

71 Fig Hill Lane, Dunmore

Vegetation Management Plan

Nordon Jago Architects

12 January 2021

Final



Report No. 17231RP4

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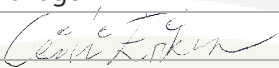
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Glossary

Acronym	Explication
APZ	Asset Protection Zone
BAM	Biodiversity Assessment Methodology
BC Act	NSW Biodiversity Conservation Act 2016
Biosecurity Act	NSW Biosecurity Act 2015
BRC	Bushland Regeneration Contractor
CEEC	Critically Endangered Ecological Community
DA	Development Application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry, and Environment
EEC	Endangered Ecological Community
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IPA	Inner Protection Area
LGA	Local Government Area
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (Now defunct)
PCT	Plant Community Type
Proposed Development	Proposed development of an eco-resort
Shellharbour 2013 LEP	Shellharbour Local Environment Plan 2013
Study Area	The property including the VMP Area comprising the entirety of Lot 3 DP717776
TEC	Threatened ecological community
VMP	Vegetation Management Plan
VMP Area	Area subject to vegetation management under direction of this Vegetation Management Plan
WoNS	Weed of National Significance

1. Introduction

Cumberland Ecology has been commissioned by Nordon Jago Architects, on behalf of Contract Properties Pty Ltd & The Trustee for Peterson Family Trust (the 'client') to prepare a Vegetation Management Plan (VMP) in support of a proposed development (the 'Project') at 71 Fig Hill Lane, Dunmore New South Wales (NSW) (hereafter referred to as the 'study area') (**Figure 1**). The Project involves the demolition of an existing derelict building and construction of an eco-tourism development under Development Application (DA) DA 0563/2019.

The focus of this VMP is areas of vegetation within the Asset Protection Zone for the development and adjacent areas of vegetation that will be retained. The area covered by this VMP is hereafter referred to as the 'VMP Area' and the majority of the vegetation in this area is to be retained, managed and revegetated (in some areas), as outlined within this VMP (**Figure 2**). The purpose of the proposed VMP Area is primarily to protect areas of vegetation within the study area that are located outside of the development footprint and the boundary of a proposed biodiversity stewardship site, which is to encompass the majority of the remainder of the property (**Figure 1**).

This VMP should be read in conjunction with the Biodiversity Development Assessment Report (BDAR) prepared by Cumberland Ecology (2019).

1.1. Purpose

The purpose of this VMP is to provide guidelines for the conservation, management and restoration of vegetation associated with the VMP Area. The VMP has been prepared to allow the retention and restoration of remnant vegetation in the VMP Area, using bushland regeneration techniques.

The aims of the plan are as follows:

- To enable protection of vegetation to be retained within the VMP Area during and after construction activities;
- To improve the biodiversity values of the VMP Area;
- To re-establish native vegetation that is broadly representative of the original vegetation community at the VMP Area, comprising three strata including canopy trees, shrubs and groundcovers;
- To establish and enhance habitat for local fauna species with the potential to occur or known to occur within the VMP Area; and
- To enhance the ecological character of the site by systematic staged removal and routine control of weed species within the VMP Area.

1.2. Background

1.2.1. Location

The study area is located within the City of Shellharbour Local Government Area (LGA). It is bound by rural properties and Minnamurra River (eastern and south-western boundaries of the property). The land use within the immediate locality of the VMP Area and wider study area currently consists of a mixture of remnant native

vegetation and rural properties, and intensive suburban development to the east across Minnamurra River comprising the Minnamurra suburb.

1.2.2. Vegetation

Vegetation within the VMP Area consists of remnants of three Threatened Ecological Communities (TECs) and areas of grassland dominated by exotic species. TECs within the VMP Area and their listing statuses under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) are:

- Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion (ILGW) – Endangered under the BC Act and Critically Endangered under the EPBC Act;
- Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISF) – Endangered under the BC Act and Critically Endangered under the EPBC Act; and
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF) – Endangered under the BC Act.

These TECs correspond to the following Plant Community Types (PCTs), which are state-wide vegetation classification units described in the BioNet Vegetation Classification database:

- ILGW – PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion;
- ISF – PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion; and
- SOFF - PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion.

1.3. Minnamurra Vegetation Area

The VMP Area and the proposed development area occurs in the northern extent of the Minnamurra Vegetation Area, which borders the Minnamurra River estuary. The Minnamurra Vegetation Area is listed as a landscape heritage item of local significance, under the *Shellharbour Local Environmental Plan 2013* (Urbis 2020). The Heritage Impact Statement prepared by Urbis (2020) found that the proposed development will have no impact on landscape items of heritage significance, including the Minnamurra Vegetation Area, and that the Project is supported from a heritage perspective.

This VMP will provide for the ongoing protection and management of the relevant section of the Minnamurra Vegetation Area that occurs within the VMP Area, through the protection and restoration of the vegetation within the VMP Area. Furthermore, the portion of the Minnamurra Vegetation Area that occurs in the wider study area, outside of the VMP Area, is proposed to be protected and managed in perpetuity under a Biodiversity Stewardship Agreement and associated management plan.

1.4. Relevant Legislation

Legislation relevant to this VMP includes:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- NSW *Biosecurity Act 2015*;
- NSW *Pesticides Act 1999*; and
- NSW *Biodiversity Conservation Act 2016*.

1.5. Structure of this VMP

The structure of the remainder of this document is as follows:

- Chapter 2 – Methodology: outlines the methods of data collection for the preparation of this VMP;
- Chapter 3 – Existing Biodiversity Values: provides a summary of the existing flora and fauna values of the VMP Area and wider study area;
- Chapter 4 - Clearing Protocols: outlines the protocols to be followed during clearing activities, involving vegetation clearing and demolition of built structures, to minimise the impacts on native flora and fauna;
- Chapter 5 – Management Zones: identifies zones within the VMP Area with differing vegetation management requirements;
- Chapter 6 – Weed Management Plan: identifies the main weed species in the VMP Area that require management and the appropriate control measures;
- Chapter 7 – Restoration and Regeneration Plan: provides details of restoration which is to be undertaken in the VMP Area and guidelines for ongoing maintenance of vegetated areas (including weed control);
- Chapter 8 – Monitoring and Reporting: outlines establishment of a monitoring program and associated reporting to ensure the objectives of the VMP are met; and
- Chapter 9 – Schedule, Timing and Responsibilities: providing information about the associated activities, who will be responsible and when these are to be implemented.

2. Methodology

2.1. Desktop Assessments

The preparation of this VMP involved a literature review to determine the most up to date methods of weed control for exotic species that are present in and adjacent to the VMP Area. This literature review involved a variety of sources including government fact sheets and websites. Personal experience of a Cumberland Ecology botanist formerly employed in bushland maintenance was also utilised.

In order to prepare species planting lists for revegetation, and revegetation strategies for remnant vegetation in the VMP Area, survey data was reviewed along with the existing Biodiversity Development Assessment Report (BDAR) prepared by Cumberland Ecology (2019) for the DA.

2.2. Field Surveys

The VMP Area was inspected on 24 May 2019 and the 26 July 2019, on each occasion by a botanist and accompanying ecologists, in order to map vegetation communities within the VMP Area, verify the existing conditions of the vegetation communities within the VMP Area, assess the overall condition of the vegetation, and to identify any locations of significant weed invasion. The site was traversed and photographs were taken in various locations. Photograph waypoints were taken using a handheld GPS device.

The wider study area was surveyed by Cumberland Ecology over a total of four days in December 2018, for the purposes of vegetation mapping and undertaking 22 Biodiversity Assessment Method (BAM) plots for a feasibility estimate for the creation of a Biodiversity Stewardship Site.

During the aforementioned surveys of the VMP Area and the location of the proposed development footprint, a total of four BAM Plots were undertaken to assess the condition and species composition of vegetation communities. Each included establishment of a 20 x 50 m plot within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20 m plot;
- Cover of 'High Threat Exotic' weed species;
- Assessment of function attributes within a 20 m x 50 m plot, including:
 - Count of number of large trees;
 - Tree stem size classes measured as 'diameter at breast height over bark' (DBH);
 - Regeneration based on the presence of living trees with stems <5 cm DBH;
 - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

3. Existing Biodiversity Values

3.1. Vegetation Communities

Four vegetation communities are present within the VMP Area (**Figure 3**). Three of these are native vegetation communities and have been matched to their Plant Community Types under NSW state-wide vegetation mapping, and the fourth is comprised of exotic grasses and other weeds. These communities are:

- PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion;
- PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion;
- PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion; and
- Exotic Grassland and Exotic Vegetation.

The occurrences of these areas within the VMP Area are described under the relevant headings below.

A list of all flora species recorded within the study area is provided in **Appendix A**.

3.1.1. PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

Approximate Area: 0.53 ha

TEC Status: Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion – EEC (BC Act)

3.1.1.1. General Description

Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (PCT 838) occurs in two condition states within the VMP Area, as described in subsequent sections. The community is equivalent to the map unit GW p34 South Coast Grassy Woodland as described in Tozer et al. (2010).

i. Forest Red Gum dominated form

This community occurs as small areas in the eastern half of the VMP Area comprising 0.25 ha in total area. The occurrence of this community in the VMP Area is extremely degraded with a native shrub and ground layer mostly absent. The canopy is dominated by *Eucalyptus tereticornis* (Forest Red Gum). The sub-canopy is dominated by *Acacia maidenii* (Maiden's Wattle) and *Acacia mearnsii* (Black Wattle), and younger individuals of these species occur in the shrub layer along with isolated individuals of *Breynia oblongifolia* (Coffee Bush) and juvenile *Streblus brunonianus* (Whale Bone Tree). The shrub layer is dominated, however, by dense thickets of the exotic *Lantana camara* (Lantana), estimated at up to 95% coverage at some locations. The exotic shrub *Solanum mauritianum* (Wild Tobacco Bush) is also present scattered within the layer.

The ground layer is sparse due to dense shading from *Lantana camara*, and fallen leaves of this species cover the majority of the surface area of the ground. There are sporadic occurrences of the native grass *Oplismenus aemulus* (Basket Grass), the only native species recorded in the layer, and the exotic *Tradescantia fluminensis* (Wandering Trad) is present in the layer in scattered, but dense patches.

A small number of twiners are present, generally scattered in the community and growing on *Lantana camara* shrubs. Species include the natives *Geitonopliesium cymosum* (Scrambling Lily) and *Cayratia clematidea* (Native Grape), and the exotic *Delairea odorata* (Cape Ivy).

An example of this form of the PCT is shown in Photograph 1.

Photograph 1. Forest Red Gum dominated form of PCT 838 with shrub layer dominated by the exotic *Lantana camara*



ii. Acacia Regrowth form

This community occurs as a strip in the western extent of the VMP Area comprising 0.27 ha in total area. It is a highly degraded form of PCT 838 and predominately consists of scattered *Acacia* spp. regrowth, mostly of a shrub height, growing over exotic grasses and forbs. *Acacia* species include *Acacia binervata* (Two-veined Hickory) and *Acacia melanoxylon* (Australian Blackwood). Exotic shrubs are present, though not dominant, and species include *Lantana camara*, *Chrysanthemoides monilifera* subsp. *monilifera* (Boneseed), and *Gomphocarpus fruticosus* (Narrow-leaved Cotton-bush).

The ground layer is heavily dominated by the exotic grass *Cenchrus clandestinus* (Kikuyu), and other exotic grasses are present and include *Chloris gayana* (Rhodes Grass), *Dactylis glomerata* (Orchard Grass), and *Paspalum dilatatum* (Paspalum). Exotic forbs are common with species present including *Bidens pilosa* (Cobbler's Pegs), *Foeniculum vulgare* (Fennel), *Ageratina adenophora* (Crofton Weed), and *Asparagus aethiopicus* (Ground Asparagus).

A few native species are scattered and uncommon in the ground layer. Species include the grass *Oplismenus aemulus* (Basket Grass), the twiner *Glycine tabacina*, and the forbs *Dichondra repens* (Kidney Weed) and *Centella asiatica* (Indian Pennywort).

Photograph 2. Acacia Regrowth form of PCT 838 on the slope along the western boundary of the VMP Area



3.1.1.2. Alignment with Threatened Ecological Communities

The Forest Red Gum dominated form of PCT 838 mapped on the VMP Area conforms to the TEC Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion, which is listed as an Endangered Ecological Community (EEC) under the BC Act. However, although this TEC is listed as a Critically Endangered Ecological Community (CEEC) under the EPBC Act, the occurrence of the PCT that exists within the VMP Area does not conform to the EPBC listing, due to the patch of the community being smaller than 0.5 ha, as per the Conservation Advice of the TEC (TSSC 2016).

The Acacia Regrowth form of the community does not conform to a TEC, as described within the final determination, as it lacks an over-storey layer. There is no derived native grassland form of the Illawarra Lowlands Grassy Woodland TEC, according to the description in the final determination (NSW Scientific Committee 2011). The occurrence of Acacia Regrowth does not constitute the vegetation community Illawarra Lowlands Grassy Woodland, and does not conform to the TEC.

