46-66 & 29 O'Connell St Caddens Vegetation Management Plan

Vantager Group

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DOCUMENT TRACKING

Project Name	46-66 & 29 O'Connell St Caddens Vegetation Management Plan
Project Number	14769
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Approved by	Robert Mezzatesta
Status	**Final**
Version Number	**V2**
Last saved on	**20 August 2020**

This report should be cited as 'Eco Logical Australia 2020. *46-66 & 29 O'Connell St Caddens Vegetation Management Plan*. Prepared for Vantager Group.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Vantager Group

Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	NSW *Biodiversity Conservation Act 2016*
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HBT	Hollow bearing tree
LGA	Local Government Area
LLS	Local Land Services
MZ	Management Zone
VMP	Vegetation Management Plan
WoNS	Weeds of National Significance

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Vantager Group for the residential subdivision and associated works at O'Connell Street, Caddens.

1.1 Background

The study area encompasses two adjoining lots, 46-66 O'Connell Street (Lot 3 / DP1103503) and 29 O'Connell Street (Lot 6 / DP593628) in the suburb of Caddens within the Penrith City Council Local Government Area (LGA) (Figure 1). An existing road easement at O'Connell Street (Lot 2 / DP 1217434) in the north has been purchased by Vantager Group for access into the site.

The study area will be subdivided to create 160 residential lots and 1 residual lot (501) and another residual lot for parkland and conservation. The proposed residential development will involve clearing of vegetation, earthworks, installation of two bioretention basins, building works, construction and dedication of roads, stormwater, civil works and landscaping.

1.2 Objectives of the VMP

The overall objectives of the VMP are to establish native species cover and density by revegetation works in areas of disturbed land and to assist in the natural regeneration of the VMP area. The VMP implementation period will run for five years or until the objectives and performance criteria outlined in this VMP are met. The objectives for the VMP are summarised in Table 1.

Table 1 VMP objectives

Objectives	Approach
Maintain and enhance habitat values	• Protect existing native vegetation • Establishment of clearly defined areas, such as the works area and any 'no-go' areas within/adjacent to work site boundaries that are not to be disturbed or damaged in any way by the works. • Control weeds and prevent new outbreaks • Assist in the natural regeneration of native species across the VMP area • Incorporate pest management actions.
Enhance native fauna habitat	• Where possible retain all hollow-bearing trees • If hollow-bearing trees cannot be retained, replace the hollows with installation of nest-boxes to mitigate loss of hollow-bearing trees at a 1:1 ratio • Increase native flora species diversity to provide native fauna habitat • Install woody debris for native fauna habitat

1.3 Preparation of this VMP

This VMP has been prepared by a suitably qualified restoration ecologist, Belinda Failes with assistance from Stacey Wilson, with over 4 years' experience in environmental consultancy and relevant Master of Environmental Science degree. Technical review has been carried out by restoration ecologist Andrew Whitford with over 10 years' experience in restoration ecology and environmental consultancy and a relevant Bachelor of Environmental Science degree.

1.4 Implementation works

A suitably qualified and experienced bush regeneration contractor is required to implement this VMP. They should be a member of the Australian Association of Bush Regenerators (AABR) or should possess the required qualifications and experience for membership. In addition to this, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009).

1.5 Key terms

For the purpose of this VMP, the following terminology has been adopted:

- Study area: The extent of 46-66 O'Connell Street, Caddens (Lot 3 / DP1103503), 29 O'Connell Street (Lot 6 / DP 593628) and O'Connell Street (Lot 2 DP 1217434), Caddens.
- Development footprint: The proportion of the site to be developed, specifically the proposed lots. This area is outside the scope of the VMP area.
- VMP area: The proportion of the site to be conserved and managed by this VMP. The VMP area is shown in Figure 1.

Figure 1: Location of the study area and VMP area

2. Description of the environment

2.1 Location

The proposed study area, defined as the area of land that is subject to the proposed development application, is approximately 12.2 ha and within the Penrith City Council Local Government Area (LGA). The study area consists of three adjoining parcels of land:

- 46-66 O'Connell Street, Caddens (Lot 3 / DP1103503)
- 29 O'Connell Street, Caddens (Lot 6 / DP593628)
- O'Connell Street, Caddens (Lot 2 / DP 1217434).

The study area is a rectangular size and orientated in an east-west direction and gently slopes south-east. It is bordered by O'Connell Street in the west, Nepean-Kingswood TAFE campus in the north, Western Sydney University (Werrington Campus) in the east and open areas and a large development site for a shopping centre complex in the south.

The VMP area is located in the southern portion of the study area. It includes a small patch of remnant vegetation mapped on the Biodiversity Values Map which will be retained as part of a residual lot (lot 335). Landscaping including the construction of two bioretention basins, parklands and walking tracks are proposed within the remnant vegetation and have been excluded from the VMP boundary. Informal walking tracks (made of gravel) will be constructed within the VMP area. Maintenance of the track has not been included in the management costs for the VMP.

2.2 Topography and hydrology

The topography within the VMP area slopes towards the south east. The 1:100,000 Soil Landscape of Penrith Series 9030 (Bannerman & Hazelton, 1990) indicates the underlying bedrock to be Wianamatta Group Ashfield Shale and Bringelly Shale formations consisting of shallow, clay and loam soils.

The study area intercepts a small portion of an unnamed tributary of Werrington Creek, mapped as a first order stream under the Strahler classification system (Figure 1). The stream has been substantially altered and its functionality diminished. The stream is located outside of the VMP area.

2.3 Vegetation communities

A detailed description of each validated vegetation community is provided below and a summary of the vegetation communities and their corresponding Plant Community Type (PCT) is provided in Table 2. A map of the validated vegetation within the VMP area is shown in Figure 2.

