



Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for Douglas Shire Council under the contract titled 'WO5429 Foreshore Management Plan'.

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1 Introduction

The coastline is an important place for many Australians, providing significant social and cultural value. This is especially so for many residents of the Douglas Shire who have identified these unique coastal landscapes and natural ecosystems among some of the most important factors attracting people to this coastline (DSC 2019a). The Douglas Shire coastline also has high tourism value, attracting many visitors to the area.

The Eastern Kuku-Yalanji and Yirriganydi peoples are the Traditional Custodians of the Land and Sea Country within the Douglas Shire. They have lived in and cared for this region for thousands of years, represented in important cultural sites throughout the Shire, and the memories and experiences of its people; past, present and future.

Douglas Shire Council (DSC) has an extensive 111 km long coastline that extends from Degarra in the north to south of Wangetti. The Shire is well known for its diverse coastline and its proximity to the Great Barrier Reef. Much of the Shire is within the Wet Tropics World Heritage Area and its dynamic coast consists of a variety of sandy beaches, rocky headlands and coastal rainforests.

The region's beaches and foreshore areas are important both to people and to the ecosystems around them. Coastal landscapes provide essential habitat for life on the foreshore and provide visual and recreational amenity to the people. Healthy coastal ecosystems are necessary to promote the resilience of plant and animal communities to coastal hazard impacts. Denser vegetation types are also effective in reducing the destructive forces of a storm tide for communities and infrastructure landward of the foreshore.

However, these ecosystems are experiencing ongoing disturbance as a result of erosion, vehicle and pedestrian access, weeds and pest species, illegal dumping, and runoff from stormwater and agricultural land. These factors threatening dune stability and reducing the erosion buffer often result in vegetation loss, impacts to native fauna species, and changes in ecosystem structure.

To help manage and protect these important coastal zones, DSC has developed five Foreshore Management Plans (FMPs) for the Wonga, Newell, Cooya, Four Mile and Oak Beaches.

1.1 Purpose

In 2019, DSC developed the Resilient Coast Strategic Plan 2019-2029 (referred to henceforth as the Strategy) and have committed to undertake actions to reduce the impacts of coastal hazards, such as erosion and coastal flooding, and activities in the coastal zone. A priority outcome of the Strategy is to undertake dune protection, maintenance and monitoring. This encompasses the foreshore area and is the focus of the FMP.

The FMPs will help to guide Council in the protection, maintenance and management of the foreshore, while maintaining the natural character of the area and respecting ecological, cultural and social values of these coastal reserves.

The plans will:

- Ensure there is a **shared understanding** of the social, cultural, environmental and economic values and uses of the foreshore area
- Identify options for the **proactive management** of vulnerable areas of the foreshore area over the next 5 years
- Help improve and maintain the vegetation cover and condition in the foreshore area.

1.2 Foreshore Management Plan area

Oak Beach is located south of the Mowbray River and forms a 1.6 km long pocket beach (Figure 1) (DSC 2019b). It is part of a mini barrier spit landform that is anchored by a rocky headland to the south. The intertidal zone is approximately 20 to 40 m wide. There is an erosion scarp evident along the beach that reaches the vegetation line.

Oak Beach is a small coastal settlement with approximately 195 residents as of the 2016 census (ABS 2017). Some of the residents at Oak Beach are absentee owners, only visiting seasonally. There are approximately 25 dwellings along the foreshore (DSC 2019b). Some of these houses are around 20 to 30 m from the erosion scarp line along the central section of the beach. During the site visits, it was noted that there is significant encroachment of the residential property boundary seaward onto Council land. This encroachment includes the construction of permanent structures and planting of non-native vegetation on Council land between the dune and the residential area.

1.3 Implementation

These FMPs were developed in consultation with each beach community as well as residents and ratepayers in the whole Shire to inform the management actions and planning decisions for the area. These actions have been tailored to incorporate what the community values about their foreshore and how the foreshore is used.

The Oak Beach FMP outlines actions for dune protection, including weed species for removal, native vegetation species for regeneration and pedestrian access management. It also provides a schedule for implementation to allow Council to prioritise actions for the area. This FMP remains non-statutory but once approved by Council provides an informed and proactive guide for the future management of Oak Beach.



Figure 1. Oak Beach foreshore management area.

2 Study area and planning context

Oak Beach is a beachfront community located on a wide, sandy and pebbly beach. The southern end of the Oak Beach is bound by a rocky headland and it extends northward to Grants Creek. The northern end extends from Grants Creek north to a rocky headland where Thala Beach Nature Reserve Resort is located. There is a variety of land zoning uses and ecological communities at Oak Beach. The following section will outline and illustrate the DSC land zoning and vegetation and faunal communities that have been identified during site visits and surveys.

2.1 Legislative, policy and strategy setting

Coastal management is guided by Commonwealth, State and local legislation. The legislation results in a complex structure of rights and responsibilities. Key legislation, plans, policies and strategies relevant to foreshore management are summarised in Table 1.

Table 1. Summary of the legislation, policy, plans and strategies relevant to foreshore management

Legislation	Relevance
Biosecurity Act 2014	 This Act provides a comprehensive biosecurity framework to manage the impacts of animal and plant diseases and pests. The purpose of this Act is to: Provide a framework for an effective biosecurity system for Queensland. Ensure the safety and quality of animal feed, fertilisers and other agricultural inputs. Help align responses to biosecurity risks in the State with national and international obligations and requirements. The purpose of the Act is also to manage risks associated with emerging, endemic and exotic pests and diseases.
Coastal Protection and Management Act 1995	 This Act aims to provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity. This Act considers the goal, core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development in the use of the coastal zone. This Act ensures that decisions about land use and development safeguard life and property from the threat of coastal hazards. This Act encourages the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.
Planning Act 2016	 This Act provides for an efficient, effective, transparent, integrated, coordinated and accountable systems of land use planning and development assessment to facilitate the achievement of ecological sustainability by: Coordinating and integrating planning at the local (i.e., planning schemes), regional and State scales Managing the process and effects of development on the environment (including managing the use of premises).
Vegetation Management Act 1999	 This Act aims to regulate the clearing of vegetation by: Managing the environmental effects of clearing. Regulating clearing in a way that conserves remnant vegetation that is an endangered regional ecosystem, an of concern ecosystem, or a leas concern regional ecosystem.

Legislation	Relevance
	 Ensuring clearing does not cause land degradation and allows for sustainable land use. Preventing the loss of biodiversity, maintain ecological processes, and reduce greenhouse gas emissions.
Environmental Protection Act 1994	 This Act aims to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, and that maintains the ecological processes on which life depends. The Act defines environmental value, environmental harm and best practice environmental management.
Nature Conservation Act 1992	 This Act aims to conserve nature while allowing for the involvement of indigenous people in the management of protected areas. This is to be achieved by a conservation strategy for QLD that declares and manages protected areas, protects native wildlife and habitats, ensures use of protected wildlife and areas to be ecologically sustainable, and allows cooperative involvement of Aboriginal and Torres Strait Islander people.
Environment Protection and Biodiversity Conservation Act 1999	 This Act aims to provide protection of the environment, promote ecologically sustainable development and the conservation of biodiversity. The Act aims to promote the use of indigenous knowledge of biodiversity through a cooperative approach to the protection and management of environments.
Queensland Local Government Act 2009	 This Act provides a system of local government in Queensland, including: The way in which a local government is constituted and the nature and extent of its responsibilities and powers A system of local government in Queensland that is accountable, effective, efficient and sustainable.
Local Laws	 Local laws sit within the Local Government Act 2009 and under the Act a local government may make and enforce any local law that is necessary or convenient for the good rule and local government of its local government area. This legislation sets out the laws for the Douglas Shire Council area, including animal management, community and environmental management, local government areas, and facilities.

2.2 Zoning

Land use

The DSC Planning Scheme (2018) has been used to understand the boundaries between different land uses (Figure 2) (DSC 2018a). At Oak Beach, the primary land use within or immediately adjacent to the foreshore area at the southern end is low density residential. There is a small area of land for conservation near Grants Creek. At the northern end of Oak Beach near Thala Beach Nature Reserve Resort, there is also rural and tourist accommodation land use within or immediately adjacent to the foreshore area. These land uses have implications for the management of the foreshore area. Changes within these zones can have flow-on impacts to the foreshore area, including:

- habitat fragmentation
- runoff
- illegal clearing and planting, including weed dispersal and growth
- impacts on fauna (light and noise pollution, road kills).

Residential

Low density residential areas provide for predominantly dwelling houses supported by community uses and small-scale services and facilities that cater for local residents (DSC 2018a). The purpose of the low density residential zone will be achieved through the following outcomes relevant to the foreshore (DSC 2018a):

- Development maintains a high level of residential amenity having regard to traffic, noise, dust, odour, lighting and other locally specific impacts.
- Development reflects and enhances the existing low density scale and character of the area.
- Development is reflective and responsive to the environmental constraints of the land.
- Development is supported by necessary community facilities, open space and recreational areas and appropriate infrastructure to support the needs of the local community.

Conservation zone

The conservation zone provides for the protection, restoration and management of areas identified to support significant biological diversity and ecological integrity (DSC 2018a). Relevant outcomes identified in the Douglas Planning Scheme for the conservation zone include (DSC 2018a):

- Protection of biological diversity, ecological integrity and scenic amenity.
- Recreational or other uses of areas are consistent with the management plans of the controlling authority so that conservation and scenic values of these areas are not adversely affected.
- Any use of land in private ownership does not affect the environmental, habitat, conservation or scenic values of that land or surrounding area.
- Any low intensity facilities based on the appreciation of the natural environment or nature based recreation only establish where there is a demonstrated need and provided they have a minimal impact on the environmental and scenic amenity values of the site or surrounding area.
- The provisions of the Return to Country Local Plan facilitate economic and social opportunities on traditional Indigenous lands.
- Further lot reconfigurations other than amalgamations, boundary realignments to resolve encroachments, or for the practical needs of essential community infrastructure, or to facilitate Return to Country outcomes do not occur.



Figure 2. Douglas Shire Council Planning Scheme land use zoning within Oak Beach foreshore area (DSC 2018).

2.3 Coastal hazards

Oak Beach is vulnerable to coastal erosion (DSC 2019b). This erosion may be temporary or permanent. Temporary erosion is generally caused by storms, winds or waves, and the beach rebuilds during calmer periods. Permanent erosion is more likely to occur over the longer-term due to rising sea levels or significant changes to sediment transport dynamics where sand becomes lost to the coastal system. Erosion may impact the foreshore area, including the vegetation, wildlife habitats, infrastructure, recreational uses or values.