3.1.2. PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

Approximate Area: 1.22 ha

TEC Status: Illawarra Subtropical Rainforest in the Sydney Basin Bioregion – EEC (BC Act)

3.1.2.1. General Description

Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion occurs in two condition states within the VMP Area, as described in subsequent sections. The community is equivalent to the map unit RF p111 Subtropical Dry Rainforest as described in Tozer (Tozer et al. 2010).

i. Degraded Form

This community occurs throughout the majority of the VMP Area comprising a total area of 1.1 ha. It exists predominately as tall regrowth of *Acacia mearnsii*, with scattered *Acacia maidenii*, and scattered occurrences of rainforest species indicating, along with the fertile soils that the community is a derived form of PCT 1300. Rainforest species present include the tree species *Alphitonia excelsa* (Red Ash), *Streblus brunonianus*, *Dendrocnide excelsa* (Giant Stinging Tree), and the climbing shrub *Maclura cochinchinensis* (Cockspur Thorn). The exotic shrub *Lantana camara* dominates the shrub layer and was estimated at 85 percent coverage (see **Photograph 3**).

The ground layer is relatively sparse, due to dense shading from *Lantana camara*. The exotic forb *Tradescantia fluminensis* is the dominant species, and the exotic vines *Passiflora subpeltata* (White Passion Flower), *Delairea odorata* and *Araujia sericifera* (Moth Vine) are common. Natives occur sporadically in the ground layer, with species recorded including the forbs *Pseuderanthemum variabile* (Pastel Flower) and *Dichondra repens*, the grass *Oplismenus aemulus*, and the climbers *Geitonopolesium cymosum* and *Cayratia clematidea*.

Photograph 3. Degraded form of PCT 1300 with a shrub layer dominated by the exotic *Lantana camara*



ii. Intact Form

This form of the community has a canopy and shrub layer dominated by native rainforest species. It occurs as a small area in the south-east of the VMP Area comprising a total area of 0.12 ha. Species present include the trees *Dendrocnide excelsa* (Giant Stinging Tree), *Baloghia inophylla* (Brush Bloodwood), *Planchonella australis* (Black Apple), and *Scolopia braunii* (Flintwood). Shrubs species include *Breynia oblongifolia* (Coffee Bush), *Pittosporum multiflorum* (Orange thorn), *Claoxylon australe* (Brittlewood), and *Ficus coronata* (Sandpaper Fig).

Native species in the ground layer include the ferns *Pellaea falcata* (Sickle Fern) and *Asplenium flabellifolium* (Necklace Fern), the forb *Pseuderanthemum variabile* (Pastel Flower), and the grass *Oplismenus aemulus* (Basket Grass). A number of climbers are also present and include *Cayratia clematidea* (Native Grape), *Parsonsia straminea* (Common Silkpod), and *Aphanopetalum resinosum* (Gum Vine).

Although the community is in good condition a number of exotic species are present in varying abundances and include the shrub *Lantana camara* (Lantana), and the ground covers *Tradescantia fluminensis* (Wandering Trad), *Ehrharta erecta* (Panic Veldtgrass), and *Lonicera japonica* (Japanese Honeysuckle).

Photograph 4 Intact form of PCT 1300 dominated by native rainforest species



3.1.2.2. Alignment with Threatened Ecological Communities

The entirety of the area of PCT 1300 mapped within the VMP Area conforms to the TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion, which is listed as an EEC under the BC Act. However, although this TEC is listed as a CEEC under the EPBC Act, the majority of the PCT within the VMP Area does not conform to the EPBC listing, as the community does not meet the condition criteria for overstorey cover of at least 30%, as per the Conservation Advice of the TEC (TSSC 2019).

3.1.3. PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion

Approximate Area: 0.04 ha

TEC Status: Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – EEC (BC Act).

3.1.3.1. General Description

This community occurs in a small area in the south of the VMP Area. The community is in generally poor condition consisting of a canopy of regrowth *Casuarina glauca* (Swamp Oak) individuals over a ground layer of exotic species such as the grass *Chloris gayana* (Rhodes Grass) and the forb *Bidens pilosa* (Cobbler's Pegs). The exotic shrub *Lantana camara* is common.

The community is equivalent to the map unit FoW p106 Estuarine Fringe Forest as described in Tozer et al. (2010).

Photograph 5 SOFF within the VMP Area



3.1.3.2. Alignment with Threatened Ecological Communities

The entirety of the area of PCT 1234 mapped within the VMP Area conforms to the TEC Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, which is listed as an EEC under the BC Act. However, although this TEC is listed as an EEC under the EPBC Act, the occurrence of the PCT within the VMP Area does not conform to the EPBC listing, as the community does not meet the condition criteria for an understorey of less than 80% exotic species.

3.1.4. Exotic Grassland and Exotic Vegetation

Approximate Area: 0.77 ha

TEC Status: Not a TEC

3.1.4.1. General Description

This vegetation does not correspond to a PCT as it is dominated by exotic species. It consists of grassland areas and small areas dominated by the shrub *Lantana camara*. Areas in the west of VMP Area at the time of the survey were wasteland areas, which were unmaintained and dominated by exotic forbs and grasses. Upper

elevations surrounding the derelict building contained a variety of exotic species, with the grasses *Cenchrus clandestinus* (Kikuyu) and *Chloris gayana* (Rhodes Grass) dominating, and a number of other exotic species present including *Foeniculum vulgare* (Fennel), *Verbena bonariensis* (Purpletop), and *Solanum mauritianum* (Wild Tobacco Bush). Lower elevations on slopes consist predominately of unmaintained areas of the exotic grass *Cenchrus clandestinus*.

The area in the east adjacent to an adjoining residential dwelling is comprised predominately of the exotic grass *Cenchrus clandestinus* and is maintained sporadically by mowing.

Photograph 6 Exotic Grassland in the West



Photograph 7 Exotic Grassland in the East



3.1.5. PCTs in the Study Area

The vegetation mapping of PCTs in the wider study area is shown in **Figure 4** and includes four TECs listed under the BC Act and/or EPBC Act:

- Dry Subtropical Rainforest (BC Act: EEC, EPBC Act: Critically Endangered)
- Coastal Saltmarsh (BC Act: EEC, EPBC Act: Vulnerable);
- Swamp Oak Floodplain Forest (BC Act: EEC, EPBC Act: EEC); and
- Littoral Rainforest (BC Act: EEC, EPBC Act: Critically Endangered).
- In addition to the TECs listed above, Mangrove Forests, which are protected habitats under the NSW *Fisheries Management Act 1994*, were found to cover large areas of the site.

3.2. Fauna Species

3.2.1. Fauna Habitat

The vegetation within the VMP Area contains a range of habitat features that provide potential foraging, shelter and breeding opportunities for fauna.

Key habitat features recorded within the VMP Area include:

- Hollow-bearing trees – providing shelter and breeding habitat for a range of reptiles, birds, arboreal mammals and microchiropteran bats (microbats);
- Rocks and leaf litter – providing foraging and basking habitat for small reptiles, and foraging habitat for invertebrate species;
- Nectar-producing trees and shrubs – foraging habitat for insects, blossom-dependant birds, arboreal mammals and megachiropteran bats (flying-foxes).

These key habitat features may provide habitat for a range of fauna, including some species that are listed as threatened under the EPBC Act and/or the BC Act.

3.2.2. General Species

The VMP Area and study area provides potential foraging and breeding habitat for a number of fauna species. Some fauna species recorded during site surveys are: Black-shouldered Kite (*Elanus axillaris*), Australian King Parrot (*Alisterus scapularis*), Lewin's Honeyeater (*Meliphaga lewinii*) and Laughing Kookaburra (*Dacelo novaeguineae*).

3.2.3. Threatened Fauna Species

No threatened species have been recorded directly within the VMP Area, however the presence of suitable habitat in addition to the proximity of recent records in the study area and locality, indicate that the following threatened species are most likely of those known to occur in the locality to utilise elements of habitat within the VMP Area:

- Glossy Black Cockatoo (*Calyptorhynchus lathami*) (BC Act: Vulnerable, EPBC Act: Not listed);
- Southern Myotis (*Myotis macropus*) (BC Act, Vulnerable; EPBC Act: Not listed); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (BC Act: Vulnerable, EPBC Act: Vulnerable).

These species would predominately utilise the VMP Area as part of a wider foraging range.

4. Clearing Protocols

This chapter outlines the protocols to be followed during clearing associated with the Project, to minimise the impacts on native flora and fauna. This chapter refers to clearing activities that will occur within the study area and the APZ within the VMP Area, but outside of the remainder of the VMP Area. For the purposes of this VMP, clearing activities also include demolition of built structures that provide potential fauna habitat.

4.1. Hygiene Protocols

To avoid the spread of *Phytophthora cinnamomi* and other soil borne pathogens, appropriate hygiene procedures and guidelines described in 'Best Practice Management Guidelines for *Phytophthora cinnamomi* within the Sydney Metropolitan Catchment Management Authority Area' (Botanic Gardens Trust 2008), as well as in the document 'Hygiene guidelines: Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomica*, myrtle rust, amphibian chytrid fungus and invasive plants' (EES 2020) will be followed.

All machinery, clothing (such as boots and gloves), and tools, which will have contact with soil will be disinfected with a spray prior to entering and leaving the site.

Recommended disinfectant products include:

- Non-corrosive disinfectants including Coolacide®, Phytoclean®, or Biogram® which can be for cleaning footwear, tools, tyres, machinery and other items in contact with soil;
- 70% Methylated spirits solution in a spray bottle which is suitable for personal use (clothing); and
- Sodium Hypochlorite 1%, which is effective, but can damage clothing and degrades rapidly in light.

4.2. Marking Limits of Vegetation Clearing

Prior to clearing being undertaken within the proposed development area, any vegetation to be retained in the VMP Area will need to be delineated. Clearing limits can be marked with high visibility tape, fencing, or other appropriate boundary markers. To avoid unnecessary damage to vegetation or inadvertent habitat removal, disturbance is to be restricted to the delineated area. No stockpiling of equipment, soils, or machinery will occur beyond the identified boundary. Sediment control measures will also be required to prevent run-off from construction activities such as soil, weed propagules and pollutants.

The person responsible for the clearance activities will be responsible for ensuring that the boundary markers are installed to enable the suitable environmental and technical inspections of the proposed disturbance to be undertaken.

4.3. Protective Fencing

In any area in which construction machinery is to be used with the potential to damage surrounding vegetation to be retained, temporary construction fencing will be installed to delineate vegetation to be retained. This includes vegetation to be retained within the VMP Area. Temporary fencing should be a metal construction fence, so it physically protects vegetation as well as visually delineates vegetation to be retained. This fencing is to remain in place until all works have been finished in adjoining areas. No vehicles or machinery will be

permitted to enter areas of vegetation to be retained. Signs should be installed on protective fencing stating that contractors are not to enter areas of environmental protection.

The person/s responsible for the clearance activities will be responsible for ensuring that the boundary markers and fences are installed to protect vegetation.

4.4. Pre-clearing Surveys

Prior to the commencement of clearing within the proposed development area and weedy areas of the VMP Area, a pre-clearing survey needs to be undertaken by a qualified ecologist. A qualified ecologist is considered to have a minimum of three years' experience in fauna handling and hold the relevant licences to permit trapping of fauna. During the survey, all features considered suitable for fauna habitat usage (e.g. nests, tree hollows, decorticated bark, man-made structures) that have the potential to be disturbed during clearing will be identified. It is likely that there could be possum dreys and bird nests present within shrubs or mid-storey vegetation. The existing built structures may also comprise bird nests and potential roosting habitat for microchiropteran bats (microbats).

Habitat features that have a high potential to support native fauna species will be identified prior to any clearing activities. These include nests, significant rock outcrops (if present) and in particular trees bearing hollows that have potential to contain species such as bats, gliders, possums, reptiles and birds. Trees containing hollows or nests that have a high potential to contain fauna will be identified (if present), recorded, flagged with fluorescent marking tape, and marked with a large (>1 m) "H" using spray paint on two sides of the tree.

As part of the pre-clearing surveys, all built structures to be demolished will also be inspected to identify any habitat features that have a high potential to support native fauna species, in particular, microbats. The surveys will include visual roost searches for crevices that a microbat may be able to access and roost in, with the aid of a torch where required, and the use of a hand-held ultrasonic bat detector. If any suitable roost sites are identified, additional surveys comprising roost watches and the deployment of ultrasonic bat detectors will be completed over a period of two nights to detect bats using the buildings. Any roost watches and ultrasonic bat detector surveys should be undertaken during spring/summer when microbats are more likely to leave their roost (and subsequently be detected) and not be carried out during periods of heavy rain. All targeted microbat surveys should be carried out by a qualified ecologist with a minimum of three years' experiences in surveying microbats.

The location of suitable nearby habitat for the release of fauna that may be encountered during the pre-clearing process will be identified and marked on a map prior to clearance works. Suitable nearby habitat for fauna release will include areas that are to be retained and that are suitable for the species detected (e.g. hollow-dependent species will be released into an area with tree hollows).

4.5. Fauna Relocation and Clearing Protocols

On the day of any clearing, a qualified ecologist will capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities. These fauna will be relocated into pre-determined habitat identified for fauna release. The clearing supervision and fauna relocation should be carried out by a qualified ecologist to ensure any harm to animals is minimised. A qualified ecologist is considered to have a minimum

of three years' experience in fauna handling and hold the relevant licences to permit trapping and relocation of fauna.

The clearing of vegetation will be conducted using a two-stage clearing process:

1. Trees marked with an "H" by the ecologist will not be cleared during the first instance of vegetation clearing in an area; however all vegetation around the tree will be so that the tree is isolated. Other habitat features marked with an "H", such as logs and log piles, will be supervised during clearing.
2. Identified habitat trees will be left to stand overnight after stage 1 clearing to allow resident fauna to voluntarily move from the area.

