Stockland
Caloundra South
Conservation Strategy

Final | May 2012

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Appendix A
Rehabilitation Strategy

Executive Summary

The Caloundra South site has been subject to considerable disturbance in the past and is heavily degraded. Much of the original vegetation has been cleared (only 15% of the pre-clearing native vegetation remains) and then planted with pine. This pine plantation was then cleared and the site was partially utilised for agricultural purposes; it is now considered vacant land. These various land uses have significantly degraded the sites ecological values; the hydrology has been altered, weeds are abundant and remnant vegetation is fragmented. The waterways with the project area discharge to the internationally protected Pumicestone Passage; development of Caloundra South needs to be undertaken in a manner that protects its ecological values.

The site retains some remnant vegetation communities which support fauna populations including significant acid frogs such as the Wallum Sedgefrog and Wallum Rocketfrog. A number of waterways crossing the site also form wildlife corridors, although they are partially discontinuous in their present state.

This Conservation Strategy outlines a framework for enhancing the biodiversity of Caloundra South and ensuring important ecological values are protected from development. It provides a response to the requirements of the Caloundra South Urban Development Area Development Scheme (October, 2011). A Public Environmental Report (PER) is currently being prepared, pursuant to the requirements of the *Environmental Protection and Biodiversity Act 1999* (EPBC Act).

This conservation strategy and the objectives of the Caloundra South Ecological Rehabilitation Strategy will be updated to be consistent with the outcomes of the PER once finalised.

Urban Development at the site can not proceed until approval under the EPBC Act is granted by SEWPC.

The Caloundra South Master plan secures the protection of approximately 600ha of land for the purpose of protecting and enhancing ecological processes. This allows for the:

- Protection of high value habitats through the retention and buffering of regional ecosystems
- Protection of habitat for significant species known to be present on site
- Enhancement of existing wildlife corridors through the site through the provision of waterway buffers
- Revegetation and creation of additional areas that are not currently vegetated
- Management of open space to promote appropriate fire regimes, weed and pest management and community interaction

This strategy establishes a framework to maintain the existing ecological values of the site, and enhances these values through additional rehabilitation works and long term management.

1 Introduction

A 'Sustainability community' is one of the key themes of the Caloundra South Urban Development Area Development Scheme (October, 2011). Caloundra South is to be a community that 'provides for the enhancement of natural ecosystems and biodiversity' and 'ensures important ecological and scenic values are protected and enhanced'.

This Conservation Strategy for Caloundra South (CS) describes in detail how this can be achieved. It responds to the UDA-wide criteria (in particular Section 3.3.6 and 3.3.8) and the Implementation Strategy (Section 5.3 Ecological Sustainability).

The Conservation Strategy provides a summary of current information about the ecological values of the site, current and potential threats to these values and management measures to protect and manage the values.

The Conservation Strategy, as endorsed by the ULDA, is to be implemented as part of subsequent development applications through the requirement for construction and environmental management plans that will include habitat protection, flora and fauna mitigation measures and ongoing monitoring regimes. Where there is a conflict between this Strategy and the Caloundra South Master Plan, the Caloundra South Master Plan prevails.

The Environmental Management strategies described in this Conservation Strategy outline the proposed on-ground management of the site to maintain or enhance ecological values. An Ecological Rehabilitation Strategy has been prepared by Greening Australia (2011) and is included in Appendix A of this document. This Rehabilitation Strategy provides an intent in relation to future rehabilitation activities, however it is likely to be updated as part of subsequent applications to reflect ongoing investigations and assessments.

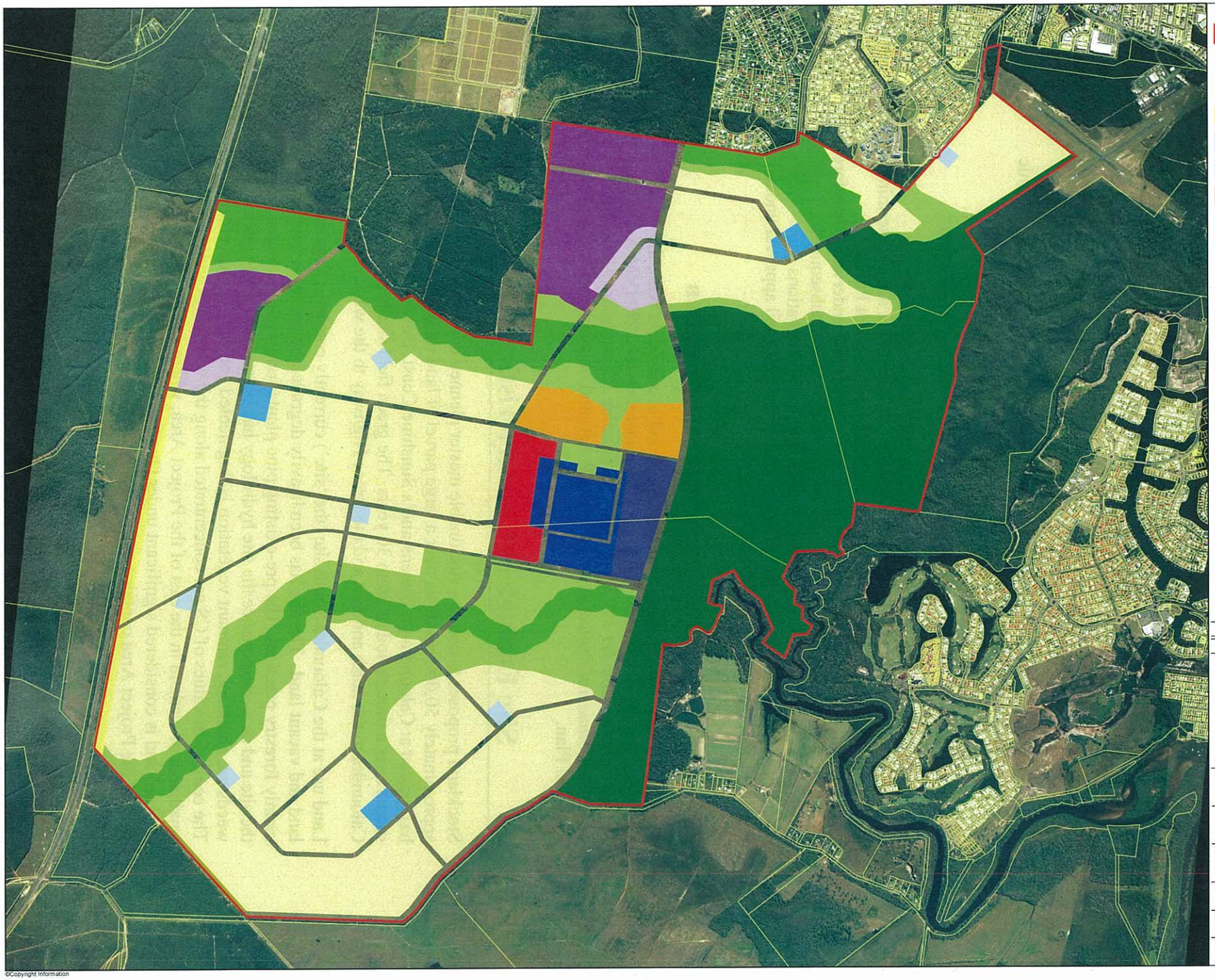
The CS proposed Master Plan (Figure 1) has been developed to ensure the protection of significant local and regional ecological features.

2 Planning Framework

2.1 Urban Development Area

The Urban Land Development Authority (ULDA) Development Scheme provides guidance in a number of areas on conservation requirements for the site, including a vision, Urban Development Area (UDA) wide criteria and conservation provisions. These have been taken into consideration in the preparation of this document. Section 5 describes how the Conservation Strategy directly responds to the UDA Wide criteria in Section 3.0 of the Development Scheme.

The Vision for the site (Map 2 in the gazetted Development Scheme) proposes that the Eastern side of the site is conserved in an Environmental Protection Zone. Its purpose is to protect areas of environmental significance and 'associated conservation, biodiversity, habitat or scenic amenity values'. It limits use of the site to low impact, low intensity land uses and provides opportunities for habitat



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2	30/05/2012	GJK	LCM	RB

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improvement. ~~It also allows multi-purpose functions for community needs (including parks, and utility installations) provided they don't compromise environmental values.~~

The key conservation objectives for Caloundra South as defined in the UDA Development Scheme are:

- Protection and support of the regional and national biodiversity values external to the UDA in the Pumicestone Passage;
- Development within Caloundra South provides for the enhancement of natural ecosystems and biodiversity values; and
- A comprehensive open space network ensures important ecological and scenic values are protected and enhanced.

2.2 EPBC Act and Public Environmental Report

A referral pursuant to the *Environmental Protection and Biodiversity Conservation Act 1999* was submitted to SEWPC in June 2011; it was determined that the proposed development at CS is a controlled action and a Public Environmental Report (PER) is required. A PER is currently underway, therefore strategies outlined in this document may be updated as part of subsequent development applications, as a result of more detailed investigations and assessments. Urban development at the site cannot proceed until approval under the EPBC Act is granted by SEWPaC.

2.3 Other State Environmental Legislation

The CS Conservation Strategy has considered, and is consistent with, the legislative requirements of the *Vegetation Management Act 1999* (VM Act), *Nature Conservation Act 1992* (NC Act), *Sustainable Planning Act ~~1997~~ 2009* (SP Act), *Environmental Protection Act 1994* (EP Act) and objectives under the SEQ Regional Plan.

3 Site Ecological Characteristics

Stockland proposes to create a sustainable master planned community catering for approximately 50,000 residents over a large parcel of land (approximately 2,310 ha) located at Caloundra on Queensland's Sunshine Coast. Development will be staged over a time period of 20 to 30 years. The green field site is bound by Caloundra to the north and east and the Bruce Highway to the west.

Land use at the Caloundra South site (the 'site') currently consists of agricultural land and vacant land. The site has been heavily degraded by previous land uses, mainly forestry practices. The pre-existing pine plantation has been cleared from the site and as a consequence the site hydrology has been significantly altered, weeds are abundant, remnant vegetation is fragmented and fire regimes changed. The ecological values of CS are concentrated along the waterways and within a small area of wetland in the east of the Project Area, where vegetation has been retained and is considered significant under Queensland legislation. Less than 15% of the Project Area contains native vegetation at present.

The site is located within the Pumicestone Passage catchment, which is within the Moreton Bay Ramsar area. Lamerough Creek, Bells Creek North and Bells Creek South traverse the site.

3.1 Vegetation

Previous studies highlighted that Caloundra South lies within the 'wallum region' of the Sunshine Coast. On a broad scale, the wallum region extends from the coast of central Queensland (Woodgate) down the eastern coast to central New South Wales (Myall Lakes). The region is characterised by non-calcerous Quaternary sands with low nutrients and acidic black waters. Vegetation is typically coastal heath and wetlands.

3.1.1 Vegetation Communities

Table 1 lists the Regional Ecosystems (RE's) mapped by the Queensland Herbarium within Caloundra South. Many of these RE's are currently considered 'of concern' under the *VM Act 1999* and for these reasons deemed of regional and state biodiversity significance under the SEQ Regional Plan. Some RE's have been recognised as 'threshold RE's'. Further clearing or loss within these threshold RE's at a state level is likely to result in a change in biodiversity status, such that an 'of concern' RE would become 'endangered' and a 'not of concern' RE would become 'of concern'.