Foreshore management precinct

The foreshore precinct at Oak Beach, which is the focus of the FMP, has been designated as the zone between the highest astronomical tide (HAT) landward to the edge of the low density residential zone (Figure 3).

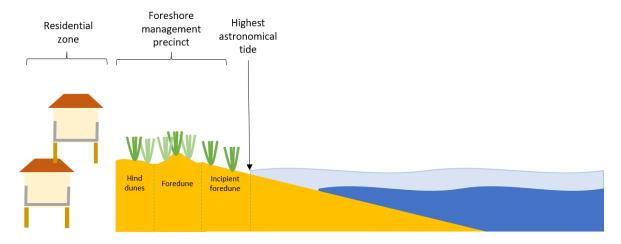


Figure 3. Graphic representation of the Oak Beach foreshore management precinct.

The foreshore area includes the dune system behind the beach, immediately landward of the HAT mark and is made up of the following three key sections (Figure 3):

- Incipient foredune: a windblown platform that forms in front of the foredune, however is not present on all beaches. This is where vegetation such as grasses and creepers first establish and provides a protective buffer to erosion, and storm effects, including winds and waves.
- **Foredune:** the main sandy formation and is of greater height than the incipient dune. Larger vegetation species establish here, including shrubs, which provide greater wind protection.
- **Hind dune:** a smaller dune system behind the foredune. These systems tend to be well established, including larger vegetation species such as trees.

3 Foreshore values

The Oak Beach foreshore is valued by residents and visitors for a number of reasons. These values play a role in the management of the foreshore area. The following section outlines the social, cultural and environmental values that have been identified for the Oak Beach foreshore area, as well as describing any threats or challenges to these values.

3.1 Knowledge sharing and community engagement

The Oak Beach community has previously been engaged through the Strategy. However, no feedback specific to Oak Beach was provided through this survey.

For this FMP, a survey was distributed to the Oak Beach community and the wider Douglas Shire residents and ratepayers to understand how they use and what they value about the foreshore zone, and how they would like to see it managed. The survey was advertised through the Council Foreshore Management Plans site, Facebook, community noticeboards, emails to residents and community groups, and physical copies available at Council offices. The survey ran from 31st March to 23rd April 2021 and received a total of 317 responses from residents and community groups throughout the Douglas Shire. A total of 41 responses were received from Oak Beach Residents, with most being homeowners.

Social values

More than half of the respondents live adjacent to the Oak Beach foreshore. The foreshore area is visited at least weekly by over half of respondents. This information indicates that the foreshore area is significant to residents, ratepayers and holiday-home owners at Oak Beach.

Residents at Oak Beach predominantly use the foreshore area for exercise, including walking and swimming (Figure 4). The foreshore is also used for relaxing and by people walking their dogs. A number of people also use the Oak Beach foreshore for recreation, including sailing and fishing. Respondents also remarked that they often met friends along the foreshore. Around one third of respondents also noted that they used the foreshore area as an extension of their yard.

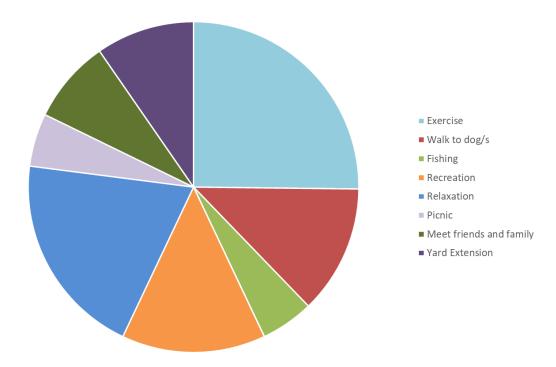


Figure 4. The most common uses of the foreshore area at Oak Beach.

Sense of place

The foreshore at Oak Beach is most valued for its natural beauty. The residents feel that Oak Beach is relatively quiet, peaceful and unspoilt. It is viewed as a place to escape the hustle and bustle and also enjoy some privacy due to the low population and lack of tourists. There is a community feel to Oak Beach. The natural habitats are also important to the residents. These habitats include turtle nesting sites, shorebirds, marine animals. Residents also enjoy beach and water views.



Concerns and threats

Residents have noticed that erosion is occurring along Oak Beach. It appears to be event-related as the sand eventually returns to the beach, however it is affecting the amenity of the foreshore. Erosion seems to be affecting the southern end of Oak Beach more than the northern end. In some places, large trees along the foreshore are being undermined by erosion. This would have an impact on the stability of the dune.

Another concern is the land clearing that is occurring along the foreshore in front of properties to create access and ocean views. Some residents have noted that vegetation is being poisoned or removed in some areas for this purpose. This includes the She Oaks (*Casuarina equisetifolia*) after which Oak Beach is named. Residents have also noticed weed infestations, particularly at the northern carpark.

Feedback from the survey also highlighted the number of dogs on the beach without a leash. There is the concern from some residents that unleashed dogs are contributing to the waste on the beach. Other noted contributions to waste on the beach included campers and fishing waste. There is also natural waste such as palm fronds and large trees. Residents frequently collect rubbish along the foreshore during their walks.



"An important component (of what is important and meaningful about the foreshore) is the She Oaks after which Oak Beach is named." — Oak Beach resident.

3.2 Environmental values

The vegetation along the foreshore at Oak Beach is heavily impacted by illegal clearing to maintain views and access. There is no mapped remnant vegetation along Oak Beach and the foreshore vegetation present is dominated by coconuts with little understorey.

Flora composition

A desktop assessment of the vegetation mapping for the northern section of Oak Beach indicates that there is no remnant vegetation associated with the foreshore area at the southern end and only a small area of regrowth vegetation has been mapped in association with the estuary to the north of the residential area and along the foreshore at the northern end near Thala Beach Nature Reserve (DOR 2020). This regrowth vegetation relates to three different Regional Ecosystem (RE) types. Descriptions, Vegetation Management (VM) Class and

Biodiversity Status (BD) are summarised in Table 2 and Figure 5. A full list of the REs at Oak Beach is provided in Attachment A. The local representation of vegetation in the dune system at Oak Beach is summarised in Table 3.

Table 2. Regional Ecosystems (RE) of Oak Beach

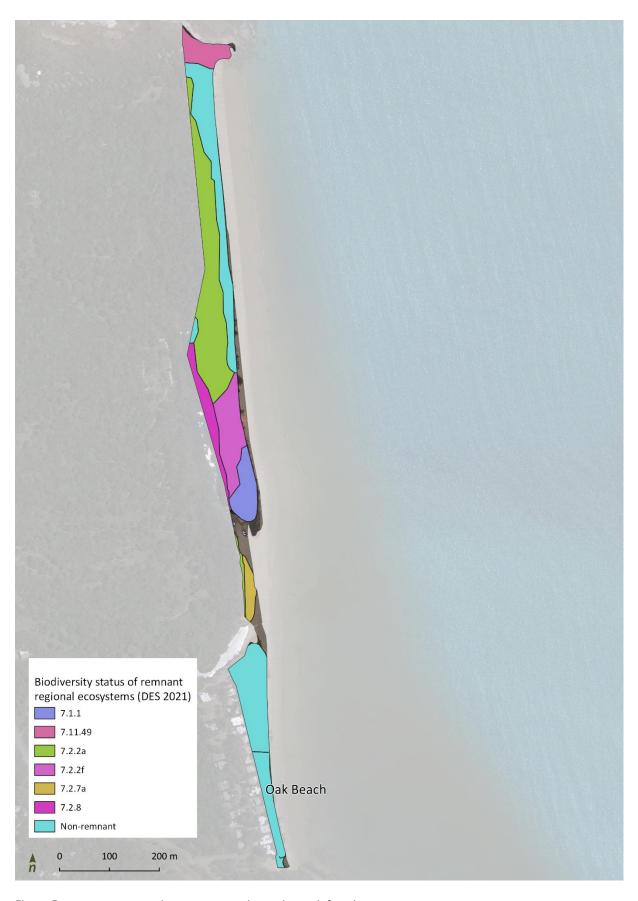
RE	Mapped RE description	VM Class ¹	BD Status ²
7.1.1	Mangrove closed shrub to open forest. Sheltered coastlines, estuaries, and deep swales between dunes, on fine anaerobic silts, inundated with saline water at high tide.	LC	NC
7.2.2f	Microphyll vine thicket occurring in clumps/groves. Inter-grove areas are occupied by sparse grasses and herbs. Common tree species include Mimusops elengi, Terminalia muelleri, Diospyros compacta, Sersalisia sericea, Ficus obliqua, Pleiogynium timorense, Canarium australianum, Exocarpos latifolius, Celtis paniculate, Denhamia fasciculiflora, Brucea javanica, Ximenia americana, Acacia oraria, Acacia leptocarpa and Persoonia falcata. Coastal foredunes.	OC	E
7.2.7a	Complex of open shrubland to closed shrubland, grassland, low woodland and open forest. Includes pure stands of Casuarina equisetifolia, and Acacia crassicarpa, Syzygium forte subsp. forte, Calophyllum inophyllum and Pandanus spp. woodland to open forest. Beach strand and foredune.	OC	Е

Table 3. Dune vegetation composition and condition at Oak Beach

Zone	Vegetation	Comments
Incipient dune	Beach vines – coastal jack bean (<i>Canavalia rosea</i>), coastal morning glory (<i>Ipomoea pes-caprae</i>) and dune bean (<i>Vigna marina</i>)	 Most exposed area Prone to atypical erosion – vegetation removed or impacted by anthropogenic activity
Foredune	Trees and shrubs — beach she oak (Casuarina equestifolia), beach almonds (Terminalia catappa, Terminalia arenicola), beauty leaf (Calophyllum inophyllum), boxwood (Planchonella obovate) and pandanus (Pandanus cookii)	 Supports larger trees and shrubs Coconuts also dominant
roredune	Vines – match box bean (<i>Entada rheedii</i>) and <i>Smilax</i> calophyllum	throughout foredune
	Casuarina equesitifolia and Hibiscus tiliaceus	

 $^{^{\}rm 1}$ VM Class: LC – Least Concern, OC – Of Concern, E – Endangered.

 $^{^{\}rm 2}$ BD Status: NC – No Concern, OC – Of Concern, E – Endangered.



 $\textbf{Figure 5.} \ \textit{Remnant regional ecosystems within Oak Beach foreshore area.}$

Conservation significance

Oak Beach is not mapped as habitat for conservation significant floral species. However, a number of environmental weeds were identified at Oak Beach.

Habitat fragmentation

The foreshore vegetation at Oak Beach is heavily disturbed. Dune vegetation in front of the houses at the southern end of Oak Beach has largely been cleared and there is little to stabilise the dune. A number of non-native species have been planted in the foreshore area in front of properties. These habitat disturbances may affect the movement of fauna and minimise their habitat connectivity.