The two-stage clearing process enables fauna to feel secure whilst clearing occurs around their tree, and allows them a chance to self-relocate upon nightfall, when foraging typically occurs. Fauna are not likely to re-inhabit trees, as they are not likely to feel secure in their tree with all trees around it cleared.

The demolition of built structures will be guided by the results of the pre-clearing surveys. Where suitable bat roost sites and evidence of bat usage is recorded, the relevant built structures should be demolished under supervision of an ecologist. Staging of the built structures may also be required to provide opportunity for any roosting bats to self-relocate. Depending on the location of potential suitable roosting sites, the method for demolition of the existing buildings may involve an initial removal of the roof structures, with the buildings left overnight without roofing. Demolition of the remaining portion of the buildings would then occur on the following day. The specific details of the recommended demolition process will be included in the pre-clearance letter, as required.

The ecologist will be present while clearing to rescue animals injured during the clearance operation. Any fauna found will be captured and relocated to nearby remnant vegetation and released after nightfall to minimise the risk of predation by diurnal predators. Any animals that are inadvertently injured will be taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized. The closest veterinary clinics to the study area are detailed within **Table 1**. The clinics should be notified prior animal transportation to ensure they are willing to treat injured animals.

Table 1 Veterinary clinics closest to the Study Area

Name	Address	Contact Number
South Coast Veterinary Hospital	3/3 Brown St, Kiama NSW 2533	(02) 4233 1781
Kiama Veterinary Hospital	66 Shoalhaven Street, Kiama NSW 2533	(02) 4232 1221
Shellharbour Veterinary Clinic	3/15-17 College Avenue, Shellharbour City Centre NSW 2529	(02) 4295 4000

All persons working on the clearing operations will be briefed about the possible fauna present at the time of construction, and what procedures should be undertaken in the event of an animal being injured or disturbed. A qualified animal rescue person, or fauna ecologist will be on call at all times during clearing.

Results and outcomes of pre-clearing and clearing fauna surveys shall be documented by the ecologist and submitted to the proponent. This includes:

- Species and numbers of individuals recorded;
- Incidence of sick or injured animals and the actions taken to care for the fauna; and
- The species and numbers of individuals that were relocated.

If a new threatened species is identified that has not previously been identified as having potential to occur, the occurrence will be surveyed and fully documented. Results will be made available to the NSW Department of Planning, Industries and Environment (DPIE) and to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) (if it is a species that is a matter of national environmental significance).

4.6. Salvage of Habitat Features

The following fauna habitat features are to be salvaged during clearing if present and stockpiled for future use in restoration of the VMP Area. Habitat features are to be stored until such time as restoration of the retained vegetation commences. Placement of stored habitat features within retained the VMP Area will be undertaken in co-ordination with the Bushland Regeneration Contractor (BRC) or the ecologist.

4.6.1. Tree Hollows

If present, any trees with hollows from clearing areas (within the proposed development) are to be salvaged and relocated within the VMP Area. If the hollows cannot be salvaged, then nest boxes can be installed as an alternative. Nest boxes of various sizes should be installed in order to cater for different native species.

4.6.2. Logs, Bushrock and Other Woody Material

Existing bushrock within the proposed development area, which is located behind the walls of the basement of the existing building, will be salvaged and relocated to the VMP Area. The placement of any salvaged materials into the VMP Area should be undertaken under the supervision of an ecologist in order to ensure that native vegetation/fauna habitat is not disturbed during the process. The locations of where salvaged items are placed within the VMP Area will be documented. Any existing logs/bushrock in the VMP Area will be retained *in-situ*.

4.7. Sediment and Erosion Control

As vegetation clearance will occur adjacent to remnant vegetation during the construction phase, secondary risks including erosion and spread of weed propagules have the potential to take place if appropriate mitigation measures are not implemented. Sediment fencing should be installed.

4.8. Disposal of Cleared Vegetation

All exotic vegetation to be removed from site will be disposed of at a waste facility that accepts and processes green waste, and will be transported in a way that prevents the spread of exotic weed propagules.

5. Management Zones

The location of management zones within the VMP Area is shown in **Figure 5**.

5.1. Management Zone 1 – Asset Protection Zone

This management zone is part of the asset protection zone for the proposed development and will be managed as an Inner Protection Area (RFS 2006), as detailed in the Bushfire Protection Assessment prepared for the project (ABPP 2019). Management Zone 1 occurs on a slope and to be consistent with the Bushfire Protection Assessment will be terraced with pedestrian paths to allow access for fire protection, and an existing access road will be maintained in this area for access by firefighting vehicles as required. Also, an area in the north of the management zone is to be utilised for effluent treatment.

Existing native vegetation within this area consisting predominately of regrowth of native *Acacia* species will be retained wherever possible where it does not conflict with construction of terraces and effluent treatment areas, and at densities consistent with management as an IPA as detailed in the below extract from (RFS 2006):

An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 metres from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2 metres above the ground.

Exotic weed species will be controlled in the management zone and the area will be revegetated with species consistent with PCT 838 (see **Table 6** in **Appendix B**). In order to be consistent with the utilisation of this area as an IPA, revegetation will give regards to any existing retained native vegetation in any strata and plantings will be undertaken at spacings with the outcome that:

- Grown canopy trees will not exceed 15% coverage (any canopy exceeding 15% coverage will be trimmed);
- Canopy will not be within 2 m of the roofline of any building and will be trimmed as required to prevent encroachment within 2 m;
- Shrubs will not be planted within 10 m of any existing tree or tree planting; and
- Shrub coverage will not exceed 10% and shrubs will be planted within clumps with a separation distance that will prevent transfer of flame in the case of a bushfire.

Within Management Zone 1, vegetation management directions within this VMP will be superseded where directed by a qualified bushfire management consultant or report prepared by one, on in any case in which directions are inconsistent with bushfire guidelines and legislation.

5.2. Management Zone 2 – Exotic Grassland

This patch of open grassland currently reduces the risk of bushfire from the site to a neighbouring residence, hence it will be maintained as an area of open exotic grassland, though should be mown intermittently to reduce spread of weeds into native vegetation within the VMP Area. A raised physical boundary such as one constructed from logs will be utilised at the interfaces of this management zone and Management Zone 3 to prevent easy spread of exotic rhizomatous grasses into native vegetation and to provide a clear delineation between the native vegetation community and grassland areas to be mown.

5.3. Management Zone 3 – PCT 1300 Degraded

Exotic vegetation will be removed within the management zone, existing native vegetation will be retained, and supplementary infill planting of native species consistent with PCT 1300 (see **Table 7** in **Appendix B**) in all strata will be undertaken to restore this vegetation community to that with the condition of an intact occurrence of PCT 1300.

5.4. Management Zone 4 – PCT 1300 Intact

Vegetation within this management is relatively intact in all strata. As such, vegetation management will be restricted to removal of all exotic species to allow for natural regeneration.

5.5. Management Zone 5 – PCT 838 Forest Red Gum

Exotic vegetation will be removed within the management zone, existing native vegetation will be retained, and supplementary infill planting of native species consistent with PCT 838 (see **Table 6** in **Appendix B**) in all strata will be undertaken to restore this vegetation community to that with the condition of an intact occurrence of PCT 838.

5.6. Management Zone 6 – PCT 1234

Exotic vegetation will be removed within the management zone, existing native vegetation will be retained, and supplementary infill planting of native species consistent with PCT 1234 (see **Table 8** in **Appendix B**) in all strata will be undertaken to restore this vegetation community to that with the condition of an intact occurrence of PCT 1234.

6. Weed Management Plan

This chapter presents a Weed Management Plan for the VMP Area. It identifies the main weed species that require management and provides details of appropriate control measures. Initially, general weed management principles are outlined, followed by more specific guidelines for weed management in the VMP Area.

6.1. Species Lists

Weeds identified by Cumberland Ecology as occurring within the VMP Area and study area make up the weed species lists used for the basis of this Weed Management Plan (refer to **Appendix A** for a list of species within the study area). A list of control methods for specific weeds recorded is provided in **Appendix C**.

Priority weeds listed in the South East Region and Weeds of National Significance (WoNS) recorded in the VMP Area are listed in **Table 2** below. Weeds listed as being Species Subject to Local Management Programs within the South East Regional Strategic Weed Management Plan 2017 – 2022 (NSW Local Land Services 2017) are also provided.

Table 2 Priority Weeds recorded within the Study Area

Species	Common Name	Status	WoNS
<i>Acetosa sagittata</i>	Rambling Dock	SSLMP	No
<i>Ageratina adenophora</i>	Crofton Weed	SSLMP	No
<i>Araujia sericifera</i>	Moth Vine	SSLMP	No
<i>Asparagus aethiopicus</i>	Asparagus Fern	SP, SSLMP	Yes
<i>Asparagus plumosus</i>	Climbing Asparagus Fern	SP, SSLMP	Yes
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	SP	Yes
<i>Delairea odorata</i>	Cape Ivy	SSLMP	No
<i>Lantana camara</i>	Lantana	SP	Yes
<i>Opuntia stricta</i>	Common Prickly Pear	SP	Yes
<i>Rubus fruticosus</i> sp. <i>agg.</i>	Blackberry complex	SP	Yes
<i>Senecio madagascariensis</i>	Fireweed	SP	Yes

Table Key: SP = State Priority Weed, RP = Regional Priority Weed, SSLMP = Species Subject to Local Management Programs

6.2. Relevant Legislation

6.2.1.1. Weeds of National Significance (WONS)

WONS are weed species occurring on a list created under the framework of the National Weeds Strategy (Australian Weeds Committee 2006). Thirty-two WONS have been agreed upon by Australian governments as the worst weeds in the country based on an assessment process that prioritised weeds based on their invasiveness, potential for spread and environmental, social and economic impacts. No legislation has been created which is applicable to WONS, and legislative control for these species is currently expected to occur under state and territory legislation pertaining to weeds.

6.2.1.2. NSW Pesticides Act 1999

The NSW *Pesticides Act 1999* controls the use of herbicides within New South Wales. Under the Act it is illegal to use herbicides for species not listed on a particular herbicide's label, or in a concentration or manner not outlined on the label. Off-label use of a particular herbicide is permitted only upon obtaining a specific permit.

6.2.1.3. NSW Biosecurity Act 2015

Weeds determined to be problematic on a State and Regional scale are handled under the NSW *Biosecurity Act 2015* (Biosecurity Act). This Act provides an outline for managing biosecurity risks in order to further prevent their spread. Each Local Land Services region has a unique Regional Strategic Weed Management Plan. The study area is located within the South East Local Land Services region.

6.3. Weed Control

6.3.1. Best Management Practice

Contractors for weed removal within the VMP Area will have regard to the following, to minimise impacts upon existing vegetation and habitats:

- The main principles of the Bradley Method of bush regeneration, i.e. not over clearing (remove only targeted species), employment of minimal disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter;
- Removal of fruiting/seeding parts of weeds carefully, to minimise spread of plant propagules;
- Use of chemicals and sprays only during suitable weather conditions (i.e. not during wet or windy conditions), and only during appropriate seasons;
- All equipment should be thoroughly cleaned prior to entering the site to minimise contamination; and
- Care should be taken not to disturb native fauna or nesting/breeding sites.

6.3.2. Weed Control Methods

With the exception of Management Zone 2, which will be retained as a lawn, all management zones will need to be cleared of exotic vegetation in the groundcover, shrub, and canopy strata. Any priority weed species will be the focus of weed removal, particularly in the initial stages of the bushland regeneration works. The goal of weed control works over the entire management period of the VMP is to eliminate all exotic weed species, and their propagules from the soil seed bank within Management Zone 1 and Management Zones 3-6)

The weed control component of bushland regeneration works should be approached using the strategies outlined below.

6.3.2.1. Manual Weed Removal

Manual removal, or hand weeding, is an effective form of weed control for small inaccessible areas when all viable parts of the plant are removed from the soil (roots, fruiting material and rhizomes) where practical. All weeds removed by hand will be handled according to best practice bush regeneration techniques to prevent dispersal of propagules from the removed weeds.

6.3.2.2. Mechanical Weed Removal

The BRC can manually clear smaller plants with mattocks, brushcutters or other suitable equipment. The root structures of large exotic shrubs and trees should be retained following felling in order to stabilise the soil.

6.3.2.3. Use of Herbicides

All herbicides should be used according to recommendations on the herbicide label. Appropriate Personal Protective Equipment (PPE) should be worn and consideration given to time of day, likelihood of rainfall, wind direction and likely impact on native species as per guidelines on the label. Use of glyphosate will be appropriate for most species. Glyphosate is the preferred herbicide for use in environmentally sensitive areas as it is rapidly broken down by microbes in the soil so residue is short lived and will not affect remnant and planted native individuals in the long term following application. As the VMP Area is not directly adjacent to any watercourses, specific forms of herbicides are not necessary as no impacts to aquatic life and amphibians will occur.

It is important to note that there can be legal restrictions and permit requirements for use of specific herbicides for specific plants, and chemical labels and permit requirements always need to be researched prior to herbicide application. While the recommended methods for weed treatment detailed in **Appendix C** are effective, some will require a permit to be undertaken. The relevant permit number is PER9907. Herbicide permits need to be obtained from the Australian Pesticides and Veterinary Management Authority.

Manual and mechanical removal will be an appropriate form of control for some species, and all chemical treatment should be carried out in accordance with best practice guidelines.

Planting should not occur within 10 days of herbicide application.