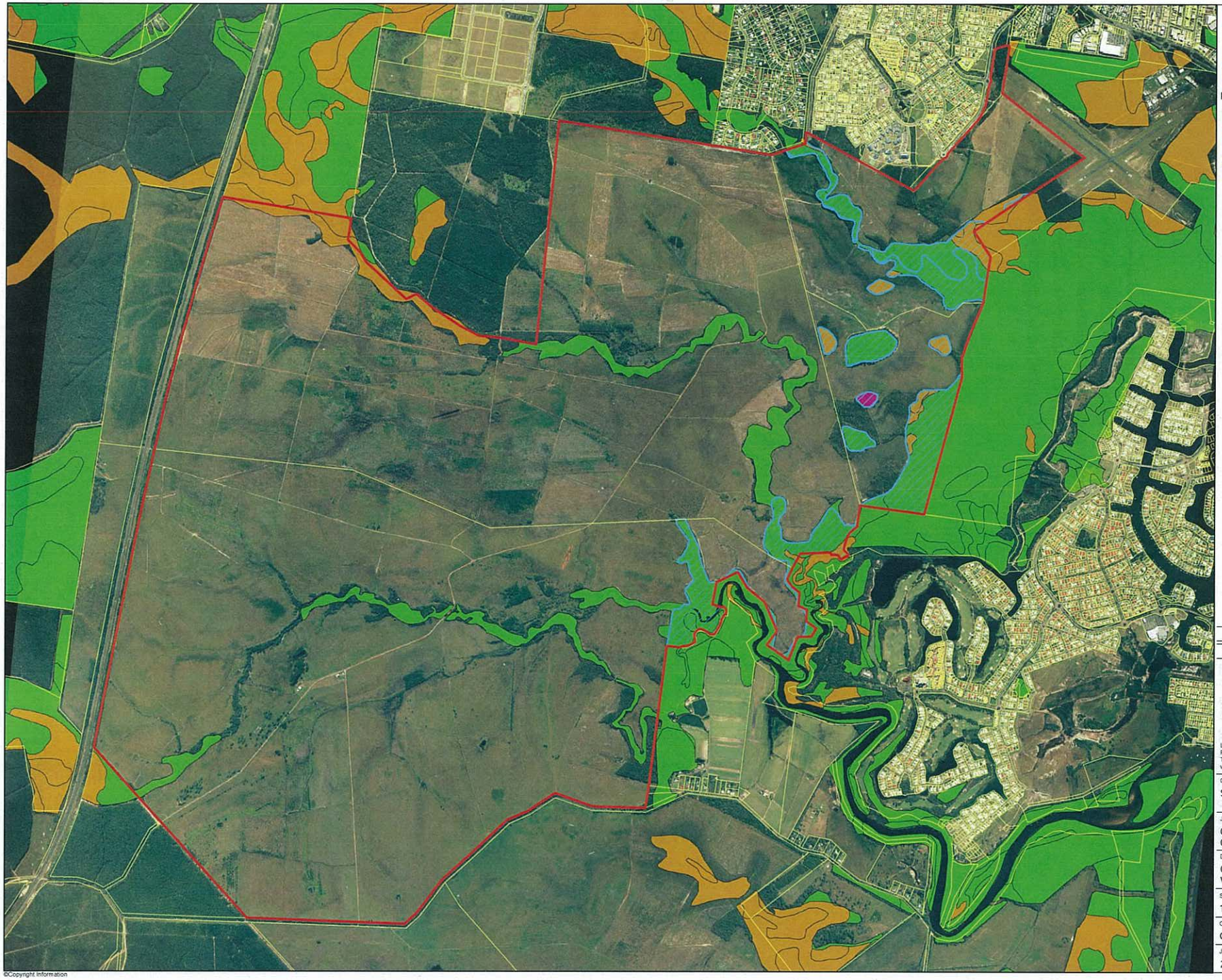
In 2008 a PMAV (Property Map of Assessable Vegetation) was prepared utilising data from vegetation surveys on the CS site and approved under the VM Act (**Figure 2**). The PMAV identifies areas of vegetation on the CS site that comply with the legislative definition for remnant vegetation, that is:

- a species composition in accordance with a recognisable RE;
- 50% mature canopy cover; and
- 75% mature canopy height.

In accordance with the VM Act, the PMAV now forms the basis for all vegetation assessment and permitting conducted by the Department of Environment and Heritage Protection (EHP) (formerly the Department of Environment and Resource Management (DERM)).

Table 1: Regional Ecosystems within the Caloundra South PMAV area

RE Code	Status	Description
12.1.1	Of Concern	*Casuarina glauca* open forest on margins of marine clay pans
12.1.2	Not of Concern	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains
12.1.3	Not of Concern	Mangrove shrubland to low closed forest on marine clay plains and estuaries
12.3.1	Endangered	Notophyll Vine forest
12.3.4*	Not of concern	*Melaleuca quinquenervia* and *Eucalyptus robusta* (paper bark and swamp mahogany) open forest
12.3.5	Of concern	*Melaleuca quinquenervia* (paperbark) open forest



Caloundra South site boundary

Cadastre

Surveyed remnant vegetation (PMAV 2008/009340)

Remnant vegetation :

Endangered

Of concern

Not of concern

Significant flora located in 2009

Significant flora located in 1999

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RE Code	Status	Description
12.3.6	Not of Concern	*Melaleuca quinquenervia, Eucalyptus tereticornis, Lophostemon sauveolens* woodland on coastal alluvial plains
12.3.8*	Of concern	Swamps with Cyperus spp., Schoenoplectus spp. and Eleocharis spp
12.3.13*	Of concern	Closed heathland (*Melaleuca thymifolia, Banksia robur, Xanthorrhoea fulva, Hakea actites, Leptospermum spp.* and *Baeckea frutescens*) on seasonally waterlogged alluvial plains
12.3.14*	Of concern	*Banksia aemula* woodland
12.9-10.14	Not of concern	*Eucalyptus pilularis* (blackbutt) open forest

* indicates a threshold RE

Floristic Species Composition

In the vegetation and fauna surveying undertaken in 1999 (LAMR, Caloundra Downs II Informal Land Use Investigation), it was estimated that only 20-60% of the endemic native flora species remain at Caloundra South. Of the 318 native species remaining, 210 were found only in the remaining native vegetation, which occurred on less than 15% of the site. The remnant vegetation at Caloundra South are considered most likely to contain significant plant species, because the communities typical to the site are restricted in their distribution (as indicated by their 'Of Concern' status under the VMA 1999). Significant species are listed as 'threatened'[1] under the *Queensland Nature Conservation Act 1992* (NC Act) and the Commonwealth *Environment Protection & Biodiversity Conservation Act, 1999* (EPBC Act).

Ecological surveys (in 1999 and 2009) and database searches indicate that there are several significant flora species (listed under the NC Act and EPBC Act) that are known to occur in the Caloundra area including:

- Attenuated wattle (*Acacia attenuata*)*;
- Little wattle (*Acacia baueri*);
- Large-leaved Chain Fruit (*Alyxia ilicifolia sub. magnifolia*);
- Hairy Joint Grass (*Arthraxon hsipidus*);
- Christmas Bells (*Blandfordia grandiflora*);
- Heart-leaved Bonewood (*Bosistoa selwynii*);
- Three-leaved Bosistoa (*Bosistoa transversa*);
- Miniature Moss-orchid (*Bulbophyllum globuliforme*);
- Stinking Laurel (*Cryptocarya foetida*);
- Swamp Stringybark (*Eucalyptus conglomerata*)*
- Queensland Nut (*Macadamia integrifolia*);
- Gympie Nut (*Macadamia ternifolia*);

[1] Extinct, Critically Endangered, Endangered, Vulnerable or Rare species are collectively referred to as 'threatened'.

- Lesser Swamp Orchid (*Phaius australis**):
- Swamp Lily (*Phaius tancarvilleae*);
- Mt Berryman Phebalium (*Phebalium distans*);
- Wallum Leek (*Prasophyllum wallum*)*;
- a sedge *Schoenus scabripes;*
- Glossy Spice Bush *Triunia robusta*, and
- Minute Orchid *Taeniophyllum muelleri.*

Only two of these were located in the 1999 and 2009 surveys at Caloundra South: Large-leaved Chain Fruit (*Alyxia ilicifolia* spp. *magnifolia*) was relatively common in the small patch of lowland rainforest in the north-eastern portion of the site and two specimens of Christmas Bells (*Blandfordia grandiflora*) were located in the regenerating wallum to the north of the lowland rainforest.

It was considered possible that four species listed under the EPBC Act may occur on site (as indicated by an * in the list). Further targeted flora surveys to confirm the presence of these species were undertaken in 2011 at times when these species were most likely to be easily identified (e.g. flowering/fruiting); no individuals of these EPBC Act species were located, though potentially suitable habitat for these species was identified.

3.2 Fauna

Numerous fauna surveys have occurred across the Caloundra South site, dating back to the Caloundra Downs II Informal Land Use Study, conducted in 1999. This study found fauna across the site to be of low diversity and occurrence, which was attributed to the extensive agricultural and silvicultural history of the site, resulting in fragmented remnant vegetation and discontinuity of significant vegetated corridors.

Ecological surveys and database searches indicate that there are several significant fauna species (listed under the NC Act and EPBC Act) and migratory species (listed under EPBC Act) known to occur in the Caloundra area, as listed in Table 2.

Table 2: Listed significant species (pursuant to NC Act and EPBC Act) known to occur in the Caloundra area

Threatened Species (* EPBC Act listed)	**Migratory Species**
Glossy Black Cockatoo (*Calyptorhynchus lathami*)	White-throated Needletail (*Hirundapus caudacutus*)
Ground Parrot (*Pezoporus wallicus*)	Spectacled Monarch (*Monarcha trivirgatus*)
Regent Honeyeater (*Anthochaera phrygia*)*	Black-faced Monarch (*Monarcha melanopsis*)
Coxen's Fig Parrot (*Cyclopsitta diopthalma coxeni*)*	Satin Flycatcher (*Myiagra cyanoleuca*)
Red Goshawk (*Erythrotriorchis radiatus*)*	Rufous Fantail (*Rhipidura rufifrons*)
Swift Parrot (*Lathamus discolour*)*	Cattle Egret (*Ardea ibis*)
Australian Painted Snipe (*Rostratula australis*)*	Great Egret (*Ardea alba*)
Black-breasted Button-quail (*Turnix melanogaster*)*	Ruddy Turnstone (*Arenaria interpres*)
Large-eared Pied Bat (*Chalinolobus dwyeri*)*	Curlew Sandpiper (*Calidris ferruginea*)
Grey-headed Flying Fox (*Pteropus poliocephalus*)*	Lesser Sand Plover (*Charadrius mongolus*)
Spot-tailed Quoll (*Dasyurus maculatus*)*	Latham's Snipe (*Gallinago hardwickii*)
Long-nosed Potoroo (*Potorous tridactylus*)*	Grey-tailed Tattler (*Heteroscelus brevipes*)
Water mouse (*Xeromys myoides*)*	Bar-tailed Godwit (*Limosa lapponica*)
Three-toed Snake-tooth Skink (*Coeranoscincus reticulatus*)*	Australian Cotton Pygmy-goose (*Nettapus coromandelianus albipennis*)
Honey Blue Eye (*Pseudomugil mellis*)*	Eastern Curlew (*Numemius madagascariensis*)
Oxleyan Pygmy Perch (*Nannoperca oxleyana*)*	Whimbrel (*Numenius phaeopus*)
Giant Barred Frog (*Mixophyes iteratus*)*	Pacific Golden Plover (*Pluvialis fulva*)
Wallum Sedgefrog (*Litoria olongburensis*)*	Painted Snipe (*Rostratula benghalensis*)
Green-thighed Frog (*Litoria brevipalmata*)*	Terek Sandpiper (*Xenus cinereus*)
Wallum Rocketfrog (*Litoria freycineti*)	Fork-tailed Swift (*Apus pacificus*)
Wallum Froglet (*Crinia tinnula*)	White-bellied Sea Eagle (*Haliaeetus leucogaster*)
Koala (*Phascolarctus cinereus*)	Rainbow Bee-eater (*Merops ornatus*)
Australian Fritillary (*Argyreus hyperbius inconstans*)	
Illidge's Ant Blue (*Acrodipsas illidgei*)	
Richmond Birdwing (*Ornithoptera richmondia*)	
Satin Blue (*Nesolycaena albosericea*)	

Of the threatened species listed above, targeted fauna surveys (1999, 2009 and 2010) found four: Wallum Froglet, Wallum Sedgefrog, Wallum Rocketfrog, and Grey-headed Flying Fox.

