Cottonwood Tree Study

08th April 2019

ARBOR AUSTRALIS CONSULTING

AUSTRALIAN HERITAGE SPECIALISTS

28°S ENVIRONMENTAL

place design group.

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1 Introduction

Project Description

Place Design Group (PDG) have been engaged by Sunshine Coast Regional Council to undertake an independent investigation of the characteristics of *Hibiscus tiliaceus* (Cottonwood Tree), their distribution, growth patterns and values within a nominated 'Study Area'.

As part of this assessment PDG undertook targeted engagement sessions with local community members in order to gain an understanding of the overall sentiment around coastal vegetation and Cottonwood Trees within the study area. Further to this, cultural heritage investigations have been undertaken to provide a description of indigenous associations with Cottonwood Trees within the study area, their significance and other relevant findings.

Ecological findings have been presented in this report. Where applicable recommendations have been indicated to assist future maintenance and management of Cottonwood Trees within the study area.

Study Area

The Study Area is described as the coastal strip situated between Victoria Terrace, Shelly Beach and Westaway Tce, Currimundi.

The Study Area includes open space areas above the HAT, east of road or private property and includes areas of adjoining estuaries, creeks and lagoons.

Typically, the study area includes vegetation communities residing above the tidal line including dunal vegetation, woodland areas, tidal swamps, headlands and planted parklands. Road reserves and carparks have been included where abutting the study area and where Cottonwood Trees were observed.

Parks found within the study area include the following:

- Shelly Beach Park
- Des Dwyer Walkway
- George Watson Park
- Ma and Pa Bendall Park
- Eleanor Shipley Park
- Sir Leslie Wilson Park

Coastal Pathway

The study area includes areas of the 'Coastal Pathway', described as a key recreational and transport infrastructure asset aligned with Sunshine Coast Council's vision to become 'Australia's most sustainable region' (Sunshine Coast Council, 2018).

A range of uses and activities can be described as occurring within the Coastal Strip. These include recreational activities, such as picnics and family events, hiking and bushwalking, organised events such as weddings and fitness activities. The coastal pathway can be considered a key driver in the maintenance requirements applicable to vegetation within the study area.

2 Targeted Engagement

Site Walkthrough Sessions

Methodology

A walkthrough from Dicky Beach to Shelly Beach was undertaken on 30th November 2018 with the aim of gaining an understanding of community and visitor sentiment regarding coastal vegetation and Cottonwood Trees within the subject site.

Information was gathered from 13 participants over a 1-hour period. Notes were recorded in the field from residents and tourists, with the average meeting running for 5 minutes.

Open ended questions in relation to vegetation assemblages and the coastal pathway were used as conversation starters. Users were asked to describe the vegetation occurring along the beach forefront and provide comments regarding general maintenance and appropriateness of existing vegetation communities.

Findings

Most participants indicated a preference for native vegetation communities and typically described the vegetation occurring along the coastal forefront as natural. Overall the majority of participants had a preference for leaving areas 'as is' and preferred to comment on the amenity of the coastal pathway.

General Comments

- 1 participant indicated that the beach forefront should consist of less houses and a wider vegetation buffer.
- A number of participants indicated that the coastal strip should be left as is with no clearing of existing vegetation.
- A number of participants indicated that they did not believe the coastal pathway was world class. A number of people believed that the pathway was world class.
- 1 participant indicated that the coastal strip at Shelly Beach was weedy and in need to maintenance.
- A number of people indicated that coastal sea views were adequate from the coastal pathway.
- 1 participant expressed safety concerns with vegetation and pathway clearances.
- 1 local resident indicated that the vegetation at Shelly Beach was a weedy mess with Cottonwood Trees and indicated that the coastal pathway should be on top of the frontal dune. The same resident indicated that Cottonwood Trees are outcompeting natives and indicated a preference for clearing for parks to host weddings and the like.

- 1 participant indicated that dunal vegetation was adequate as it prevents soil erosion.
- 1 participant indicated a preference for more seating along the coastal pathway and thinning out of shrub species to allow water views.
- A number of participants indicated that the coastal strip should be left as is in a natural state.
- 1 participant indicated that along the coastal pathway additional trees including ornamental gardens would be desirable and indicated that dunal areas should be left as is.
- Some participants suggested more shade over the coastal pathway
- 1 participant indicated that no more Norfolk Island Pines should be planted
- 1 participant indicated that water bubblers should be found more regularly along the coastal pathway

Targeting Stakeholder Meetings

Methodology

Meetings were set up with key stakeholders as provided by SCRC. Each meeting went for 15 minutes with participants providing comments, findings and general feelings around Cottonwood Trees with the study area. 5 open ended questions were asked of each participant in order to stimulate discussion.

Residents that were unable to attend face to face meetings were given the opportunity to provide comments via telephone conferencing or email correspondence. A number of emails were also received following meetings with participants providing additional reporting, studies and correspondence relating to historical findings and previously commissioned studies.

During meetings notes were taken and key themes summarised and compiled as part of the report findings.

Findings

Most participants had a reasonable understanding of previous studies conducted in Shelly Beach including report findings and council submissions regarding clearing of Cottonwood Trees, coastal views and fauna interactions.

Participants were clearly either for or against the management of Cottonwood Trees within the study area, specifically Shelly Beach.

General Comments and Concerns

- Some participants were concerned about large scale clearing of Cottonwood Trees within coastal areas if approval was given for clearing at Shelly Beach.
- Most participants indicated that vegetation management within coastal areas is currently inadequate. This included weed control and management of viewshed along the Coastal Pathway.
- Some participants indicated that greater education needs to come from council in relation to the suitability of Cottonwood Trees within dunal areas.
- A number of participants believe that significant growth has occurred over the past 20 years and that the vegetation on the frontal dune looked significantly different when they first invested in their coastal property.
- A number of participants indicated a reduction in land value due to Cottonwood Trees impacting viewshed from their property.
- A number of participants have suggested that council need a dunal management policy to guide revegetation works and maintenance activities such as weed control.
- 1 resident suggested that council need to be more proactive and that other areas of the coast are getting more maintenance attention than Shelly Beach.
- The majority of participants and residents acknowledged a divide in their local community due to previous studies undertaken and proposals to manage Cottonwood Trees. It was suggested that this has also led to physical confrontations and social isolation for some.
- Some participants indicated that residents are planting trees at their own accord within dunal areas and have watered and fertilised these plantings. The purpose of this was not revealed. It was indicated that actions such as this have been reported to council and have not been actioned on.
- Some residents expressed concerns with the study being undertaken and believe it may be a vailed attempt to get the original proposal of viewshed clearing through to the advantage of some residents.

Habitat

- Some participants were concerned about loss of turtle habitat on frontal dunes due to the impact of Cottonwood Trees on nesting sites at Shelly Beach.
- Some participants referenced information from Dr Col Limpus which they say identifies Shelly Beach as a future hotspot for Loggerhead nesting. It is suggested that due to climate change northern beaches (Mon Repos) will get hotter and therefore Loggerhead Turtles will prefer southern cooler beaches such as Shelly Beach.
- One participant indicated that the sex of turtles is decided by the beach temperature in which they are born.
- Some participants indicated that Cottonwood Trees prevent light spill onto beaches from residential areas and therefore contribute towards the nesting success of Shelly Beach.

- Some participants indicated that previous light studies were undertaken and that clearing of Cottonwood Trees at Shelly Beach will not increase light levels to beach areas.
- 1 participant indicated that nesting on Shelly Beach was present prior to Cottonwood Trees when the area was a caravan park.
- Some participants suggested that screening may be suitable if light spill is an issue from residential areas.
- Some people have suggested that Shelly Beach does not represent a typical dunal section as the dune was constructed and that it is a rocky shore with sand overlay. It was suggested that this is the reason turtles like the area as the sand is more stable.
- Some participants believe that Cottonwood Tree roots make it difficult for turtle nesting and believe that numbers have reduced over the years due to this.

Vegetation and Management

- All participants agreed that dunal areas should be comprised of native plant species that are fit for purpose.
- Some participants were concerned about the loss of native vegetation and biodiversity within dunal areas dune to competition from Cottonwood Trees.
- Some participants challenged the Queensland Herbariums description of Cottonwood Trees. Indicating that they do not fit the definition of a pioneer plant and are not representative of RE 12.2.14.
- Some participants believe that Cottonwood Trees are native pioneer trees that from an integral part of the regional ecosystem described as 12.2.14.
- Some participants acknowledged that Cottonwood Trees are a pioneer species and that their presence within the site will decline in the future due to successional change of dunal areas.
- Some participants indicated that the Cottonwood Trees at Shelly Beach were planted by council.
- Some participants indicated better species selection is required for revegetation works in dunal areas.
- 1 participant suggested that pruning may be acceptable to reduce canopy spread.
- 1 participant suggested that pruning would not be suitable as Cottonwood Trees provide cover at the ground level which fauna utilise.
- The majority of participants indicated that reveg areas should be managed in a different way to remnant vegetation areas.
- A number of participants indicated that reveg areas should be managed for people due to the objectives of the Coastal Pathway to provide a world class pathway, coastal views, CPTED and amenity for users.
- Some participants indicated that Cottonwood Trees provide good shade cover in

coastal areas.

- Some participants suggested more planting of native trees in areas where nesting will occur.
- Some people were concerned about the cost to council and ratepayers if a high level of vegetation management including weed control and replenishing was to be undertaken.
- Some people that were opposed to pruning and clearing of Cottonwood Trees in dunal areas indicated that pruning and uplifting may be appropriate for individual specimens outside of dunal communities i.e. parks.
- 1 person indicated that a previous report undertaken for the coastal pathway included some requirements for dunal management including species. Cottonwood Trees were not listed in this report for revegetation in dunal areas.
- 1 participant suggested that the Qld Herbarium changed its opinion of the status of Cottonwood Trees within RE 12.2.14 following previous work undertaken.
- Some participants have indicated that numbers are increasing and will continue too without management.
- Suggested replacement species included Banksias and Sheoaks.

Geomorphology

- Some participants were concerned with dunal stabilisation if Cottonwood Trees are to be removed in dunal areas. One participant indicated that Cottonwood Trees help to harden dunes therefore providing greater stability to the dunal area during tidal events and storm surges.
- Some participants indicated that Cottonwood Trees belong on the second dune rather than frontal dune.
- Some participants believed that the dune provided key protection to adjacent residential areas during storm events and if the stability of the dune is jeopardised by clearing of Cottonwood Trees then residential areas will be at a greater risk of inundation.
- Some participants indicated that the frontal dune at Shelly Beach was constructed rather than natural.

Safety and Visual Amenity

- Some participants commented on unsavoury behaviours amongst Cottonwood Tree in dunal areas. This included selling of illicit substances, sexual activity, urinating/defecation and drug use. It was also noted that camping has been observed within dunal areas in association with Cottonwood stands.
- Some participants commented on unsafe conditions along the coastal pathway due to Cottonwood Trees and indicated that they know people who will not use certain

sections of the coastal pathway at Shelly Beach due to CPTED issues.

- Some residents believe that council has a legal obligation to ensure the coastal pathway is safe.
- Some participants indicated that views are adequate and therefore why manage areas for viewshed – views should be revealed along the pathway rather than fully open.
- Some participants have indicated Cottonwood Trees have an unpleasant aroma.
- 1 participant indicated that the trees are visually unappealing and do not provide the same amount of shade as other species.

3 Cultural Heritage

Introduction

The investigation regarding the overall characteristics of Cottonwood trees (Cottonwood Tree Study) in the vicinity of Currimundi to Wickham Point, Caloundra was identified as requiring specialist consideration for cultural heritage. Australian Heritage Specialists (AHS) assisted with these requirements.

In particular, the management and protection of the cottonwood trees will need to be developed in consultation with the Kabi Kabi First Nation People (Kabi Kabi), who are the Aboriginal Party for the Study Area under the provisions of the *Aboriginal Cultural Heritage Act 2003*.

The following information outlines the progress of cultural heritage matters for the project at the end of February 2019.

Approach

The assessment has been completed in two parts:

- Initial consultation with Kabi Kabi.
- Undertake on-ground site investigations to define cultural heritage attributes.

Methodology

The following scope has been implemented for cultural heritage matters:

Stage	Activities
Stage One (Consultation)	Consultation with Kabi Kabi Representatives to confirm project information and a suitable framework for further consultation to be completed.
Stage Two (Site Investigations & Reporting)	Further meetings during Stage Two will be programmed to ensure appropriate engagement and facilitation of cultural matters is properly developed. AHS will also provide preliminary advice regarding any cultural heritage compliance issues (if any) arising from the proposed activities (for further phases of the project to consider). On completion, an outline report (this report) was completed to capture the results of cultural inputs from Kabi Kabi during consultation and site investigations.

Background

Floral Emblem for Reconciliation

The five-petal Native Cotton, Desert Rose, or Native Hibiscus as we know it, was chosen by members to symbolise the scattering of the stolen generations and their resilience to the eugenic policies of Australia. This was initially proposed by members of the Kimberley Stolen Generation

Aboriginal Corporation, and later endorsed by the National Sorry Day Committee.

This flower was adopted because it is found widely across Australia and it is a survivor. Its colour denotes compassion and spiritual healing (note the colour of the flower emblem is a lilac which is attributed to the *Alyogyne huegelii* species of native hibiscus. This species is well established as an outstanding garden plant), as well as commonly being recognised by First Australian People as a significant tree within their cultures.

Figure 1: *Alyogyne huegelii* flower (Source: Australian National Botanical Gardens, 2017)

Results

Stage One (Consultation)

Stage One activities commenced in October 2018, including contact with Senior Elders from the Kabi Kabi group. It was recommended that discussions regarding the cottonwood trees within the Study Area be held initially with Mr Norman Bond who is an Applicant for the Kabi Kabi First Nation People (The Aboriginal Party for the Study Area).

Initial consultation with Kabi Kabi confirmed that the cottonwood tree is considered as a significant tree species by the Kabi Kabi People for a variety of reasons. Older trees are also found to co-exist in the vicinity of middens, highlighting long term congregational areas.

Having discussed the project in further detail with Mr Bond, it was requested that further consultation, site investigations and reporting be held with Mr Kerry Jones, also an Applicant for Kabi Kabi People This was commenced during November 2018 via teleconference.

Stage Two (Site Investigations and Reporting)

Further consultation was held with Mr Jones in December 2018, in which he confirmed an interest in participating in a meeting and site investigation.

During initial consultation, Mr Jones also confirmed a direct cultural connection between the cottonwood tree and the Kabi Kabi People's traditional use and occupation of the Sunshine Coast area, which he believes should be captured by the study.

A meeting was held on the 21st February 2019 between Kerry Jones and Benjamin Gall (AHS) to finalise these requirements, in accordance with the agreed approach to manage cultural heritage matters.

At the meeting, it was confirmed that the cotton wood tree is of cultural significance to the Kabi Kabi People within the Study Area for the following reasons:

- They are an Indigenous species to the Study Area. The traditional Kabi Kabi name for the cotton wood tree is Toowalpin.
- Timber is used to make the drill stick to 'male' and bottom stick to 'female' for hand-drill fire-making, the softness of the wood itself being noted.
- Cottonwood hibiscus flowers are edible, and they can also be used for medicinal purposes, while the liquid obtained from the inner bark has traditionally been used to relieve dysentry.
- The large leaves of the cotton tree (*Hibiscus tiliaceus*) can be used as dressings on wounds. The leaf is simply heated over the fire and pressed on to the injury until it sticks, stopping the flow of blood. The bark of the stem is used for congested chests and for a mother delivering a baby.
- The inner bark strands can be woven to create strings (cordage) that is suitable for basketmaking, canoes or fishing nets.
- The Kabi Kabi people regard the cotton wood tree for shade and amenity. They are often cultural 'indicators' in that large cottonwood hibiscus trees have been found close to the ancient stone fish traps and middens.

The meeting also revealed that Kabi Kabi continue to utilise the cotton wood tree for traditional and contemporary practices, including a recent example where a traditional bark canoe was constructed during NAIDOC Week (2017).

Figure 1: Kabi Kabi bark canoe constructed for 2017 NAIDOC Week workshop (SCC, 2017)

The project was part of a workshop run by Kabi Kabi custodians at the Caloundra Regional Gallery, which involved in traditional bark canoe-making and fishnet making using inner bark strands from the cotton wood tree.

At the conclusion of the meeting, a brief site inspection of the Study Area was undertaken with Kerry Jones (Kabi Kabi Applicant) and Benjamin Gall (Australian Heritage Specialists), targeting the foreshore and dunes at Shelley Beach.

A number of large colonies of cotton wood trees were observed during the site inspection, which were found to be relatively new growth, probably 20-30 years old. Whilst these trees were not necessarily of any substantial age, they were discussed by My Jones in the context of the abovementioned cultural importance that they hold to Kabi Kabi People generally, particularly that they represent an aspect of Aboriginal tradition and continual occupation of the area, regardless of their age.

A section of Shelley Beach where the cotton wood tress exist was also noted by Mr Jones as providing light screening from nearby houses, which protects turtle nesting habitat from light pollution on the dunes.

Compliance

In this light, consultation has revealed that some potential compliance needs surrounding the cotton wood trees should be considered for the Study Area. The following section outlines the relevant legislation (and associated duty of care) applicable to Aboriginal cultural heritage.

Aboriginal Cultural Heritage Act 2003

The applicable legislation in Queensland for Aboriginal (Indigenous) cultural heritage is the *Aboriginal Cultural Heritage Act 2003* (ACHA). The ACHA states that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the "cultural heritage duty of care") (Section 23[1]).

The Act defines cultural heritage as (S8):

- A significant Aboriginal area or Aboriginal object.
- Evidence, of archaeological or historic significance, of Aboriginal occupation of an area.

A significant Aboriginal area is "an area of particular significance to Aboriginal people" because of either or both of the following:

- Aboriginal tradition.
- The history, including contemporary history, of any Aboriginal party for the area (S9).

The ACHA states that it is an offence for a person to harm, remove or possess cultural heritage if the person "knows or ought reasonably to know that the object is Aboriginal cultural heritage" (S26).

Cultural Heritage Duty of Care

The study has confirmed that the cotton wood trees have been identified as being an important aspect of Aboriginal tradition to the Kabi Kabi People as both a resource species, as well as an 'indicator' of the potential presence of cultural activities.

It is important to note that Cotton wood trees are generally located in coastal areas; particularly dunes, foreshores and estuaries; which are areas which are also highlighted in section 6.2 of the Cultural Heritage Duty of Care Guidelines as holding high potential for Aboriginal cultural heritage significance to exist (tangibly and intangibly).

For this reason, anyone proposing to develop (particularly by way of ground disturbing activities) in the vicinity of coastal habitats (which includes cotton wood trees), should consider their duty of care, prior to commencing any physical works or activities.

Under the *Aboriginal Cultural Heritage Act 2003*, responsibility for cultural heritage duty of care is placed on the developer, be it government or private developer. The Cultural Heritage Duty of Care Guidelines state the framework in which compliance can be reached.

A copy of the Duty of Care Guidelines is provided in Appendix B.

Conclusions and Recommendations

The Kabi Kabi Traditional People are the Aboriginal Party for the Study Area. Consultation with authorised representatives has confirmed that the cotton wood tree is significant to the Kabi Kabi People. The cotton wood trees in the Study Area are an important aspect of Kabi Kabi's traditional culture.

The Kabi Kabi People also recognise that the majority of everyday activities that Sunshine Coast Council are required to undertake to maintain the general health and vigour of the cotton wood trees within the Study Area is unlikely to harm cultural heritage, particularly if it involves general pruning and tree care (carried out in accordance with relevant Australian Standards).

The following activities are however considered by Kabi Kabi to have the potential to cause harm to cultural heritage, and should not be undertaken without direct consultation with authorised Kabi Kabi representatives:

1. Removal of cotton wood trees (living or dead) which propose the removal of the trees and/or roots from the soil.
2. Substantial alteration to an area where colonies of cotton wood trees currently exist, (which holds the potential to directly or indirectly impact their health and vigour).

Kabi Kabi indicated that they would be happy to participate in further consultation surrounding any proposal which considers the ongoing management needs of cotton wood trees within the Study Area or more broadly on the Sunshine Coast.

It is therefore recommended that Sunshine Coast Council continue to hold direct consultation with the Kabi Kabi prior to the commencement of any proposed activities surrounding colonies of cotton wood trees, to confirm that no further compliance obligations exist for these proposed activities.

Should a management plan or overarching strategy be developed for the cotton wood tree within areas of the Sunshine Coast, further input should be sought directly from authorised Kabi Kabi representatives.

4 Ecological Assessment

Refer to Appendix A for Ecological Assessment

As a component of this study, 28 South Environmental Pty Ltd and Arbor Australis Pty Ltd were engaged to work as part of the broader landscape and communications team to provide an independent, impartial and objective assessment of cottonwood within the study area. This ranged from the Cottonwoods overall characteristics, growth patterns and attributes from a practical basis and have regard to specific locational considerations, its relationship with other related habitat and proved advice on how, why and where alternative landscape options could be considered.

Appendix A

Ecological Assessment Report

28 South Environmental

28ºS
ENVIRONMENTAL

Cottonwood Assessment

Ecological Assessment Report

Prepared for Sunshine Coast Council

C/- Place Design Group Pty Ltd

February 2019

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1.0 Introduction

1.1 Background

28 South Environmental Pty Ltd (**28 South**) has been engaged by Place Design Group Pty Ltd on behalf of Sunshine Coast Council (**SCC**), to undertake an independent, impartial and objective ecological assessment of *Hibiscus tiliaceus* (cottonwood) occurring within a defined area along the Caloundra coast[1] (**Attachment 1**, referred to herein as the 'Study Area'). Within the Study Area, the scope of works for the assessment focused on: the distribution of cottonwood; typical growth patterns; habitat values and/or features provided by cottonwood; various ecological situations and relationship with the surrounding landscape; and the overall consideration of current landscaping management as well as the inclusion of cottonwood in the Sunshine Coast Council Local Government Area Biosecurity Plan.

The Study Area includes public open space occurring east of beachfront esplanade roads or property boundaries to the Highest Astronomical Tide (**HAT**) line. The landscape context of the Study Area varies from landscaped parks and open space, to exposed frontal dunes, rear beach ridges and hind dunes, estuaries and coastal lakes which vary between coastal lowland forest, tidal swamps, closed shrublands and coastal grassland. **Attachment 1** provides a contextual overview of the Study Area. The Study Area receives varying levels of public visitation and use for recreational purposes and is subject to SCC management and maintenance.

1.2 Purpose of this Report

The purpose of this report is to:

- present the findings of the in-field ecological assessment of the Study Area; and
- provide discussion and consideration of relevant environmental legislation and policy applicable to cottonwood within the Study Area.

[1] The designated Study Area being Kings Beach, Shelly Beach, Moffat Beach, Dicky Beach, Currimundi School, Currimundi Mid North and the Currimundi Lakes Entrance

It is understood that this information will provide SCC with guidance for the selection of landscape management options, specifically for cottonwood occurring within public areas of their Local Government Area. This Report, its findings and recommendations are temporal in nature and are appropriate to the legislative framework at the time of writing. Future management actions on cottonwoods within the Study Area must be undertaken with consideration to the applicable legislative framework relevant at the time of undertaking the action.

2 Cottonwood Distribution, Habitat and Regional Ecosystem Association

Cottonwood is a member of the mallow family (*Malvaceae*) and is an evergreen, flowering plant. Specimens often have sprawling characteristics, typically reach heights of 3-10 m with an annual growth rate of 0.75-1.5 m per year (Elevitch & Thomson 2006). The general form of cottonwood is often described as having short trunks with sprawling, intertwined branches and root systems quickly forming an impenetrable thicket (Elevitch & Thomson 2006). Contemporary literature repeatedly describes this species as cosmopolitan, with a natural range throughout the tropics and sub-tropics. Such a broad range is due to the efficient natural dispersal of floating seed pods via oceanic currents as well as historic transportation around the globe to be utilised for amenity value, particularly their use as wind-breakers, landscape trees and for coastal stabilisation (Chang *et al.* 2011). The current distribution of cottonwood includes tropical and sub-tropical America, Asia, Australia and the Pacific Islands. Due to natural and anthropogenic dispersal, the indigenous distribution of the species is unclear (Takayama *et al*. 2006 and Elevitch & Thomson 2006).

The species prefers coastal environments including waterlogged soils of brackish swamps and well-drained dunal environments; however, it has also been successfully introduced to, and cultivated at, elevations of up to 800 m above sea level (Allen 2002, Elevitch & Thomson 2006). Once established, the species often persists and spreads with in a sprawling and dominating nature, with fast-spreading roots and rapid regeneration result in the species being a known successful coloniser, particularly after disturbance events (Elevitch & Thomson 2006). Additionally, the species is noted to be a highly competitive species and is generally resistant to competition from other endemic species (Elevitch & Thomson 2006). Cottonwood is widely utilised as a species in rehabilitation and stabilisation efforts in coastal systems. The Gold Coast City Council refence this species a relevant for rehabilitation efforts in dunal systems[2].

Cottonwood is considered to be naturalised and native in Australia, where it is found in remnant vegetation communities and is propagated and utilised in landscaping and

[2] Planning Scheme Policies Policy 15 – Management of Coastal Dune Areas – Gold Coast City Council 2007

revegetation efforts – particularly in coastal areas[3]. Distribution in Australia is described to be in coastal regions of the Northern Territory through Queensland and to southern New South Wales (CSIRO 2018). Elevitch and Thomson (2006) highlight the need for regular maintenance if cottonwood is used for landscaping due to its colonising capacity and suckering root systems.

