



**KOALA BEACH
HABITAT RESTORATION PLAN
REVISED**

OCTOBER 2015

Prepared for the Koala Beach Wildlife and Habitat Management Committee

Cover: Aerial photograph Koala Beach and surrounds



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1 Background

The Koala Beach Estate is a residential development in Tweed Shire, located between Pottsville and Hastings Point. The estate includes 499 residential lots and two rural residential lots within 87.52 hectares of the 364 hectare site.

Koala Beach Estate is bounded on the east and southeast by the estuarine Cudgera Creek and on the north and northwest by Christies Creek. The overall property comprises – 365 ha and spans the south-eastern corner of land west of Cudgera Creek. Low-lying land to the west of the site is largely cleared and devoted to grazing and cultivation of sugar cane. Tweed Bicentennial Environmental Park adjoins Koala Beach to the south and reserves an area of native vegetation west of Cudgera Creek.

Prior to 1996 the Koala Beach Estate and surrounding areas were predominantly used to graze cattle. Apart from the original homestead there were no residences on the site, access was limited, and there was little human activity. Prior to construction of a bridge across Cudgera Creek to facilitate development of Stages 1 and 2, vehicular access was restricted to a low-standard track from Round Mountain Road. A small area devoted to banana growing in the north of the site had been abandoned.

The majority of the southern 80 hectares now under residential development was previously cleared of the original forest communities and is interspersed with mixed exotic and native grassland, stands of native woodland or isolated native trees and parklands. Extensive swamp sclerophyll forest in the southern part of the site was previously cleared (likely 40 to 50 years ago) and now supports regenerating stands, presumably representative of original plant communities.

The fire history of the site is not recorded, however scarring on trees and the nature of the understorey suggests a relatively high frequency of low intensity burns prior to commencement of the Koala Beach development. The fires were probably used to promote ground layer growth for grazing purposes.

2 Scope of the Plan

This Habitat Restoration Plan (revised 2012) was prepared as a recommendation and action within the Overall Management Guidelines for the Koala Beach Wildlife and Habitat Management Committee (Bushland Restoration Services 2009). The preparation of the original Habitat Restoration Plan (Bushland Restoration and Rehabilitation Pty. Ltd. 2004) was recommended in the revised Koala Beach Koala Plan of Management (AKF 2004).

The revision (2012) of the Plan involved consultation with Tweed Shire Council officers from the different departments and officers with interest in the management of open space, infrastructure and bushland in Koala Beach. These interests included Natural Resources (Bushland Officer, Biodiversity Team Leader, Feral Animal Officer, and Community Support Officer), Recreation Services (Manager, Coordinator and Supervisor) and Engineering Services (Manager of Works). A second revision (2015) of the Plan has involved the update of the works program and actions.

The division of the site into Work Zones was initially based on the boundaries of the work units defined in the 2004 plan. Boundaries have been modified where necessary to take into consideration the restoration undertaken over the six year period to 2010, other management activities and changes such as clearing for Asset Protection Zones (APZ's) and management of drainage lines and reserves.

Restoration activities included in the Plan incorporate actions and recommendations from the Overall Management Plan (2009) and individual threatened species, flora and fauna, monitoring programs.

The 2004 Plan provides details of vegetation communities and distribution of weeds prior to commencement of on ground restoration activities in 2004. This plan supersedes the 2004 plan.

The Overall Management Guidelines (2009) incorporate all the ongoing management requirements from the separate species, habitat and environmental management plans and conditions of development consent. Actions from the Overall Management Guidelines have been incorporated into the restoration activities in this Plan. For the purposes of this Plan the timing of implementation of actions has been updated. A summary of the actions is included in **Appendix 1** with relevant actions highlighted.

3 Purpose and Objectives

The purpose of the revised Plan is to provide a coordinated approach to the on-ground habitat restoration of public lands on the Koala Beach Estate consistent with the Overall Management Guidelines (2009).

The objectives of the revised Plan are to:

- identify and map areas of public land into homogenous Management Classes according to the distinctive, on-ground management regimes required by each class. Responsibility for implementation of management actions should be assigned to the appropriate section within Tweed Shire Council;
- map specific work units (Zones) within each management class and document the site-specific management required for each Zone;
- to provide guidance on habitat restoration standards and procedures;
- to provide on-ground guidance on planting of street trees within the Estate;
- to identify opportunities to promote community involvement in the implementation of restoration actions;
- to propose management prescriptions to improve the current condition of Threatened Species habitat and identify additional areas suitable for expansion of habitat for known populations;
- to provide a prioritised Action Implementation Schedule; and
- to provide a monitoring and reporting framework.

4 Management Classes and Responsibility

To achieve the objectives of this habitat restoration plan (refer **Section 3**) the site was divided into seven homogeneous parts (Management Classes) that require distinctive management regimes – taking into account prescribed existing management, current practice, the section within Tweed Shire Council responsible for implementation of on-ground works and proposed new management prescriptions.

The seven Management Classes are:

1. Bushland / Habitat
2. Existing and proposed plantings of native forest;
3. Core Hairy Joint Grass *Arthraxon hispidus* management area
4. Buffer to Hairy Joint Grass management area
5. Bushfire Asset Protection Zones;
6. Local Parks and sports fields;
7. Sewage / drainage / water-supply infrastructure.

The Management Classes listed above are shown in **Figures 1, 2 and 3**, and details on each Class are provided in the following sections.

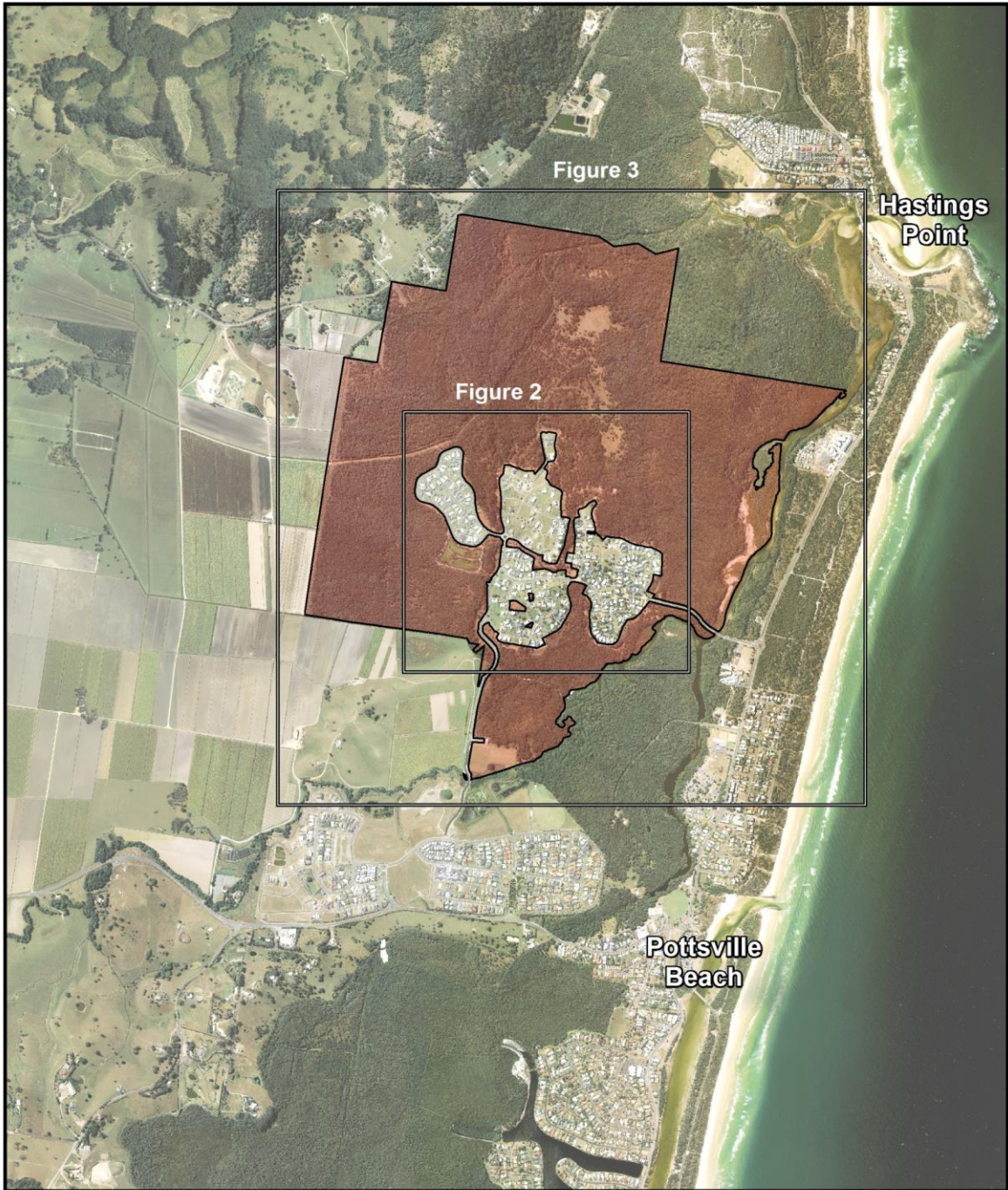


FIGURE 1
Key map

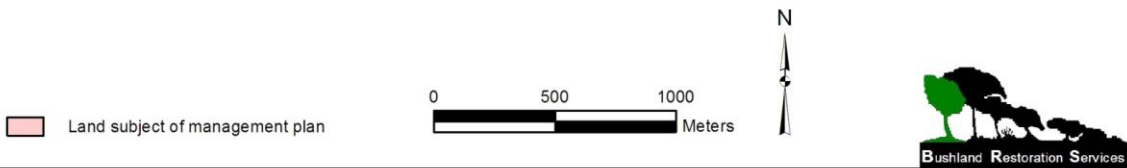


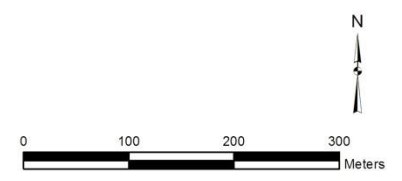


FIGURE 2
Management classes
Work zones

- Management classes and managers**
- Bushland / Habitat - NRMU
 - Existing and proposed plantings - NRMU
 - Core Arthraxon management area - NRMU
 - Buffer to Arthraxon management area - NRMU
 - Bushfire APZ - NRMU / RSU
 - Local parks and sports grounds - RSU
 - Sewage / drainage / water infrastructure - WU

Note: Acronyms
 NRMU - Natural Resources Management Unit
 RSU - Recreation Services Unit
 WU - Work Unit
 APZ - Asset Protection Zone

- Prescribed APZ outer boundaries
 - Work zone boundaries
 - Property boundary
- Note: numbers on figure refer to work zones



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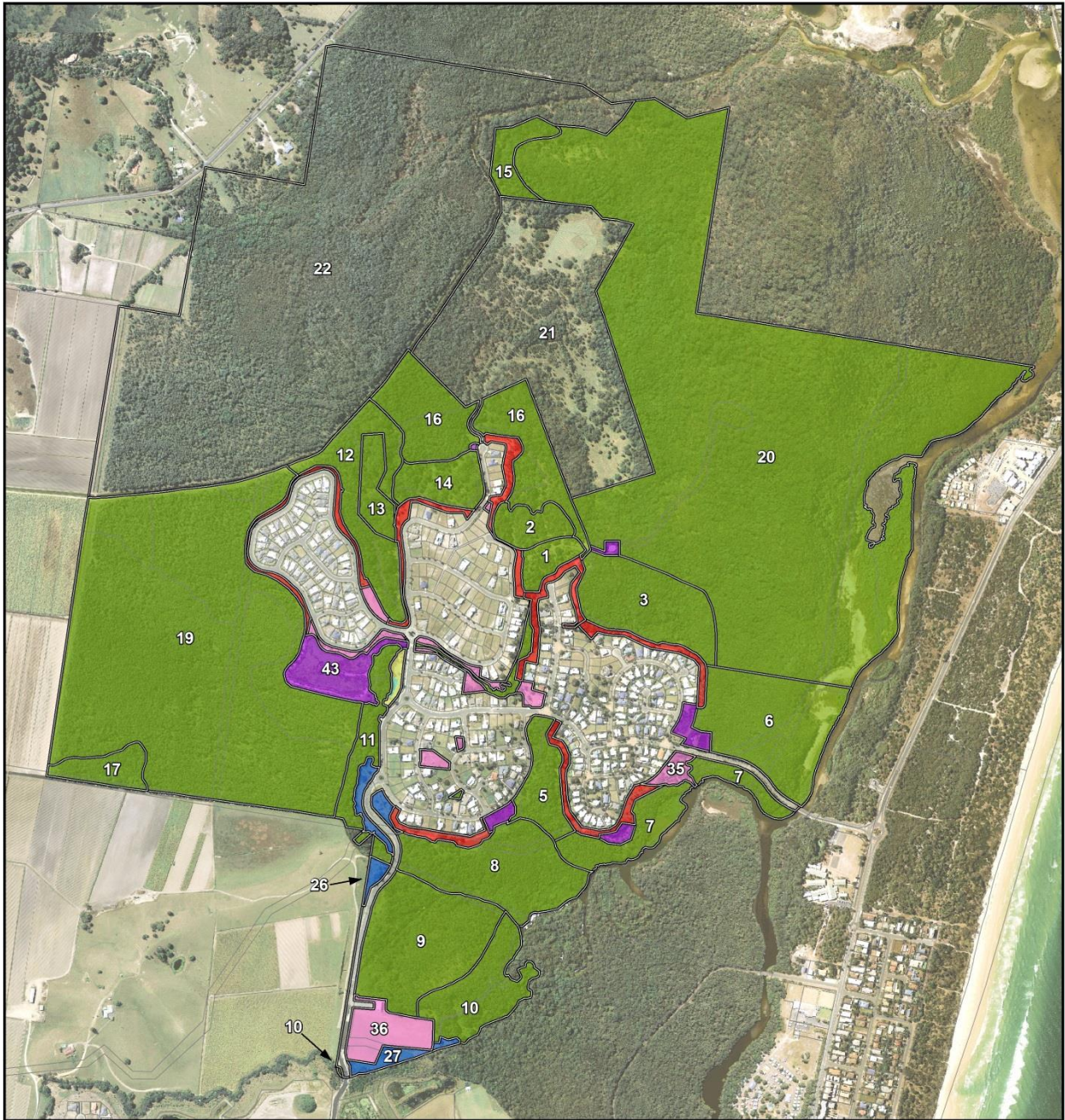


FIGURE 3
Management classes
Work zones

Management classes and managers

- Bushland / Habitat - NRMU
- Existing and proposed plantings - NRMU
- Core Arthraxon management area - NRMU
- Buffer to Arthraxon management area - NRMU
- Bushfire APZ - NRMU / RSU
- Local parks and sports grounds - RSU
- Sewage / drainage / water infrastructure - WU

Note

Road verges and footpaths are managed by WU / RSU

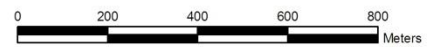
Note: Acronyms

NRMU - Natural Resources Management Unit
 RSU - Recreation Services Unit
 WU - Work Unit
 APZ - Asset Protection Zone

Work zone boundaries

Notes: work zone boundaries and labels
 Numbers on figure refer to work zones
 See Figure 2 for work zones not labelled in this figure

Property boundary



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4.1 Bushland / Habitat

These are areas of existing native vegetation where the principal proposed management is to reduce and then maintain the cover of exotic plant species to an appropriate level in order to improve and maintain habitat. The majority of the project area is in this class and includes a number of areas the subject of the existing habitat restoration plan. The prescriptions in the Restoration Plan prepared in 2004 are consistent with proposed prescriptions for this class in the revised Plans (2012 and 2015). The Natural Resources Management Unit (NRMU) will be solely responsible for land in this class.

4.1.1 Existing and proposed plantings of native forest

Plantings of native trees have been undertaken in areas where the existing vegetation consisted mainly of exotic grassland / shrubland, generally in accord with conditions of consent. The plantings have generally been successful. Ongoing control of competing weeds, mainly exotic grasses, is required in a significant part of these areas. Additional areas of exotic grassland / shrubland have been planted by the community during 2012 – 2013 and additional areas are identified for possible further plantings of native trees. On-going maintenance of these areas would also be required. NRMU will be solely responsible for land in this class.

4.1.2 Core Hairy Joint Grass *Arthraxon hispidum* management area

This area is small, but has been separately identified because of the very small area of this threatened species of grass in the site and the risk of serious setbacks that may occur if there is any confusion regarding its location. The area requires highly specialised management to encourage the survival and spread of this threatened grass. NRMU will be solely responsible for land in this class.

Existing and future management of this area is prescribed in the monitoring plan (Fountain, T. 2008)

4.1.3 Buffer to Hairy Joint Grass management area

See 4.3 above with regard to the core area. The buffer has been distinguished from the core area because the management is also highly specialized but quite different from the core area. NRMU will be solely responsible for land in this class.

Existing and future management of this area is prescribed in the monitoring plan (Fountain, T. 2008)

4.1.4 Bushfire Asset Protection Zones

Conditions of consent to the subdivision of the residential area at Koala Beach have prescribed the creation and maintenance of bushfire Asset Protection Zones (APZs). These are strips of land of varying width along the urban / bushland interface that generally have a low cover of trees and groundcovers and sections are maintained by regular mowing.

The APZs are exclusively on land owned by council and are currently maintained by Council.

Recreation Services Unit (RSU) currently maintains the majority of these areas, with the exception of small areas within water quality control basins that are maintained by the Works Unit (WU). It is proposed that RSU and WU continue to undertake maintenance work in these areas and responsibility be shared with the NRMU to ensure that their habitat value is maximized.

4.1.5 Local parks and sports grounds

These areas are currently maintained by RSU, who will retain sole responsibility for land in this class. Discussion is required between NRMU and RSU to determine appropriate management of the common boundary that occurs between some natural areas and parks and sportsground.

4.1.6 Sewage / Drainage / Water Supply Infrastructure

Infrastructure assets such as sediment detention ponds, sewage and water pump stations and the water reservoir are located on lots that are adjacent to bushland or have some native vegetation on the lots. A significant part of the drainage infrastructure consists of watercourses and detention ponds with a considerable cover of native vegetation and fauna habitat. It is proposed the WU be solely responsible for land in this class. NRMU will provide advice to ensure that habitat values are maintained.

NRMU is responsible for coordinating the management of drainage line 4 (see Fig. 2).

Refer to the Control Plan for Cane Toads at Koala Beach Estate (Gray, P., 2011); for additional management measures for these sites.

5 Work Zones and Management Actions

The site has been divided into Work Zones within each management class to guide the implementation of works and ensure a systematic and comprehensive approach to restoration. The Work Zone numbering links to the same label number in the implementation table (**Table 1**). The areas of each work Zone are listed in **Appendix 2**.

The sequence of proposed works is based upon the need to arrest the degradation factors while maximising the regeneration potential in each Zone. Seasonal weather conditions and the need to systematically follow up weed control have also been considered.

Work generally commences in one Zone and on completion of primary and follow up works resulting in stabilisation of the Zone then continues to the next Zone. Due to the substantial primary work undertaken between 2004 and 2006 works could simultaneously continue in a number of Work Zones. The Work Zones will link up and can then be consolidated and worked as one unit.

A list of weeds for all restoration areas is provided in **Appendix 3**. Explanations of the weed treatment techniques are included in **Appendix 4**.

Description and actions are provided for each of the Work Zones including actions identified in monitoring plans for Threatened species, such as Glossy Black-cockatoo, Blossom Bat and Planigale where relevant.

Essential continuing follow up or maintenance will be necessary for all Zones where primary work has been undertaken. The Zones where primary work was undertaken in 2004 – 2006 should be a priority. Most of these Zones had some minimal follow up during 2007 and 2008. Primary and follow up work commenced again in 2012, continuing through to 2015. The extent of previous work is included for each Zone.

The Work Zones requiring restoration are divided into, previously worked 1 – 18 (72.8ha), no previous works 19 – 22 (233ha), Arthraxon site 23, Buffer site 11 and plantings 24 – 27.

The management classes for Zones managed by other departments are grouped into Recreation Services Unit 28 – 36, Works Unit 37 – 43 and Asset Protection Zones (NRMU and Recreation Services Unit) 44 – 49. General management guidelines are provided.

5.1 Native fauna

Management of native fauna is a priority for the KBWHM Committee. The management of fauna is often linked to vegetation management and where relevant has been included in the actions detailed for individual Work Zones (refer **Section 5**).

Plans of management and monitoring plans have been prepared for the Threatened fauna being, Common Blossom Bat, Glossy Black-cockatoo, Planigale and Koala. Actions from the Plans of Management are itemised in the Overall Management Guidelines (2009) and a summary included in **Appendix 1** of this Plan.

Listed below are the Work Zones where Threatened fauna plans include recommendations for restoration actions.

- Common Blossom Bat – Work Zone 1;
- Glossy Black-cockatoo – Work Zone 2 and part work Zones 16 and 20;
- Planigale – Monitoring locations in Work Zones 2, 3, 8, 12, 19, 20, 21 and 22; and
- Koala – conditions of consent required restoration of Koala habitat in Work Zones 3, 4, 5, 12, 13, Koala food tree plantings in Zones 24 – 27 and planting of Koala food trees as street trees;
- Superb Fruit-dove – conditions of consent required the planting of twenty Small-fruited Figs *Ficus obliqua*; and
- Restoration actions are not included in recommendations for management of Bush Stone-curlew and Black Bittern.



Plate 1 - Large Tallowwood – Koala Food Tree

5.2 Bushland/Habitat

The following twenty Work Zones are classified as Bushland/Habitat.

5.2.1 Zone 1 – Common Blossom Bat Reserve

5.2.1.1 Location and extent

Zone 1 is at the northern extent of Bottlebrush Drive and has an area of 1.35ha.