A further five EPBC terrestrial migratory bird species were identified on site in previous surveys: Black-faced Monarch, Cattle Egret, Great Egret, Rainbow Bee-eater and Rufous Fantail. These species are all considered common and are abundant throughout the Sunshine coast region.

The following additional investigations are underway in response to the PER guidelines:

- Investigations to identify the presence and potential for the project to impact on the Water mouse (*Xeromys myoides*),
- Investigations into the presence and distribution, impacts of the development and management requirements for the Wallum Sedgefrog, and other wallum dependent frogs.

The PER guidelines also require migratory birds and wetlands of international importance (located outside the site boundary) to be considered in the PER.

3.2.1 Wallum froglet, Wallum rocketfrog and Wallum sedgefrog

The Wallum sedgefrog, wallum rocketfrog, and wallum froglet all have similar habitat requirements and tolerances, and are commonly referred to as 'wallum dependent frogs' or 'acid frogs'. These frogs, particularly the wallum sedgefrog, are the subject of further investigations occurring as part of the PER process.

The Wallum Froglet is abundant and widespread across the site. It is particularly prevalent in open modified habitats within the northern portion of the site, coinciding with old silviculture furrows which collect pools of water during rainfall. It is theorised frog species are found in these furrows as they are ephemeral and not suitable for fish species that predate frog eggs and tadpoles.

Wallum Rocketfrogs were also located across the site, particularly in highly modified land within 60 to 350m of remnant vegetation (Sanders; 2010).

Wallum sedgefrogs were identified in the eastern portion of the site in ecological surveys in 2010, after a significant rain event. At the time of the 2010 survey, the highest densities were recorded in low-lying melaleuca swamps with a dominant sedge understory and wallum areas. Further investigations between January and March 2012 have identified the wallum sedgefrog within remnant and non-remnant habitats across parts of the site, and generally in areas formerly under plantation pine, now dominated by exotic grasses, pine stumps and sedges. Ongoing assessments to determine the habitat characteristics will further inform environmental management plans and requirements for subsequent applications.

This Conservation Strategy intends to provide for the protection and rehabilitation of habitat within the waterway corridors and buffers. This also provides opportunities to improve connectivity through the site.

The overarching objective of this strategy is to maintain conditions conducive to sustainable wallum sedgefrog populations with connectivity between populations within and outside the site. This includes measures for the protection and enhancement of habitat and conditions that supports wallum sedge frog populations, as well as the retention, consolidation and enhancement of corridors or corridor function across the site. As part of a construction and environmental management plan, a focus on the protection and re-establishment of habitat and connectivity within the water way corridor and adjoining open space areas is required. The plan will be consistent with the relevant UDA wide criteria from the Development Scheme, namely:

- Retaining where possible locally significant wetlands, remnant vegetation and habitat for fauna
- Enhance wetland communities as part of the rehabilitation of ecological corridors
- Provide ecological corridors and linkages, including areas outside the neighbourhood or community

- Provide new planting that comprises predominantly endemic species
- Provide corridors of sufficient width to protect and improve the ecological function of these corridors
- Corridors will contain a diversity of habitat types to provide wildlife connectivity and linear habitat
- Development adjacent to the open space network must address potential edge effects.

3.2.2 Water mouse

The water mouse is the subject of further investigations occurring as part of the PER process, however no individual of this species has been identified within the Caloundra South site during previous investigations. Potential habitat and evidence of nesting has been identified downstream of the site as part of recent investigations. The finding of these further investigations will be incorporated in future environmental management plans, which will be submitted with subsequent development applications.

3.2.3 Grey-headed flying fox

An individual was sighted flying over the Project Area in 1999. There are no camps within the Project Area with the closest known camp located approximately 30km west in the Sunshine Coast hinterland. The remnant vegetation and larger individual trees on site have value as food resources in the local landscape. This species may be an occasional visitor to the vegetated waterways on the Project Area in response to flowering events.

3.2.4 Oxleyan pygmy perch and Honey blue-eye

The absence of Oxleyan pygmy perch or Honey blue-eye is not surprising as low densities have been recorded in past surveys in adjacent streams; Honey blue-eye abundances can also be highly variable. Despite their absence in the current surveys (2010 and 2011), it is considered that there is a potential for their presence in the project area due to the presence of critical habitat and proximity to adjacent streams from which they have been recorded.

3.2.5 Migratory birds

All species of migratory birds located on site are terrestrial and are considered widespread and abundant within the region. No populations of these birds within the Project Area are considered to represent a significant portion of the species population. Further investigations into migratory birds outside the site are currently underway as part of the PER process, in response to the PER guidelines. The finding of these further investigations will be incorporated in future environmental management plans, which will be submitted with subsequent development applications.

3.3 Habitats

The native and significant flora and fauna associated with Caloundra South are located within or in close proximity to areas of natural habitat remaining on the site.

A habitat assessment was undertaken in 2009 for Caloundra South. Historic land uses at Caloundra South have reduced the wallum habitat that was originally present on the site and introduced new communities. Data collected suggests the existing habitat on site can be classified into eight key habitats (BAAM 2009). Some of these habitats represent regrowth or degraded vegetation (Section 2.3.1) and others include regional ecosystems that are representative of vegetation communities that have been substantially reduced throughout SEQ due to coastal development (Section 2.3.2). The mapped habitats are shown in **Figure 3**.

As part of the response to the PER guidelines, further habitat assessments for the MNES flora and fauna species on site will be included in the PER.

3.3.1 Low Value Habitats

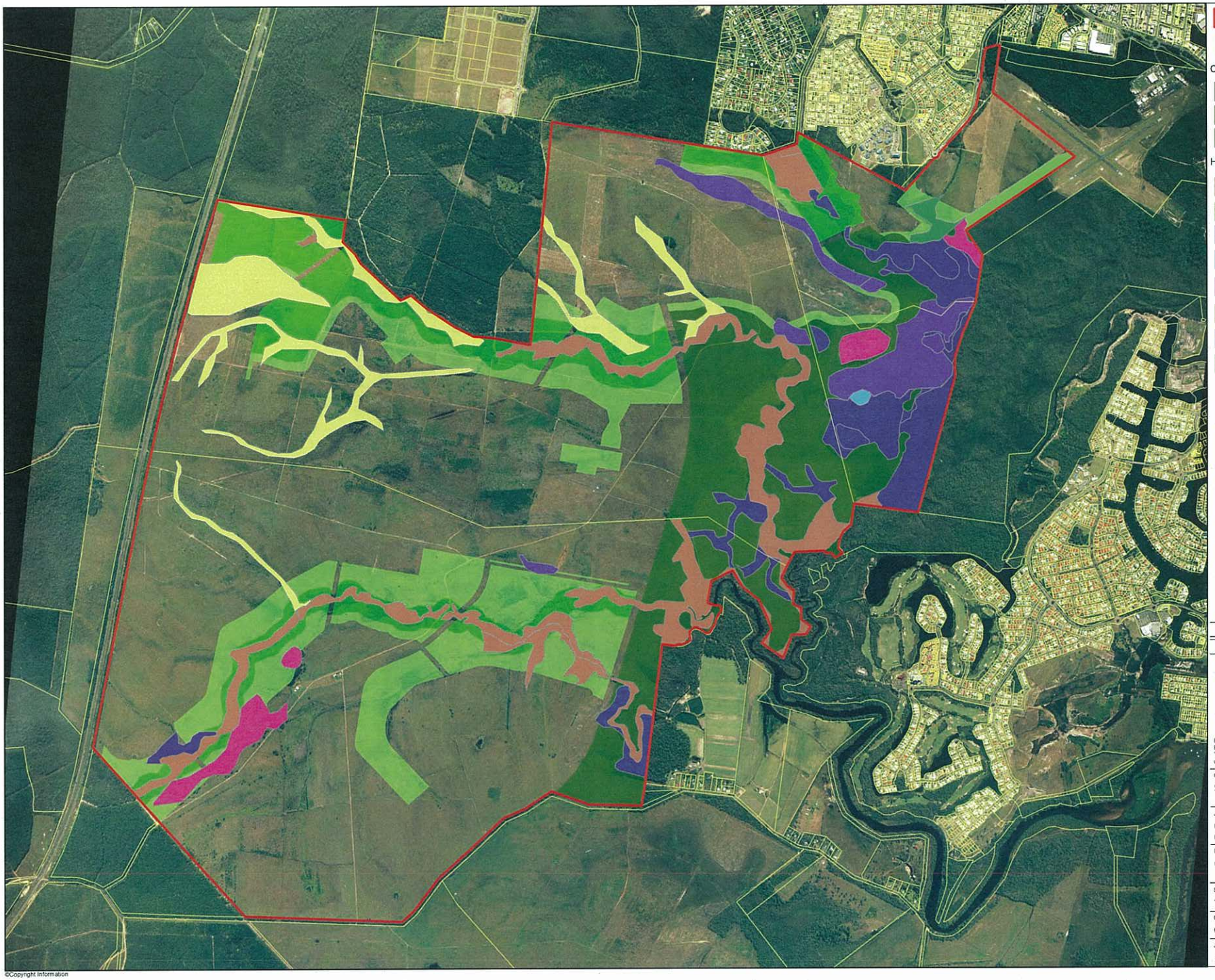
Although there are only four 'low value habitats', these habitats make up 88% of Caloundra South. They represent areas that were previously under pine plantation and have recently been harvested and maintained through systematic 'chopper-rolling' (a process used to remove pine stumps after harvest). The habitats are not associated with any particular type of regional ecosystem recognised under the VM Act, nor are they recognised as significant communities within the local or federal (EPBC Act) legislation. Investigations undertaken as part of the PER process have however identified that some of these areas are more widely utilised by the acid frog group than previously thought, and therefore further definition of habitat value is being progressed as part of the PER. Migratory birds may be sighted occasionally within these areas, however they are not reliant on them for breeding or feeding purposes.

3.3.2 High Value Habitats

Six 'high value habitats' were identified at Caloundra South, covering 12% of the subject site. They represent areas that have not been directly affected by pine plantation (i.e. waterway corridors, wetlands and patches of remnant forest) or areas that have been able to recover enough to attain a reasonable cover of native species (i.e. heath and wallum). These habitats are associated with RE's (although one habitat type may represent more than one RE) and are known to provide elements essential to supporting native flora and fauna (particularly significant species). The values of each of the habitats are noted in Table 3 and illustrated in **Figure 3**.

High value habitats as described below have been largely conserved within the Caloundra South Land Use Plan in Environmental Protection or Open Space Buffer land use types.

Paperbark / Forest Red Gum riparian habitat (4.9%) - tall, open forest dominated by *Melaleuca quinquenervia* to 16m with emergent *Eucalyptus*



Caloundra South site boundary

Cadastre

Caloundra South master plan:

- Sport and recreation
- Open space buffer
- Environmental protection

Habitat types:

- Melaleuca/Forest red gum
- Heath
- Wallum
- Lowlands rainforest
- Blackbutt (mixed eucalypt open forest)
- Reed dominated drainage lines
- Maleleuca swamp
- Paperbark and Pine Regrowth

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tereticornis to 22 m. The mid-dense shrub layer contains *Elaeocarpus reticulates*, *Acacia leiocalyx*, *Glochidion sumatranum*, *Allocasuarina litoralis* and *Leptospermum polygalifolium*. Wetter ground layers are dominated by *Lepironia articulata* and *Cladium procerum*, grading into *Baumea rubiginosa* and *Blechnum indicum*. Generally in good condition although it is invaded by *Pinus elliottii*, *Lantana camara* and *Megathyrsus maximus*.

