man's cap (*Polycarpaea corymbosa*), slender dwarf morning glory (*Evolvulus alsinoides*), arrow leaf morning glory (*Xenostegia tridentate*) and common everlasting (*Chrysocephalum apiculatum*). Other common species include Java sedge (*Cyperus javanicus*), *Schizachyrium spp*., lemon scented grass (*Elionurus citreus*), hairy trefoil (*Desmodium rhytidophyllum*), beach star (*Cyperus pedunculatus*), fuzzy rattlepod (*Crotalaria montana*), *Bulbostylis barbata*, *Mnesithea rottboellioides*, cornet grass (*Perotis rara)*, *Zornia dyctiocarpa var. filifolia*, sand rattlepod (*Crotalaria mitchellii*), smooth flax lily (*Dianella longifolia*), firegrass (*Schizachyrium fragile*), spade flower (*Hybanthus enneaspermus*), flatsedge (*Cyperus scaber*) and stiff leaved spermacoce (*Spermacoce brachystema*). The most serious weed is blue couch (*Digitaria didactyla*), which was possibly sown as a pasture species in the Slade Point area. Other common weeds include red natal grass (*Melinis repens*), snake weed (*Stachytarpheta jamaicensis*), Seaforth burr (*Cenchrus echinatus*), tridax daisy (*Tridax procumbens*), couch grass (*Cynodon dactylon*), hairy pigweed (*Portulaca pilosa*), Mexican clover (*Richardia brasiliensis*), crowsfoot grass (*Dactyloctenium aegyptium*), siratro (*Macroptilium atropurpureum*) and Guinea grass (*Megathyrsus maximus*). Unlike surrounding vegetation communities, RE 8.2.9 requires fire to maintain diverse structure and composition every 4-6 years. Burns should only be planned and conducted when rapid regeneration of the grassy layer is expected (DEHP 2018). A fire management strategy has been prepared by QPWS in 2004 to provide guidance on appropriate fire management strategies for the reserve (MRC 2008).

8.2.14 describes *Banksia integrifolia subsp. compar* and/or *Corymbia tessellaris* and/or *Acacia disparrima subsp. disparrima* shrubland to open forest. Within Slade Point Reserve, RE 8.2.14 includes a small area of rainforest that contains a patched mosaic of coastal banksia *(Banksia integrifolia)*, coastal she-oak *(Casuarina equisetifolia)* and bare sand. Species associated with this RE include weeping cabbage palm *(Livistona decora), Jasminum sp*. tuckeroo *(Cupaniopsis anacardioides),* tea tree *(Leptospermum sp.),* wattle *(Acacia sp.)* and foam bark *(Jagera pseudorhus var. pseudorhus)*. The sparse ground layer includes blady grass *(Imperata cylindrica)*, giant spear grass *(Heteropogon triticeus)*, coastal love grass *(Eragrostis interrupta)* and blue flax lily *(Dianella caerulea)*. Processes such as clearing for coastal development and disturbance by recreational users have reduced the quality of this ecosystem. The fire management strategy discourages deliberate burning of this RE, instead encourages adjacent burns to fire adapted ecosystems under optimal conditions to avoid fire penetration Infestations of exotic grass such as Guinea grass *(Megathyrsus maximus)* will reduce weed competition and reduce and fuel loads in the area.

RE 8.12.27b occurs together with 8.2.6a in the northern section of Zone G and describes *Corymbia tessellaris* and/or *Eucalyptus tereticornis* open forest commonly associated with codominant canopy species including pink bloodwood (*C. intermedia*) and Clarkson's bloodwood (*C. clarksoniana*). A mid dense to very sparse shrub layer of *Livistona decora* persists with associated species sometimes including swamp mahogany (*Lophostemon suaveolens*), albizia (*Albizia procera*), Tim Tim (*Timonius timon var. timon*), wattle (*Acacia spirorbis subsp. solandri*), prickly pine (*Bursaria incana*), cocky apple (*Planchonia careya*), broad leaf tea tree (*Melaleuca viridiflora var. viridiflora*) and various pioneering rainforest species. A minimal shrub layer consisting of isolated plants may be present and the ground layer is usually sparse to mid-dense. In the past this community was extensively found between Sarina and Hay Point, however fragmentation has resulted in a scant community scattered south of Eimeo to the eastern side of Connors Range 10km west of Carmila. This community is further threatened by fragmentation and weed incursion however some remnants have successfully regrown from very old clearing. Problem weeds include lantana (*Lantana camara*), red natal grass (*Melinis repens*), molasses grass (*Melinis minutiflora)*, Guinea grass (*Megathyrsus maximus*), billy goat weed (*Ageratum conyzoides subsp. conyzoides*), corky passion vine (*Passiflora suberosa*), passionflower (P. *pallida*), thatch grass (*Hyparrhenia rufa*) and tridax daisy (*Tridax procumbens*).