5.2.1.2 Vegetation and habitat features

The vegetation is Coast Banksia (*Banksia integrifolia*) woodland extending to the north of the east west track along the ridge which divides Zone 1 from Zone 2 to the north.

The dominant weed is Setaria (*Setaria spachelata*) which is interspersed throughout the native Kangaroo Grass (*Themeda triandra*) and Scented Top (*Capillipedium spicigerum*) in the south.

Additional weeds are minimal and include Lantana (*Lantana camara*), Rhodes Grass (*Chloris gayana*), Cottonbush (*Gomphocarpus fruticosus*), Blue Billygoat Weed (*Ageratum houstonianum*), Whisky Grass (*Andropogon virginicus*), Molasses Grass (*Melinis minutiflora*), Broad-leaved Paspalum (*Paspalum mandiocanum*), Winter Senna (*Senna pendula* var *glabrata*), Rattlepod (*Crotalaria* sp.), Climbing Nightshade (*Solanum seaforthianum*) and Giant Devils Fig (*Solanum chrysotricum*).

5.2.1.3 Previous works

Zone 1 was previously dominated by exotic grasses and Lantana. The entire Zone has had weed control works that were initiated in 2004 in line with the management plan (Coburn & Markus 2000) these works have continued until the present time. The Setaria is significantly reduced and the recruitment of native grasses and Coast banksia has been encouraged.

5.2.1.4 Threatened or significant species

Koala Beach Estate provides a regionally significant food resource for the Common Blossom Bat (*Syconycteris australis*), particularly during winter months. As such, the Common Blossom Bat reserve (Zone 1) was set aside during the development assessment process for Stage 4.

Koalas have also been recorded from this zone.

5.2.1.5 Management issues

The Blossom Bat Monitoring Reports (Hannah & Lewis 2007 and Hannah 2010 and 2013) note that mature Coast Banksia on site are senescing and there is a lack of recruitment of the species. As Coast Banksia is a very important winter food source for the Common Blossom Bat at Koala Beach, the lack of recruitment is a concern.

The 2010 and 2013 monitoring reports recommend continuing control of woody weeds and exotic grasses and protection of new seedlings with tree guards to protect from wallaby browsing. The 2007 report also recommended supplementary planting adjacent to the site using seedlings, which are recruiting, on the slashed Asset Protection Zone to the west. The dense cover of exotic grass has in the past suppressed native recruitment, therefore the continued control has facilitated recruitment of Coast Banksia.

Should monitoring subsequent to restoration works determine that recruitment is still not occurring, supplementary plantings are to occur, but are to be confined to the eastern section of this Zone.

5.2.1.6 Management actions required

Maintenance spray should be performed by experienced bush regenerators to encourage native groundcovers to expand and dominate the ground layer. Continue to promote regeneration of Coast Banksia in the area.

Commence work at the south east corner and work north throughout the Zone.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds. Care is required to ensure that native grasses and groundcovers are not sprayed, the *Setaria* and Scented Top appear similar in appearance unless in flower;
- Spot spray Blady Grass where it is competing with recruitment of Coast Banksia and other native plants;
- Monitor weed regrowth and manage as necessary with the aim to control exotic grasses and other weeds before they reach maturity and produce seed. The area to be followed up on three monthly basis.

The ridge and entrance tracks are to be maintained by slashing at regular intervals to retain a firebreak. Care is to be taken to remain within the current formation to avoid damage to native vegetation. RSU is to retain responsibility for slashing of the track with NRMU to be responsible for monitoring.

5.2.1.7 Related Documents

- Plan of Management for the Queensland Blossom Bat *Syconycteris australis* on the Koala Beach Residential Estate, 2000 (Coburn & Markus 2000).
- Blossom Bat Monitoring Report, Koala Beach Estate, Winter 2007 Report (Hannah & Lewis 2007).
- Blossom Bat Monitoring Report, Koala Beach Estate, Winter 2010 (Hannah & Lewis 2010).
- Blossom Bat Monitoring Report, Koala Beach Estate, Winter 2013 (Hannah 2013)



Plate 2 - Track between Zone 1 Common Blossom Bat Reserve and Zone 2 Glossy Black shows mid-storey of well-established regenerating Eucalypt and Casuarina with some Coast Banksia.

5.2.2 Zone 2 - Glossy Black-cockatoo

5.2.2.1 Location and extent

Zone 2 is located north west of Melia Close and to the north of the ridge track dividing this Zone from Zone 1. The Zone has an area of 1.87ha.

5.2.2.2 Vegetation and habitat features

The vegetation is Forest Oak *Allocasuarina torulosa* woodland to forest.

Weeds are generally in low density and include Setaria in wet gullies and scattered Lantana, Broad-leaved Paspalum, Corky Passionfruit *Passiflora suberosa*, Narrow-leaved Cottonbush and Ground Asparagus *Protasparagus aethiopicus*

5.2.2.3 Previous works

The Zone was previously dominated by dense Lantana and exotic grasses in the gullies and along edges with large patches of Lantana and exotic grasses scattered throughout. Native grasses and groundcovers have established throughout the Zone. The entire Zone has had primary and maintenance weed control works since 2004 under the original PoM (Fitzgerald 2000) until the present time. The Zone has remained in good condition.

Dumping of garden waste and rubbish has become a problem where houses back onto lower slopes of the zone. Council is to be notified when dumpings observed.

5.2.2.4 Threatened or significant species

In addition to Glossy Black Cockatoos, the Threatened Pink Nodding Orchid *Geodorum densiflorum* has been recorded on the upper slopes of the Zone. Koalas also move through this area.

Planigale monitoring works are undertaken in this zone.

5.2.2.5 Management Issues

The Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2014) concludes "Mortality and senescence of Forest Oaks within the reserved habitat stands and their vicinity remained at a low and stable rate". Fitzgerald (2014) recommends the following:

- Recruitment issues / Forest Oak mortality: collect seed and propagate seedlings from the reserved habitat stands (preferably from 'preferred feed trees': listed in Appendix D of the 2011 monitoring report).
- Establish approximately 50 Forest Oak plants to approximately 1m height and plant these in gaps and edges of the reserved habitat stands and reservoir stands when large enough.
- Continue to control weeds and encourage native species regeneration in accordance with the revised Koala Beach Habitat Restoration Plan. Weeds need to be treated periodically and on an ongoing basis to ensure reduced competition with native plants;

5.2.2.6 Management actions required

Commence work at the south east corner of the Zone on the northern side of the ridge track working east to west across the Zone moving north.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds. Care is required to ensure that native grasses, groundcovers and the Pink Nodding Orchid are not sprayed,
- Coolatai Grass infestation to be monitored each visit and hand weeded with seed bagged and removed from site,

- Woody weeds are to be cut, scrape and painted. Smaller Lantana can be hand pulled;
- Plant 50 Forest Oak seedlings grown in Council nursery from local seed in gaps and on edges;
- Continue follow up on a regular basis two to four monthly basis depending on the season.

5.2.2.7 Related Documents

- Plan of Management for the Glossy Black-cockatoo at the Koala Beach Estate (Fitzgerald 2000)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2005)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2007)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2009)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2011)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2014)

5.2.3 Zone 3 - Muskheart

5.2.3.1 Location and extent

Zone 3 is north of Muskheart Avenue and extends south from Zone 1. The Zone has an area of 6.39ha.

5.2.3.2 Vegetation and habitat features

The northern section is Brushbox *Lophostemon confertus* and mixed eucalypt forest with rainforest understorey changing to Broad-leaved Paperbark *Melaleuca quinquenervia* and Swamp Oak *Casuarina glauca* forest in the south.

5.2.3.3 Previous works

The Zone had previously been dominated by dense Lantana in the gullies and exotic grasses along edges extending into the forest. The entire Zone has had primary and maintenance weed control works from 2004 to 2006. Follow up works commenced again in 2014. The Zone has remained in good condition with Lantana, Tobacco Bush *Solanum mauritianum* and exotic grasses beginning to re-establish particularly in gullies and on edges.

5.2.3.4 Threatened or significant species

A Glossy Black Cockatoo watering site is known from within this work zone. Additionally, there are a number of artificial nesting hollows for Glossy Black Cockatoos in this zone.

Planigale monitoring works are undertaken in this zone.

5.2.3.5 Management issues

Weed is minimal and is generally confined to the edge adjacent to the Asset Protection Zone (APZ) and open gaps colonised by exotic grass. Weeds include Corky Passionfruit, Lantana, Setaria, Broad-leaved Paspalum, Blue Billygoat Weed and Tobacco Bush. Gardens, growing vegetables / herbs and garden dumpings extend into the APZ and the Zone. A large area in the south-east corner of this zone is dominated by native vines – mainly Morinda and Watervine. Some pruning may be required to reduce burden on small trees.

5.2.3.6 Management actions required

Commence work at the south east corner and work in an east west direction moving north throughout the Zone to link with Zone 1.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds.

- Tobacco Bush, Lantana and other woody weeds are to be cut, scrape and painted;
- Control native vines where impacting on native trees and shrubs;
- Follow up on regular three to four monthly basis.

Verify records of *Endiandra muelleri* var. *bracteata* made from this zone.

5.2.3.7 Additional works required

Artificial nesting hollows have been installed within this Zone. These need to be monitored and maintained on a bi-annual basis.

5.2.3.8 Related Documents

- Plan of Management for the Glossy Black-cockatoo at the Koala Beach Estate (Fitzgerald 2000)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2005)
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- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2009)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2011)
- Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2014)



Plate 3 - Northern section of Zone 3

5.2.4 Zone 4 – Upper Grey Gum Gully

5.2.4.1 Location and extent

Zone 4 is between Bottlebrush Drive and Marsupial Drive and is the area known as Upper Grey Gum Gully. The Zone includes a recent extension to include the drainage line from the sediment pond to Macadamia Avenue. RSU previously managed the watercourse. The Zone has an area of 0.75ha.

5.2.4.2 Vegetation and habitat features

This Zone is long and narrow but the gully habitat is important as habitat for Koalas and provides a vegetated link between the north and south.

The northern section is woodland with the upper strata dominated by Small-fruited Grey Gum, with a mixed rainforest understorey.

The southern section is re-growth subtropical rainforest dominated by Guioa and Foambark.

5.2.4.3 Previous works

The Zone had previously been dominated by Lantana in the lower gully and exotic groundcovers such as Mistflower *Ageratina riparia*, Crofton Weed and Fishbone Fern *Nephrolepis cordifolia*. Exotic grasses dominated the drain section. The entire gully has had primary and maintenance works from 2004 until the present time. The drain has had works commencing in 2009 and continuing to January 2011. Council has slashed to the edges of the gully as part of maintenance of the Asset Protection Zone.

A small supplementary planting of mixed Koala food trees has been undertaken at the head of the gully with most trees well grown and tree guards removed.

The restoration of the drain on the west provides an example of the use of naturally regenerating native grasses and sedges (**See Plate 15**).

5.2.4.4 Threatened or significant species

Koalas are known to utilise this work zone.

Rusty Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *bracteata*) is present in the southern section of this work zone.

A recommendation of the management plan (TSC 2002) for amelioration of the single plant in Stage 3 was to propagate additional plants for planting at the site. There is potential for expanding this project to include propagation of additional plants for planting in the vicinity of the single plant in Upper Grey Gum Gully.

5.2.4.5 Management issues

Weeds are minimal and include Setaria, Broad-leaved Paspalum, Whisky Grass, Lantana, Winter Senna, Corky Passionfruit, Blue Billygoat Weed. Large Mexican Fern Trees (*Schizolobium* sp.) and *Fucreae* sp. on the southern upper bank of the watercourse have been controlled. Dumping of garden waste is a threat to the zone. Exotic grasses in mown areas of the adjoining APZ rapidly grow and produce seeds during spring and summer seasons reinfesting edges of the zone.

5.2.4.6 Management actions required

Commence work at the northern end of the Zone working to the south to the sediment pond then west along the watercourse.

- Council to notify adjacent landholders of the importance of the Zone and the restoration being undertaken. Include information on native grasses and sedges and appropriate species for planting in adjacent gardens;

- Council to remove rubbish from drain and surrounding area;
- Spot spray throughout the Zone taking care to avoid native grasses and sedges;
- Selectively control native vines where damaging native trees;
- Plant additional Koala food trees to extend the planting;
- Follow up on a regular three to four monthly basis.

Initiate on-ground works to expand the sub-population of *Endiandra muelleri* subsp. *bracteata* known from this work zone.

- Collect and propagate two sets of stems from each of the 14 individuals known from Koala Beach Estate. These works need to be undertaken under license from the NSW Office of Environment and Heritage, and under the supervision of Dr. Maurizio Rossetto of the Royal Botanic Gardens and Domain Trust.
- Ensure that one set of stems from each of the 14 individuals is planted at this work zone.
- Identify a suitable location with similar habitat to plant the second set of 14 individuals.

5.2.4.7 Additional information

Areas of still, freshwater within Zone 4 provide potential breeding and foraging habitat for Cane Toads.

5.2.4.8 Related Documents

- Management Plan for the Endangered Plant Rusty Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *bracteata*) on Stage 3 of the Koala Beach Estate, Tweed Shire (Benwell 2002)
- NSW Recovery Plan *Endiandra muelleri* subsp. *bracteata* (Green-leaved Rose Walnut) and *Endiandra hayesii* (Rusty Rose Walnut) (DEC 2004)

5.2.5 Zone 5 – Lower Grey Gum Gully

5.2.5.1 Location and extent

Zone 5 is between Sassafras Street and Macadamia Drive and is the area known as Lower Grey Gum Gully. The Zone has an area of 2.75ha.

5.2.5.2 Vegetation and habitat features

The vegetation is Small-fruited Grey Gum *Eucalyptus propinqua* forest grading into Broad-leaved Paperbark forest. This Zone was identified as important habitat for Koalas in particular females with young. Koala food trees were planted in the Zone in 2002 by a local community group and in 2006 by Australian Koala Foundation volunteers.

5.2.5.3 Previous works

The Zone had previously been dominated by dense patches of Lantana which extended into the canopy, dense Corky Passionfruit growing into the canopy and a dense groundcover of exotic grasses. The entire Zone has had primary and maintenance works from 2004 to the current time. The dense groundcover of exotic grasses has been converted to native rainforest species and Lantana was virtually absent when primary works were completed. The trees from the 2002 planting are up to 12 metres high and the 2006 plantings are well established. Additional planting could be undertaken at the west of the Zone adjacent to the sediment pond on Macadamia Drive.

5.2.5.4 Threatened or significant species

Glossy Black-cockatoos and Koalas have been recorded from this work zone.

5.2.5.5 Management issues

Weeds include scattered Broad-leaved Paspalum, Lantana, Tobacco Bush, Winter Senna, Climbing Nightshade and White Passionflower *Passiflora suberosa*, Setaria and Blue Billygoat Weed. Weeds being mainly exotic grasses and Corky Passionfruit persist on the edges and in gaps where there are no canopy trees.

Garden waste has been dumped along some edges including *Aloe* sp. on the eastern edge generally within the Asset Protection Zone.

5.2.5.6 Management actions required

Commence work at the north of the Zone working in an east to west direction moving south.

- Council to notify adjacent landholders of the importance of the Zone and the restoration being undertaken.
- Council to remove dumped garden waste from the eastern edge;
- Spot spray grasses and groundcover weeds throughout. Where Corky Passionfruit is dense on the ground spot spray. Care where native grasses and groundcovers are present;
- Follow up at three month intervals and to be carefully timed before weeds reach maturity and produce seed;

The Koala food tree Small-fruited Grey Gum has limited recruitment throughout the gully. Natural recruitment is generally rainforest species and native groundcovers which include dense areas of native rainforest grasses. Small-fruited Grey Gum should be included in any future plantings.

Disturbance trials (including burn) within monitoring plots were set up by students from Murwillumbah TAFE in April 2008. The trials were to determine methods to encourage recruitment of Small-fruited Grey Gum. No recruitment of Small-fruited Grey Gum was recorded in 2008-2009. Additional trials could be undertaken in conjunction with work in Zone 1.

Additional stems of Small-fruited Grey Gum are to be planted in gaps on edges at the south west of the Zone.

5.2.5.7 Additional works required

Artificial nesting hollows have been installed within this work zone, which need to be monitored and maintained on a bi-annual basis.

5.2.6 Zone 6 – Entrance north

5.2.6.1 Location and extent

Zone 6 is north of Cudgera Avenue as it enters Koala Beach and extends south from Zone 20 then east across to Cudgera Creek. The northern boundary is the track which leads from the asset protection Zone east to the creek. The Zone has an area of 8.67ha.

5.2.6.2 Vegetation and habitat features

The vegetation is Swamp Mahogany *Eucalyptus robusta* and Tallowwood *Eucalyptus microcorys* forest grading into Broad-leaved Paperbark forest on the east.

This Zone is an important area of Koala habitat and Koalas have been recorded from this Work Zone.

Large-footed Fishing Bat *Myotis macropus* roosts underneath the bridge over Cudgera Creek.

5.2.6.3 Previous works

The Zone had previously been dominated by dense patches of Lantana and exotic grasses mainly along the western edge. There were large patches of Bitou Bush towards the creek. The entire Zone has had primary and intermittent maintenance works from 2007 until the present time. The previous works were concentrated along the western edge with works extending throughout the Zone on one occasion mainly to control Bitou Bush.

5.2.6.4 Threatened or significant species

Koalas have been recorded from this work zone.

5.2.6.5 Management issues

Weeds are minimal with small and very isolated Lantana, Broad-leaved Paspalum, Bitou Bush, Umbrella Tree and Corky Passionfruit. Weeds along the western edge include Corky Passionfruit, Setaria, Broad-leaved Paspalum, Blue Billygoat Weed and Tobacco Bush.

Care should be taken when working in this Zone to not disturb a colony of the threatened Large-footed Fishing Bat *Myotis macropus* that roosts under Cudgera Creek bridge.

5.2.6.6 Management actions required

Commence work at the north-west corner adjacent to Zone 3 and work in an east west direction moving south to Cudgera Avenue.

- Spot spray grasses and groundcover weeds throughout. Care is to be taken where native grasses and groundcovers are present;
- Cut, scrape and paint or hand pull larger woody weeds; and
- Follow up at regular three to four monthly intervals.

5.2.6.7 Additional works required

Artificial nesting hollows have been installed within this work Zone. These need to be monitored and maintained on a bi-annual basis.

5.2.7 Zone 7 – Entrance south

5.2.7.1 Location and extent

Zone 7 is south of Cudgera Avenue as it enters Koala Beach, extending west to south of Cudgera Avenue to link with Zones 4 and 8. The Zone has an area of 4.40ha.

5.2.7.2 Vegetation and habitat features

The vegetation is Broad-leaved Paperbark and Swamp Oak forest.

5.2.7.3 Previous works

Lantana and exotic grasses had previously dominated the Zone. The Zone has had limited previous works in the western section mainly to control dense Lantana behind the houses. Works in this Zone were undertaken as an extension of Zone 5 in the later parts of the 2004 – 2006 works program.

5.2.7.4 Threatened or significant species

Koalas have been observed in this work zone.

5.2.7.5 Management issues

Weeds include dense Setaria and Broad-leaved Paspalum on edges, clumps of Lantana and scattered Winter Senna, Corky Passionfruit, Climbing Nightshade in the east grading to scattered or isolated plants in the west.

Care should be taken when working in this Zone to not disturb a colony of the threatened Large-footed Fishing Bat *Myotis macropus* that roosts under Cudgera Creek bridge.

5.2.7.6 Management actions required

Commence work at the bridge and work in a north south direction moving to the west.

- Spot spray (west) and over spray (east) grasses, groundcover weeds and Lantana;
- Cut, scrape and paint larger Lantana and woody weeds;
- Follow up spot spray throughout; and
- Follow up the eastern section after two to three months to control the dense grasses and re-sprouting Lantana, and then continue at three to four monthly intervals.

5.2.7.7 Additional works required

There is a gap in the vegetation and bollards along the creek in the south eastern corner of the Zone. It is recommended that Council investigate extending the bollards to minimize impact on the creek bank.

Artificial nesting hollows have been installed within this Zone. These need to be monitored and maintained on a bi-annual basis.



Plate 4 Gap in vegetation on northern bank of Cudgera Creek

5.2.8 Zone 8 – Macadamia south

5.2.8.1 Location and extent

Zone 8 extends south west from Zone 5 (Lower Grey Gum Gully) south of Macadamia Avenue west to the Link Road and south to the east west drainage line. The Zone extends to plantings in the west. The Zone has an area of 7.64ha.

5.2.8.2 Vegetation and habitat features

The vegetation varies from Swamp Oak forest with eucalypt and rainforest species in the mid stratum along the northern edge to Broad-leaved Paperbark, Brush Box *Lophostemon confertus* and Pink Bloodwood *Corymbia intermedia* / Swamp Mahogany forest in the south. There are two exotic pine plantations in the east adjacent to the creek.

5.2.8.3 Previous works

The Zone has had limited previous works along the northern edge south of the Asset Protection Zone and along the roadside on the west. These works were an extension of Zone 5 works during the 2004 – 2006 works program. The central and southern areas have had no previous works as evidenced by the presence of dense weeds.

5.2.8.4 Threatened or significant species

Koalas have been recorded in this Zone.

Planigale monitoring works are undertaken within this Zone.

5.2.8.5 Management issues

Weeds include Climbing Nightshade seedlings and some mature plants, Coastal Morning Glory *Ipomoea cairica*, Lantana and numerous mature Winter Senna. There are patches of dense exotic grasses including Setaria, Broad-leaved Paspalum and Rhodes Grass. East and south of Macadamia Drive in dry areas, and to a lesser degree in wet areas, there are dense patches of Lantana and Winter Senna and scattered Tobacco Bush, Bitou Bush, Climbing Solanum and Giant Devils Fig.