6.3.3. Staging of Weed Control

6.3.3.1. Primary Weeding

Primary weeding is the first stage of bushland regeneration. Primary weeding may involve techniques such as:

- The selective spraying of weeds, with selective and non-selective herbicides;
- Cutting/scraping and painting deep rooted woody weeds and climbers with hand tools, chainsaws and brush cutters and painting cut stumps with herbicides containing Glyphosate or Picloram;
- Target drilling and injecting certain large tree weeds (such as Camphor Laurel) with herbicides such as Glyphosate and a Garlon/diesel mix;
- Selective hand removal of weeds and wicker wiping of tall herbaceous weeds in situations where damage to proximate, low growing native plants can be avoided; and
- Hand removal of tubers, bulbs, rhizomes and other underground storage organs as required.

6.3.3.2. Maintenance Weeding

Follow-up weeding should be undertaken in relevant areas of the VMP Area that have received past primary weeding treatments in the following months, to treat any regrowth of woody weeds. Follow-up weeding would

need to be undertaken over a 12-month period after primary weeding has occurred. Owing to the types of exotic species that occur on the VMP Area, it is expected that the seed bank would contain abundant weed seeds, in addition to root tubers and other propagules in the soil which would continue to sprout. This is particularly the case for the problematic *Asparagus aethiopicus* which occurs within the VMP Area and surrounding areas.

Follow-up weeding involves the selective removal or treatment of weeds, whilst allowing regenerating or planted native plants to increase in size, abundance and percentage cover. All weeds should be targeted during the follow-up weeding phase. The follow-up bushland regeneration works are likely to be required at least every month until weeds are at negligible levels. Site visits may be more frequent if it is determined necessary.

It is recommended that woody weeds, climbers, and key herbaceous weeds (which are highly likely to be much more prevalent after clearing) are subject to a programme of intense follow up weeding around any patches of regenerating native herbaceous plants to encourage the spread of the native plant species.

Follow-up weeding should be implemented for a minimum period of five continuous years, after primary weeding and erosion control and revegetation works have commenced. Maintenance weeding would likely overlap with the staged removal. After the five-year follow-up and maintenance period has been completed, a review should be conducted to determine on-site maintenance requirements.

6.4. Weed Management within the VMP Area

This section provides details of the weed management actions that are required on the VMP Area. Weed control methods for all weeds recorded on the site are provided in **Appendix C**.

An environmentally sensitive marker dye should be used in the herbicide solution during any herbicide spraying to ensure areas of weeds are not missed. Knapsack sprayers with a spray cone fitted to direct the spray towards the ground should be used to prevent herbicide drift into adjacent vegetated areas with non-target species.

The directions under the following headings should be undertaken sequentially during site preparation.

6.4.1. Sediment Fencing

Temporary silt sediment fencing should be installed in any areas in which erosion is likely to occur following removal of exotic species.

6.4.2. Priority Weeds

The first priority for weed treatment will be targeting mature individuals of priority weeds and other weeds of regional concern. Many of these species are perennial and take several years to reach reproductive maturity so are easily controlled providing juveniles are continuously eradicated before reaching maturity.

6.4.3. Primary Weeding

Following control of mature individuals of the main priority weed species, primary weeding should be undertaken throughout the VMP Area. The aims of primary weeding will be:

- Eliminating any woody weed species; and

- Targeting and eliminating any large, dominant infestations of exotic herbs and grasses.

Prior to chemical treatment any seed on mature exotic plants should be bagged to prevent seed fall and addition to the exotic soil seed bank of propagules.

The goal of primary weeding for the VMP Area will be to eliminate all the larger weed infestations to allow planting to take place to fill gaps in the understorey and canopy without competition from weed species.

The BRC should provide a program to outline the works to be undertaken. Spot spraying with herbicide will be used in any areas where there is negligible risk to collateral damage of native vegetation as it is more cost and time effective than hand weeding techniques

Following the initial spraying of areas in which revegetation is to take place the site should be left for three weeks to allow time for treated weeds to die back. After this period the entire area should be resprayed with Glyphosate again, with a focus made on treating any exotic plant species that still have green colouring left in the foliage.

It is recommended that all woody exotic shrubs and mid-storey species are cut at the base with a chainsaw, brush cutters or other suitable equipment. Immediately after cutting, the base of the stump should be painted with undiluted Glyphosate. Root structures should be left in-site following herbicide application to prevent erosion.

6.4.4. Ongoing Weed Maintenance

Ongoing maintenance of the VMP Area should occur for a five-year period by the contracted bushland regeneration company, and each area should be covered in its entirety once every month, to diminish the soil seed bank of exotic weed species present on site. In order to eliminate the occurrence of these species they need to be controlled before they have a chance to set seed.

The following sequential steps are recommended to manage each area of the site effectively for each site visit:

1. Initially the bushland regeneration team visiting the VMP Area should sweep from one end to the other. During this sweep weeds occurring alongside native plants should be removed by hand and any weed occurring within a patch of dominant native plants (such as a patch of grasses). During this sweep regrowth individuals of harder to manage weeds that require other techniques such as sawing, digging, drilling etc. should be targeted.
2. A member of the team should then sweep the entire area, spraying all regrowth weeds between native plantings/remnant natives in open areas with herbicide, and spot spraying where possible in regeneration areas.

It is important during site visits for ongoing weed maintenance that as many weeds as possible are controlled so individuals are not able to achieve maturity and set seed between site visits. Some weed species such as *Bidens pilosa* (Cobbler's Pegs) are prolific seeders, and many exotic plants can have seed that remains viable in the soil for long periods of time. In order to effectively diminish the soil seed bank of exotic species it is important that individuals are not allowed to set seed.

During site visits for weed control, regrowth of priority weeds, other Species Subject to Local Management Plans, and WoNS (**Table 2**) should be prioritised for control. Individual plants of these species on site should not be allowed to produce seed.

6.5. Weed Suppression Materials and Erosion Control

As **Management Zones 3-6** contain native vegetation with remnant native species occurring in all strata, weed suppression materials should not be utilised as they also inhibit native regrowth, and stabilisation of the soil surface should be by revegetation planting predominately. In areas in which plantings are not preventing erosion, control materials such as jute matting which also function as weed suppression materials can be utilised specifically where erosion is occurring, and should be used in conjunction with other methods to slow water flow such as by using logs secured with wooden stakes. As **Management Zones 3-6** contain remnant native ground layer species, and also contain a native soil seed bank, it is not appropriate to use mulch (OEH 2011).

Management Zone 1 will require complete revegetation of a native ground layer, which currently is completely dominated by exotic species, and as such mulch can be used as required to suppress weed growth in this area. Any mulch used is required to comply with *The mulch order 2016* and *The mulch exemption 2016* issued under the *Protection of the Environment Operations (Waste) Regulation 2014* of the *NSW Protection of the Environment Operations Act 1997*.

7. Restoration and Regeneration Plan

7.1. Objectives

This chapter provides details of restoration which will be undertaken in areas of the VMP Area and guidelines for ongoing maintenance of vegetated areas (including weed control). Restoration will need to occur where there is extensive weed cover either in the ground layer or shrub layer. Species typical of the relevant community should be planted out in these areas.

The objectives for the VMP Area are to achieve the following performance-based outcomes:

- Control threats affecting the health of regenerating native vegetation in the VMP Area and inhibiting the future regeneration potential of these plant communities;
- Increase species diversity and percentage cover of native vegetation plant species in the VMP Area;
- Improve the resistance of native vegetation within the VMP Area to future weed colonization and establishment and related threats, by initiating the two above aims; and
- Use measurable indicators to monitor regeneration responses and to assist in prioritizing bushland regeneration works during the proposed works program.

7.2. Signage

Signs will be installed along the outer boundary of areas of native vegetation to undergo full restoration (**Management Zones 3-6**) where the public could access the vegetation requesting that restoration areas are not accessed and listing the TECs undergoing restoration and their listing statuses under the BC Act and EPBC Act.

7.3. Recommended Revegetation Techniques

Appropriate plant species for each vegetation community to be revegetated within the VMP Area are provided in **Appendix B** and are to be used for selection for re-vegetation of **Management Zones 1, 3, 5, and 6** within the VMP Area. **Management Zone 2** is to be retained as an area of lawn and **Management Zone 4** is to be restored through assisted natural regeneration, without any revegetation planting.

7.3.1. Species Selection and Planting Densities

7.3.1.1. Species Selection

It is recommended that a mix of local native trees, shrubs, and ground layer plants are replanted at the specified densities outlined in **Section 7.3.1.2** below. All species to be planted are to be species naturally occurring within each vegetation community as outlined in tables in **Appendix B**. All plants should be disease and pest-free, hardened off and well-watered at the time of planting. All plants are to be provided in a healthy condition with good root development and a sturdy shoot system.

As many species as possible from the species list for each community should be planted for each stratum. Nursey stock of local provenance for all species listed in **Appendix B** are unlikely to be available, but at least 70% of the recommended species for each stratum in each vegetation community within **Management Zones 3, 5, and 6** should be utilised in plantings. A wide selection of species should also be utilised in **Management**

Zone 1, however it is recognised that due to planting restrictions due to the dual use as an APZ, using 70% of recommended species may not be feasible.

Final species selection will be based upon:

- Availability of seed material;
- Exclusion of plants likely to naturally regenerate on the site; and
- Previous experience with species re-vegetation performance.

7.3.1.2. Planting Densities

Recommended planting densities for each Management Zone are provided under the following headings:

i. Management Zone 1

Recommended planting densities for **Management Zone 1** in areas remaining after installation of terraced foot paths, effluent management infrastructure, and outside of the existing access track are:

- Trees: 1 unit/30m²;
- Shrubs: 1 unit/20m²; and
- Ground Covers: 4 units/1m².

Planting densities will be modified as required to give regard to existing native vegetation in each stratum.

Species will be selected from **Table 6** in **Appendix B** and be consistent with PCT 838. Shrubs and trees will be planted within the management zone as instructed in **Section 5.1** to comply with utilisation of the area as the IPA of an APZ.

ii. Management Zone 3

Recommended planting densities for **Management Zone 3** are:

- Trees: 1 unit/10m²;
- Shrubs: 1 unit/10m²; and
- Ground Covers: 2 units/1m².

Planting densities will be modified as required to give regard to existing native vegetation in each stratum.

Species will be selected from **Table 7** in **Appendix B** and be consistent with PCT 1300.

iii. Management Zone 5

Recommended planting densities for **Management Zone 5** are:

- Trees: 1 unit/20m²;
- Shrubs: 2 unit/5m²; and

- Ground Covers: 4 units/1m².

Planting densities will be modified as required to give regard to existing native vegetation in each stratum.

Species will be selected from **Table 6** in **Appendix B** and be consistent with PCT 838.

iv. Management Zone 6

Recommended planting densities for **Management Zone 1** in areas remaining after installation of terraced foot paths, effluent management infrastructure, and outside of the existing access track are:

- Trees: 1 unit/15m²;
- Shrubs: 1 unit/5m²; and
- Ground Covers: 2 units/1m².

Planting densities will be modified as required to give regard to existing native vegetation in each stratum.

Species will be selected from **Table 8** in **Appendix B** and be consistent with PCT 1234.

7.3.2. Characteristic Planting Units

Grasses may be planted in clumps of four (spaced 15–20 cm apart within clumps) to generate physical / structural support for each other and microclimates. Wind pollinated grasses such as *Microlaena stipoides* (Weeping Grass) may be particularly planted in clumps to aid fertilisation.

7.3.3. Plant Supply

Plants to be used in the VMP Area must be of local provenance origin (sourced from seed or cuttings taken from within the LGA), and seed should be collected from the study area in particular, by a local bushland regeneration company for growth in a nursery to be utilised as part of the plantings within the VMP Area.

Prior to planting it may be necessary to collect or source suitable quantities of local native seed to ensure suitable numbers of local provenance vegetation seed are available for the plant propagation phase of the proposed bushland reconstruction works programme.

If required, local native plant species should be collected using principles prescribed in 'Bringing the Bush back to Western Sydney' (DIPNR 2003). Seeds and vegetative propagules should be of local provenance.

It may be necessary to get the required amounts of seed and vegetative material contract-collected and grown-on by specialist nurseries. Local native plants should be grown in Forestry Tube-type (tubestock)/Hiko containers.

7.3.4. Re-vegetation Objectives to Maximise Fauna Utilisation

- Increase winter flowering Eucalypts for threatened bird species such as the Regent Honeyeater and Swift Parrot;
- Include marsupial feed trees such as various Eucalypt species;

- Increase trees and groundcovers favoured by arboreal mammals such as flowering Eucalypts; and
- Include species that mature to become good hollow-bearing trees (such as Eucalypts) for hollow-dependent fauna such as parrots, owls, gliders and microbats.

7.4. Planting Guide

The following is a guide to ensure success of tubestock plantings:

- Holes for tube stock should be dug deep enough that at least a few centimetres of the plant are below the soil surface;
- Treatment of soils within each planted tubestock plant hole with a plant establishment aid that contains a mix of materials such as slow and quick release fertilisers, water holding crystals, and wetting agents. These agents assist in establishing newly installed plants and can reduce establishment watering resources by up to 50%;
- Soil should be filled back in surrounding the tubestock;
- Plants need to be watered once immediately following planting; and
- A plastic tree guard should be installed around plants following planting and watering to protect them from herbivory, and herbicide drift during site visits for weed control.

The density of four ground cover plants per m² for this project may make hand weeding unsafe with every individual plant surrounded by a tree guard as tree guards are secured in place with bamboo stakes and can be dangerous (an eye hazard when bending and removing weeds). For this reason, the BRC should determine a safe proportion of groundcover plants to be selectively protected with trees guards, and caution should be used when spraying herbicide around plants without tree guards. All shrub and tree individuals planted will have tree guards installed.