Heath (0.2%) - this community has been slashed by mechanical means, leading to a very uniform height at around 25 – 30cm and a lack of shrub species. This community is characterized by the presence of *Boronia falcifolia*, *Empodisma minus*, *Sporadanthus interruptus*, *Caustis recurvata*, *Epacris pulchella*, *Laxmannia compacta*, *Patersonia glabrata, Xanthorrhoea fulva* and *Strangea linearis*.

Wallum (2.0%) - coastal wallum with emergent *Acacia leiocalyx*, evident above and upper stratum dominated by *Gahnia sieberiana*, *Persoonia sericea* and *Melastoma affine*. The very dense lower ground layers are characterized by *Gleichenia mendellii*, *Baumea rubiginosa*, and *Empodisma minus*, *Cyperus melanostachys*, *Hibbertia acicularis*, *Xyris complanata*, *Platysace ericoides*, *Epacris pulchella*, and *Xyris complanata*.

Lowland rainforest (0.0004%) - lowland rainforest with an upper canopy that is dominated by *Eucalyptus racemosa*, and *Corymbia intermedia* to 25m. The dense shrub and sub-canopy layers are characterized by *Syzygium australe*, *Schizomeria ovata*, *Pouteria chartacea* and *Livistona decipiens*. Ground layers are dominated by litter and *Imperata cylindrica*. *Cissus hypoglauca* and *Freycinetia scandens* are common vines.

Blackbutt open forest (1%) - tall, open forest with a canopy at around 25 – 28m that is dominated by *Eucalyptus pilularis*, *Eucalyptus racemosa*, and *Corymbia intermedia*. The sparse to mid-dense sub-canopy is dominated by *Melaleuca quinquenervia* whilst the sparse to mid-dense shrub layer is dominated by *Acacia leiocalyx*, *Acacia disparrima*, *Glochidion ferdinandi*, *Hovea lanceolata*, *Petalostigma pubescens* and *Allocasuarina litoralis*. The mid-dense ground layer is a patchwork of litter and grasses.

Paperbark dominated swamp (3.9%) - wetland vegetation with a mid-dense canopy averaging 28m is dominated by *Melaleuca quinquenervia*. The very sparse sub-canopy layer is dominated by the occasional *Glochidion sumatranum* and *Livistona australis*. The sparse shrub layer is characterized by *Melastoma affine* and *Acacia leiocalyx*. The dense ground layer is a patchwork of *Lepironia articulata* and *Blechnum indicum*.

Table 3: Values of high value habitats within Caloundra South

Habitat and Description	Photographic Representation	Values
Paperbark /Forest Red Gum riparian habitat.		Aligns with RE12.3.4 Aligns with RE12.3.5 Protects waterway and off-site receiving environments Reasonable condition Provides wildlife corridor Supports significant flora potentially occurring on site (particularly Attenuate Wattle, Swamp Lily and Lesser Swamp Orchid). Supports significant fauna potentially occurring on site.
Heath		Aligns with RE12.3.13 Represents an Of Concern RE Regenerating habitat Supports significant flora potentially occurring on site. Supports significant fauna potentially occurring on site.
Wallum		Aligns with RE12.3.14 Represents an Of Concern RE Regenerating marginal potential habitat for Lesser Swamp Orchid and Attenuate Wattle. Supports significant flora, specifically: Christmas Bells. Supports significant fauna, specifically: Wallum sedgefrog, Wallum froglet
Lowland Rainforest		Aligns with RE12.3.1 Represents an Endangered RE Contains mature trees Supports significant flora, specifically: Large-leaved Chain Fruit.

Habitat and Description	Photographic Representation	Values
Blackbutt open forest		Aligns with RE12.9-10.14 Contains mature trees Represents only dry open forest on the site
Paperbark dominated swamp		Aligns with RE12.3.5 Aligns with RE12.3.6 Important hydrological function Protects water quality in nearby receiving environments Supports significant flora potentially occurring on site (particularly Swamp Lily). Supports significant fauna potentially occurring on site.

3.4 Wildlife Corridors

On a local scale, there are several creeks running through the subject site, including Bells Creek (North and South branches) and Lamerough Creek, which provide opportunities for fauna movement across the site in an east-west direction. The remnant vegetation within these corridors forms a generally discontinuous wildlife corridor, which functions to allow the passage of various species of fauna, and allows genetic exchange for flora. These corridors allow for fauna movement between habitat areas within the site and to immediately adjacent habitat areas.

Fauna species within the local area that would utilise these corridors include small, forest dwelling bird species, common mammal species such as possums, native rodents, bandicoots and dasyurids as well as common amphibian and reptile species. Significant species, that have the potential to utilise these areas include the Wallum sedgefrog (*litora olongburensis*)Wallum Froglet (*Crinia tinula*), Wallum Rocketfrog (*Litoria freycineti*), Lewin's Rail (*Lewinia pectoralis*) and the Long-nosed Potoroo (*Potorous tridactylus tridactylus*).

Lamerough Creek and its associated riparian vegetation currently provides connectivity between the planned Caloundra South Environmental Protection area and a patch of remnant vegetation on SCRC land to the south of the Caloundra Landfill and Resource Recovery Centre and future state industrial land.

The Bells Creek North riparian corridor provides connectivity between the eastern Environmental Protection area within the Caloundra South Development Scheme and a section of Beerwah State Forest to the west of the Bruce Highway, as part of the recognised bio-regional corridor. There are also areas of Sunshine Coast

Regional Council (SCRC) conservation reserve adjacent to the Beerwah State Forest that contribute to this habitat patch. SCRC is also the owner of a parcel to the adjacent to Bells Creek North that currently supports pine plantation. There is a diverse range of vegetation communities mapped within this western habitat patch, including wet heath, paperbark forest, open eucalypt woodland and open forest with a vine understorey. Investigations undertaken as part of the PER process have also identified the significance of this corridor for habitat connectivity, particularly for the acid frogs, both within and beyond the site boundary.

Bells Creek South provides connectivity to in an east-west direction to a section of Beerwah State Forest that is currently utilised as a managed pine plantation. Whilst this link does provide a connection, it does not form part of the bioregional corridor and as such, is not as significant in terms of fauna corridors as Bells Creek North and Lamerough Creek. The pine plantation provides very limited habitat for common and significant native flora and fauna.

The Pumicestone Passage Major Bio-Regional Corridor is located to the east of the subject site and incorporates some of the remnant vegetation in the south-east of the subject site. It is identified by the Queensland Government (EPA 2002) as having regional and state significance. The corridor runs north-south, encompassing the shores of Pumicestone Passage, Bells Creek North, the wetlands to the north of Pelican Waters and the mouth of Lamerough Creek.

The general function of the Pumicestone Passage Major Bioregional Corridor is to permit fauna movement and exchange of genetic material in a north-south direction. The corridor includes the wetlands to the north of Pelican Waters (Lot 408) which is an area proposed for many years as a National Park. The wetlands form an important habitat node within the corridor and provide opportunity for movement further north or west to Beerburrum State Forest through the subject site along Bells Creek (North Branch) or Lamerough Creek. The corridor is characterised by poorly connected remnant vegetation, which is a result of land management practices utilised by various land owners.

At a larger landscape scale, the Bruce Highway forms a significant barrier to the movement of fauna to habitat areas to the west of the highway. Large areas of native bushland have been retained within the Beerwah State Forest to the west of the Bruce Highway. Bells Creek North and Bells Creek South currently pass under the Bruce Highway in culverts. . . The importance of these east-west links is recognised. Future works should be considered to enhance connectivity at these crossing points, however this will require multi-agency involvement in the development of solutions.

The proposed Eastern Wildlife Corridor, which stretches from the Alps in Victoria to the Atherton Tablelands in Queensland's north, is located to the west of the subject site. This corridor is intended to link existing National Parks and reserves along the entire route by encouraging landholders within the identified corridor to conserve existing vegetation and rehabilitate or regenerate degraded areas. The corridor is predicted to become increasingly important as global warming and climate change alter the natural ranges of some native fauna. The Eastern Wildlife Corridor suffers the same issues as the bio-regional corridor in that it

incorporates many properties that have been subject to differing land management.

Figure 4 shows the location and orientation of the wildlife corridors within and adjacent to Caloundra South.

3.5 Pumicestone Passage

The waterways within the Project Area discharge to Pumicestone Passage and Bells Creek, which form a Nationally Important Wetland and are also subject to the Ramsar Convention on Wetlands 1971 (**Figure 5**). The Project Area itself is not within the boundaries of the Ramsar Wetland, however the eastern border of the site is, on average, within 2km of the wetland boundary, and directly adjacent where it borders Bells Creek.

The Passage is recognised as a Fish Habitat Area (under the Queensland *Fisheries Act 1994*) and is known to support wading birds (many of which are listed as Threatened or Migratory under the NC Act and EPBC Act). The waders feed on the vast tidal flats formed by the build up of silt carried down by surrounding creeks and extensive habitat (seagrass meadows, mudflats, salt-marshes and mangrove communities) that occur throughout the passage.

Hence, the Pumicestone Passage is also an integral part of the CAMBA[2] and JAMBA[3] agreements, with at least 50 listed migratory species (Pumicestone Passage Advisory Taskforce: 2007) found in the Pumicestone Passage. The Passage also supports other important marine species such as turtles and dugongs.

Further investigations into migratory birds and Ramsar values are underway as part of the PER process.

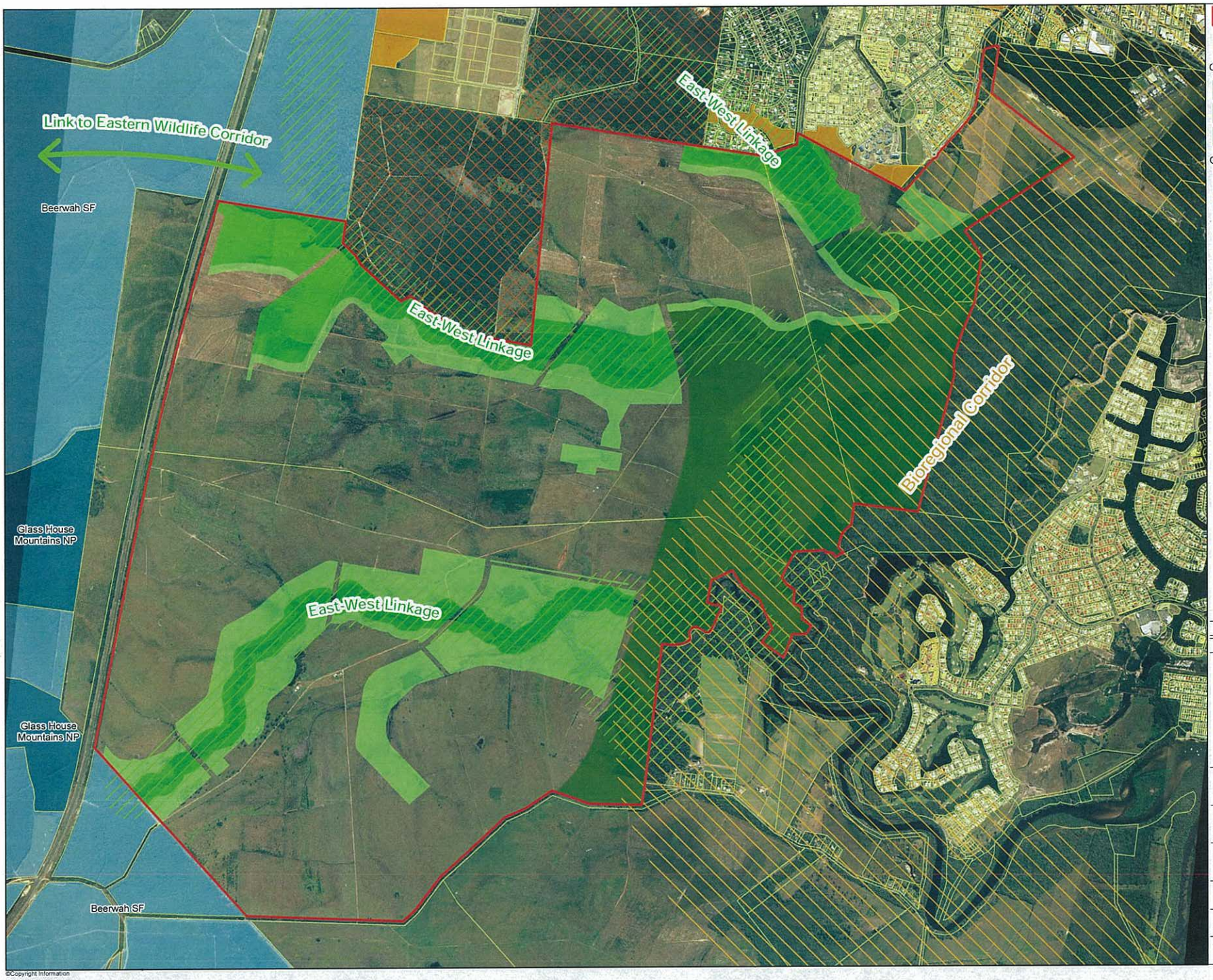
Bells Creek, which is outside of the Caloundra South UDA boundary, may also support habitat for the Water Mouse; investigations are currently being undertaken as part of the PER process to confirm this. As noted in section 3.2.3, the findings of these further investigations will be incorporated in future environmental management plans, which will be submitted with subsequent development applications.