The Queensland Herbarium is responsible for devising the Technical Descriptions for Regional Ecosystems (**RE**)[4]. A review of REs identified by the Queensland Herbarium has identified that one (1) RE (12.2.14a[5]) within the Southeast Queensland Bioregion is known to support cottonwood. This RE is described as '*Casuarina equisetifolia* subsp*. incana* woodland to low open forest on exposed frontal areas'. A Draft Technical Description for this RE has been prepared by the Queensland Herbarium and has been included in **Attachment 2**. Although this Technical Description is only Draft at this stage, it is important and relevant to consider the Herbarium's detailed information and current position on this community's composition. The Draft Technical Description lists cottonwood as occurring in 13% of baseline sites; however, where it does occur at these sites, it has been identified by the Queensland Herbarium as a dominant species, with up to 93% crown coverage. It is relevant to assume that such a dominance in the 13% of reference sites has occurred as a result of the cottonwood's pioneering and opportunistic nature (Liu *et al.* 2014; Elevitch & Thomson 2006), potentially through catalysing factors such as natural disturbance (cyclone damage, storm events, bushfires) or anthropogenic disturbance[6].

A review of RE mapping within the Study Area has identified that the parent RE 12.2.14 is mapped to occur in the northern extent of the Study Area (Currimundi Mid North) as shown within the mapping found in **Attachment 3**. Based on the species' endemicity and by virtue of the Herbarium including the species as a dominant or associated species within REs; it is

[3] It is also noted that cultivar specimens (*Hibiscus rubra*) are commonly utilised in landscaping and can potentially occur in natural systems as an escapee. This survey did not undertake assessment of each individual specimen or group to establish if they were in fact cultivars.

[4] In summary, REs are mapped by the Queensland Herbarium to define areas of intact vegetation which meet defined qualitative and quantitative criteria e.g. patch size, canopy cover, canopy height and vegetation composition. These areas are afforded varying levels of legislative protection and conservation status. This is dependant on their location, size and extent when compared to pre-clearing vegetation community mapping and situational circumstance.

[5] This technical description is currently in draft format and mapping of the extent of this community is not currently available to the public. It is, however, relevant to consider the potential presence of this sub-community through the presence of the overarching community 12.2.14 which it has been derived from.

[6] It is relevant to understand historical clearing patterns in coastal environments within in highly urban settings.

considered that cottonwood is a native species. As such, it should not be considered a biosecurity risk through local government management policies or under the *Biosecurity Act 2014*.

3 Legislative Framework

The following sections describes the legislative framework as it relates to the cottonwood and potential actions to be undertaken as a result of this Report. This includes Federal, State and Local level legislative and policy considerations.

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) provides the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined under the EPBC Act as 'Matters of National Environmental Significance' (**MNES**). Under the EPBC Act, a referral to the Department of the Environment Energy (**DoEE**) is required if a proposed action could cause a Significant Impact on MNES.

Cottonwood is not a MNES and does not define any Threatened Ecological Community. Other MNES such as marine turtles, migratory birds and other coastal Threatened Ecological Communities may be present within the Study Area. All management actions undertaken by SCC should consider such MNES.

3.1.2 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (**NC Act**) establishes approval triggers and an assessment process for clearing protected plants. Cottonwood is listed as a Least Concern species and is not a protected plant species under the NC Act. The in-field assessment of the cottonwood allowed for the determination of potential impacts to fauna species listed under the *Nature Conservation (Wildlife) Regulation* 2006 through the potential provision of habitat.

3.1.3 Matters of State Interest

The Queensland Government defines matters of State Interest with referral triggers and responsible agencies within Schedule 10 of the *Planning Regulation 2017* (**Planning Reg**). Environmental matters of State Interest that have been considered as a part of this assessment are summarised in **Table 1.**

Table 1 - Referral Agencies and Triggers under the Planning Reg

Matter of Interest	Schedule 10 Reference	Referral Agency (if Triggered)	Referral Agency Assessment Matters for Further Assessment
Fish Habitat Areas **Attachment 4**	Part 6, Division 2, Table 1 & Divisions 4, Table 1	N/A	A number of the estuaries within the Study Area are identified as Tidal Waterways (Tooway Creek and Currimundi Creek). Estuaries and smaller waterways are identified as "Queensland waterways for waterway barrier works". No components of the Study Area are identified as Fish Habitat Management Areas.
Clearing Native Vegetation **Attachment 5**	Part 3, Division 4, Table 3	N/A	A number of areas supporting native vegetation are mapped under the Vegetation Management mapping as Category B and C Vegetation.
Wetland Protection Area	Part 20	N/A	N/A – No areas mapped.
Koala Habitat Areas	Part 10, Division 2, Table 1	SCC	N/A – No areas mapped

Table 1 shows that the Study Area contains mapping of regulated vegetation and various waterway values (Tidal Waterways and Queensland waterways for waterway barrier works).

Though not considered a true marine plant (i.e. a mangrove, seagrass, etc), cottonwood may qualify as 'adjacent vegetation' to tidally-influenced areas. Adjacent vegetation is defined within the *Queensland Departments of Primary Industries and Fisheries Fish Habitat management Operational Policy* (FHMOP 001) and is relevant to the plant's contribution to fisheries' significance and productivity (Couchman & Beumer 2007, p.29):

> **Low fisheries significant plants** generally include non-tidal, terrestrial plants, whole or part, such as river gums, terrestrial grasses and palm trees. In certain circumstances, a particular species may dominate (e.g. *Hibiscus*) and may therefore play a greater role in fisheries production. A fisheries development approval application is not required for any disturbance to low fisheries significance plants.

Cottonwood occurring within the Study Area generally occurs above the HAT; however, could be considered a "low fisheries significant plant" as it may occur adjacent to Tidal Waterways

and contribute to fisheries production. Subsequently, disturbance or removal of cottonwoods that are of low fisheries significance will not require a fisheries permit.

3.1.4 Matters of Local Interest – Sunshine Coast Council

SCC defines matters of environmental interest, with associated overlay triggers set out in both the *Sunshine Coast Planning Scheme 2014* and its constituent overlay mapping. Environmental matters of local interest considered as a part of this assessment are summarised in **Table 2**.

Table 2 - Matters of Local Environmental Interest

Matters of Interest	Location of Study Area	Relevant Code	Further Assessment Required?
Biodiversity, Waterways and Wetlands **Attachment 6**	Native Vegetation Areas and Water Related Areas within the Biodiversity, Waterways and Wetlands overlay are mapped within the Study Area. The Native Vegetation Areas are generally consistent with the mapped remnant and regrowth regulated vegetation mapped at State level. The Water Related Areas relevant to the Study Area includes Riparian Protection Areas, Natural Waterbodies (the estuaries) and a Wetland Area (Currimundi Mid North).	Biodiversity Waterways and Wetlands Overlay Code	**Yes.** See **Section 6.1.2**
Coastal Protection **Attachment 7**	The majority of the Study Area is mapped within the Coastal Protection Overlay along the coastline.	Coastal Protection Overlay Code	**Yes.** See **Section 6.1.2**

Table 2 identifies two (2) ecologically-focussed overlay triggers within the Study Area; Biodiversity, Waterways and Wetlands Overlay and the Coastal Protection Overlay. This report considers the location of each surveyed cottonwood within the Study Area and whether these individuals are located within either Overlay. Discussion is provided in the following sections regarding the ramifications for actions to be undertaken on cottonwoods that are situated within these Overlays.

4 In-field Assessment

4.1 Desktop and GIS Review

Prior to undertaking in-field assessments, a review was undertaken of high-quality aerial imagery of the Study Area to determine the vegetation signature of cottonwood and to define target areas for survey efforts. This review of aerial imagery determined that cottonwood occurred in higher densities in disturbed foredune locations and surrounding landscaped parks and open space areas.

4.2 In-field Assessment Methodology and Data Capture

4.2.1 In-Field Assessment Method

A team of two (2) Ecologists from 28 South and one (1) Arborist from Arbor Australis undertook detailed in-field assessments throughout the Study Area in August 2018. This in-field assessment involved a total of 45 person-hours and included within the Study Area:

- spatial capture (via a differential global positioning system (**DGPS**)) of the position of all cottonwoods occurring as communities and individuals;
- an assessment of relevant ecological and arboricultural information for each surveyed cottonwood community and individual; and
- a detailed botanical assessment, including ground-truthing of RE mapping and preparation of detailed flora species lists.

4.2.2 Data Dictionary

Prior to undertaking in-field assessments, a proforma was developed to ensure all relevant data was collected on the DGPS. Data that was collected provides insight into the following:

- the landscape setting where cottonwood occurred (e.g. urban park settings, along a creek or estuary, located within the dune systems, within intact bushland);
- ecological role and function of the cottonwood (e.g. occurring as an isolated individual, forming a monoculture or as part of intact remnant bushland, amenity or hazard issues including Crime Prevention through Environmental Design (**CPTED**) issues, etc.);

- location relevant to State and Local Environmental mapping (i.e. Regulated Vegetation, Fish Habitat Areas, SCC Environmental Overlay Mapping); and
- identification of any management that has been occurring to the cottonwood (e.g. lifting of canopy, pruning, etc.).

4.3 Vegetation Communities

The Study Area comprises various landforms and underlying geologies, with two land zones present:

- alluvial coastal quaternary deposits; and
- coarse and fine-grained quaternary age sedimentary deposits.

Surface soils consist of sand to sandy loam substrates with cliff areas occurring along Moffat Beach containing increased sediment material in the form of rocks and stone. These landforms support landscaped parks and open space areas, areas of disturbed native vegetation occurring adjacent to parks or esplanade roads, foredune communities and more intact remnant vegetation including coastal low open forest, closed shrubland and coastal grasslands and melaleuca swamps.

A description of each vegetation community within the Study Area is provided in the following sections of this report. A full flora species list collected during meander surveys of the Study Area is provided in **Attachment 8**[7].

4.3.1 Vegetation Community 1 – Landscaped Open Space and Parks

This community was the most abundant within the Study Area. It occurred in areas located along the coastal strip used for recreational and open space purposes by the general public. The community was often associated with beach picnic areas and carparks; therefore the understorey was generally mown lawn with garden beds and landscaped vegetation. Species commonly occurring within this community included *Araucaria heterophylla* (Norfolk Island pine), *Pandanus tectorius* (screw pine), cottonwood and *Lomandra longifolia* (spiny-headed

[7] This list is not exhaustive and is comprised of readily discernible plant species during field surveys which were limited by temporal conditions, project timeframes, plant ecology and access amongst other generally survey constraints.

mat-rush). Common weeds included *Conyza bonariensis**[8] (fleabane), *Soliva sessilis** (bindii), *Hypochaeris radicata** (catsear) and *Solanum americanum** (nightshade).

4.3.2 Vegetation Community 2 – Fragmented Coastal Low Open Forest

This community was highly variable and the second-most abundant within the Study Area. This community was found in dunes, steep slopes and cliff areas as well as higher zones in dry areas and often adjoining Vegetation Community 1. This community generally occurred as unmanaged, historically-disturbed remnants of coastal open low forest. The canopy was dominated by *Casuarina equisetifolia* (coast she-oak) and cottonwood with varying associations of *Banksia integrifolia* (coast banksia), *Glochidion ferdinandi* (cheese tree) and *Cupaniopsis anacardioides* (tuckeroo). Cottonwood is an associated species occurring in the lower-lying, wetter areas near creek mouths and outlets (including engineered drainage features). Shrub species included *Acacia disparrima* (hickory wattle), *Macaranga tanarius* (macaranga) and *Myoporum acuminatum* (emu bush). Due to historic disturbance and encroachment by residential development, there was a high level of exotic plant species present including *Schinus terebinthifolius** (broad-leaved peppertree), *Sphagneticola trilobata** (Singapore daisy) and *Melinis minutiflora** (molasses grass). There was also a high diversity of garden escapee species observed within this community, particularly in inaccessible areas near cliffs and dwellings.

4.3.3 Vegetation Community 3 – Closed Shrubland and Coastal Grassland on Dunes

This community was observed in foredune areas within the Study Area. The community was dominated by *Acacia sophorae* (coastal wattle) and hickory wattle with occasional coast banksia and coast she-oak. The distribution of the coastal wattle was variable and at times replaced with taller specimens of cottonwood in damper areas. Where cottonwood dominated, there were minimal to no groundcover species present. In other areas, groundcover species included *Spinifex sericeus* (beach spinifex), *Carpobrotus glaucescens* (pig's face), *Dianella caerulea* (blue flax lily) and *Ipomoea pes-caprae* subsp*. brasiliensis** (beach morning glory) which grows sparsely across the dunes where shrubs are absent. Common weeds such as

[8] * denotes an exotic species.

*Gloriosa superba** (flame lily) and *Bryophyllum delagoense** (mother-of-millions) occurred in moist areas.

4.3.4 Vegetation Community 4 – Melaleuca Swamps in Dune Swales

This community was generally restricted to low tracts of land behand coastal dunes and was found to be generally damp and marshy in nature. This community was dominated by *Melaleuca quinquenervia* (broad-leaved paperbark) and *Melaleuca viridifolia* (red-flowering paperbark) in a dense open forest structure. Other species included *Casuarina glauca* (swamp oak), *Lophostemon suaveolens* (swamp box), cheese tree, *Alphitonia excelsa* (red ash) and tuckeroo. Shrubs were not common but included species such as hickory wattle, tuckeroo and macaranga. Groundcovers were sparse, consisting of various sedge species within swales and *Themeda triandra* (kangaroo grass) and *Ischaemum triticeum* (dune grass) on drier edges. There were some fringing areas of wallum heath (in the vicinity of Currimundi School and Currimundi Mid North) which commonly supported *Banksia robur* (swamp banksia), *Gahnia aspera* (red saw sedge) and other native sedge species.

4.3.5 Vegetation Community 5 – Low Closed Forest

This community occurred in the hind dune areas of the Study Area where residential development has not occurred, and bushland is retained (mostly in the Currimundi School and Currimundi Mid North sections, but also in a small component of the Shelly Beach section). The community was dominated by tuckeroo and *Alectryon coriaceus* (beach birds eye). These species formed dense stands in some areas that have been hedged where the Coastal Walk trails through the vegetation community. Other associated species included coast banksia, *Acronychia imperforata* (beach acronychia), *Pittosporum ferrugineum* (rusty pittosporum) and *Cyclophyllum coprosmoides* (coastal canthium). Height of the vegetation within this community generally increased with distance from the foredune. In areas where this community has matured, vegetation reached heights of over 20 m with occasional *Ficus* spp. (fig species) and *Elaeocarpus obovatus* (hard quandong). With proximity to the foredune, canopy height reached a maximum of 2 m, likely in response to prevailing easterly winds and salt spray. Shrubs were infrequent and generally composed of hickory wattle and regenerating canopy species. Groundcovers included *Ottochloa gracillima* (carpet grass), *Commelina diffusa* (blue wanderer), *Parsonsia straminea* (monkey rope vine) and *Flagellaria indica* (whip vine) extending into the canopy in places.

5 In-field Results

Field assessments of cottonwood determined the location of individual trees and cottonwood clusters. **Figures 1-7** within **Attachment 9** indicate the location of each surveyed cottonwood individual and cluster within the Study Area. These figures can be cross-referenced with additional information collected for each of the surveyed individual trees and clusters, describing the various ecological and arboricultural situations observed throughout the Study Area (**Attachment 10**). A summary of the overall abundance, distribution, and the general ecological situation for cottonwoods observed within the Study Area is provided in the following sections.

A total of 27 individual cottonwood trees and 29 cottonwood clusters were surveyed within the Study Area. The distribution of cottonwoods over the Study Area was assessed as a percentage of area covered by the surveyed communities and individual trees[9]. To determine the relative distribution of cottonwoods, the following variables and circumstances were explored:

- the area covered by cottonwood within the whole of the Study Area;
- the area covered by cottonwood within each of the Study Area sites;
- the area covered by cottonwood within Remnant Vegetation[10];
- the area covered by cottonwood within dune areas[11]; and
- the area covered within landscaped open spaces and parklands[12].

A summary of the data is presented in **Table 3**.

[9] Individual trees were assigned a nominal 36m^2, based on an average Tree Protection Zone of ~3.4m or diameter at breast height of 280mm. It is noted that some individuals would cover significantly greater areas, but most individuals would cover significantly less area and the nominal 36m^2 is intended as a guide only. Individuals should be assessed for retention should civil works be proposed within proximity to their Tree Protection Zone.
[10] Remnant Vegetation includes the Category B and C Regulation Vegetation mapped by the Department of Natural Resources, Mines and Energy.
[11] Dune areas were defined as areas occurring between sand beaches and maintained/managed private or public areas within the Study Area specifically on the first dune in the dune system. This includes Remnant Vegetation and non-remnant vegetation.
[12] Landscaped Open Space and Parks being the public areas that are managed and maintained.

Table 3 - Summary of cottonwood area coverage data

	Area (in hectares)	Area of Surveyed Cottonwood	Cottonwood Percentage Coverage
Whole of Study Area	49.73	2.37	4.78%
Remnant Vegetation	10.55	0.25	2.45%
Dunes	19.45	1.04	5.11%
Landscaped Open Spaces and Parks	19.73	0.79	4.05%
Sections			
Currimundi Lakes Entrance	3.88	0.24	6.38%
Currimundi Mid North	4.61	0.011	0.23%
Currimundi School	6.57	0.23	3.62%
Dicky Beach	8.39	0.49	5.95%
Moffat Beach	6.63	0.39	5.98%
Shelly Beach	8.29	0.6	7.27%
Kings Beach	11.36	0.38	3.35%

Overall, 4.78% of the Study Area[13] supported cottonwood trees. The distribution over the Study Area indicates higher densities in landscaped open space areas and dunes than in remnant vegetation. There was also a considerably higher density of cottonwood occurring at Shelly Beach (7.27% of total area) compared to other sections.

[13] The Study Area is general in nature and the meets and bounds directly influence the ultimate area and percentage cover within this assessment. It has been defined to align with the requested extent provided within the SCC briefing. Cottonwood percentages within the Study Area have been provided to give contextual information regarding the extent of cottonwood. Percentages would be impacted should the extent of study be altered.

6 Discussion

In the 4.78% of the Study Area where cottonwood was observed, the species often formed monocultures and often dominated all strata, further limiting other vegetation. In most cases, no other species (or an occasional emergent native species) occurred in these cottonwood clusters. Where located in foredunes, the cottonwood where often sprawling and generally dominating, consistent with the species description in contemporary literature. In landscaped situations, cottonwoods were often observed to be maintained in some form, generally by having their canopy lifted over pathways or limbs pruned. However, in many instances' management had either failed or had not occurred for some time. In such situations, the cottonwood individual or community had become sprawling in nature or was overhanging pathways or carparks. Areas that supported dune systems, particularly along the Shelly Beach frontage, contained large communities of cottonwood where historical revegetation efforts had either failed or had not occurred.

Whilst the domination of cottonwood may appear to be a negative, it is noted that the species is persisting in such a way that is typical of their colonising nature. These dynamic environments are subject to successional processes and it is not unlikely that natural dieback of cottonwood and replacement by other native colonising or dunal species would occur over time. Additionally, it is important to note that cottonwood, particularly in the foredunes areas of the Study Area provides value for dune stabilisation within these high energy environments. The use of this species in public open space areas provides for landscape amenity including shading over paths and picnic areas. Recommended management options for areas where cottonwoods are dominating are discussed in **Section 6.2**.

6.1 Statutory Considerations

This section identifies relevant statutory considerations for cottonwoods in the Study Area, current at the time of writing this Report, in the context of potential management of individuals and clusters. It is important to note that the overarching legislative framework applicable to management of cottonwoods within the Study Area (e.g. referral triggers, application and permit requirements) may change over time. Future management actions on cottonwoods within the Study Area must be undertaken with consideration to the applicable legislative framework relevant at the time of undertaking any action.

6.2 Environment Protection and Biodiversity Conservation Act 1999

As noted, cottonwood is not considered to be a MNES nor define any Threatened Ecological Communities. Despite this, any management measured undertaken on cottonwoods or any other vegetation/landforms within the study area which may impact MNES should consider potential primary or secondary impacts on MNES (e.g. impacts to extents of Threatened Ecological Communities, marine turtle nesting habitat, migratory bird habitat etc.)

6.2.1 State Triggers

6.2.1.1 Native Vegetation Clearing

A total of five (5) individual cottonwoods (IDs 7, 22, 23, 24 & 25) and portions of four (4) cottonwood clusters (IDs 15, 23, 24 & 25) are located within areas mapped as Regulated Vegetation (refer **Attachments 9** and **10**). Cottonwood in these areas form part of intact bushland communities and are not causing CPTED or management issues at the time of survey. As such, maintenance is not specifically required. Should removal of, or impact to, these cottonwood trees or communities be deemed necessary in the future, clearing exemptions outlined in the Planning Regulation do not apply. Consequently, a referral to the State Assessment and Referral Agency (**SARA**) would be required unless the action is to meet any of the exempt clearing works listed under Schedule 21 of the *Planning Regulation 2017* or through local government exemptions.

6.2.1.2 Fish Habitat Areas

It was determined that 4 cottonwood individuals (IDs 7, 23, 24 & 25) and 5 cottonwood communities (IDs 7, 13, 14, 19 & 25) contribute to (or are likely to contribute to) Low Fisheries significance. It should be noted that these cottonwoods are not dominant in nature, and therefore, do not contribute to high fisheries significance. All of these cottonwood(s) are situated within estuaries or a drainage channel above the HAT line. Removal of, or impact to, these plants does not require an application to the Department of Primary Industries and Fisheries.

6.2.2 Sunshine Coast Council Local Planning Scheme

Upon review of the SCC Planning Scheme 2014 and the relevant overlay codes, it is important to note that the removal of, or impact to, cottonwoods in an *environmentally important area* as

a result of development as defined under the *Planning Act 2016*, generally requires demonstration of the "avoid, minimise, mitigate" principle. *Environmental important areas* are those included in the Biodiversity, Waterways and Wetlands Overlay mapping and generally occur outside of landscaped open space areas (e.g. Native Vegetation Areas, Riparian Protection Areas, etc). It is understood that future actions undertaken by SCC as a result of this study will not occur for the purposes of development, but rather will be for the benefit of landscape amenity value, recreation purposes and ecological restoration efforts. Notwithstanding, future actions occurring within or adjoining *ecologically important areas* should also consider the "avoid, minimise, mitigate" principle.

6.3 Management Options

This report has presented the location of each surveyed cottonwood individual and cluster within the Study Area as well as applicable legislative triggers for clearing of, or impacts to, this vegetation. **Attachment 10** provides a tabulated and itemised assessment of the relevant regulatory considerations applicable to each surveyed cottonwood individual or cluster. SSC may wish to consider options for management of the trees. These include, but are not limited to the following:

- No action.
- Continue maintenance that is currently occurring.
- Start maintenance where not currently occurring. This may include remedial pruning, lifting of canopy, cut-back of roots, among other options identified as appropriate by an Arborist.
- Removal of an individual cottonwood and replacement with another native species.
- Staged removal and replacement of a cottonwood cluster through strategic ecological restoration works.

Importantly there ae a number of management option for each individual/cluster that may be considered appropriate and numerous management options may be applicable and should be given consideration. Prior to any future works, further assessment of each cottonwood

individual or cluster should be undertaken to determine its relevance to the EPBC Act, fisheries significance, regulated vegetation or any other relevant legislation at that point in time.

For areas where cottonwood forms monocultures, staged removal and replacement is a potential management option. This should be undertaken as a progressive removal process in conjunction with well designed, longer term ecological restoration efforts. This management option will require the preparation of an Ecological Restoration Plan to guide works by outlining the process of management, its sequencing and transitional/successional planting programs. Preparation of this Plan is best practice for sensitive environs such as dunal systems and must consider obligations under the EPBC Act and other relevant State and Local planning instruments. Detailed consideration should be given to ensure the timing of works is appropriate (e.g. outside of turtle breeding season, avoidance of migratory bird movement patterns and not during significant weather events to avoid potential erosion and plant loss). Given the highly dynamic nature of the dune systems, staging should be directional from the beachfront and progressing into the dunes. Should works be undertaken within dunal areas, it is recommended that these occur over a period of seasons and be successional from the coastal side towards the hind dune. This will allow for plant establishment over the foredune areas initially while retaining taller vegetation over dune crests until such time that taller transitional species (e.g. coast she-oak) can be established.

Consideration should be given to replacement species that will establish relatively quickly in order to regain soil stability and to avoid and minimise potential erosion. An example planting palette is provided in **Table 4**. These species are also consistent with the current and pre-clear REs in the immediate locality of the Study Area. **Attachment 11** includes the RE Technical Descriptions which list all other appropriate species to be considered in any future rehabilitation projects.

Management of the individual Cottonwood, both in mown parks and adjacent to paths, needs to be managed based on risk and amenity value. To maintain the benefits of the shade that the Cottonwoods provide to users of the parks and paths. It would be prudent to establish a structure inspection and pruning program. Inspection should be carried out at 12-month intervals with the aim of assessing the structure of trees that overhang high use spaces (paths, seating and park features). Trees deemed to be structurally sound should be retained and managed until they are no longer viable for retention due to issues of compromised structural

integrity. Inspections are to be carried out by an experienced Arborist with a minimum of AQF level 5 qualifications. Inspection will be predominantly visual; however, over time some trees may require diagnostic testing to confirm tree structure.

Remedial works are likely to include lifting of canopies over paths and features together with end weight reduction to reduce limb failure potential. This proposed management is to be implemented regardless of other strategies Council may adopt to manage Cottonwood populations.

Where groups of Cottonwoods are located within mown grass areas, a further management strategy could be implemented to cut back sucker growth; this management will stop further spreading and a reduction in usable public space.