Table 2: Vegetation communities and their condition listing under the BC and EPBC Act criteria within the study area

Plant Community Type	Vegetation Community	Condition	BC Act	EPBC Act
PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland	Intact	CEEC	CEEC

The vegetation within the VMP area contains remnant vegetation of the community PCT 849, Cumberland Plain Woodland of the Sydney Basin Bioregion, comprising regenerating native vegetation and dense clusters of woody weeds.

The remnant canopy contains scattered mature *Eucalyptus tereticornis* (Forest Red Gum), *E. moluccana* (Grey Box) and immature individuals. The northern portion of the VMP area contains a dense midstorey of *Olea europaea* ssp. *cuspidata* (African olive), *Pyracantha crenulata* (Nepalese Firethorn) and *Ligustrum lucidum* (Large-leaved Privet). Native ground cover species were poorly represented under the dense midstorey of woody weeds.

In the southern portion of the VMP area, the woody weeds occur less frequently and native ground cover species are dominant. *Bursaria spinulosa* (Blackthorn) was present in the midstorey and diverse assemblage of native ground cover species including: *Aristida ramosa* (Purple Wiregrass)*, Microlaena stipoides* (Weeping Grass) and *Dichondra repens* (Kidney Weed).

The outer edge of the remnant vegetation contains open grasslands. These varied from dense exotic grasses *Eragrostis curvula* (African Lovegrass) and patches dominated by native grasses such as *Aristida ramosa*, *Cymbopogon refractus* (Barb-wired Grass) and *Themeda triandra* (Kangaroo Grass).

It was noted during field surveys that some excavation works had occurred on site and has resulted in removal to regenerating and mature native canopy species mapped as PCT 849. The area of disturbance occurs outside of the VMP area.

2.4 Flora species

The field survey identified 75 flora species, comprising 34 native species and 41 exotic species. A full list of flora species recorded within the study area is available in Appendix A.

2.5 Priority Weeds

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds. Under the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the *Greater Sydney Regional Strategic Weed Management Plan 2017-2022*. Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Of the weeds identified during the field survey, six have been listed as state level priority weeds and nine listed as other weeds of regional concern. The weeds present on site, their priority listing under the Biosecurity Act, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in Table 3.

A full list of weeds recorded during the field survey is provided in Appendix B.

Table 3: Priority weed species recorded in the study area

Scientific Name	Common Name	WoNS	Priority Weed Objective or Asset at Risk[1]
State Priority Weeds[2]			
Asparagus asparagoides	Bridal Creeper	Yes	Asset Protection
Asparagus aethiopicus	Ground Asparagus	Yes	Asset Protection
Lycium ferocissimum	African Boxthorn	Yes	Asset Protection
Opuntia sp.	Prickly Pear	Yes	Asset Protection
Rubus fruticosus agg.	Blackberry	Yes	Asset Protection
Senecio madagascariensis	Fireweed	Yes	Asset Protection
Other Weeds of Regional Concern[3]			
Andropogon virginicus	Whisky Grass	No	Environment
Araujia sericifera	Moth Vine	No	Environment
Cinnamomum camphora	Camphor Laurel	No	Environment, Agriculture, Human health
Eragrostis curvula	African Lovegrass	No	Environment
Hyparrhenia hirta	Coolatai Grass	No	Environment, Agriculture
Ligustrum lucidum	Large-leaved Privet	No	Environment, Human health
Ligustrum sinense	Narrow-leaved Privet	No	Environment, Human health
Olea europaea subsp. cuspidata	African Olive	No	Containment
Pyracantha sp.	Nepalese Firethorn	No	Environment

2.6 Fauna habitat

Fauna habitat throughout the study area is generally poor as the understorey has been predominantly cleared and infested with exotic grasses and woody weeds. The remnant vegetation retained in the VMP area provides suitable foraging habitat and sheltering habitat. Four hollow-bearing trees (HBTs) and three stags were identified within the VMP area. The hollows vary in sizes and would accommodate a range of fauna from microbat species to medium size animals such as possum or bird species.

A medium stick nest was recorded on the outer limbs of *Eucalyptus tereticornis* within the VMP area. Two Australian Ravens were observed in the tree near the nest. No ravens were observed contributing to the nest during field surveys in July 2020. It is recommended that these HBTs are to be retained. The

[1] Refer to *Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022* for specific species legal requirements

[2] Mandatory measure (Whole of NSW)

[3] Regional Strategic Response

location of the HBTs and stags is provided in Figure 3. The eastern most HBT will be retained as part of the proposed works.

Targeted surveys were conducted within the VMP area to identify potential habitat for Cumberland Plain Land Snails (*Meridolum corneovirens*). The targeted surveys did not record the presence of any live or deceased individuals (i.e. snail shells). The surveys identified that the VMP area does not provide suitable habitat for this species. The study area contains a high density of African Olive which does not provide suitable habitat for the Cumberland Plain Land Snail. Leaf litter and fallen logs was limited within this area. Additionally, the vegetation has been isolated from other patches of intact native vegetation.

Figure 2: ELA validated vegetation communities, 2020

3. Construction and preliminary works

The civil construction company shall be responsible for the following works.

3.1 Temporary fencing

The edge of the VMP area where it borders the development footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator.

3.2 Soil and water management

An Erosion and Sediment Control Plan, preferably as part of a Construction Environmental Management Plan, must be developed and implemented prior to any on-ground works. These should be in accordance with best management practices as described in Landcom's Blue Book (2004). Prior to construction commencing, sediment fencing will be required around the construction area to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period. Sediment fencing should be monitored during the entirety of the construction period by the Project Ecologist or Bush regenerator contractor.