7.5. Ongoing Maintenance of Plantings

During site visits for weed control of the revegetation areas, the contracted bushland regeneration team should monitor the plantings for death of individual plants which should be replaced with another individual of the same vegetation form during subsequent site visits to ensure at the end of the management period there are not gaps in vegetation cover. Although native plants generally only need to be watered once upon planting, drought periods or hot, dry weeks in warmer months of the year can result in death of plantings, particularly during El Nino years. The contracted bushland regeneration team should water plantings during site visits in these periods to prevent the loss of plantings from dehydration.

8. Monitoring and Reporting

It is recommended that a project manager/supervisor with the BRC be assigned to coordinate, supervise and manage all works and correspondence with respect to the restoration of the VMP Area. The project manager must be available for the duration of the project and become familiar with the site and progress of all aspects of works undertaken.

The project manager will be responsible for allocation of maintenance tasks to personnel in response to establishment issues and other factors as monitoring results are reported (e.g.: plant losses/re-planting, weed control, irrigation). Regular monitoring and feedback from personnel will assist in the allocation of labour relative to available funds.

8.1. Monitoring Program

The following activities are to be conducted as part of the monitoring program:

- Establish a series of fixed monitoring points. Five monitoring points will be established as a minimum, with one installed in each of **Management Zone 1** and **Management Zones 3-6**;
- Take photographs every six months from each monitoring point. Compare photographs to previous years;
- Five monitoring locations are proposed (**Figure 6**). Note any weeds occurring in at the locations as well as projective foliage cover of native and exotic species in each stratum. Record numbers of failed plantings in each quadrat; and
- Note any other weed outbreaks in the regeneration and restoration areas. This can be done while walking between monitoring points.

Monitoring will be conducted before weed control commences to record base-line condition. Once works commence, monitoring will be conducted every six months for the life of the VMP.

During the period of six-monthly monitoring, if maintenance weeding is conducted, each patch of land where weed control has occurred should be checked approximately a month afterwards.

8.2. Reporting

A brief and concise report should be prepared every 12 months for the life of the VMP. This report will be forwarded to City of Shellharbour Council and will provide a record of the implementation of the VMP. The report will:

- Describe the revegetation works undertaken;
- State the findings of the biannual monitoring activities;
- Discuss any problems encountered in implementing the VMP; and
- Recommend any adaptations or additions to the VMP.

The report should contain the photographs. Any other notable occurrences of weeds should also be reported. The report should also recommend and prioritise areas where weed control should be targeted in the next year of works.

At the end of the life of the VMP, a final inspection and associated report will need to be provided which details the success of works undertaken in the VMP Area.

9. Schedule Timing and Reporting

9.1. Responsibilities

It is recommended that a project manager/supervisor with the BRC be assigned to coordinate, supervise and manage all works and correspondence with respect to the restoration of the VMP Area. The project manager must be available for the duration of the project and become familiar with the site and progress of all aspects of works undertaken.

The Project Manager responsible for supervising any works assigned to the Bushland Regeneration Contractor (BRC) in **Table 3** is required to have a minimum qualification of Certificate II in Bushland Regeneration, or equivalent (e.g. Certificate II Conservation and Land Management). In addition, the supervisor is required to be eligible for full professional membership of the Australian Association of Bush Regenerators (AABR).

All other BRC personnel working on the project must have a minimum of one year's demonstrated experience in bushland regeneration.

Monitoring and Reporting is to be undertaken by a suitably qualified Bushland Management Consultant (such as a Bushland Regeneration Team Leader) or Ecological Consultant. The person undertaking the monitoring and reporting should be able to identify all flora species.

9.2. Schedule of Works

This VMP is scheduled over a period of five years. The measures that will be implemented during the five-year time period are outlined below:

- Installing Signage;
- Weed control;
- Planting of canopy, shrub, and groundcover species;
- Replacement of any tube stock individuals that have died between site visits; and
- Monitoring and reporting.

These works will be implemented in a series of phases as follows:

- Phase 1 – Site Preparation;
- Phase 2 – Restoration Works Commence;
- Phase 3 – Maintenance; and
- Phase 4 – Monitoring and Reporting.

Timing and responsibilities at each phase of management is shown within **Table 3**. The timing and responsibilities during clearing for fauna is shown in **Table 4**. These tables assign each activity for the management zone within each phase to those responsible.

Table 3 Timing and Responsibilities

Management Zone	Action	Responsibility	Performance Criteria	Timing
Phase 1 Site Preparation				
VMP Area	Delineation of clearing boundary	Property Owner or Project Manager	Marking using GPS and high visibility flagging tape and boundary markers.	Before construction works commence
VMP Area (All management zones except Management Zone 2)	Establish fixed monitoring points	Bush Regeneration Contractor or Ecologist	Using star pickets (or something smaller like a small stake and pink flagging) and GPS, establish a series of monitoring sites that can be used for photograph comparison, measuring weed and planting retention.	Prior to commencement of Bushland Restoration and Weeding works
VMP Area	Delineate and protect retained native vegetation	Property Owner or Project Manager	Temporary metal fencing and/or high visibility marking tape with clear signage installed.	Prior to construction works commencing
VMP Area and wider Study Area	Harvesting of native seed	Bush Regeneration Contractor	Seed collection undertaken	As soon as possible

Management Zone	Action	Responsibility	Performance Criteria	Timing
Development Area and APZ (Management Zone 1)	Pre-clearance surveys undertaken	Ecologist	Pre-clearance surveys have been completed and associated reporting submitted.	Prior to vegetation clearing.
Development Area and APZ (Management Zone 1)	Vegetation Clearing	Contractor	Vegetation removed	As per construction schedule
Development Area and APZ (Management Zone 1)	Salvage Habitat Features	Contractor	Tree hollows, log hollows, bushrock and other woody material will be salvaged and stockpiled for future use in revegetation areas and for habitat complexity.	Prior to/during clearing
Boundary of Management Zones 3-6	Install signage	Property Owner or BRC Project Manager	Signage installed at publicly accessible locations	Before Phase 2 commences

Management Zone	Action	Responsibility	Performance Criteria	Timing
Interface of Management Zone 2 and 3	Install barrier	Contractor	Physical barrier, such as logs, installed at ground level	Before Phase 2 commences
Phase 2 - Restoration Works Commence				
VMP Area (Excluding Management Zone 2)	Fixed Point Monitoring	Bush Regeneration Contractor	Photographs of fixed monitoring sites before initial weeding.	Prior to commencement of restoration works for each area.
VMP Area (Excluding Management Zone 2)	Carry out primary weeding	Bush Regeneration Contractor	Main weed infestations and priority weeds and WONS removed - Reproductively mature plants absent from site.	First two months of restoration works.
VMP Area (Excluding Management Zone 2)	Fixed Point Monitoring	Bush Regeneration Contractor	Photographs of fixed monitoring sites.	Prior to commencing works

Management Zone	Action	Responsibility	Performance Criteria	Timing
VMP Area (Excluding Management Zone 2 and 4)	Revegetation of Canopy, shrub, and ground cover species	Bush Regeneration Contractor	Native plants have been planted in all vegetation strata at densities detailed in Chapter 7 .	Immediately upon completion of Primary Weeding
VMP Area (Excluding Management Zone 2)	Carry out secondary weeding	Bush Regeneration Contractor	Weed regrowth following primary weeding removed. Work has commenced on control of annual weed species.	Following primary weeding, site visits monthly.
Phase 3 - Maintenance				
Management Zone 2	Mowing	Gardener	Exotic grassland maintained to prevent weed spread	As required
VMP Area (Excluding Management Zone 2)	Carry out maintenance weeding throughout the VMP Area	Bush Regeneration Contractor	Existing weed growth minimised or controlled. Regrowth following secondary weeding controlled. No new weed species or infestations.	Monthly for each zone for duration of 5 year maintenance period under VMP

Management Zone			Action	Responsibility	Performance Criteria	Timing
					Weed coverage should be less than 30% at end of first year, less than 20% at end of second year, less than 15% at end of third year, less than 10% at end of fourth year, and less than 5% at end of fifth year.	
VMP Area (Excluding Management Zone 2 and 4)	Maintenance of plantings	Bush Regeneration Contractor	Any dead plantings replaced.		Monthly for each zone for duration of 5 year maintenance period under VMP	
			Plants watered when drought stressed.			
			Additional plantings where required due to observed gaps in any strata.			
			At the end of management period of VMP species densities should be as detailed in Chapter 7			
Phase 4 - Monitoring and reporting						
VMP Area	Biannual inspection of site	Bushland Management Consultant or Ecologist	Site inspection completed as outlined in Chapter 8.		Every 6 months for 5 year maintenance period of VMP	

Management Zone	Action	Responsibility	Performance Criteria	Timing
VMP Area	Progress report preparation	Bushland Management Consultant or Ecologist	Annual report prepared on progress of restoration works.	Once a year for the 5 year maintenance period of VMP
VMP Area	Final Inspection of Site.	Bushland Management Consultant or Ecologist	Final Inspection carried out at completion of VMP.	After 5 years of maintenance under VMP
VMP Area	Final Report.	Bushland Management Consultant or Ecologist	Final report detailing success of restoration or outlining further works needed.	After 5 years of maintenance under VMP

Table 4 Timing and responsibilities for fauna management during clearing

Area	Action	Responsibility	Performance Criteria	Timing (since commencement of VMP)
Development area (outside of the VMP Area)	Habitat Assessment	Fauna Ecologist	Spray paint trees and habitat features e.g. Hollows, logs with 'H', record suitable habitat in built structures	1-2 weeks prior to Clearing
Development area (outside of the VMP Area)	Fauna Relocation and Clearing	Fauna Ecologist	Capture and/or remove fauna to pre-determined habitat for release.	Day of clearing
Development area (outside of the VMP Area)	Salvage Habitat Features	Contractor working with Ecologist	Tree hollows, log hollows, bushrock and other woody material will be salvaged and stockpiled for future use in VMP Area and for habitat complexity	1-2 weeks after Clearing
VMP Area	Nest Box	Contractor working with Ecologist	Where hollow relocation not possible, nest box placed in tree.	Prior to clearing

10. References

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- EES. 2020. Hygiene guidelines: Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, myrtle rust, amphibian chytrid fungus and invasive plants.
- NSW Local Land Services. 2017. South East Regional Strategic Weed Management Plan 2017-2022.
- NSW Scientific Committee. 2011. Illawarra lowlands grassy woodland in the Sydney Basin Bioregion - endangered ecological community listing. *in* Office of Environment and Heritage (NSW), editor., Hurstville.
- OEH. 2011. Conservation Management Notes - Natural Regeneration. Office of Environment and Heritage, Sydney.
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- TSSC. 2016. Approved conservation advice (incorporating listing advice) for the Illawarra and south coast lowland forest and woodland ecological community.
- TSSC. 2019. Conservation Advice (incorporating listing advice) for Illawarra-Shoalhaven subtropical rainforest of the Sydney Basin Bioregion.
- Urbis. 2020. Heritage Impact Statement: 71 Fig Hill Lane, Dunmore.

APPENDIX A :

Flora Species Recorded in Study Area

Table 5 Species recorded within Study Area

BAM GFG	Family	Scientific Name	Common Name	Native	Exotic	HTW
Tree (TG)	Acanthaceae	<i>Avicennia marina</i> subsp. <i>australasica</i>	Grey Mangrove	YES		
Tree (TG)	Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	YES		
Tree (TG)	Euphorbiaceae	<i>Baloghia inophylla</i>	Brush Bloodwood	YES		
Tree (TG)	Fabaceae (Mimosoideae)	<i>Acacia binervata</i>	Two-veined Hickory	YES		
Tree (TG)	Fabaceae (Mimosoideae)	<i>Acacia maidenii</i>	Maiden's Wattle	YES		
Tree (TG)	Flacourtiaceae	<i>Scolopia braunii</i>	Flintwood	YES		
Tree (TG)	Lauraceae	<i>Endiandra sieberi</i>	Hard Corkwood	YES		
Tree (TG)	Meliaceae	<i>Melia azedarach</i>	White Cedar	YES		
Tree (TG)	Moraceae	<i>Ficus macrophylla</i>	Moreton Bay Fig	YES		
Tree (TG)	Moraceae	<i>Streblus brunonianus</i>	Whalebone Tree	YES		
Tree (TG)	Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay	YES		
Tree (TG)	Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	YES		
Tree (TG)	Oleaceae	<i>Notelaea longifolia</i>	Large Mock-olive	YES		
Tree (TG)	Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree	YES		
Tree (TG)	Proteaceae	<i>Banksia integrifolia</i>	Coast Banksia	YES		
Tree (TG)	Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash	YES		
Tree (TG)	Rutaceae	<i>Geijera salicifolia</i>	Brush Wilga	YES		
Tree (TG)	Sapindaceae	<i>Guioa semiglauc</i>	Guioa	YES		
Tree (TG)	Sapotaceae	<i>Planchonella australis</i>	Black Apple	YES		