Encouraging the natural regeneration of native species is the best method for restoration of an area. For this to occur a viable seed bank must be present, and re-growth must include all native plant species from each stratum level. In areas where natural regeneration is to occur, the area should be clearly marked to exclude public access. In these areas, ongoing maintenance is required to minimise re-growth of weed species. However, the planting of local native vegetation (revegetation) is sometimes required due to insufficient cover or re-growth of native species.

Revegetation techniques

Revegetation in natural areas aims to reinstate Regional Ecosystems communities as described by Queensland Herbarium (Regional Ecosystem Description Database). In disturbed areas, pre-clearing mapping is available to inform what Regional Ecosystems were present prior to vegetation clearing.

Suggested techniques for coastal revegetation in the Mackay Regional Council area include:

- Local native species for planting should be sourced from within the Sarina Proserpine lowlands Subregion of the Central Queensland Coast Bioregion.
- Site preparation, such as weed control, should be carried out prior to planting.
- Depending on the site-specific circumstances coastal plantings may benefit from the use of mulch, weed mats, stakes, and/or tree guards.
- Tubestock planted in sandy soils will benefit from the addition of a wetting agent and fertiliser at the time of planting (eg. Terracottem).
- Ongoing maintenance of the site is required.

Consideration of fire risk

State Planning Policy 1/03 under the Sustainable Planning Act 2009 deals with the mitigation of adverse impacts of bushfire, and includes a natural hazard assessment for bushfires and the subsequent provision of safety buffers. According to this policy, a low hazard score and no prescribed safety buffer width is allocated to “narrow strips of coastal vegetation with a linear shape, less than 50 hectares in area and more than one kilometre from the nearest extensive vegetation, on 0-5% slope, with an eastern aspect” (Queensland Government, 2003).

All revegetation activities undertaken as part of coastal projects will be done so with consideration of this State Planning Policy. Designated space for fire breaks and emergency vehicle access will be provided between freehold properties and natural environment areas being revegetated, as per Mackay Regional Council Coastal Management Guidelines (2012).

Selecting plants for revegetation

The table below provides a generic list of recommended species for dune revegetation in the Mackay region, compiled from characteristic species of relevant Regional Ecosystems (8.1.1 8.1.2, 8.2.1, 8.2.2, 8.2.6a and 8.2.9a), various coastal species lists from Subregion 2, revegetation recommendations, and field observations.

The species selected for revegetation at any particular location will ultimately depend on current and preclearing Regional Ecosystem mapping, and site-specific conditions (such as aspect, topography, existing vegetation, soil condition, availability of appropriate plants, etc).