5.2.8.6 Management actions required

Commence work at the north-west corner working in a north south direction to the east then change direction and work east west towards the creek.

- Cut, scrape and paint Lantana, Winter Senna, Climbing Nightshade and other woody weeds;
- Spot spray small weed seedlings and exotic grasses and groundcovers.
- Overspray larger patches of Lantana and leave in situ;
- Drill and inject large exotic pine trees (*Pinus* sp.) In areas where pine coverage is very dense in the canopy consider whether it is necessary to stage the control program. As a priority control pines where they are adjacent to native trees to allow for native tree expansion and recruitment into the area currently occupied by the pines;
- Follow up spot spray throughout the Zone;
- Follow up drill and inject and cut, scrape and paint throughout the two exotic pine plantations,
- Follow up western section after three months and eastern section after two months then continue at three to four monthly intervals.

5.2.8.7 Additional information

The neighbour on the eastern corner of Macadamia Avenue has undertaken some planting behind the sediment pond.

5.2.8.8 Related Documents

- Control Plan for Cane Toads, Koala Beach Estate, Tweed LGA (Gray 2011)
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2007 (Hannah 2007)
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2012 (Hannah 2012)
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2014 (Hannah 2014)

5.2.9 Zone 9 – Sports Fields north

5.2.9.1 Location and extent

Zone 9 is located north of the sporting fields and extends from the Link Road east to Zone 10. The Zone has an area of 9.05ha.

5.2.9.2 Vegetation and habitat features

The vegetation is Swamp Oak forest with Spring Grass *Erichloa procera*, Sea Celery *Apium prostratum*, grassland/forbland and Swamp Oak forest with Bahai Grass *Paspalum notatum* grassland.

5.2.9.3 Previous works

The Zone has had minimal previous works restricted to the western edge along the roadside as part of the 2009 – 2010 planting maintenance program. The eastern section has had no previous works as evidenced by the presence of dense weeds in the higher areas. Sections of the Zone are regularly inundated.

5.2.9.4 Threatened or significant species

Koalas have been recorded from this Zone.

5.2.9.5 Management issues

Weeds include Winter Senna, Lantana, Climbing Nightshade, Broad-leaved Paspalum, Setaria, Bahai Grass, Giant Devils Fig, Groundsel Bush, Tobacco Bush, Blue Billygoat Weed, Wild Aster, Broad-leaved Carpet Grass, and Cuphea.

5.2.9.6 Management actions required

Commence work at the north-west corner working in a north south direction from the drain to the club house moving east to Zone 10 and the creek.

- Cut, scrape and paint Lantana, Groundsel, Winter Senna, Climbing Nightshade and other woody weeds;
- Spot spray exotic grasses and groundcovers and smaller woody weeds;
- Overspray larger patches of Lantana and larger Groundsel and leave in situ;
- Follow up spot spray throughout the Zone; and
- Follow up throughout the Zone at regular two to three monthly intervals then when stabilized continue at three to four monthly intervals.

5.2.10 Zone 10 – Creek

5.2.10.1 Location and extent

Zone 10 is east of the sports fields and extends to the southern boundary of Koala Beach along Cudgera Creek. The Zone has an area of 4.65ha.

5.2.10.2 Vegetation and habitat features

The vegetation varies from Swamp Oak forest near the sports fields to sedgelands closer to the creek. In the north there is an area of Brushbox forest with a mid-stratum of rainforest species. There is a planting adjacent to the south west corner of the Zone.

5.2.10.3 Previous works

The Zone had primary works commenced in 2010 in the south adjacent to the creek as compensation for vegetation loss during construction of the bridge over Cudgera Creek. Work has extended north along the east of the sportsfields. Plantings extend along the south and south east of the sportsfields.

5.2.10.4 Threatened or significant species

Koalas have been recorded in this Zone.

5.2.10.5 Management issues

Weeds include Broad-leaved Paspalum, Setaria, Rhodes Grass and dense Winter Senna along the creek and Setaria and Broad-leaved Paspalum in open areas. There are scattered Camphor Laurel on the creek and Corky Passionfruit, Umbrella Tree, Cocos Palm *Archontophoenix cunninghamiana*, Lantana and Climbing Nightshade to the west of the creek. The southern creek bank located in Pottsville Environment Park has had weed control.

5.2.10.6 Management actions required

Commence work at the plantings on the Link Road and work in a north south direction moving to the east.

- Cut, scrape and paint Lantana, Winter Senna and woody weeds;
- Spot spray throughout the Zone to control exotic grasses and groundcovers and smaller woody weeds;
- Follow up throughout the Zone on a regular basis initially at two to three monthly intervals then continue at three to four monthly intervals.

Council provides ongoing funding to control dense weed on the southern bank of Cudgera Creek within Pottsville Environment Park initially through the Bush Futures project. This action has reduced weed re-introduction in this Zone.

Related Documents

- Pottsville Environment Park Restoration Plan (BRS 2011)

5.2.11 Zone 11 – Macadamia West

See Section 5.5.1 Arthraxon Buffer

5.2.12 Zone 12 - The Tongue

5.2.12.1 Location and extent

Zone 12 is between Lomandra Avenue and Sugar Glider Drive and excludes the Dunghir Aboriginal Site (Zone 13). The Zone has an area of 5.42ha

5.2.12.2 Vegetation and habitat features

The vegetation is Broad-leaved Paperbark and Swamp Oak forest with areas of Brushbox.

5.2.12.3 Previous works

Dense Lantana and exotic grasses had previously dominated the Zone. The Zone had previous works throughout as part of the 2004 – 2006 works program, with minimal follow up to 2009. Follow up commenced in 2012 continuing to 2015.

5.2.12.4 Threatened or significant species

Planigale monitoring works are undertaken in this Zone.

5.2.12.5 Management issues

Weeds are mainly in the section along Christies Creek where there was a dense cover of Broad-leaved Paspalum and patches of Lantana. Other weeds include scattered Setaria, Crofton Weed, Blue Billygoat Weed, Mistflower, Cuphea, and Winter Senna. Winter Senna requires primary work in the northern section. Dumpings of garden waste occur along the edges. Large areas of this Zone remain underwater during wet weather.

5.2.12.6 Management actions required

Commence work at the southern tip and work in an east west direction moving north to Christies Creek.

- Spot spray all introduced grasses, groundcover weeds and small woody weeds;
- Cut, scrape and paint larger woody weeds including Winter Senna and Lantana in northern section;
- Control vines where impacting on native trees and shrubs;
- Follow up on a regular basis at three to four monthly intervals.



Plate 5 Native Basket Grass expands as dominant Broad-leaved Paspalum is controlled in Zone 12

5.2.13 Zone 13 - Dunghir Aboriginal Site

5.2.13.1 Location and extent

Zone 13 is located north west of Lomandra Avenue and has been fenced along Lomandra Avenue to protect the Aboriginal site. The Zone has an area of 1.76ha

5.2.13.2 Vegetation and habitat features

The vegetation is Tallowwood/Small fruited Grey Gum forest.

5.2.13.3 Previous works

The Zone has had previous works along the southern edges. These works were an extension of Zone 12 in the 2004 – 2006 works program. Primary and follow up works have been undertaken from 2012 to 2015.

5.2.13.4 Threatened or significant species

Koalas and Planigales are known from this Zone.

Planigale monitoring works are undertaken in this Zone.

5.2.13.5 Management issues

Weeds include Lantana, Winter Senna, Tobacco Bush, Broad-leaved Paspalum, Setaria, Whisky Grass, Corky Passionfruit and Camphor Laurel *Cinnamomum camphora*. The Zone is a hotspot for Solanum weed species and introduced Passiflora species

5.2.13.6 Management actions required

Commence work at the south east corner and work in an east west direction moving north.

- Spot spray grasses and groundcover weeds including emerging Solanum and Passiflora species;
- Cut, scrape and paint Lantana, Winter Senna and other woody weeds;
- Continue regular spot spray to ensure that persistent weeds do not re-establish;
- Follow up at regular two to three monthly intervals then extend to four monthly intervals.

5.2.13.7 Related Documents

- *Cultural Heritage Management Plan for Stages 5 and 6 (2004)*



Plate 6 - Good condition forest in the south of Zone 13

5.2.14 Zone 14 - Compensation

5.2.14.1 Location and extent

Zone 14 is located north and west of Lomandra Avenue. The Zone has an area of 2.62ha.

5.2.14.2 Vegetation and habitat features

The vegetation is Swamp Oak forest with dense groundcover of *Setaria* and Broad-leaved *Paspalum*. The eastern section of the Zone was subject to unauthorized clearing with compensation including weed control and plantings.

5.2.14.3 Previous works

The Zone had previously been dominated by dense groundcover of exotic grasses. The entire Zone has had primary works from 2007 until 2009. The primary works resulted in native groundcovers replacing the dense exotic grasses and groundcovers. Due to lack of follow up dense exotic grasses and *Cuphea* have re-invaded the Zone.

5.2.14.4 Threatened or significant species

Koalas are known from this work zone.

5.2.14.5 Management issues

The dominant weeds are the grasses, *Setaria* and Broad-leaved *Paspalum*. Other weeds include Blue Billygoat Weed, *Cuphea*, Mistflower, Winter Senna and Lantana.

5.2.14.6 Management actions required

Commence work at the south west corner working in an east west direction moving north.

- Spot spray grasses and groundcover weeds. The initial spray to be selective and concentrate on areas previously worked, adjacent to native groundcovers and to the drip line of native trees and shrubs. Gradually increase the area of exotic grasses controlled, staged to keep pace with the natural regeneration of groundcovers and seedlings;
- Cut, scrape and paint Lantana, Winter Senna and other woody weeds. Cut into billets;
- Continue regular spot spray to ensure that exotic grasses do not re-establish;
- Follow up at regular two monthly intervals then extend to three to four monthly intervals.

5.2.15 Zone 15 – The Barrage

5.2.15.1 Location and extent

Zone 15 is in the north east of the site and is adjacent to Christies Creek. The access track from Lomandra Avenue through the private land has a locked gate and requires permission and key. The track is low lying and requires slashing for safe access.

The Zone has an area of 1.78ha.

5.2.15.2 Vegetation and habitat features

The vegetation is good condition Tallowwood /Grey Gum/ Blackbutt *Eucalyptus pilularis* forest extending into Brushbox /Pink Bloodwood forest. The Zone is important Koala habitat.

5.2.15.3 Previous works

The Zone had been previously dominated by dense Lantana throughout. The entire Zone had previous primary works from 2006 to 2008. Primary and follow up works have been undertaken from 2014 to 2015.

5.2.15.4 Threatened or significant species

Koalas are known from this Zone.

5.2.15.5 Management issues

Weeds include Lantana, Winter Senna, Blue Billy Goat Weed, White Passionflower and exotic grasses including Broad-leaved Paspalum, Setaria, Molasses Grass, Sour Grass (*Paspalum conjugatum*) and Vasey Grass (*Paspalum urvillei*). Access is difficult in wet weather and if track is not slashed.

5.2.15.6 Management actions required

Commence work at the northern tip at the barrage and work in an east west direction moving south.

- Spot spray throughout the Zone to control exotic grasses and groundcovers and smaller woody weeds:
- Cut, scrape and paint small woody weeds such as Lantana, cut into billets and leave on site;
- Follow up at regular three to four monthly intervals.

5.2.16 Zone 16 – Christies

5.2.16.1 Location and extent

Zone 16 is north of work Zones 2 and 14 and extends to Christies Creek. The northern and eastern boundaries extend to the private lot (Zone 21). The access track to the private land divides the Zone. The Zone has been included to complement Zones 2 and 14 and extend restoration works to the boundary of the estate and the creek. The Zone has an area of 9.04ha.

5.2.16.2 Vegetation and habitat features

The vegetation is Swamp Oak forest with ground stratum of Broad-leaved Paspalum. In the north east on higher areas there is Kangaroo Grass under Swamp Oak/Brushbox forest and an area of Tallowood/Ironbark *Eucalyptus siderophloia* forest.

5.2.16.3 Previous works

The Zone has had minimal previous work on the east of the access track being an extension of the 2004 – 2006 works program in Zone 2. The works for the Glossy Black-cockatoo site had previously extended to the track and included plantings of Forest Oak. There have been no previous works west of the track as evidenced by the density of weeds.

5.2.16.4 Threatened or significant species

Koalas are known from this Zone. The north-eastern section of this Zone is Glossy Black Cockatoo habitat.

5.2.16.5 Management issues

The major weeds are the dominant groundcovers being Broad-leaved Paspalum and Setaria. Other weeds include Winter Senna, Lantana, Camphor Laurel and Corky Passionfruit. The eastern section has scattered weed which increases in density west of the track.

5.2.16.6 Management actions required

Commence work at the boundary with Zone 2 and work in an east west direction moving north initially to the track then work the western section to the creek.

- Spot spray throughout the eastern section to control the exotic grasses;

- Cut, scrape and paint scattered woody weeds such as Lantana and Winter Senna and exotic vines such as Corky Passionfruit;
- Spot spray and overspray throughout the western section to control exotic grasses and groundcovers weeds and smaller weeds including Lantana
- Cut, scrape and paint woody weeds such as Lantana and Winter Senna and exotic vines such as Corky Passionfruit;
- Drill and inject scattered weed trees such as Camphor Laurel throughout the whole of the Zone; and
- Spot spray throughout the whole of the Zone.
- Follow up at regular three to four monthly intervals.

5.2.17 Zone 17 – Camphor

5.2.17.1 Location and extent

Zone 17 is located in the south west corner of the site adjacent to the southern boundary. The Zone has been identified and excluded from Zone 19, as there is a stand of Camphor Laurel. Access to the Zone is along the western boundary fence line adjacent to the cane paddocks.

The area of the Zone is 1.88ha.

5.2.17.2 Vegetation and habitat features

The vegetation is Broad-leaved Paperbark and Swamp Oak forest with an understorey of exotic grasses. There is a section of Swamp Oak and Camphor Laurel forest with dense mid stratum of Camphor Laurel.

5.2.17.3 Previous works

During the 2004 – 2006 works program Camphor Laurel was controlled within part of the Zone. Primary work has not been undertaken throughout the Zone.

Fox dens have been recorded in this Zone and fumigation undertaken. This Zone should be investigated for active dens annually.

5.2.17.4 Threatened or significant species

No Threatened or significant species have been recorded in this Zone.

5.2.17.5 Management issues

Weeds include Camphor Laurel, Lantana, Winter Senna, Umbrella Tree *Schefflera actinophylla*, Tobacco Bush in the mid stratum and Blue Billygoat Weed, Broad-leaved Carpet Grass, Groundsel, Cuphea, Lantana, Bahai Grass, Corky Passionfruit, Broad-leaved Paspalum, Umbrella Tree, Winter Senna in the ground stratum.

Wild dog and fox recorded in this Zone and adjoining caneland.

5.2.17.6 Management actions required

Commence work at the south east corner and work in an east to west direction moving north throughout the Zone.

- Spot spray throughout the Zone controlling the Broad-leaved Paspalum and other groundcovers weeds
- Cut, scrape and paint all woody weeds being sections of dense Camphor Laurel and scattered Lantana, Groundsel, Umbrella Tree and Winter Senna;
- Drill and inject all larger Camphor Laurel and other large woody weeds;

- As the Camphor Laurel die the site will be open to light and a flush of weeds. Regular well timed follow up is essential once the Camphor Laurel have been injected. Spot spray throughout the site at one to three monthly intervals until Broad-leaved Paspalum and groundcover weeds are controlled;
- Follow up at regular three to four monthly intervals.

Zone 17 provides the opportunity to trial the conversion of dense exotic grasses and groundcovers to native groundcovers.

5.2.17.7 Additional information

- *Wild dog control*

Wild Dog trapping was undertaken in this zone during 2011 and to the west on private property in 2014-2015.

- *Fox dens*

Tweed Shire Council monitors and fumigates fox dens as required in this Zone.

- *Encroachment of agricultural drainage infrastructure*

A system of agricultural drains is located on the western edge of management Zones 17, 19 and 22. The western edge of these management Zones has a boundary with a neighbouring property that is used for the production of sugar cane. The drainage infrastructure is to the east of the boundary depicted in the digital cadastre and appears to be located on land owned by council (management Zones 17 and 19) and land proposed to be dedicated to council when the creation of two rural residential lots in the northern part of Koala Beach is completed (management Zone 22). The apparent encroachment is about 10 metres wide in the vicinity of management unit 17, widening to 30 metres in the vicinity of the Christies Creek drain (see **Figure 3**).

The position of the boundary should be confirmed by survey undertaken by Council to determine extent of encroachment.

5.2.18 Zone 18 – Endiandra Reserve

5.2.18.1 Location and extent

Zone 18 is located on Hovea Drive within the residential area having house lots on three sides. The Zone has an area of 0.04ha.

5.2.18.2 Previous works

Dumped garden waste has been previously removed from in and around this Zone. Primary work has been undertaken in 2012 – 2015.

5.2.18.3 Threatened or significant species

Zone 18 (Lot 345 in Stage 3) has been set aside to conserve a single specimen of Green-leaved Rose Walnut which is endangered under the NSW TSC Act (1995). Thirteen additional specimens have been recorded at Koala Beach, one in Stage 5 and twelve specimens in Stage 7. The vegetation is regenerating rainforest.

Description - Green-leaved Rose Walnut *Endiandra muelleri* subsp. *bracteata*

A tree up to 30m tall with brown bark, often in loose round plates, twigs and branchlets are covered in hairs. The moderately glossy leaves are oval or drawn out towards the tips, and measure 6 – 12 cm long and 3 – 5 cm wide, with three to five pairs of side veins. Flushes of new growth are pinkish-green.

Flowers are small, yellowish and hairless, and are held in small clusters. The fleshy fruits are egg-shaped, 2.5 – 3 cm long and black when ripe.

5.2.18.4 Management issues

Dumped garden waste present adjacent to the fence within the Zone includes invasive weed species such as *Callisia* sp.

Lantana was the only weed referred to in the plan. Weeds included *Ochna serrulata*, Corky Passionfruit, Broad-leaved Paspalum, Coastal Morning Glory, Winter Senna and Climbing Nightshade. There is minimal weed remaining in the Zone.

5.2.18.5 Management actions required

Bush regenerators to remove dumped garden waste from the Zone for pick up by Council. Council is to notify neighbours of the value of the bushland remnant and request a cessation to dumping.

The Green-leaved Rose Walnut is to be located and marked with flagging tape while bush regenerators are working within the Zone.

- Hand weed within a 2m perimeter of the Green-leaved Rose Walnut,
- Spot spray throughout the remainder of the Zone;
- Follow up on a regular basis at three to four monthly intervals.

Monitor the Zone to record recruitment of Green-leaved Rose Walnut. Plant an additional five Green-leaved Rose Walnut using cuttings sourced from the estate.

5.2.18.6 Additional information

As a recommendation of the management plan (Benwell 2002) a paling fence has been constructed around the Zone to discourage rubbish dumping into the Zone.

The plan also recommended the propagation of five additional Green-leaved Rose Walnut from local cuttings and planting along with assorted low growing rainforest species.

A path to the plant was also recommended.

5.2.18.7 Related Documents

- *Management Plan for the Endangered Plant Rusty Green-leaved Rose Walnut (Endiandra muelleri subsp. bracteata), Koala Beach Stage 3* (Benwell 2002)



Plate 7 – View to eastern edge of Zone 18 from Hovea Drive

5.2.19 Zone 19 - Grassy

5.2.19.1 Location and extent

Zone 19 is the south west corner of Koala Beach. The Zone has an area of 47.81ha.

5.2.19.2 Vegetation and habitat features

The vegetation is dominated by Broad-leaved Paperbark and Swamp Oak.

The structure is generally mid high to tall open forest, but in parts the canopy is more open.

There are small numbers of Camphor Laurel in the upper stratum.

The mid stratum is generally very sparse. The ground stratum is generally dense to sparse.

With the exception of a few very low lying areas, the ground stratum is dominated by exotic species of grass, principally *Setaria* and *Broad-leaved Paspalum*.



Plate 8 - Dense groundcover of exotic grasses Zone 19

5.2.19.3 Previous works

No previous works.

5.2.19.4 Threatened or significant species

Koalas are known from this Zone.

Planigale monitoring works were initially undertaken in this Zone.

5.2.19.5 Management issues

Zone 19 is large and will be difficult to restore due to the dense groundcover of exotic grasses. Weeds include Camphor Laurel, Lantana and Tobacco Bush in the mid stratum and Setaria, Broad-leaved Carpet Grass, Camphor Laurel, Cuphea, Lantana, Vasey Grass, Broad-leaved Paspalum and Tobacco Bush in the ground stratum.

5.2.19.6 Management actions required

The large size of the Zone and the dense groundcover of exotic grasses throughout would require a long term commitment to restoration.

Action 49 in the Overall Management Guidelines (BRS 2009) recommends the “staged replacement of exotic grasses with native ground covers for Stages 5 and 6 in accordance with the Planigale PoM (Callaghan et. al. 2005) and the Estate-wide Habitat Restoration Plan” (2009). Pitfall 2 in the Planigale Monitoring (Hannah 2007) is located in this Zone and recorded the highest groundcover of weeds. Dot point two in the recommendations states that Planigale are likely to avoid areas dominated by dense Setaria and Broad-leaved Paspalum.

Trials are recommended as part of this Plan to control dense groundcover weeds at trap location Pitfall 2. The trial is to be included with the Planigale monitoring in consultation with the contractor undertaking the monitoring. There has been evidence from previous restoration works on the site that exotic groundcovers will convert to native groundcovers with specialist management.

5.2.19.7 Additional information

In the mid-1990s Zone 19 was relatively weed free. The ground stratum in the majority of this area is now dominated by weeds, probably as a result of drainage undertaken by neighbouring landholders to the west.