3.3 Soil preparation

Where topsoil has been modified from its original condition, the soil will need to be prepared prior to revegetation. Works are to be carried out after completion of the subdivision works. The following works will be undertaken:

- Allow weed seed to germinate and spray with herbicide
- Place a minimum of 200 mm of topsoil (from stockpile or imported)
- Improve as required to achieve a locally appropriate soil (e.g. gypsum, trace minerals, etc.)
- Rip and cultivate to ensure a soft, friable soil
- Mulching to a depth of 100mm or jute matting with a heavy weight jute matt (<850g/m2) on slopes, where water flow is expected or in areas of erosion

Soil preparation other than installation of jute matting / mulch is to be undertaken by the civil contractor in consultation with a suitably qualified ecologist or bush regenerator. The installation of jute matting / mulch will be carried out during vegetation works by the vegetation management contractor.

3.4 Management of weeds within the study area

Prior to the clearing of works within the study area it is highly recommended that weeds are removed from within the study area. Weed propagules should be bagged and taken to a green waste recycling facility for correct disposal. Woody weeds may be removed using machinery provided that the propagules are removed.

Ongoing weed maintenance may be required in the remainder of the study area during construction phase to ensure weeds do not spread to adjacent lands. Weeds should be treated in accordance with best management practices provided in Appendix B.

4. Vegetation management works

4.1 Management zones

The total VMP area is approximately 0.36 ha and encompasses the south of the development area. There are three VMP management zones:

- Zone 1: Exotic Grasses – Weed control and revegetation
- Zone 2: Woody weeds – Weed control and revegetation
- Zone 3: Intact Cumberland Plain Woodland – Weed control and regeneration.

Further descriptions are provided below:

4.1.1 Management Zone 1: Exotic Grasses – Weed control and revegetation

Zone 1, an area of approximately 0.02 ha, includes the interface between the adjacent exotic grassland and remnant native vegetation. This zone includes a native canopy of *Eucalyptus tereticornis* and a dense exotic grass layer of *Eragrostis curvula* (African Lovegrass) (Photo 1). This zone may also be impacted during the construction works in the adjacent land. Management of sediment and erosion control will be conducted as part of the construction works to mitigate impacts into this zone.

First year works will involve the slashing and spraying of pasture grasses and herbaceous weeds throughout Zone 1 using a non-selective herbicide. Care must be taken to prevent off-target spraying of native groundcovers. These works are to be completed prior to second year revegetation works to reduce competition on native saplings.

Zone 1 will be revegetated with Cumberland Plain Woodland using tubestock, with groundcovers and sedges / grasses and shrubs as per the densities shown in Table 3. Mulch requirements are identified in Table 4 and planting densities for the management zones are listed in Table 5 below. Specifications for revegetation activities, including seed collection is provided in Appendix B. A recommended planting list of Cumberland Plain Woodland species is provided in Appendix C.

Photo 1: Management zone 1: showing dense sward of *Eragrostis curvula* on edge of Cumberland Plain Woodland

4.1.2 Management Zone 2: Woody weeds – Weed control and revegetation

Zone 2, an area of approximately 0.19 ha, encompasses Cumberland Plain Woodland in poor condition. This zone has a native canopy and exotic understorey dominated by dense stands of *Olea europaea* subsp. *cuspidata* (African Olive). Ground cover species are limited in this management zone (Photo 2).

First year works will require the removal of large stands of African Olive and any woody weeds present throughout Zone 2. Mechanical removal will be used to control dense stands of woody weeds. Mulch produced by mechanical removal can be left in situ and germinating seed spot sprayed accordingly. Native canopy must be isolated from dense stands of woody weeds prior to mechanical removal to prevent damage during works. This will require the use of cut and paint methods to remove woody weeds immediately surrounding native canopy to create a protection buffer. Smaller isolated patches of woody weeds can be treated using cut and paint methods. Large African Olives will be treated and removed off site. Specifications for weed control methods are provided in Appendix B.

Second year works will involve revegetation of treated areas in Zone 2 using Cumberland Plain Woodland tubestock, with groundcovers and sedges / grasses and shrubs as per the densities shown in Table 5. It is also assumed that 100% of the zone will require mulch to a depth of 100 mm, which is expected to be supplied by the chipping the woody weeds in-situ and the clearance of vegetation from the development footprint. Plantings will need to be Cumberland Plain Woodland species of local provenance as per the list (Appendix C).

Photo 2: Management zone 2 dense woody weeds with limited native groundcover species

4.1.3 Management Zone 3: Intact Cumberland Plain Woodland – Weed control and assisted regeneration

Zone 3, an area of approximately 0.14 ha, encompasses the intact Cumberland Plain Woodland in the south of the VMP area. This zone contains mature and immature *Eucalyptus tereticornis* (Forest Red

Gum) in the canopy, occasional *Bursaria spinosa* (Blackthorn) in the midstorey and native groundcovers; including *Microlaena stipoides* (Weeping Grass), *Einadia nutans* and *Dichondra repens* (Kidney Weed) (Photo 3). Scattered clumps of woody weeds are present within the zone and include African Olive and *Lycium ferocissimum* (African Boxthorn), however, native groundcover species persist under the woody weeds.

First year works will require the removal of woody weeds present throughout Zone 3. Woody weeds are present in smaller densities than zone 2 and generally contain native groundcover species below. Smaller isolated patches of woody weeds can be treated using cut and paint methods. Large, individual African Olives will be treated and removed off site. Cut woody weeds may be used as stick-piles in management zone 2 and 3 to provide refuge habitat for fauna species. Specifications for weed control methods are provided in Appendix B.