There are a number of factors that may be contributing to the disturbed foreshore vegetation. These factors and their potential impacts on the foreshore's ecology are listed in Table 4.

Table 4. Disturbances and their impacts to the flora and fauna of Oak Beach

Disturbance	Potential impacts to ecology
Dune erosion	 Further loss of vegetation and fauna habitat Loss of sea turtle nesting habitat through loss of the foredune vegetation Increase foredune slope and decreasing suitability for nesting sea turtles Reduced biodiversity
Vegetation loss	 Increases in foreshore dune erosion Exposure of hind dune systems and vegetation that are less adapted to extreme weather events Loss of breeding and roosting habitat for nesting shorebirds and sea turtles Loss of food trees for southern cassowary
Weeds	 Compete with native species for resources – light, nutrients, space Reduced biodiversity of flora Loss of habitat and food plants for conservation significant species Create barriers for connectivity and fauna population dispersal
Pest animals	 Predation of native animals Sea turtle nest predation Reduced fauna populations and diversity
Stormwater and agricultural runoff	 Impacts to marine fauna Increased sediment runoff and resulting increases in nearshore turbidity Increased nutrient loads and subsequent algal blooms
Coconut debris	 Fallen fronds and fruit reduce recruitment of native species Reduced opportunity for sea turtle nesting Increase habitat for rodents and potential bird egg predation

Fauna

Oak Beach provides limited habitat features which may support fauna of conservation significance such as nesting turtles; shorebirds and other notable species such as the endangered southern cassowary (*Casuarius casuarius johnsonii*) (southern population). The remnant vegetation of Oak Beach is mapped as 'Essential Habitat' for the endangered southern cassowary and regulated under the *Vegetation Management Act 1999* (VM Act). The full list of these species is provided in Attachment B.

The foredune areas are typically vegetated with larger tree species once well established. It is amongst this vegetation above the high tide area that marine turtles prefer as nesting areas. The vegetated areas provide the ideal temperature and protection for incubation and hatchling survival. There is limited intact vegetation in Oak Beach suitable for nesting. Sections of Oak Beach have eroded to form steep slopes which are not suitable for

nesting turtles to traverse as they prefer a slow slope. Locals have reported turtles nesting to the north of the estuary that adjoins Oak Beach.

Pest species

During the site inspection, a number of environmental weeds were identified at Oak Beach, one of which is the coconut palm. According to the most recent audit, there are approximately 360 coconut palm specimens on Oak Beach (DSC 2015). The environmental weeds identified at Oak Beach are summarised in Table 5. Environment weeds pose a threat to the biodiversity of a habitat and can kill native vegetation, establishing a monoculture.

Table 5. Weed species identified at Oak Beach (BQ 2020, Conn 2021, DSC 2015, Murphy et al. 2017)

Scientific name	Common name	Dispersal Method	Environmental Impacts
Cocos nucifera	Coconut palm	 Large nuts which fall from trees Nuts germinate if uneaten 	 Identified as a transformer weed in littoral (coastal) rainforests Outcompetes native species for space, light and nutrients Falling nuts and fronds cause physical damage to species below
Sphagneticola trilobata	Singapore daisy	Spreads by cuttings from slashing and pruning	 Outcompetes native species for space, light and nutrients Invades lawns, irrigated areas, and around drains
Sansevieria trifasciata	Mother-in-law's tongue	 Spreads by dumping of garden waste Seeds spread by birds and other animals 	 Forms dense infestations Outcompetes native species for space, light and nutrients Tends to form monoculture
Bryophyllum delagoense	Mother of millions	 Spread by floodwaters Spread by animals, vehicles and garden waste 	 Invades coastal dunes, grasslands and woodlands Outcompetes native species for space, light and nutrients Very poisonous to humans and livestock
Opuntia sp.	Prickly pear	 Spread by birds and animals eating the fruit Spread by animals and floods moving broken stems 	 Outcompetes native species for space and nutrients, esp. in hot, dry conditions Can harm animals and prevent them from eating
Leucaena leucocephala	Leucaena	 Spreads seeds by wind, water and animals Spreads rapidly to adjacent areas 	 Forms dense thickets which hinder movement of wildlife Strongly outcompetes native plants for space, light and nutrients

Vegetation management

Douglas Shire Council has a number of instruments to manage the vegetation at Oak Beach. The Coconut Management Plan (DSC 2015) defines the objectives for the management of coconut palms on Council-controlled land. The plan identifies the coconut trees within a given location and provides an assessment of the potential risk, distribution, impacts and associated costs of management.

The Douglas Shire Biosecurity Plan (2017-2021) guides the management of invasive biosecurity matter as well as locally declared pests (plants and animals) as outlined in the *Biosecurity Act 2014*. Under this plan, there are programs being undertaken by DSC to eradicate pest species. Prioritisation of pest species is based on several factors, including (DSC 2017):

- Existing plans and priorities on a national, state and local level
- Impacts and threats
 - Conservation and biodiversity
 - o Riparian or aquatic environment
 - o Agricultural or production
 - o Residential and urban areas
- Capacity to manage
 - Achievability
 - o Current extent.

These programs include (relevant to vegetation) (DSC 2017):

- Siam Weed Eradication Program
- Hiptage eradication Program
- Miconia Species (Four Tropical Weeds Eradication Program.

3.3 Amenity and liveability

Due to the undeveloped nature of Oak Beach, there is minimal infrastructure, including formalised access points to and along the foreshore. The accessibility and recreational uses of the Oak Beach foreshore area are summarised in this section and the management implications are discussed.

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Infrastructure

There are car parks at the northern and southern ends of Oak Beach which also provide pedestrian access to the foreshore. There is no vehicle or boat access to Oak Beach, however, there are anecdotal reports of residents launching sailing boats from the shore.

Passive recreation

The accessibility of Oak Beach offers residents and visitors the opportunity to engage in passive recreational activities. As a number of residents have beachfront properties, this makes the foreshore and beach more readily accessible compared to other locations in the Douglas Shire. Examples of such activities include:

- walking along the foreshore and beach
- bird watching
- fishing
- watercraft sports

These activities are relatively low impacts but can still affect the foreshore condition. If foreshore users create informal access tracks through the vegetation to access the foreshore and beach, this can lead to a loss of vegetation, destabilisation of the sand or soil which may lead to erosion and dune destabilisation, and it could also contribute to habitat loss and destruction. Activities such as bird watching, water sports and fishing will have similar impacts on the foreshore in relation to access. Dumping of fishing nets or waste may also occur.

Pedestrian access

A recent audit of the beach access points within the Douglas Shire found that there are 19 access tracks at Oak Beach. The majority of these are private access tracks to houses. There are three formalised access tracks, at the northern, mid and southern points of the beach. The creation of informal access tracks presents challenges to foreshore management, particularly with regards to illegal vegetation clearing and dune destabilisation.

Dog off-leash areas

There are no off-leash dog areas along the Oak Beach foreshore. However, the responses from the survey indicate that a number of dog owners allow their dogs off-leash in this area. Dogs pose a risk to fauna as they may attack or scare vulnerable species, particularly when off-leash.



Oak Beach

4 Management precincts

The Oak Beach foreshore area has been divided into four management precincts to allow management actions to be tailored specifically to the threats and challenges within each precinct. The four precincts are:

- Precinct 1 Thala Beach Nature Reserve Resort
- Precinct 2 Northern residential area
- Precinct 3 Central residential area
- Precinct 4 Southern Oak Beach



Figure 6. Oak Beach foreshore management precincts.

The threats and challenges within each management precinct are summarised in Table 6. These threats and challenges have been identified through the background review, site inspections and community engagement feedback.

Table 6. Oak Beach foreshore management precincts threats and challenges

Precinct	Key foreshore threats and challenges
1 – Thala Beach Nature Reserve Resort Private property with foreshore access limited to resort visitors or by boat.	 Pedestrian and other access along foreshore with potential sensitive and vulnerable habitats, including turtle and shorebird nesting areas – access above the intertidal zone during nesting and hatching season may pose a threat to vulnerable species. Environmental weeds may be present – may impact the conservation value and native vegetation cover within the precinct.
2 – Northern residential area Residential area set back from foreshore with good vegetation buffer width.	 Environmental weeds present – may impact the conservation value and native vegetation cover within the precinct. Pedestrian and other access along foreshore within potential sensitive and vulnerable habitats, including turtle and shorebird nesting areas – access above the intertidal zone during nesting and hatching season may pose a threat to vulnerable species.
3 – Central residential area Central section with residential properties on foreshore.	 Illegal clearing to create informal beach access tracks through the vegetation and encroachment onto the foreshore area – these activities may not meet the conservation objectives, including biological diversity, ecological integrity and scenic amenity. Pedestrian and other access along foreshore within potential sensitive and vulnerable habitats, including turtle and shorebird nesting areas – access above the intertidal zone during nesting and hatching season may pose a threat to vulnerable species. Environmental weeds present and native vegetation clearing – may impact the conservation value within the precinct. Dogs off leash along the foreshore and beach – may impact the conservation and recreation amenity of the precinct.
4 – Southern Oak Beach Access point for residents and visitors.	 Erosion occurring most often at this end of Oak Beach – may impact the recreation amenity in the precinct and foreshore access. Insufficient waste disposal facilities – may impact the recreation amenity in the precinct and the foreshore area.

5 Management plan

The following section outlines the management actions to address the threats and challenges that have been identified for the Oak Beach foreshore area. The objectives for management have also be identified in order to inform measurements for management success. Priorities have also been set to appropriately guide management of the foreshore threats and challenges over the immediate, medium and longer-term timeframes. In addition, any monitoring and evaluation activities that are to take place following the implementation of the actions will also be summarised to measure the progress of the foreshore management.

5.1 Management objectives

Objectives are useful for measuring the success of the management actions undertaken. They are based on the community values identified through the engagement process. The objectives will guide the metrics for monitoring and evaluation of the management actions. They can be applied at the whole of foreshore (community) and precinct scale.

Management objectives for Oak Beach foreshore

- Maintain the overall natural form and function of the beach.
- Enhance and maintain vegetation condition littoral rainforests, dune vegetation for vulnerable species and to prevent dune erosion.
- Build positive behaviour change outcomes to minimise adverse impacts of foreshore use.
- Proactively undertake waste management along the foreshore.
- Proactively undertake weed management to restore native vegetation habitats
- Monitor the presence and health of potential turtle and shorebird nesting sites in foreshore areas.
- Enforce illegal clearing local laws to prevent further establishment of unauthorised and informal beach access tracks.