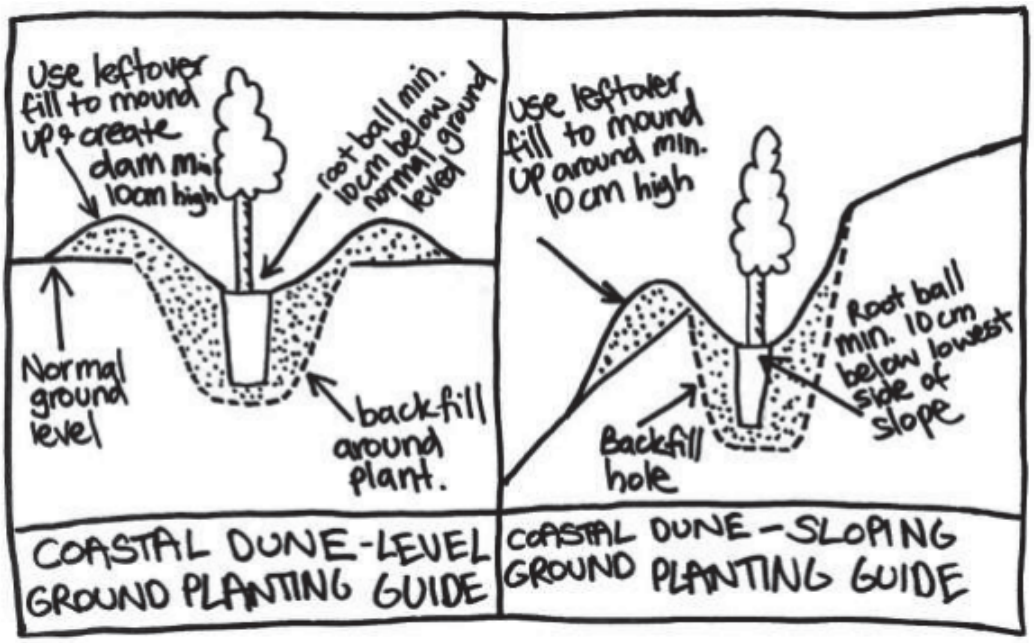


Figure 1: Coastal dune planting guide

APPENDIX 4*: Generic list of recommended species for coastal revegetation in the Mackay Region

** Local experts will be consulted for specific advice regarding unique vegetation communities, where appropriate.*

Species name	Common name	Habit	Regional Ecosystem
Acacia leptocarpa	north coast wattle, slender fruited wattle	Tree	8.2.6
Acacia oraria	coast wattle	Tree	8.2.2; 8.2.6
Acronychia laevis	hard aspen, glossy acronychia, yellow wood	Tree	8.2.2
Alphitonia excelsa	red ash, soapy ash	Tree	8.2.1; 8.2.6
Argusia argentea	octopus bush	Tree	8.2.1
Banksia integrifolia subsp. compar	coastal banksia	Tree	8.2.6
Calophyllum inophyllum	beauty leaf, beach calophyllum, ball nut	Tree	8.2.1
Canavalia rosea	beach bean	Groundcover	8.2.1
Capparis lucida	coastal caper	Tree	8.2.1; 8.2.2
Casuarina equistifolia	coastal she-oak	Tree	8.2.1
Chionanthus ramiflorus	native olive	Tree	8.2.2; 8.2.6
Clerodendrum floribundum	lolly bush	Tree	8.2.2; 8.2.6
Clerodendrum inerme	coastal lollybush	Shrub	8.2.1
Corymbia tessellaris	Morton Bay ash	Tree	8.2.6
Crinum pendunculatum	river lily, swamp lily	Herb	8.2.1
Crotalaria mitchellii	sand rattlepod	Herb	8.2.9
Cupaniopsis anacardioides	tuckeroo	Tree	8.2.1; 8.2.2; 8.2.6
Cymbopogon refractus	barbed wire grass	Grass	8.2.9
Cyperus pedunculatus	pineapple sedge	Sedge	8.2.1; 8.2.9
Dianella caerulea	blue flax lily	Herb	8.2.6; 8.2.9
Dianella longifolia	smooth flax lily	Herb	8.2.6a; 8.2.9
Diospyros geminata	scaly ebony	Tree	8.2.2; 8.2.6
Dodeonaea viscosa subsp.viscosa	sticky hop bush	Shrub	8.2.1
Drypetes deplanchei	yellow tulip	Tree	8.2.2
Eragrostis interrupta	coastal love grass	Grass	8.2.6; 8.2.9
Eriachne triodioides	wanderrie grass	Grass	8.2.6; 8.2.9
Eugenia reinwardtiana	beach cherry	Shrub	8.2.2
Euroschinus falcatus	ribbonwood	Tree	8.2.2; 8.2.6
Eustrephus latifolius	wombat berry	Climber	8.2.2; 8.2.6
Ganophyllum falcatum	scaly ash	Tree	8.2.2; 8.2.6
Geitonoplesium cymosum	scrambling lily	Climber	8.2.2; 8.2.6
Heteropogon triticeus	giant spear grass	Grass	8.2.2; 8.2.9
Hibbertia scandens	golden Guinea flower, snake vine	Climber/groundcover	8.2.1
Hibiscus heterophyllus	native hibiscus	Shrub	8.2.6
Imperata cylindrica	blady grass	Grass	8.2.6; 8.2.9
Ipomoea pes-caprae	goats foot convolvulus	Groundcover	8.2.1
Jagera pseudorhus	foam bark	Tree	8.2.6
Jasminum didymium	native jasmine	Climber/Shrub	8.2.2; 8.2.6
Lomandra longifolia	spiny-headed mat-rush	Herb	8.2.6
Macaranga tanarius	macaranga	Tree	8.2.2; 8.2.6
Mallotus philippensis	red kamala	Tree	8.2.2; 8.2.6
Melia azedarach	white cedar	Tree	8.2.6