Table 4 - Recommended Species Palette for Future Revegetation Projects

Species	Common Name	Relevant Regional Ecosystems	Values and Comments
Canopy and Shrubs			
Acacia sophorae	coast wattle	12.2.14a	Present. Coloniser of exposed sand.
Banksia integrifolia	coast banksia	12.2.5, 12.2.7, 12.2.14a, 12.9-10.4	Present.
Banksia robur	swamp banksia	12.2.12	Present
Casuarina equisetifolia	coast she-oak	12.2.14a	Present. Tolerates high saline environments.
Casuarina glauca	swamp she-oak	12.2.7	Present. Tolerates high saline environments.
Cupaniopsis anacardioides	tuckeroo	12.2.5, 12.2.7, 12.2.14a	Present.
Groundcover			
Carpobrotus glaucescens	pigs face	12.2.14a	Present. Readily stabilises dunes and foredunes.
Spinifex sericeus	coastal spinifex	12.2.14a	Present.
Dianella caerulea	blue flax lily	12.2.14a	Present.

7 Summary of Findings

Cottonwoods comprised roughly 4.78% of the Study Area. Their distribution varied according to their ecological context with greater abundance in open space and park areas due to their historical use as a landscaping species; and dunes and beach frontages due to their colonising abilities where regular maintenance does not occur. In remnant bushland areas, cottonwood infrequently occurred as individuals; this observation can be directly associated with the relatively intact nature of the remnant environments.

Where individual trees are located within park areas, they provide significant benefit to the users in the form of shade. When considering the management options put forward in this assessment, the benefits the trees provide in each location needs to be carefully considered.

As a result of the in-field assessment and the determination of relevant legislation requirements, a number of management options have been identified and discussed. It is understood that this report may be used to guide the appropriate selection of landscape management options for cottonwood individuals and clusters within the Study Area. It is important to note that the overarching legislative framework applicable to management of cottonwoods within the Study Area (e.g. referral triggers, application and permit requirements) may change over time. Future management actions on cottonwoods within the Study Area must be undertaken with consideration to the applicable legislative framework relevant at the time of undertaking the action.

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State of Queensland (Department of Science, Information Technology and Innovation) [Accessed 26 Sept. 2018]

Photo Plates

Photo Plate 1 – indicating a cottonwood cluster (ID 12 **Attachment 9**) that has been lifted over pedestrian pathway (Moffat Beach). It is noted that this is unmanaged on the beachward side which is shown in Photo Plate 2.

Photo Plate 2 – indicating the cottonwood cluster as in Photo 1 whereby the beachward side is not maintained (Moffat Beach section). Minor occurrences of other dunal species are noted within this cluster

Photo Plate 3 – illustrating lower windswept clusters of cottonwood adjoining native vegetation on a dune system (Shelly Beach section).

Photo Plate 4 –absent understorey underneath a cottonwood community (Shelly Beach section). It is noted these areas are isolated to minor pockets where cottonwood are dominate.

Photo Plate 5 –maintained nature of the public land between private residence and beach within the Currimundi Lakes Entrance section.

Photo Plate 6 - typical structure and composition of a dune vegetation community (Currimundi Lakes Entrance section).

Photo Plate 7 - indicating the typical structure and composition of the Melaleuca Swamp vegetation community (Currimundi School section).

Photo Plate 8 - indicating area where dunal systems have been subject to various impacts from exposure, weed incursion however remain in a stable state (Currimundi Mid North section).

Photo Plate 9 - structure and composition of the Melaleuca vegetation community (Currimundi School section).

Photo Plate 10 - structure and composition of the Melaleuca community (Currimundi School section).

Photo Plate 11 - typical structure and composition of the fragmented coastal vegetation community adjoining landscaped open space and park areas (Kings Beach section)

Photo Plate 12 - structure and composition of landscaped open space and park areas (Kings Beach section)

Photo Plate 13 - structure and composition of the fragmented coastal vegetation community adjoining landscaped open space and park areas (Kings Beach section)

Photo Plate 14 - typical structure and composition of the fragmented coastal vegetation community and example of hedging occurring for visual amenity (Moffat Headland)

Photo Plate 15 - typical structure and composition of a dune vegetation community (Shelly Beach section).

Photo Plate 16 – isolated cottonwood clusters along dune areas between council parkland and beach (Shelly Beach section).

Photo Plate 17 – isolated clusters of cottonwood along Shelly Beach foreshore (Shelly Beach section).

Photo Plate 18 - cottonwood cluster at rear of parkland over drainage system (Moffat Headland section).

Photo Plate 19 - cottonwood cluster over drainage feature at rear of council parkland (Moffat Headland section).

Photo Plate 20 - cottonwood cluster with emergent native canopy (Moffat Headland section).

Photo Plate 21 – example of lifting over a pathway (Moffat Headland section)

Photo Plate 22 –individual cottonwood on an engineered embankment adjoining a road (Moffat Headland section)

Photo Plate 23 - cottonwood cluster along Shelly Beach dune with intersperse shrubs, grasses and forbs (Shelly Beach section). Variable dunal community present in rear of frame typical of the intermixed community matrix along this dunal system.

Photo Plate 24 – large cottonwood cluster occurring along a drainage channel and overhanging coastal walk (Shelly Beach section).

Photo Plate 25 –cottonwood cluster along drainage feature (Shelly Beach section)

Photo Plate 26 - cottonwood cluster sprawling over carpark (Shelly Beach section)

Photo Plate 27 –typical structure and composition of the coastal dune community (Currimundi Mid North section)

Photo Plate 28 – revegetation works adjoining Currimundi School

Photo Plate 29 – Estuary located in the Currimundi School/Currimundi Mid North section

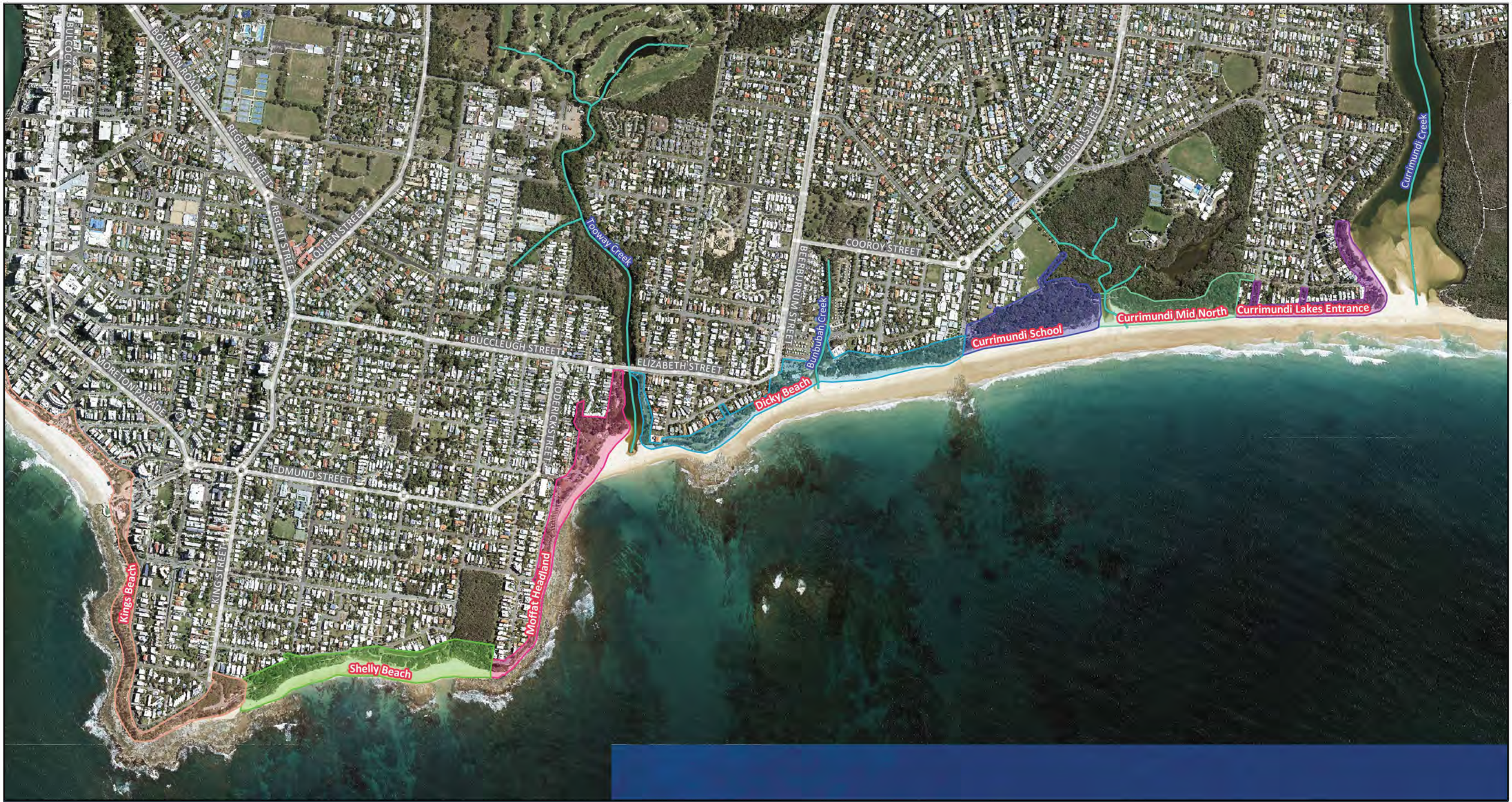
Photo Plate 30 – Estuary located in the Currimundi Mid North section

Photo Plate 31 – individual cottonwood in the Currimundi Lakes Entrance section and example of management over beach

Photo Plate 32 –individual cottonwood in the Currimundi Lakes Entrance section and example of management over beach

28ºS
ENVIRONMENTAL

Attachment 1



Cottonwood Assessment

Legend

Attachment 1 - Study area locality and context

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Study Area Sections

- Currimundi Lakes Entrance
- Currimundi Mid North
- Currimundi School
- Dicky Beach
- Kings Beach
- Moffat Headland
- Shelly Beach
- Roads
- Waterways

250 0 0 250 500 750m

1:12,000 (A3) GDA 94 MGA 56

Issue Date	Revision	Author
4 December 2018	Rev A	RF
Approved	**Revision Note**	
MT		

28ºS ENVIRONMENTAL

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ENVIRONMENTAL

Attachment 2

Draft technical description of 12.2.14a - Casuarina equisetifolia subsp. incana woodland to low open forest on exposed frontal areas

Emergent (Ht avg=15m, 14-16m, 2 sites; Cover avg=4.5%, 1-8%, 2 sites)

Dominant species (cover)
Cupaniopsis anacardioides (8, 13%), *Casuarina equisetifolia subsp. incana* (1, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (13%, 1), *Cupaniopsis anacardioides* (13%, 8)

Tree 1 (Ht avg=9m, 6-12m, 8 sites; Cover avg=45.03%, 7-98%, 8 sites; SD/ha avg=1,176, 400-2,500, 5 sites)

Dominant species (cover)
Hibiscus tiliaceus (93, 13%), *Casuarina equisetifolia subsp. incana* (36, 88%), *Acacia disparrima subsp. disparrima* (5, 13%), *Banksia integrifolia* (3, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (88%, 36), *Acacia disparrima subsp. disparrima* (13%, 5), *Banksia integrifolia* (13%, 3), *Hibiscus tiliaceus* (13%, 93)

Tree 2 (Ht avg=5.5m, 4-7m, 3 sites; Cover avg=35.67%, 12-60%, 3 sites)

Dominant species (cover)
Casuarina equisetifolia subsp. incana (36, 38%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (38%, 36)

Shrub 1 (Ht avg=2.3m, 1-4.5m, 6 sites; Cover avg=19.87%, 2-41.2%, 6 sites; SD/ha avg=1,595, 520-2,500, 4 sites)

Dominant species (cover)
Argusia argentea (41, 13%), *Lumnitzera racemosa* (30, 13%), *Hibiscus tiliaceus* (9, 25%), *Casuarina equisetifolia subsp. incana* (8, 25%), *Acacia sophorae* (4, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (25%, 8), *Exocarpos cupressiformis* (25%), *Hibiscus tiliaceus* (25%, 9), *Acacia sophorae* (13%, 4), *Alphitonia excelsa* (13%), *Argusia argentea* (13%, 41), *Avicennia marina subsp. australasica* (13%), *Banksia integrifolia* (13%, 2), *Breynia oblongifolia* (13%), *Cupaniopsis anacardioides* (13%, 2), *Dodonaea viscosa subsp. burmanniana* (13%), *Lantana camara* (13%), *Livistona decora* (13%), *Lumnitzera racemosa* (13%, 30), *Mallotus discolor* (13%), *Melaleuca quinquenervia* (13%, 1), *Pandanus tectorius* (13%), *Passiflora suberosa* (13%), *Schefflera actinophylla* (13%)

Ground (Ht avg=0.5m, 0.1-1m, 8 sites; Cover avg=42.28%, 5-100%, 8 sites)

Dominant species (cover)

Zoysia macrantha subsp. macrantha (60, 13%), *Juncus kraussii* (50, 25%), *Sporobolus virginicus* (30, 13%), *Imperata cylindrica* (20, 13%), *Spinifex sericeus* (17, 38%)

Species (frequency, cover)

Passiflora suberosa (63%), *Eragrostis interrupta* (50%, 2), *Ipomoea pes-caprae subsp. brasiliensis* (50%), *Bidens pilosa* (38%), *Emilia sonchifolia* (38%), *Hibbertia scandens* (38%, 2), *Spinifex sericeus* (38%, 17), *Achyranthes aspera* (25%, 1), *Carpobrotus glaucescens* (25%), *Cassytha glabella forma glabella* (25%, 2), *Cenchrus echinatus* (25%), *Chorizandra cymbaria* (25%, 1), *Cymbopogon refractus* (25%), *Cyperus polystachyos* (25%, 15), *Ischaemum triticeum* (25%), *Juncus kraussii* (25%, 50), *Schefflera actinophylla* (25%), *Senecio pinnatifolius var. pinnatifolius* (25%), *Sonchus oleraceus* (25%), *Stephania japonica* (25%, 1), *Vincetoxicum carnosum* (25%), *Acrostichum speciosum* (13%), *Alphitonia excelsa* (13%), *Asparagus aethiopicus cv. Sprengeri* (13%), *Baccharis halimifolia* (13%, 1), *Baumea juncea* (13%), *Blechnum indicum* (13%), *Boerhavia albiflora var. heronensis* (13%, 3), *Boerhavia pubescens* (13%), *Casuarina equisetifolia subsp. incana* (13%), *Crotalaria lanceolata subsp. lanceolata* (13%), *Cucumis maderaspatanus* (13%), *Cupaniopsis anacardioides* (13%, 2), *Cyperus stradbrokensis* (13%, 1), *Dianella caerulea* (13%, 1), *Erigeron bonariensis* (13%, 1), *Erigeron pusillus* (13%, 1), *Erigeron sumatrensis* (13%), *Eugenia uniflora* (13%), *Euphorbia heterophylla* (13%), *Fimbristylis ferruginea* (13%), *Geitonoplesium cymosum* (13%), *Heteropogon contortus* (13%, 1), *Hibiscus tiliaceus* (13%, 2), *Hypochaeris radicata* (13%), *Imperata cylindrica* (13%, 20), *Ischaemum australe* (13%, 3), *Jasminum didymum* (13%), *Jasminum didymum subsp. didymum* (13%, 1), *Lantana camara* (13%, 1), *Lepturus repens* (13%, 1), *Lobelia anceps* (13%, 1), *Macroptilium atropurpureum* (13%, 1), *Oenothera drummondii subsp. drummondii* (13%, 1), *Passiflora foetida* (13%), *Sacciolepis indica* (13%, 1), *Samolus repens* (13%), *Schinus terebinthifolius* (13%), *Schoenus nitens* (13%, 1), *Senecio pinnatifolius* (13%), *Sesuvium portulacastrum* (13%), *Smilax australis* (13%), *Solanum nigrum subsp. nigrum* (13%), *Solanum nodiflorum* (13%, 7), *Sporobolus virginicus* (13%, 30), *Symphyotrichum subulatum* (13%, 1), *Trachymene procumbens* (13%), *Tribulus cistoides* (13%), *Vigna marina* (13%), *Vitex trifolia* (13%), *Xyris complanata* (13%, 1), *Zinnia peruviana* (13%), *Zoysia macrantha subsp. macrantha* (13%, 60)

Summary

Species recorded	Total: 86; Woody: 20; Ground: 73; Avg spp/site: 17.88; StDev: 6.45
Basal Area	Avg BA/site: 9.66 m²/ha; Range: 2 - 17 m²/ha; StDev: 5.01 m²/ha
Structural Form range	Low Woodland: 37.5%; Low Open-Forest: 25%; Low Open-Woodland: 12.5%; Open-Forest: 12.5%; Low Closed-Forest: 12.5%
Representative sites	(54306, 19858, 29923, 27647, 29956, 14766, 14955, 16459)

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Attachment 3

- previously cleared areas (refer s261ZB)
- maintenance activities (refer s261ZC)
- firebreak or fire management line (refer s261ZD)
- accepted development vegetation clearing code (refer s261ZE)
- conservation purposes (refer s261ZG)
- authorised in particular circumstances (refer s385).

Some exemptions under the NCA are the same as exempt clearing work (formerly known as exemptions) from the *Vegetation Management Act 1999* (i.e. listed in the Planning Regulations 2017) while some are different.

If the proposed area to be cleared is shown as blue (i.e. high risk) on the flora survey trigger map, a flora survey of the clearing impact area must be undertaken in accordance with the flora survey guidelines. The main objective of a flora survey is to locate any endangered, vulnerable or near threatened plants (EVNT plants) that may be present in the clearing impact area.

If a flora survey identifies that EVNT plants are not present within the clearing impact area or clearing within 100m of EVNT plants can be avoided, the clearing activity is exempt from a permit. An exempt clearing notification form must be submitted to the Department of Environment and Science, with a copy of the flora survey report, at least one week prior to clearing. The clearing must be conducted within two years after the flora survey report was submitted.

If a flora survey identifies that EVNT plants are present in, or within 100m of, the area to be cleared, a clearing permit is required before any clearing is undertaken. The flora survey report, as well as an impact management report, must be submitted with the application form clearing permit.

In an area other than a high risk area, a clearing permit is only required where a person is, or becomes aware that EVNT plants are present in, or within 100m of, the area to be cleared. You must keep a copy of the flora survey trigger map for the area subject to clearing for five years from the day the clearing starts. If you do not clear within the 12 month period that the flora survey trigger map was printed, you need to print and check a new flora survey trigger map.

Further information on protected plants is available at
http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/

For assistance on the protected plants flora survey trigger map for this property, please contact the Department of Environment and Science at palm@des.qld.gov.au.

3.7 Emissions Reduction Fund (ERF)

The ERF is an Australian Government scheme which offers incentives for businesses and communities across the economy to reduce emissions.

Under the ERF, landholders can earn money from activities such as planting (and keeping) trees, managing regrowth vegetation and adopting more sustainable agricultural practices.

The purpose of a project is to remove greenhouse gases from the atmosphere. Each project will provide new economic opportunities for farmers, forest growers and land managers.

Further information on ERF is available at https://www.qld.gov.au/environment/land/state/use/carbon-rights/.

4. Contact information for DNRME

For further information on vegetation management:
Phone 135VEG (135 834)
Email vegetation@dnrme.qld.gov.au
Visit www.dnrme.qld.gov.au/our-department/contact-us/vegetation-contacts to submit an online enquiry.

For contact details for other State and Commonwealth agencies, please see Section 6.

5. Maps

The maps included in this report may also be requested individually at:

https://www.dnrme.qld.gov.au/qld/environment/land/vegetation/vegetation-map-request-form
and
http://www.ehp.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php

Regulated vegetation management map

The regulated vegetation management map shows vegetation categories needed to determine clearing requirements. These maps are updated monthly to show new property maps of assessable vegetation (PMAV).

Vegetation management supporting map

The vegetation management supporting map provides information on regional ecosystems, wetlands, watercourses and essential habitat.

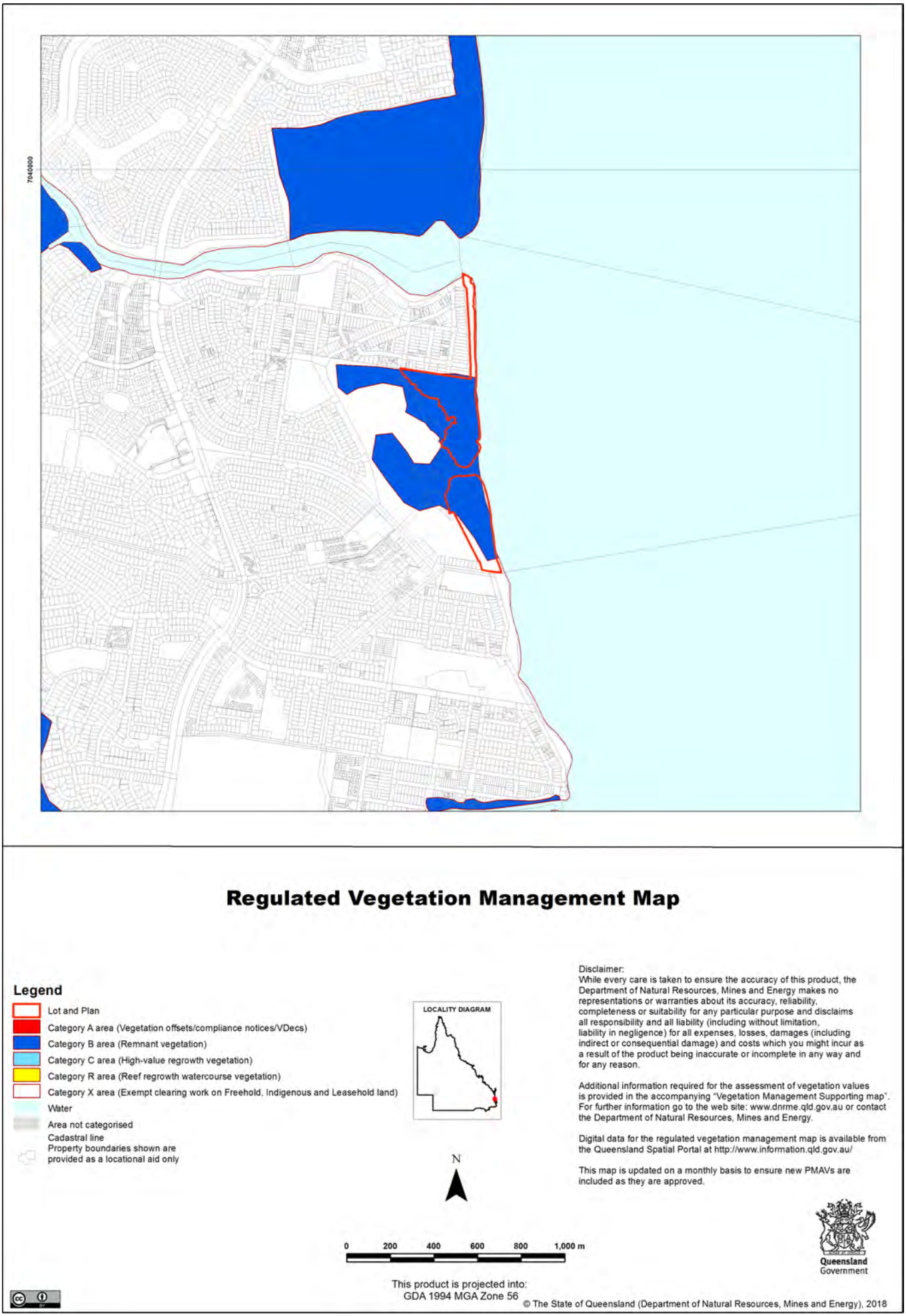
Coastal/non coastal map

The coastal/non-coastal map confirms whether the lot, or which parts of the lot, are considered coastal or non-coastal for the purposes of the accepted development vegetation clearing codes and the State Development Assessment Provisions (SDAP).