5.2 Management prioritisation

Prioritisation of the management actions has been assigned as immediate, medium-term or future.



Immediate (recommend implementation within next 12 months)

Actions for immediate prioritisation include sites where weeds are present and it is necessary to eradicate the weeds and revegetate the site with native vegetation cover. Environmental weeds pose a significant threat to the values of the Oak Beach residents, including the natural habitats and wildlife. Actions also revolve around access and use of the foreshore area, such as for fishing or pedestrians. The uses may pose a threat the sensitive habitats and management actions are focussed on minimising the impact.



Medium-term (recommend implementation within next 2-3 years)

Medium term priority actions are recommended to be implemented within the next two to three years. These actions are important for the management of the foreshore precinct, however, they require community engagement and education to understand their benefits. There is an element of community involvement with the medium-term actions.

Future management actions are those that first require an evaluation of the outcomes from immediate to medium-term actions that have been undertaken before being implemented. It is recommended that future actions are implemented within five years. This timeframe allows sufficient time for immediate actions to be implemented and their progress and success to be evaluated.

5.3 Management actions

The approach to foreshore management at Oak Beach is incremental, slowly integrating actions based on their priorities taking into consideration the existing foreshore condition and management. For example, based on site inspections and survey feedback, the dune requires revegetation to stabilise and prevent erosion, and manage land that has been cleared. To ensure that the action is accepted, there is an incremental vegetation buffer being established, first starting with a 5 m dune vegetation buffer width that will assist with dune stabilisation against erosion.

Management actions and their priorities for the Oak Beach foreshore are summarised in Table 7. Maps of the management actions for each precinct are provided in Attachment C.

Table 7. Management concerns identified at Oak Beach

Objectives and management actions	Precinct 1	Precinct 2	Precinct 3	Precinct 4
<u>Objective 1:</u> Protect sensitive and vulnerable habitats, including dune vegetation, and turtle and shorebird nesting sites.				
A1.1: Undertake beach monitoring for turtle and shorebird nesting sites in collaboration with local environmental groups and the Oak Beach community during nesting and hatching seasons to understand the impact access and disturbed foreshore vegetation habitats may have on these environments. Survey vegetation cover to assess revegetation requirements to support nesting.	1	1	1	
<u>A1.2:</u> Formalise and maintain defined access tracks and install appropriate signage at the beach and land entrance. This is to minimise the impact on the frontal dune.	1	1	3	1
<u>A1.3:</u> Erect signs at formal beach access points indicating that dogs are to be kept on leash along the beach.		2	2	2
<u>A1.4:</u> Install rubbish bins at the Council carparks at the foreshore at the end of Oak Beach Rd and at the end of Oak St near Grant Creek to minimise rubbish on the beach.		1		1
<u>Objective 2:</u> Restore the biological diversity, ecological integrity, scenic amenity and dune stability of the foreshore.				
A2.1: Commence a dune protection and maintenance program in partnership with the community using Oak Beach as a pilot site. Undertake dune revegetation with native species (see Attachment D) within a 5 m buffer landward of the HAT mark with low-growing species to maintain views, regenerate land that has been cleared and to stabilise the dune to protect against erosion.	3	3	1	2

Objectives and management actions

Precinct 1

Precinct 2

Precinct 3

Precinct 4

<u>A2.2:</u> Establish a weed eradication and maintenance program to remove environmental weeds present in the foreshore area and undertake revegetation with native species (see Attachment D).







<u>A2.3:</u> Undertake a community education program in partnership with the Oak Beach community to communicate knowledge around foreshore weeds, including transfer and establishment, awareness and management.



5.4 Monitoring and evaluation

The success of the immediate priority management actions is measured through monitoring and evaluation mechanisms. The monitoring focusses on the sensitive and vulnerable environments, including turtle and shorebird nesting habitats, and key coastal vegetation habitats.

Nesting habitats

The habitat monitoring will be undertaken to observe where turtle and shorebird nesting habitat is present in the foreshore area. Turtle monitoring should be undertaken based on the Queensland Marine Turtle Field Guide (Attachment E) between November and March to assess the seasonal use of these habitats by turtles (QPWS, DES 2016). Guidelines for shorebird monitoring will need to be developed based on local knowledge. It is recommended that the monitoring be undertaken in partnership with the local environmental or community groups. In addition, a platform on the DSC website should be created for residents and visitors to submit photos and information regarding any turtle or shorebirds they notice when using the foreshore. The purpose of the habitat monitoring is to understand which species are accessing the foreshore area for nesting and hatching, as well as the vegetation composition of these habitats.

Vegetation

The vegetation monitoring is a simple measure for the percentage of cover and survival success. This monitoring should be undertaken on a yearly basis to record the survival rate. It is recommended that vegetation is monitored on a yearly basis at the end of the wet season.

The purpose of collecting information about the success of revegetation and other site management issues such as exotic plants (environmental weeds), other threats, habitat quality and connectivity, and significant species values is to be able to refine and direct resources accordingly. Flexibility in program delivery is required to maintain the condition of assets such as plantings, respond to threats as they change through time and account for new values if they emerge during the delivery of the project.

Monitoring and evaluation metrics

Table 8 outlines the monitoring and evaluation metrics for the corresponding management action to evaluate the progress and success of implementation. A detailed method for rapid vegetation assessment is supplied in Attachment E.

Table 8. Foreshore management action monitoring and evaluation metrics

Management action	Monitoring	Evaluation metrics	Timing
Fauna monitoring	Nesting speciesVegetation composition of nesting habitats	Turtle tracks, bird nestsPopulation dynamicsAnimal health	Nesting season
Vegetation monitoring	Species specific observations to identify which species may be doing poorly	Measure of the percentage survival of revegetationPercentage survival of key species	Annual

Management action	Monitoring	Evaluation metrics	Timing
	Weed cover within each of the canopy layers (top 5 transforming weed species)	 Percentage cover over canopy layers of weeds Percentage of bare/disturbed ground Natural recruitment Habitat connectivity Significant species 	

• • •

6 References

Australian Bureau of Statistics (ABS) (2017). 2016 Census QuickStats. Accessed online from: https://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20QuickStats

Business Queensland (Queensland Government) (BQ) (2020). Invasive plants. Accessed 13th April 2021 from: https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/weeds-diseases/invasive-plants

Conn, B.J. (2021) Loganiaceae. In: *Weeds Australia*. Centre for Invasive Species Solutions, Canberra. Accessed 13th April 2021 from: https://profiles.ala.org.au/opus/weeds-australia.

Department of Resources (DOR) (2020). Vegetation management regional ecosystem map – version 11.0.

Douglas Shire Council (DSC) (2015). Coconut Management Plan.

DSC (2017). Douglas Shire Biosecurity Plan 2017-2021.

DSC (2018a). Douglas Shire Council Planning Scheme.

DSC (2018b). Coastal Hazard Adaptation Strategy Phase 3-5 Douglas Shire Council: Community Survey Results.

DSC (2019a). Building a Resilient Coast for Douglas Shire: Community Engagement Results.

DSC (2019b). Resilient Coast Strategic Plan.

Florentine, S., Pohlman, C. and Westbrooke, M. (2015). The effectiveness of different planting frameworks for recruitment of tropical rainforest species on ex-rainforest land. Doi: https://doi-org.elibrary.jcu.edu.au/10.1111/rec.12317

Murphy H T, Ford A, Graham E, Metcalfe D (2016) Mapping to underpin management of tropical littoral rainforest. CSIRO, Cairns.

Queensland Parks and Wildlife Service (QPWS), Department of Environment and Science (DES) (2016). Queensland Marine Turtle Field Guide.

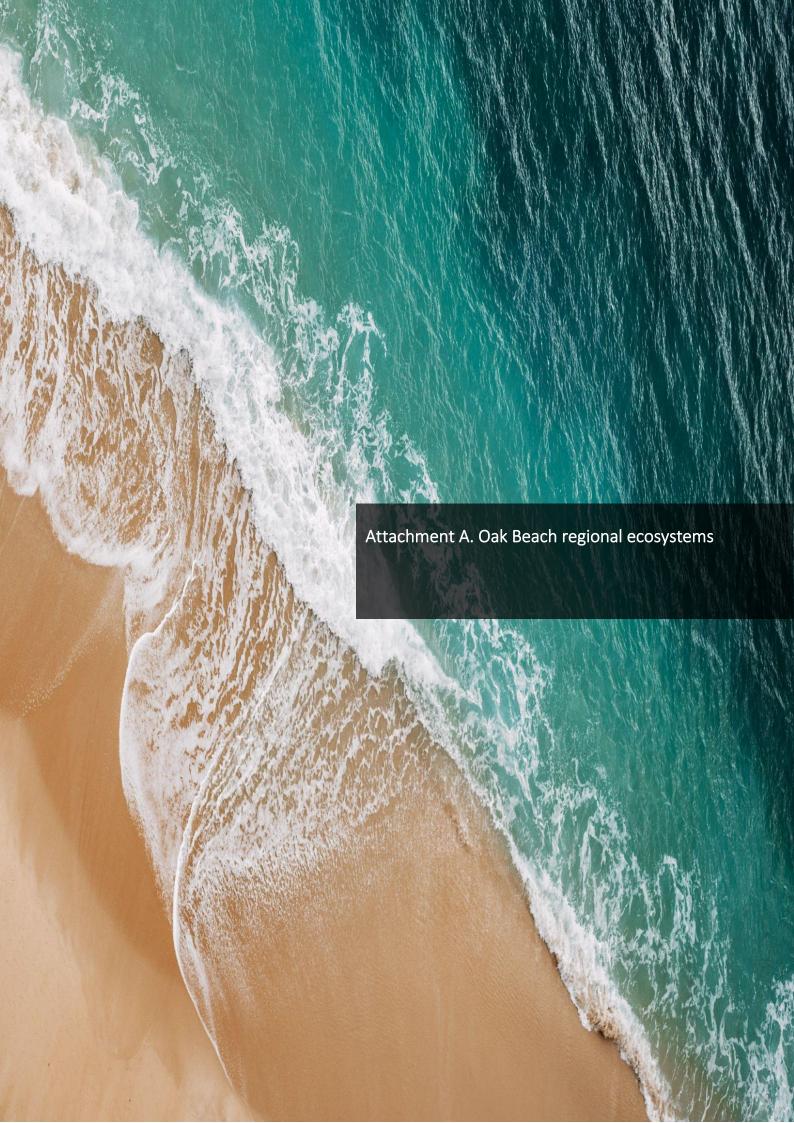


Table 9. Oak Beach regional ecosystems (REs)