Tree (TG)	Urticaceae	<i>Dendrocnide excelsa</i>	Giant Stinging Tree	YES
Shrub (SG)	Chenopodiaceae	<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>		YES
Shrub (SG)	Chenopodiaceae	<i>Sarcocornia quinqueflora</i> subsp. <i>quinqueflora</i>		YES
Shrub (SG)	Chenopodiaceae	<i>Suaeda australis</i>		YES
Shrub (SG)	Ebenaceae	<i>Diospyros australis</i>	Black Plum	YES
Shrub (SG)	Euphorbiaceae	<i>Claoxylon australe</i>	Brittlewood	YES
Shrub (SG)	Fabaceae (Faboideae)	<i>Indigofera australis</i>	Australian Indigo	YES
Shrub (SG)	Fabaceae (Mimosoideae)	<i>Acacia irrorata</i>	Green Wattle	YES
Shrub (SG)	Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>		YES
Shrub (SG)	Fabaceae (Mimosoideae)	<i>Acacia mearnsii</i>	Black Wattle	YES
Shrub (SG)	Moraceae	<i>Ficus coronata</i>	Creek Sandpaper Fig	YES
Shrub (SG)	Myrsinaceae	<i>Aegiceras corniculatum</i>	River Mangrove	YES
Shrub (SG)	Myrsinaceae	<i>Myrsine variabilis</i>		YES
Shrub (SG)	Myrtaceae	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	YES
Shrub (SG)	Phyllanthaceae	<i>Breynia oblongifolia</i>	Coffee Bush	YES
Shrub (SG)	Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange Thorn	YES
Shrub (SG)	Pittosporaceae	<i>Pittosporum revolutum</i>	Rough Fruit Pittosporum	YES
Shrub (SG)	Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum	YES
Shrub (SG)	Rutaceae	<i>Acronychia oblongifolia</i>	White Aspen	YES
Shrub (SG)	Rutaceae	<i>Melicope micrococca</i>	Hairy-leaved Doughwood	YES
Shrub (SG)	Sapindaceae	<i>Alectryon subcinereus</i>	Wild Quince	YES
Shrub (SG)	Solanaceae	<i>Duboisia myoporoides</i>	Corkwood	YES

Other (OG)	Aphanopetalaceae	<i>Aphanopetalum resinosum</i>	Gum Vine	YES
Other (OG)	Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod	YES
Other (OG)	Celastraceae	<i>Celastrus australis</i>	Staff Climber	YES
Other (OG)	Fabaceae (Faboideae)	<i>Glycine tabacina</i>	Variable Glycine	YES
Other (OG)	Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily	YES
Other (OG)	Menispermaceae	<i>Sarcopetalum harveyanum</i>	Pearl Vine	YES
Other (OG)	Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>	Snake Vine	YES
Other (OG)	Moraceae	<i>Maclura cochinchinensis</i>	Cockspur Thorn	YES
Other (OG)	Passifloraceae	<i>Passiflora herbertiana</i>		YES
Other (OG)	Smilacaceae	<i>Smilax australis</i>	Lawyer Vine	YES
Other (OG)	Vitaceae	<i>Cayratia clematidea</i>	Native Grape	YES
Other (OG)	Vitaceae	<i>Cissus antarctica</i>	Water Vine	YES
Grass & grasslike (GG)	Cyperaceae	<i>Ficinia nodosa</i>	Knobby Club-rush	YES
Grass & grasslike (GG)	Juncaceae	<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush	YES
Grass & grasslike (GG)	Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	YES
Grass & grasslike (GG)	Poaceae	<i>Cynodon dactylon</i>	Common Couch	YES
Grass & grasslike (GG)	Poaceae	<i>Dichelachne crinita</i>	Longhair Plumegrass	YES
Grass & grasslike (GG)	Poaceae	<i>Entolasia marginata</i>	Bordered Panic	YES
Grass & grasslike (GG)	Poaceae	<i>Imperata cylindrica</i>	Blady Grass	YES
Grass & grasslike (GG)	Poaceae	<i>Oplismenus aemulus</i>		YES
Grass & grasslike (GG)	Poaceae	<i>Phragmites australis</i>	Common Reed	YES
Grass & grasslike (GG)	Poaceae	<i>Sporobolus virginicus</i>		YES

Forb (FG)	Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel Flower	YES
Forb (FG)	Aizoaceae	<i>Tetragonia tetragonoides</i>	New Zealand Spinach	YES
Forb (FG)	Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	YES
Forb (FG)	Amaryllidaceae	<i>Crinum pedunculatum</i>	Swamp Lily	YES
Forb (FG)	Apiaceae	<i>Centella asiatica</i>	Indian Pennywort	YES
Forb (FG)	Araceae	<i>Gymnostachys anceps</i>	Settler's Twine	YES
Forb (FG)	Asteraceae	<i>Leptinella longipes</i>		YES
Forb (FG)	Asteraceae	<i>Senecio lautus</i>	Variable Groundsel	YES
Forb (FG)	Chenopodiaceae	<i>Atriplex australasica</i>		YES
Forb (FG)	Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew	YES
Forb (FG)	Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	YES
Forb (FG)	Geraniaceae	<i>Geranium homeanum</i>		YES
Forb (FG)	Juncaginaceae	<i>Triglochin striata</i>	Streaked Arrowgrass	YES
Forb (FG)	Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	YES
Forb (FG)	Primulaceae	<i>Samolus repens</i>	Creeping Brookweed	YES
Fern (EG)	Adiantaceae	<i>Adiantum formosum</i>	Giant Maidenhair	YES
Fern (EG)	Adiantaceae	<i>Pellaea falcata</i>	Sickle Fern	YES
Fern (EG)	Aspleniaceae	<i>Asplenium flabellifolium</i>	Necklace Fern	YES
Fern (EG)	Dennstaedtiaceae	<i>Pteridium spp.</i>		YES
Exotic	Alliaceae	<i>Nothoscordum borbonicum</i>	Onion Weed	YES
Exotic	Apiaceae	<i>Foeniculum vulgare</i>	Fennel	YES
Exotic	Apocynaceae	<i>Araujia sericifera</i>	Moth Vine	YES YES

Exotic	Apocynaceae	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush	YES	
Exotic	Arecaceae	<i>Phoenix canariensis</i>	Canary Island Date Palm	YES	YES
Exotic	Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	YES	YES
Exotic	Asparagaceae	<i>Asparagus plumosus</i>	Climbing Asparagus Fern	YES	YES
Exotic	Asteraceae	<i>Ageratina adenophora</i>	Crofton Weed	YES	YES
Exotic	Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	YES	YES
Exotic	Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	YES	YES
Exotic	Asteraceae	<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	YES	
Exotic	Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	YES	
Exotic	Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	YES	
Exotic	Asteraceae	<i>Delairea odorata</i>	Cape Ivy	YES	YES
Exotic	Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	YES	
Exotic	Asteraceae	<i>Soliva sessilis</i>	Bindyi	YES	
Exotic	Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	YES	
Exotic	Asteraceae	<i>Taraxacum officinale</i>	Dandelion	YES	
Exotic	Brassicaceae	<i>Brassica fruticulosa</i>	Twiggy Turnip	YES	
Exotic	Cactaceae	<i>Opuntia stricta</i>	Common Prickly Pear	YES	YES
Exotic	Caprifoliaceae	<i>Lonicera japonica</i>	Japanese Honeysuckle	YES	YES
Exotic	Chenopodiaceae	<i>Atriplex prostrata</i>		YES	
Exotic	Chenopodiaceae	<i>Chenopodium album</i>	Fat Hen	YES	
Exotic	Commelinaceae	<i>Tradescantia fluminensis</i>	Wandering Jew	YES	YES
Exotic	Euphorbiaceae	<i>Euphorbia peplus</i>	Petty Spurge	YES	

Exotic	Fabaceae (Caesalpinioideae)	<i>Senna pendula</i> var. <i>glabrata</i>		YES
Exotic	Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover	YES
Exotic	Fabaceae (Faboideae)	<i>Vicia sativa</i>	Common vetch	YES
Exotic	Malvaceae	<i>Lagunaria patersonia</i>	Norfolk Island Hibiscus	YES
Exotic	Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow	YES
Exotic	Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	YES
Exotic	Myrsinaceae	<i>Lysimachia arvensis</i>	Scarlet Pimpernel	YES
Exotic	Passifloraceae	<i>Passiflora subpeltata</i>	White Passionflower	YES
Exotic	Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongues	YES
Exotic	Poaceae	<i>Avena barbata</i>	Bearded Oats	YES
Exotic	Poaceae	<i>Bromus catharticus</i>	Prairie Grass	YES
Exotic	Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu Grass	YES
Exotic	Poaceae	<i>Cenchrus pennisetiformis</i>	Buffel Grass	YES YES
Exotic	Poaceae	<i>Chloris gayana</i>	Rhodes Grass	YES YES
Exotic	Poaceae	<i>Dactylis glomerata</i>	Cocksfoot	YES
Exotic	Poaceae	<i>Ehrharta erecta</i>	Panic Veldtgrass	YES YES
Exotic	Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass	YES
Exotic	Poaceae	<i>Paspalum dilatatum</i>	Paspalum	YES YES
Exotic	Poaceae	<i>Phalaris aquatica</i>	Phalaris	YES
Exotic	Poaceae	<i>Setaria parviflora</i>		YES
Exotic	Polygonaceae	<i>Acetosa sagittata</i>	Rambling Dock	YES YES
Exotic	Rosaceae	<i>Rubus fruticosus</i> sp. agg.	Blackberry complex	YES

Exotic	Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush	YES	
Exotic	Verbenaceae	<i>Lantana camara</i>	Lantana	YES	YES
Exotic	Verbenaceae	<i>Verbena bonariensis</i>	Purpletop	YES	
Exotic	Verbenaceae	<i>Verbena rigida</i> var. <i>rigida</i>	Veined Verbena	YES	
Exotic	Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	YES	

APPENDIX B :

Species Planting Lists

Table 6 Species Planting List for PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion

Stratum	Scientific Name	Common Name
Tree	<i>Acacia maidenii</i>	Maiden's Wattle
Tree	<i>Angophora floribunda</i>	Rough-barked Apple
Tree	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum
Tree	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark
Tree	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Tree	<i>Streblus brunonianus</i>	Whalebone Tree
Shrub	<i>Acacia implexa</i>	Hickory Wattle
Shrub	<i>Breynia oblongifolia</i>	Coffee Bush
Shrub	<i>Cassine australis</i> var. <i>australis</i>	
Shrub	<i>Diospyros australis</i>	Black Plum
Shrub	<i>Indigofera australis</i>	Australian Indigo
Shrub	<i>Leucopogon juniperinus</i>	Prickly Beard-heath
Shrub	<i>Maclura cochinchinensis</i>	Cockspur Thorn
Shrub	<i>Notelaea venosa</i>	Veined Mock-olive
Shrub	<i>Pittosporum multiflorum</i>	Orange Thorn
Shrub	<i>Pittosporum revolutum</i>	Rough Fruit Pittosporum
Shrub	<i>Pittosporum undulatum</i>	Sweet Pittosporum
Shrub	<i>Rapanea variabilis</i>	
Shrub	<i>Rubus parvifolius</i>	Native Raspberry
Ground - Sedge	<i>Carex longibrachiata</i>	
Ground - Grass	<i>Cymbopogon refractus</i>	Barbed Wire Grass
Ground - Grass	<i>Cyperus imbecillis</i>	
Ground - Grass	<i>Cyperus laevis</i>	
Ground - Grass	<i>Echinopogon caespitosus</i> var. <i>caespitosus</i>	Tufted Hedgehog Grass
Ground - Grass	<i>Echinopogon ovatus</i>	Forest Hedgehog Grass
Ground - Grass	<i>Entolasia marginata</i>	Bordered Panic
Ground - Grass	<i>Eragrostis leptostachya</i>	Paddock Lovegrass
Ground - Grass	<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass
Ground - Grass	<i>Microlaena stipoides</i>	Weeping Grass
Ground - Grass	<i>Oplismenus aemulus</i>	
Ground - Grass	<i>Oplismenus imbecillis</i>	
Ground - Grass	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock
Ground - Grass	<i>Themeda australis</i>	

Stratum	Scientific Name	Common Name
Ground - Forb	<i>Commelina cyanea</i>	Native Wandering Jew
Ground - Forb	<i>Dianella longifolia</i>	Blueberry Lily
Ground - Forb	<i>Dichondra repens</i>	Kidney Weed
Ground - Forb	<i>Galium propinquum</i>	Maori Bedstraw
Ground - Forb	<i>Geranium homeanum</i>	
Ground - Forb	<i>Plectranthus parviflorus</i>	
Ground - Forb	<i>Pratia purpurascens</i>	Whiteroot
Ground - Forb	<i>Pseuderanthemum variabile</i>	Pastel Flower
Ground - Forb	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	Indian Weed
Ground - Forb	<i>Solanum prinophyllum</i>	Forest Nightshade
Ground - Climber	<i>Cayratia clematidea</i>	Native Grape
Ground - Climber	<i>Desmodium varians</i>	Slender Tick-trefoil
Ground - Climber	<i>Eustrephus latifolius</i>	Wombat Berry
Ground - Climber	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Ground - Climber	<i>Glycine clandestina</i>	Twining glycine
Ground - Climber	<i>Glycine microphylla</i>	Small-leaf Glycine
Ground - Climber	<i>Glycine tabacina</i>	Variable Glycine
Ground - Climber	<i>Hibbertia scandens</i>	Climbing Guinea Flower
Ground - Climber	<i>Marsdenia rostrata</i>	Milk Vine
Ground - Climber	<i>Pandorea pandorana</i>	Wonga Wonga Vine
Ground - Climber	<i>Parsonsia straminea</i>	Common Silkpod
Ground - Climber	<i>Tylophora barbata</i>	Bearded Tylophora

Table 7 Species planting list for PCT 1300: Whalebone Tree – Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion

Stratum	Scientific Name	Common Name
Tree	<i>Acacia maidenii</i>	Maiden's Wattle
Tree	<i>Acmena smithii</i>	Lilly Pilly
Tree	<i>Alphitonia excelsa</i>	Red Ash
Tree	<i>Baloghia inophylla</i>	Brush Bloodwood
Tree	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum
Tree	<i>Cryptocarya microneura</i>	Murrogun
Tree	<i>Dendrocnide excelsa</i>	Giant Stinging Tree
Tree	<i>Ehretia acuminata</i> var. <i>acuminata</i>	Koda
Tree	<i>Eucalyptus quadrangulata</i>	White-topped Box
Tree	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Tree	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese Tree
Tree	<i>Guioa semiglauca</i>	Guioa
Tree	<i>Planchonella australis</i>	Black Apple
Tree	<i>Scolopia braunii</i>	Flintwood
Tree	<i>Streblus brunonianus</i>	Whalebone Tree
Shrub	<i>Abutilon oxycarpum</i> var. <i>oxycarpum</i>	Straggly Lantern-bush
Shrub	<i>Acronychia oblongifolia</i>	White Aspen
Shrub	<i>Alectryon subcinereus</i>	Wild Quince
Shrub	<i>Backhousia myrtifolia</i>	Grey Myrtle
Shrub	<i>Breynia oblongifolia</i>	Coffee Bush
Shrub	<i>Callistemon salignus</i>	Willow Bottlebrush
Shrub	<i>Cassine australis</i> var. <i>australis</i>	
Shrub	<i>Claoxylon australe</i>	Brittlewood
Shrub	<i>Croton verreauxii</i>	Green Native Cascarilla
Shrub	<i>Diospyros australis</i>	Black Plum
Shrub	<i>Ficus coronata</i>	Creek Sandpaper Fig
Shrub	<i>Hibiscus heterophyllus</i> subsp. <i>heterophyllus</i>	Native Rosella
Shrub	<i>Maclura cochinchinensis</i>	Cockspur Thorn
Shrub	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree
Shrub	<i>Melicope micrococca</i>	Hairy-leaved Doughwood
Shrub	<i>Melicytus dentatus</i>	Tree Violet
Shrub	<i>Myrsine variabilis</i>	
Shrub	<i>Notelaea venosa</i>	Veined Mock-olive

Stratum	Scientific Name	Common Name
Shrub	<i>Pittosporum multiflorum</i>	Orange Thorn
Shrub	<i>Pittosporum revolutum</i>	Rough Fruit Pittosporum
Shrub	<i>Pittosporum undulatum</i>	Sweet Pittosporum
Shrub	<i>Sarcomelicope simplicifolia</i> subsp. <i>simplicifolia</i>	Big Yellow Wood
Shrub	<i>Wilkia huegeliana</i>	Veiny Wilkiea
Ground - Sedge	<i>Carex longibrachiata</i>	
Ground - Sedge	<i>Cyperus laevis</i>	
Ground - Sedge	<i>Cyperus tetraphyllus</i>	
Ground - Grass	<i>Oplismenus aemulus</i>	
Ground - Grass	<i>Oplismenus imbecillis</i>	
Ground - Forb	<i>Aneilema acuminatum</i>	
Ground - Forb	<i>Commelina cyanea</i>	Native Wandering Jew
Ground - Forb	<i>Gymnostachys anceps</i>	Settler's Twine
Ground - Forb	<i>Plectranthus parviflorus</i>	
Ground - Forb	<i>Pseuderanthemum variabile</i>	Pastel Flower
Ground - Forb	<i>Stellaria flaccida</i>	
Ground - Fern	<i>Adiantum aethiopicum</i>	Common Maidenhair
Ground - Fern	<i>Adiantum formosum</i>	Giant Maidenhair
Ground - Fern	<i>Adiantum hispidulum</i>	Rough Maidenhair
Ground - Fern	<i>Arthropteris tenella</i>	
Ground - Fern	<i>Asplenium australasicum</i>	Bird's Nest Fern
Ground - Fern	<i>Asplenium flabellifolium</i>	Necklace Fern
Ground - Fern	<i>Doodia aspera</i>	
Ground - Fern	<i>Lastreopsis decomposita</i>	Trim Shield Fern
Ground - Fern	<i>Pellaea falcata</i>	Sickle Fern
Ground - Fern	<i>Pyrrosia rupestris</i>	Rock Felt Fern
Ground - Climber	<i>Aphanopetalum resinosum</i>	Gum Vine
Ground - Climber	<i>Cayratia clematidea</i>	Native Grape
Ground - Climber	<i>Celastrus australis</i>	Staff Climber
Ground - Climber	<i>Cissus antarctica</i>	Water Vine
Ground - Climber	<i>Cynanchum elegans</i>	White-flowered Wax Plant
Ground - Climber	<i>Eustrephus latifolius</i>	Wombat Berry
Ground - Climber	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Ground - Climber	<i>Gynochthodes jasminoides</i>	Sweet Morinda
Ground - Climber	<i>Legnephora moorei</i>	Round-leaf Vine

Stratum	Scientific Name	Common Name
Ground - Climber	<i>Marsdenia flavescens</i>	Hairy Milk Vine
Ground - Climber	<i>Marsdenia rostrata</i>	Milk Vine
Ground - Climber	<i>Pandorea pandorana</i>	Wonga Wonga Vine
Ground - Climber	<i>Parsonsia straminea</i>	Common Silkpod
Ground - Climber	<i>Sarcopetalum harveyanum</i>	Pearl Vine
Ground - Climber	<i>Smilax australis</i>	Lawyer Vine
Ground - Climber	<i>Stephania japonica</i> var. <i>discolor</i>	Snake Vine
Ground - Climber	<i>Trophis scandens</i> subsp. <i>scandens</i>	Burny Vine

Table 8 Species planting list for • PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion

Stratum	Scientific Name	Common Name
Tree	<i>Casuarina glauca</i>	Swamp Oak
Shrub	<i>Melaleuca ericifolia</i>	Swamp Paperbark
Shrub	<i>Myoporum acuminatum</i>	Boobialla
Shrub	<i>Sarcocornia quinqueflora</i> subsp. <i>quinqueflora</i>	
Ground - Grass	<i>Entolasia marginata</i>	Bordered Panic
Ground - Grass	<i>Oplismenus imbecillis</i>	
Ground - Sedge	<i>Baumea juncea</i>	
Ground - Sedge	<i>Carex appressa</i>	Tall Sedge
Ground - Sedge	<i>Gahnia clarkei</i>	Tall Saw-sedge
Ground - Rush	<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush
Ground - Rush	<i>Juncus usitatus</i>	
Ground - Grass	<i>Phragmites australis</i>	Common Reed
Ground - Forb	<i>Alternanthera denticulata</i>	Lesser Joyweed
Ground - Forb	<i>Centella asiatica</i>	Indian Pennywort
Ground - Forb	<i>Commelina cyanea</i>	Native Wandering Jew
Ground - Forb	<i>Lobelia anceps</i>	
Ground - Forb	<i>Rumex brownii</i>	Swamp Dock
Ground - Forb	<i>Samolus repens</i>	Creeping Brookweed
Ground - Climber	<i>Parsonsia straminea</i>	Common Silkpod
Ground - Climber	<i>Stephania japonica</i> var. <i>discolor</i>	Snake vine

APPENDIX C :

Weed Control Methods

Table 9 Weed Control Methods for weed recorded within Study Area

Species	Common Name	Treatment Methods
<i>Bidens pilosa</i>	Cobbler's Pegs	- Hand Weed - Spot Spray Glyphosate 10mL/1L
<i>Cirsium vulgare</i>	Spear Thistle	
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	
<i>Senecio madagascariensis</i>	Fireweed	
<i>Soliva sessilis</i>	Bindyi	
<i>Sonchus oleraceus</i>	Milk Thistle	
<i>Taraxacum officinale</i>	Dandelion	
<i>Brassica fruticulosa</i>	Twiggy Turnip	
<i>Atriplex prostrata</i>		
<i>Chenopodium album</i>	Fat Hen	
<i>Euphorbia peplus</i>	Petty Spurge	
<i>Trifolium repens</i>	White Clover	
<i>Vicia sativa</i>	Common Vetch	
<i>Modiola caroliniana</i>	Red-flowered Mallow	
<i>Lysimachia arvensis</i>	Scarlet Pimpernel	
<i>Plantago lanceolata</i>	Lamb's Tongues	
<i>Avena barbata</i>	Bearded Oats	
<i>Bromus catharticus</i>	Brome Grass	
<i>Cenchrus clandestinus</i>	Kikuyu Grass	

Species	Common Name	Treatment Methods
<i>Cenchrus pennisetiformis</i>	Buffel Grass	
<i>Dactylis glomerata</i>	Orchard grass	
<i>Ehrharta erecta</i>	Panic Veldtgrass	
<i>Lolium perenne</i>	Perennial Ryegrass	
<i>Paspalum dilatatum</i>	Dallis Grass	
<i>Phalaris aquatica</i>	Phalaris	
<i>Setaria parviflora</i>	Pigeon Grass	
<i>Verbena bonariensis</i>	Purple Top	

Species	Common Name	Treatment Methods
<i>Nothoscordum gracile</i>	Onion Weed	- Can be extremely difficult to control due to numerous bulbils sprouting from main bulb which break off underground and form new plants - The plant can be dug out carefully with hand tools; an effort must be made to carefully remove and bag all bulbils formed around the main bulb. - Follow up hand weeding for many months is required to remove juvenile plants; control is easier if juvenile plants are carefully dug out, taking care to bag and remove bulbs, before bulbils have formed - Spray with 10mL/1L glyphosate every month; adult plants may take several months to die back. Repeat monthly to control sprouting juvenile plants. - Wipe leaves of plants with undiluted glyphosate monthly, without missing juvenile sprouting plants. This can be nearly as time consuming as hand digging plants out - Any flowering stem should be cut and bagged, along with any head with seed.

Species	Common Name	Treatment Methods
<i>Foeniculum vulgare</i>	Fennel	- Hand weed or spot spray juveniles with glyphosate 15mL/L or metsulfuron methyl 7 g/100 L + non-ionic surfactant - Tall, mature individuals can be removed with a mattock, with care taken to sever the tap root as deep below ground as possible - Spot spray mature individuals and regrowth with glyphosate 15mL/L or metsulfuron methyl 7 g/100 L + non-ionic surfactant - Care needs to be taken to prevent damage to native vegetation when spraying tall individuals
<i>Araujia sericifera</i>	Moth Vine	- Hand Weed Juveniles - Spray juveniles with glyphosate 10mL/1L - Skirt mature vines (cut through plant close to root) and then pull root manually or apply undiluted glyphosate to cut surface - Scrape and paint vine with undiluted glyphosate
<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush	- Hand Weed Juveniles - Spot Spray Glyphosate 15mL/1L - Cut and Paint Glyphosate 50mL/100mL

Species	Common Name	Treatment Methods
<i>Phoenix canariensis</i>	Canary Island Date Palm	- Large trees require an arborist to safely remove - PPE including thick leather gloves and eye protection should be used when handling small individuals due to dangerous spines at leaf bases - Cut all leaves off at base with long handles loppers - Remove leaves from site for safety of other site users (handle with caution due to spines) - Cut tree below crown and leave stump to rot - Use hand tools such as a trowel or knife to dig up seedlings

Species	Common Name	Treatment Methods
<i>Asparagus aethiopicus</i> and <i>Asparagus plumosus</i>	Sprenger's Asparagus and Climbing Asparagus	- Any branches profuse with fruit should be cut with secateurs and bagged to prevent further spread of species by birds - Juvenile plants can be eased out of soil with a trowel or knife - care should be taken to remove below ground plant material - For large, mature plants the woody crown at the base can be cut around with a sharp knife, or hacked out with a mattock or peter lever and removed - it is easiest to cut all branches off near the base with secateurs prior to removing crown - plant will not resprout from water storing tubers or roots below ground so these can be left to rot to reduce soil disturbance. - Spray mature and juvenile plants with metsulfuron methyl 6g/100mL + surfactant
<i>Ageratina adenophora</i>	Crofton Weed	- Hand Weed - Spot Spray with Glyphosate 5mL/1L - Slash large individuals with brushcutter and spray regrowth foliage with glyphosate 5mL/1L

Species	Common Name	Treatment Methods
<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Boneseed	- Small individuals are easily removed by hand due to shallow root system - Cut larger plants at base with loppers and apply undiluted glyphosate to cut stump - Spray seedlings with glyphosate 10mL/1L
<i>Delairea odorata</i>	Cape Ivy	- Hand weed taking care to bag and remove all stem pieces - Spray with glyphosate 10mL/1L (spraying of regrowth may be necessary in following site visits) - Cut stem aerial stems at 1m height and hand remove remaining rooted plant parts of treat cut surface with undiluted glyphosate

Species	Common Name	Treatment Methods
<i>Opuntia stricta</i>	Common Prickly Pear	- This weed is difficult to treat with chemicals, and chemicals such as arsenic that do kill the plant are highly toxic to other plants and animals so should not be used in bushland - Due to the introduction of the Cactoblastis moth in 1926, which preys on the species, mature individuals of the plant occur only sporadically and are easily manually removed - As the plant reproduces vegetatively the entirety of the plant must be bagged and removed from the site, including as much root material as possible. As the plant is soft the above ground areas of the plant are easily cut into pieces with a hand saw, and after removal of the upper areas of the plant the root material should be dug out with a hand mattock.
<i>Lonicera japonica</i>	Japanese Honeysuckle	- Cut and scrape vine stems with undiluted glyphosate - Hand weed seedlings - Spray low lying foliage, regrowth foliage, and seedlings with 20mL/1L Glyphosate & metsulfuron methyl(e.g. Brush-Off) 10.5g/10L + non-ionic surfactant - Roots of plant can be dug up with mattock or shovel

Species	Common Name	Treatment Methods
<i>Tradescantia fluminensis</i>	Wandering Jew	- Small infestations can be removed by hand weeding - Care needs to be taken not to leave behind any plant material which will resprout. - Large infestations can be controlled by spraying with glyphosate 10mL/1L, and the use of a surfactant will increase the efficacy of herbicide. Spraying needs to be repeated during every site visit. It can take several months before the mature plants appear to be affected but a sudden die off will occur after several months of treatment. Any regrowth material following die off of mature plants needs to be sprayed or removed by hand. - Large infestations can be raked up and bagged and removed from site. This is time consuming and labour intensive due to the large mass and weight of heavy infestations of healthy plants. - Large infestations can be covered with black plastic sheets for several months. The plants will die eventually due to lack of required sunlight. This method is not recommended for bushland regeneration as it also inhibits regrowth form seed of native plant species.