APPENDIX 4: Generic list of recommended species for coastal revegetation in the Mackay Region

Species name	Common name	Habit	Regional Ecosystem
Mimusops elengi	red coondoo	Tree	8.2.2
Morinda citrifolia	giant morinda, cheese fruit, smelly cheese tree	Tree	8.2.1
Pandanus tectorius	beach pandan, coastal screw, pine pandanus	Tree	8.2.1; 8.2.6
Pittosporum ferrugineum	rusty pittospporum	Tree	8.2.1; 8.2.6
Planchonia careya	cocky apple	Tree	8.2.6
Pleiogynium timorense	Burdekin plum	Tree	8.2.2; 8.2.6
Scaevola taccada	sea lettuce	Shrub	8.2.1
Sophora tomentosa	silver bean	Shrub	8.2.1
Spinifex sericeus	beach spinifex	Grass	8.2.1
Sporobolus virginicus	marine couch	Groundcover	8.2.1
Stephania japonica	tape vine	Climber/groundcover	8.2.1; 8.2.2; 8.2.6
Sterculia quadrifida	peanut tree	Tree	8.2.2; 8.2.6
Terminalia muelleri	coast damson	Tree	8.2.1; 8.2.2; 8.2.6
Themeda triandra	kangaroo grass	Grass	8.2.6; 8.2.9
Thespesia populnea	tulip tree	Tree	8.2.1
Thuarea involuta	birds beak grass	Grass	8.2.1
Vigna marina	vigna	Groundcover	8.2.1
Vitex rotundifolia	creeping vitex, beach vitex	Groundcover	8.2.1
Vitex trifolia	coastal vitex, common blue vitex	Shrub	8.2.1
Xerochrysum bracteatum	golden everlasting daisy	Herb	8.2.9

View sensitive native plant list

Species name	Common name	Habit	Regional Ecosystem
Acacia simsii	Sim's wattle	Shrub	8.2.6
Caesalpinia bonduc	nicker nut	Climber	8.2.1
Canavalia rosea	beach bean	Groundcover	8.2.1
Clerodendrum inerme	coastal lollybush	Shrub	8.2.1
Crinum pedunculatum	river lily, swamp lily	Tufty	8.2.1
Crotalaria mitchellii	sand rattlepod	Herb	8.2.9
Cymbopogon refractus	barbed wire grass	Grass	8.2.9
Cyperus pedunculatus	pineapple sedge	Sedge	8.2.1; 8.2.9
Dianella caerulea	blue flax lily	Herb	8.2.6; 8.2.9
Dianella longifolia	smooth flax lily	Herb	8.2.6a; 8.2.9
Dodonaea viscosa subsp. viscosa	sticky hop bush	Shrub	8.2.1
Eragrostis interrupta	coastal love grass	Grass	8.2.6; 8.2.9
Eriachne triodioides	wanderrie grass	Grass	8.2.6; 8.2.9
Eustrephus latifolius	wombat berry	Climber	8.2.2; 8.2.6
Geitonoplesium cymosum	scrambling lily	Climber	8.2.2; 8.2.6
Heteropogon triticeus	giant spear grass	Grass	8.2.6; 8.2.9

APPENDIX 4: Generic list of recommended species for coastal revegetation in the Mackay Region