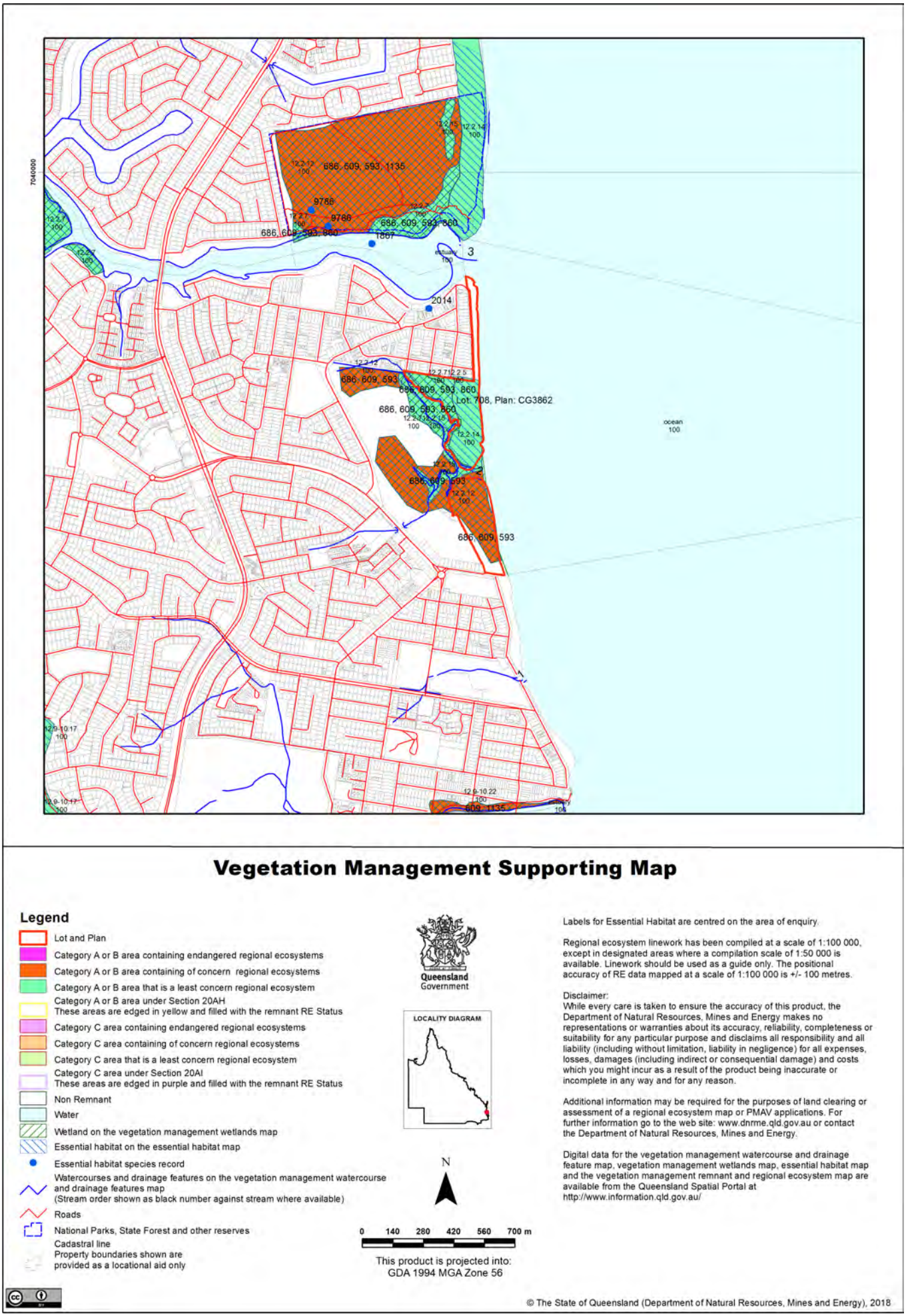
Protected plants map

The protected plants map shows areas where particular provisions of the *Nature Conservation Act 1992* apply to the clearing of protected plants.

5.1 Regulated vegetation management map



5.2 Vegetation management supporting map



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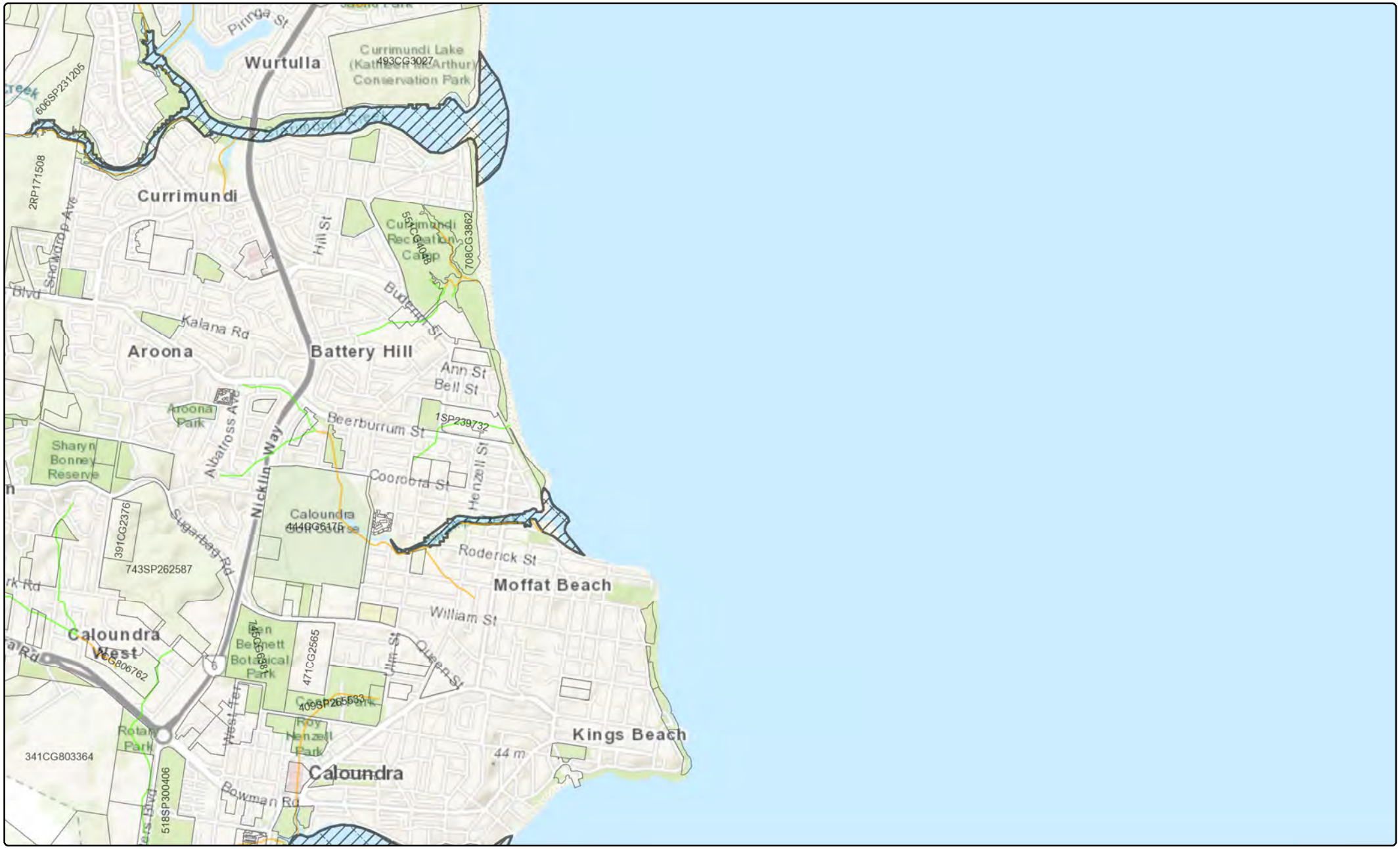
Attachment 4



DA Mapping System – Print Screen

Department of State Development, Manufacturing, Infrastructure and Planning

Queensland Government

0 580 1,160 1,740 2,320

Metres

Date: 04/12/2018

N

Legend

Cadastre (50k)

Cadastre (50k)

Queensland waterways for waterway barrier works

1 - Low

2 - Moderate

3 - High

4 - Major

Fish habitat management area A

FHAA

Fish habitat management area B

FHAB

Tidal waterways

Tidal waterways

Queensland Government

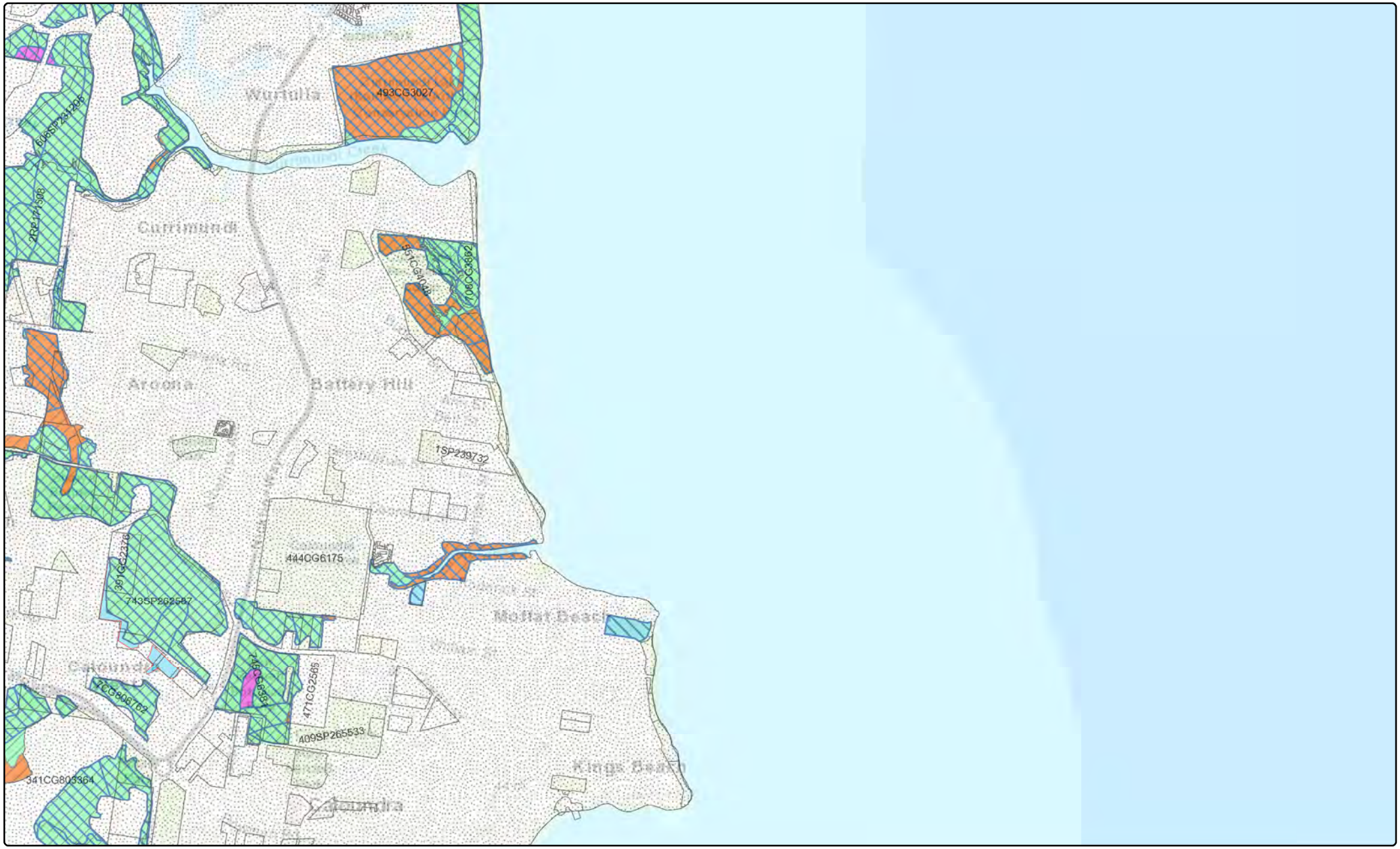
Department of State Development, Manufacturing, Infrastructure and Planning

DA Mapping System – Print Screen

Date: 04/12/2018

28ºS
ENVIRONMENTAL

Attachment 5



DA Mapping System – Print Screen

Department of State Development, Manufacturing, Infrastructure and Planning

0 580 1,160 1,740 2,320

Metres

Date: 04/12/2018

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Disclaimer:
This map has been generated from the information supplied to the Department of State Development, Manufacturing, Infrastructure and Planning for the purposes of the Development Assessment Mapping System. Note that this is a print screen only. The map generated has been prepared with due care based on the best available information at the time of publication. The State of Queensland holds no responsibility for any errors, inconsistencies or omissions within this document. Any decisions made by other parties based on this document are solely the responsibility of those parties. This information is supplied subject to the full terms and conditions available on the department's website.

Legend

Cadastre (50k)

Cadastre (50k)

Regulated vegetation management map (Category A and B extract)

Category A on the regulated vegetation management map

Category B on the regulated vegetation management map

Essential habitat

Essential habitat

Regulated vegetation management map (other vegetation categories)

Category C on the regulated vegetation managment map

Category R on the regulated vegetation management map

Category X on the regulated vegetation management map

Vegetation management regional ecosystem map

Category A or B area containing endangered regional ecosystems

Category A or B area containing of concern regional ecosystems

Category A or B area that is a least concern regional ecosystem

Non remnant

Water

Vegetation management coastal and non-coastal bioregions and sub-regions

Coastal bioregions and sub-regions

Non coastal bioregions and sub-regions

Queensland Government

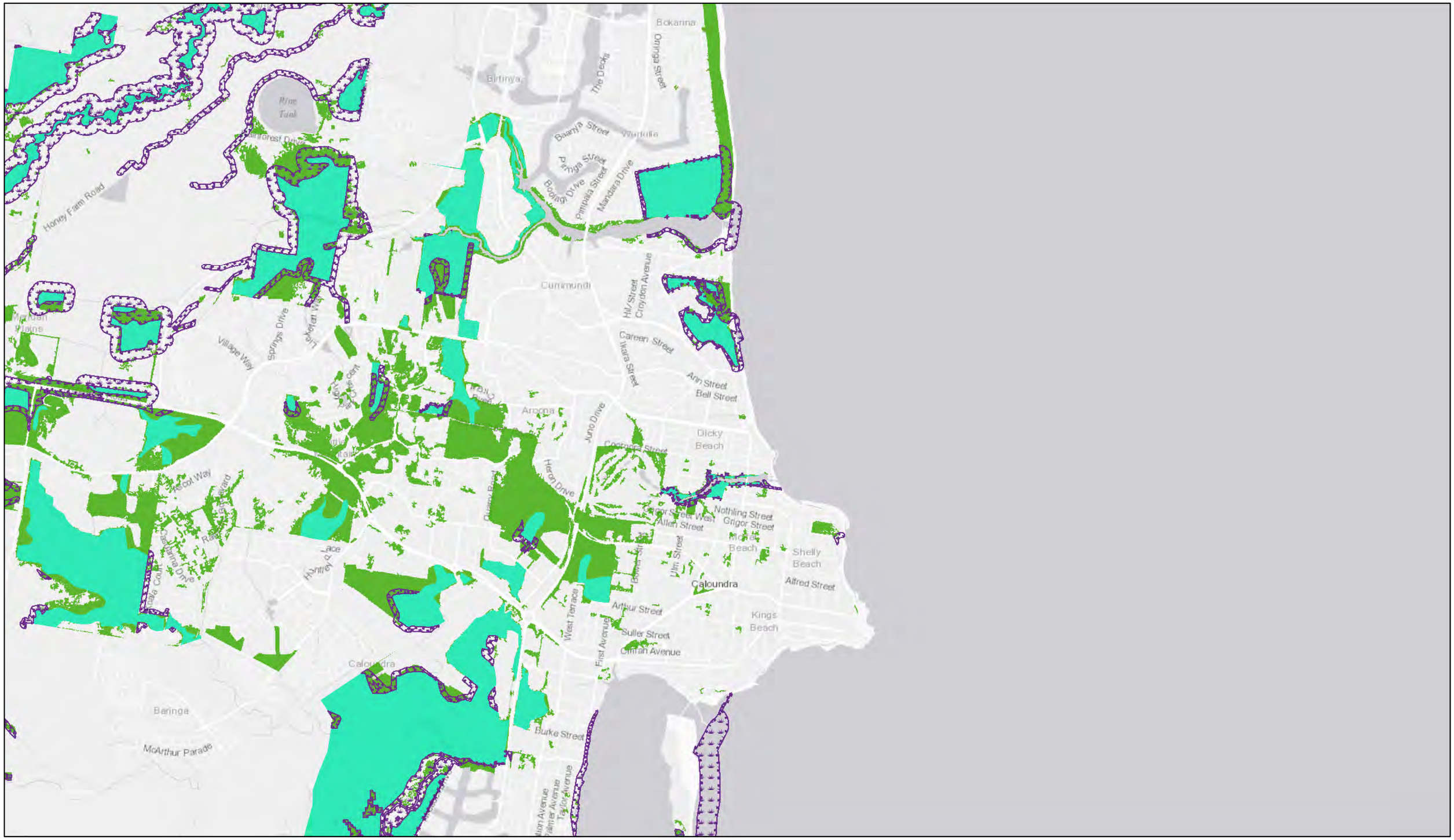
Department of State Development, Manufacturing, Infrastructure and Planning

DA Mapping System – Print Screen

Date: 04/12/2018

28ºS
ENVIRONMENTAL

Attachment 6



Biodiversity

Sunshine Coast Council
Locked Bag 72
Sunshine Coast Mail Centre QLD 4560

N

1:36,000

0 750 1,500 3,000 Meters

Printed on A3 paper

Date: December 4, 2018

Author :

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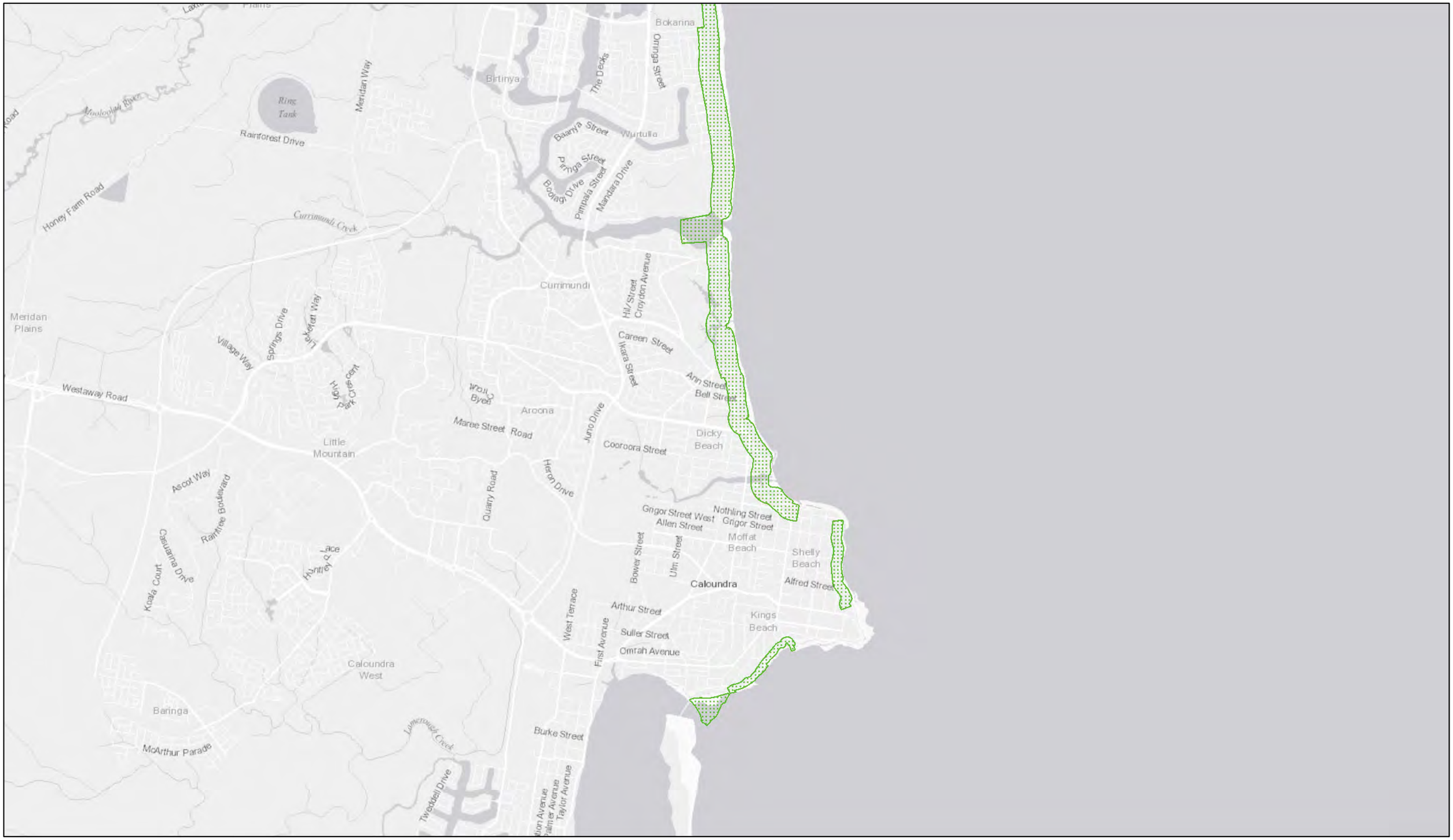
Attachment 7



Coastal Protection

Sunshine Coast Council
Locked Bag 72
Sunshine Coast Mail Centre QLD 4560

N

1:36,000

0 750 1,500 3,000 Meters

Printed on A3 paper

Date: December 4, 2018

Author :

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Attachment 8

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Attachment 8

Scientific Name	Common Name
Native species	
Acacia disparrima	hickory wattle
Allocasuarina littoralis	black she oak
Alphitonia excelsa	red ash
Angophora leiocarpa	rusty gum
Banksia integrifolia	silver banksia
Banksia spinulosa	
Brachychiton acerifolius	flame tree
Brachychiton rupestris	bottle tree
Corymbia citriodora subsp. variegata	spotted gum
Corymbia intermedia	pink bloodwood
Cynodon dactylon	couch grass
Dendrophthoe glabrescens	mistletoe
Eucalyptus propinqua	grey gum
Eucalyptus racemosa	scribbly gum
Eucalyptus seeana	narrow leaved red gum
Eucalyptus siderophloia	grey ironbark
Gahnia aspera	sword sedge
Geitonoplesium cymosum	scrambling lily
Glochidion ferdinandi	cheese tree
Grevillea baileyana	white oak
Macadamia integrifolia	macadamia
Melaleuca quinquenervia	broad-leaved paperbark
Parsonsia straminea	monkey rope vine
Platycerium bifurcatum	elkhorn fern
Pteridium esculentum	bracken
Syzygium oleosum	purple lily pilly
Exotic	
Acalypha wilkesiana	
Ageratum houstonianum	blue billy goat weed
Alternanthera brasiliana	purple joyweed
Archontophoenix alexandrae	Queen Alexandra palm
Asparagus africanus	climbing asparagus
Asparagus densiflorus	asparagus fern
Axonopus compressus	broad-leaved carpet grass

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Scientific Name	Common Name
Bambusa sp.	structural bamboo
Bidens pilosa	cobbler's pegs
Calliandra haematocephala	powder puff tree
Calyptocarpus vialis	creeping cinderella weed
Caryota sp.	fish tail palm
Chloris gayana	Rhode's grass
Citrus reticulata	orange
Ctenanthe setosa	never never plant
Conyza bonariensis	fleabane
Cycas revoluta	cycad
Dracaena marginata	dragon tree
Duranta repens	geisha girl
Dypsis lutescens	golden cane palm
Ficus benjamina	weeping fig
Ficus hillii	
Gamochaeta coarctata	elegant cudweed
Gardenia sp.	gardenia
Grevillea banksia (cultivar)	red silky oak
Hibiscus rosa-sinensis	hibiscus
Howea forsteriana	kentia palm
Libidibia ferrea	leopard tree
Magnolia sp.	magnolia
Mangifera indica	mango
Megathyrsus maximus var *pubiglumis*	green panic
Metrosideros sp.	
Morus nigra	mulberry
Murraya koenigii	curry tree
Murraya paniculata	orange jessamine
Musa acuminata	banana
Neonotonia wightii	glycine
Oxalis pes-caprae	
Oxalis sp.	oxalis
Passiflora edulis	passion fruit
Syngonium podophyllum	arrow head plant
Plantago lanceolata	common ribwort
Plumeria sp.	frangipani
Roystonea regia	royal bottle palm
Sansevieria trifasciata	mother in laws tongue

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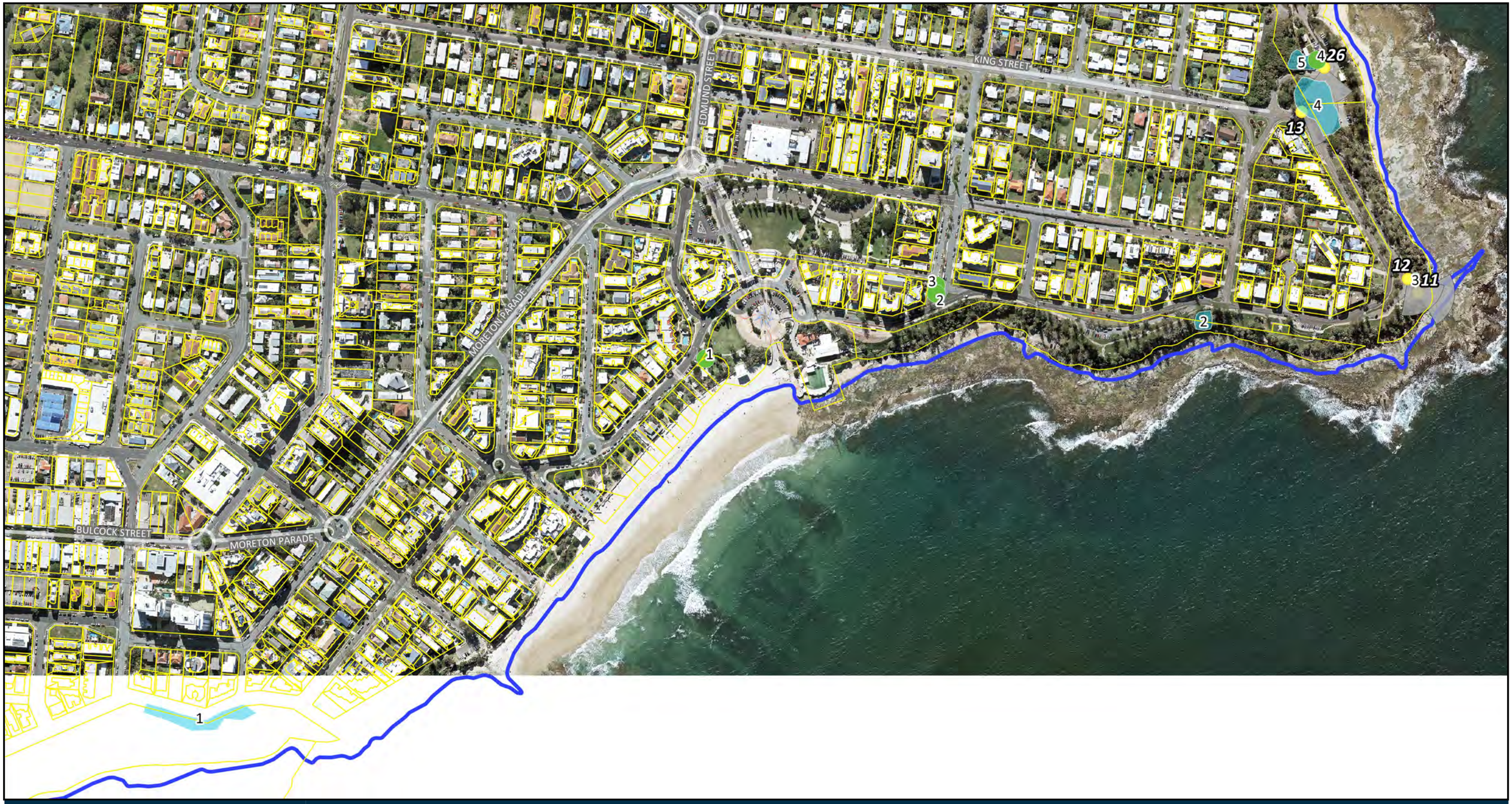
Scientific Name	Common Name
Schefflera actinophylla	umbrella tree
Schefflera arboricola	umbrella bush
Schinus terebinthifolius	broad leaved pepper tree
Senecio madagascariensis	fireweed
Schizolobium parahyba	Brazilian fern tree
Strelitzia reginae	bird of paradise plant
Syagrus romanzoffiana	Cocos palm
Viburnum sp.	