4 Potential Threats and Core Ecological Values

Due to the inter-related nature of ecological values, key areas of the site often have two or more values. For example, intact riparian habitats along waterways act as important wildlife corridors, include remnant regional ecosystems (RE's) and contribute to the maintenance of water quality in downstream ecosystems. This implies that a riparian habitat may be subject to many different threats that will determine the appropriate management strategy for this area. Vegetation communities have been treated separately (as well as collectively) because whilst

[2] China Australia Migratory Bird Agreement (CAMBA)

[3] Japan Australia Migratory Bird Agreement (JAMBA)



Caloundra South site boundary

Cadastre

Caloundra South master plan:

- Sport and recreation
- open space buffer
- Environmental protection

QLD estate:

- National park
- State forest
- Bioregional corridor
- Local corridor
- SCRC Environmental Reserves
- SCRC owned land

Issue	Date	By	Chkd	Appd
2	31/05/2012	GJK	LCM	RB

Meters

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Job Title: Caloundra South Conservation Strategy

Drawing Title: Caloundra South Wildlife Corridors

Scale at A3	Drawing Status
1:25,000	Draft

Coordinate System: GDA 1994 MGA Zone 56

Job No	Figure No
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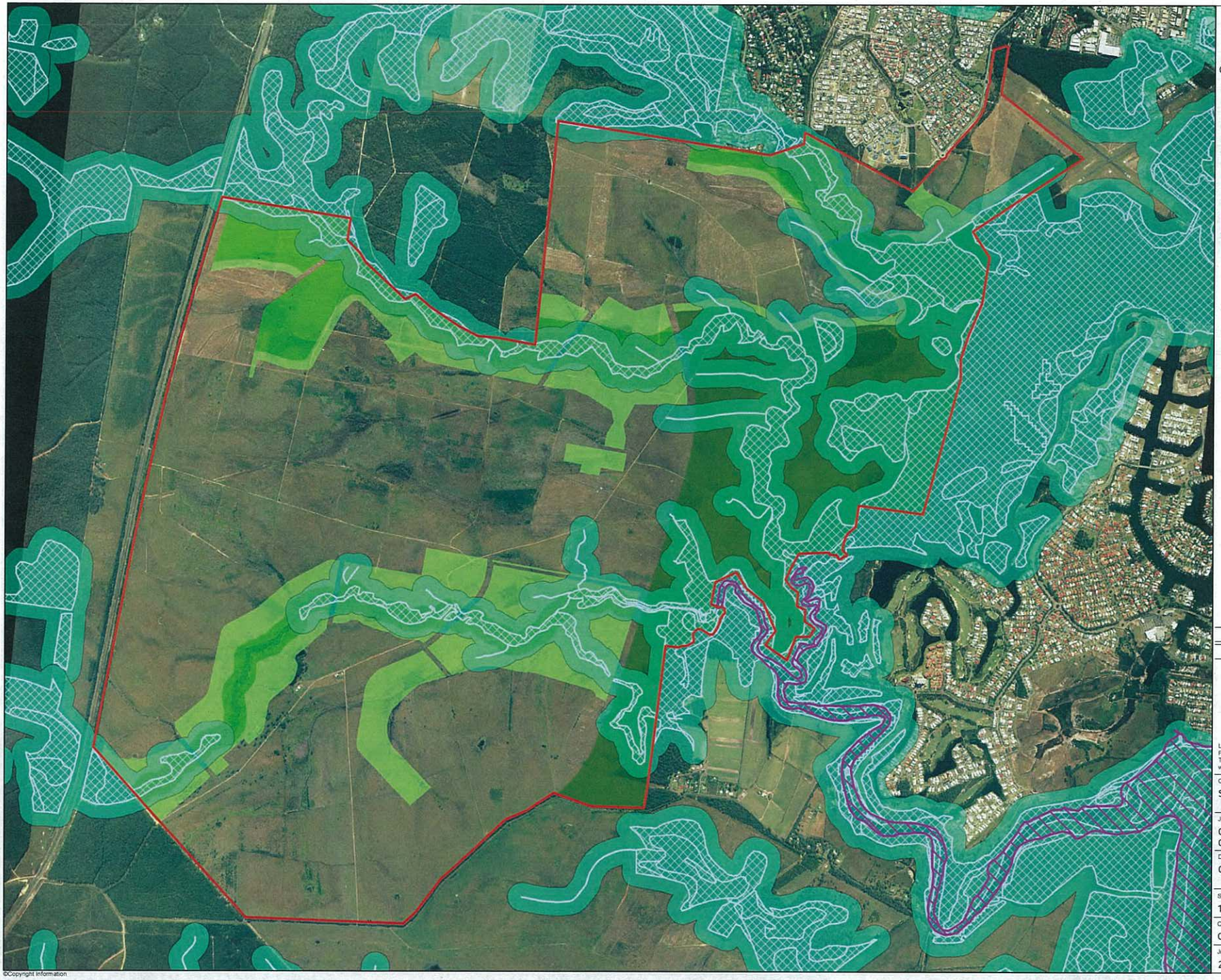

Caloundra South site boundary

Cadastre

Caloundra South master plan:

Sport and recreation

open space buffer

Environmental protection

WMA wetlands:

WMA wetlands trigger areas

RAMSAR wetlands

Issue	Date	By	Chkd	Appd
2	31/05/2012	GJK	LCM	RB

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Drawing Title
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Scale at A3	Drawing Status
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Coordinate System
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Job No	Figure No
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they are the key components in all core ecological values, each community is susceptible to different threats either because of its situation at Caloundra South or because of its natural vulnerabilities.

Despite large areas of the site being degraded, significant ecological values are still represented in some parts of the site and require protection and conservation. Table 4 lists the core values to be protected. It also identifies the potential for threats to these values that could occur as a result of development of the site, without mitigation or management.

Section 5 of this report (Table 6) outlines mitigation and measures that will be applied to remove or reduce the impact of potential threats. These will be documented in further detail in subsequent Environmental Management Plans lodged with future applications.

Table 4 Potential Threats to Ecological Values

Core Ecological Values	**Declining water quality**	**Changes to hydrology – increased flows, longer inundation and infrequent drying**	**Clearing for residential development**	**Linear Infrastructure**	**Weed invasion**	**Human Access**	**Feral and domestic animal invasion**	**Edge effects (impacts limited to the edge of ecosystems)**	**Fragmentation**
Waterways / Paperbark & Red Gum riparian forest	*	*		*	*		*	*	*
Heath / Wallum	*	*	*	*	*			*	*
Lowland rainforest					*				
Blackbutt open forest			*	*	*		*	*	*
Paperbark wetlands	*	*	*	*	*		*	*	*
Reedy drainage lines & Open Water	*	*	*	*	*		*	*	*
Wildlife/Waterway Corridors		*	*	*	*		*	*	*
Significant Species	*	*	*	*	*		*	*	*
Wallum Frogs	*	*	*	*		*	*	*	*
Grey-headed Flying Fox			*	*					
Freshwater fish	*	*		*	*	*	*		
Migratory birds	*		*	*	*	*	*		
Flora	*	*	*	*	*	*	*	*	*
Pumicestone Passage	*	*				*			

5 Land-use Planning

The Caloundra South Master plan uses land use planning mechanisms to protect the core ecological values of the site by designating key areas for conservation. These areas align with the CD vision Map 2 of the Development Scheme. The Conservation Network itself will be split into Environmental Protection (Section 5.1) and Open Space (Waterway Buffers, Section 5.2) land-use types. Areas of Sport and Recreation land will also be able to support some ecological function where significant features are currently present. Table 5 below summarises the proposed land-use types.

Table 5: Caloundra South proposed land-use types and area

Land Use
Centres – District Centres
Centres – Neighbourhood Centres
Centres – Retail Core
Commercial & Office
Community -Education
Community - Health
Industry & Business
Mixed Residential
Showroom
Urban Living
Road
Recreation
Sport
Environmental Protection
Open Space (Waterway buffer)

Ecological restoration is proposed to be carried out within all Open Space Waterway Buffer areas adjacent to Bells Creek North, Bells Creek South and Lamerough Creek and all Environmental Protection Areas.

5.1 Environmental Protection

The Environmental Protection area provides a minimum of 440ha for the protection of land to maintain biodiversity, ecological processes, water quality, landscape character and community wellbeing. The Environmental Protection land use relates to areas of core ecological value, including:

- High value habitats;
- Essential habitat for significant species; and
- Part of the Bells Creek North, Bells Creek South and Lamerough Creek waterway corridors.

The Environmental Protection area excludes activities that will result in the removal of native vegetation, with the exception of the construction of necessary linear infrastructure to provide essential services to the broader development area. For example, clearing of vegetation may be required for the construction of a waterway crossing for a road, sewerage, electricity or communications. Prior to clearing it must be demonstrated that the infrastructure is essential and that no alternative suitable location exists.

As well as maintaining existing remnant and regrowth vegetation, revegetation of cleared areas will be undertaken to enhance the existing values of this area. For further details refer to the *Caloundra South Ecological Rehabilitation Strategy* (Appendix A).

The Environmental Protection area along the eastern boundary of the Caloundra South site has been designed and located to ensure the protection of a diverse range of vegetation and habitat types. Within this area there are areas of open eucalypt forest, paperbark forest and swamp, wallum and heath. Of significance within this area is a patch of Blackbutt (mixed open eucalypt forest), that corresponds with endangered remnant regional ecosystem 12.3.1. This remnant patch has been located within the Environmental Protection area to provide for suitable protection against indirect impacts associated with edge effects. A minimum buffer of 30 metres has been provided from the adjacent residential areas.

Activities that are compatible with Environmental Protection area include:

- Retention of existing native vegetation;
- Revegetation and habitat enhancement within areas that are not currently vegetated, including additional wetland habitat creation;
- Management of weed and pest species;
- Routine burning to promote a natural fire regime; and
- Low-impact recreation trails.

The extent of these activities are described in detail in Section 6.0.

5.2 Open Space

With the proposed CS structure plan the Open Space (Waterway Buffer, Recreation and Environmental Protection areas) ~~zoning~~ area provides a land use type in which the requirements for the protection of the natural environment from surrounding development and the safety of the neighbouring community can be achieved. The function of the Open Space Waterway Buffer area is to protect and conserve remnant vegetation, protect habitat areas for significant flora and fauna, buffer the waterway corridors and significant habitat areas within the site and to provide fauna connectivity (wildlife corridors). As well as retaining and protecting existing ecological features, the open space network also allows for large areas of revegetation and restoration.