Species name	Common name	Habit	Regional Ecosystem
Hibbertia scandens	golden Guinea flower, snake vine	Climber/groundcover	8.2.1
Imperata cylindrica	blady grass	Grass	8.2.6; 8.2.9
Ipomoea pes-caprae	goats foot convolvulus	Groundcover	8.2.1
Jasminum didymium	native jasmine	Climber/shrub	8.2.2; 8.2.6
Lomandra longifolia	spiny-headed mat-rush	Herb	8.2.6
Scaevola taccada	sea lettuce	Shrub	8.2.1
Sophora tomentosa	silver bean	Shrub	8.2.1
Spinifex sericeus	beach spinifex	Grass	8.2.1
Sporobolus virginicus	marine couch	Groundcover	8.2.1
Stephania japonica	tape vine	Climber/groundcover	8.2.1; 8.2.2; 8.2.6
Themeda triandra	kangaroo grass	Grass	8.2.6; 8.2.9
Thuarea involuta	birds beak grass	Grass	8.2.1
Vigna marina	vigna	Groundcover	8.2.1
Vitex rotundifolia	creeping vitex, beach vitex	Groundcover	8.2.1
Vitex trifolia	coastal vitex, common blue vitex	Shrub	8.2.1
Xerochrysum bracteatum	golden everlasting daisy	Herb	8.2.9

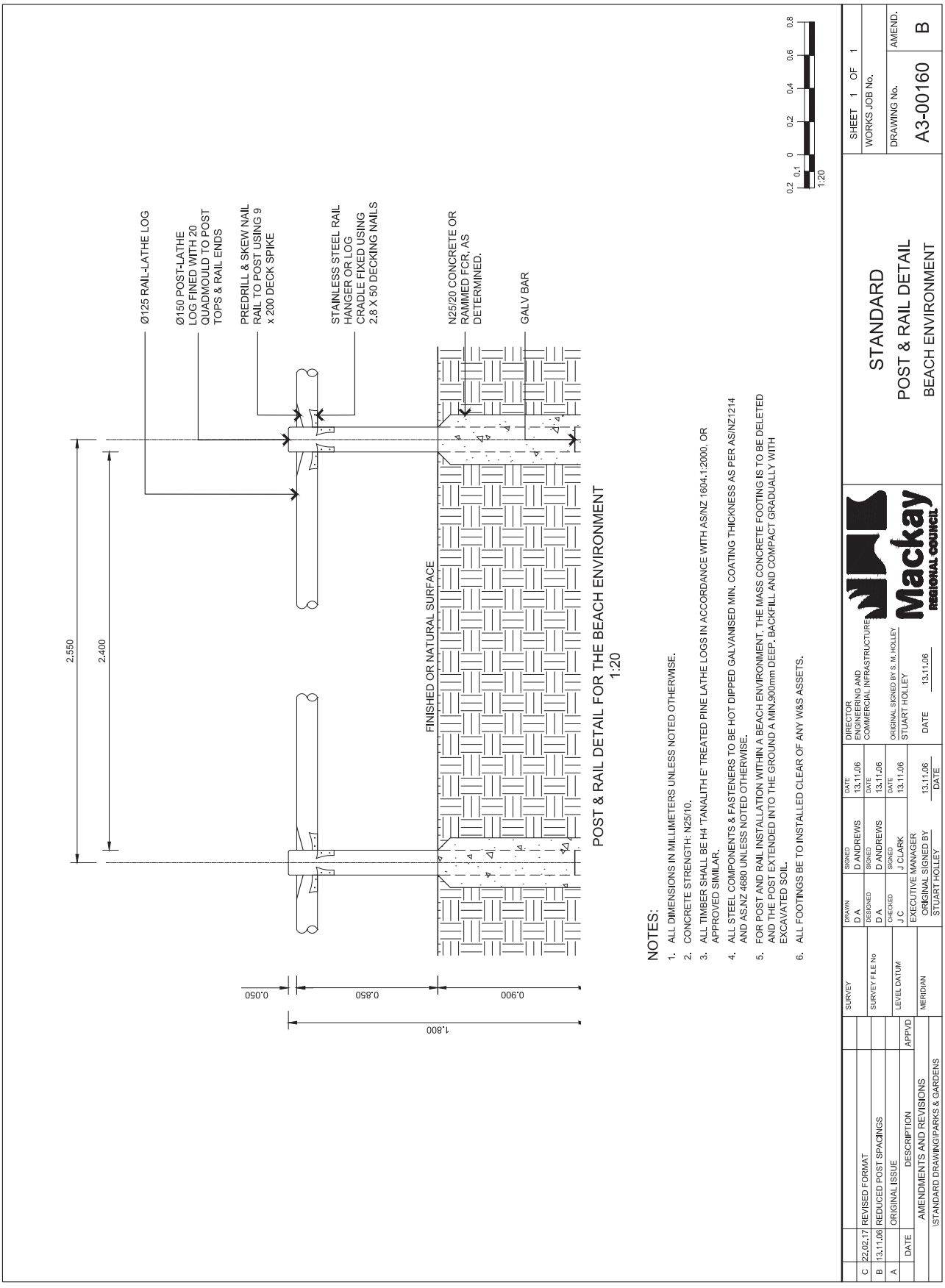
Principles	Comments
Staged weed removal	• Weed removal should be carried out in a staged approach. • Work outwards from intact remnants of coastal vegetation as a priority. • Particularly important in removal of non-native vegetation along the dune scarp. • Large woody weeds should be removed slowly to ensure the replaced native vegetation provides sufficient habitat value and protection against erosion before more removal of woody species.
Physical weed removal	• Physical weed removal, including hand pulling, chipping or cutting weeds is effective in small infestations in environmentally sensitive areas.
Mechanical weed removal	• Mowing or brush cutting will suppress weed growth, discourage seeding and spread. • This method should be used particularly in areas bordering large infestations. • Care should be taken to reduce potential disturbance as excessive mowing and brush cutting can facilitate further weed growth and reduce regeneration of native vegetation.
Herbicide weed removal	• The application of herbicides includes foliage or basal spraying, cut/ paste and stem injection where applicable. • Spraying may be carried out on large or robust weed infestation, particularly to gain initial control of an infestation. However the majority of spraying is likely to be small scale 'spot spray' applications to minimise non-target impacts. • Roundup Bi-active ® is recommended due to its low toxicity to wildlife and humans.
Timing	• Weed control on foredunes to occur between April and October only, to avoid turtle nesting season (November to March). • Weed control on hind dunes can occur at any time of the year depending on local weather conditions. Herbicide application is ineffective if carried out during rain periods, or once the plants have entered their non-active period during extended dry periods.
Consideration of fire risk	• Once treated, remaining dead woody weeds (such as Lantana) should be pulled away from native trees to reduce the fire risk to fire-sensitive coastal vegetation should 'accidental' fires occur. This woody, dry biomass serves as fuel for fires and by pulling it away from native trees it reduces the chances of fire reaching the canopy. • Mulching down of large, dense areas of dead woody weeds using brush cutters or hand tools, would similarly reduce fire risk and allow native plants a better chance at regeneration.
Preventing re-infestations	• Keep maintenance vehicles on the existing tracks where possible to reduce disturbance. • Clean maintenance vehicles before and after access to the site to prevent weed spread or introduction. • Monitor the success of weed control techniques and native regeneration following several wet seasons to assess whether revegetation might be needed in large areas of infestation.