RE	Description	VM Class	BD Status
7.11.49	Eucalyptus leptophleba (Molloy red box), Corymbia clarksoniana (Clarkson's bloodwood) and E. platyphylla open forest to woodland. Moist metamorphic foothills.	OC	OC
7.2.2a	Notophyll vine forests, often with Acacia emergents. Species commonly include Cupaniopsis anacardioides, Diospyros geminata, Canarium australianum, Alphitonia excelsa, Acacia crassicarpa, Pleiogynium timorense, Chionanthus ramiflorus, Mimusops elengi, Polyalthia nitidissima, Millettia pinnata, Geijera salicifolia, Ficus opposita, Sersalisia sericea, Terminalia muelleri, T. arenicola, Drypetes deplanchei, and Exocarpos latifolius. Lowlands on dune sands, of the moist and dry rainfall zones.	ОС	E
7.2.8	Melaleuca leucadendra (weeping tea tree) open forest to woodland. Sands of beach origin.	OC	E

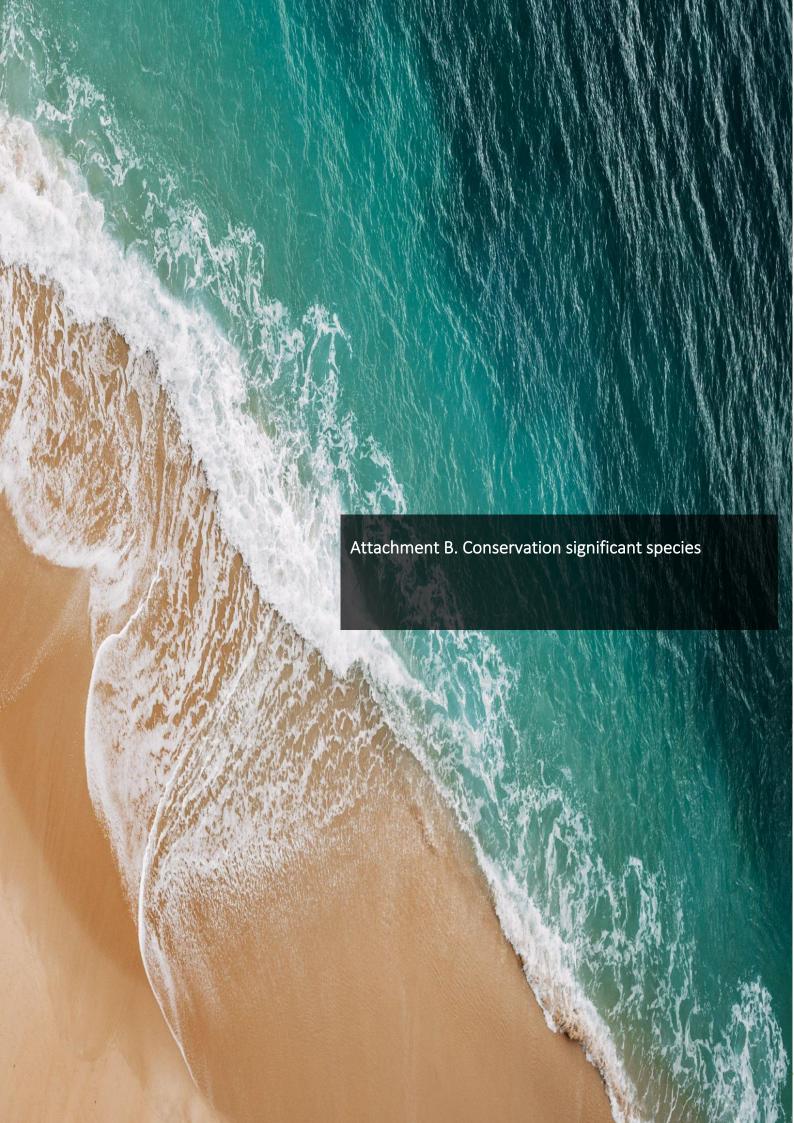


Table 10. Conservation significant fauna at Oak Beach and likelihood of occurrence

Scientific name	Common name	EPBC Act	NC Act	Likelihood of occurrence
		Shorebirds		
Esacus magnirostris	Beach-stone curlew	_	V	Likely
Casuarius casuarius johnsonii	Southern cassowary	E	E	Possible
Calidris ferruginea	Curlew sandpiper	CE	CE	Likely
Numenius madagascariensis	Eastern curlew	CE	E	Likely
Charadrius mongolus	Lesser sand plover	E	E	Likely
Charadrius leschenaultii	Greater sand plover	V	V	Likely
Calidris canutus	Red knot	E	E	Likely
		Sea turtles		
Natator depressus	Flatback turtle	V	V	Likely
Chelonia mydas	Green turtle	V	V	Likely
Eretmochelys imbricata	Hawksbill turtle	V	E	Likely
Dermochelys coriacea	Leatherback turtle	E	E	Possible
Caretta caretta	Loggerhead turtle	E	E	Likely
Lepidochelys olivacea	Olive ridley turtle	E	E	Likely
		Other		
Hirundapus caudacutus	White-throated needletail	V	V	Likely
Cyclopsitta diophthalma macleayana	Macleay's fig-parrot	_	V	Likely
Crocodylus porosus	Estuarine crocodile	_	V	Likely

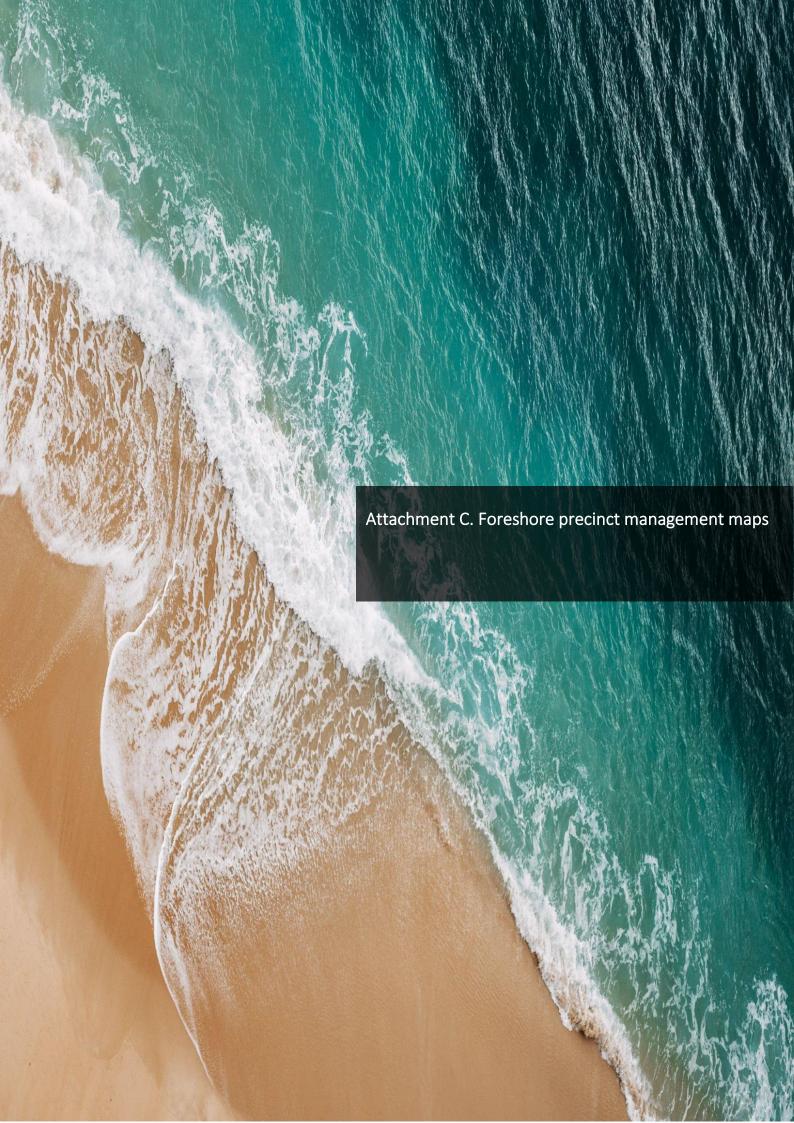




Figure 7. Oak Beach foreshore precinct 1 management actions.

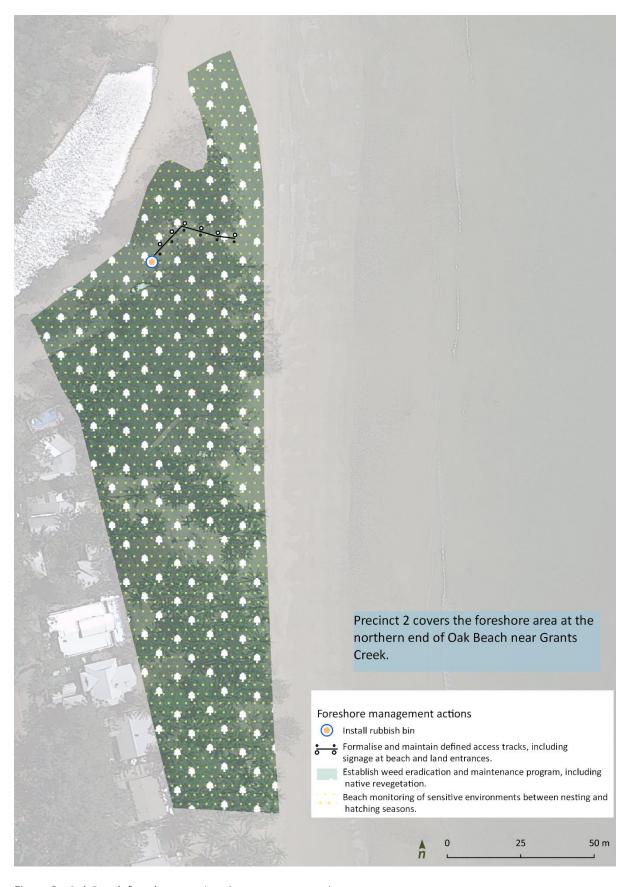


Figure 8. Oak Beach foreshore precinct 2 management actions.



Figure 9. Oak Beach foreshore precinct 3 management actions.



Figure 10. Oak Beach foreshore precinct 4 management actions.