Following primary weed control, approximately 25% of this zone is expected to require revegetation to reinstate native shrubs and increase species diversity in the ground layer. Plantings will need to be Cumberland Plain Woodland species of local provenance as per the list (Appendix C).

Photo 3: Management zone 3 showing native species diversity in ground layer and scattered clumps of woody weeds

4.2 Weed control

4.2.1 Primary and secondary weed control

All weeds, including woody weeds in the understorey will require treatment. Secondary and maintenance weed control will be required following revegetation. During these weed control activities care must be taken to avoid impacts to natural regeneration of native species.

Primary and secondary weed control will include woody weed and exotic grass control, specifically the control of *Ligustrum* sp. (Privet), *Lycium ferocissimum* (African Boxthorn), *Pyracantha crenulata* (Nepalese Firethorn) and *Eragrostis curvula* (African Lovegrass). Mechanical control techniques will be required during primary weed control. Juvenile woody weed can be hand-pulled, provided the whole root is removed. Large *Ligustrum* sp. plants can be treated during secondary treatment, using cut and paint method.

Follow up treatments of woody weeds including *Ligustrum* sp. seedling growth will be required. For more information on specific weed control techniques, see Appendix B.

Secondary weed control should target Asparagus species and other less prevalent woody weeds found within the VMP Area.

4.2.2 Maintenance

Following secondary weed removal and revegetation, all areas will require ongoing maintenance to control weed regrowth from the soil seed bank. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in Appendix B.

Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance programs will also comment on other site issues such as rabbit activity. Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting.

4.2.3 Revegetation

Revegetation works are required within all management zones (Table 4). Management zone 3 currently contains a high density of native species within the ground cover and scattered native shrubs. It is assumed that natural regeneration will occur and as such only 25% of the area will require revegetation.

Revegetation works will include planting of native groundcover species, grasses and shrubs using tube stock and Hiko / Viro cells. Planting of canopy species has not been included as canopy cover is currently sufficient in the VMP area.

Mulch, where needed, is to be applied providing a depth of 100mm. Mulch can be sourced from native vegetation earmarked for removed from the development area or externally sourced. Jute matting is to be used instead of mulch in areas of high erosional potential.

Planting densities for the management zones are provided Table 5. A recommended planting list is provided in Appendix C.

Table 4: Planting assumptions and mulch requirements

Management Zone	Area (m^2)	Revegetation Area (%)	Revegetation Area (m^2)	Mulch (%)	Mulch (m^2)
MZ1	0.02	100	200	100	200
MZ2	0.19	100	2,000	100	2,000
MZ3	0.14	25	350	0	0

Table 5: Revegetation densities

Management Zone	Revegetation Area (m^2)	Planting densities (per (m^2))				Total plant requirements
		Trees	Shrubs	Herbs/Scramblers	Sedges/Grasses	
MZ1	200	0	1/50	1.00	3.00	*804*
MZ2	1,900	0	1/20	1.00	3.00	*8,100*
MZ3	350	0	1/50	1.00	1.00	*707*
TOTAL		**0**	**111**	**2,550**	**6,950**	**9,611**

4.3 Seed collection

Where planting is required, seed must be collected from local provenance species. Seeds from native grasses and shrubs should be collected from within the site prior to any clearing works for construction.

Seeds from groundcovers, shrubs and trees should be collected from within 5 kilometres of the site. If seed is not available within 5 kilometres, this radius can be extended to a maximum of 10 km.

Native grasses typically have much larger dispersal mechanisms and are to be collected from within a 10 km radius of the site.

Where the species identified in this VMP cannot be sourced, they may be substituted for other Cumberland Plains Woodland species as identified by Tozer (2003). Trees must be substituted with trees, shrubs with shrubs etc.

Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances. Record keeping of seed collection and planting locations is to follow the Flora Bank guidelines (Mortlock, 2000). This is important for this site as future revegetation works across surrounding areas are likely to draw on seed sources created through these revegetation works. The bush regeneration contractor is responsible for recording this information and providing it to Council.