APPENDIX 6: Main weed species found in coastal areas in the Mackay region

Species name	Common name	Form
Agave sp.	sisal hemp	Succulent
Ageratum conyzoides subsp. conyzoides	billy goat weed	Herb
Alternanthera brasiliana	red-leaved alternanthera	Herb
Antigonon leptopus	coral vine	Climber
Aster subulatus	wild aster, bushy starwort	Herb
Bidens alba var. radiata	cobbler's peg	Herb
Bougainvillea sp	bougainvillea	Vine
Bryophyllum sp.	mother-of-millions	Shrub
Bryophyllum delagonenses	mother-of-millions hybrid	Shrub
Callisia fragrans	callisia	Herb
Catharanthus roseus	pink periwinkle	Herb
Cenchrus echinatus	Seaforth burr	Grass
Cocus nucifera	coconut palm	Tree
Conyza canadensis var. pusilla	fleabane	Herb
Corymbia torelliana	cadagi	Ree
Crotalaria pallida	rattlepod	Herb
Dactyloctenium sp.	button grass	Grass
Delonix regia	poinciana	Tree
Dichantium annulatum	sheda grass	Grass
Digitaria didactyla	blue couch	Grass
Duranta erecta	duranta	Shrub
Eleusine indica	crowsfoot grass	Grass
Emilia sonchifolia	emelia	Herb
Euphorbia cyathophora	painted spurge	Herb
Hyparrhenia rufa	thatch grass	Grass
Ipomoea indica	coastal morning glory	Herb
Lantana camara	lantana	Shrub or branched climber
Leucaena leucocephala	leucaena	Small tree
Macroptilium atropurpureum	siratro	Vine
Megathyrsus maximus	Guinea grass	Grass
Melinus repens	red natal grass	Grass
Melinis minutiflora	molasses grass	Grass
Mimosa pudica	sensitive weed	Herb
Momordica charantia	balsam pear	Vine
Oenothera drummondii subsp. drummondii	beach evening primrose	Herb
Opuntia stricta	common prickly pear	Succulent
Opuntia monacantha	drooping prickly pear	Succulent
Passiflora foetida	stinking passionfruit	Climber
Passiflora suberosa	corky passionfruit	Climber
Psidium guajava	guava	Small tree
Portulaca pilosa	hairy pigweed	Succulent