To improve the habitat and fauna connectivity associated with Bells Creek North, the proposed Master Plan allows for an average 200m wide Open Space

Waterway Buffer, that will generally consist of a ~~100 metre wide~~ core revegetation corridor ~~measured 50 metres either side of the creek centreline,~~ with low-impact activities, water sensitive urban design measures and infrastructure ~~able to~~ may be located in the outer ~~50 metres~~ of this 200 metre buffer. This buffer area has been widened along some sections of Bells Creek North to increase opportunities for fauna habitat protection and provide opportunities for fauna movement and refuge. The extent of works within this buffer area will be further defined through environmental management plans developed as part of the PER, and detailed design as part of future applications. The Rehabilitation Plan included in Appendix A defines the strategy for rehabilitation within these areas and is expected to be supplemented by the outcomes of the PER assessments and frog management strategy.

Lamerough Creek will consist of a similar revegetation and land use configuration as open space areas along Bells Creek North. The Open Space Buffer has also been extended to the west along the northern edge of the site to enhance fauna movement opportunities.

The Bells Creek South riparian zone will be retained and enhanced as part of the Master Plan. It has value as core habitat and the provision of water treatment. This strategy locks in a viable east-west corridor for potential future linkages if the pine plantation is decommissioned and restored as native habitat. The Master Plan allows for a revegetated corridor with a minimum width of 100 metres with a ~~50 metres~~ core revegetation corridor, with low-impact activities, water sensitive urban design measures and infrastructure located outside the core corridor. The extent of works within this buffer area will be further defined through detailed design as part of future applications. The Rehabilitation Plan, included in Appendix A defines the strategy for rehabilitation within these areas, is expected to be supplemented by the outcomes of the PER assessments and frog management strategy. This buffer area may also be extended along sections of Bells Creek South to protect fauna habitat and provided opportunities for fauna movement and refuge.

The Caloundra South Master Plan allows for the retention of these corridors, as well as an enhancement in the total width and quality of riparian vegetation and associated habitats. The long term viability of these corridors will be dependent on rehabilitation works and careful management of activities and uses adjacent to these corridors. The placement of Sport and Recreation land adjacent to the Waterway Open Space Buffer area is intended to provide further protection to the fauna movement corridor function of these areas.

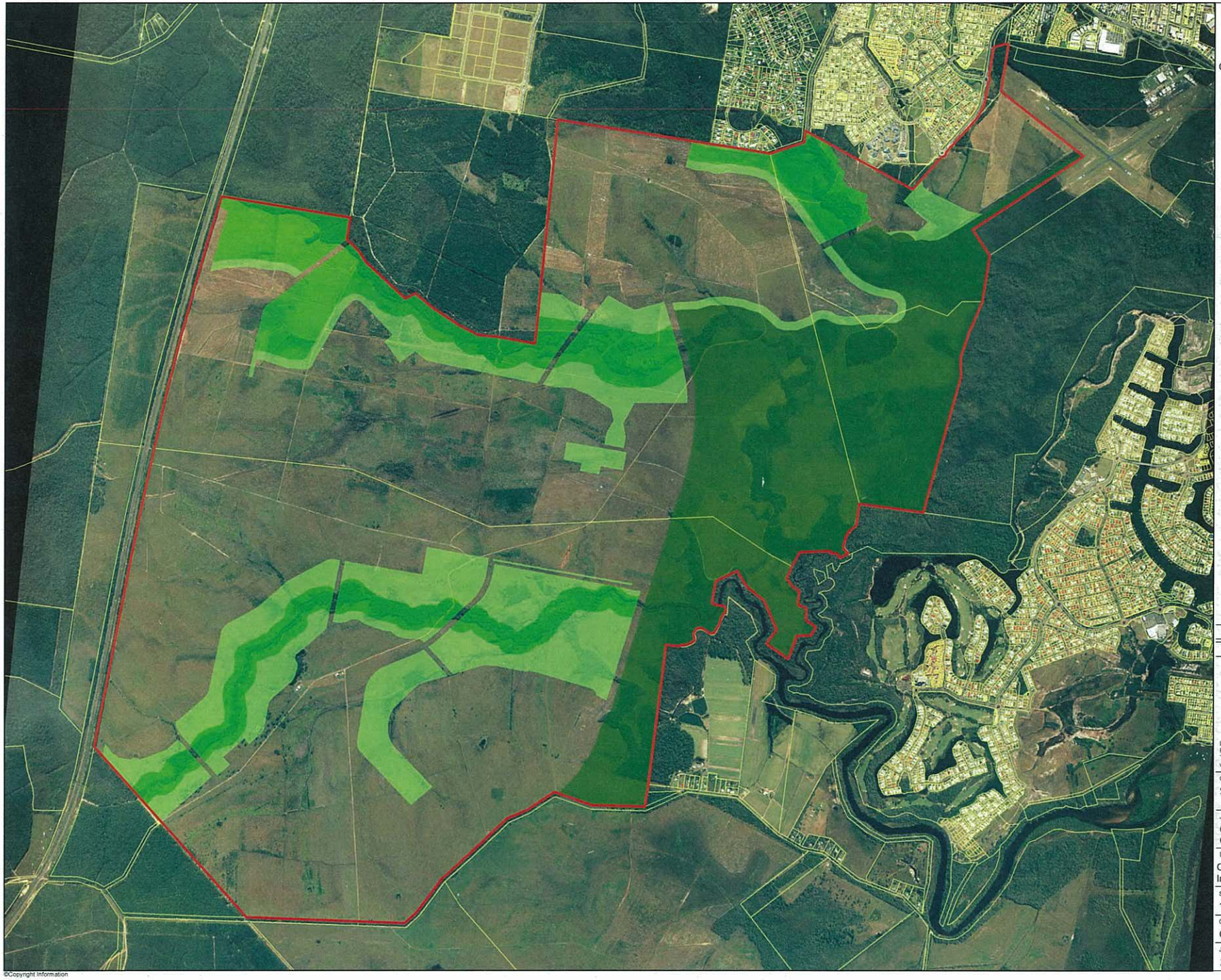
The Open Space Waterway Buffer is also intended to mitigate against several potential threats, including:

- Declining water quality (including changes to pH, nutrients and sedimentation);
- Changes in hydrology (increased flows, longer inundation and infrequent drying);
- Habitat fragmentation; and
- Edge effects to conservation areas.

Bordering the Open Space Buffer Land Use Area along the waterways is the Sport and Recreation Land Use Area, which provides further buffering of significant areas from urban development. The Open Space Waterway Buffer and Sport and Recreation land Use Areas provide for 'green corridors' throughout the site (**Figure 6**). An example cross-section of a typical buffer on the development is shown in **Figure 7.**

Development is generally excluded from the Open Space Waterway Buffer areas except recreational, water sensitive urban design and other passive uses that do not result in significant earthworks (filling), a significant increase in impervious surfaces and/or reduction in water quality. Activities that are likely to be compatible with the open space areas include:

- Revegetation or landscaping with native species;
- Provision of stormwater management devices beyond the core revegetated zone as described in Section 5.2.1
- Passive open space;
- Recreation ;
- Community Facilities; and
- Some forms of public art.



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Drawing Title
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Indicative Green Space Corridors

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Coordinate System
GDA 1994 MGA Zone 56

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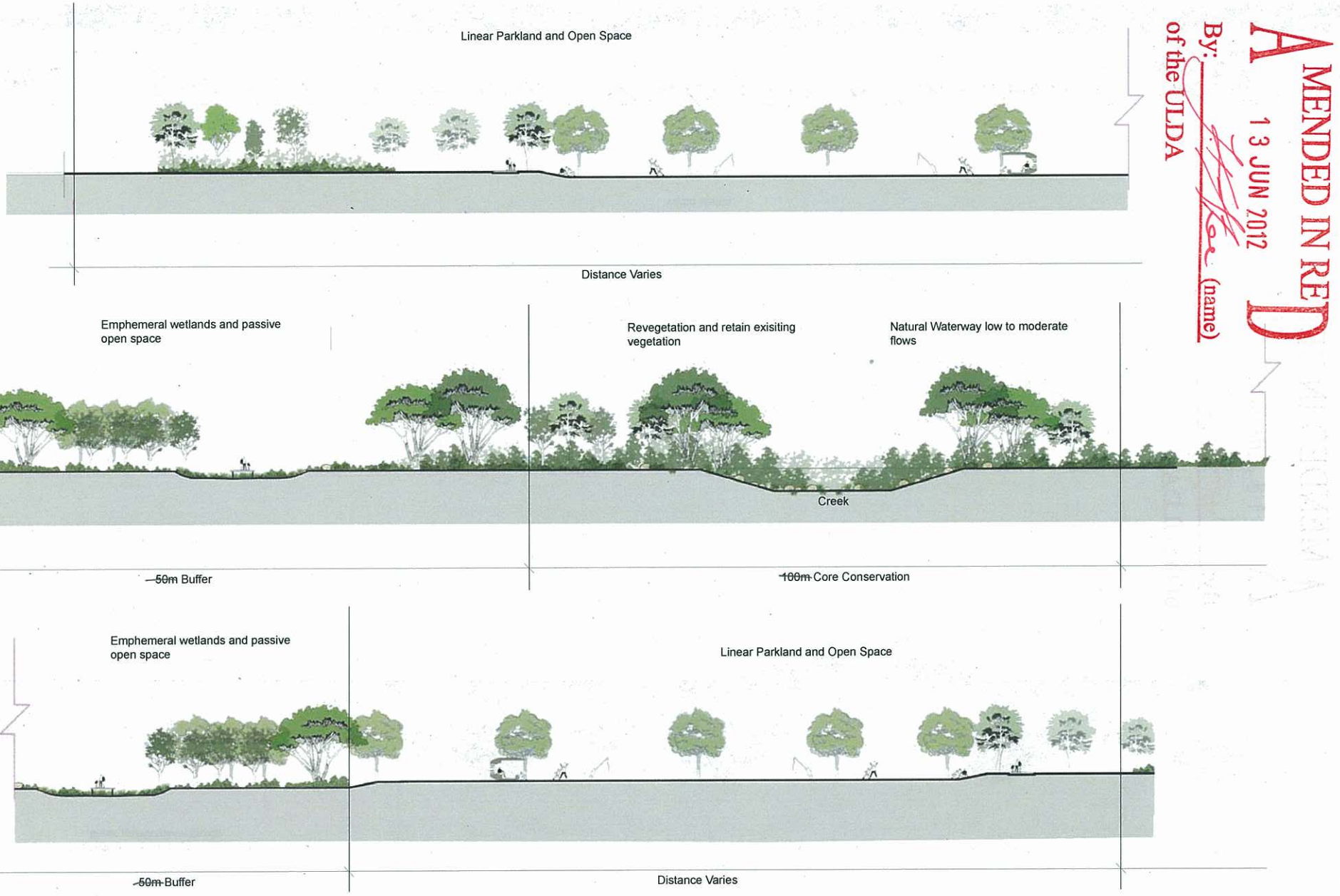

Indicative
~~Caloundra Downs South~~
Lamerough Creek and Bells Creek North Concept Section

(subject to further detailed groundtruthing + investigation)