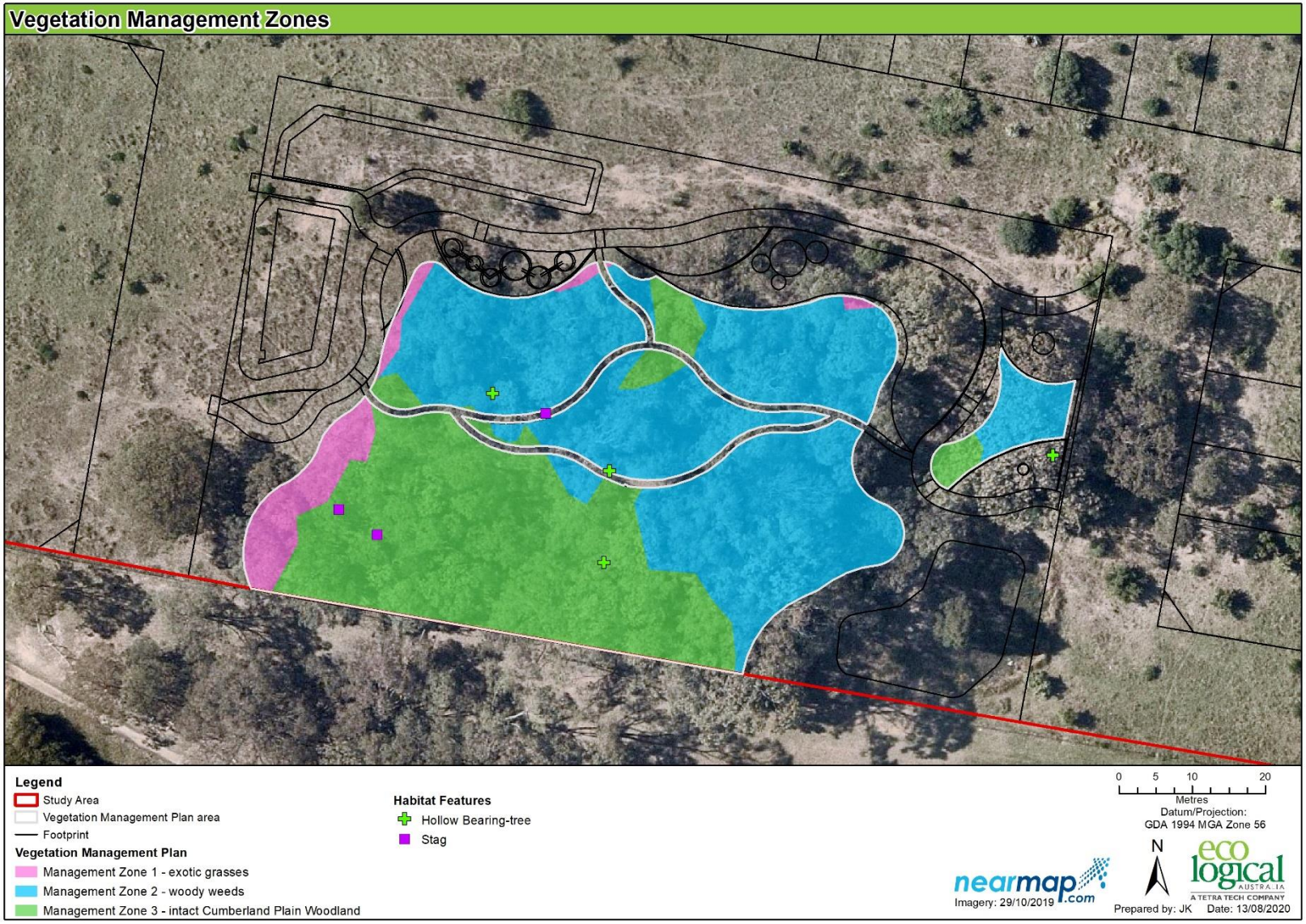

Figure 3: Vegetation management zones

4.4 Pest control

Pest control is the responsibility of the land holders, which is to be undertaken by relevant contractors.

The field surveys have identified the presence of the following introduced species within the study area:

- Introduced mammals:
  - *Oryctolagus cuniculus* (European rabbits)
  - *Lepus europaeus* (European hare)
  - *Vulpes vulpes* (Red Fox)
- Introduced birds
  - *Sturnus vulgaris* (Common Starling)
  - *Acridotheres tristis* (Common Myna)
  - *Turdus merula* (Common Blackbird)

4.4.1 Integrated rabbit and hare management

The European rabbit is declared a noxious animal in NSW. Landholders are obliged to control rabbit populations on their land. The European hare, unlike rabbits are not listed as noxious animal in NSW, however, they are responsible for the loss of biodiversity including grazing of regenerating plants and spread of disease.

The aim of control within this VMP is to reduce the impact of exotic herbivores on the natural environment (DPI). Rabbits and hare were recorded within the study area. These species have potential to impede the success of the VMP.

A variety of control techniques and methods should be used to control for rabbits and could include:

- Destruction of rabbit warrens: If warrens are found they will be mechanically ripped
- Construction fencing, and sediment fencing, be installed in such a way that can also exclude rabbits (see Appendix B).
- Poisoned baits, when required and should only be undertaken by appropriately trained personnel.
- Release of biological control agents such as Rabbit haemorrhagic disease (RHD), also known as rabbit calicivirus disease (RCD) for large populations
- The coordination and implementation of rabbit control across multiple properties will help achieve a better outcome for reducing rabbit activity within the VMP area.

4.4.1.1 Stage 1 – Initial reduction

Where rabbit density is medium to high, the objective is to reduce the population to a manageable level - usually by a poisoning program, but only during the non-breeding season. If control must be carried out during the breeding season, use warren ripping or fumigation. Breeding may occur during most times of the year, but usually follows milder seasons when conditions are conducive to pasture growth.

Initial reduction may also be achieved by the arrival (natural or introduced) of rabbit haemorrhagic disease virus (RHDV) or myxomatosis.

4.4.1.2 Stage 2 – Follow up control

If rabbit density is low the objective is to reduce the population further so that it cannot recover quickly. Follow up control is usually achieved by fumigation, harbour destruction or targeted shooting.

When this stage is fully implemented and maintained, rabbit impact should not return to its former level.

4.4.1.3 Stage 3 – Advanced control

Once rabbit densities are very low then management will likely focus on harbour destruction and targeted shooting. Regular use of advanced control and monitoring, as part of overall property management, should avoid the need to repeat stages 1 and 2.

4.4.2 European Red Fox Monitoring

Scats from the European Red Fox was observed within the study area. This species is likely to prey on introduced small mammals and other native fauna species. If the population of rabbits and hares decline, the number of foxes within the study area are also expected to decline. Monitoring of fox numbers can be conducted during monitoring of rabbit and hare.

4.4.3 Integrated bird management

Common Myna's are listed as one of the world's most invasive species. This species is known to defend a territory and will prevent native species from utilising tree hollows, nest boxes or foraging resources within their territory.

The Common Starling are also a hollow-nesting species and highly aggressive towards native birds, reptiles and mammals which utilise tree hollows. They prefer to roost in exotic vegetation such as African Olive and Firethorn (DPI 2020).

The Common Blackbird builds a nest out of grasses bound with mud. It will occasionally use a tree hollow for nesting.