Species	Common Name	Treatment Methods
<i>Senna pendula</i> var. <i>glabrata</i>		- Hand weed juveniles - Spray juvenile individuals with glyphosate 10mL/1L - Cut and paint mature individuals with undiluted glyphosate
<i>Sida rhombifolia</i>	Paddy's Lucerne	- Hand weed - Spray with glyphosate 10mL/1L - Cut large, firmly rooted individuals at the base with secateurs and paint with undiluted glyphosate
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	- Spray juveniles with glyphosate 10mL/1L - Cut mature individuals with saw or loppers near ground level and paint stump with undiluted glyphosate or Triclopyr (600g/L formulation)/diesel at 4L/60L concentration (as per Garlon 600 label) - Use a power drill (9mm drill bit with dowelling tip) to drill holes less than 20 mm apart throughout lignotuber of mature trees and fill holes with glyphosate a 1:5 mixture with water. After all holes have been filled with herbicide mixture refill holes with herbicide mixture a second time (plant will have absorbed herbicide by this time). Check trees monthly for regrowth and repeat treatment if resprouting foliage is observed

Species	Common Name	Treatment Methods
<i>Passiflora subpeltata</i>	White Passion Flower	- Hand weed - Scrape stems with knife and paint exposed surface with undiluted glyphosate - Spray foliage with glyphosate 10mL/1L plus non-ionic surfactant
<i>Chloris gayana</i>	Rhodes Grass	- Hand weed juveniles - Remove carefully with secateurs and bag seed plumes of mature plants - Dig mature plants out of the ground with a mattock; or - Brushcut mature plants to near ground level and spray with glyphosate 10mL/1L - During subsequent site visits spray regrowth foliage with glyphosate 10mL/1L

Species	Common Name	Treatment Methods
<i>Acetosa sagittata</i>	Turkey Rhubarb	- Bag and remove seed present on mature plants - Cut vines close to the ground and dig out as much as of root system and tubers as possible - Juvenile plants growing from seed can be dug out or hand pulled - Tuber at base of plant needs to be removed - On individuals with deep and difficult to remove tubers, stems can be scraped on one side with a blade for a length of 45cm and scraped area painted with undiluted glyphosate - This treatment may need to be repeated on subsequent site visits - On plants with difficult and deep to remove tubers the tubers close to the surface can also be scraped and painted with undiluted glyphosate
<i>Rubus fruticosus</i> sp. agg.	Blackberry complex	- It is possible to spray with 10mL/1L glyphosate however it will leave dangerous thorned stems - Wearing thick clothing and leather glove uses loppers to cut close to base and apply undiluted glyphosate to cut stems (remove cut foliage and stems cautiously) - Spray regrowth foliage with glyphosate 10mL/1L

Species	Common Name	Treatment Methods
<i>Solanum mauritianum</i>	Wild Tobacco Bush	- When working with this plant additional PPE may be required as some individuals are sensitive to the shedding fine hairs of the species - Recommended PPE is a dust mask, long sleeve shirt and pants + gloves - Hand weed juveniles - Mature individuals can be cut and painted with glyphosate 10mL/1L
<i>Lantana camara</i>	Lantana	- Hand weed juveniles and regrowth from small pieces - Spot spray with glyphosate 10mL/1L - Slash using brushcutter, or hand cut with loppers, and spray regrowth foliage with glyphosate 10mL/1L - Cut near ground level and paint with undiluted glyphosate - Some individuals will have stumps which will still regrow foliage, spray regrowth foliage with glyphosate 10mL/1L

FIGURES



Legend

- VMP Area
- Study Area
- Land Subject to DA0563/2019
- Preliminary Biodiversity Stewardship Site Boundary

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)



cumberland
ecology

0 50 100 150 200 m

Figure 1. Location of the VMP Area and Study Area



Legend

- VMP Area
- Study Area
- Land Subject to DA0563/2019
- Preliminary Biodiversity Stewardship Site Boundary

Image Source:
NearMap
(dated 29-3-2019)

Coordinate System: MGA Zone 56 (GDA 94)

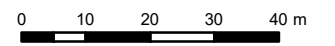


Figure 2. Extent of the VMP Area

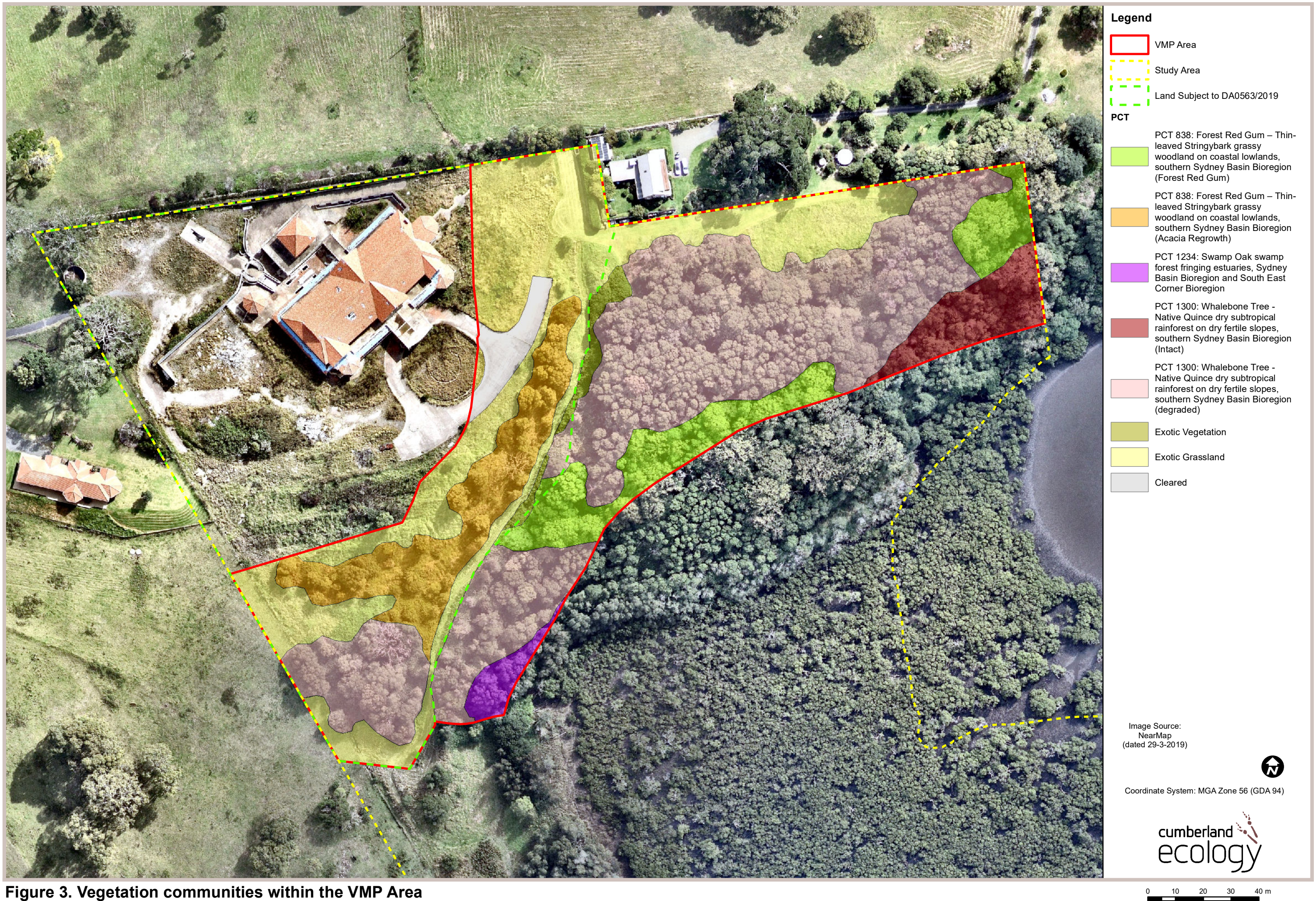
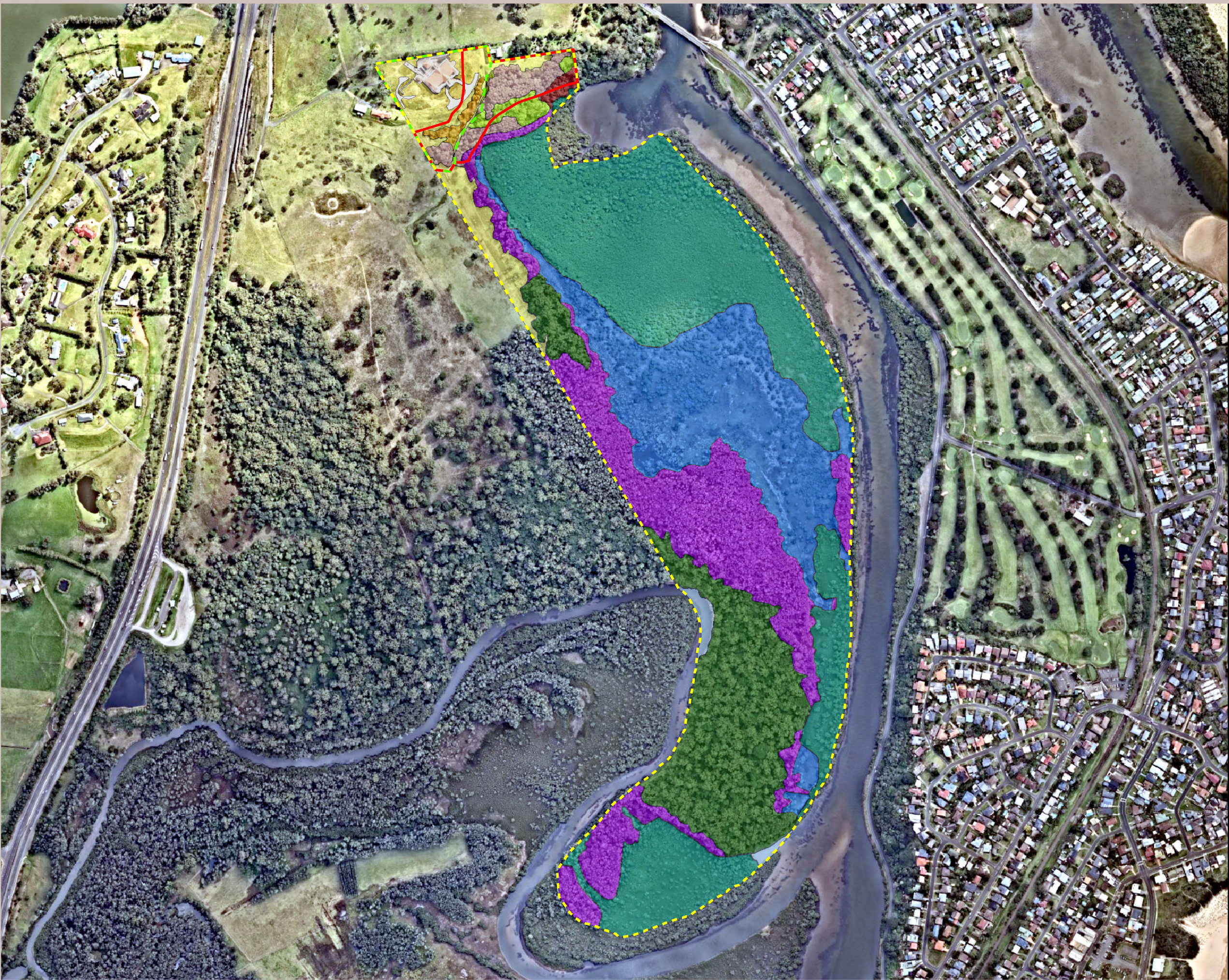


Figure 3. Vegetation communities within the VMP Area



Legend

- VMP Area
- Study Area
- Land Subject to DA0563/2019

PCT

- PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (Forest Red Gum)
- PCT 838: Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (Acacia Regrowth)
- PCT 910: Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion
- PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
- PCT 1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion
- PCT 1126: Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
- PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (Intact)
- PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (degraded)
- Exotic Vegetation
- Exotic Grassland
- Cleared
- Water

Image Source:
NearMap
(dated 29-3-2019)



Coordinate System: MGA Zone 56 (GDA 94)



0 50 100 150 200 m

Figure 4. Vegetation communities within the Study Area



Figure 5. Management zones



Figure 6. Monitoring plot locations