The composition of the ground stratum has noticeably changed since detailed records were made in 1994 as part of the Tweed Coastal Remnant Bushland Inventory (James and Murray). The proportion of weed cover in the ground stratum was recorded for sixteen plant communities that made up what is now Zone 19. The cover of weeds (exotic grasses) was less than 20% over approximately 70% of the Zone. Weeds were dominant in the ground stratum in only approximately 10% of the Zone.

The native ground stratum species that have been displaced are wetland sedges, grasses and herbs.

The drainage infrastructure on the western boundary of Zone 19 has been greatly improved since 1994. Improvements include increases in the cross section of drains, construction of a barrage on Christies Creek and improvements in pumping equipment (especially the replacement of a tractor power take-off driven pump with an automated electric driven pump). Any improvement to drainage at this location would not only drain the cane fields to the west, but also the wetlands on the subject property.

It would appear that the depth and duration of inundation of the wetlands has been considerably reduced since 1994 providing suitable conditions for establishment of exotic grasses.

This change in drainage is likely to have had a range of impacts on the function of the wetland, including recent records of fallen trees, in addition to the change in the composition of the ground stratum vegetation.

The formerly relatively weed-free section of Zone 19 is classified as SEPP 14 and is Zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforests).

5.2.19.8 Related Documents

- *Koala Beach Habitat Restoration Plan*, (BRS, revised 2009)
- *Koala Beach Estate - Overall Management Guidelines* (BRS, revised 2009)
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2007 (Hannah 2007)



Plate 9 - Planigale trap line in Zone 19

5.2.20 Zone 20 - Water tower to Cudgen Nature Reserve

5.2.20.1 Location and extent

Zone 20 is the large north western section of Koala Beach which links to Cudgen Nature Reserve on the northern boundary. The Zone has an area of 83.72ha.

5.2.20.2 Vegetation and habitat features

The Zone consists of a large number of vegetation communities as it is located on a mixture of hillside terrain and floodplain / sandplain.

The vegetation is in generally good condition with weeds concentrated in wet gullies, gaps in the forest and previously disturbed areas. The Zone was previously classified as relatively weed free native forest.

The Tweed Vegetation Management Strategy (Kingston et. al. 2004) identifies the following vegetation communities:

- Coastal Blackbutt Open Forest to Woodland,
- Coastal Swamp Box Open Forest to Woodland,
- Blackbutt Open Forest Complex,
- Brush Box Open Forest,
- Broad-leaved Paperbark Closed Forest to Woodland,
- Broad-leaved Paperbark + Swamp She-oak Closed Forest to Woodland,
- Broad-leaved Paperbark + Eucalyptus spp. +/- Swamp Box Closed Forest to Woodland,
- Saltmarsh Communities, and
- Mangrove Open Forest to Woodland.

5.2.20.3 Previous works

Feral dog and Fox control works.

5.2.20.4 Threatened or significant species

Glossy Black Cockatoos and Koalas are known from this Zone.

5.2.20.5 Management issues

Weeds include Lantana, Bitou Bush and Corky Passionflower in the mid stratum and Setaria, Vasey Grass and Broad-leaved Paspalum in the ground stratum.

The isolated locations of weeds have been recorded during previous fauna surveys by the Bushland and Pest Control Officers and bush regenerators involved in the adjacent Blossom Bat project.

5.2.20.6 Management actions required

The recommendation is to target these locations with the restoration team taking a small spray pack and chemical dripper bottle.

Isolated weeds such as Lantana and Bitou Bush to be hand pulled and larger plants cut, scraped and painted.

Areas of exotic grasses to be spot sprayed.

5.2.20.7 Additional works

Wild Dog and Fox control works were undertaken in this Zone during 2011.

5.2.21 Zone 21 - Ranch Sites Stage 7

5.2.21.1 Location and extent

Zone 21 remains in private ownership and was the final stage (Stage 7) of the development and includes two ranch sites. The Zone has an area of 26.32ha.

5.2.21.2 Vegetation and habitat features

The vegetation includes Swamp Oak forest, Swamp Oak/Swamp Mahogany forest and rainforest along the edges.

The rainforest pockets have been identified as roosting habitat for the Common Blossom Bat.

5.2.21.3 Previous works

No previous works in this Zone.

5.2.21.4 Threatened or significant species

Two Threatened flora species were recorded in the rainforest, Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *bracteata*) and White Lace-flower (*Archidendron hendersonii*).

Koalas and Common Blossom Bat are also known from this Zone.

Planigale monitoring works were initially undertaken in this Zone.

5.2.21.5 Management issues

Weeds include areas of dense exotic grasses and Lantana particularly along the forest edge with some patches extending into the forest. Grasses include Setaria, Broad-leaved Paspalum and Broad-leaved Carpet Grass *Axonopus compressus*.

5.2.21.6 Management actions required

The Plan of Management for the Environmental Protection Areas – Stage 7 (Callaghan et. al. 2003) provides details for restoration of the environmental protection areas within the Zone for a three year period.

The Plan of Management also states that “on-ground restoration works to implement this PoM should be consistent with a detailed Overall Habitat Restoration Plan for the Koala Beach Estate.

This plan will include a map depicting the current extent of weed invasions within the 7(l) and 7(a) Environmental Protection Zone lands, proposed work Zones, prioritisation of works, weed control methods, timing and proposed plantings”.

Restoration works are included as compensation as recommended in the eight part test for Threatened Species habitat.

Recommendations are that a detailed restoration plan is prepared for Zone 21 on finalisation of the transfer of the land or revision of this Plan in December 2018.

5.2.21.7 Related Documents

- *Plan of Management for Land Zoned 7 (l) Environmental Protection (Habitat) and 7(a) Environmental Protection (Wetland and Littoral Rainforest) Koala Beach Stage 7*, (Callaghan, et. al. 2003).
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2007 (Hannah 2007)

5.2.22 Zone 22 - North

5.2.22.1 Location and extent

Zone 22 is located north west of Christies Creek and is held in the ownership of the Ray Group. The Zone has an area of 75.12ha

5.2.22.2 Vegetation and habitat features

The vegetation varies from good condition Swamp Mahogany forest in the north to Swamp Oak and Broad-leaved Paperbark forest with dense understorey of Broad-leaved Paspalum in the south. There is scattered Winter Senna and Lantana and isolated Camphor Laurel, Cocos Palms *Aracastum romanzoffianum* and Umbrella Trees.

5.2.22.3 Previous works

No previous works in this Zone.

5.2.22.4 Threatened or significant species

Further investigation required to identify Threatened Species in this Zone.

5.2.22.5 Management issues

Planigale monitoring works are undertaken in this Zone.

Further investigation is required to identify management issues present in this Zone.

5.2.22.6 Management actions required

Recommendations are that a detailed restoration plan is prepared for Zone 22 on finalisation of the transfer of the land to Council or revision of this Plan in December 2018.

5.2.22.7 Additional information where relevant

The land is proposed to be transferred to council on completion of the final stage 7.

5.3 Plantings - Existing and Proposed

5.3.1 Zones 24 - 27

5.3.1.1 Location and extent

These four Zones are plantings initially undertaken as part compensation for the construction of the sports fields and road from Macadamia Drive to the sports fields.

5.3.1.2 Vegetation and habitat features

Zones 24, 25 and 26 are Koala food tree plantings and 27 rainforest species

5.3.1.3 Previous works

The Koala food tree plantings have been successful with trees up to 9m high. Zone 27 had low survival rate of plants. The planting Zones have all had follow up weed control during 2010 to 2015. A community planting day was held in 2011 to replace the failed planting in Zone 27. Additional community plantings in 2012 and 2013 have extended Zone 27 to the west with a total of 1400 trees being planted.

5.3.1.4 Threatened or significant species

Koalas have been recorded in this Zone.

5.3.1.5 Management issues

All plantings had mesh fencing to control access and browsing by wallabies. Part of the fencing has been removed in Zones 24 – 26 to allow fauna, particularly Koalas, access to the Zones. The fencing has remained along the road frontage.

5.3.1.6 Management actions required

The plantings will require four monthly spot spray of the exotic grasses and groundcovers. The exotic groundcovers will be gradually naturally replaced by native grasses and groundcovers and also shaded out by the plantings and natural regeneration.

Zone 25 was previously recommended for extension planting using Koala food trees. Natural regeneration has progressed in this Zone. A small extension planting of Koala food trees which does not extend into the mowed road verge is recommended. The planting will require fencing or guards to protect the young plants from wallaby browsing and Council mowing.



Plate 10 Trees well established and shading out weed regrowth Zone 27

5.4 Core Hairy Joint Grass

5.4.1 Zone 23 - Arthraxon Reserve

5.4.1.1 Location and extent

Zone 23 is the management area for the Threatened Hairy Joint Grass *Arthraxon hispidus* and is located west of Lomandra Avenue and surrounded by Zone 11. The Zone has an area of 0.39ha.

5.4.1.2 Vegetation and habitat features

The Zone consists of two sections, the core management area where the Hairy Joint Grass is located and the surrounding buffer which is mainly *Setaria* with a *Cuphea* understorey.

5.4.1.3 Previous works

Works have been undertaken in the Zone for the past seven years being concentrated on the control of dense *Setaria* and more recently *Cuphea*.

5.4.1.4 Threatened or significant species

Hairy Joint Grass *Arthraxon hispidus*.

5.4.1.5 Management actions required

The report recommends plantings along the eastern edge of the slashed buffer adjacent to Lomandra Avenue and at the northern section of the buffer. Koala feed trees had been planted in the eastern section but had a low survival rate due to predation by wallabies.

The pegged core area is managed by bush regeneration contractors under the guidance of the Bushland Officer as detailed in the Summer Arthraxon Monitoring Report (2008).

5.4.1.6 Additional information

The whole Zone is managed by NRMU. The grassed buffer section is maintained by Recreation Services in conjunction with the Koala Beach slashing program. A buffer of 5m is left along the edge of the forest on the west.

5.4.1.7 Related Documents

- *Arthraxon hispidus Population Plan of Management (2004)*
- *Arthraxon hispidus Summer 2008 Monitoring Report (Feb 2008)*



Plate 11 (Left) *Arthraxon hispidus* reshooting (October) amid the weed *Cuphea* and exotic grasses.

Plate 12 (Below) Core Arthraxon area (long grass) and buffer after mowing.



5.5 Buffer Hairy Joint Grass

5.5.1 Zone 11 – Macadamia West

5.5.1.1 Location and extent

Zone 11 is west of Macadamia Drive and Lomandra Avenue and extends to the drainage reserve south of Sugar Glider Drive. The Zone excludes the Arthraxon site and drainage line to the sediment ponds and plantings in the south. The Zone has an area of 2.79ha.

5.5.1.2 Vegetation and habitat features

The vegetation is Swamp Box /Swamp Oak forest with rainforest species in the mid stratum.

5.5.1.3 Previous works

The Zone has had minimal previous works confined to the west of the Arthraxon site and a small area to the south. Council has removed the woody weeds and vegetation around the drainage

line in the north.

A community planting was undertaken in 2013 in the north of the Zone. Additional planting could be undertaken within open areas in this zone.

Plant at low density (i.e. 1 tree/5m²) within the recommended area with Koala feed trees Swamp Mahogany, Small-fruited Grey Gum and Tallowwood. Prior to planting prepare the area by spot spraying circles of 1-2m diameter and use heavy plastic tree guards to protect the trees from grazing.

5.5.1.4 Threatened or significant species

No Threatened or significant species have been recorded in this work zone.

5.5.1.5 Management issues

The major weed is Setaria and Broad-leaved Paspalum with occurrences of Blue Billygoat Weed and other groundcover herbs. The southern section has Setaria and Broad-leaved Paspalum on edges, and large Lantana and Winter Senna, Corky Passionfruit, scattered Giant Devils Fig and Climbing Nightshade.

5.5.1.6 Management actions required

Work to commence in the north along the southern edge of the drainage line working in an east west direction moving to the south.

- Spot spray to control introduced grasses and other groundcover weeds throughout forested area including the 5m buffer on east along the forest edge and through the planting. Care to be taken as Arthraxon is likely to occur along the edge;
- Cut, scrape and paint woody weeds including Lantana, Winter Senna and Giant Devils Fig;
- Overspray dense patches of Lantana and leave in situ;
- Cut Corky Passionfruit at head height and roll up base and hang up in fork of tree;
- Follow up spot spray throughout the Zone;
- Follow up at three monthly intervals until exotic grasses are under control and then at three to four monthly intervals.

5.6 Bushfire Asset Protection Zones

The following seven Work Zones are the combined responsibility of NRMU and RSU.

5.6.1 Zones 37 - 43 - Asset Protection Zones

5.6.1.1 Location and extent

These Zones are maintained by RSU under the guidance of NRMU and inspected on an annual basis, prior to the start of the bushfire danger period. The maintenance is by slashing to reduce the fuel load within the APZ. In some instances the APZ appears to extend beyond the prescribed distance required e.g. sections of 39 and 41

5.6.1.2 Threatened or significant species

No Threatened or significant species have been recorded in these Zones.

5.6.1.3 Management issues

Encroachment of private infrastructure into APZs by neighboring residents.

5.6.1.4 Management actions required

The yearly inspection of these Zones should check that the Zones are not extending further than required or beyond the currently maintained area into the native vegetation. If required, stakes should be erected to mark the extent of the APZ.

RSU slashing contractors are to be briefed on the management of the Zones and care is to be taken not to extend boundaries into native vegetation.

5.7 Parks and Sports fields

The following nine Zones are the responsibility of Recreation Services Unit (RSU).

5.7.1 Zone 28 - Dunghir Aboriginal Cultural Site

5.7.1.1 Location and extent

The Zone has an area of 0.06ha and is the location of a large Fig tree surrounded by mown grasses.

5.7.1.2 Previous works

The site is regularly maintained by RSU.

5.7.1.3 Management issues

There are isolated weeds surrounding the base of the tree including Ochna, Ground Asparagus and Camphor Laurel seedlings. These weeds should be spot sprayed ensuring not to damage any regenerating native seedlings.

5.7.1.4 Management actions required

Maintenance –Continue mowing of exotic grasses leaving a buffer around the base of Fig tree.



Plate 13 - Large Fig tree in the Zone 28

5.7.2 Zones 29 – 36 - Gardens and Playgrounds

5.7.2.1 Location and extent

The Zones are either planted gardens or mown areas with playground equipment and shrub or tree plantings which are maintained by RSU.

5.7.2.2 Threatened or significant species

No Threatened or significant species have been recorded in these Zones.

5.7.2.3 Management actions required

Garden plantings are to be local native species suitable for the location. Tree plantings in the larger parks for example Zones 30 and 33 are to include habitat trees such as Swamp Mahogany, Grey Gum, Forest Oak and Coast Banksia.

Care is to be taken when mowing, slashing or spraying adjacent to work Zones managed by NRMU. Work Zones 30, 32, 33 and 35 are adjacent to native vegetation. As these areas are regularly used by birds for nesting or shelter the boundaries to be clearly defined so that habitat along edges is not disturbed.

Council is to investigate the placement of bollards where boundaries are not clearly defined.

Care to be taken when maintaining garden plants. Garden plants are used by birds and other fauna. Consideration is to be given to timing of pruning when plants are not in flower, careful pruning of dominating native vines (e.g. Monkey Rope Vine) and spraying of native groundcovers.

5.8 Sewage, drainage and infrastructure

The following six Work Zones are the responsibility of Works Unit.

5.8.1 Zones 44 - 49 - Sewage/drainage/water infrastructure

5.8.1.1 Location and extent

Two Zones 44 and 45 are unlikely to have any impacts on habitat management as one is a pump station and the other is a reservoir.

The remaining Zones, 46 to 49 are storm-water detention ponds and all adjoin native vegetation managed by NRMU.

5.8.1.2 Vegetation and habitat features

The vegetation surrounding these man-made ponds was generally in poor condition requiring considerable work to provide habitat for native wildlife, and a barrier to prevent Cane Toads utilising the ponds as breeding hubs. The fencing, plantings and maintenance has excluded Cane Toads and significantly improved the habitat for native wildlife.

5.8.1.3 Previous works

Mown grasses around the ponds has been replaced by native vegetation. Plantings of native groundcovers has been undertaken since 2011 and Cane Toad exclusion fences installed. The native vegetation surrounding the ponds has been maintained by bush regenerators commencing in 2014. Community Cane Toad musters have been undertaken since December 2009. Cane Toad traps were trialled in summer 2014/2015.



Plate 14 Sediment fencing and plantings to deter Cane Toads in Zone 46

5.8.1.4 Threatened or significant species

No Threatened or significant species have been recorded in these Zones.

5.8.1.5 Management issues

The sediment detention ponds and surrounding areas previously provided prime habitat for Cane Toads. Fence and weed maintenance to continue to ensure Cane Toads are excluded.

5.8.1.6 Management actions required

Works have focused on reducing the suitability of these sites for feral animal species. The dense plantings of sedges and grasses around the ponds discourage Cane Toads. Current plantings along edges which include Lomandra and native sedges are being maintained to retain the dense cover.

The *Control Plan for Cane Toads, Koala Beach Estate, Tweed Shire* (Gray 2011) has been prepared to guide Cane Toad control at Koala Beach and is intended to be implemented as part of this Plan.

6 Habitat Restoration Standards and Procedures

Regeneration and restoration of native plant communities is acknowledged to be a complex, long-term process and more than just weed control or tree planting exercises. While weed control is of paramount importance, all weeds are seen as part of a dynamic, interacting ecosystem. By exploiting the natural regeneration potential of the native vegetation, weed species can be controlled in such a way that they are replaced by native species rather than by other weeds. This approach utilises the processes of natural regeneration and succession to ensure the long-term viability of the native floral and faunal communities (Joseph 1998).

The approach proposed in this Plan is firmly based on the principle that effective and sustainable rehabilitation of native plant communities requires an integrated approach which takes into account a range of ecological factors and utilizes a variety of practical measures. Where a site has a variety of weeds an integrated approach contrasts with more traditional approaches based on weed control, which set priorities on a species by species level and selectively target individual species. If carried out in isolation from other ecological considerations, these approaches lead to increased re-infestation or to the replacement of targeted species with other weeds some of which may even be more damaging.

The restoration at Koala Beach requires assisted regeneration and reconstruction approaches. The assisted regeneration approach is appropriate in relatively intact plant communities where limited interventions such as weed control are sufficient to restore the native vegetation e.g. along the forest edges. The reconstruction approach is where revegetation techniques will be implemented e.g. planting of habitat trees for Koalas or Blossom Bats.

Weeds must be controlled in such a way that they are replaced by native species. Weed control in this context consists of several stages: (a) primary weed control (b) follow up weed control and (c) maintenance of the site.

6.1 Primary weed control

This involves initial weed control within a designated area and aims at destroying the parent weed seed source on the site.

The process of primary weed control requires accurate identification of all plant species and application of the appropriate control method for individual weed species. At Koala Beach it involves techniques such as spraying large areas of introduced grasses, cutting and painting or overspray of Lantana or injection of large Tobacco Bush and Winter Senna.

On the other hand it may involve delicate hand removal of weed seedlings adjacent to native seedlings. Effective and accurate weed control at this stage is fundamental to successful restoration of plant communities.

6.2 Follow up control

Upon completion of primary weed control, resources for plant growth such as light, space, moisture and nutrients are made available to nearby plants and soil seed banks. Plants both native and weed will start regenerating and the aim is to remove the weeds at seedling stage so as to prevent their further spread. By controlling weeds before they flower and fruit also makes available the resources for native regenerating plants.

The follow up weed control generally involves spot spraying the emerging weed seedlings in the site after primary weed control. Accurate identification of all plants is vital at this stage as

incorrect identification can result in the destruction of native species and exhaustion of the native soil seed bank or the promotion of weed species if incorrectly identified as native species.

Follow-up weed control is essential to the long-term restoration of native vegetation. Regeneration of native species may be initiated but will be short-lived if weeds reclaim the site.

6.3 Maintenance

Timely site maintenance which frequently involves spot spraying of weed species is ongoing. Frequency and duration will vary according to the response of the native vegetation, viability of weed seed in the soil and the proximity of weed sources for re-infestation of the site.



Plate 15 - Drainage line managed by NRMU as an extension of Zone 4
The vegetation is naturally regenerating native grasses and sedges

6.4 Planting

The following guidelines should be applied to any plantings undertaken as part of the restoration program to reinstate plant communities.

- Maintenance of genetic integrity: only local species provenances (i.e. from the Koala Beach site or nearby similar vegetation communities) should be used in planting and seeding treatments.
- Restoration of original vegetation communities: revegetation should aim to restore the original pattern of vegetation types.
- Planting local native tree species in appropriate locations: this will progressively suppress exotic grasses and groundcovers and provide habitat for Threatened fauna (e.g. Tallowwood (*Eucalyptus microcorys*), Grey Gum (*E. propinqua*), Ironbark (*E. siderophloia*), Brush Box (*Lophostemon confertus*), Forest Oak (*Allocasuarina torulosa*), and Coast Banksia (*Banksia integrifolia*) in upland areas; Swamp Mahogany (*E. robusta*), Swamp Turpentine (*L. suaveolens*), Swamp Oak (*Casuarina glauca*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) in low-lying areas).
- Control of wallaby grazing: one of the most serious obstacles to successful and quick establishment of native trees within Koala Beach is wallaby grazing. Tree plantings to be protected by suitable tree-guards or fencing.

6.5 Threatened Species

A section 132 (NPW Act 1974) licence is required by OEH for any works in or near threatened species habitat or endangered ecological communities.

As Endangered Ecological Communities and species listed as threatened in the NSW *Threatened Species Act* (1995) occur in Koala Beach a current Section 132 licence must be held by bush regenerators working on the site. Guidelines for Working in Threatened Species Habitat (**Appendix 7**) must be followed.