Prior to installation of any nest boxes, exclusion of Common Starlings and Common Myna's from the study area is required. This is likely to be achieved through habitat modification such as the removal of woody weeds.

4.5 Fauna and habitat enhancement

The protection of native biodiversity is important in the long-term health and rehabilitation of native ecological communities. Bringing the bush back manual by Department of Infrastructure, Planning and Natural Resources (2003) provides practical management techniques to minimise the impacts to native fauna during bush regeneration works. Recommendations relevant to this VMP include:

- Work in areas where native resilience is higher before targeting degraded patches.
- Large woody weeds which provide habitat for fauna should be treated and left in situ to provide habitat.

Additionally, mulch should be free of weed propagules. Large woody material (<10cm diameter) removed from within the study area / impact area can be used as habitat structures within the VMP area. Woody material provides microhabitat for fauna species, soil stability and nutrients cycling.

There is potential that one hollow-bearing tree may be impacted by the proposed development (located in the south-east see Figure 3). If hollow-bearing trees are removed from the development footprint, any hollows identified should be cut out and used as habitat in the VMP area. In addition, best practices for habitat management recommends that nest boxes are installed in the VMP area prior to vegetation clearing to provide supplementary habitat for displaced fauna. Nest boxes are to be installed at the following ratio:

- Microbats – one nest box for every small hollow (<5 cm) removed.
- Birds (parrot species) – 1 nest box for every 5 – 15 cm hollow removed suitable for this species.
- Possum / gliders – 1 nest box for every 5 – 15 cm hollow removed suitable for this species.

The placement of all fauna habitat augmentation and nest box installation, if required, is to be carried out under the supervision of a qualified ecologist.

Photo 4: tree hollow recorded in the VMP area showing evidence of recent use

5. Implementation schedule

5.1 Implementation schedule

The VMP will have an implementation period of five (5) years or until the required objectives for the VMP area as identified in Table 7 are met, whichever is longer.

An indicative implementation schedule has been provided in Table 6.

Responsibilities have been identified as below:

Key	Civil Construction activities (Civil contractor)	
	Vegetation Management Works (Bush regenerator contractor)	

5.2 Adaptive management

As this is a long-term project that will be implemented over a number of years, an adaptive management approach will be implemented that enables the successful contractor to learn from and respond to successful and unsuccessful techniques used on the site. In its simplest form this may include the substitution of species identified in the planting table or for undertaking advanced direct seeding techniques in place of manual planting techniques for revegetation.

The success of the works will be determined by meeting the performance criteria identified in Table 7. Contractors have the flexibility to implement different techniques to those specified here providing that performance criteria are met. Any major departures from the VMP or proposed changes to performance criteria must be approved in writing by Penrith City Council.

5.3 Review of the Vegetation Management Plan

At the conclusion of the five years, the VMP will need to be revised to guide the on-going management of the VMP site.

Table 6: Implementation schedule

Treatment	Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Civil works																				
Install construction fencing and 'no go area' signage																				
Install sediment fencing																				
Management of Kangaroos																				
Revegetation																				
Seed collection, cleaning, storage																				
Site Preparation																				
Install jute matting / mulch																				
Tubestock, supply and install																				
Irrigation																				
Replacement tubestock, supply and install																				
Weed control																				
Primary																				
Secondary																				
Maintenance																				
Other works																				
Monitoring and reporting																				

6. Monitoring and reporting

The bush regeneration contractor and the land manager(s) will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformance and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e. learning from past experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

6.1 Monitoring

Monitoring will be undertaken by vegetation surveys and photo monitoring. Monitoring will need to be implemented prior to works commencing to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:

- set up a minimum of three photo monitoring points within the VMP area
- place two six-foot star pickets 10 m apart
- record the location (eastings and northings) of the first star picket with a GPS as well as the bearing to the second star picket
- take a digital photo from the first star picket looking towards the second star picket, the entire length of the star picket visible in the photo to act as a reference point
- label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken (e.g. 01_180330 for a photo taken at the first photo monitoring point on the 30th March 2020).

Monitoring results will be included in progress reports as per Section 6.2.

6.2 Progress reports

Progress reports are to be provided on an annual basis until the completion of the project. This reporting includes the implementation of the monitoring actions specified in Section 6.1 and a description of the works that have been undertaken. These reports will be submitted to Penrith City Council. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock
- a summary of works carried out within the period including

  - date and time of site visits
  - works completed on the site at each visit
  - a table detailing total man hours for each task carried out on site
  - methods of weeding undertaken and details of herbicide use
  - numbers of tubestock planted if applicable
  - methods implemented for Assisted Natural Regeneration
- photo and quadrat monitoring results to date
- a description of any problems encountered in implementing the works recommended in the VMP and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- any observations of sedimentation or erosion beyond the boundary of the development and observations of exotic lawn encroachment into VMP area boundary.
- if applicable, the results of the implementation works in relation to the relevant performance criteria.

6.3 Performance criteria

The performance criteria are detailed in Table 7.

Failure to meet these performance criteria will mean that the maintenance period will be extended until they are achieved. Therefore, maintenance must continue until Penrith City Council agrees that the objectives and performance criteria have been met and the maintenance period has concluded. The author of this VMP or equally qualified and experienced person must prepare a statement certifying the compliance of the performance criteria at the end of 5-year period.

If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. The civil contractor and the bush regeneration contractor, in consultation with Penrith City Council, can adapt these criteria as required in response to the success of rehabilitation works.