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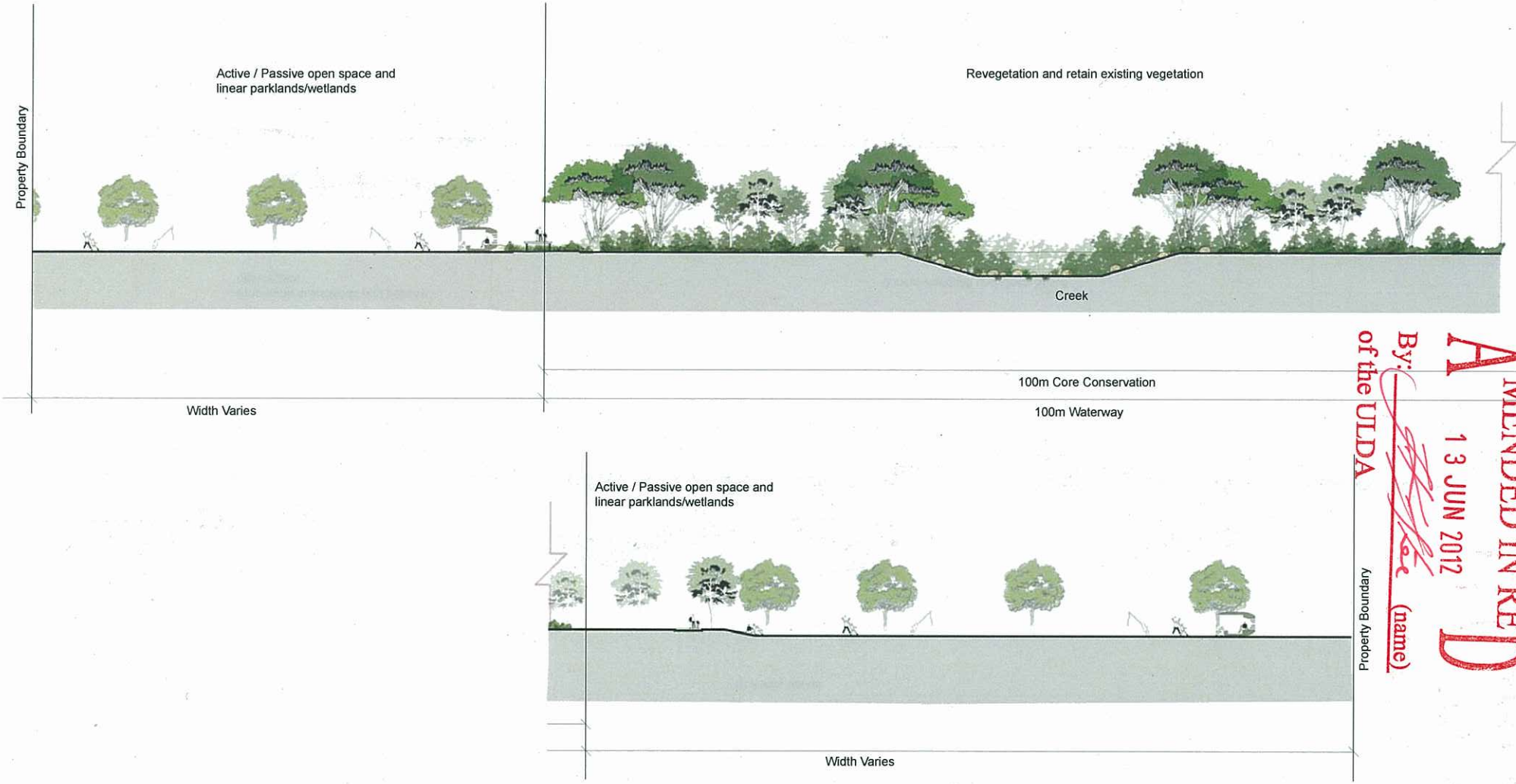

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6 Planning Framework

The Urban Land Development Authority (ULDA) Development Scheme provides guidance in a number of areas on conservation requirements for the site, including a vision, Urban Development Area (UDA) wide criteria and conservation provisions. These have been taken into consideration in the preparation of this document. Table 6 describes how the Conservation Strategy directly responds to the UDA Wide criteria in Section 3.0 of the Development Scheme.

The Vision for the site (Map 2 in the gazetted Development Scheme) proposes that the Eastern side of the site is conserved in an Environmental Protection Zone. Its purpose is to protect areas of environmental significance and 'associated conservation, biodiversity, habitat or scenic amenity values'. It limits use of the site to low impact, low intensity land uses and provides opportunities for habitat improvement. ~~It also allows multi-purpose functions for community needs (including parks, and utility installations) provided they don't compromise environmental values~~.

The key conservation objectives for Caloundra South as defined in the UDA Development Scheme are:

- Protection and support of the regional and national biodiversity values external to the UDA in the Pumicestone Passage;
- Development within Caloundra South provides for the enhancement of natural ecosystems and biodiversity values; and
- A comprehensive open space network ensures important ecological and scenic values are protected and enhanced.

Table 6: Relevant UDA Site-wide Criteria for Caloundra South Conservation Strategy

Strategic UDA Criteria	Proposed Actions
Retaining where possible locally significant wetlands, remnant vegetation and habitat for fauna	All wetlands, as mapped in the DERM Wetland Info database, will be retained within the Environmental Protection, Open Space (Waterway Buffer) and Sport and Recreation land use types (refer to Figure 1). Water Sensitive Urban Design measures proposed for the project (in areas zoned for Open Space purposes) will include the construction of ephemeral wetlands for the purposes of water quality treatment. This features will be designed to include additional habitat for significant fauna species. All surveyed remnant vegetation, as mapped in the approved Property Map of Assessable Vegetation (PMAV 2008/009340) will be retained within the Environmental Protection area, with the exception of infrastructure corridors. Mapped remnant Regional Ecosystems not subject to the PMAV mapping will also be retained within the Open Space Buffer areas associated with Bells Creek North, Bells Creek South and Lamerough Creek (with the exception of areas required for infrastructure corridors). High value habitat for fauna has been retained within the Environmental Protection and Open Space land use types. The following high value habitat types have been identified across the site and retained within Environmental Protection and Open Space land use types.: • Wallum - 37ha • Melaleuca/Forest Red Gum riparian habitat - 111.9ha • Heath - 7.1ha • Lowlands rainforest - 1.2ha • Blackbutt (mixed eucalypt open forest) – 25.1ha • Reed dominated drainage lines – 27ha • Melaleuca swamp – 105.2ha • Paperbark and pine regrowth – 8.1ha Habitat has been retained for significant fauna species that are known to utilise the site, or are highly likely to occur within the site. These habitat areas provide for a broad range of habitat resources (i.e. foraging, breeding, nesting, roosting) across the site. These areas will be rehabilitated where necessary, as outlined in the Ecological Rehabilitation Strategy (Appendix A). The land-use plan allows for the provision of habitat for the following significant species: • Acid Frogs (Wallum Sedge Frog, Wallum Froglet, Wallum Rocketfrog) within the Heath, Wallum, Melaleuca swamp and some reed dominated drainage lines. A Frog Management Plan is currently being prepared as part of the response to the PER guidelines, to determine the specific habitat needs of Acid Frogs appropriate management and conservation actions,. This will be applied to future applications and development outcomes. • Grey-headed Flying Fox within the Blackbutt (mixed open eucalypt forest), Lowland Rainforest and Melaleuca swamp areas

Strategic UDA Criteria	Proposed Actions
	• Osprey and White-bellied Sea Eagle within the Melaleuca/Forest Red Gum riparian zones. • Terrestrial migratory species such as the Rufous Fantail, Black-faced Monarch and Spectacled Monarch within the Blackbutt (mixed open eucalypt forest), Melaleuca swamp and Lowland Rainforest areas. • Native freshwater fish within waterway corridors.
Enhance wetland communities as part of the rehabilitation of ecological corridors	The Caloundra South Ecological Rehabilitation Strategy (Appendix A) provides for the rehabilitation of the riparian corridors associated with Bells Creek North, Bells Creek South and Lamerough Creek. Within these areas the proposed vegetation management strategies include installation of new vegetated areas, assisted regeneration of regrowth areas and enhancement of existing remnant vegetation communities. Much of the mapped wetland communities within these corridors are within the Open Space Buffer land-use type and existing wetland communities will be retained and enhanced. To enhance areas of existing wetlands the ecological corridors planting and regeneration techniques will be specific to the wetland communities where present. Management will include weed treatment, assisted regeneration and planting with wetland specific species. A bioregional corridor to the east of the Caloundra South UDA provides connectivity between the Bribie Island National Park and the Environmental Protection area of Caloundra South. Restoration works within the Environmental Protection area will include management. Wetland communities are obviously dependent on the maintenance of water quality and hydrological regimes. The Stormwater Management Plan prepared by WBM describes how these water regimes will be maintained to protect wetlands within the site. Water Sensitive Urban Design measures will include the creation of additional wetland habitat through the installation of ephemeral wetlands for the purposes of water quality treatment.
Provide ecological corridors and linkages, including to areas outside the neighbourhood or community	The Bells Creek (north and south) and Lamerough Creek riparian corridors have been retained within areas of Environmental Protection and Open Space Buffer. Further protection for these corridors is provided through Sport and Recreation zoned land that flanks the waterway corridors (zoned as Open Space). The bioregional corridor to the east of the Caloundra South site will be improved through the retention of the Environmental Protection area and restoration works within these areas. The Bruce Highway remains a major barrier to wildlife movement along this corridor. There may be opportunities to enhance habitat connectivity, however this aspect will require multi-agency involvement in the development of solutions.
Provide new planting that comprises predominantly endemic species	The intent of the Caloundra South Ecological Rehabilitation Strategy (Greening Australia 2011) is to manage the vegetation within the Environmental Protection and Open Space areas so that they reach remnant status. To achieve remnant status under the VMA it will be necessary to utilise endemic species that occurred within the mapped pre-clearing REs. A seed collection regime has already commenced to provide source plants that are of local providence and supplement the existing vegetation on site.
Provide corridors of	A 100m corridor associated with Bells Creek South and a 200m corridor associated with Bells Creek North and Lamerough

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By: (name)
of the ULDA

Strategic UDA Criteria	Proposed Actions
sufficient width to protect and improve the ecological function of these corridors (including 100m corridor across Bells Creek South, 200m across Lamerough Creek and 200m across Bells Creek North)	Creek have been protected within the Open Space land-use. Bells Creek North and Lamerough Creek are wider than Bells Creek South due to their inclusion in the bio-regional corridor and relative importance in comparison. These two corridors will be heavily vegetated to provide a core conservation zone ~~of approximately 100m width~~, with ~~50m either side~~ the outer edges being utilised where required for stormwater management devices, passive open space or pedestrian/cycle paths. The total width of the green space corridor has been enhanced through the placement of Sport and Recreation land adjacent to the corridors associated with the creek systems. Where feasible, these areas will be provided with landscaping utilising native endemic vegetation. The mapped widths of 100m and 200m are considered sufficient to maintain ecological connectivity within the riparian corridors of Bells Creek and Lamerough Creek. Land use within the Sport and Recreation land will include lower intensity practices. This will assist in further buffering the core corridor area protected within the Open Space – Buffer zones.
Immediate waterway corridor adjacent to the creek top of bank is to be retained for environmental protection	Within the Open Space corridor, a core 100m area either side of the creek will be retained for core conservation purposes, with vegetation either retained or rehabilitated. Land at the landward edges of the Open Space corridor (~~50m either side of the core 100m conservation zone~~) will be utilised where required for stormwater management devices, passive recreation or pedestrian/cycle paths.
Riparian corridors of Lamerough Creek, Bells Creek North and South will be subject to extensive rehabilitation works to enhance habitat values	The existing riparian corridors associated with Lamerough Creek, Bells Creek North and Bells Creek South are currently mapped as containing remnant Regional Ecosystems. The Caloundra South Ecological Rehabilitation Strategy (Greening Australia 2011) outlines a number of vegetation management strategies designed to enhance the habitat values of the riparian corridors. Where remnant vegetation is present within the corridors weed management is proposed to be carried out to maintain the quality of the existing remnant vegetation. Non-chemical management measures may be required where there is the potential for water quality or habitat impacts. A combination of assisted regeneration and planting works are proposed to be implemented where regrowth or degraded vegetation is currently within the riparian corridors. Regrowth management will again focus on weed treatment to allow native vegetation to establish from the existing seed bank. Planting installation will utilise endemic plant species within the ground, shrub and tree layer. These management techniques will assist in the development of a natural vegetation community that will provide habitat for fauna and flora.
Corridors will contain a diversity of habitat types to provide wildlife connectivity and linear habitat	The existing riparian corridors associated with Lamerough Creek, Bells Creek North and Bells Creek South contains a diversity of habitat to support both aquatic and terrestrial fauna and flora. The corridor widths of 100m and 200m have been determined to ensure appropriate habitat values and wildlife connectivity can be maintained within these areas. The Rehabilitation Strategy will also incorporate management and revegetation techniques designed to ensure remnant status is achieved for the vegetation communities within the corridor. Target vegetation communities have been determined based on the existing regrowth characteristics and the pre-clearing Regional Ecosystem mapping. Habitat types within the riparian corridors will include Melaleuca/Forest Red Gum forest, Melaleuca and Swamp Mahogany Open Forest, wetland, wallum and heath. This diversity of habitat types will provide for fauna movement and connectivity for a high diversity of wildlife species, including the identified significant species that are known to occur on the site.