6.6 Cultural Heritage

It is an offence against the NSW *National Parks and Wildlife Act* 1974 (Section 90:1) for a person who, without obtaining the consent of the Director General, knowingly destroys, defaces or knowingly causes or permits destruction or defacement or damage to a relic or Aboriginal place.

If Aboriginal sites or artefacts should be encountered during restoration works at the site work must stop and the NSW OEH Regional Archaeologist, Coffs Harbour or the Sites Officer OEH Alstonville is to be notified immediately.

6.7 Chemical Use

Use of chemicals such as herbicides and their additives must only be carried out by personnel who hold current chemical users certificates.

These chemicals must be used in accordance with label directions unless an off-label use permit is procured from the APVMA (Australian Pesticides and Veterinary Medicines Authority). Chemical use records must also be kept for conditions, areas treated, amounts used and application rates in accordance with the *NSW Pesticides Act* (1999) (**Appendix 5**).

Bush regenerators working on site are to comply with the Tweed Shire Council Pesticide Notification Plan.

6.8 OH&S Requirements

Contractors working on the site are required to comply with the requirements of the NSW *Workplace Health and Safety Act* (2011) and regulations.

The Act requires Job Safety Analysis (JSA) sheets to be compiled for work sites and to be read and signed by all site workers daily prior to commencement of work (**Appendix 6**). Any potential hazards at work sites need to be assessed and steps taken to make the tasks as safe as reasonably practicable.

6.9 Personnel

Contractors implementing the Plan are to be listed on Tweed Shire Council Panel of Providers for bush regenerators.

Contractors are to be fully qualified and experienced bush regenerators with a minimum of Conservation Land Management Certificate 3 or equivalent and two years' experience working in coastal sclerophyll, wetland and rainforest communities.

Supervising bush regenerators are to hold a minimum of Conservation Land Management Certificate 4 and four years' experience working in coastal sclerophyll, wetland and rainforest communities and the habitat of threatened flora and fauna.

Skills are to include a high level of plant identification particularly grasses and groundcover, native and exotic. The restoration challenge at many of the sites in Koala Beach is the control of exotic grasses and facilitating conversion to native grasses and groundcovers.

7 Street Tree Management Procedure

Street trees have been maintained by RSU with replacements required due to tree losses or removal required due to damage of infrastructure.

Street tree health is to be assessed annually and any damage caused to adjacent infrastructure noted, all losses replaced by RSU in consultation with NRMU. The tree species currently include primary Koala habitat trees, many of which have grown tall and in some instances caused damage to infrastructure. Where possible these trees should be retained.

New plantings are to be local native species, preferably Koala habitat trees. Where the position is unsuitable for a Koala habitat tree then plantings can include species such as Tuckeroo *Cupaniopsis anacardioides*, Tulipwood *Harpulia pendula*, Broad-leaved Lilly Pilly *Acmena hemilampra*, Blue Lilly Pilly *Syzygium oleosum*, Coastal Banksia *Banksia integrifolia*, Swamp Box *Lophostemon suaveolens* and Weeping Bottlebrush *Callistemon viminalis*. A full list of species suitable for planting at Koala Beach is provided in **Appendix 9**.

A regular assessment needs to be undertaken to identify instances where weed species such as *Duranta* have been planted along nature strips. All identified occurrences need to be removed and replaced with suitable species.

Koala feed tree removal procedures for Koala Beach residential Estate 2014 has been prepared by Tweed Shire Council.

Turnbull, J Hopkins, M 2014 *Koala feed tree removal procedures for Koala Beach residential Estate*.

8 Pest Animal Management

There are a number of pest animals known from Koala Beach Estate. These include Wild Dogs, Cane Toads, Foxes, Rabbits and Hares, and Indian Myna.

Management actions have been undertaken in some works Zones; these have been noted in the relevant sections of this Plan.

Species specific management plans have been developed to coordinate works throughout the estate.

The Control Plan for Cane Toads, Koala Beach Estate, Tweed Shire Gray 2011

Wild Dog and Fox monitoring and Control Koala Beach Estate NRM Unit 2011- 2014.

9 Koala Beach Community Involvement

Tweed Shire Council has encouraged resident participation on the KBWHM committee. The Tweed Community Support Officer has encouraged residents and interested local community members to be involved in activities such as tree planting, information sessions and guided walks. Specific activities to include Cane Toad Awareness, Bushfire Awareness, Koala Spotting and tree planting.

Potential additional planting sites for community participation include:

- Work Zone 23 along edge of Arthraxon;

- Work Zone 25 corner of Macadamia and the Link Road (see Plate 16);
- Work Zone 5 south west corner of Lower Grey Gum Gully on Macadamia Drive; and
- Work Zone 14 Compensation.

Prior to planting all the sites will require the control of dense exotic grasses by slashing or spot spraying. See **Section 6.4** for guidelines on planting including species selection and protection from predation.



Plate 16 - Potential extension of planting Work Zone 25

10 Implementation Table

The numbered Work Zones within each management class (refer **Figures 2** and **3**) are linked to the implementation table.

The implementation table provides the location and main actions for each of the identified work units within the management classes. See **Table 1**.

Work Zones within management classes that are the responsibility of the Natural Resources Management Unit also include priority for works, the number of bush regeneration person days per quarter for years 1 and 2 works and total person days and cost for years 1 and 2.

The works program provides estimated costs and timeframes for implementation of restoration activities. These estimates provide a guide to the time and resources required to undertake work based on the site assessment undertaken in preparation of this plan. Actual costs may vary from these estimates due to a range of circumstances. The program is ongoing commencing in 2012 with the table revised in 2015.

The numbered identifier allocated to the Work Zones is used in **Section 5** to guide implementation of on ground bush regeneration works and other management.

11 Monitoring and Evaluation

11.1 Monitoring

The main application of a monitoring program should be the prediction of factors in the restoration project, such as:

- Follow up programs for weed species;
- Native species regrowth (rate and amount of regeneration, whether planting will be required);
- Changes in species abundance, diversity and cover over time;
- Cost and time required for each component of the project;
- Response to different weed control techniques;
- Threatened species (presence, regeneration, habitat); and
- Success of revegetation (survival, growth rate).

Before setting up the monitoring program the objectives of the restoration project need to be referred to and the amount and type of data necessary to monitor the objective identified.

A photo point is to be set up within each work zone marked with a surveyors peg or star picket and flagging tape attached to a nearby tree. The photo point location is to be recorded using a hand held GPS and recorded on the Daily Record Sheet (DRS) (**Appendix 5**). A Site Attribute and Habitat Assessment Data Sheet is to be completed for each work zone (refer to Appendix 9 for Monitoring Proforma). A photo-point is to be established, a photo taken and Monitoring Proforma completed in each work zone prior to the commencement of work.

Additional photo points to be set up by the bush regenerators prior to commencement of works in each zone where points of interest are observed, e.g. dense weed, rubbish dumping or fauna habitat.

The additional photo points are to be recorded on the DRS with a photo point number, site identifier and description, direction facing and GPS co-ordinates.

The photo points are to be set up as follows:

- Photo point location to be marked using a star-picket with flagging tape tied to the top.
- The star-picket to be located in the centre of the photo to provide a reference point.
- Photos to be taken at the same time of the day each time.
- The camera lens, angle and height to be the same for each photo.

Performance Indicators (Monitoring & Assessment Proforma see **Appendix 10**).

The following performance indicators will be used to determine the success of the project.

1. Structural and Compositional Integrity
 - Percentage cover of exotic plant species reduced in each stratum
 - Percentage cover of native plant species increased in each stratum
2. Dominant Weed Assessment
 - Number of dominant weeds reduced in each stratum
 - Percentage cover of dominant weeds reduced in each stratum
3. Weed Density and Severity Scores

- Weed density and severity scores reduced

4. Threats

- Reduction of weeds in zones worked after one year of primary treatment and follow up as detailed in work program. Weeds to be at a level where there is nil fruiting - no mature plants present.
- Increased neighbour and community interest and appreciation of bushland as evidenced by involvement in restoration activities, reduction of garden dumpings and rubbish and inappropriate garden plantings.

11.2 Reporting

All work activities including chemical use will be recorded on a Daily Record Sheet (Appendix 5). The daily reporting on the DRS will be summarised on a regular basis. An annual meeting will be held with council to review the progress of the project, identify the extent of area worked, discuss effectiveness of management actions and identify any new management issues and to provide follow up photographs.

The details of the content, duration and frequency of reporting will be determined by the funding source.

It is recommended that the following components be included in project reporting:

- A summary of works completed by work zone (including all information recorded on Daily Record sheets);
- Rapid Assessment data sheets;
- Photo–point locations and photos;
- Photo documentation of work activities;
- Evaluation of performance indicators;
- Any other management issues;
- Resources used including labour; and
- Any adaptive management approaches used or proposed.

It is recommended that annual reporting and a final report at the end of the project is to include:

- Progress of the Implementation Schedule and details of work performed;
- Monitoring results and compliance with performance indicators;
- Any changes in the Implementation Schedule as a result of adaptive management;
- Progress of ongoing site management issues;
- Any records of threatened flora and fauna species; and
- Recommendations regarding the ongoing management of the site.

The funding body may require baseline and subsequent ArcView shapefiles relating to the site and project.

The purpose of regular monitoring, recording and reporting is not just to document the progress of the project, but also to provide feedback to the managers on the success or failure of the various management strategies and allow adaptation of the restoration program to achieve best practice outcomes.

11.3 Adaptive Management

The management actions recommended in this Plan are intended to provide a basis for the success of the project. A key factor for success will be the ability of those implementing the Plan to respond to changing site conditions. The purpose of regular monitoring, recording and reporting is not just to document the progress of the project, but also to respond to unanticipated

circumstances, provide feedback to the managers on the success or failure of the various management strategies and allow adaptation of the rehabilitation techniques and implementation schedule to achieve maximum effectiveness in weed control and habitat management.

This adaptive management approach is especially important in relation to the control of weeds and where applicable the species selection for planting programs. Regular monitoring is to be used to assess the effectiveness of management strategies and provide the basis for adaptation of the implementation schedule.

Any amendment to this Plan will be submitted to Council for approval.

12 References

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Appendix 1 – Summary Overall Management Guidelines (2009)

Note to the Committee: In the majority of cases, actions will be undertaken by other agencies rather than the Committee itself. For example, in the case of ongoing monitoring and restoration programs, the Committee will have overall responsibility for ensuring satisfactory implementation by the relevant consultants appointed for the specific tasks through Tweed Shire Council. Where annual or regular checks are indicated, the Committee will generally only be required to check with the relevant representative or authority to confirm ongoing implementation and to rectify any failures. Annual checks have been scheduled for the end of each financial year.

Note – Green highlight shows actions covered by the HRP

5.0 Habitat Protection Measures

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
Koala PoM (2004)																	
1. Ensure ongoing legal protection for all primary Koala food trees.	Regular Check													TSC		No Cost	
2. Ensure residents are aware of any primary Koala food trees that occur on their land.	Annual Check													TSC		No Cost	
Glossy Black-cockatoo PoM (2004)																	
3. Ensure ongoing legal protection for all identified Glossy Black-cockatoo food, roost and nest trees.	Annual Check													TSC		No Cost	
4. Ensure residents are aware of any Glossy Black-cockatoo food trees that occur on their land.	Annual Check													TSC		No Cost	

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
Blossom Bat PoM (2004)																	
5. Investigate placement of interpretive signs are provided and then effectively maintained in the Blossom Bat habitat area.	Investigate													Committee TSC		Budget	
6. Ensure all rainforest areas at Koala Beach are permanently protected.	Annual Check													TSC Consultant		Budget	
7. Include rainforest sites in Restoration Plan review 2009 and 2013	Review 2013													Consultant		Budget	
Conditions of Consent																	
8. Ensure ongoing compliance with the Bushfire Management Plans and Section 88B instruments.	Regular Check													TSC Bushland Officer		No Cost	

6.0 Threat Abatement Measures

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
Koala PoM (2004)																	
9. Ensure that domestic dogs (and cats) are not brought onto the Estate.	Regular Check													TSC-Committee		Budget (TSC Patrols)	
10. Ensure that building contractors are effectively advised of the no domestic dogs requirement.	Regular Check													TSC-Committee		No Cost	

11. Ensure that there is adequate signage and ongoing policing of the no domestic dogs (and cats) provision.	Regular Check																			TSC-Committee		No Cost	
12. Seek to ensure compliance with the 40km/hr vehicle speed restriction.	Regular Check																			TSC		No Cost	
13. Make recommendations to Council to address any vehicle speeding issues.	Regular Check																			Committee		No Cost	
14. Ensure that a stout rope (minimum 50mm diameter) is installed in all swimming pools.	Regular Check																			TSC		No Cost	
15. Ensure minimum ground clearance of 300mm for all fencing (except pools).	Regular Check																			TSC		No Cost	

Glossy Black-cockatoo PoM (2004)																							
16. Ensure adherence to the Glossy Black-cockatoo habitat protection and bushfire management requirements.	Regular Check																			TSC-Committee		No Cost	
17. Implement annual fox control program, monitor effectiveness and make adjustments if necessary over time.	Regular Action																			Committee-Consultant		Budget	
18. Ensure the gate across the roadway above Stage 4 is kept closed for emergency and management use only.	Regular Check																			TSC-Committee		No Cost	
Blossom Bat Eight Part Test																							
19. Seek to ensure compliance with the 20km/hr vehicle speed limit in the proximity of the reserved Blossom Bat habitat area.	Regular Check																			TSC		No Cost	

20. Make recommendations to Council to address any vehicle speeding issues in the proximity of the reserved Blossom Bat habitat area.	Periodic Action																	Committee		No Cost	
Bush Thick-knee Survey Reports																					
21. Implement annual feral animal management program, monitor effectiveness and make adjustments if necessary over time.	Regular Action																	Committee-Consultant		see 17above	

7.0 Habitat Restoration Measures

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
22. Implementation of Estate-wide Habitat Restoration as prioritised in Plan	Regular Action													Committee Consultant		Budget	
23. Ensure adequate monitoring for all habitat restoration activities.	Annual Review													Committee-Consultant		Budget	
24. Monitoring results to be reported annually to the Committee.	Annual Review													Consultant		as above	
25. Take remedial actions if required in response to the monitoring results for the habitat restoration program.	Periodic Action													Committee		No Cost	
26. Review the Estate-wide Habitat Restoration Plan in 2014 as recommended	Five year review													Committee - Consultant	2014	Budget	
27. Follow-up required on the initial plantings undertaken in Lower Grey Gum Gully.	Regular Action													Committee-Consultant		Budget	

28. Ensure funding for ongoing implementation of the Estate-wide Habitat Restoration Plan is effectively allocated by TSC from the "Special Rate" through the Committee.	Regular Action																TSC-Committee		Budget		
29. Ensure all restoration plantings have been propagated from locally collected seed.	As required																	TSC-Consultant		No Cost	
30. Investigate Bushfire Asset Protection Zones that overlap with habitat restoration areas are effectively marked by metal posts and signs.	Annual Check																	TSC		No Cost	
31. Report any accidental damage during bushfire fuel management activities beyond the marked area to Council.	Periodic Action																	Committee		No Cost	
32. Ensure that any future species or habitat management plans are consistent with the KPoM.	Periodic Action																	Committee-TSC		No Cost	
ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost				
Glossy Black-cockatoo PoM (2004)																					
33. Recommendations for monitoring for recruitment of young <i>Allocasuarina torulosa</i> are included in the monitoring plan	Regular Action																	Committee-Consultant		Budget	
34. Plantings have been undertaken as recommended. To be maintained	Regular Action																	Committee Consultant		Budget	
35. Ensure fuel loads are adequately managed in and around the Glossy Black-	Regular Action																	TSC-Committee-		Budget	

cockatoo significant habitat area in accordance with the relevant Bushfire Management Plans and the Estate-wide Habitat Restoration Plan.																		Consultant				
36. Ensure weeds are successfully managed in the Glossy Black-cockatoo significant habitat area in accordance with the Estate-wide Habitat Restoration Plan.	Regular Action																	Committee-Consultant		Budget		
ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost					
Blossom Bat PoM (2004)																						
37. Encourage residents to plant local native tree and shrub species that are known Blossom Bat food resources.	Regular Action																	Committee-TSC		No Cost		
38. Ensure weeds are successfully managed in the Blossom Bat significant habitat area in accordance with the Estate-wide Habitat Restoration Plan.	Regular Action																	Committee-Consultant		Budget		
39. Public access is effectively managed by closed gate and central access track within the Blossom Bat significant habitat area.	Regular Check																	Committee-TSC		No Cost		
40. Ensure monitoring for recruitment of young <i>Banksia integrifolia</i> and undertake additional plantings within the Blossom Bat significant habitat area where recommended by annual monitoring. This should be undertaken in accordance with the Estate-wide Habitat Restoration Plan.	Regular Action																	Committee-Consultant		Budget		
41. Ensure fuel loads are adequately managed in and around the Blossom Bat	Regular Action																	TSC-Committee-		Budget		

significant habitat area in accordance with the relevant Bushfire Management Plans and the Estate-wide Habitat Restoration Plan.																Consultant			
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ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
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Arthraxon hispidus PoM (2004)

42. Ensure that slashing and weed control are undertaken each August (with mulch removal) and November-December as detailed in the PoM.	Twice per year													Consultant		Budget	
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43. Ensure that transplanting is undertaken each November to 2006. Completed	No action																
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Rusty Green-leaved Rose Walnut PoM

44. Investigate the planting and maintenance of five Rusty Green-leaved Rose Walnuts to the Stage 3 reserve by 2005.	Implement 2012													TSC Consultant	2012 Outstanding	Budget	
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45. Investigate and implement ongoing habitat restoration works in accordance with the Rusty Green-leaved Rose Walnut PoM and the Estate-wide Habitat Restoration Plan.	Regular Action													TSC Consultant		Budget	
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ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
Eight Part Tests																	
46. Compensatory Koala habitat plantings and restoration to be maintained for Stages 5 and 6 in accordance with the Estate-wide Habitat Restoration Plan.	Regular Action													TSC Consultant		Budget	
47. Compensatory Koala habitat plantings at the Sports Fields to be maintained and fences removed when plants advanced.	Regular Action													TSC Consultant		Budget	
48. Compensatory Planigale habitat plantings and restoration to be maintained for Stages 5 and 6 in accordance with the Estate-wide Habitat Restoration Plan.	Regular Action													TSC Consultant		Budget	
49. Staged replacement of exotic grasses with native ground covers for Stages 5 and 6 in accordance with the Planigale PoM and the Estate-wide Habitat Restoration Plan.	Regular Action													Consultant		Budget	
50. Investigate that 10 propagated Endiandra sourced from Stage 7 specimens are successfully established in Upper Grey Gum Gully.	Implement 2012													TSC Consultant	2012 Outstanding	Budget	
51. Investigate that the vegetative buffer between house blocks 352-358 and 410-414 is established in accordance with the Estate-wide Habitat Restoration Plan and Bushfire Management Plan for Stage 3.	Implement 2012													TSC Consultant	2012	Budget	
52. Investigate maintenance of fringe	Implement													TSC	Commen	Budget	

plantings in the stormwater retention pond adjacent to Stage 6, subject to ongoing mosquito control requirements.	2012																Consultant	ced 2015		
53. Investigate that a minimum of 20 locally sourced Small-fruited Figs <i>Ficus obliqua</i> are included in the prescribed compensatory plantings and successfully established. Plant and maintain as required.	Investigate																TSC Consultant		Budget	

8.0 Ongoing Research, Monitoring and Reporting

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
Koala PoM (2004)																	
54. Ensure implementation of the Koala Monitoring Program: October to November.	Two yearly basis													Committee-Consultant		\$6,000	
55. Ensure Streetscape plantings are checked annually and replacements planted for any losses.	Annual Action													TSC		No Cost	
56. Investigate the preparation of an information brochure which is updated on a regular basis to reflect outcomes from the monitoring programs for Koalas and other threatened species.	Investigate													Committee	News letter	Budget as required	
57. Ensure that the information brochure is provided to all new residents.	Regular Action													TSC Committee	-	No Cost	
58. Koala monitoring results to be reported annually to the Committee.	Annual Action													Consultant		Budget	

Planigale PoM (2004)																	
59. Review implementation of the annual (Spring) monitoring program as specified in the Planigale PoM. Recommended implementation three yearly (2012)	Three yearly action													Committee-Consultant	2012 2015	Budget	
60. Planigale monitoring results to be reported annually to the Committee. (2012)	Three yearly action													Consultant	2012 2015		
61. Planigale monitoring results should guide ongoing habitat restoration.	As above													Committee-Consultant	2015		

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
Blossom Bat PoM (2004)																	
62. Ensure implementation of the (Winter) monitoring program as specified in the Blossom Bat PoM. Recommended that implemented Four yearly (2012)	Four yearly Action													Committee-Consultant	2013 2017	Budget	
63. Investigate extension of monitoring within the urban area to determine use of <i>Banksia integrifolia</i> .	Investigate													TSC Consultant		Budget	
64. Monitor to include impacts of both habitat management and urban development. Performance indicators: comparison of the number of captures per metre/hour between years; number of recaptures of known individuals; comparison of the number of pregnant females and juveniles caught each year.	Four yearly Action													Committee-Consultant	2013 2017	See above	

65. Blossom Bat monitoring results to be reported annually to the Committee and NPWS.	Four yearly Action																Consultant	20123 2017	see above	
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ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost
Glossy Black-cockatoo PoM (2004)																	
66. Ensure implementation of the annual monitoring program as specified in the Glossy Black-cockatoo PoM.	Annual Action													Committee-Consultant	2014 - 2019	Budget	
67. Identify and count all feed trees, roost and breeding trees within the identified Glossy Black-cockatoo significant habitat area.	Annual Action													Consultant		see above	
68. Monitor continued use of the significant habitat area by Glossy Black-cockatoos.	Annual Action													Consultant		see above	
69. Monitor invasive weed species that may compromise the integrity of the identified Glossy Black-cockatoo significant habitat area.	Annual Action													Consultant		see above	
70. Encourage residents to compile sightings for collation in conjunction with the annual monitoring program. This would include distributing record sheets and material on identification.	Annual Action													Committee		No Cost	
71. Glossy Black-cockatoo monitoring results to be reported annually to the Committee and DECC.	Annual Action													Consultant		see 65 above	