28ºS
ENVIRONMENTAL

Attachment 9



Cottonwood Assessment

Kings Beach

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide
- Photo Locations

Note: 3.35% of the Kings Beach Survey Area supports Cottonwood (i.e 3811m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo Locations	

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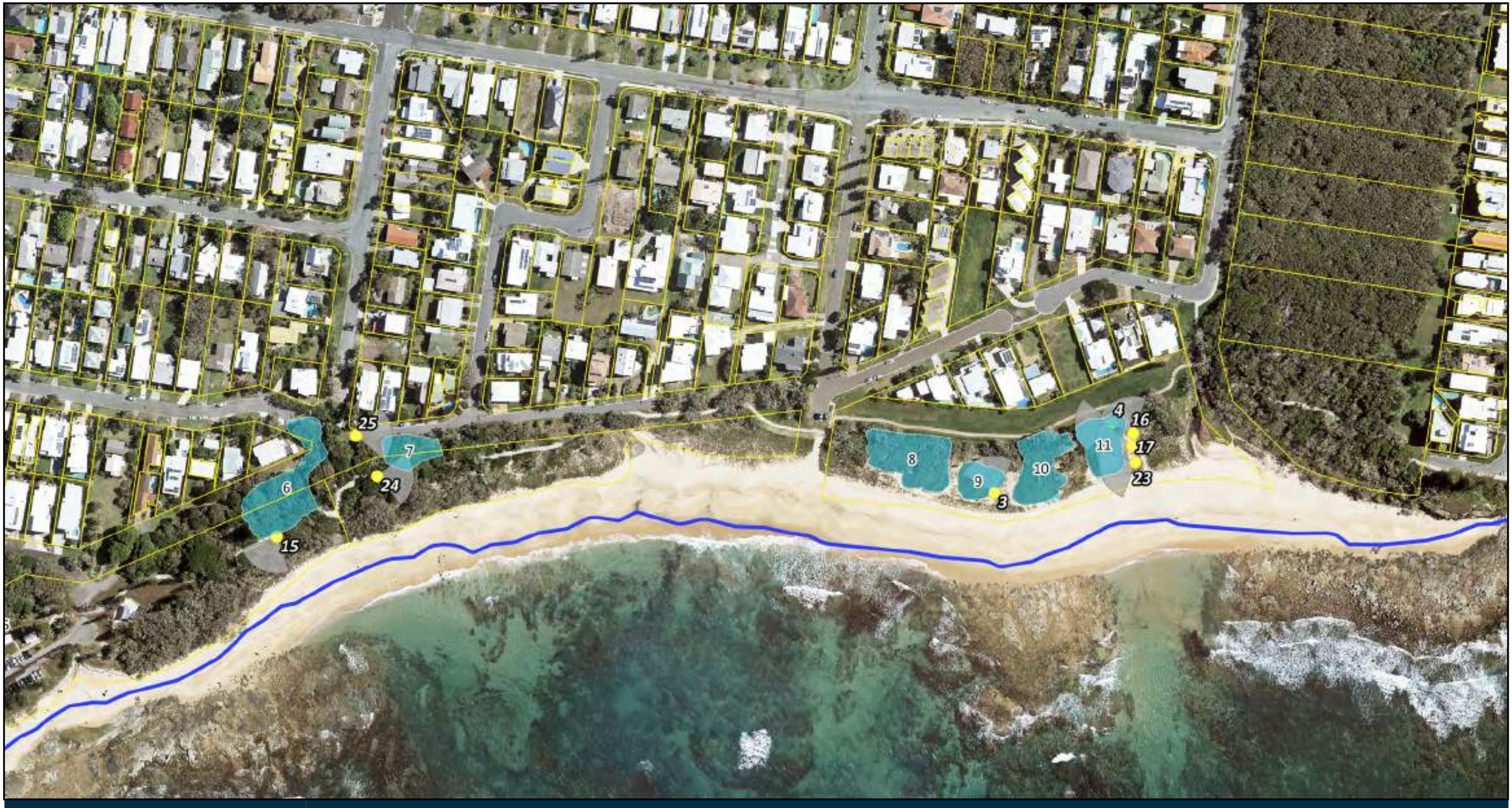
1:4,500 (A3) GDA 94 MGA 56

N

28ºS ENVIRONMENTAL



Cottonwood Assessment

Shelly Beach

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide
- Photo Locations

Note: 7.27% of the Shelly Beach Survey Area supports Cottonwood (i.e 6034m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo Locations	

50 0 50 100 150 m

N

1:2,200 (A3) GDA 94 MGA 56

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Cottonwood Assessment

Moffat Headland

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide
- Photo Locations

Note: 5.98% of the Moffat Headland Survey Area supports Cottonwood (i.e 3968m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo locations	

50 0 50 100 150 m

1:2,500 (A3) GDA 94 MGA 56

N

28°S ENVIRONMENTAL

Cottonwood Assessment

Dicky Beach

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide
- Photo Locations

Note: 5.95% of the Dicky Beach Survey Area supports Cottonwood (i.e 4997m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo locations	

50 0 50 100 150 m

1:2,700 (A3) GDA 94 MGA 56

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Cottonwood Assessment

Currimundi School

28 South Project Ref: 2018-064

Data Sources: Aerial Imagery (Place Design Group, 2 August 2018); Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

28ºS ENVIRONMENTAL

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronimical Tide (HAT)
- Category B Regulated Vegetation
- Photo Locations

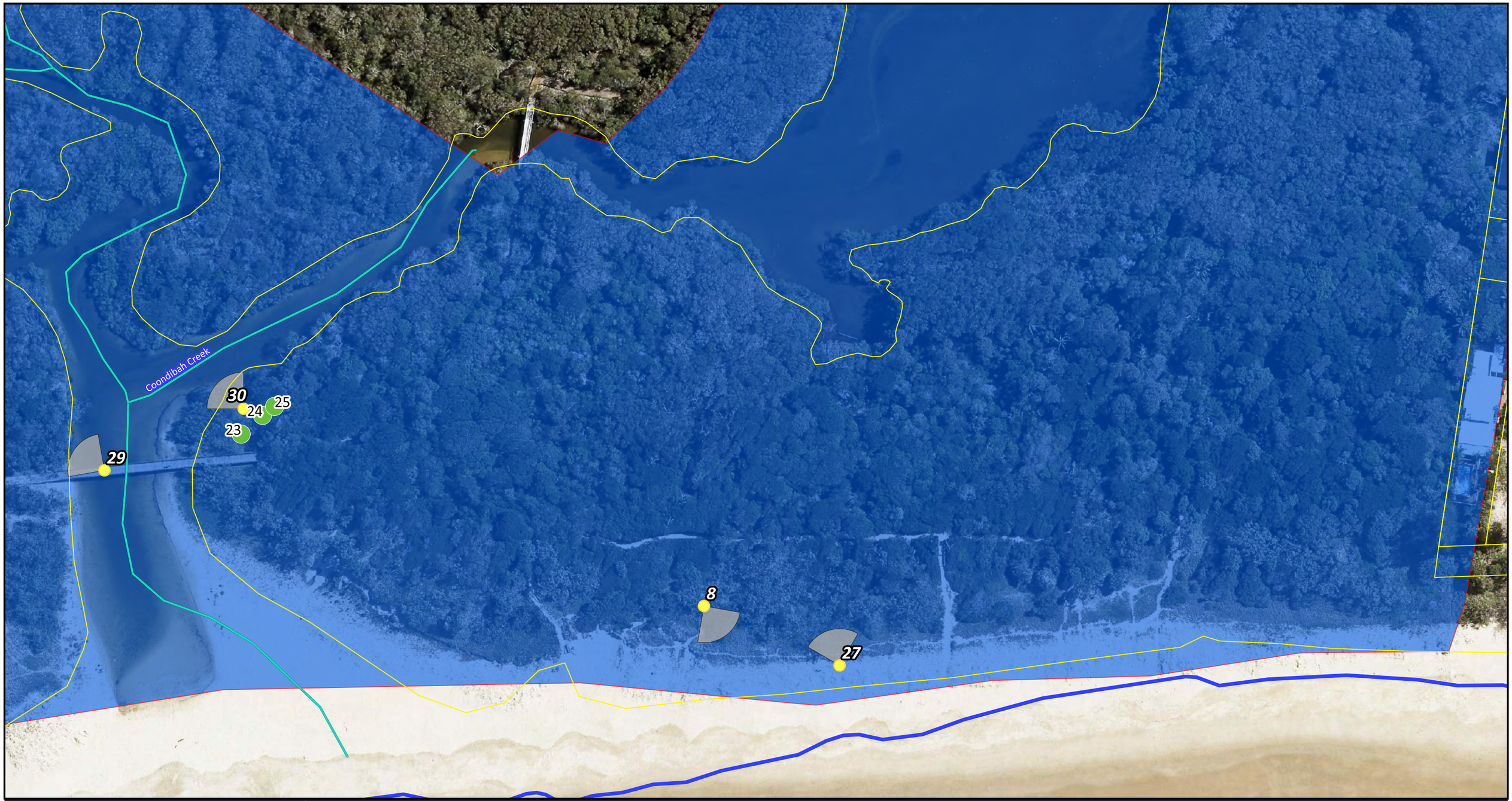
Note: 3.62% of the Currimundi School Survey Area supports Cottonwood (i.e 2382m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo locations	

50 0 50 100 m

N

1:1,700 (A3) GDA 94 MGA 56



Cottonwood Assessment

Currimundi Mid North

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide (HAT)
- Category B Regulated Vegetation
- Photo Locations

Note: 0.23% of the Currimundi Mid North Survey Area supports Cottonwood (i.e 108m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo Locations	

25 0 25 50 75 m

1:1,500 (A3) GDA 94 MGA 56

N

28°S ENVIRONMENTAL

Cottonwood Assessment

Currimundi Lakes Entrance

28 South Project Ref: 2018-064

Data Sources:
Aerial Imagery (Place Design Group, 2 August 2018);
Digital Cadastre Database (Dept. Natural Resources and Mines, 2016).

Legend

- Individual Cottonwood
- Cottonwood Polygon
- Cadastre (Lot/Plan)
- Highest Astronomical Tide (HAT)
- Category B Regulated Vegetation
- Photo Locations

Note: 6.38% of the Currimundi Lakes Entrance Survey Area supports Cottonwood (i.e 2476m2)

Issue Date	Revision	Author
4 April 2019	Rev B	RF
Approved	**Revision Note**	
MT	Photo locations	

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Attachment 10

Cottonwood Tree (Points)

Tree ID	Location	Location Notes	Landscape Situation	Role	Maturity	Function	Regulated Vegetation	Native Vegetation (SCC Overlay)	Riparian Protection Area (SCC Overlay)	Wetland (SCC Overlay)	Marine Plant	Fisheries Productivity Significance	Amenity Value	Hazard Comment	Current Management	Native Canopy Present	Over Grown	CPTED Issues	Further Comments
1	Kings Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Nil	Lifted	No	No	No	Landscape planting
2	Kings Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Failure management	No	No	No	Low over road, cavities past failure
3	Kings Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	Yes	No	No	No		Shade Tree	Lean, root plate failure	Failure management	No	No	No	Low over road, cavities past failure
4	Kings Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Nil	Lifted	No	No	No	Over park bench
5	Moffat Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No			Root plate failure	Failure management	No	No	No	Old failure
6	Moffat Beach	Park	Urban Park/ Landscaping		Over Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	exposed roots rubbing branches	Lifted	No	No	No	Over carpark
7	Moffat Beach	Boardwalk	Creek & Waterway		Juvenile	Isolated tree (surrounded by maintained area)	Yes	Yes	Yes	No	Yes	Low	Natural regrowth	Nil	Individual, No Management	No	No	No	Future overhanging
8	Dicky Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lift over road	Lifted	No	No	No	Sucker growth
9	Dicky Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lift over road	Lifted	No	No	No	Sucker growth
10	Dicky Beach	Footpath	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lift over road	Lifted	No	No	No	Sucker growth
11	Dicky Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Lifted	No	No	No	
12	Dicky Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Lifted	No	No	No	
13	Dicky Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Lifted	No	No	No	
14	Dicky Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Lifted	No	No	No	
15	Dicky Beach	Park	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Lean, root plate failure	Lifted	No	No	No	
16	Dicky Beach	Adjoining Parkland	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Nil	Lifted	No	No	No	Landscaping planting
17	Dicky Beach	Dune Area	Coastal Dunes (Regeneration)	Part of community	Mature	Dunes	No	No	No	No	No			Nil	Individual, No Management	Yes	No	No	Isolated tree, may impact natives in future
18	Dicky Beach	Landscaping	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Nil	Lifted	No	No	No	
19	Dicky Beach	Landscaping	Urban Park/ Landscaping		Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No		Shade Tree	Nil	Lifted	No	No	No	
20	Currimundi School	Back of dune	Urban Park/ Landscaping		Early Mature	Isolated tree (surrounded by maintained area)	No	Yes	Yes	No	No			Nil	Individual, No Management	Yes	No	Yes	Edge of bushland
21	Currimundi School	Back of dune	Urban Park/ Landscaping		Early Mature	Isolated tree (surrounded by maintained area)	No	Yes	Yes	No	No			Nil	Individual, No Management	Yes	No	Yes	Edge of bushland
22	Currimundi School	Back of dune	Coastal Dunes (Regeneration)	Sparse	Early Mature	Isolated tree (surrounded by maintained area)	Yes	Yes	Yes	Yes	No			Nil	Individual, No Management	Yes	No	Yes	Regrowth around base of tree
23	Currimundi Mid North	Estuary	Estuarine	Part of community	Semi-mature	Large remnant bushland	Yes	Yes	No	Yes	Yes	Low		Nil	Individual, No Management	Yes	No	No	
24	Currimundi Mid North	Estuary	Estuarine	Part of community	Semi-mature	Large remnant bushland	Yes	Yes	No	Yes	Yes	Low		Nil	Individual, No Management	Yes	No	No	
25	Currimundi Mid North	Estuary	Estuarine	Part of community	Semi-mature	Large remnant bushland	Yes	Yes	No	Yes	Yes	Low		Nil	Individual, No Management	Yes	No	No	

Cottonwood Tree (Points)

Tree ID	Location	Location Notes	Landscape Situation	Role	Maturity	Function	Regulated Vegetation	Native Vegetation (SCC Overlay)	Riparian Protection Area (SCC Overlay)	Wetland (SCC Overlay)	Marine Plant	Fisheries Productivity Significance	Amenity Value	Hazard Comment	Current Management	Native Canopy Present	Over Grown	CPTED Issues	Further Comments
26	Currimundi Lakes Entrance	Edge of road, growing on trunk of Melaleuca	Urban Park/ Landscaping		Early Mature	Isolated tree (surrounded by maintained area)	No	No	No	No	No			Nil	Individual, No Management	Yes	No	No	Historically lopped and regrown
27	Currimundi Lakes Entrance	Park over seat	Urban Park/ Landscaping		Early Mature	Isolated tree (surrounded by maintained area)	No	No	Yes	No	No		Shade Tree	Lean, root plate failure, cavities	Lifted	No	Yes	No	Overhanging park bench

Note: Management Options are suggestions only and are based on in-field assessment undertaken in August 2018 and relevant legislalation applicable August - December 2018. Future management options will require reconsideration of applicable legislative requirements and necessary approvals and permits for impacting or removing cottonwood.

Cottonwood Clusters (Polygons)

ID	Location	Location Notes	Landscape Situation	Role	Maturity	Function	Native Vegetation Overlay) %	Reg Veg Overlay (SCC	Riparian Protection Area (SCC Overlay)	Wetlands (SCC Overlay)	Marine Plant	Fisheries	Amenity Value	Hazard Comment	Current Mgt Noted	Native Canopy Present	Over Grown	CPTED Issues	Further Comment
1	Kings Beach	Car park	Urban Park/ Landscaping		Mature	Isolated clump (surrounded by maintained area)	71 - 100	No	No	No	No	No	Shading carpark	Overhanging carpark	Lifted	Yes	No	Yes	Encroaching on car park
2	Kings Beach	Gully on stormwater outlet in cliff	Urban Park/ Landscaping		Early Mature	Isolated clump (surrounded by maintained area)	30 - 50	No	No	No	No	No	Shading path	Regressing in health	Lifted	Yes	No	Yes	Height over path should be managed if retained over head.
3	Kings Beach	Top of cliff next to road	Urban Park/ Landscaping		Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	No	No	No			Lifted	No	Yes	Yes	Height over path should be managed if retained over head. Other natives occuring within and surrounding
4	Kings Beach	End of road end access path	Bushland	Dominant	Mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No			No		Low over path	Failure management	No	Yes	Yes	Height over path should be managed if retained over head.
5	Kings Beach	Rear of hill west of park	Bushland	Dominant	Mature	Fragmented Bushland	70 - 100	No	No	No	No	No	Part of fragment bushland		Lifted	Yes	No	Yes	Fringing native trees, overhanging toilets, very dense at low east edge
6	Shelly Beach	West of path	Urban Park/ Landscaping		Mature	Fragmented Bushland	70 - 100	No	No	No	No	No	Shade for path	Nil	Lifted	Yes	No	Yes	Very dense west of path, sight lines and height not much east if any
7	Shelly Beach	Between path and road	Creek & Waterway	Dominant	Mature	Dunes	70 - 100	No	No	No	No	Yes	Low	Low over path	Lifted	Yes	Yes	Yes	Small monoculture along creek drain, lifted over path, manage to maintain spread
8	Shelly Beach	Dune next to mown area and beach	Coastal Dunes (Regeneration)	Dominant	Mature	Dunes	50 - 70	No	No	No	No	No			Monoculture, No Management	Yes	Yes	No	Sparse acacia and wattle wind pruned reduce spread lift over grass to west
9	Shelly Beach	Dune between beach and park	Coastal Dunes (Regeneration)	Dominant	Early Mature	Dunes	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	No	Sparse native trees on edges
10	Shelly Beach	Dune between beach and park	Coastal Dunes (Regeneration)	Dominant	Mature	Dunes	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	No	Sparse native trees on edges lift over mown park
11	Shelly Beach	Dune next to mown area and beach	Coastal Dunes (Regeneration)	Dominant	Semi-mature	Dunes	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	No	Sparse acacia and wattle wind pruned reduce spread lift over grass to west
12	Moffat Beach	Grass parkland behind beach	Urban Park/ Landscaping	Forming monoculture	Mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	No	No	No	Shade for path and BBQ/Picnic Area	Low over path	Lifted	No	Yes	Yes	Overhanging picnic area and park, spreading towards beach
13	Moffat Beach	Park at rear on drainage feature/path	Bushland	Sparse	Semi-mature	Fragmented Bushland	0 - 10	No	Yes	No	No	Yes	Low	Part of intact bushland	Nil	Lifted	Yes	No	Yes	Potential to encroach on path (both coast walk and bushpath) - unlikely to become dominant

ID	Location	Location Notes	Landscape Situation	Role	Maturity	Function	% Native Vegetation	Reg Veg Overlay	Riparian Protection Area (SCC Overlay)	Wetlands (SCC Overlay)	Marine Plant	Fisheries	Amenity Value	Hazard Comment	Current Mgt Noted	Native Canopy Present	Over Grown	CPTED Issues	Further Comment
14	Moffat Beach	Edge of beach	Urban Park/ Landscaping		Semi-mature		50 - 70	No	Yes	Yes	No	Yes	Low		Lifted	Yes	No	Yes	Young regrowth and spreading, maintain spread
15	Dicky Beach	Top of dune beside creek	Coastal Dunes (Regeneration)	Forming monoculture	Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	Yes	No	No	No	No			Monoculture, No Management	Yes	Yes	Yes	Casuarina specimens occuring on creek side clump
16	Dicky Beach	Top of dune beside creek	Coastal Dunes (Regeneration)	Forming monoculture	Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	Yes	Pandanus occuring within and adjoining clump
17	Dicky Beach	Grass area behind beach	Urban Park/ Landscaping		Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	Yes	Pandanus and banksia occurring within and surrounding
18	Dicky Beach	Grass area behind beach	Urban Park/ Landscaping		Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	No	No	No			Monoculture, No Management	Yes	Yes	Yes	Pandanus and banksia occurring within and surrounding
19	Dicky Beach	Along drainage feature	Creek & Waterway	Part of community	Early Mature	Estuarine	10-30	No	Yes	No	No	Yes	Low	Adjoining park along drainage feature	Lifted	Yes	No	Yes	Height over path should be managed if retained over head.
20	Dicky Beach	Along southern edge of walkway to beach	Coastal Dunes (Regeneration)	Part of community	Mature	Dunes	30 - 50	No	No	No	No	No		Adjoining dune along walkway		Yes	No	Yes	Future path or domination
21	Currimundi School	Edge of Intact Bushland	Coastal Dunes (Regeneration)	Forming monoculture	Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	Yes	Yes	No	No			Monoculture, No Management	Yes	Yes	Yes	Pandanus, melaleuca occuring within the adjioning climp
22	Currimundi School	Edge of Intact Bushland	Coastal Dunes (Regeneration)	Part of community	Mature	Dunes	50 - 70	No	Yes	Yes	No	No		Shade over path	Lifted	Yes	No	Yes	Height over path should be managed if retained over head.
23	Currimundi School	Edge of Intact Bushland	Coastal Dunes (Regeneration)	Forming monoculture	Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	Yes	Yes	Yes	Yes	No			Lifted	Yes	Yes	Yes	Height over path should be managed if retained over head.
24	Currimundi School	Edge of Intact Bushland	Coastal Dunes (Regeneration)	Forming monoculture	Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	Yes	Yes	Yes	Yes	No			Lifted	Yes	Yes	Yes	Height over path should be managed if retained over head.
25	Currimundi School	Edge of Intact Bushland	Bushland	Sparse	Mature	Large remnant bushland	0 - 10	Yes	Yes	No	Yes	No		Part of intact bushland		No	No	No	Isolated trees
26	Currimundi Lakes Entrance	Car park area	Urban Park/ Landscaping		Semi-mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No		No			Overhanging road	Lifted	Yes	Yes	Yes	Height over path should be managed if retained over head.
27	Currimundi Lakes Entrance	Along sth edge of walkway at top of dune	Coastal Dunes (Regeneration)	Dominant	Mature	Dunes	70 - 100	No	No	Yes	No	No		Shade over path	Overhanging	Lifted	Yes	No	Yes	Overhanging path, emergent natives
28	Currimundi Lakes Entrance	On lake beach/walkway	Urban Park/ Landscaping		Mature	Isolated clump (surrounded by maintained area)	70 - 100	No	No	Yes	No	No		Shade over path		Lifted	No	No	Yes	Height over path should be managed if retained over head.

ID	Location	Location Notes	Landscape Situation	Role	Maturity	Function	Native Vegetation Overlay (Reg Veg Overlay) %	Riparian Protection Area (SCC Overlay)	Wetlands (SCC Overlay)	Marine Plant	Fisheries	Amenity Value	Hazard Comment	Current Mgt Noted	Native Canopy Present	Over Grown	CPTED Issues	Further Comment
29	Currimundi Lakes Entrance	On lake beach/walkway	Urban Park/ Landscaping		Mature	Fragmented Bushland	70 - 100	No	No	Yes	No	Yes	Low	Shade over path		Lifted	No	No	Yes	Height over path should be managed if retained over head.

Note: Management Options are suggestions only and are based on in-field assessment undertaken in August 2018 and relevant legistalation applicable August - December 2018. Future management options will require reconsideration of applicable legislative requirements and necessary approvals and permits for impacting or removing cottonwood.

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Attachment 11

Corymbia intermedia +/- Lophostemon confertus +/- Banksia spp. +/- Callitris columellaris open-forest on beach ridges usually in southern half of bioregion

Pre-clearing area (ha), remnant area (ha) and per cent remaining:	16,048	11,363	71%

Species recorded:	Total: 158; woody: 61; ground: 122; Avg. spp./site: 27.9; std dev.: 5.0, 17 site(s)
Basal area:	Avg./site: 19.3 m²/ha, range: 9.0 - 33 m²/ha, std. deviation: 7 m²/ha, 16 site(s)
Structural formation:	Woodland: 29%; open-forest: 29%; closed-forest: 24%; open-woodland: 6%; low woodland: 6%; low open-forest: 6%, 17 site(s)
Representative sites:	15224, 16442, 16463, 16465, 16467, 16468, 16470, 16471, 16479, 16480, 16481, 16492, 19836, 19868, 27239, 27263, 27283.