Strategic UDA Criteria	Proposed Actions
Fauna refuges are to be located adjacent to Bells Creek North and South to provide a safe haven for fauna during rainfall	The habitat areas associated with Bells Creek North South are predominantly composed of Melaleuca/Forest Red Gum/Swamp Mahogany open forest and wetlands. These habitat areas are adapted to ephemeral inundation. The majority of areas within the green corridors of Open Space Buffer and Sport and Recreation land within Bells Creek have been designed to be above the Q100 flood levels. Within Bells Creek South the areas of ecological restoration proposed within the Sport and Recreation land serves this purpose. Fauna movement solutions will be provided within the road infrastructure to ensure connection with the intact Environmental Protection area to the east.
Development adjacent to the green space network must address potential edge effects	Potential edge effects will be mitigated along Bells Creek North, Bells Creek South and Lamerough Creek by the placement of Sport and Recreation land adjacent to the core corridor and buffer area. The uses associated with Sport and Recreational land result in less impact than residential, commercial and industrial land-uses. Open Space and recreation areas located adjacent to the habitat area minimise edge effects through: • Landscape and amenity plantings comprising of native vegetation; • Turfed, open space grass areas and ephemeral wetlands provide for treatment of stormwater runoff; • Reduced light and noise impacts; • Reduced potential for weed intrusion due to management of parklands; and • Reduced impacts from litter and pollution. Sport and Recreation land can also provide marginal habitat resources for flora and fauna through the retention of habitat features and landscaping with endemic flora in some locations. Potential edge effects on the Environmental Protection area are likely to arise as a result of the adjacent transport corridor. Impacts may include elevated levels of noise and light, pollution in stormwater runoff, corridor fragmentation and fauna injury and mortality by vehicle strike. These impacts can be mitigated through: • Installation of fauna fencing; • Wildlife crossing structures • Stormwater treatment devices within the road reserve; • Installation of noise walls; and • Planning of lighting to avoid light spill over into the Environmental Protection area.

7 Environmental Management Strategies

The establishment of a conservation network via land use planning mechanisms provides a framework for the preservation the core ecological values at Caloundra South. However, adopting a policy of leaving the vegetation unmanaged will not guarantee the survival of the vegetation communities. The threatening processes of weed invasion, inappropriate fire regimes, feral animal invasion and altered hydrology would continue. Restoration and management, rather than simply preservation, is required.

Restoration will involve revegetation, creation of essential habitat, ensuring connectivity for wildlife movement, control of exotic weeds, pest control, managing fire regimes and water quality. Maintenance of hydrological regimes is also an essential part of the management of the conservation areas on site.

Details of the Environmental Management Strategies that will be necessary to Minimise conservation threats are described below.

7.1 Water Quality and Hydrology Buffers

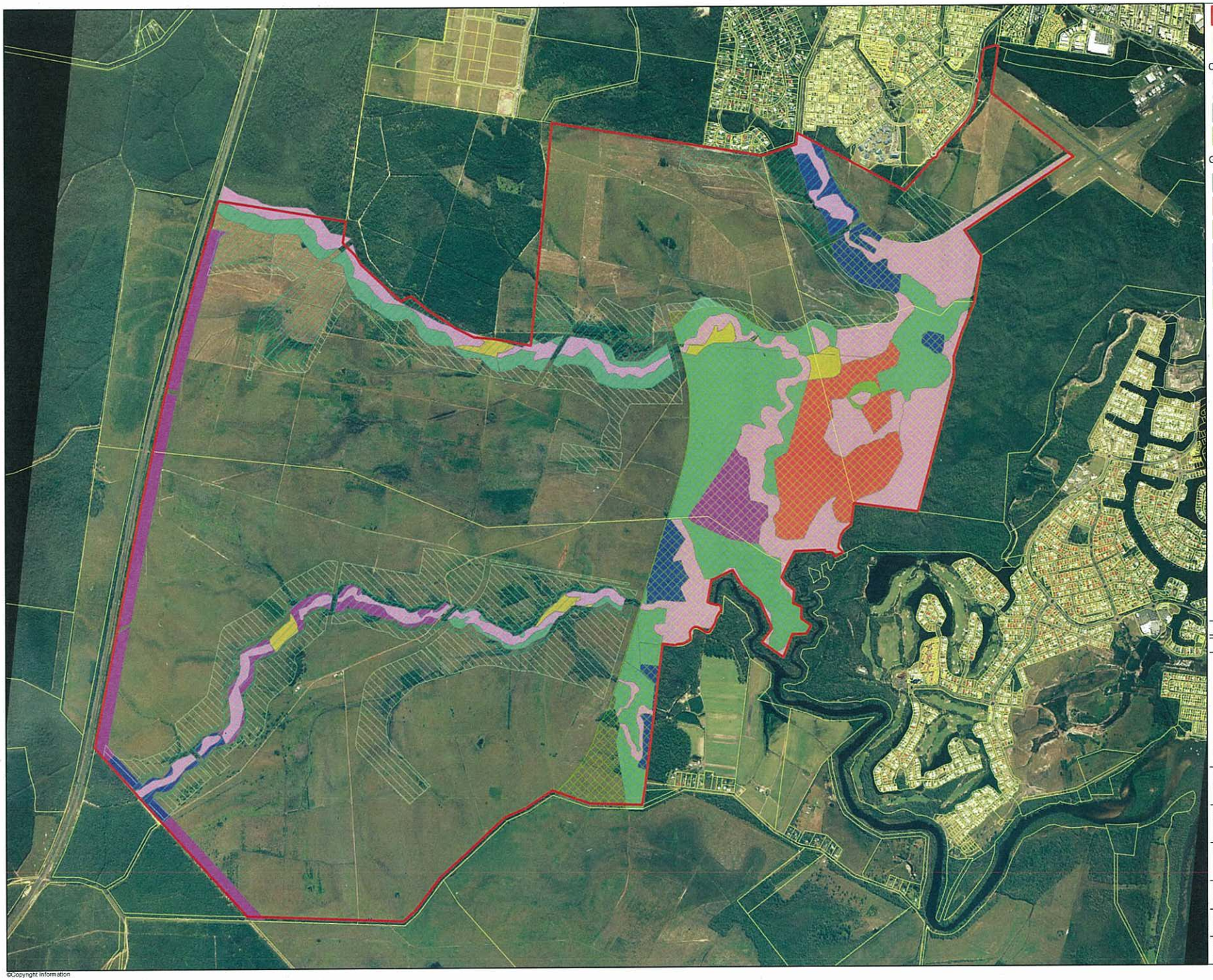
Caloundra South supports waterways and catchments that flow to and contain areas of significant wetlands. There are two types of wetlands on the site, i.e. Paperbark (*Melaleuca spp.*) dominated wetlands and wet heath (including wallum). These types of wetlands also exist directly to the east of the site. All wetlands rely on periodic inundation and drying times and are adapted to absorbing a certain amount of nutrients. Typically, Paperbark wetlands are subject to a higher level of flooding and nutrient recharge when compared to heath land. Excessive stormwater flows and nutrient loads to Paperbark wetlands can cause eventual dieback of the vegetation, whereas heath lands can undergo an eco-tonal shift that results in the heath land being lost to Paperbark wetland.

Hydrological modelling is currently being undertaken as part of the PER process to determine likely changes. This is further outlined in the Stormwater Management Plan (WBM:2011) included in the master plan.

7.2 Revegetation & Rehabilitation

The proposed revegetation and rehabilitation areas (refer to the attached Rehabilitation Plan for further details) consist of areas of mapped remnant vegetation that are outside of the recognised PMAV (**Figure 8**). These areas have been identified as degraded vegetation communities, suffering weed invasion and other edge effects. However, they still have core ecological value as habitat for significant species, waterway protection and/or wildlife corridors.

The strategic focus of revegetation and rehabilitation at Caloundra South will also protect and strengthen existing corridors along Lamerough Creek, Bells Creek (north) and Bells Creek (south) to facilitate fauna movement in an east-west direction. These corridors are vital to allow fauna movement between coastal areas and the forests further inland. Revegetation / rehabilitation of areas along the eastern boundary of the site will contribute to the Pumicestone Passage



Caloundra South site boundary

Cadastre

Caloundra South master plan:

- Sport and Recreation
- Open space buffer
- Environmental protection

GA Restoration Plan:

- Assisted regeneration
- Assisted regeneration, regrowth management
- Biohub
- Installation
- Regrowth management
- Regrowth management, installation
- Remnant enhancement

Issue	Date	By	Chkd	Appd
2	31/05/2012	GJK	LCM	RB

Meters

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Client
Stockland

Job Title
Caloundra South
Conservation Strategy

Drawing Title
Caloundra South Revegetation Plan

Scale at A3	Drawing Status
1:25,000	Draft

Coordinate System
GDA 1994 MGA Zone 56

Job No	Figure No
222431-01	008

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Bioregional Corridor, and strengthen the opportunities for north – south corridors.. The protection and restoration of wetlands, wallum and heath areas in the north-east of Caloundra South will add to the diversity of vegetation communities currently represented within the wildlife corridor. This will encourage a greater diversity of species to utilise the corridor.

The areas marked for revegetation and rehabilitation require management to reach their full ecological potential. Areas for rehabilitation require weed management and supplementary planting, while areas marked for revegetation are currently mostly devoid of native vegetation and will require site preparation, mulching, planting and on-going maintenance. The proposed revegetation and rehabilitation will increase the area of high quality remnant vegetation available to biodiversity in the long term, providing the site with greater species richness and diversity. The strengthening of degraded ecosystems may also make it possible to re-introduce some significant flora and fauna species that would have originally occurred on the site pre-clearing.

Revegetation and habitat creation will focus on the use of flora species that will expand the extent of existing ecosystems, provide suitable buffering to existing high value vegetation and provide habitat for significant species known to exist on site, particularly acid frogs.

The Rehabilitation Strategy provides an intent in relation to future rehabilitation activities, however it is likely to be updated as part of subsequent applications to reflect ongoing investigations and assessments.

7.3 Enhancement of Habitat

In its current state, Caloundra South represents a site that is relatively poor in native vegetation and native species diversity with only 20 – 60% of native species likely to be remaining on site and the majority of these occurring on approximately 12% of the site. Hence, there is a real need to increase native vegetation planting at Caloundra South and restore some of the disused agricultural land to its natural state. The rehabilitation of areas within Environmental Protection and Open Space areas provides an opportunity to increase the representation of native species at Caloundra South, which would benefit all native fauna (especially significant fauna) and meet the requirements of the vision for the development outlined in Section 1.0 of this document.

As mentioned in Section 2.2, the subject site has the potential to support a variety of significant species that rely on wetland and heath (wallum) habitats. Previous studies specifically mention, the potential for rehabilitation / revegetation of the site to contribute to the area of breeding habitat available to species of acid frogs.

The proposed Master Plan and ecological rehabilitation plan has allowed for the retention of a wide range of habitat types to enhance the availability of habitat across the site.