72. Inform and involve representatives of the Committee to ensure sightings records as well as concerns are incorporated into annual reports.	Annual Action																	Committee		No Cost	
73. Ensure implementation of the weed management program as specified in the Glossy Black-cockatoo PoM.	Regular Action																	Committee-Consultant		Budget	

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Year	Budgeted Cost	Actual Cost				
Bush Thick-knee Eight Part Test																					
74. Collate annual Bush Thick-knee sighting records.	Annual Action																	TSC Committee		Budget	
Superb Fruit-dove Eight Part Test																					
75. Ensure any records of known kills of Superb Fruit-doves from collision with windows in the vicinity of Fig trees are recorded and collated.	Annual Check																	TSC Committee		No Cost	
Black Bittern Eight Part Test																					
76. Ensure that any observed decline in water quality in Christies Creek is brought to the attention of the Committee and TSC.	Annual Check																	Committee		No Cost	
Arthraxon hispidus PoM (2004)																					
77. Ensure implementation of the annual monitoring program as specified in the Arthraxon PoM.	Twice per year																	Committee-Consultant	Annjual	\$4000	

78. Ensure conduct of seed dormancy research as detailed in the PoM.	Complete 2005																	Committee-Consultant			
79. Arthraxon monitoring results to be reported annually to the Committee.	Annual Action																	Consultant		Budget	
Estate-wide Habitat Restoration Plan (2004)																					
80. Ensure annual monitoring and reporting to the Committee.	Annual Action																	Committee-Consultant		Budget	
Feral Animal Management Program																					
81. Ensure twice-yearly monitoring and collation of ongoing sighting records.	Twice per year																	Committee-Consultant		Budget	
Mosquito Management Program																					
82. Ensure reporting to Council on Mosquito outbreaks in accordance with Council requests.	Periodic Action																	Committee-TSC		No Cost	
Walking Trail Maintenance Program																					
83. Investigate requirements for walking trails within the Estate.	Investigate																	Committee-TSC		Budget	

9.0 Review of Management Actions and Plans

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
Koala PoM (2004)																	
84. Ensure a thorough review of the Koala PoM after 5 years.	Review in 2014													Committee	2014 2019	Budget	

85. Ensure that the Koala PoM is subsequently amended if necessary.	2014																		Committee	2014 2019	Budget	
Glossy Black-cockatoo PoM (2004)																						
86. Provide annual review of the PoM and amend if considered necessary.	Annual review																		Committee-Consultant		Budget	
Blossom Bat PoM (2004)																						
87. Provide a four yearly review of the Plan of Management and amendment if considered necessary.	Four year review																		Committee-Consultant	2013 2017	Include in 61 above	
Estate-wide Habitat restoration Plan (2004)																						
88. Ensure a thorough review of the Estate-wide Habitat Restoration Plan after 5 years.	Review in 2019																		Committee	2015 2019	Include in 25 above	
89. Ensure that the Estate-wide Habitat Restoration Plan is subsequently amended if necessary	2019																		Committee	2015 2019	As above	
Arthraxon hispidus PoM (2004)																						
90. Assess performance indicators annually.	Annual Review																		Committee-Consultant		Budget	
91. Establish ex situ collection if the population shows marked decline or if the majority of performance measures fail to be met.	Annual Check																		Committee-Consultant		Budget	
Bush Stone-curlew Survey Reports																						
92. Ensure a thorough review of traffic speed control measures in the case of any	Annual Check																		Committee		No Cost	

Bush Thick-knee road-kills.																			
Superb Fruit-dove Eight Part Test																			
93. Ensure appropriate action is taken in the case of any deaths of Superb Fruit-doves from collision with windows.	Annual Check																Committee TSC		No Cost

10.0 Bushfire Management

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost	
94. Maintain reduced fuel loads (as prescribed in the relevant Bushfire Management Plan for each stage) within Inner and Outer Asset Protection Zones.	Regular Action													TSC		No Cost		
Inner Asset Protection Zone																		
95. Plantings restricted to fire-retardant species.	Regular Check													TSC		No Cost		
96. No buildings or structures allowed except with approval from Council.	Regular Check													TSC		No Cost		
Outer Asset Protection Zone																		
97. No fencing or structures allowed except with approval from Council and using non-combustible materials.	Regular Check													TSC		No Cost		
Hazard reduction burning																		
98. Mosaic of cool burns recommended in consultation with NPWS, TSC and the Rural Fire Service.	Annual Action													TSC		No Cost		

99. Low intensity burns may be required for some buffer areas where maintenance of vegetation is dependent upon fire.	Annual Action																	TSC-Consultant		No Cost		
100. Important to protect mature trees for hollow-dependent fauna.	Annual Action																		TSC-Committee		No Cost	
101. Ensure appropriate signage is maintained on the Arthraxon reserve fencing to exclude bushfire asset protection Zone maintenance activities.	Annual Check																		TSC		Budget	
Increased community awareness																						
102. Increased community awareness of the need for hazard reduction programs controlled burning and firebreaks recommended through letterbox information drops and TSC hotline.	Annual Action																		TSC		Budget	

11.0 Archaeological Sites

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
103. Ensure ongoing compliance with the Aboriginal Site Management Plan.	Regular Check													TSC		No Cost	

12.0 Other Actions - 2015

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Completed	Budgeted Cost	Actual Cost
104. Monitoring of bat boxes under Cudgera Creek bridge	Annual Action													TC C			
105. Introduced and invasive street tree and park plantings to be replaced by local native species	Regular Action													TSC	2015 - 2019		
106. Estate wide terrestrial bird survey as funding available	Annual Action													TC C		Subject to funding	

Summary of actions requiring allocation of funds 2015 - 2019

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Due	Budgeted Cost	Actual Cost
Ensure that domestic dogs (and cats) are not brought onto the Estate (9).	Regular Check													Committee TSC	Ongoing	\$6,000 (TSC Patrols)	
Implement annual dog and fox and feral animal control program, monitor effectiveness and make adjustments if necessary over time (17).	Annual action													Committee-Consultant	Annual	\$3,500	
Implementation of Estate-wide Habitat Restoration as prioritised in Plan (22)	Annual action													Committee Consultant	Ongoing	\$24,000	
Ensure adequate monitoring for all habitat restoration activities (23).	Annual action													Committee-Consultant	Annual	\$1,500	
Review the Estate-wide Habitat Restoration Plan after 5 years (26).	Five year Review													Committee - Consultant	2019	\$4,500	
Ensure that slashing and weed control are undertaken each August (with mulch removal) and November-December as detailed in the Arthraxon PoM (42).	Twice per year													Consultant TSC	Annual	\$3,000	
Ensure implementation of the annual monitoring program as specified in the Arthraxon PoM (77).	Twice per year													Committee-Consultant		Included above	
Review implementation of the annual (Spring) monitoring program as specified in the Planigale PoM. Recommended implementation three yearly (2010) (59).	Three year Review													Committee-Consultant	2015 2018 Spring	\$6,000	
Ensure a thorough review of the Koala PoM after 5 years (84).	Five year review													Committee	2014 2019	\$4,500	

ACTIONS	Frequency	J	F	M	A	M	J	J	A	S	O	N	D	Responsibility	Date Due	Budgeted Cost	Actual Cost
Ensure implementation of the annual monitoring program as specified in the Glossy Black-cockatoo PoM (86).	Annual Action													Committee-Consultant	2015 to 2019	\$3,500	
Ensure implementation of the (Winter) monitoring program as specified in the Blossom Bat PoM. Recommended that implemented Four yearly (2011) (62).	Four year Review													Committee-Consultant	2017 Winter	\$6,000	
Ensure annual implementation of the Koala Monitoring Program: October to November (54).	Two yearly basis													Committee-Consultant	2017 Spring	\$6,000	
Monitoring of bat boxes under Cudgera Creek bridge (104).	Annual Action													TC C	2016	\$3,600	
Estate wide terrestrial bird survey (106).	Annual Action													TC C	Subject to funding	\$10,000 Initial	

Appendix 2 – Work Zone Areas

Area of work Zones

Work Zones	Area (hectares)
1	1.35
2	1.87
3	6.39
4	0.75
5	2.75
6	8.67
7	4.40
8	7.64
9	9.05
10	4.65
11	2.79
12	5.42
13	1.76
14	2.62
15	1.78
16	9.04
17	1.88
18	0.04
19	47.81
20	83.72
21	26.32
22	75.12
23	0.39
24	0.67
25	0.33
26	0.36
27	0.81
28	0.06
29	0.04
30	0.29
31	0.46
32	0.64
33	0.33
34	0.28
35	0.65
36	2.44
37	1.04
38	1.09
39	0.84
40	1.09
41	0.71
42	1.07
43	0.74
44	0.03
45	0.18
46	0.66
47	0.31
48	0.32
49	2.77
Total	324.42

Appendix 3 – Weed List

Botanical Name	Common Name
<i>Ageratina adenophora</i>	Crofton Weed
<i>Ageratina riparia</i>	Mistflower
<i>Ageratum houstonianum</i>	Blue Billygoat Weed
<i>Andropogon virginicus</i>	Whisky Grass
<i>Asclepias curavassica</i>	Blood Flower
<i>Aster subulatus</i>	Wild Aster
<i>Axonopus compressus</i>	Broad-leaved Carpet Grass
<i>Baccharis halimifolia</i>	Groundsel
<i>Chloris gayana</i>	Rhodes Grass
<i>Cinnamomum camphora</i>	Camphor Laurel
<i>Cirsium vulgare</i>	Spear Thistle
<i>Conyza bonariensis</i>	Flaxleaf Fleabane
<i>Cuphea carthagenensis</i>	Cuphea
<i>Drymaria cordata</i> subsp. <i>diandra</i>	Tropical Chickweed
<i>Echinochloa crus-galli</i>	Barnyard Grass
<i>Erechtites valerianifolia</i>	Brazilian Fireweed
<i>Gnaphalium</i> sp	A Cudweed
<i>Gomphocarpus fruticosus</i>	Narrow leaved Cotton Bush
<i>Hydrocotyle bonariensis</i>	A Pennywort
<i>Hyparrhenia hirta</i>	Coolatai Grass
<i>Hypochoeris radicata</i>	Cat's Ear
<i>Ipomoea cairica</i>	Coast Morning Glory
<i>Lantana camara</i>	Lantana
<i>Melinis minutiflora</i>	Molasses Grass
<i>Passiflora edulis</i>	Common Passionfruit
<i>Passiflora suberosa</i>	Corky Passionfruit
<i>Passiflora subpeltata</i>	White Passionflower
<i>Paspalum conjugatum</i>	Sour Grass
<i>Paspalum notatum</i>	Bahai Grass
<i>Paspalum urvillei</i>	Vasey Grass
<i>Paspalum wettsteinii</i>	Broad-leaved Paspalum
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Phytolacca octandra</i>	Inkweed
<i>Schefflera actinophylla</i>	Umbrella Tree
<i>Senecio madagascariensis</i>	Fireweed
<i>Senna pendula</i> var <i>glabrata</i>	Winter Senna
<i>Setaria sphacelata</i>	South African Pigeon Grass
<i>Sida rhombifolia</i>	Paddy's Lucerne
<i>Solanum capsicoides</i>	Devil's Apple
<i>Solanum chrysotrichum</i>	Giant Devil's Fig
<i>Solanum pseudocapsicum</i>	Jerusalem Cherry
<i>Soliva sessilis</i>	Bindyi
<i>Trifolium repens</i>	White Clover
<i>Urena lobatus</i>	Urena
<i>Urochloa mutica</i>	Para Grass

Appendix 4 – Weed Control Methods

(Adapted from R.Joseph 2002)

"Cut-scrape-paint" method: This method applies to all woody shrubs, trees and some vines.

- (a) Cut plant low to the ground at an angle.
- (b) Apply herbicide immediately at the rate of 1 part glyphosate : 1.5 parts water with a paintbrush approximately 1.5 cms wide.
- (c) Scrape sides lightly to reveal green tissues and apply the herbicide to the scraped area.
- (d) Take care that the brush is not contaminated with soil.

Note: Where practicable, all seed which has high viability and longevity should be removed from the parent and either composted on site or removed from the site, e.g. Senna spp.

Stem Injection: This method applies to all woody trees and shrubs.

- (a) With a 10mm drill make a hole, at a slight angle, into the trunk. (Note: it is important not to make drill hole too deep).
- (b) Apply herbicide immediately into the hole using a tree injecting device (if using glyphosate, apply at the rate of 1 : 1.5).
- (c) Repeat this procedure in around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, make a hole above it. (Note: two rows will be sufficient for trees with trunks of 6-10 cms.; larger trunk diameters will need correspondingly more).
- (d) Treat all visible lateral roots as per (a).

Spot Spraying: This is carried out using a 15 litre back-pack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used, with the addition of the red marker dye. For plants which show some resistance to herbicides e.g. Glory Lily, or when growing conditions are not optimal, an acidifying agent L.I. 700® or sticker Protec® is also added. Recently it has been observed that a mixture of glyphosate and Metsulphuron methyl has produced promising results for plants that are difficult to control with glyphosate alone (Note: an appropriate permit is required for this 'off-label' herbicide usage).

Overspray: This method is applicable to large, dense infestations of such plants as Bitou Bush and Lantana where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, to protect native seedlings from predators such as wallabies and to avoid trampling by humans.

- (a) Spray over the top of the infestation, using a weak solution of glyphosate (Note: any native plants that may be under the weed will be protected by the foliage cover of the weed).
- (b) Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.

Note: For Lantana, the usual dilution rate is glyphosate 1 : 100 water; for Bitou Bush glyphosate 1 : 150 - 1 : 300 water. Weaker solutions are most effective in the winter months.

Alternatively, weeds can be cut and flattened with brush-hooks or loppers and the subsequent regrowth sprayed with glyphosate.

Crowning: This method is applicable to weeds which have their growing points below the surface of the ground (corms, bulbs, rhizomes, clumped or fibrous root systems etc. e.g. Asparagus spp. and grasses).

(a) Grasp the leaves or stems and hold them tightly so that the base of the plant is visible. Plants with sharp leaves or stems should be cut back first.

(b) Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.

(c) Cut through the roots close to the base. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.

(d) Remove the plant. Make sure that the base of the plant where the roots begin, is completely removed.

Hand Pull: Gently pull seedling out by the roots, wiggling the plant to fully free them.

Appendix 5 – Daily Record Sheet

Site Name / Location:

Date:/...../..... Time:am/pm -.....am/pm

Staff:

Work Zone:

Growing Conditions	Temperature	Weather Conditions	Wind Direction
<input type="checkbox"/> Very Good	<input type="checkbox"/> Cool < 20°	<input type="checkbox"/> Showers	<input type="checkbox"/> Calm /
<input type="checkbox"/> Good	<input type="checkbox"/> Warm 21 - 25°	<input type="checkbox"/> Overcast	<input type="checkbox"/> L.Air /
<input type="checkbox"/> Poor	<input type="checkbox"/> V.Warm 26 - 30°	<input type="checkbox"/> Clear Sky	<input type="checkbox"/> L.Breeze /
<input type="checkbox"/> Very Poor	<input type="checkbox"/> Hot > 30°	<input type="checkbox"/> Variable	<input type="checkbox"/> G.Breeze /

Work Undertaken: (Work location and direction, primary or follow up, main weed species, control methods used)

Chemicals Used:

Herbicide	Batch Number	Dilution Rate	Total Chemical	Operator Initials	Equipment
Additives					

Further Observations (Results of previous work, plantings, flowering & fruiting times of weeds & natives; natural regeneration, OH&S) / **Maps / Notes over page**

Appendix 6 – Job Safety Analysis

Sample Risk Assessment Form

HAZARD IDENTIFIED	RISK RATING	CONTROL MEASURE RISK ASSESSMENT
Traffic Hazard Working in close proximity to roads		<input type="checkbox"/> Use traffic controller <input type="checkbox"/> Use of safety signs <input type="checkbox"/> Use of witches hats or temporary barrier <input type="checkbox"/> High visibility clothing
Sun Exposure Hot conditions		<input type="checkbox"/> Reduce exposure time – rest breaks <input type="checkbox"/> Provide ample water <input type="checkbox"/> Protective clothing and sunscreen
Working With Chemicals		<input type="checkbox"/> Current MSDS held <input type="checkbox"/> Adequate washing facilities <input type="checkbox"/> Hazardous substances stored and labelled correctly <input type="checkbox"/> Use of personal protective clothing <input type="checkbox"/> Rotate tasks to avoid prolonged exposure
Biological Hazard Needle stick injury		<input type="checkbox"/> Inspect site before work commences <input type="checkbox"/> Provide appropriate waste disposal container <input type="checkbox"/> Personal protective equipment
Manual Handling Handling heavy objects		<input type="checkbox"/> Use correct lifting and carrying techniques <input type="checkbox"/> Use lifting aids <input type="checkbox"/> Use wheelbarrow etc. wherever possible <input type="checkbox"/> Ensure clear area before lifting <input type="checkbox"/> Share the load <input type="checkbox"/> Rotate activities or rest breaks <input type="checkbox"/> Appropriate personal protective clothing
Crush Impact Cut, crush and impact		<input type="checkbox"/> Knowledge and correct use of tools <input type="checkbox"/> Appropriate personal protective clothing <input type="checkbox"/> Correct tool for job
Slips, Trips and Falls		<input type="checkbox"/> Avoid carrying awkward or heavy objects on uneven ground <input type="checkbox"/> Remove all potential hazards if possible or mark with coloured tape <input type="checkbox"/> Do not leave tools lying in pathways <input type="checkbox"/> Do not run

		<input type="checkbox"/> Ensure boots are firmly laced
Hazardous Plants Plants that may cause allergic reaction		<input type="checkbox"/> Identify plants which may cause allergic reactions <input type="checkbox"/> Mark area with coloured tape
Bites and Stings		<input type="checkbox"/> Create disturbance on site before beginning work <input type="checkbox"/> Apply insect repellent <input type="checkbox"/> Wear appropriate personal protective equipment

Sample Risk Assessment Matrix

How severely could it hurt someone Or How ill could it make someone	Very likely - could happen anytime	Likely - could happen sometime	Unlikely - <i>could happen,</i> <i>but very rarely</i>	Very unlikely - could happen, but probably never will
☠ kill or cause permanent disability or ill health	1	1	2	3
Long term illness or serious injury	1	2	3	4
Medical attention and several days off work	2	3	4	5
! First aid needed	3	4	5	6

Appendix 7 – NPWS Checklist for Bush Regeneration

NPWS checklist for bush regeneration in threatened species habitat or an endangered ecological community

The following guidelines are derived from the relevant sections of NPWS Draft Checklist for Bush Regeneration Activities in the Habitat of Threatened Species, Endangered Populations and Endangered Ecological Communities.

Management Planning:	yes	no	more info attached
The proposed activities will be in accordance with a management plan or site plan (map). Please attach the plan or relevant sections of the plan or strategy to the licence application.			
The project has been discussed with the relevant Landcare coordinator. If not, provide details of any other professional advice you have sought, e.g. from a qualified bush regenerator.			
A NPWS Wildlife Atlas database search of a 5km radius of the site has been undertaken to identify threatened flora/fauna species known or likely to occur on the site.			
Prior to commencing any works on site, a permit or permission will be obtained from the relevant landowner(s) or land manager(s).			
Training and supervision:	yes	no	more info attached
All activities by workers will be regularly checked and approved by the co-ordinator.			
All workers will be informed of any threatened species or endangered ecological communities known from the area or which may occur in the area and the potential impacts of activities on these species/communities e.g. vines on the edge of a littoral rainforest remnant may protect the remnant from salt-bearing winds.			
All workers have adequate weed and native plant identification skills i.e. all workers can identify and differentiate between weeds and native plants that occur on the site.			
Workers will be familiar with the identifying features of threatened flora that are known or likely to occur in the project area. Where threatened species known from the area are similar to weed species, the distinguishing features between these will be understood prior to commencing the work.			
Access to site:	yes	no	more info attached
All vehicular access to the site will be restricted to formed roads.			