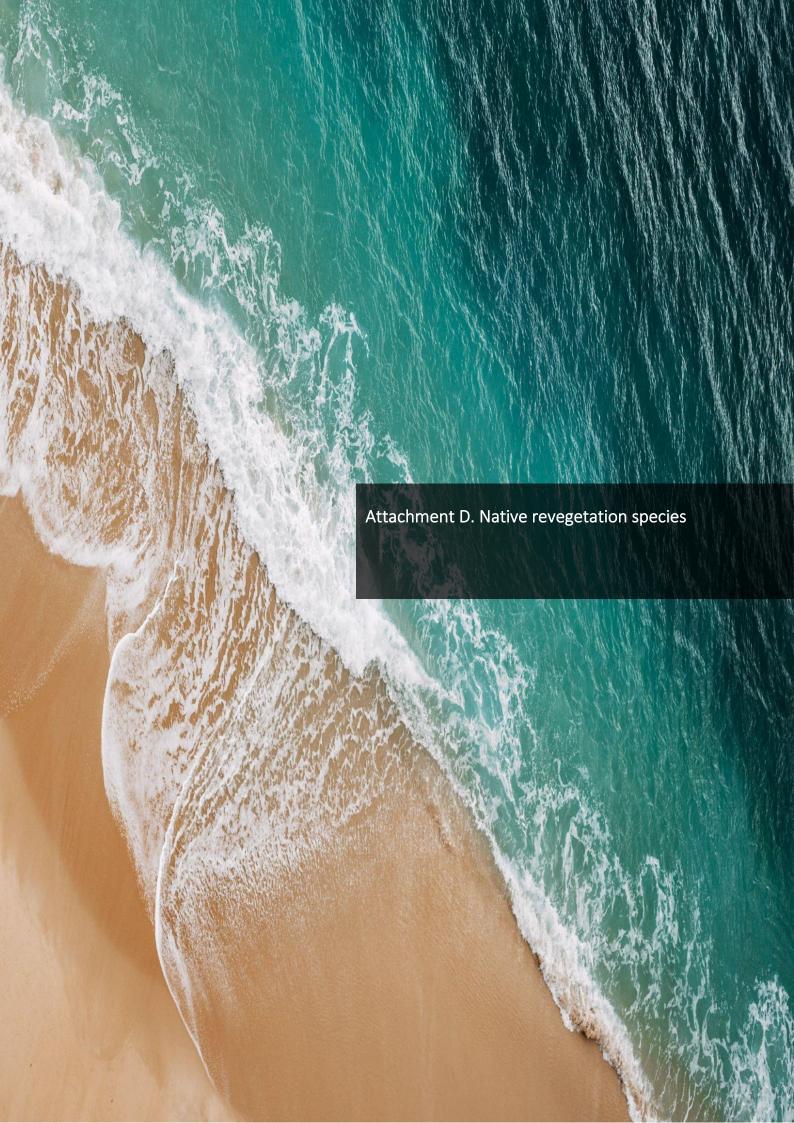


Table 11. Native species for foreshore revegetation

Botanical name ³	Common name	Precinct 1	Precinct 2	Precinct 3
Acacia crassicarpa	Northern golden wattle	✓		•
Acacia mangium	Broadleaf salwood	✓		~
Acacia oraria	Coastal wattle	✓		~
Aglaia elaeagnoidea	Coastal boodyarra	✓		~
Alphitonia petriei*	Sarsaparilla		~	
Alyxia spicata	Chain fruit		•	~
Atractocarpus fitzalanii	Brown gardenia	→		~
Barringtonia asiatica	Mango bark, Mango pine			
Barringtonia calyptrata	Mango pine	✓		✓
Beilschmiedia obtusifolia	Blush walnut	~		~
Blepharocarya involucrigera	Rose butternut	~		~
Brachychiton acerifolius	Illawarra flame tree	~		~
Breynia cernua	Fart bush	~	✓	~
Calophyllum inophyllum	Beach calophyllum	✓		~
Calophyllum sil	Blush touriga			
Canarium vitiense	Canarium	✓		~
Carallia brachiata	Corky bark, Fresh water mangrove	•		~
Casuarina equisetifolia	Beach casuarina	✓	•	~
Cerbera manghas	Sea mango	→	•	~
Chionanthus ramiflora	Native olive	✓		~
Clerodendrum longiflorum	Long flowered clerodendrum	~	•	~
Colubrina asiatica	Beach berry bush	✓	✓	~
Cordia subcordata	Sea trumpet			✓

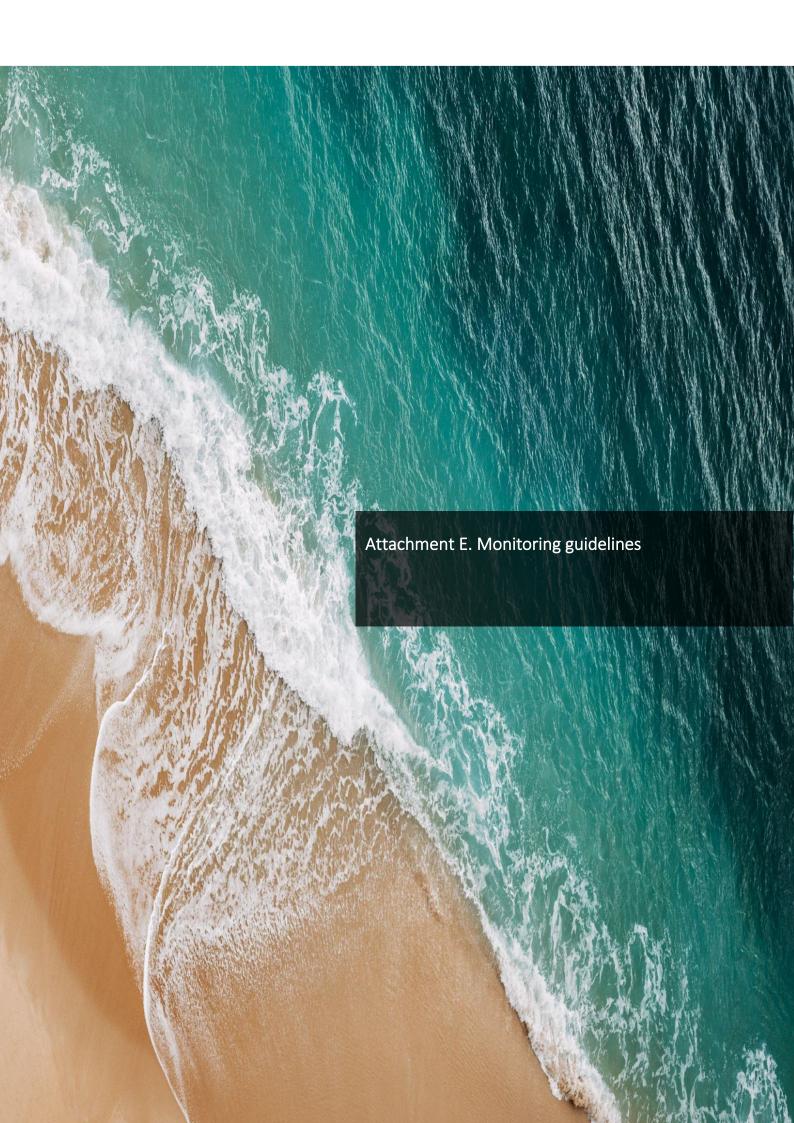
 $^{^3}$ * denotes pioneer species that will grow and establish quickly, allowing for natural recruitment or planting of secondary species.

Botanical name ³	Common name	Precinct 1	Precinct 2	Precinct 3
Crinum pedunculatum	Beach lily, Swamp lily	✓	✓	•
Cupaniopsis anacardioides	Beach Tamarind	✓		✓
Cyperus pedunculatus		✓	✓	•
Deplanchea tetraphylla	Golden bouquet tree	✓	•	•
Dillenia alata	Red beech	✓		•
Diospyros compacta	Australian ebony	✓	•	•
Dodonea viscosa	Hop bush	✓		✓
Elaeodendron melanocarpum	False olive	~	•	~
Eucalyptus plattyphylla	Ghost gum			
Euroschinus falcata*	Pink poplar		•	
Ficus benjamina	Weeping fig	✓	•	✓
Ficus drupacea	Drupe fig	✓		✓
Ficus microcarpa	Small fruited fig	✓		✓
Ficus opposita	Sandpaper fig	✓		~
Ficus racemosa	Cluster fig	✓		✓
Ganophyllum falcatum	Daintree hickory	✓		✓
Glochidion harveyanum	Harvey's buttonwood	✓	•	•
Glochidion philippicum	Daintree cheese tree	✓		•
Gmelina dalrympleana	White beech	✓	•	✓
Gomphandra australiana	Buff beech	✓	✓	✓
Guioa acutifolia*	Glossy tamarind		✓	
Haemodorum coccineum	Blood root	✓	✓	✓
Hibiscus tiliaceus	Coast cottonwood	✓	✓	✓
Intsia bijuga	Kwila	✓		✓
lpomoea pes-caprae	Coastal morning glory	✓	✓	✓
Jagera pseudorhus	Foambark	→		✓

Botanical name ³	Common name	Precinct 1	Precinct 2	Precinct 3
Livistona muelleri	Northern Cabbage Tree Palm	•		•
Lophostemon suaveolens	Swamp mahogany, swamp box			
Macaranga tanarius	Kamala, Blush macaranga	~		~
Mallotus philippensis	Red Kamala	~		~
Maytenus fasciculiflora	Orangebark			
Melaleuca leucadendra	Weeping paperbark			
Melaeuca viridiflora	Broad leaved paperbark			
Melia azederach	White cedar			
Micromelum minutum	Lime berry	~		~
Miliusa brahei	Rasberry jelly plant	~		~
Millettia pinnata	Pongamia tree	~		~
Mimusops elengi	Red coondoo	~		~
Mischocarpus exangulatus	Red bell mischocarp	~	•	~
Morinda citrifolia	Rotten cheesefruit	~		~
Pandanus tectorius	Beach pandan	~		~
Pittosporum ferrugineum	Rusty pittosporum	~	•	~
Planchonia careya	Cocky apple	•		~
Pleiogynium timorense	Burdekin plum	•		~
Polyscias elegans	Celerywood	•		~
Pouteria chartacea	Thin leaved coondoo	~	•	~
Pouteria obovata	Yellow boxwood	~	•	~
Premna serratifolia	Coastal premna	~	•	~
Ptychosperma elegans	Solitaire palm			~
Rhus taitensis	Sumac	~		✓
Scaevola taccada	Beach lettuce	~		~

• • •

Botanical name ³	Common name	Precinct 1	Precinct 2	Precinct 3
Schefflera actinophylla	Umbrella tree	~		~
Scolopia braunii	Brown birch	✓		~
Sporobolus virginicus	Sand couch	~	~	✓
Sterculia quadrifida	Peanut tree	~		~
Syzygium angophoroides	Yarrabah satinash	~		~
Syzygium hemilamprum (Syn. Acmena hemilampra)	Blush satinash	~		~
Tarenna dallachiana	Tree ixora	✓		~
Terminalia arenicola	Brown damson	✓		✓
Terminalia catappa	Indian almond	✓		✓
Terminalia microcarpa	Damson plum	✓		~
Terminalia muelleri	Mueller's damson	✓		✓
Thespesia populneoides	Tulip tree	✓		✓
Thurea involute	Tropical beachgrass	✓	~	~
Timonius timon	False fig	~		~
Vitex rotundifolia	Beach vitex	·	~	~
Vigna marina	Beach pea	✓	✓	✓