Stratum: **T1**

Height avg. = 15.8m, range 7-25m, 17 sites

Crown cover avg. = 60.7%, range 15.0-85.0%, 17 sites

Stem density/ha avg. = 529, range 60-1540, 14 sites

Dominant species (relative cover, frequency): Lophostemon confertus (52, 65%), Callitris columellaris (48, 24%), Corymbia intermedia (41, 76%), Banksia aemula (15, 47%), Allocasuarina torulosa (12, 24%)

Frequent species (cover, frequency): Corymbia intermedia (21, 76%), Lophostemon confertus (37, 65%), Banksia aemula (10, 47%), Allocasuarina torulosa (10, 24%), Banksia integrifolia (3, 24%), Callitris columellaris (19, 24%), Corymbia gummifera (11, 12%), Persoonia stradbrokensis (1, 12%), Acronychia imperforata (6%), Banksia serrata (29, 6%), Endiandra sieberi (6, 6%), Eucalyptus racemosa subsp. racemosa (5, 6%), Eucalyptus resinifera (51, 6%), Eucalyptus tereticornis (25, 6%), Livistona australis (3, 6%), Melaleuca quinquenervia (5, 6%), Monotoca sp. (Fraser Island P.Baxter 777) (6%), Persoonia virgata (6%)

Stratum: **T2**

Height avg. = 7.4m, range 3-16m, 14 sites

Crown cover avg. = 16.5%, range 5.0-42.0%, 14 sites

Stem density/ha avg. = 252, range 80-700, 10 sites

Dominant species (relative cover, frequency): Lophostemon confertus (40, 41%), Corymbia intermedia (29, 35%), Acacia leiocalyx (23, 35%), Banksia integrifolia (3, 24%)

Frequent species (cover, frequency): Lophostemon confertus (5, 41%), Acacia leiocalyx (3, 35%), Corymbia intermedia (5, 35%), Banksia integrifolia (24%), Allocasuarina torulosa (6, 18%), Callitris columellaris (2, 18%), Monotoca scoparia (7, 18%), Allocasuarina littoralis (6, 12%), Banksia serrata (15, 12%), Acacia disparrima subsp. disparrima (6%), Acacia flavescens (6%), Alphitonia excelsa (1, 6%), Cissus hypoglauca (2, 6%), Elaeocarpus reticulatus (2, 6%), Endiandra sieberi (6%), Eucalyptus resinifera (6%), Glochidion sumatranum (7, 6%), Lophostemon suaveolens (25, 6%), Melaleuca quinquenervia (10, 6%), Petalostigma pubescens (1, 6%)

Stratum: **S1**

Height avg. = 2.1m, range 1-4m, 15 sites

Crown cover avg. = 23.7%, range 1.0-60.0%, 15 sites

Stem density/ha avg. = 305, range 20-800, 8 sites

Dominant species (relative cover, frequency): Monotoca scoparia (25, 24%), Persoonia virgata (18, 35%), Leucopogon margarodes (14, 24%), Acacia leiocalyx (12, 35%), Lantana camara (8, 24%)*

Frequent species (cover, frequency): Acacia leiocalyx (1, 35%), Persoonia virgata (3, 35%), Lantana camara (2, 24%), Leucopogon margarodes (2, 24%), Monotoca scoparia (2, 24%), Acacia disparrima subsp. disparrima (10, 18%), Astrotricha glabra (6, 18%), Banksia aemula (1, 18%), Banksia integrifolia (1, 18%), Banksia serrata (18%), Monotoca sp. (Fraser Island P.Baxter 777) (11, 18%), Acacia concurrens (6, 12%), Acacia ulicifolia (8, 12%), Allocasuarina littoralis (2, 12%), Alphitonia excelsa (3, 12%), Austromyrtus dulcis (1, 12%), Cupaniopsis anacardioides (3, 12%), Leucopogon pimeleoides (12%), Lophostemon confertus (5, 12%), Persoonia stradbrokensis (12%), Zieria smithii (1, 12%), Acrotriche aggregata (2, 6%), Allocasuarina torulosa (5, 6%), Aotus lanigera (30, 6%), Banksia oblongifolia (1, 6%), Banksia robur (1, 6%), Cissus hypoglauca (20, 6%), Dillwynia floribunda (20, 6%), Dodonaea triquetra (15, 6%), Dodonaea viscosa (1, 6%), Elaeocarpus reticulatus (2, 6%), Endiandra sieberi (1, 6%), Exocarpos latifolius (1, 6%), Glochidion sumatranum (10, 6%), Hibbertia linearis (1, 6%), Leptospermum semibaccatum (15, 6%), Leptospermum trinervium (2, 6%), Leucopogon leptospermoides (6%), Lomatia silaifolia (6, 6%), Parsonsia straminea (1, 6%), Pultenaea villosa (5, 6%), Ricinocarpos pinifolius (1, 6%), Schefflera actinophylla (6%), Styphelia viridis (6%)*

Stratum: **S2**

Height avg. = 1.1m, range 1-1.2m, 4 sites

Crown cover avg. = 13.8%, range 5.0-20.0%, 4 sites

Frequent species (cover, frequency): Alphitonia excelsa (1, 12%), Dodonaea triquetra (12%), Leucopogon margarodes (6, 12%), Acacia leiocalyx (6%), Acacia suaveolens (6%), Banksia robur (12, 6%), Hibbertia linearis (6%), Leucopogon pimeleoides (6, 6%), Monotoca scoparia (5, 6%), Ochrosperma lineare (2, 6%), Opuntia stricta (6%), Pultenaea paleacea (6%), Pultenaea villosa (10, 6%), Strangea linearis (6%), Zieria smithii (8, 6%)*

Stratum: **G**

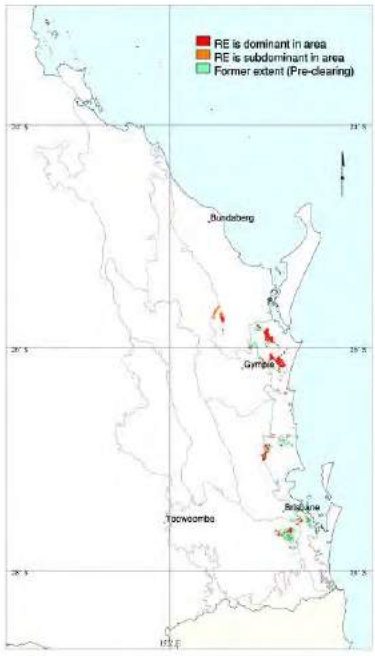
Height avg. = 0.6m, range 0.3-1m, 17 sites

PFC avg. = 43.7%, range 10-80%, 17 sites

Dominant species (relative cover, frequency): Imperata cylindrica (21, 88%), Pteridium esculentum (20, 94%), Themeda triandra (14, 59%), Austromyrtus dulcis (12, 47%), Eriachne pallescens (10, 29%)

Frequent species (cover, frequency): GRAMINOIDS: Imperata cylindrica (12, 88%), Themeda triandra (7, 59%), Cymbopogon refractus (4, 29%), Eriachne pallescens (5, 29%), Entolasia stricta (2, 24%), Lepidosperma laterale (4, 24%), Caustis blakei (17, 18%), Cyperus stradbrokensis (4, 18%), Paspalidium gausum (1, 18%), Schoenus nitens (1, 18%), Aristida calycina (1, 12%), Caustis recurvata (8, 12%), Eragrostis brownii (1, 12%), Eragrostis spartinoides (2, 12%), Trachystylis stradbrokensis (12%), Capillipedium spicigerum (6%), Cyperus enervis (6%), Cyperus indet. (6%), Cyperus scaber (1, 6%), Cyperus subulatus (1, 6%), Digitaria parviflora (6%), Eragrostis pubescens (6%), Eriachne pallescens var. pallescens (6%), Gahnia clarkei (10, 6%), Oplismenus aemulus (1, 6%), Panicum simile (6%), Paspalidium distans (6%), Sporobolus creber (6%), Urochloa foliosa (1, 6%)
FORBS: Pteridium esculentum (12, 94%), Lomandra longifolia (2, 76%), Dianella caerulea (1, 65%), Austromyrtus dulcis (4, 47%), Smilax australis (1, 41%), Desmodium rhytidophyllum (29%), Hibbertia scandens (1, 29%), Commelina diffusa (1, 24%), Geodorum densiflorum (1, 24%), Hardenbergia violacea (24%), Monotoca sp. (Fraser Island P.Baxter 777) (1, 24%), Schizaea bifida (1, 24%), Stephania japonica (24%), Acacia ulicifolia (1, 18%), Alphitonia excelsa (1, 18%), Boronia rosmarinifolia (1, 18%), Cassytha glabella (2, 18%), Dianella crinoides (1, 18%), Eustrephus latifolius (18%), Leucopogon pimeleoides (18%), Lomandra multiflora (18%), Lomatia silaifolia (7, 18%), Monotoca scoparia (18%), Passiflora suberosa (18%), Platysace ericoides (1, 18%), Pomax umbellata (4, 18%), Smilax glyciphylla (2, 18%), Bossiaea heterophylla (12%), Brunoniella australis (1, 12%), Cissus hypoglauca (5, 12%), Desmodium gunnii (1, 12%), Emilia sonchifolia* (1, 12%), Glycine clandestina (12%), Glycine cyrtoloba (12%), Gompholobium pinnatum (12%), Hibbertia linearis (1, 12%), Hibbertia vestita (12%), Lantana camara* (12%), Oxalis rubens (1, 12%), Patersonia glabrata (12%), Persoonia stradbrokensis (12%), Persoonia virgata (1, 12%), Strangea linearis (12%), Xanthorrhoea johnsonii (3, 12%), Abrus precatorius (1, 6%), Acacia disparrima subsp. disparrima (6%), Ageratum houstonianum* (6%), Allocasuarina torulosa (1, 6%), Aotus ericoides (1, 6%), Asparagus africanus* (1, 6%), Aster subulatus* (1, 6%), Asteraceae indet. (1, 6%), Baloskion tetraphyllum (8, 6%), Banksia integrifolia (1, 6%), Breynia oblongifolia (6%), Calochlaena dubia (6%), Cassytha filiformis (6%), Cassytha pubescens (1, 6%), Clematicissus opaca (6%), Clerodendrum floribundum (6%), Conyza bonariensis* (6%), Crassocephalum crepidioides* (6%), Cyanthillium cinereum (6%), Dipodium variegatum (1, 6%), Dodonaea viscosa subsp. burmanniana (6%), Duboisia myoporoides (6%), Empodisma minus (1, 6%), Epacris pulchella (1, 6%), Glochidion ferdinandi (6%), Gomphocarpus physocarpus* (6%), Hibbertia stricta (1, 6%), Kennedia rubicunda (6%), Leptomeria acida (6%), Leptospermum trinervium (2, 6%), Leucopogon leptospermoides (6%), Leucopogon margarodes (6%), Lomandra confertifolia subsp. pallida (6%), Melaleuca saligna (6%), Melichrus procumbens (6%), Persoonia media (6%), Petrophile shirleyae (6%), Pimelea linifolia (1, 6%), Plectranthus parviflorus (1, 6%), Podolepis longipedata (6%), Poranthera microphylla (1, 6%), Pterostylis nutans (6%), Ricinocarpos pinifolius (6%), Rubus parvifolius (1, 6%), Trachymene incisa (6%), Tricoryne anceps subsp. pterocaulon (1, 6%), Tricoryne elatior (1, 6%), Trochocarpa laurina (6%), Zieria smithii (1, 6%)*

Eucalyptus racemosa subsp. racemosa woodland on sedimentary rocks



Pre-clearing area (ha), remnant area (ha) and per cent remaining:	54,153	20,666	38%

Species recorded: Total: 200; woody: 52; ground: 163; Avg. spp./site: 35.4; std dev.: 5.2, 20 site(s)

Basal area: Avg./site: 23.9 m²/ha, range: 12.0 - 42 m²/ha, std. deviation: 9 m²/ha, 20 site(s)

Structural formation: Woodland: 75%; open-forest: 15%; open-woodland: 10%, 20 site(s)

Representative sites: 15506, 16446, 16451, 16472, 16516, 19740, 38444, 38445, 38726, 38744, 38745, 38746, 38747, 38882, 38885, 38886, 38887, 38892, 38909, 38911.

Stratum: **T1**

Height avg. = 23.2m, range 14-31.5m, 20 sites

Crown cover avg. = 38.0%, range 5.0-70.0%, 20 sites

Stem density/ha avg. = 154, range 40-320, 18 sites

Dominant species (relative cover, frequency): Eucalyptus racemosa subsp. racemosa (58, 100%), Corymbia intermedia (33, 65%), Angophora leiocarpa (9, 25%), Eucalyptus siderophloia (7, 35%), Angophora woodsiana (3, 25%)

Frequent species (cover, frequency): Eucalyptus racemosa subsp. racemosa (20, 100%), Corymbia intermedia (14, 65%), Eucalyptus siderophloia (2, 35%), Angophora leiocarpa (5, 25%), Angophora woodsiana (1, 25%), Eucalyptus microcorys (3, 20%), Eucalyptus resinifera (5, 20%), Eucalyptus tindaliae (15, 20%), Lophostemon suaveolens (5, 20%), Lophostemon confertus (8, 10%), Melaleuca quinquenervia (3, 10%), Corymbia trachyphloia subsp. trachyphloia (5%), Eucalyptus robusta x E.tereticornis (5, 5%)

Stratum: **T2**

Height avg. = 12.4m, range 6-16.5m, 17 sites

Crown cover avg. = 18.1%, range 5.0-40.0%, 18 sites

Stem density/ha avg. = 329, range 60-880, 17 sites

Dominant species (relative cover, frequency): Angophora woodsiana (31, 30%), Corymbia intermedia (30, 65%), Allocasuarina littoralis (25, 45%), Eucalyptus racemosa subsp. racemosa (18, 70%), Eucalyptus siderophloia (18, 25%)

Frequent species (cover, frequency): Eucalyptus racemosa subsp. racemosa (3, 70%), Corymbia intermedia (5, 65%), Allocasuarina littoralis (4, 45%), Acacia disparrima subsp. disparrima (1, 35%), Angophora woodsiana (6, 30%), Lophostemon suaveolens (2, 30%), Eucalyptus siderophloia (2, 25%), Eucalyptus tindaliae (2, 25%), Melaleuca quinquenervia (3, 25%), Angophora leiocarpa (2, 20%), Lophostemon confertus (4, 20%), Banksia integrifolia subsp. compar (1, 15%), Eucalyptus resinifera (1, 15%), Eucalyptus microcorys (10%), Acacia concurrens (5%), Acacia leiocalyx subsp. leiocalyx (2, 5%), Alphitonia excelsa (1, 5%), Banksia integrifolia subsp. integrifolia (10, 5%), Corymbia trachyphloia subsp. trachyphloia (10, 5%), Melaleuca salicina (3, 5%), Persoonia stradbrokensis (5%)

Stratum: **T3**

Height avg. = 5.3m, range 3-9m, 4 sites

Crown cover avg. = 5.5%, range 1.0-11.0%, 4 sites

Stem density/ha avg. = 100, range 80-120, 2 sites

Frequent species (cover, frequency): Corymbia intermedia (5, 10%), Lophostemon confertus (1, 10%), Allocasuarina littoralis (1, 5%), Banksia integrifolia subsp. integrifolia (5, 5%), Eucalyptus racemosa subsp. racemosa (1, 5%), Melaleuca quinquenervia (3, 5%), Syncarpia glomulifera (1, 5%)

Stratum: **S1**

Height avg. = 4.1m, range 1.5-6.5m, 20 sites

Crown cover avg. = 15.7%, range 3.0-40.0%, 20 sites

Stem density/ha avg. = 876, range 240-2200, 16 sites

Dominant species (relative cover, frequency): Allocasuarina littoralis (37, 60%), Alphitonia excelsa (21, 50%), Acacia leiocalyx subsp. leiocalyx (20, 45%), Acacia disparrima subsp. disparrima (20, 65%), Banksia integrifolia subsp. compar (19, 35%)

Frequent species (cover, frequency): Gahnia sieberiana (1, 5%), Acacia disparrima subsp. disparrima (3, 65%), Allocasuarina littoralis (7, 60%), Alphitonia excelsa (4, 50%), Acacia leiocalyx subsp. leiocalyx (3, 45%), Lophostemon suaveolens (1, 40%), Banksia integrifolia subsp. compar (1, 35%), Corymbia intermedia (30%), Eucalyptus racemosa subsp. racemosa (1, 25%), Eucalyptus siderophloia (25%), Acacia concurrens (20%), Angophora woodsiana (3, 20%), Lophostemon confertus (2, 20%), Petalostigma pubescens (1, 20%), Angophora leiocarpa (1, 15%), Eucalyptus resinifera (15%), Melaleuca quinquenervia (2, 15%), Allocasuarina torulosa (1, 10%), Banksia integrifolia (3, 10%), Corymbia trachyphloia subsp. trachyphloia (1, 10%), Glochidion ferdinandi (2, 10%), Leptospermum polygalifolium (10%), Leptospermum trinervium (10%), Melaleuca sieberi (1, 10%), Acacia flavescens (2, 5%), Acacia leiocalyx (2, 5%), Banksia spinulosa (5, 5%), Cinnamomum camphora (1, 5%), Endiandra sieberi (20, 5%), Eucalyptus microcorys (5%), Eucalyptus tindaliae (5%), Glochidion sumatranum (5%), Hakea florulenta (5%), Jacksonia scoparia (5, 5%), Jagera pseudorhus (5%), Lantana camara* (5, 5%), Lantana camara var. camara (5%), Ochna serrulata* (1, 5%), Parsonsia straminea (2, 5%), Persoonia stradbrokensis (1, 5%), Persoonia virgata (1, 5%), Schefflera actinophylla (1, 5%), Syagrus romanzoffiana* (5%)*

Stratum: **S2**

Height avg. = 2.0m, range 1.5-2.5m, 14 sites

Crown cover avg. = 13.2%, range 5.0-30.0%, 14 sites

Stem density/ha avg. = 986, range 340-1500, 13 sites

Dominant species (relative cover, frequency): Allocasuarina littoralis (32, 30%), Alphitonia excelsa (28, 50%), Acacia disparrima subsp. disparrima (27, 45%), Acacia leiocalyx subsp. leiocalyx (19, 25%), Lophostemon suaveolens (9, 30%)

Frequent species (cover, frequency): Alphitonia excelsa (4, 50%), Acacia disparrima subsp. disparrima (3, 45%), Allocasuarina littoralis (4, 30%), Corymbia intermedia (30%), Lophostemon suaveolens (1, 30%), Acacia leiocalyx subsp. leiocalyx (4, 25%), Banksia integrifolia subsp. compar (1, 25%), Eucalyptus racemosa subsp. racemosa (20%), Acacia concurrens (1, 15%), Lantana camara var. camara (2, 15%), Leptospermum polygalifolium (1, 15%), Leptospermum trinervium (1, 15%), Persoonia stradbrokensis (1, 15%), Senna pendula var. glabrata (15%), Angophora leiocarpa (1, 10%), Corymbia trachyphloia subsp. trachyphloia (10%), Eucalyptus resinifera (1, 10%), Eucalyptus siderophloia (10%), Glochidion ferdinandi (3, 10%), Jagera pseudorhus (1, 10%), Melaleuca sieberi (3, 10%), Ochna serrulata* (1, 10%), Petalostigma pubescens (2, 10%), Acacia flavescens (1, 5%), Acacia leiocalyx (3, 5%), Alectryon tomentosus (5%), Angophora woodsiana (3, 5%), Banksia integrifolia subsp. integrifolia (1, 5%), Dodonaea triquetra (1, 5%), Endiandra sieberi (10, 5%), Glochidion sumatranum (5%), Hakea florulenta (5%), Lophostemon confertus (5, 5%), Melaleuca quinquenervia (5%), Monotoca scoparia (1, 5%), Persoonia virgata (1, 5%), Schefflera actinophylla (5%), Xanthorrhoea latifolia subsp. latifolia (5%)*

Stratum: **G**

Height avg. = 0.5m, range 0.3-1m, 20 sites

PFC avg. = 59.9%, range 25-85%, 20 sites

Stem density/ha avg. = 140, 1 site

Dominant species (relative cover, frequency): Ptilothrix deusta (29, 35%), Imperata cylindrica (25, 70%), Themeda triandra (20, 75%), Pteridium esculentum (17, 70%), Entolasia stricta (14, 85%)

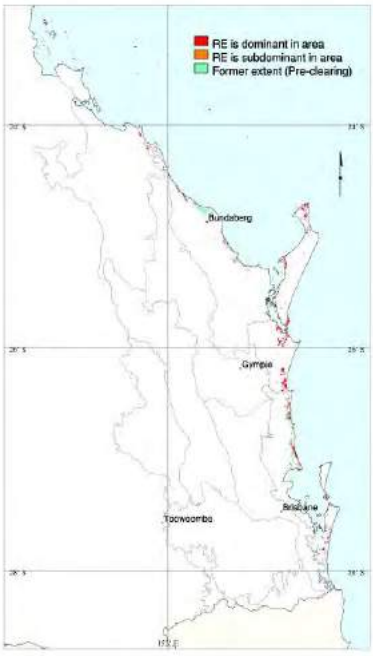
Frequent species (cover, frequency): GRAMINOIDS: Entolasia stricta (8, 85%), Themeda triandra (14, 75%), Alloteropsis semialata (1, 70%), Imperata cylindrica (15, 70%), Lepidosperma laterale var. laterale (4, 60%), Panicum effusum (1, 50%), Ptilothrix deusta (19, 35%), Cymbopogon refractus (30%), Aristida warburgii (1, 25%), Gahnia aspera (1, 25%), Lepidosperma laterale (4, 25%), Panicum simile (2, 25%), Aristida benthamii (20%), Digitaria ramularis (20%), Eragrostis brownii (20%), Eremochloa bimaculata (15%), Oplismenus aemulus (20, 15%), Paspalidium distans (15%), Aristida vagans (10%), Dichelachne sp. (Brisbane B.K.Simon 3221) (10%), Eragrostis spartinoides (10%), Fimbristylis cinnamometorum (10%), Panicum decompositum var. tenuius (10%)
FORBS: Pteridium esculentum (12, 70%), Lomandra multiflora subsp. multiflora (1, 65%), Cyanthillium cinereum (55%), Hibbertia vestita var. vestita (1, 50%), Desmodium rhytidophyllum (1, 40%), Eustrephus latifolius (40%), Goodenia rotundifolia (1, 40%), Patersonia sericea var. sericea (2, 40%), Acrotriche aggregata (1, 35%), Boronia rosmarinifolia (1, 35%), Dianella caerulea (1, 35%), Lobelia purpurascens (35%), Cassytha pubescens (1, 30%), Haemodorum austroqueenslandicum (30%), Lomandra longifolia (3, 30%), Geodorum densiflorum (25%), Glycine clandestina var. clandestina (25%), Glycine tabacina (25%), Gompholobium pinnatum (25%), Passiflora suberosa (25%), Pimelea linifolia subsp. linifolia (25%), Tricoryne elatior (25%), Alphitonia excelsa (20%), Schizaea bifida (20%), Xanthorrhoea latifolia subsp. latifolia (1, 20%), Hybanthus stellarioides (15%), Lomandra confertifolia subsp. pallida (1, 15%), Phyllanthus virgatus (15%), Pseuderanthemum variabile (15%), Pultenaea paleacea (2, 15%), Stephania japonica (15%), Trachymene incisa subsp. incisa (15%), Viola hederacea (15%), Ajuga australis (10%), Asplenium flabellifolium (10%), Cestrum parqui* (10%), Daviesia ulicifolia subsp. ulicifolia (10%), Dianella revoluta (10%), Dipodium variegatum (10%), Flemingia parviflora (2, 10%), Geitonoplesium cymosum (10%), Glossocardia bidens (10%), Hibbertia stricta (1, 10%), Hibbertia vestita (1, 10%), Lomandra multiflora (1, 10%), Lophostemon suaveolens (1, 10%), Pandorea jasminoides (10%), Parsonsia straminea (3, 10%), Pimelea linifolia (1, 10%), Platylobium formosum (10%), Schinus terebinthifolius* (10%), Smilax australis (10%)*

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

Melaleuca quinquenervia or rarely M. dealbata open-forest on sand plains



Pre-clearing area (ha), remnant area (ha) and per cent remaining:	29,829	19,628	66%

Species recorded: Total: 190; woody: 50; ground: 158; Avg. spp./site: 29.0; std dev.: 8.0, 15 site(s)

Basal area: Avg./site: 32.4 m²/ha, range: 16.0 - 57 m²/ha, std. deviation: 13 m²/ha, 14 site(s)

Structural formation: Woodland: 40%; open-forest: 40%; open-woodland: 7%; low woodland: 7%; low open-forest: 7%, 15 site(s)

Representative sites: 13906, 14065, 14095, 14097, 15225, 16438, 16441, 16444, 16457, 16485, 16523, 19759, 19867, 27451, 29964.