Unnecessary damage to sites will be avoided e.g. avoid working in wet weather to lessen soil compaction.			
To reduce the possibility of introducing plant diseases and weeds the following measures will be applied: (1) Secateurs will be sharp and cleaned with methylated spirits; and (2) Footwear will be cleaned of loose soil and preferably treated with bleach between sites.			
Impacts on flora:	yes	no	more info attached
Prior to any works being undertaken, the presence or absence of threatened flora will be determined by a thorough walking search of the area.			
All threatened flora will be tagged with highly visible flagging tape before work commences. If a number of individuals occur in a clump, the area should be marked out with flagging tape.			
Cutting or damaging of threatened flora will be avoided.			
All plants will be positively identified before they are removed (pulled, cut, poisoned etc.).			
Weed removal within two metres of a threatened species will be undertaken by hand.			
Impacts on fauna:	yes	no	more info attached
All workers will be aware of any threatened fauna that are known or likely to occur on site, and the potential impacts of the proposed activities on those species.			
The habitat and refuge potential of weeds and rubbish will be considered prior to removal e.g. Lantana can provide cover for threatened fauna such as the Bush-hen. Dead Lantana and poisoned Camphor Laurels should, where possible, be left in situ.			
Weeds will be removed gradually in areas where an infestation is extensive. Ideally, 50% of weeds that may provide habitat should be left until native plant species have re-established and provide alternative refuge.			
Disturbance to, and removal of rocks, logs and other potential refuge sites will be avoided.			
A herbicide registered for use near waterways will be used within five metres of waterways.			
Herbicide spraying will be restricted to a distance greater than five metres from watercourses where threatened frogs are known or likely to occur and within a ten metre radius of records of threatened frogs.			
A buffer of one metre along other watercourses will be maintained in which no herbicide will be sprayed.			
Care will be taken to minimise disturbance to shy or cryptic species e.g.			

the Marbled Frogmouth roosts in vine 'curtains'.			
Care will be taken to minimise disturbance to the leaf litter layer.			
Reconstruction through revegetation: (Note - this section does not address propagation or planting of threatened species. This activity would need to be separately addressed).	yes	no	more info attached
Seed collection or cuttings will be from species, populations or ecological communities other than those listed as threatened (unless licensed)			
Prior to collecting any seed or cuttings permission will be obtained from the relevant landholder or manager of the site e.g. a licence is required to collect native plants on National Parks estate.			
Seed collection from any one species will be limited to less than 10% of the available crop at that site.			
Seed collection from any individual plant will be limited to less than 10% of the available crop.			
If your seed source is used by other seed collectors, has consideration been given to minimising any cumulative impacts to the source plants? Some individual plants are known as a reliable seed source and their seed is collected extensively. This may result in – (1) a reduction in genetic diversity); and (2) an impediment to the individual's natural ability to regenerate.			
When collecting propagation material from a wild population, collection will be random from as many individuals as possible across the population to ensure a representative range of genetic material is collected. Collectors will avoid selection of propagation material on the basis of physical attributes e.g. tallest, most attractive, greatest amount of seed or flowers.			
Plantings will be sourced from stock of local provenance.*			
Will propagated material collected only be used at the subject site? I.e. excess material will only be used at other sites if it meets the provenance criteria.			
(Plants are likely to be purchased from reputable commercial nurseries – appropriate seed collecting techniques assumed)			
A buffer of five metres will be maintained around all threatened plant specimens. Planting will only be undertaken outside this buffer. This requirement is intended to protect the roots of the threatened plant from damage or introduction of disease.			
Care will be taken to ensure that mulch does not introduce weeds or impede natural regeneration at the site.			
Care will be taken to ensure that weeds and/or <i>Phytophthora cinnamomi</i> are not introduced to a site from pots of cultivated plants.			
Consideration will be given to the possible impacts of plantings on the ecological requirements of threatened species at the site e.g. reduced light, competition, etc.			

Species will be planted within their natural habitat and range. Plantings will be guided by the plants' local habitat preferences e.g. the species used for plantings along watercourses should be those that naturally occur in that habitat in your local area.			
Herbicide use: (Note - A permit from the National Registration Authority for Agricultural and Veterinary Chemicals PO Box E240, Kingston ACT 2604 may be required for herbicide use that is not consistent with conditions specified on the label).	yes	no	more info attached
A buffer of two metres will be maintained around all threatened plant specimens. Herbicide use will only be undertaken outside this buffer.			
Herbicide use will cease where there are any signs of threatened species being affected by herbicide e.g. browning off, wilting or deformed growth.			
All herbicide spray operators will be capable of undertaking precise and effective weed control.			
Spray will be directed away from threatened flora.			
Herbicide will only be sprayed in suitable weather conditions when the impact of spray drift (windy) or run-off (wet) on threatened flora is minimised.			
Marker dyes e.g. white field marker' will be mixed with herbicide before use. Marker dye enables the worker to see where the spray is landing.			
Reporting and data records:	yes	no	more info attached
Any new records of threatened species will be provided within three months to NPWS. These records will be in a format appropriate for entry into the Wildlife Atlas, once identification of a threatened species is confirmed by a recognised authority.			

*Local provenance species should be regarded as those species propagated from material that has been collected from a natural wild population as close as possible to a site. For example, within the local catchment which may be based on a local creek.

Appendix 8 – Related Documents

Planning Documents

- ❖ *Eight Part Test Report for Stage 3 (2001)*
- ❖ *Eight Part Test Report for Stage 4 (2001)*
- ❖ *Eight Part Test Report for Stages 5 and 6 (2002)*
- ❖ *Bush Thick-knee Pre-construction Survey Report for Stage 3 (2002)*
- ❖ *Bush Thick-knee Pre-construction Survey Report for Stage 4*
- ❖ *Conditions of Development Consent for Stages 1 and 2*
- ❖ *Conditions of Development Consent for Stage 3*
- ❖ *Conditions of Development Consent for Stage 4*
- ❖ *Conditions of Development Consent for Stages 5 and 6*
- ❖ *Conditions of Development Consent for Sports fields*
- ❖ *Bushfire Management Plan for Stages 1 and 2*
- ❖ *Bushfire Management Plan for Stage 3*
- ❖ *Bushfire Management Plan for Stage 4*
- ❖ *Bushfire Management Plan for Stages 5 and 6*
- ❖ *Plan of Management for adjacent Environmental Protection Zone: Stage 3*
- ❖ *Plan of Management for adjacent Environmental Protection Zone: Stage 4*
- ❖ *Restoration Plan for adjacent land 7(I) Environmental Protection Habitat-Stage 4*
- ❖ *Plan of Management for adjacent Environmental Protection Zone: Stages 5 and 6*
- ❖ *Plan of Management for adjacent Environmental Protection Zone: Sports Fields*
- ❖ *Eight Part Test Report for Stage 7 (2003)*
- ❖ *Plan of Management for adjacent Environmental Protection Zones: Stage 7*
- ❖ *Conditions of Development Consent Stage 7*
- ❖ *Bushfire Management Plan for Stage 7*
- ❖ *Koala Beach DCP SecB10 April 2008*

Fauna Management Plans

- ❖ *Koala Management Plan (1994)*
- ❖ *Koala Beach Koala Plan of Management (2004)*
- ❖ *Glossy Black-cockatoo Plan of Management (2004)*
- ❖ *Blossom Bat Plan of Management (2004)*
- ❖ *Common Planigale Plan of Management (2005)*
- ❖ *DEC Recovery Plan Bush Stone Curlew (2006)*

Fauna Monitoring Programs

- ❖ *Report on Survey for Bush Thick-knees (Stone-curlew) Stage 3 (2002)*
- ❖ *Koala Beach Estate Koala Monitoring Program (2005)*

- ❖ *Koala Beach Koala Monitoring Program Summary (2008)*
- ❖ *Koala Beach Estate Koala Monitoring Program (2014)*
- ❖ *Blossom Bat Monitoring Report Winter 2007*
- ❖ *Blossom Bat Monitoring Report Winter 2010*
- ❖ *Blossom Bat Monitoring Report Winter 2013*
- ❖ *Glossy Black-cockatoo Monitoring Report (2005)*
- ❖ *Glossy Black-cockatoo Monitoring Report (2007)*
- ❖ *Glossy Black-cockatoo Monitoring Report (2011)*
- ❖ *Glossy Black-cockatoo Monitoring Report (2014)*
- ❖ *Planigale Monitoring Report Spring 2007*
- ❖ *Planigale Monitoring Report Spring 2012*
- ❖ *Planigale Monitoring Report Spring 2015*
- ❖ *Koala Beach Proposed Fauna Monitoring Program (2007)*

Flora Management Plans

- ❖ *Management Plan for the Endangered Plant Rusty Green-leaved Rose Walnut (2002)*
- ❖ *Arthraxon hispidus Population Plan of Management (2004)*
- ❖ *Estate-wide Koala Beach Habitat Restoration Plan (2004)*
- ❖ *Koala Beach Habitat Restoration Plan (2015)*

Flora Monitoring Programs and Reports

- ❖ *Arthraxon hispidus Monitoring Report Summer 2008*
- ❖ *Bush Regeneration Report (2007)*
- ❖ *Native Flora for Planting at Koala Beach (2008)*

Feral Pest Management

- ❖ *Koala Beach Fox trapping Session (Winter 2006)*
- ❖ *Koala Beach Fauna Monitoring and Winter Fox Control Progress Report (2007)*
- ❖ *Fox Control Program (2008)*
- ❖ *Control Plan for Cane Toads, Koala Beach Estate – June 2011 – June 2012*
- ❖ *Wild Dog and Fox Monitoring and Control Koala Beach Estate - 2011-2014*

Other

- ❖ *Cultural Heritage Management Plan for Stages 5 and 6*
- ❖ *Archaeological Assessment Stage 7 (2003)*
- ❖ *Overall Management Guidelines for the Koala Beach Wildlife and Habitat Management Committee (2005)*
- ❖ *Overall Management Guidelines for the Koala Beach Wildlife and Habitat Management Committee (2009)*

Appendix 9 – Native Flora recommended for Planting

Native Flora Recommended for Planting at Koala Beach (TSC NRM Unit, June 2008)

Koala Beach can be divided into two broad vegetation communities;

- 1) Swamp sclerophyll areas which are located at lower elevations and are typified by Broad-leaved Paperbark and Swamp Oak forests. These communities occur adjacent to Sugar Glider Drive and lower sections of Sassafras Drive, Macadamia Drive and Muskheart Circuit and;
- 2) Wet sclerophyll eucalypt forests on the low hills above the floodplain including Blackbutt (*Eucalyptus pilularis*), Tallowood (*Eucalyptus microcorys*) and Brushbox (*Lophostemon confertus*) open forests which may contain small rainforest remnants.

To guide landholders in the selection of appropriate species for use in suburban gardens consideration needs to be given to the slope, aspect, drainage and soil characteristics of their site as well as any existing onsite vegetation that may provide shade, shelter or competition for planted species.

South- and east-facing slopes tend to be more protected, cooler, moister and more likely to support rainforest and moisture loving species, while hill tops and north- or west-facing slopes which are more exposed to the sun and drying winds are more likely to support sclerophyll or hardier rainforest species. Low-lying areas will favour species that can tolerate prolonged water inundation or periodically wet soils.

Consideration should also be given the time that you will have to tend the garden, whether supplementary water will be required, what type of garden you are trying to create, e.g. low maintenance, bird-attracting, bush tucker, scented, etc. In addition the mature size of any species planted needs to be considered to avoid having to remove plants in the longer term; smaller, fast-growing and short-lived species can be inter-planted with slower growing or larger species as an interim measure.

Listed below is a small selection of locally endemic native species that would be suitable for planting at Koala Beach, reputable local nurseries should also be able to provide advice on what to plant where.

Common Name	Scientific Name	Habitat	Habit
Tall Shrubs – Small Trees (5-15m)			
Broad-leaved Lilly Pilly	<i>Acmena hemilampra</i>	Occurs in STRf & LRf; hardy in full-sun and adaptable to a range of free-draining soils	Commonly a 5-12m bushy coastal shrub/tree (can grow to 30m); Flaky, often fissured bark, bark on twigs smooth, becoming slightly flaky with age; attractive white fruits and decorative foliage.
Red Ash	<i>Alphitonia excelsa</i>	Natural colonizer of a range of situations from warmer Rf, OF and dry woodland, often in sheltered gullies or on steep slopes of the coast and inland; Planted as hardy cover spp due to rapid growth, potential cabinet	Mostly 15-20m , some to 35m; Open crown with silver-backed leaves, buds and young stems grey to golden-brown hairy.

Common Name	Scientific Name	Habitat	Habit
		timber.	
Rough-leaved Elm	<i>Aphananthe philippinensis</i>	In STRf and DRf, often along streams or on alluvial flats; fruits desirable to birds; appealing tree which adapts to cold and dry sites; hardy when established.	Shrub or tree 8-20m+ , depending upon water availability; Dense, handsome foliage and compact tight crown with sandpaper rough leaves.
Broad-leaved Native Gardenia	<i>Atractocarpus benthamianus</i>	Grows in STRf, WTRf and tall sclerophyll forest, north from Forster to Nambour, Qld.	Tall shrub or small tree to c. 8m high, young shoots pubescent; Leaves opposite or in whorls of 3 or 4; flowers white, fragrant.
Grey Myrtle	<i>Backhousia myrtifolia</i>	In warmer rainforest, often close to streams and other sheltered sites; In open situations foliage is dense to the ground; Profuse flowering, hardy to cool conditions, can be slow growing at first.	3-7m with finely scaly bark.
Weeping Bottlebrush	<i>Callistemon viminalis</i>	Common along stream banks and watercourses; often rocky areas; adaptable to full sun, most soil types and conditions, may be frost tender when young; bird attractive.	Bushy 8-12m high or smaller; bark dark, furrowed; branches generally arching/weeping covered in silky hairs when young.
Brown Kurrajong	<i>Commersonia bartramia</i>	In warmer rainforest, its margins and clearings on the coast and ranges; Important regeneration able to handle exposure; with fast growth rate, while filtered shade does not inhibit plants developing beneath; Frost sensitive when very young but generally very hardy.	7-8m tall; Pale trunk and horizontally layered branches are attractive especially when in flower.
Forest Maple	<i>Cryptocarya rigida</i>	From coastal STRf and WTRf, especially on their margins, and in tall eucalypt forest; north from Ourimbah area.	Shrub to small tree 6-15m
Tuckeroo	<i>Cupaniopsis anacardioides</i>	In LRf and scrub near the sea and along estuaries; Handsome small to medium shade tree or dense shrub	To 10m , often smaller in isolated or exposed sites; new growth shortly pubescent and

Common Name	Scientific Name	Habitat	Habit
		when more exposed, seed attractive to birds; hardy and adaptable.	pink.
Orange Boxwood	<i>Denhamia celastroides</i>	Grows in most types of rainforest and margins with wet sclerophyll forest; tolerant of moderate frosts and full sun, prefers some shade may be slow growing.	Shrub or small tree to 7m high; branchlets striate.
Corkwood	<i>Duboisia myoporoides</i>	In high-rainfall areas and on margins of STRf, WTRf, LRF and DRf and in regrowth; Hardy, fast growing and suitable for regeneration plots	6-10m shrubby tree, can reach 20 m high; Bark thick and corky, showy flowers.
Blueberry Ash	<i>Elaeocarpus reticulatus</i>	Mostly in gullies or along watercourses in marginal Rf areas, moist open forests and adjacent to the ocean; From sea-level to the ranges.	2-3m shrub to 6-8m small tree; attractive small flowers followed by blue fruits; very hardy, tolerate frost, salt air, poor soil, wind, full sun and periodic dryness.
Red Olive Plum	<i>Elaeodendron australe</i> (<i>Cassine australis</i>)	Along the coast and ranges in coastal, inland and depauperate rainforests; Adaptable, bushy to the ground and excellent screen.	To 8m high, dioecious; stiff, leathery leaves are dark green and glossy with toothed or scalloped margins; bright-orange-red fruit occur in clusters and hang for several months.
Guioa	<i>Guioa semiglauc</i>	Grows in warmer rainforest from the coast to the ranges, often in regrowth; versatile, fast-growing and bird attracting, useful in regeneration plots; hardy.	6-10m , taller on fertile sites; Common pioneer spp., may produce several trunks or branch low down; Bark smooth, grey to dark grey, often ± blotched with lichen; New growth pubescent and adult foliage distinctly grey-green on underside.
Native Frangipani	<i>Hymenosporum flavum</i>	Grows in or near rainforest or WSf on fertile soils, north from Grose Valley (near Sydney) and inland to the Liverpool Ra.	Tall shrub or small tree, 8-12m rarely to 20 m high, occasionally partly deciduous; fragrant flowers in spring.
Foambark	<i>Jagera pseudorhus</i>	Occurs in warmer rainforests,	5-10m in open and up

Common Name	Scientific Name	Habitat	Habit
		WSf and their margins, on stream and creek banks on basaltic and alluvial soils; Full-sun and mild frost are tolerated	to 15m in forest, often smaller in open; Umbrella shaped crown and distinctive ferny foliage which apricot-pink flushes, most parts densely rusty-hairy.
Red Kamala	<i>Mallotus philippensis</i>	Grows on margins and within warmer rainforest; chiefly north from the Hunter R.; tough in full sun and depleted soil, useful regeneration spp.	Tree to 10m high, fruits covered in red granular material used in dyeing;
Muttonwood	<i>Myrsine variabilis</i> (<i>Rapanea variabilis</i>)	Grows on margins and within warmer rainforest; tough in full sun and depleted soil, useful regeneration spp.	Tree to 10m high.
Large-leaved Mock-olive	<i>Notelaea longifolia</i>	From Lismore to Cape York; hardy in dry and low fertility sites; useful regeneration spp to attract native bees and flies.	To c.8-9m high, often with a dense crown of leathery leaves; branchlets grey or brown, usually with conspicuous white lenticels.
Scrub Turpentine	<i>Rhodamnia rubescens</i>	In STRf, WTRf, LRF, DRf and sclerophyll ecotone, common in margins and regrowth; Fruit provides valuable food source for frugivorous birds; Hardy in a wide range of soil types, habitats and temperature ranges	To 10m high, occasionally taller; Bark reddish brown, rough, scaly and fissured; young stems densely hairy, leaves hairy underneath.
Scentless Rosewood	<i>Synoum glandulosum</i>	Widespread in warmer rainforest, north from Milton.	Small tree to 7m high, with brown scaly bark, new growth pubescent.
Brush Cherry	<i>Syzygium australe</i>	In Rf along the E coast, almost always next to creeks; Excellent ornamental with dense crown, shade or screen tree Adapts to most soils, full sun and some frost; may suffer from psyllid attack.	From 3-30m , dependent upon site, usually <10m in the open; with attractive flowers and fruits, new growth is reddish.
Blue Lilly Pilly	<i>Syzygium oleosum</i>	Grows in LRF, STRF, WTRf and moist open forests from Wollongong to NE Qld; Often appears as regrowth; Adaptable to soils, fast-growing,	To 10m ; In full sun has dense, ground-hugging foliage with frequent bronze flushes of growth, with flaky bark, purple fleshy fruits and

Common Name	Scientific Name	Habitat	Habit
			attractive foliage and form.
Water Gum	<i>Tristaniopsis laurina</i>	Grows near creeks in and around Rf and WSf; Widespread along coast and ranges; Handsome tree for screen or fill-in beneath taller spp; Handles cold, medium frost, wet soil, low fertility and full sun.	5-10m high but may grow to 20m; Usually shrubby tree with smooth, pale bark shedding in strips, leaves redden during cold weather
Tree Heath	<i>Trochocarpa laurina</i>	Grows in wet sclerophyll forest, warm-temperate rainforest to 800 m alt. and littoral rainforest, north from Bermagui.	Compact shrub to crooked tree to 13m high often shorter, glabrous; bark grey to brownish black, corky, finely fissured to platy.
Shrubs (<6m)			
Narrow-leaved Gardenia	<i>Atractocarpus chartaceus</i>	Grows in STRf and DRf, north from Richmond R. to Gladstone, Qld	Shrub to c. 3m high, ± pubescent.; Leaves opposite or in whorls of 3; flowers white, fragrant
Coffee Bush	<i>Breynia oblongifolia</i>	Widespread in or near warmer rainforest, also in moist areas in woodland and eucalypt forest.	Shrub to 3m high
Broad-leaved Palm Lilly	<i>Cordyline petiolaris</i>	In warmer rainforest and WSf from coastal lowlands and ranges, north from the Nambucca River to SW of Gladstone, Qld.	Shrub to 5m high, often sprawling and branched.
Red fruited Palm Lilly	<i>Cordyline rubra</i>	Coastal lowlands and ranges; north from Lismore to about Bundaberg. In warmer rainforest and wet sclerophyll forest.	Shrub to 4m ; sometimes branched.
Narrow-leaved Palm Lilly	<i>Cordyline stricta</i>	On coastal lowlands and ranges north from near Bilpin (lower Blue Mts).	Shrub to 5m high, sometimes sprawling and branched towards base.
Glossy Laurel	<i>Cryptocarya laevigata</i>	Rf understory shrub	To 5m tall, Dense, dark green, glossy foliage; hardy, bushy from young age with attractive red fruits.