Table 7: Performance criteria

Management Zones	Establishment		Maintenance	
	Year 1	Year 2	Year 3 – 4	Year 5
All Zones	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation **Civil construction works:** • All construction and sediment fencing / no go area signage installed • All earthworks completed under the supervision of an ecologist or bush regenerator • Pest control management plan in consultation with LLS, with rabbit fencing installed (if required) • All rubbish and debris removed **Vegetation management works:** • Revegetation is to be undertaken with a minimum of 60% of the benchmark levels for species diversity as provided in Table 8 • A minimum of 85% survival rate of all vegetation strata planted in each zone (e.g. tree, shrub and groundcover) • No area greater than 2m x 2m without native cover • Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree, etc.) and must not decrease species diversity. Any new species must be from the community being emulated and of local provenance • Treatment of any new weed breakouts • Monitoring and reporting undertaken in accordance with Section 6 • No encroachment of exotic lawn into VMP area (it is assumed that grass-proof edging will be used wherever landscaping or lawn is adjacent to the VMP area • No erosion or sedimentation within the VMP area			
MZ1 – MZ3	• Treat 100% of priority weeds • Treat 95% of the weeds • Treatment of new weed breakouts	• No greater than 10% cover by both priority weeds • No greater than 25% cover by other weeds • Suppression of all weeds during revegetation • Shrub and groundcover cover no less than 40% of their respective benchmark levels provided in in Table 9. • 85% survival rate of plantings, replacement plantings where required.	• No greater than 5% cover by priority weeds • No greater than 10% cover by other weeds • Shrub and groundcover cover no less than 60% of benchmark levels provided in Table 8.	• No greater than 2% cover by priority weeds • No greater than 4% cover by other weeds Shrub and groundcover cover no less than 75% of benchmark levels provided in Table 8.

Table 8: Benchmark conditions for vegetation communities within the VMP area

PCT ID and Scientific name	Vegetation Community	Species richness			Cover (%)		
		Canopy	Shrub	Groundcover	Canopy	Shrub	Groundcover
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland	5	8	26	53	16	67

* Based on monthly average following average rainfall year. Note: groundcovers include grasses and forbs but does not include ferns or other vegetation types within the groundstorey strata.

7. Cost

The cost of implementation for five-year period is approximately **$90,096** exclusive of GST and CPI. An indicative annual costing timeline is provided in Table 9.

Rates and costs are based on typical commercial rates. Assumptions that have been made with regard to estimating costs have been outlined below.

7.1 Construction and preparation works

Civil construction activities are identified in Table 6 these have not been included in Table 9.

7.2 Vegetation management works

7.2.1 Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost $2,000 for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.2 Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $5.50 per tree and shrub including tree guards, planting, water crystals, fertiliser and initial watering, and an estimated $2.50 per grass, sedge and groundcover including planting, water crystals and initial watering.

A total of approximately 10,000 plants will be required to achieve the densities identified in the VMP, including a 20% replacement rate.

It has been assumed that mulch will be generated from site works, with costs provided for mulch spreading and installation only. Note that if this is not the case, then much will need to be brought in, thus increasing the expected cost.

7.2.3 Seed collection

A nominal budget for the collection of seed has been included as a separate task. However, this does not take into account the timing or works or the seasonal nature of seed collection. If further seed collection works are required, this may be an additional cost.

7.2.4 Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and vegetation surveys, and conducting the baseline surveys
- preparing a yearly report, including photo points and vegetation surveys until the completion of the project

7.2.5 Pest control works

The cost for implementation of pest control works over the length of the maintenance period is difficult to predict until the preliminary monitoring works have been undertaken. The costs for undertaking the pest species monitoring and the subsequent control works have not been included in this costing.

Table 9: Indicative costs per year

Treatment	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Revegetation						
Seed collection, cleaning, storage	$1,381	$0	$0	$0		$1,381
Site Preparation	$2,450	$0	$0	$0	$0	$2,450
Jute Matting / Mulch	$7,350	$0	$0	$0	$0	$7,350
Tubestock, supply and install	$23,333	$0	$0	$0	$0	$23,333
Replacement tubestock, supply and install	$0	$2,333	$2,333	$0	$0	$4,667
Irrigation	$3,308	$368	$0	$0	$0	$3,675
Weed control						
Preliminary - Years 1-2	$8,350	$8,350	$0	$0	$0	$16,700
Establishment - Years 3-5	$0	$0	$5,567	$5,567	$5,567	$16,700
Associated costs						
Disbursements	$835	$835	$557	$577	$577	$3,340
Monitoring & Reporting	$2,100	$2,100	$2,100	$2,100	$2,100	$10,500
Totals	**$49,106**	**$13,986**	**$10,557**	**$8,223**	**$8,223**	**$90,096**

References

Bannerman SM and Hazelton PA, 1990, Soil Landscapes of the Penrith 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.

Brodie L 1999. *The National Trust Bush Regenerators Handbook*. National Trust of Australia (NSW).

Buchanan R.A. 2000. *Bush regeneration: recovering Australian landscapes.* 2nd Edition. TAFE NSW, Sydney.

Department of Primary Industries (DPI) 2014. *Noxious and environmental weed control handbook – A guide to weed control in non-crop, aquatic and bushland situations*. 6th Edition. Department of Trade and Investment, Regional Infrastructure and Services. Available at: http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/weeds/publications/noxious-enviro-weed-control

Department of Primary Industries (DPI) https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/pest-animals-in-nsw/rabbits/rabbit-control

Department of Primary Industries (DPI) 2020. Starlings. https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/pest-animals-in-nsw/pest-birds/starlings

Landcom 2004 The Blue Book, Managing Urban Stormwater: Soils and Construction – Volume 1

Mortlock, W. 2000. The Hawkesbury-Nepean Catchment Management Authority (2000) Florabank Guideline 10: Seed collection ranges for revegetation. Online resource: http://www.florabank.org.au/files/documents/Guideline%20No.%2010%20-%20Seed%20collection%20ranges%20for%20revegetation.pdf Accessed July 2020

Office of Environment and Heritage (OEH) 2013. The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 2.0. NSW Office of Environment and Heritage, Sydney.