Stratum: **T1**

Height avg. = 15.5m, range 8-25m, 15 sites

Crown cover avg. = 47.7%, range 10.0-76.0%, 15 sites

Stem density/ha avg. = 588, range 480-860, 5 sites

Dominant species (relative cover, frequency): Melaleuca quinquenervia (86, 87%), Eucalyptus robusta (45, 27%), Eucalyptus tereticornis (6, 27%)

Frequent species (cover, frequency): Melaleuca quinquenervia (43, 87%), Eucalyptus robusta (10, 27%), Eucalyptus tereticornis (2, 27%), Lophostemon suaveolens (2, 20%), Banksia integrifolia (2, 13%), Allocasuarina littoralis (8, 7%), Alphitonia excelsa (7%), Banksia aemula (4, 7%), Casuarina glauca (8, 7%), Corymbia intermedia (7%), Livistona decora (2, 7%), Lophostemon confertus (5, 7%), Melaleuca dealbata (66, 7%)

Stratum: **T2**

Height avg. = 7.5m, range 4-14m, 11 sites

Crown cover avg. = 13.8%, range 2.0-30.0%, 11 sites

Stem density/ha avg. = 360, range 220-460, 3 sites

Dominant species (relative cover, frequency): Melaleuca quinquenervia (59, 60%)

Frequent species (cover, frequency): Melaleuca quinquenervia (13, 60%), Banksia integrifolia (2, 20%), Eucalyptus robusta (4, 20%), Acacia concurrens (5, 13%), Acacia leiocalyx (7, 13%), Corymbia intermedia (1, 13%), Glochidion sumatranum (2, 13%), Acacia disparrima subsp. disparrima (1, 7%), Livistona decora (6, 7%), Lophostemon suaveolens (4, 7%), Melaleuca cheelii (2, 7%), Melaleuca linariifolia (2, 7%), Melaleuca sieberi (1, 7%)

Stratum: **S1**

Height avg. = 2.0m, range 1.5-3m, 13 sites

Crown cover avg. = 15.5%, range 1.0-65.0%, 13 sites

Stem density/ha avg. = 293, range 20-800, 3 sites

Dominant species (relative cover, frequency): Banksia robur (34, 27%)

Frequent species (cover, frequency): Phragmites australis (9, 13%), Gahnia aspera (1, 7%), Gahnia sieberiana (8, 7%), Banksia robur (11, 27%), Acacia disparrima subsp. disparrima (2, 20%), Baccharis halimifolia (6, 20%), Banksia integrifolia (2, 20%), Lantana camara* (1, 20%), Acacia leiocalyx (1, 13%), Alphitonia excelsa (13%), Cupaniopsis anacardioides (13%), Hakea actites (2, 13%), Lophostemon suaveolens (9, 13%), Melaleuca pachyphylla (15, 13%), Melastoma malabathricum subsp. malabathricum (3, 13%), Acacia hubbardiana (7%), Acronychia imperforata (1, 7%), Allocasuarina littoralis (1, 7%), Austromyrtus dulcis (7%), Callitris columellaris (1, 7%), Corymbia tessellaris (7%), Cyclophyllum coprosmoides (7%), Dodonaea triquetra (1, 7%), Elaeocarpus reticulatus (5, 7%), Eucalyptus robusta (25, 7%), Exocarpos latifolius (7%), Glochidion lobocarpum (7%), Glochidion sumatranum (3, 7%), Leptospermum juniperinum (7%), Leucopogon leptospermoides (7%), Lophostemon confertus (1, 7%), Macaranga tanarius (1, 7%), Melaleuca quinquenervia (3, 7%), Parsonsia straminea (1, 7%), Persoonia media (1, 7%), Persoonia virgata (1, 7%), Pleiogynium timorense (7%), Pultenaea myrtoides (1, 7%), Viminaria juncea (2, 7%), Xanthorrhoea fulva (9, 7%)*

Stratum: **G**

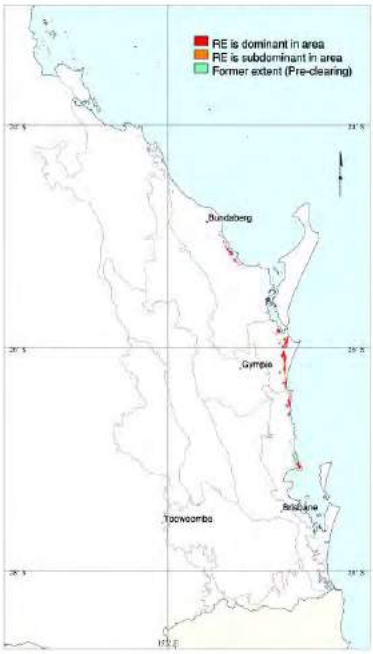
Height avg. = 0.8m, range 0.3-2m, 15 sites

PFC avg. = 64.7%, range 5-95%, 15 sites

Dominant species (relative cover, frequency): Baumea juncea (26, 40%), Imperata cylindrica (24, 47%), Blechnum indicum (12, 53%), Austromyrtus dulcis (4, 27%), Passiflora suberosa (4, 27%)*

Frequent species (cover, frequency): GRAMINOIDS: Imperata cylindrica (18, 47%), Baumea juncea (13, 40%), Cyperus polystachyos (40%), Paspalum scrobiculatum (1, 20%), Cynodon dactylon (3, 13%), Entolasia stricta (13%), Gahnia clarkei (4, 13%), Ischaemum australe (1, 13%), Juncus continuus (8, 13%), Lepironia articulata (20, 13%), Phragmites australis (46, 13%), Themeda triandra (37, 13%), Andropogon virginicus (3, 7%), Axonopus compressus* (7%), Axonopus fissifolius* (7%), Baumea articulata (5, 7%), Caustis blakei subsp. blakei (5, 7%), Chorizandra cymbaria (1, 7%), Cladium procerum (67, 7%), Cyathochaeta diandra (1, 7%), Cymbopogon refractus (7%), Cyperus brevifolius* (7%), Cyperus haspan (1, 7%), Cyperus lucidus (2, 7%), Digitaria didactyla* (7%), Eragrostis spartinoides (1, 7%), Fimbristylis indet. (7%), Gahnia aspera (20, 7%), Gahnia sieberiana (1, 7%), Heteropogon contortus (1, 7%), Leersia hexandra (7%), Megathyrsus maximus* (7%), Ottochloa gracillima (7%), Panicum effusum (4, 7%), Paspalidium gracile (7%), Paspalum indet. (7%), Paspalum paniculatum* (1, 7%), Poaceae indet. (30, 7%), Sacciolepis indica (1, 7%), Schoenus apogon (7%), Schoenus brevifolius (10, 7%), Scleria sphacelata (1, 7%)*
FORBS: Blechnum indicum (10, 53%), Austromyrtus dulcis (4, 27%), Centella asiatica (1, 27%), Hibbertia scandens (1, 27%), Parsonsia straminea (1, 27%), Passiflora suberosa (3, 27%), Smilax australis (1, 27%), Acacia disparrima subsp. disparrima (20%), Baccharis halimifolia* (9, 20%), Cyclosorus interruptus (3, 20%), Leucopogon pimeleoides (2, 20%), Lomandra longifolia (20%), Pteridium esculentum (1, 20%), Alternanthera denticulata (13%), Cassytha pubescens (13%), Dianella caerulea (13%), Glochidion ferdinandi (13%), Glycine clandestina (13%), Hibbertia stricta (13%), Hibbertia vestita (13%), Ipomoea cairica* (11, 13%), Leptospermum juniperinum (2, 13%), Leptospermum polygalifolium (13%), Persicaria decipiens (13%), Phytolacca octandra* (1, 13%), Pimelea linifolia (1, 13%), Pultenaea paleacea (5, 13%), Pultenaea retusa (13%), Sporadanthus caudatus (8, 13%), Ageratum houstonianum* (1, 7%), Alphitonia excelsa (7%), Asclepias curassavica* (7%), Baloskion pallens (50, 7%), Baloskion tetraphyllum (7%), Banksia robur (7%), Boronia falcifolia (7%), Calochlaena dubia (30, 7%), Cassytha glabella (1, 7%), Centipeda minima (7%), Cirsium vulgare* (7%), Comesperma defoliatum (1, 7%), Corymbia intermedia (7%), Crassocephalum crepidioides* (7%), Crotalaria lanceolata (7%), Cyanthillium cinereum (7%), Dentella repens (7%), Desmodium rhytidophyllum (7%), Dianella congesta (7%), Diplatia furcata (1, 7%), Drymaria cordata* (15, 7%), Eclipta prostrata (2, 7%), Epaltes australis (7%), Eriocaulon australe (30, 7%), Eurychorda complanata (5, 7%), Exocarpos cupressiformis (1, 7%), Ficus opposita (7%), Ficus rubiginosa (7%), Glochidion sumatranum (7%), Gomphocarpus physocarpus* (1, 7%), Gompholobium pinnatum (1, 7%), Gonocarpus chinensis subsp. verrucosus (7%), Gonocarpus micranthus subsp. ramosissimus (1, 7%), Grevillea leiophylla (1, 7%), Hakea florulenta (7%), Hibiscus diversifolius (7%), Hydrilla verticillata (7%), Hydrocotyle bonariensis* (1, 7%), Hydrocotyle paludosa (2, 7%), Hydrocotyle verticillata (7%), Hypericum gramineum (7%), Hypochaeris radicata* (7%), Hypolepis muelleri (5, 7%), Ipomoea pes-caprae (1, 7%), Jasminum didymum subsp. racemosum (7%), Kennedia rubicunda (1, 7%), Lantana camara* (7%), Lepyrodia scariosa (1, 7%), Leucopogon leptospermoides (2, 7%), Lindernia crustacea (7%), Lindsaea ensifolia subsp. ensifolia (1, 7%), Lindsaea incisa (1, 7%), Lobelia stenophylla (7%), Lophostemon suaveolens (7%), Lygodium microphyllum (10, 7%), Marsilea indet. (15, 7%), Melaleuca linariifolia (7%), Melaleuca thymifolia (7%), Melastoma malabathricum subsp. malabathricum (7%), Melicope elleryana (7%), Mitrasacme polymorpha (1, 7%), Monotoca scoparia (1, 7%), Muellerina celastroides (1, 7%), Murraya paniculata cv. Exotica* (7%), Ochna serrulata* (7%), Passiflora subpeltata* (7%), Persicaria attenuata (7%), Persicaria strigosa (7%), Persoonia stradbrokensis (7%), Phyllanthus virgatus (1, 7%), Pinus elliottii* (7%), Platysace linearifolia (1, 7%), Pterostylis indet. (7%), Rivina humilis* (7%), Schefflera actinophylla (7%), Schinus terebinthifolius* (7%), Sida rhombifolia* (7%), Stackhousia viminea (7%), Stephania japonica (4, 7%), Syagrus romanzoffiana* (7%), Tricoryne elatior (1, 7%), Velleia spathulata (1, 7%), Villarsia exaltata (1, 7%), Viola betonicifolia subsp. novaguineensis (7%), Viola hederacea (3, 7%), Xanthorrhoea fulva (6, 7%), Xyris complanata (7%)*

Closed-heath on seasonally waterlogged sand plains



Pre-clearing area (ha), remnant area (ha) and per cent remaining: 13,981 10,699 77%

Species recorded: Total: 66; woody: 36; ground: 47; Avg. spp./site: 19.4; std dev.: 4.5, 7 site(s)

Basal area: 0

Structural formation: Closed-heath: 57%; open-heath: 29%; shrubland: 14%, 7 site(s)

Representative sites: 14087, 14090, 16443, 16450, 16493, 16524, 19859.

Stratum: **E**

Height avg. = 3.3m, range 3-3.5m, 2 sites

Crown cover avg. = 4.0%, range 3.0-5.0%, 2 sites

Stem density/ha avg. = 100, 1 site

Frequent species (cover, frequency): Elaeocarpus reticulatus (1, 14%), Eucalyptus robusta (3, 14%), Melaleuca quinquenervia (3, 14%)

Stratum: **S1**

Height avg. = 1.6m, range 1-2m, 6 sites

Crown cover avg. = 34.2%, range 10.0-90.0%, 6 sites

Dominant species (relative cover, frequency): Banksia robur (57, 43%), Xanthorrhoea fulva (53, 29%), Sprengelia sprengelioides (27, 29%), Baeckea frutescens (20, 29%), Leptospermum liversidgei (16, 29%)

Frequent species (cover, frequency): Banksia robur (13, 43%), Baeckea frutescens (8, 29%), Leptospermum liversidgei (4, 29%), Leptospermum polygalifolium (2, 29%), Melaleuca quinquenervia (29%), Persoonia virgata (1, 29%), Sprengelia sprengelioides (8, 29%), Xanthorrhoea fulva (34, 29%), Acacia hubbardiana (14%), Aotus ericoides (15, 14%), Banksia oblongifolia (2, 14%), Epacris obtusifolia (14%), Hakea actites (1, 14%), Leptospermum whitei (9, 14%), Melaleuca nodosa (20, 14%), Melaleuca pachyphylla (14%), Ochrosperma lineare (3, 14%), Pultenaea paleacea var. pauciflora (14%)

Stratum: **S2**

Height avg. = 1.0m, range 0.8-1.1m, 3 sites

Crown cover avg. = 66.7%, range 60.0-75.0%, 3 sites

Dominant species (relative cover, frequency): Leptospermum liversidgei (23, 29%), Aotus ericoides (16, 29%), Baeckea frutescens (14, 43%), Leucopogon leptospermoides (4, 29%)

Frequent species (cover, frequency): Baeckea frutescens (7, 43%), Aotus ericoides (7, 29%), Leptospermum liversidgei (17, 29%), Leucopogon leptospermoides (1, 29%), Baloskion tenuiculme (14%), Banksia oblongifolia (10, 14%), Boronia falcifolia (7, 14%), Cassytha filiformis (14%), Cassytha glabella (5, 14%), Epacris microphylla (10, 14%), Epacris obtusifolia (14%), Gonocarpus micranthus subsp. ramosissimus (14%), Hibbertia salicifolia (2, 14%), Leptomeria acida (14%), Leptospermum speciosum (5, 14%), Monotoca scoparia (14%), Ochrosperma lineare (6, 14%), Olax retusa (3, 14%), Persoonia virgata (2, 14%), Pimelea linifolia (14%), Pinus elliottii (1, 14%), Platysace linearifolia (14%), Sprengelia sprengelioides (8, 14%), Strangea linearis (14%), Xanthorrhoea fulva (32, 14%)*

Stratum: **G**

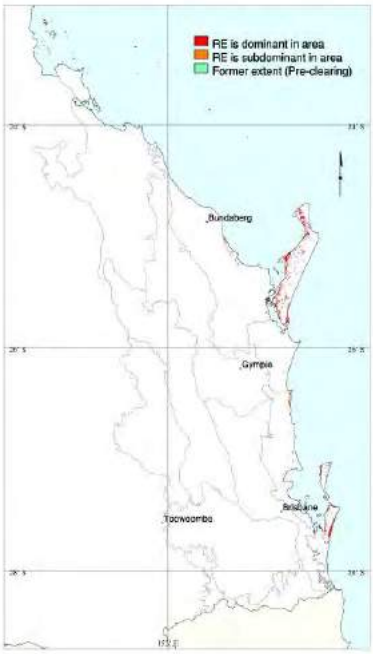
Height avg. = 0.7m, range 0.5-1m, 6 sites

PFC avg. = 39.2%, range 5-80%, 6 sites

Dominant species (relative cover, frequency): Baloskion pallens (47, 43%), Empodisma minus (29, 43%), Xanthorrhoea johnsonii (19, 29%), Banksia robur (13, 29%), Sprengelia sprengelioides (11, 29%)

Frequent species (cover, frequency): GRAMINOIDS: Caustis recurvata (4, 29%), Baumea articulata (5, 14%), Caustis blakei subsp. blakei (4, 14%), Entolasia stricta (14%), Gahnia sieberiana (3, 14%), Schoenus brevifolius (1, 14%)
FORBS: Boronia falcifolia (1, 57%), Strangea linearis (1, 57%), Baloskion pallens (11, 43%), Empodisma minus (20, 43%), Pimelea linifolia (1, 43%), Selaginella uliginosa (43%), Banksia oblongifolia (1, 29%), Banksia robur (8, 29%), Cassytha glabella (1, 29%), Comesperma defoliatum (1, 29%), Hibbertia salicifolia (1, 29%), Leptospermum semibaccatum (4, 29%), Leptospermum whitei (2, 29%), Sprengelia sprengelioides (1, 29%), Xanthorrhoea johnsonii (15, 29%), Aotus ericoides (1, 14%), Baeckea frutescens (5, 14%), Baloskion indet. (2, 14%), Baloskion tetraphyllum (1, 14%), Blechnum indicum (1, 14%), Burchardia umbellata (1, 14%), Cassytha filiformis (14%), Drosera burmanni (14%), Drosera peltata (1, 14%), Durringtonia paludosa (14%), Epacris microphylla (1, 14%), Epacris obtusifolia (1, 14%), Epacris pulchella (1, 14%), Eurychorda complanata (1, 14%), Gonocarpus micranthus subsp. micranthus (1, 14%), Goodenia indet. (1, 14%), Leptocarpus tenax (1, 14%), Leucopogon leptospermoides (14%), Melaleuca thymifolia (14%), Persoonia virgata (2, 14%), Philotheca queenslandica (1, 14%), Pseudanthus orientalis (5, 14%), Pteridium esculentum (5, 14%), Sporadanthus interruptus (1, 14%), Trachymene incisa (1, 14%), Xanthorrhoea fulva (4, 14%)

Gahnia sieberiana, Empodisma minus, Gleichenia spp. closed-sedgeland in coastal swamps



Pre-clearing area (ha), remnant area (ha) and per cent remaining: 16,343 16,111 99%

Species recorded: Total: 14; woody: 5; ground: 11; Avg. spp./site: 9.7; std dev.: 1.2, 3 site(s)

Basal area: 0

Structural formation: Closed-sedgeland: 100%, 3 site(s)

Representative sites: 16456, 16478, 16486.

Stratum: **S1**

Height avg. = 1.8m, range 1.5-2m, 3 sites

Crown cover avg. = 31.7%, range 20.0-50.0%, 3 sites

Dominant species (relative cover, frequency): Leptospermum liversidgei (38, 100%), Gahnia sieberiana (38, 100%), Epacris microphylla (34, 67%), Melaleuca quinquenervia (2, 33%), Leptospermum semibaccatum (2, 33%)

Frequent species (cover, frequency): Gahnia sieberiana (11, 100%), Leptospermum liversidgei (12, 100%), Epacris microphylla (13, 67%), Leptospermum semibaccatum (1, 33%), Melaleuca quinquenervia (1, 33%)

Stratum: **G**

Height avg. = 0.9m, range 0.8-1m, 3 sites

PFC avg. = 100.0%, range 100-100%, 3 sites

Dominant species (relative cover, frequency): Gleichenia mendellii (45, 100%), Empodisma minus (44, 100%), Lepironia articulata (10, 67%), Epacris microphylla (5, 33%), Melaleuca quinquenervia (2, 67%)

Frequent species (cover, frequency): GRAMINOIDS: Lepironia articulata (10, 67%)
FORBS: Empodisma minus (43, 100%), Gleichenia mendellii (45, 100%), Blechnum indicum (1, 67%), Hibbertia salicifolia (1, 67%), Melaleuca quinquenervia (2, 67%), Aotus ericoides (1, 33%), Comesperma defoliatum (1, 33%), Drosera binata (1, 33%), Epacris microphylla (5, 33%), Sprengelia sprengelioides (1, 33%)

Draft technical description of 12.2.14a - Casuarina equisetifolia subsp. incana woodland to low open forest on exposed frontal areas

Emergent (Ht avg=15m, 14-16m, 2 sites; Cover avg=4.5%, 1-8%, 2 sites)

Dominant species (cover)
Cupaniopsis anacardioides (8, 13%), *Casuarina equisetifolia subsp. incana* (1, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (13%, 1), *Cupaniopsis anacardioides* (13%, 8)

Tree 1 (Ht avg=9m, 6-12m, 8 sites; Cover avg=45.03%, 7-98%, 8 sites; SD/ha avg=1,176, 400-2,500, 5 sites)

Dominant species (cover)
Hibiscus tiliaceus (93, 13%), *Casuarina equisetifolia subsp. incana* (36, 88%), *Acacia disparrima subsp. disparrima* (5, 13%), *Banksia integrifolia* (3, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (88%, 36), *Acacia disparrima subsp. disparrima* (13%, 5), *Banksia integrifolia* (13%, 3), *Hibiscus tiliaceus* (13%, 93)

Tree 2 (Ht avg=5.5m, 4-7m, 3 sites; Cover avg=35.67%, 12-60%, 3 sites)

Dominant species (cover)
Casuarina equisetifolia subsp. incana (36, 38%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (38%, 36)

Shrub 1 (Ht avg=2.3m, 1-4.5m, 6 sites; Cover avg=19.87%, 2-41.2%, 6 sites; SD/ha avg=1,595, 520-2,500, 4 sites)

Dominant species (cover)
Argusia argentea (41, 13%), *Lumnitzera racemosa* (30, 13%), *Hibiscus tiliaceus* (9, 25%), *Casuarina equisetifolia subsp. incana* (8, 25%), *Acacia sophorae* (4, 13%)

Species (frequency, cover)
Casuarina equisetifolia subsp. incana (25%, 8), *Exocarpos cupressiformis* (25%), *Hibiscus tiliaceus* (25%, 9), *Acacia sophorae* (13%, 4), *Alphitonia excelsa* (13%), *Argusia argentea* (13%, 41), *Avicennia marina subsp. australasica* (13%), *Banksia integrifolia* (13%, 2), *Breynia oblongifolia* (13%), *Cupaniopsis anacardioides* (13%, 2), *Dodonaea viscosa subsp. burmanniana* (13%), *Lantana camara* (13%), *Livistona decora* (13%), *Lumnitzera racemosa* (13%, 30), *Mallotus discolor* (13%), *Melaleuca quinquenervia* (13%, 1), *Pandanus tectorius* (13%), *Passiflora suberosa* (13%), *Schefflera actinophylla* (13%)

Ground (Ht avg=0.5m, 0.1-1m, 8 sites; Cover avg=42.28%, 5-100%, 8 sites)

Dominant species (cover)

Zoysia macrantha subsp. macrantha (60, 13%), *Juncus kraussii* (50, 25%), *Sporobolus virginicus* (30, 13%), *Imperata cylindrica* (20, 13%), *Spinifex sericeus* (17, 38%)

Species (frequency, cover)

Passiflora suberosa (63%), *Eragrostis interrupta* (50%, 2), *Ipomoea pes-caprae subsp. brasiliensis* (50%), *Bidens pilosa* (38%), *Emilia sonchifolia* (38%), *Hibbertia scandens* (38%, 2), *Spinifex sericeus* (38%, 17), *Achyranthes aspera* (25%, 1), *Carpobrotus glaucescens* (25%), *Cassytha glabella forma glabella* (25%, 2), *Cenchrus echinatus* (25%), *Chorizandra cymbaria* (25%, 1), *Cymbopogon refractus* (25%), *Cyperus polystachyos* (25%, 15), *Ischaemum triticeum* (25%), *Juncus kraussii* (25%, 50), *Schefflera actinophylla* (25%), *Senecio pinnatifolius var. pinnatifolius* (25%), *Sonchus oleraceus* (25%), *Stephania japonica* (25%, 1), *Vincetoxicum carnosum* (25%), *Acrostichum speciosum* (13%), *Alphitonia excelsa* (13%), *Asparagus aethiopicus cv. Sprengeri* (13%), *Baccharis halimifolia* (13%, 1), *Baumea juncea* (13%), *Blechnum indicum* (13%), *Boerhavia albiflora var. heronensis* (13%, 3), *Boerhavia pubescens* (13%), *Casuarina equisetifolia subsp. incana* (13%), *Crotalaria lanceolata subsp. lanceolata* (13%), *Cucumis maderaspatanus* (13%), *Cupaniopsis anacardioides* (13%, 2), *Cyperus stradbrokensis* (13%, 1), *Dianella caerulea* (13%, 1), *Erigeron bonariensis* (13%, 1), *Erigeron pusillus* (13%, 1), *Erigeron sumatrensis* (13%), *Eugenia uniflora* (13%), *Euphorbia heterophylla* (13%), *Fimbristylis ferruginea* (13%), *Geitonoplesium cymosum* (13%), *Heteropogon contortus* (13%, 1), *Hibiscus tiliaceus* (13%, 2), *Hypochaeris radicata* (13%), *Imperata cylindrica* (13%, 20), *Ischaemum australe* (13%, 3), *Jasminum didymum* (13%), *Jasminum didymum subsp. didymum* (13%, 1), *Lantana camara* (13%, 1), *Lepturus repens* (13%, 1), *Lobelia anceps* (13%, 1), *Macroptilium atropurpureum* (13%, 1), *Oenothera drummondii subsp. drummondii* (13%, 1), *Passiflora foetida* (13%), *Sacciolepis indica* (13%, 1), *Samolus repens* (13%), *Schinus terebinthifolius* (13%), *Schoenus nitens* (13%, 1), *Senecio pinnatifolius* (13%), *Sesuvium portulacastrum* (13%), *Smilax australis* (13%), *Solanum nigrum subsp. nigrum* (13%), *Solanum nodiflorum* (13%, 7), *Sporobolus virginicus* (13%, 30), *Symphyotrichum subulatum* (13%, 1), *Trachymene procumbens* (13%), *Tribulus cistoides* (13%), *Vigna marina* (13%), *Vitex trifolia* (13%), *Xyris complanata* (13%, 1), *Zinnia peruviana* (13%), *Zoysia macrantha subsp. macrantha* (13%, 60)

Summary

Species recorded	Total: 86; Woody: 20; Ground: 73; Avg spp/site: 17.88; StDev: 6.45
Basal Area	Avg BA/site: 9.66 m²/ha; Range: 2 - 17 m²/ha; StDev: 5.01 m²/ha
Structural Form range	Low Woodland: 37.5%; Low Open-Forest: 25%; Low Open-Woodland: 12.5%; Open-Forest: 12.5%; Low Closed-Forest: 12.5%
Representative sites	(54306, 19858, 29923, 27647, 29956, 14766, 14955, 16459)

Appendix B

Duty of Care Guidelines

ARBOR AUSTRALIS CONSULTING

AUSTRALIAN HERITAGE SPECIALISTS

28°S ENVIRONMENTAL

place design group.