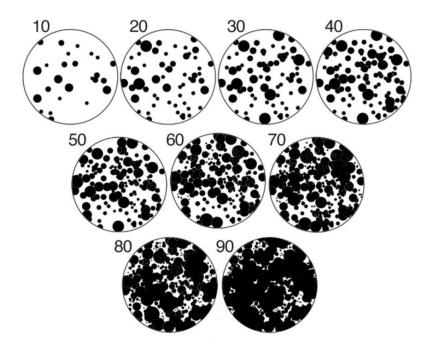


Rapid Vegetation Assessment Method Data collection

	Survey ID	Description of survey					
	Sarvey ID	2 compaign of survey					
survey ation	Assessor Name/s	Descriptive text					
General survey information	Date of record	Date					
G	Assessment number	Assessment	1	2	3	4	5
	General Location	Descriptive text					
Specific location	Easting	GPS spatial data					
ecific lo	Northing	GPS spatial data					
δ	Spatial uncertainty	GPS spatial data					
		Desi	red cover by year !	<u> </u> 5			
	Present	1 (1-5)	2 (6-25)	3 (26-50)	4 (51-75)	5 (76-100)	Absent
		- (/	_ (/	- (== == ,	. (:- /	- (,	
Under							
Mid							
Over							
		Cur	rent overall cover	<u> </u>	<u>l</u>	<u> </u>	
	Present	1 (1-5)	2 (6-25)	3 (26-50)	4 (51-75)	5 (76-100)	Absent
Under							
Mid							
Over							
	1	Percenta	ge survival of each	layer		1	
	Present	1 (1-5)	2 (6-25)	3 (26-50)	4 (51-75)	5 (76-100)	Absent
Under							
Mid							
Over							
		Species	specific observati	ons			
	% Un	derstorey	% Mid-	-storev	% Ove	erstorey	%
Cn 1		,	-	,		,	
Sp. 1							
Sp. 2							
Sp. 3							
Sp. 4							
	1		1				<u> </u>

Sp. 5							
		Env	vironmental weeds co	ver			
	Present	1 (1-5)	2 (6-25)	3 (26-50)	4 (51-75)	5 (76-100)	Absent
Under							
Mid							
Over							
		High t	hreat environmental v	weeds			
	W 1	Jnderstorey	% Mid-		% Ove	erstorey	%
	/6 C	muerstorey	/6 IVIIU-	storey	// OVE	ristorey	/0
Sp. 1							
Sp. 2							
Sp. 3							
Sp. 4							
Sp. 5							
		Bare gr	ound created by distu	rbance			
	Present	1 (1-5)	2 (6-25)	3 (26-50)	4 (51-75)	5 (76-100)	Absent
Vehicles							
People							
Erosion							
Other							
			Natural recruitment				
		Absent	Pres	sent		%	
Under							
Mid							
Over							
			Connectivity				
	Patch size (ha)		Distance (km)		Connection		
Patch 1					Н	M	L
Patch 2					Н	M	L
Patch 3					Н	М	L
		Sigr	nificant species identif	ied			
	Location	Population size	Threat		Proposed res	sponse	
-							

Sp. 1		
Sp. 2		
Sp. 3		



 $\textbf{Figure 11.} \ \textit{Schematic representation of percentage cover categories}.$

Queensland Marine Turtle Field Guide











Queensland's coast has some of the most important marine turtle nesting sites in the world. Six species of threatened marine turtles nest along our idyllic beaches. These rookeries support significant nesting populations of green, loggerhead, hawksbill, flatback and olive ridley turtles.

One of the most serious threats to nesting turtle populations is the destruction of their eggs and hatchlings by predators. Feral pigs have been found to be responsible for destroying over 70 per cent of turtle nests at nesting beaches on Cape York, continued loss at this rate is not sustainable. Other predators include foxes, dogs, dingoes and goannas.

To reduce predation on marine turtle nests and help the recovery of threatened marine turtle populations, the Australian and Queensland Governments have together invested nearly \$7million in the Nest to Ocean Turtle Protection Program. The program supports predator control and turtle monitoring at priority nesting beaches. It also assists Traditional Owner and

community groups to increase their participation in these important activities.

This field guide has been developed as part of the Nest to Ocean Turtle Protection Program. Correctly identifying marine turtles, and the animals that prey on their nests, provides valuable information about turtle populations and shows where predator control activities are most needed.

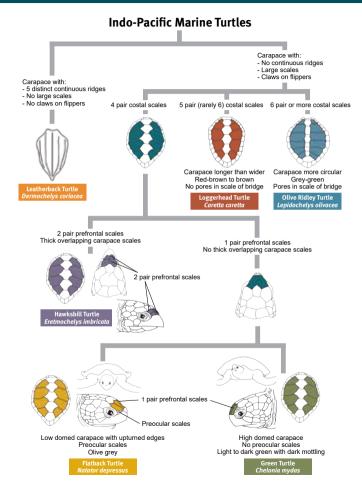




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Marine Turtle Species Identification Key



Photographs of Adults and Hatchlings







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Olive Ridley Turtle Lepidochelys olivacea

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Hawksbill Turtle Eretmochelys imbricata

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Loggerhead Turtle Caretta caretta

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Flatback Turtle Natator depressus

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Leatherback Turtle Dermochelys coriacea

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Marine Turtle Track Identification Key

Alternating Stroke

Flipper marks alternate



Track Features

Early morning monitoring is best as tracks will deteriorate over time. The clarity of tracks can be affected by flipper damage, terrain, sand moisture, tides, wind and weather. Look for several key identifying features, along different sections of track.

The key track identification features are:

- Stroke Style
- · Track Width
- · Hind Flipper Marks
- Front Flipper Marks
- Plastron Drag
- · Tail Drag



Loggerhead

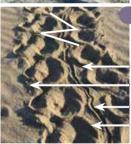
Track Width Less than 1 meter

Hind Flipper

Front Flipper

Plastron Drag

Tail Drag Not present



Hawksbill

Track Width Approx. 70-80 cm

Hind Flipper

Front Flipper

Plastron Drag

Tail Drag



Olive Ridley

Track Width Approx. 70-80 cm

Hind Flipper

Front Flipper

Plastron Drag

Tail Drag





Flipper marks side by side





Green

Track Width Approx. 94-144 cm

Hind Flipper

Front Flipper

Plastron Drag

Tail Drag

Flatback

Track Width Approx. 90-100 cm

Hind Flipper

Front Flipper

Plastron Drag

Tail Drag

Track Direction

Clues to determine track direction:

Turtles push sand backwards, the higher sand mound is at the back

If track overlaps, the top track is the returning track.

Sand is always thrown back over the emerging track when digging.

Measuring Width

Measure from outer edge of track. This may be the front or rear flipper, depending on species.

Leatherback

Track Width Greater than 2 meters

Hind Flipper

Front Flipper

Plastron Drag Not Visible

Tail Drag



Basic Beach Monitoring

Guidelines on how to **Record** data and implement **Action** during a basic beach survey (see page 9). These may be tailored to suit individual monitoring programs and implemented in accordance with training.

Record

Species Identification: Use track or sighting to identify species.

GPS Nest Location: Note GPS coordinates & waypoint number.

False Crawl: Track with no nest.

Extent of Damage: Partial or complete destruction of nest.

Evidence of Predation: Diggings, tracks, sighting.

Predator Identification: Use track or sighting to identify species.

Hatchlings Emerged: Yes, hatchling tracks or sighting.

Tag Information: Note tag ID number and its location on turtle.

Curved carapace length (CCL): From front (where skin and carapace meet), down midline to back edge of carapace (over tail).



Action

Photograph: To verify species and/or nest damage/predation.

Mark Nest: Install marker to indicate nest location (if required).

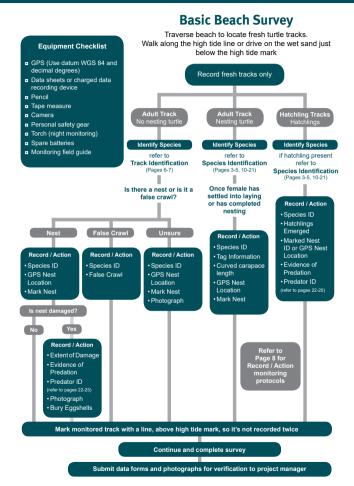
Bury Eggshells and Mark Track: To avoid record duplication; mark track line above the high tide mark.

Submit Data: Project manager to submit data to the relevant Queensland Department.





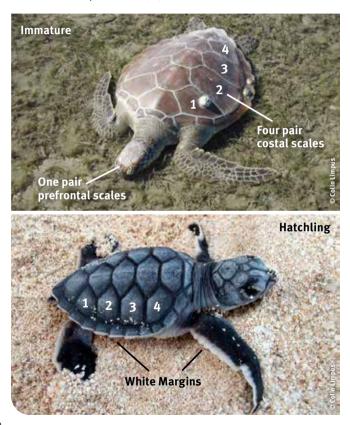






Green Turtle, Chelonia mydas

Status: Nationally Vulnerable, Queensland Vulnerable



Key Identification Features











Breast Stroke Track

Carapace Scales

4 Pair Costal Scales

1 Pair Prefrontal Scales

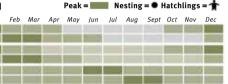
Qld Nesting Sites

Adult: Carapace is a high dome. Colour is light to dark green with dark mottling. Plastron colour is cream-white.

Hatchling: Black-dark brown with white margins, white plastron.

Breeding Season











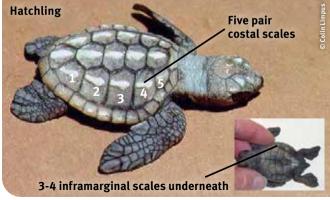




Loggerhead Turtle, Caretta caretta

Status: Nationally Endangered, Queensland Endangered





Loggerhead Turtle

Key Identification Features









Alternating Track

Carapace Scales

5 Pair Costal Scales

Qua nesting sites

Adult: Carapace is longer than wider. Colour is red-brown to brown. Plastron colour is yellow.