APPENDIX 6: Main weed species found in coastal areas in the Mackay region

Species name	Common name	Form
Ricinus communis	castor oil plant	Sub-shrub
Richardia brasiliensis	Mexican clover	Herb
Salsola australis	prickly starwort	Succulent shrub
Sansevieria trifasciata	mother-in-laws tounge	Herb
Senna pendula var. glabrata	Easter cassia	Shrub or branched climber
Sida cordifolia	sida	Sub-shrub
Solanum capsicoides	devil's apple	Sub-shrub
Solanum chrysotrichum	devil's fig	Sub-shrub
Solanum nigrum	black nightshade	Sub-shrub
Solanum seaforthianum	Brazilian nightshade	Sub-shrub
Sphagneticola trilobata	Singapore daisy	Groundcover
Stachytarpheta jamaicensis	snake weed	Herb or sub-shrub
Stylosanthes humilis	stylo	Herb
Themeda quadrivalvis	grader grass	Grass
Tradescantia spathacea	Moses-in-a-cradle	Herb
Tridax procumbens	tridax daisy	Herb
Triumfetta rhomboidea	Chinese burr	Sub-shrub
Urochloa decumbens	signal grass	Grass
Yucca aloifolia	yucca	Succulent



POST & RAIL DETAIL FOR THE BEACH ENVIRONMENT
1:20

NOTES:

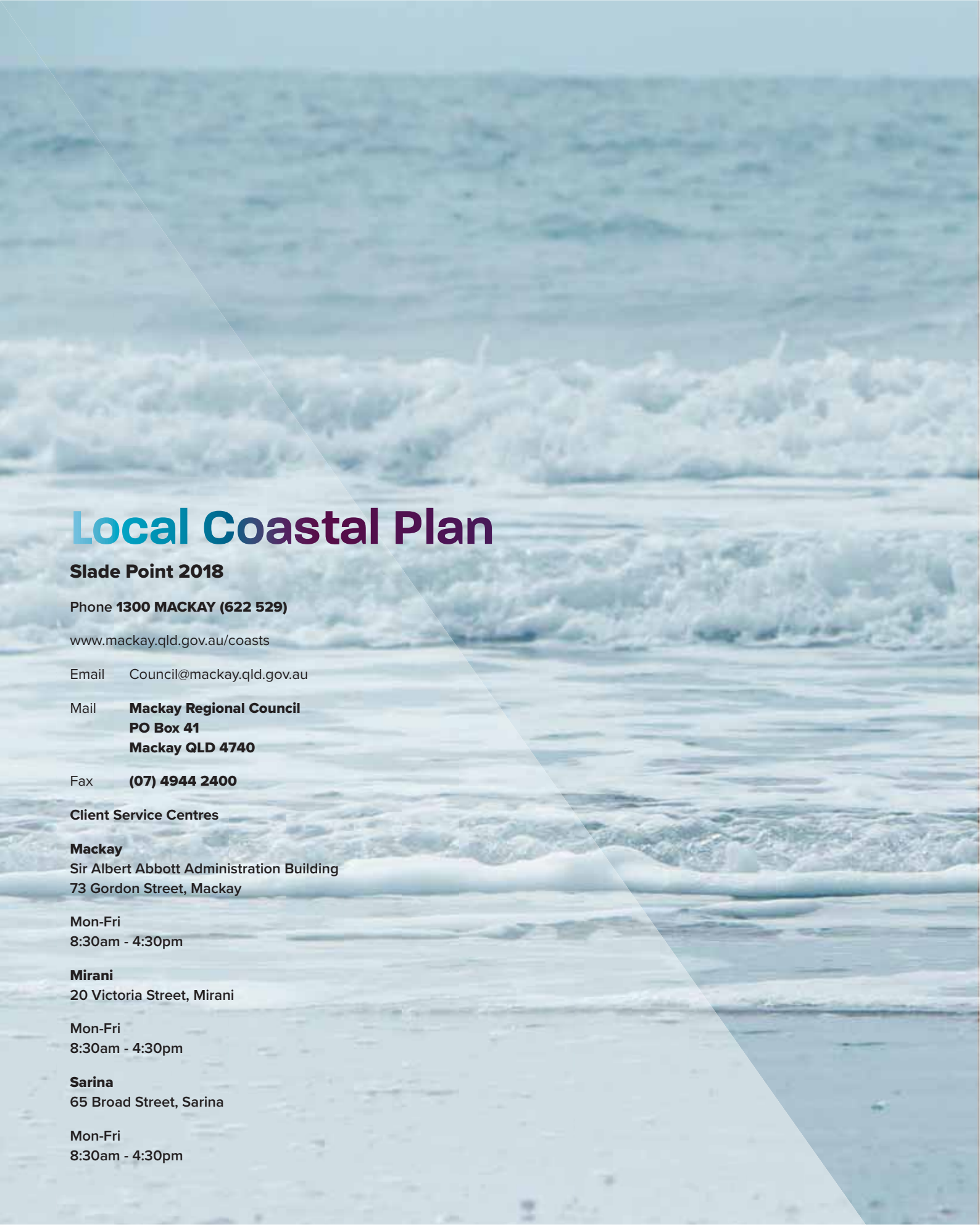
1. ALL DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. CONCRETE STRENGTH: N25/10.
3. ALL TIMBER SHALL BE H4 'TANALITH E' TREATED PINE LATHE LOGS IN ACCORDANCE WITH AS/NZ 1604.1:2000, OR APPROVED SIMILAR.
4. ALL STEEL COMPONENTS & FASTENERS TO BE HOT DIPPED GALVANISED MIN. COATING THICKNESS AS PER AS/NZ1214 AND AS.NZ 4680 UNLESS NOTED OTHERWISE.
5. FOR POST AND RAIL INSTALLATION WITHIN A BEACH ENVIRONMENT, THE MASS CONCRETE FOOTING IS TO BE DELETED AND THE POST EXTENDED INTO THE GROUND A MIN.900mm DEEP. BACKFILL AND COMPACT GRADUALLY WITH EXCAVATED SOIL.
6. ALL FOOTINGS BE TO INSTALLED CLEAR OF ANY W&S ASSETS.

				SURVEY	DRAWN	SIGNED	DATE	DIRECTOR ENGINEERING AND COMMERCIAL INFRASTRUCTURE	
C	22.02.17	REVISED FORMAT			D A	D ANDREWS	13.11.06		
B	13.11.06	REDUCED POST SPACINGS		SURVEY FILE No	DESIGNED	SIGNED	DATE		
A		ORIGINAL ISSUE			D A	D ANDREWS	13.11.06		
	DATE	DESCRIPTION	APP'VD	LEVEL DATUM	CHECKED	SIGNED	DATE	ORIGINAL SIGNED BY S. M. HOLLEY STUART HOLLEY	
					J C	J CLARK	13.11.06		
		AMENDMENTS AND REVISIONS		MERIDIAN	EXECUTIVE MANAGER				
		\STANDARD DRAWING\PARKS & GARDENS			ORIGINAL SIGNED BY STUART HOLLEY		13.11.06 DATE	DATE 13.11.06	

Mackay REGIONAL COUNCIL

STANDARD
POST & RAIL DETAIL
BEACH ENVIRONMENT

SHEET 1 OF 1
WORKS JOB No.
DRAWING No. A3-00160
AMEND. B



Local Coastal Plan

Slade Point 2018

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Client Service Centres

Mackay
Sir Albert Abbott Administration Building
73 Gordon Street, Mackay

Mon-Fri
8:30am - 4:30pm

Mirani
20 Victoria Street, Mirani

Mon-Fri
8:30am - 4:30pm

Sarina
65 Broad Street, Sarina

Mon-Fri
8:30am - 4:30pm

Australian Government

National Landcare Programme

Mackay Regional Council

Reef Catchments