Aboriginal Cultural Heritage Act 2003
Duty of Care Guidelines

Gazettal Date: 16 April 2004

Department of Aboriginal and
Torres Strait Islander Partnerships

Queensland
Government

PART 1 – Information to Assist in Using these Guidelines

1.0 Preamble

1.1

The *Aboriginal Cultural Heritage Act 2003* ("the Act") commenced on 16 April 2004. The Act binds all persons, including the State, and is intended to provide effective recognition, protection and conservation of Aboriginal cultural heritage.

Principles Underlying the *Aboriginal Cultural Heritage Act 2003*

1.2

The following fundamental principles underlie the Act's main purpose:

- the recognition, protection and conservation of Aboriginal cultural heritage should be based on respect for Aboriginal cultural and traditional practices;
- Aboriginal people should be recognised as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage;
- it is important to respect, preserve and maintain knowledge, innovations and practices of Aboriginal communities and to promote understanding of Aboriginal cultural heritage;
- activities involved in recognition, protection and conservation of Aboriginal cultural heritage are important because they allow Aboriginal people to reaffirm their obligations to "law and country";
- there is a need to establish timely and efficient processes for the management of activities that may harm Aboriginal cultural heritage.

Distinction between Aboriginal cultural heritage and Native Title

1.3

Aboriginal cultural heritage values should not be confused with native title. As with non-Aboriginal heritage values, Aboriginal cultural heritage can exist on an area regardless of the nature of land tenure. The existence of Aboriginal cultural heritage in an area does not mean that native title exists over that area.

Definition of Aboriginal cultural heritage

1.4

The Act defines Aboriginal cultural heritage as anything that is:

- a significant Aboriginal area in Queensland; or
- a significant Aboriginal object; or
- evidence, of archaeological or historic significance, of Aboriginal occupation of an area of Queensland.

A significant Aboriginal area or object must be particularly significant to Aboriginal people because of either or both of the following:

- Aboriginal tradition;
- the history, including contemporary history, of any Aboriginal Party for the area.

Aboriginal cultural heritage areas do not have to contain physical markings

1.5

In the same way as non-Aboriginal heritage values are capable of protection, it is not necessary for an area to contain markings or other physical evidence indicating Aboriginal occupation or otherwise denoting the area's significance for the area to be protected as a significant Aboriginal area under the Act.

Role of the Aboriginal Party

1.6

The views of the Aboriginal Party for an area are key in assessing Aboriginal cultural heritage and managing any activity likely to excavate, relocate, remove or harm Aboriginal cultural heritage.

1.7

In assessing a significant Aboriginal area the legislation provides that regard may also be had to authoritative anthropological, biogeographical, historical and archaeological information.

1.8

Before an area can be registered on the Aboriginal Cultural Heritage Register, the person seeking to register the area must be able to demonstrate that the application is consistent with this information.

1.9

Appropriately qualified persons such as anthropologists, archaeologists and historians can also provide valuable assistance in this regard.

Due Diligence – The Precautionary Approach

1.10

The Act requires that a person must exercise due diligence and reasonable precaution before undertaking an activity which may harm Aboriginal cultural heritage.

Aboriginal cultural heritage duty of care

1.11

Section 23(1) of the Act states that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the "cultural heritage duty of care").

1.12

Section 23(2) of the Act states that without limiting the matters that may be considered by a Court required to decide whether a person has complied with the cultural heritage duty of care in carrying out an activity, the Court may consider the following:

- the nature of the activity, and the likelihood of its causing harm to Aboriginal cultural heritage;
- the nature of the Aboriginal cultural heritage likely to be harmed by the activity;
- the extent to which the person consulted with Aboriginal parties about the carrying out of the activity, and the results of the consultation;

- whether the person carried out a study or survey, of any type, of the area affected by the activity to find out the location and extent of the Aboriginal cultural heritage, and the extent of the study or survey;
- whether the person searched the database and register for information about the area affected by the activity;
- the extent to which the person complied with cultural heritage duty of care guidelines;
- the nature and extent of past uses in the area affected by the activity.

Meeting the Duty of Care

1.13

Section 23 of the Act provides that a person who carries out an activity is taken to have complied with the cultural heritage duty of care in relation to Aboriginal cultural heritage if –

(a) the person is acting –

- under the authority of another provision of this Act that applies to the Aboriginal cultural heritage; or
- under an approved Cultural Heritage Management Plan that applies to the Aboriginal cultural heritage; or
- under a native title agreement or another agreement with an Aboriginal Party, unless the Aboriginal cultural heritage is expressly excluded from being subject to the agreement; or
- in compliance with gazetted cultural heritage duty of care guidelines; or
- in compliance with native title protection conditions, but only if the cultural heritage is expressly or impliedly the subject of the conditions; or

(b) the person owns the Aboriginal cultural heritage, or is acting with the owner's agreement; or

(c) the activity is necessary because of an emergency, including for example, a bushfire or other natural disaster.

Duty of Care Guidelines

1.14

Section 28 of the Act states that the Minister may by gazette notice notify guidelines ("cultural heritage duty of care guidelines") identifying reasonable and practicable measures for ensuring activities are managed to avoid or minimise harm to Aboriginal cultural heritage.

1.15

There is no offence in not complying with the cultural heritage duty of care guidelines. However, complying with the guidelines affords strict compliance with the cultural heritage duty of care. Where Aboriginal cultural heritage is harmed by an activity, and the activity is not otherwise covered by sections 23(3), 24(2), 25(2) or 26(2) of the Act, failure to have complied with the guidelines may result in prosecution under the Act. Maximum penalties for contravening the cultural heritage duty of care are $117 800 for an individual and $1 178 000 for a corporation.

Another Option for Legal Protection

1.16

The Act expressly recognises that the views of the Aboriginal Party for an area are key in assessing and managing any activity which is likely to harm Aboriginal cultural heritage. Under the Act, there is provision for voluntary agreements and Cultural Heritage Management Plans with the relevant Aboriginal Party. You have a complete defence under the Act in relation to any activity undertaken in accordance with such agreements or Cultural Heritage Management Plans.

Other Information

1.17

Ask First – A guide to respecting Indigenous heritage places and values, released by the Australian Heritage Commission, provides a practical guide to consulting and negotiating with Aboriginal people about their cultural heritage. Available from the Australian Heritage Commission website:

http://www.environment.gov.au/heritage/ahc/publications/ask-first-guide-respecting-indigenous-heritage-places-and-values

1.18

The Land Court of Queensland can assist in the provision of mediation in relation to Aboriginal cultural heritage matters.

1.19

Persons and organisations involved in activities likely to impact on Aboriginal cultural heritage may wish to consider strategic planning in relation to cultural heritage as well as training, monitoring, audit and review of their cultural heritage management systems.

1.20

Should you require assistance in determining your responsibilities under these guidelines, you should contact the Cultural Heritage Unit, Department of Aboriginal and Torres Strait Islander Partnerships on 1300 378 401.

PART 2 – Guidelines under section 23(1) of the *Aboriginal Cultural Heritage Act 2003*: reasonable and practicable measures for ensuring activities are managed to avoid or minimise harm to Aboriginal cultural heritage

2.0 Introduction

2.1

These guidelines have been gazetted as cultural heritage duty of care guidelines by the Minister responsible for the administration of the legislation under section 28 of the *Aboriginal Cultural Heritage Act 2003* and identify reasonable and practicable measures for ensuring that activities are managed to avoid or minimise harm to Aboriginal cultural heritage in a way that meets the duty of care requirements under section 23 of the *Aboriginal Cultural Heritage Act 2003*.

2.2

These guidelines recognise that it is unlikely that Aboriginal cultural heritage will be harmed where:

- the current or proposed activity is on an area previously subject to significant ground disturbance and the activity will impact only on the area subject to the previous disturbance; or
- the impact of the current or proposed activity is unlikely to cause any additional harm to Aboriginal cultural heritage than that which has already occurred[1].

2.3

It is important to note that these guidelines do not permit activities which, although causing no surface disturbance or no additional surface disturbance to an area, may harm scarred or carved trees or rock art without the agreement of the Aboriginal Party for the area or a Cultural Heritage Management Plan undertaken pursuant to Part 7 of the Act.

3.0 Definitions

3.1

The definitions used in the Act apply in relation to these guidelines.

3.2

In addition to the definitions used in the Act, the following definitions are used within these guidelines:

[1] This is not to say that a particular area may not continue to have importance under Aboriginal tradition or history even though it has been subject to significant ground disturbance. The Melbourne Cricket Ground, for example, is located on the site of an important Aboriginal meeting place – whilst this important value continues to exist it cannot generally be further harmed by maintenance or use as the area has been completely developed.

"Cultural Heritage Find," means a significant Aboriginal object or, evidence of archaeological or historic significance of Aboriginal occupation of an area of Queensland, or Aboriginal human remains, found in the course of undertaking an activity covered by these guidelines.

"Developed Area" means that the area is developed or maintained for a particular purpose such as use as a park, garden, railway, road or other access route, navigation channel, municipal facility or infrastructure facility, such as power lines, telecommunication lines or electricity infrastructure.

"No Additional Surface Disturbance" means surface disturbance not inconsistent with previous surface disturbance.

"Significant Ground Disturbance" means:

> disturbance by machinery of the topsoil or surface rock layer of the ground, such as by ploughing, drilling or dredging;
>
> the removal of native vegetation by disturbing root systems and exposing underlying soil.

"Surface Disturbance" means any disturbance of an area which causes a lasting impact to the land or waters during the activity or after the activity has ceased.

4.0 The nature of the activity and the likelihood of its causing harm to Aboriginal cultural heritage – Section 23(2)(a)

Activities involving No Surface Disturbance (Category 1)

4.1

Where an activity involves no Surface Disturbance of an area it is generally unlikely that the activity will harm Aboriginal cultural heritage and the activity will comply with these guidelines.

4.2

In these circumstances, it is reasonable and practicable for the activity to proceed without further cultural heritage assessment.

4.3

The following are examples of activities that may proceed under category 1:

- walking[2]
- driving along existing roads and tracks (within the existing alignment) or other infrastructure footprint
- aerial surveys
- navigating through water
- cadastral, engineering, environmental or geological surveys using methods (such as GPS systems) which do not cause surface disturbance

[2] Although activities such as walking through a culturally significant place are permitted under this guideline, it is important to be aware that merely being present in a culturally significant place may cause offence to Aboriginal people and, where this is known, due respect should be paid to these cultural sensitivities.

- photography

Activities causing No Additional Surface Disturbance (Category 2)

4.4

Where an activity causes No Additional Surface Disturbance of an area it is generally unlikely that the activity will harm Aboriginal cultural heritage or could cause additional harm to Aboriginal cultural heritage to that which has already occurred, and the activity will comply with these guidelines.

4.5

In these circumstances, subject to the measures set out in paragraphs 4.7 – 4.11, it is reasonable and practicable for the activity to proceed without further cultural heritage assessment.

4.6

The following are examples of activities that may generally proceed under category 2:

- Cultivation of an area which is currently subject to cultivation
- Grazing cattle on an area where cattle are currently grazed
- Use and maintenance of existing roads, tracks and power lines within the existing infrastructure alignment, or other infrastructure footprint
- Use, maintenance and protection of services and utilities (such as electricity infrastructure; water or sewerage disposal) on an area where such services and utilities are currently being provided
- Use, maintenance and protection of services and utilities (such as electricity infrastructure; water or sewerage disposal) on an area immediately adjacent to where such services and utilities are currently being provided providing the activity does not involve additional surface disturbance
- Tourism and visitation activities on an area where such activities are already taking place

Excavating, relocating, removing or harming Aboriginal cultural heritage

4.7

If at any time during the activity it is necessary to excavate, relocate, remove or harm a Cultural Heritage Find the activity should cease immediately. You must notify the Aboriginal Party for the area and seek their advice and agreement as to how best this may be managed to avoid or minimise harm to the Aboriginal cultural heritage. Paragraph 6.0 sets out examples of features highly likely to constitute or contain a Cultural Heritage Find.

Reaching Agreement

4.8

It is advisable that the terms of any agreement you reach with the Aboriginal Party for the area be recorded and documented in the event of future disputes.

Failure To Reach Agreement

4.9

Where agreement cannot be reached with the Aboriginal Party for the area, you continue to have a duty of care obligation under section 23 of the Act and must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage including, where necessary, through the development of a Cultural Heritage Management Plan under Part 7 of the Act.

Aboriginal Cultural Heritage Register and Aboriginal Cultural Heritage Database

4.10

An activity under category 2 that will excavate, relocate, remove or harm Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database should not proceed without the agreement of the Aboriginal Party for the area or a Cultural Heritage Management Plan undertaken pursuant to Part 7 of the Act.

4.11

Information regarding Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database may be obtained from the Cultural Heritage Unit.

5.0 The nature and extent of past uses in the area affected by the activity - Section 23(2)(g)

Developed Areas (Category 3)

5.1

Where an activity is proposed in a Developed Area it is generally unlikely that the activity will harm Aboriginal cultural heritage and the activity will comply with these guidelines.

5.2

In these circumstances, subject to the measures set out in paragraphs 5.8 - 5.12, it is reasonable and practicable that the activity proceeds without further cultural heritage assessment.

5.3

The following are examples of activities that may generally proceed within a Developed Area:

- Use and maintenance of existing roads, tracks and power lines within the existing alignment, or other infrastructure footprint;
- Use and maintenance of services and utilities (such as electricity infrastructure; water or sewerage disposal) on an area where such services and utilities are currently being provided.

Areas previously subject to Significant Ground Disturbance (Category 4)

5.4

Where an activity is proposed in an area, which has previously been subject to Significant Ground Disturbance it is generally unlikely that the activity will harm Aboriginal cultural heritage and the activity will comply with these guidelines.

5.5

In these circumstances, subject to the measures set out in paragraphs 5.6 - 5.12, it is reasonable and practicable that the activity proceeds without further cultural heritage assessment.

5.6

In some cases, despite an area having been previously subject to Significant Ground Disturbance, certain features of the area may have residual cultural heritage significance. These features are set out in paragraph 6.0 of these guidelines.

5.7

It is important to be informed about any cultural heritage significance that may attach to these features and extra care must be taken prior to proceeding with any activity that may cause additional surface disturbance to the feature, or the area immediately surrounding the feature which is inconsistent with the pre-existing Significant Ground Disturbance. In these circumstances, it is necessary to notify the Aboriginal Party and seek:

- Advice as to whether the feature constitutes Aboriginal cultural heritage; and
- If it does, agreement as to how best the activity may be managed to avoid or minimise harm to any Aboriginal cultural heritage.

Excavating, relocating, removing or harming a Cultural Heritage Find

5.8

If at any time during the activity it is necessary to excavate, relocate, remove or harm a Cultural Heritage Find the activity should cease immediately. You must notify the Aboriginal Party for the area and seek their advice and agreement as to how best this may be managed to avoid or minimise harm to the Aboriginal cultural heritage. Paragraph 6.0 sets out examples of features highly likely to constitute or contain a Cultural Heritage Find.

Reaching Agreement

5.9

It is advisable that the terms of any agreement you reach with the Aboriginal Party for the area be recorded and documented in the event of future disputes.

Failure To Reach Agreement

5.10

Where agreement cannot be reached with the Aboriginal Party for the area, you continue to have a duty of care obligation under section 23 of the Act and must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage including, where necessary, through the development of a Cultural Heritage Management Plan under Part 7 of the Act.

Aboriginal Cultural Heritage Register and Aboriginal Cultural Heritage Database

5.11

An activity under category 3 or category 4 that will excavate, relocate, remove or harm Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database should not proceed without the agreement of the Aboriginal Party for the area or a Cultural Heritage Management Plan undertaken pursuant to Part 7 of the Act.

5.12

Information regarding Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database may be obtained from the Cultural Heritage Unit.

Activities causing additional surface disturbance (Category 5)

5.13

A category 5 activity is any activity, or activity in an area, that does not fall within category 1, 2, 3 or 4.

5.14

Where an activity is proposed under category 5 there is generally a high risk that it could harm Aboriginal cultural heritage. In these circumstances, the activity should not proceed without cultural heritage assessment. Cultural heritage assessment should involve consideration of the matters a Court may consider under section 23(2) of the Act, set out in paragraph 1.12 of the Preamble to these guidelines.

5.15

Particular care must be taken where it is proposed to undertake activities causing additional surface disturbance to the features likely to have cultural heritage significance, set out in paragraph 6.0 of these guidelines.

5.16

It is important to be informed about any cultural heritage significance that may attach to these features and extra care must be taken prior to proceeding with any activity that may cause additional surface disturbance of the feature, or the area immediately surrounding the feature. Where an activity is proposed under category 5, it is necessary to notify the Aboriginal Party and seek:

- Advice as to whether the feature constitutes Aboriginal cultural heritage; and
- If it does, agreement as to how best the activity may be managed to avoid or minimise harm to any Aboriginal cultural heritage.

Excavating, relocating, removing or harming a Cultural Heritage Find

5.17

If at any time during the activity it is necessary to remove or relocate or harm a Cultural Heritage Find the activity should cease immediately. You must notify the Aboriginal Party for the area and seek their advice and agreement as to how best this may be managed to avoid or minimise harm to the Aboriginal cultural heritage. Paragraph 6.0 sets out examples of features highly likely to constitute or contain a Cultural Heritage Find.

Reaching Agreement

5.18

It is advisable that the terms of any agreement you reach with the Aboriginal Party for the area be recorded and documented in the event of future disputes.

Failure To Reach Agreement

5.19

Where agreement cannot be reached with the Aboriginal Party for the area, you continue to have a duty of care obligation under section 23 of the Act and must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage including, where necessary, through the development of a Cultural Heritage Management Plan under Part 7 of the Act.

Aboriginal Cultural Heritage Register and Aboriginal Cultural Heritage Database

5.20

An activity under category 5 that will excavate, relocate, remove or harm Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database should not proceed without the agreement of the Aboriginal Party for the area or a Cultural Heritage Management Plan undertaken pursuant to Part 7 of the Act.

5.21

Information regarding Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database may be obtained from the Cultural Heritage Unit.

6.0 The nature of the Aboriginal cultural heritage likely to be harmed by the activity - Section 23(2)(b)

6.1

The following features are highly likely to have cultural heritage significance. These features include, but are not limited to:

Ceremonial places: The material remains of past Aboriginal ceremonial activities come in the form of earthen arrangements or bora grounds and their associated connecting pathways, and stone circles, arrangements and mounds. Indigenous people used these places for ceremonies, including initiation and inter-group gatherings.

Scarred or carved trees: Scars found on large mature trees often indicate the removal of bark by Indigenous people to make material items like canoes, containers, shields and boomerangs. Carved trees generally feature larger areas of bark that have been removed and carved lines deeply etched into the timber. Carvings include geometric or linear patterns, human figures, animals and birds.

Burials: Pre-contact Aboriginal burials are commonly found in caves and rock shelters, midden deposits and sand dunes. Burial sites are sensitive places of great significance to Indigenous people.

Rock art: Queensland has a rich and diverse rock art heritage. Rock art sites can include engravings, paintings, stencils and drawings. Paintings, stencils and drawings may have been done for everyday purposes, but are often used for ceremonial and sacred functions. Engravings include designs scratched, pecked or abraded into a rock surface.

Fish traps and weirs: Fish traps and weirs are stone or wooden constructions designed to capture aquatic animals, predominantly fish. Traps are considered as structures made

predominantly from stone to form a type of pen or enclosure. Weirs are constructions designed to block the natural flow of water in creeks, streams and other watercourses.

Occupation sites: These are places where the material remains of human occupation are found. Such sites contain discarded stone tools, food remains, ochre, charcoal, stone and clay hearths or ovens, shell middens and shell scatters, including deposits found in rock shelters and caves. These deposits may be buried. Other evidence of occupation sites includes the remains of Aboriginal dwellings or "gunyahs".

Quarries and artefact scatters: Quarries are places where raw materials such as stone or ochre were obtained through either surface collection or sub-surface quarrying. Stone collected or extracted from stone quarries was used for the manufacture of stone tools. Ochre, a type of coloured clay, was utilised by Indigenous people in rock art and for body and wooden tool decoration.

Grinding grooves: Grinding grooves represent the physical evidence of past tool making or food processing activities. They are generally found near water sources. The presence of long thin grooves may indicate where the edges of stone tools were ground. Food processing activities such as seed grinding can leave shallow circular depressions in rock surfaces.

Contact Sites: The material remains of Indigenous participation in the development of Queensland after the arrival of European settlers. These include former or current Aboriginal missions, native mounted police barracks and historical camping sites.

Wells: Rock wells are reliable water sources that have been altered by Indigenous people for the storage of water. The presence of wells often indicates the location of routes frequently travelled by Indigenous people in the past.

6.2

Landscape features, which may also have cultural heritage significance include:

- Rock outcrops
- Caves
- Foreshores and coastal dunes
- Sand Hills
- Areas of biogeographical significance, such as natural wetlands
- Permanent and semi-permanent waterholes, natural springs.
- Particular types of native vegetation[3]
- Some hill and mound formations

[3] Unless otherwise provided for under these guidelines (such as provisions in relation to scarred trees or places entered onto the Aboriginal Cultural Heritage Register or Database), the control and maintenance of native vegetation by pruning and lopping may proceed, subject to the provisions of the *Vegetation Management Act 1999* and other relevant legislation.

6.3

The views of the Aboriginal Party for an area are key in helping assess the Aboriginal cultural heritage significance of these kinds of features.

6.4

Appropriately qualified persons such as anthropologists, archaeologists and historians can also provide valuable assistance.

7.0 The extent to which the person consulted with Aboriginal parties about the carrying out of the activity and the results of the consultation - Section 23(2)(c)

7.1

The views of the Aboriginal Party for an area are key in assessing and managing any activity likely to excavate, relocate, remove or harm Aboriginal cultural heritage.

7.2

Ask First – A guide to respecting Indigenous heritage places and values, released by the Australian Heritage Commission, provides a practical guide to consulting and negotiating with Aboriginal people about their cultural heritage. Available from the Australian Heritage Commission website: http://www.environment.gov.au/heritage/ahc/publications/ask-first-guide-respecting-indigenous-heritage-places-and-values

7.3

Any activity undertaken in accordance with an agreement with the relevant Aboriginal Party for the area satisfies the Aboriginal cultural heritage duty of care under the Act.

Reaching Agreement

7.4

It is advisable that the terms of any agreement you reach with the Aboriginal Party for the area be recorded and documented in the event of future disputes.

Failure To Reach Agreement

7.5

Where agreement cannot be reached with the Aboriginal Party for the area, you continue to have a duty of care obligation under section 23 of the Act and must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage including, where necessary, through the development of a Cultural Heritage Management Plan under Part 7 of the Act.

8.0 Whether the person carried out a study or survey, of any type, of the area affected by the activity to find out the location and extent of Aboriginal cultural heritage, and the extent of the study or survey - Section 23(2)(d)

8.1

A cultural heritage study or a cultural heritage survey should be carried out where it is necessary to identify and assess the Aboriginal cultural heritage values of an area, for example where an activity is likely to excavate, relocate, remove or harm Aboriginal cultural heritage.

8.2

A cultural heritage study or survey can be undertaken as part of the process for developing a Cultural Heritage Management Plan under Part 7 of the Act.

8.3

Although it may be a useful reference point, you should not rely solely on information contained within the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database in deciding whether or not to undertake a cultural heritage study or survey. Neither should you rely solely on archaeological information about an area, as this may not address the particular significance of the area as a result of Aboriginal tradition or the history of the Aboriginal Party for the area.

8.4

As highlighted in *Ask First – A guide to respecting Indigenous heritage places and values*, you should not rely solely on previous work to identify significant Aboriginal cultural heritage, as the Aboriginal people involved in previous studies or surveys may not have disclosed the existence of cultural heritage places as they may not have been under immediate threat at the time the earlier study was undertaken.

8.5

Further guidance on when a cultural heritage study or survey is required may be obtained by:

- Seeking the views of the Aboriginal Party for the area and ascertaining from the Aboriginal Party as to whether a study or survey is required;
- Seeking information from the Aboriginal Cultural Heritage Register and the Aboriginal Cultural Heritage Database as to whether there are any known cultural heritage values that could be affected by your activity[4];
- Seeking advice from appropriately qualified persons such as anthropologists, archaeologists and historians;
- Assessing the nature of the Aboriginal cultural heritage likely to be harmed;
- Assessing the nature of the activity and the likelihood of its causing harm to Aboriginal cultural heritage;

[4] It is important to note that an assessment needs to be made as to whether your activity will indirectly harm Aboriginal cultural heritage not located directly within the area of actual activity e.g. damming a creek may impact on Aboriginal cultural heritage downstream from the dam.

- Assessing the nature and extent of past uses in the area affected by the activity;
- Seeking further advice from the Cultural Heritage Unit.

8.6

The Aboriginal Party for the area must be given the opportunity to be involved in undertaking the cultural heritage study or survey and their advice must be sought as to how best to manage any activity, which may harm cultural heritage identified by the study or survey.

9.0 Whether the person searched the database and register for information about the area affected by the activity - Section 23(2)(e)

9.1

An activity that will excavate, relocate, remove or harm Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database should not proceed without the agreement of the Aboriginal Party for the area or a Cultural Heritage Management Plan undertaken pursuant to Part 7 of the Act.

9.2

Information regarding Aboriginal cultural heritage entered on the Aboriginal Cultural Heritage Register or the Aboriginal Cultural Heritage Database may be obtained from the Cultural Heritage Unit.