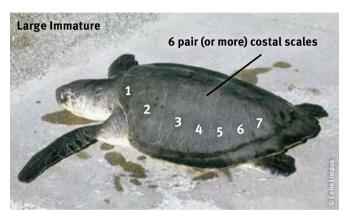
Hatchling: Dark brown with 5 costal scales and dark plastron with 3-4 inframarginal scales.





Olive Ridley Turtle, Lepidochelys olivacea

Status: Nationally Endangered, Queensland Endangered





Olive Ridley Turtle

Key Identification Features









Alternating Track

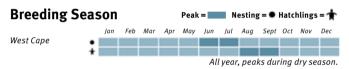
Carapace Scales

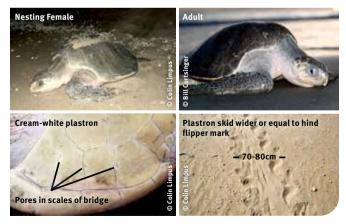
6 Pair (or more) Costal Scales

Qld Nesting Sites

Adult: Carapace is circular. Colour is grey-green with no conspicuous markings. Plastron colour is cream-white.

Hatchling: Charcoal-grey/black-brown on both sides.



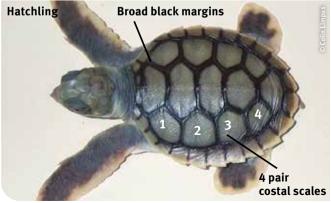




Flatback Turtle, Natator depressus

Status: Nationally Vulnerable, Queensland Vulnerable





Key Identification Features











Breast Stroke Track

Carapace Scales

4 Pair Costal Scales

1 Pair Prefrontal Scales

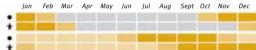
Qld Nesting Sites

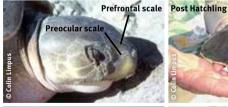
Nesting = ● Hatchlings = 🛨

Adult: Carapace is a low dome, smooth with upturned edges. Colour is grey to pale-grey or olive. Preocular scales. Plastron is creamy-yellow. Hatchling: Olive-green, scales with broad black margin. Plastron is a solid white.

Breeding Season









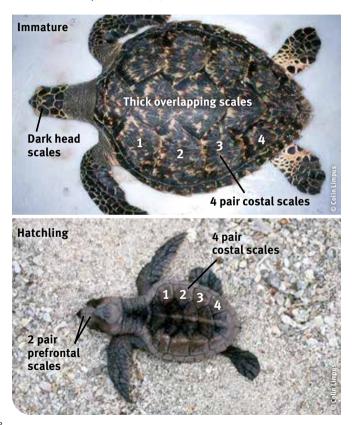






Hawksbill Turtle, Eretmochelys imbricata

Status: Nationally Vulnerable, Queensland Vulnerable



Key Identifcation Features











Alternating Track

Scales Thick Overlapping

4 Pair Costal Scales

2 Pair Prefrontal Scales

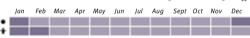
Qld Nesting Sites

Adult: Carapace has thick overlapping scales. Colour is olive green or brown and is extensively variegated with brown/black markings. Adult plastron is yellow or white with black spots.

Hatchlings: Dark brown.

Breeding Season

Northern Great Barrier Reef and Torres Strait









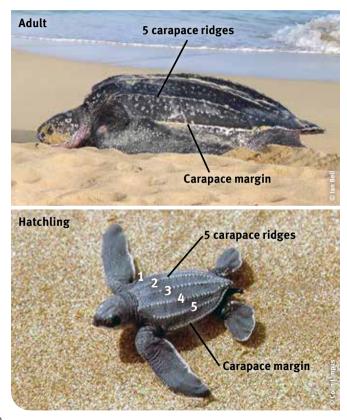
Peak = Nesting = Hatchlings = ★





Leatherback Turtle, Dermochelys coriacea

Status: Nationally Vulnerable, Queensland Endangered



Leatherback Turtle

Key Identification Features









Breast Stroke Track

No Carapace Scales

5 Carapace Ridges

Qld Nesting Sites

Adult: Carapace is long and pointed. Long ridges run down the length of carapace. Colour is a uniform black-brown. Soft leathery skin.

Hatchlings: Finely beaded, black with white markings on the carapace ridges and plastron.

Apr

Breeding Season







South Eastern Queensland

Adult





Aug





Predator Track Identification

Fox

Straight track, hind feet reusing front feet impressions

Small track

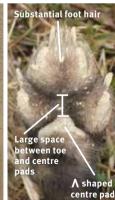
width







- Front foot is larger than back foot.
- Elongated oval shaped claws, may not show on track.
- Substantial foot hair, sometimes visible on track impression.
- Large space between centre pad and toe pads.
- Centre pad has a distinct inverted V shape.
- Tracks are straight, hind feet reusing front feet impressions.
- · Small track width.







Management Options

- Den detection and fumigation
- Ground shooting
- TrappingBaiting
- Exclusion fencing
- Nest protection (cages)



Wild Dog or Dingo





Track Identification Features

- Front foot is larger than back foot.
- Little or no foot hair in between pads.
- Small space between centre pad and toe pads.
- Centre pad almost triangular.
- Foot imprint rounded.
- Tracks are straight but not as neat and aligned as a fox's track.







Front



Back

Management Options

- Ground shooting
- Leg hold trapping
- Baiting (1080 or strychnine)
- · Exclusion fencing
- Nest protection (cages)

Feral Pig



Pigs eat 100 percent of nest eggs, predating many nests per night

Track Identification Features

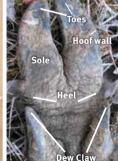
- Back feet slightly larger than front.
 - Foot print consists of a two toe hoof and two dew claws.
 - Dew claws distinctive identification feature but may not be present in harder soils.
 - Small stride and narrow straddle.



Dew claw visible in sand impression









- Ground/aerial shooting
- Trapping
- Baiting
- Exclusion fencing
- Nest protection (cages)





Goanna



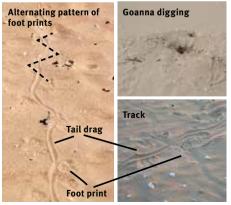
Track Identification Features

- Both walk and run tracks have alternating foot prints.
- Trail drag usually visable.



Nest Predation Identification

- Goannas burrow into nest at an angle from the side of the nest, not vertical from directly above.
- The burrow is typically domed shape, not circular.



Management Options

- Trapping
- Exclusion fencing
- Nest protection (cages)

Principles of Pest Management

Managing pest animals requires long-term control programs and a variety of approaches. Effective programs are designed around these eight principles:

1. INTEGRATION

Ensuring pest management programs are an integral part of the management of natural areas.

2. PUBLIC AWARENESS

Raising public awareness and knowledge of pests to increase community and individual participation in pest management.

3. COMMITMENT

Gaining a commitment to long term programs by the community, industry groups and government entities.

4. CONSULTATION AND PARTNERSHIP

Establishing partnerships between local communities, industry groups, state government agencies and local governments to achieve a collaborative approach.

5. PLANNING

Consistent planning at local, regional, state and national levels ensures combined resources target the agreed priorities.

6. PREVENTION

Preventing the spread of pests, and using early detection and intervention to control pests.

7. BEST PRACTICE

Using ecologically and socially responsible pest management practices to protect the environment and natural resources.

8. IMPROVEMENT

Research and regular monitoring and evaluating of programs helps improve and refine pest management practices.



Threats to Marine Turtles

Marine turtles are long-lived and slow to mature. Depending on the species they can take anywhere between 8–50 years to reach breeding age. Due to the range of threats, at their different life stages, it is thought that only 1 in 1000 hatchlings will survive to adulthood and then return to the beach to nest. For this reason it is critical to address the range of threats throughout their lifecycle.

Threats include:

- Native and introduced animals predating turtle eggs and hatchlings.
- Vehicles compacting turtle nests or forming tyre ruts that trap hatchlings.
- Humans taking turtle eggs.
- Bycatch of marine turtles in fisheries.
- · Marine debris.
- Impact to breeding habitat from coastal development and artificial lighting.
- Deteriorating water quality.
- Unknown and possibly unsustainable levels of turtle harvesting, in and outside Australian waters.

What you can do:

- Support the management of predators such as pigs, dogs and foxes around turtle nesting beaches.
- Report turtle nests and predated turtle nests to your local ranger.
- Keep your dogs on a lead when walking on the beach during nesting/hatchling season.
- Drive slowly on beaches and avoid driving over nests. Drive on the wet sand below the high tide mark to avoid making wheel ruts.
- Pick up marine debris from the beach and waterways.
- Report ghost nets to your local ranger.
- At night, minimise lights on the beach, including campfires.
- Support sustainable, traditional use of adult turtles and turtle eggs.

Acknowledgements

The Queensland Parks and Wildlife Service Nest to Ocean Turtle Protection Program Team would like to acknowledge the contribution of staff from the following organisations in the development of the field guide: Western Cape Turtle Threat Abatement Alliance supported by Cape York Natural Resource Management, Balkanu Cape York Development Corporation, Aak Puul Ngantam, Feralfix, World Wildlife Fund for Nature, and University of Oueensland, Also acknowledged is the input and advice of staff from our partnering Australian and Queensland Government departments.

References

Biosecurity Act 2014 (Qld)

Cape York Sea Turtle Project Turtle: Track Monitoring Manual. (Cape York Sustainable Futures)

Limpus, C. J. (2008). A Biological Review of Australian Marine Turtles.
1. Loggerhead Turtle Caretta caretta (Linnaeus). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (2008). A Biological Review of Australian Marine Turtles. 2. Green Turtle Chelonia Mydas (Linnaeus). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (2009). A Biological Review of Australian Marine Turtles. 3. Hawksbill Turtle Eretmochelys Imbricata (Linnaeus). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (2008). A Biological Review of Australian Marine Turtles. 4. Olive Ridley Turtle Lepidochelys Olivacea (Eschcholtz). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (2007). A Biological Review of Australian Marine Turtles. 5. Flatback Turtle Natador Depressus (Garman). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (2009). A Biological Review of Australian Marine Turtles. 6. Leatherback Turtle Dermochelys Coriacea (Vandelli). (Queensland Government Environmental Protection Agency: Brisbane.)

Limpus, C. J. (1992a). Indo-Pacific Marine Turtle Identification Key. (Queensland Department of Environment and Heritage, Brisbane.)

Markovina, K. (2015) Turtle Monitoring Field Guide (Edition 7). (Western Australian Government Department of Parks and Wildlife.)

Nest to Ocean Turtle Protection Program: 2014 to 2018 Improving Turtle Nest Success Through Predator Control.

Queensland Government Department of National Parks, Recreation, Sports and Racing, Queensland Parks and Wildlife Service (2014).



Green Turtles on Raine Island © Duncan Limpus