Common Name	Scientific Name	Habitat	Habit
Copper Laurel	<i>Eupomatia laurina</i>	Widespread in or near warmer rainforest and moist eucalypt forest on the coast and lower ranges; suits a shady site.	Loose, arching shrub 2-5m , branchlets often black.
Hovea	<i>Hovea acutifolia</i>	Grows on rainforest margins or in WSf or other damp sheltered sites.	Slender shrub to c. 4m high; stems and branches with a dense covering of grey to rusty, curled and crinkled hairs intermixed with longer, straight hairs.
Olive Tea-tree	<i>Leptospermum liversidgei</i>	In low-lying sandy and peaty swamp coastal heath; does well in most soils that don't dry out readily and tolerates waterlogging; Sunny or semi-shaded sites suit.	To 4m high, bark close, younger stems with a short pubescence and foliage lemon-scented;
Wild May	<i>Leptospermum polygalifolium</i>	From sandy soils, common in moist sites and along watercourses; Reliable in a range of soils and conditions, variable in form, often used for screening or windbreak; Hardy and tolerates extended wet or dry periods.	1-6m x 1-3m ; spreading, silky-hairy new growth, sometimes bronze;
A Tea-tree	<i>Leptospermum whitei</i>	Grows in heath in sandy, swampy coastal soils; adaptable to soils; will not tolerate drying out, tolerates full sun to semi-shade, damaged by heavy frosts.	2-6m high with fibrous flaking bark in reddish-brown layers, younger stems pubescent;
Narrow-leaved Orangebark	<i>Maytenus silvestris</i>	In DRf, vine thickets, open forest and moist eucalypt forest, north from Camden and the Illawarra region.	Shrub to 4.5m high; narrow, toothed leaves and bright orange fruit with black seeds and orange surround.
White Dogwood	<i>Ozothamnus diosmifolius</i>	Grows on margins of rainforest and in heath in a variety of soils, often on ridges; widespread, north from Eden district.	Much-branched, erect shrub to 5m high, usually c. 2m high; branches with short rough hairy covering.
Narrow-leaved Geebung	<i>Persoonia linearis</i>	In sclerophyll forest or woodland on various soils; south from the Macleay R. catchment.	Erect shrub or small bushy tree 2-6m with flaky bark, young branchlets moderately

Common Name	Scientific Name	Habitat	Habit
			to densely hairy.
Orange Thorn	<i>Pittosporum multiflorum</i> (<i>Citriobatus multiflorus</i>)	Grows in or near rainforest or wet sclerophyll forest, on shales or well-drained volcanic soils; provides roost site for small birds.	Rigid, much-branched 1–3m high, sometimes straggly shrub, branches bearing numerous slender spines; stems brittle.
Rough-fruited Pittosporum	<i>Pittosporum revolutum</i>	Grows in Rf, WSf, chiefly in coastal districts; very hardy in a range of situations, including full sun and light frost	Shrub to c. 3m high depending upon exposure, up to 8m in Rf
Hairy Psychotria	<i>Psychotria loniceroides</i>	Grows in LRF, warmer rainforest and wet sclerophyll forest; widespread, north from Bega district.	Shrub or small tree to c. 5m high, usually shorter.
Banana Bush	<i>Tabernaemontana pandacaqui</i>	Grows in warmer rainforest and wet sclerophyll forest, north from Manning R.	Shrub to 3m high, glabrous; fragrant white flowers and attractive yellow, banana-shaped fruit, seeds surrounded by red pulp
Poison Peach	<i>Trema tomentosa</i> var. <i>viridis</i> (<i>T. aspera</i>)	Widespread in regrowth and margins of rainforest, in moist sclerophyll forest and in open rocky areas.	Shrub or small tree 3–6m tall, young branches pubescent; small black fruits attractive to parrots.
Veiny Wilkiea	<i>Wilkiea heugeliana</i>	In all rainforest except CTRf; widespread on the coast and ranges, north from the Beecroft Peninsula to SE Qld; hardy in sun or shade and most soils with adequate drainage.	Bushy shrub to 6m ; attractive black fruits on yellow receptacle; stiff leaves with toothed margin.
Palms and Cycads			
Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	In STRf and LRF, mostly beside creeks and on wet alluvial flats, often in groves; Hardy to full sun, tolerates some cold; best planted enmasse.	20–25m tall and 25 cm diameter, enlarged at the base.
Shining Burrawang	<i>Lepidozamia peroffskyana</i>	In hilly country, in WSf and edges of STRf and WTRf; north from the Manning R. to Nambour, Qld. Sometimes cultivated as an ornamental,	Thick trunk 0.5–7m high, usually less than 3m; compound leaves 2–3 m long on mature plants; leaflets up to

Common Name	Scientific Name	Habitat	Habit
		slow growing.	200 x 10-30cm long thick and glossy; male and female cones on separate plants
Walking Stick Palm	<i>Linospadix monostachya</i>	In STRf, WTRf and occasionally CTRf, from Bulahdelah to Gympie; The stems have been used to make walking sticks. The small knob at the base of the stem being carved to form a handle.	Single stemmed palm, stems mostly 1.3–2m high , occasionally to 5 m high, 2–3 cm diameter; Leaves divided, 50–130 cm long; flowers on a simple pendulous spike, 1–1.5 m long; bright red fruits.
Cabbage-tree Palm	<i>Livistona australis</i>	Widespread in coastal districts commonly in colonies; Grows in moist sclerophyll forest, along stream banks and often in swampy sites, and on margins of rainforest; require some early protection but hardy once established, tolerate some drying out, light frosts.	20-30m high (occasionally more), up to 50 cm diam., marked with annular scars and furrows;
Pineapple Zamia	<i>Macrozamia lucida</i>	In WSf and edges of STRf and WTRf north from Pottsville to Nambour, Qld; slow growing.	Unbranched palm-like shrub, stem mostly subterranean to 10–20 cm diameter , or more; Leaves mostly 2–15 in the crown, 80–110 cm long; male and female cones on separate plants.
Twiners/Scramblers			
Wombat Berry	<i>Eustrephus latifolius</i>	Grows in sclerophyll forest, woodland, heath and on margins of Rf; widespread, from coastal districts and inland.	Vine with stems to 6m long, sometimes much branched; yellow fruit capsule opens to reveal glossy black seeds.
Scrambling Lilly	<i>Geitonoplesium cymosum</i>	Grows in or near Rf, in sclerophyll forest and woodland, widespread in coastal districts and also on the ranges.	Vine with stems to 8m long; fruit a black globose berry.
Purple Coral Pea	<i>Hardenbergia violacea</i>	Widespread in a variety of habitats.	Climbing or prostrate, glabrous sub-shrub; stems often to 2 m

Common Name	Scientific Name	Habitat	Habit
			long.
Climbing Guinea Flower	<i>Hibbertia scandens</i>	Occurs in moist sclerophyll forests, heaths and littoral forests.	Climber/sprawler with stems to 4m long.
Morinda	<i>Morinda jasminoides</i>	Grows in rainforest and sclerophyll forest, often in gullies; widespread.	Woody climber or scrambling shrub, ± glabrous; fruit an irregularly shaped orange fleshy head.
Groundcover/Clumpers			
Native Ginger	<i>Alpinia caerulea</i>	Widespread in coastal rainforest; attractive arching stems and blue fruits.	Perennial herb with stems to 3m high.
Midgen Berry	<i>Austromyrtus dulcis</i>	Grows in heath or dry sclerophyll forest on sandy soils along coast.	Semi-prostrate spreading shrub, up to 0.5m high, with finely flaky bark; young shoots densely hairy.
Gristle Fern	<i>Blechnum cartilagineum</i>	Widespread hardy fern found in open forest and rainforest.	Fronds erect, clustered, all ± similar, pinnate, usually 50–100cm long, often pink when young, pale green and ± harsh when mature, segments usually alternate.
River Lily	<i>Crinum pedunculatum</i>	From shady, moist conditions under a canopy to exposed beach fronts, swamps and along stream banks; Hardy to sun, shade, poor drainage, saline influence, frost and indifferent soil.	Clumping plant with stout, sometimes branching pseudo stem to 45cm high; fragrant flowers carried on ends of stems
Blue Flax Lilly	<i>Dianella caerulea</i>	Grows in heath to sclerophyll forest.	Perennial tufted, solitary herb to 0.5m high.
Tall Saw-sedge	<i>Gahnia clarkei</i>	Grows on creek banks and near swampy areas in coastal districts, extending inland; attracts threatened Varied Sword-grass Brown butterflies.	Tuft forming sedge with stout stems, 2-2.5m high, "cutting edged" leaves and golden brown flower plumes followed by reddish brown fruit.
Mat Rush	<i>Lomandra hystrix</i>	Grows amongst rocks in Rf streams, often as dense	1m bushy clumps.

Common Name	Scientific Name	Habitat	Habit
		colonies; hardy but needs ample water initially, adaptable to full sun, shade, frost and variable soils; excellent stream-bank erosion inhibitor.	
Long-leaved Mat-rush	<i>Lomandra longifolia</i>	From inland areas to the coast; Needs free-drainage but adaptable to most soils and locations provided they receive some sunshine, hardy to most frosts; very variable spp so select local variants for planting.	1m+ clumps; tussocks form an important refuge for many fauna spp.
Kangaroo Grass	<i>Themeda australis</i>	Widespread in a variety of habitats.	Tufted perennial grass to 1.2m high; often tinted red.
Grass Tree	<i>Xanthorrhoea johnsonii</i>	Usually grows in sclerophyll forest and heath in well-drained sites; north from Singleton, widespread.	Trunk 0.1–5m high; stem and crown usually 1; young leaves in spreading upright tuft; old leaves often strongly reflexed.
Threatened Species			
Beach Acronychia	<i>Acronychia imperforata</i>	Grows in lowland rainforest, usually near the coast in LRF; excellent for regeneration; May prove difficult to purchase as hard to propagate.	From 2-15m dependent upon site conditions, salt exposure, etc., commonly 6-10m ; Maintains an attractive lightly-leaved crown, frequently holding decorative fruits.
Toothed-leaved Palm Lily	<i>Cordyline congesta</i>	On coastal lowlands.	Shrub to 3m high, sparsely branched; with toothed margins and clusters of orange-red fruits
Long-leaved Tuckerroo	<i>Cupaniopsis newmannii</i>	In and on the margin of WTRf and STRf from Mullumbimby to Beenleigh, also Kin Kin, Qld.	Attractive shrub to small tree 3-8m , young shoots rusty, hairy; slender trunked, rarely branching; leaves compound with up to 24 leaflets
Rough-shelled Bush Nut	<i>Macadamia tetraphylla</i>	In STRf; Usually near the coast, confined chiefly to the Tweed and Richmond Rivers	Small to medium-sized tree 8-15m and often as broad; new growth

Common Name	Scientific Name	Habitat	Habit
		and to Mt. Tamborine.	reddish, attractive chains of flowers.
Stinking Cryptocarya	<i>Cryptocarya foetida</i>	In LRf and occasionally STRf, usually on sandy soils, mature trees known to occur on basalt.	Small to medium sized tree ; young growth hairy, soon becoming glabrous; flowers sometimes with an offensive odour.
Davidson's Plum	<i>Davidsonia pruriens</i> var. <i>jerseyana</i>	Confined to STRf and WSf at low altitudes in coastal areas.	Small, slender tree to 6-8m may be unbranched or form a clump of stems; new growth pink, hairy; blue-black ovoid fruit make excellent jam.
Sweet Myrtle	<i>Gossia fragrantissima</i> (<i>Austromyrtus fragrantissima</i>)	In DRf, STRf and riverine Rf of coastal districts from Lismore to Currumbin Creek.	Shrub or small tree , bark rough, flaky or fissured; fragrant flowers and small orange to red fruits.
Fine-leaved Tuckeroo	<i>Lepiderema pulchella</i>	In riverine, LSTRf and LRf from Brunswick River to Tallebudgera Ck.	Small tree 6-10m , new growth pink to pale green and limp, hardening to dark green; orange fruits develop in December.

Abbreviations

OF	- Open Forest
Rf	- Rainforest
DRf	- Dry rainforest
LRf	- Littoral rainforest
WTRf	- Warm Temperate rainforest
STRf	- Sub-Tropical rainforest
LSTRf	- Lowland Sub-Tropical rainforest
WSf	- Wet Sclerophyll forest

Feed species for local threatened fauna

Koala (*Phascolarctos cinereus*)

These species are large canopy trees that are unlikely to be suitable for use in residential blocks but could be utilised in public reserve areas, on larger blocks or along roadsides where appropriate. Local Koalas may also browse on or roost in other species.

Common Name	Scientific Name	Habitat
Grey Gum	<i>Eucalyptus propinqua</i>	Lower to mid slopes as part of wet sclerophyll assemblage

Common Name	Scientific Name	Habitat
Tallowwood	<i>Eucalyptus microcorys</i>	Lower to upper slopes as part of wet sclerophyll assemblage
Forest Red Gum	<i>Eucalyptus tereticornis</i>	Alluvial flats and lower to mid slopes on fertile soils
Swamp Mahogany	<i>Eucalyptus robusta</i>	Low lying, swampy or periodically inundated areas

Glossy Black-cockatoo (*Calyptorhynchus lathami*)

Glossies feed on the seeds of a range of She-oaks (*Casuarina* and *Allocasuarina*) and are dependent upon large hollow bearing eucalypts for nesting sites. The most appropriate species for domestic gardens are:

Common Name	Scientific Name	Habitat	Habit
Forest Oak	<i>Allocasuarina torulosa</i>	Upper slopes as understorey species in wet and dry open to tall open sclerophyll forest. Generally on higher-nutrient soils and in moister situations than <i>A. littoralis</i> .	Slender tree up to 10m, usually dioecious (male and female flowers on different plants).
Black She-oak	<i>Allocasuarina littoralis</i>	In sclerophyll woodland or tall heath, on sandy on poor soils; coast and adjoining tablelands.	Tree 5–15 m high, usually dioecious.

Common Blossom Bat (*Syconycteris australis*)

Blossom bats roost in rainforest species and preferentially forage on Coast Banksia (*Banksia integrifolia*), they also utilise other flowering sclerophyll species some of which may be too large for domestic gardens, including Swamp Mahogany, Forest Red Gum, Pink Bloodwood (*Corymbia intermedia*) and Broad-leaved Paperbark (*Melaleuca quinquenervia*). Suitable feed species for suburban gardens include:

Common Name	Scientific Name	Habitat	Habit
Coast Banksia	<i>Banksia integrifolia</i>	Widespread in coastal sites and near ranges, common on consolidated sand dunes and along tidal inlets in woodland	5–25m high, according to exposure. Leaves whorled, margins entire with occasional short teeth, lower surface white-shortly hairy
Swamp Banksia	<i>Banksia robur</i>	In woodland and heath in sandy ± permanently damp sites on the coast	Shrub with several stems arising from a lignotuber, usually 1–2 m high; branchlets rusty-tomentose
Fern-leaved Banksia	<i>Banksia oblongifolia</i>	In dry sclerophyll forest to heath; widespread on the coast	Several-stemmed shrub to 3 m high with lignotuber; bark reddish to grey-brown

Common Name	Scientific Name	Habitat	Habit
Wallum Banksia	<i>Banksia aemula</i>	From low sclerophyll woodland or tall shrubland (wallum) on consolidated sand dunes, also on sandy flats which are sometimes seasonally waterlogged	Bushy shrub robust tree to 8 m high; bark warty
Old Man Banksia	<i>Banksia serrata</i>	Usually in dry sclerophyll forest or woodland on sandstone or consolidated sand dunes, on the coast	Shrub or tree, to 16 m high in favourable habitats, sometimes a shrub to 3 m in coastal sites high; bark warty
Heath-leaved Banksia	<i>Banksia ericifolia</i>	From heath, dry sclerophyll forest and woodland, widespread on the coast and ranges	Tall bushy shrub or small tree to 6 m high, single-stemmed at base
Wallum Bottlebrush	<i>Callistemon pachyphyllus</i>	Grows in moist ground in Wallum heath and hind dunes	Dense straggling shrub to 1.5 m high
Willow Bottlebrush	<i>Callistemon salignus</i>	Mostly grows in low-lying river flats and damp creeks, rarely in dry areas	Large shrub or small tree 3–10 m high; bark papery and peeling

Common Planigale (*Planigale maculata*)

Common Planigales are tiny marsupials with a body length of about 8 cm and a tail as long again. They differ from the common house mouse in having a long, pointed snout and large rounded ears. The head has a flattened appearance. Their fur is grey-brown above, sometimes with tiny white spots, and paler below (DECC 2008). Planting of specific flora species in suburban gardens is unlikely to provide useful habitat for planigales where adjacent bushland areas are in good condition. Planigales are also unlikely to nest in residential buildings.

They inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks. They are fierce carnivorous hunters and agile climbers, preying on insects and small vertebrates, some nearly their own size. They breed from October to January when females build a nest lined with grass, eucalypt leaves or shredded bark (DECC 2008).

To assist the survival of this species at Koala Beach a number of strategies are being implemented by Council in conjunction with the Koala Beach Wildlife Habitat Management Committee including, fox and feral cat control, protection of surrounding bushland through weed management to ensure adequate understorey diversity, maintenance of appropriate fire regimes to retain leaf litter and hollow logs, retention of adequate ground cover, especially near waterways, and protection from further development or clearing.

Residents can help this species to survive by controlling cane toads when encountered, avoid 'tidying' areas of bushland adjacent to their property, and contacting Council Officers if positive identification is required prior to rodent control where some uncertainty exists as to the target rodent's identification.

Further Information Sources

Flora

Threatened Species of the Upper North Coast of New South Wales: Flora, NSW National Parks & Wildlife Service 2002a, NSW National Parks and Wildlife Service, Coffs Harbour, NSW.

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Eucalypts and Angophoras of the North Coast, New South Wales, C. L. Bale, Botany Department, University of New England, Armidale, NSW, 2003.

Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT, David Keith, Department of Environment and Conservation, NSW, July 2004.

Tweed Vegetation Management Strategy 2004, M.B. Kingston, J.W. Turnbull and P.W. Hall, report prepared for Tweed Shire Council, August 2004

Flora Websites

Royal Botanic Gardens Sydney – photos, line drawings, etc

<http://plantnet.rbgsyd.nsw.gov.au/search/florasearch.htm>

Terania Rainforest Publishing – photos and info

<http://www.rainforestpublishing.com.au/library.html>

NSW Department of Environment and Climate Change –Threatened spp data, photos

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_allspecies.aspx

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The Australian Museum Complete Book of Australian Mammals, 1983, (ed. Ronald Strahan), Angus and Robertson.

The Field Guide to the Mammals of Australia, Peter Menkhorst and Frank Knight, 2004, Oxford University Press.

Reptiles and Amphibians of Australia, 2000, Harold G. Cogger, Chelsea Green Publishing

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The Field Guide to the Birds of Australia, Graham Pizzey and Frank Knight, 1998, Angus & Robertson, Australia.

The Slater Field Guide to Australian Birds, Peter, Pat and Raoul Slater, 1989, Landsdowne Publishing Pty Ltd, Australia.

Fauna Websites

Australian Museum online

<http://www.austmus.gov.au/>

Frogs Australia Network

http://www.frogsaustralia.net.au/frogs/display.cfm?frog_id=172

Australian Water birds

<http://www.environment.gov.au/biodiversity/migratory/waterbirds/wetbrds.html>

Appendix 10 – Monitoring and Evaluation Proforma & Guideline

(A guide to completing this form is included in the appendices of the Bush Futures SAP guidelines. This form should be completed for **each zone**. Assessment should be made of the zone as a whole. A form must be completed **before** works begin, and again **six monthly** and/or on **completion** of work.)

Date		Observer	
Site name		Site location	
Zone		Area	

Dominant Vegetation Community

Vegetation Description

Dominant Species Canopy			
Dominant Species Mid			
Dominant Species Ground			

Notes and Comments (including Threatened Species observations, presence of EEC, variations in veg types and location)

Structural and Compositional Integrity							
Stratum	Height Range(m)	%Cover			Disturbance Type / Stratum	Score (1-4)	
		Natives	Exotics	Total			
Emergent					Native Vegetation Cover		
Canopy					Age Class Diversity		
Mid					Native Species Composition		
Ground					Overstorey Regeneration		
					Growth Stage		
Notes and Comments:						Overall Score (average)	

Habitat Features (Score 0-3)

Hollows(>5cm)		Glossy Black Cockatoo feed tree	
Fallen Logs		Koala feed tree	
Native Grass/Reed/Sedge		Blossom bat feed tree	
Riparian/Wetland		Flying Fox Camp	
Gullies		Other Feature	
Rock/Boulders			
Cave/Overhangs		Raw Score (sum of all scores)	
Low Cover/Thickets		Habitat Assessment Score (TSC Office use)	

Dominant Weed Assessment

% cover

Species	Upper	Mid	Lower

Weed Total Score (DxS) =

Weed Density Score (D) =

- 1_Few or no weeds observed (No or Light Infestation).
- 2_Weeds mainly edges /very scattered (Light to Mod)
- 3_Weeds common, but patchy or scattered (including canopy)
- 4_Weeds throughout excluding canopy (Heavy infestation)
- 5_Weeds throughout including the canopy (Heavy infestation)

Weed Severity Score (S) =

- 1_No problem weeds present
- 2_Infestation is mostly cat 3 weeds
- 3_Infestation a mix of cat 2 & 3 weeds
- 4_Infestation mostly cat 2 or a cat 1 weed present
- 5_2 or more cat 1 weeds present

Other weeds

Threats:

Other Threats	Score (0-3)
Erosion	
Grazing	
Dumping	
Inapro. fire regime	
Vehicles	
Clearing	
Underscrubbing	
Other	
Raw Score	
Scaled Score <i>(TSC Office use)</i>	

Management notes:

Erosion Control	
Structural Works	
Rubbish removal	
Contamination	
Pest Control	
Fire Management	
Other	

Fencing (if applicable)

Fence Type	Length	Cost
Fencing Notes:		

Photo points

Photo point No.	Description	Direction	GPS co-ordinates	
			Easting	Northing

Guidelines to completing Monitoring and Evaluation Proforma

- A Monitoring and evaluation form should be completed for each area before works begin. Assessment should be made in the area as a whole.
- Given limited time in the field and the subjective/qualitative nature of rapid assessment, estimating many of the environmental variables listed here is difficult. Professional judgement and discretion will be required to deduce normal limits.

Section 1: Work area details - Complete details in the table provided.

Section 2: Dominant vegetation community

Section 3: Structural and compositional integrity

Age Class Diversity: A measure of the spread of sizes of trees, shrubs and other vegetation within each stratum.

2 = normal range of size classes in stratum

1 = reduced range of size classes in stratum (for example, same-aged cohorts)

Native species composition: A measure of whether a normal range of species are regenerating on site or whether fewer species are emerging than expected (for example, same species cohorts).

Overstorey regeneration: a measure of the extent to which canopy species are regenerating.

2 = overstorey species are common or patchy

1 = overstorey species are absent or uncommon (less than expected)

Growth stage: a measure of the successional stage of vegetation as an indication of disturbance history.

4 = *Old growth*. Mature forest or other vegetation with common age-related features such as fallen logs, senescent trees, stags, tree hollows, epiphytes, buttresses, very large trees, emergents etc. (Rare).

3 = *Mature vegetation*. Well-developed vegetation, e.g. >40yrs old for forests; 3-8 years old for shrublands and 1-5 years old for non-woody vegetation.

2 = *Advanced regrowth*. Intermediate successional development, e.g. 10-4-years old for forests; 3-8 years old for shrublands and 1-5 years old for non-woody vegetation.

1 = *Early successional development*. E.g. < 10 years for forests; < 3 years for shrublands and < 1 year for non-woody vegetation.

Section 4: Habitat features

Section 5: Dominant weed assessment