Tozer, M. 2003. *Native Vegetation of the Cumberland Plain, Western Sydney*. NSW NPWS, Hurstville.

Appendix A : Species recorded within the study area

Family	Species Name	Common Name	Exotic (*)
Apocynaceae	*Araujia sericifera*	Moth Vine	*
Apocynaceae	*Nerium oleander*	Oleander	*
Asparagaceae	*Asparagus aethiopicus*	Ground Asparagus	*
Asparagaceae	Asparagus asparagoides	Bridal Creeper	*
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*
Asteraceae	*Cirsium vulgare*	Spear Thistle	*
Asteraceae	*Cymbonotus lawsonianus*	Bear's Ears	
Asteraceae	*Euchiton sphaericus*		
Asteraceae	*Lactuca seriola*		
Asteraceae	*Senecio madagascariensis*	Fireweed	*
Asteraceae	*Sigesbeckia orientalis*	Indian Weed	
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	*
Asteraceae	*Taraxacum officinale*	Dandelion	*
Cactaceae	*Opuntia stricta*	Prickly Pear	*
Campanulaceae	*Wahlenbergia gracilis*		
Campanulaceae	*Wahlenbergia stricta*	Australian Bluebell	
Caryophyllaceae	*Petrorhagia dubia*	-	*
Casuarinaceae	*Casuarina cunninghamiana*	River Oak	
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	
Commelinaceae	*Commelina cyanea*	Scurvy Weed	
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Cyperaceae	*Carex inversa*		
Cyperaceae	*Cyperus brevifolius*	Mullumbimby Couch	*
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge	*
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	
Fabaceae (Faboideae)	*Glycine clandestina*	Love Creeper	
Fabaceae (Faboideae)	*Glycine tabacina*		
Fabaceae (Faboideae)	*Lotus uliinosus*		*
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	*
Fabaceae (Faboideae)	*Vicia sativa*	Vetch	*
Gentianaceae	*Centaurium spp.*		

Family	Species Name	Common Name	Exotic (*)
Geraniaceae	*Geranium solanderi*	Native Geranium	
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*
Linaceae	*Linum trigynum*		*
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	*
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	
Myrtaceae	*Eucalyptus moluccana*	Grey Box	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	
Oleaceae	*Ligustrum lucidum*	Broad-leaved Privet	*
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	*
Oleaceae	*Olea europaea* subsp. *cuspidata*	African Olive	*
Passifloraceae	*Passiflora* sp.		*
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Blackthorn	
Plantaginaceae	*Plantago lanceolata*	Plantain	*
Poaceae	*Andropogon virginicus*	Whisky Grass	*
Poaceae	*Aristida ramosa*	Purple Wiregrass	
Poaceae	*Briza subaristata*		*
Poaceae	*Chloris ventricosa*	Plump Windmill Grass	
Poaceae	*Cymbopogon refractus*	Barbed-wire Grass	
Poaceae	*Cynodon dactylon*	Common Couch	
Poaceae	*Ehrharta erecta*	Vasey Grass	*
Poaceae	*Eragrostis curvula*	African Lovegrass	*
Poaceae	*Hyparrhenia hirta*	Coolatai Grass	*
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass	
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass	
Poaceae	*Oplismenus aemulus*	Australian Basket Grass	
Poaceae	*Panicum simile*	Two-colour Panic	
Poaceae	*Paspalum dilatatum*		*
Poaceae	*Sporobolus creber*	Western Rat-tail Grass	
Poaceae	*Themeda triandra*	Kangaroo Grass	
Primulaceae	*Anagallis arvensis*	Scarlet Pimpernel	*
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	
Rosaceae	*Pyracantha crenulata*	Nepalese Firethorn	*
Rosaceae	*Rubus fruiticosus* sp. agg.	Blackberry	*
Rubiaceae	*Asperula conferta*	Common Woodruff	
Solanaceae	*Lycium ferocissimum*	African Boxthorn	*
Solanaceae	*Solanum linnaeanum*	Apple of Sodom	*

Family	Species Name	Common Name	Exotic (*)
Solanaceae	*Solanum pseudocapsicum*	Jerusalem Cherry	*
Solanaceae	*Solanum sisymbriifolium*		*
Ulmaceae	*Ulmus parvifolia*	Chinese Elm	*
Verbenaceae	*Verbena bonariensis*	Purple Tops	*
Verbenaceae	*Verbena rigida*		*

Appendix B : Techniques and specifications

Weed control

Weed control involves a combination of mechanical, physical and chemical techniques to remove the weeds and prevent regrowth. Weed control will be undertaken across the entire zone. A selection of the best suited weed control method within the site depends on a number of factors including:

- the species or combination of weeds being targeted
- the density of the weeds
- resources available (time, labour, equipment and finances)
- weather conditions of the day

Weed control techniques

Detail of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying, and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

Annual grasses

Annual grasses should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Perennial grasses

Perennial grasses, such as *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum), *and Pennisetum clandestinum* (Kikuyu Grass) will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted removal to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Woody weeds

Follow up treatment of woody weeds, including *Lantana camara* (Lantana) will be controlled by the cut and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed and will be determined by the bush regeneration contractor. Primary weed control should use techniques that will not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

Creepers and climbers

The control of vines, creepers and climbers, varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

Herbaceous weeds

Where individual plants of herbaceous weeds, such as *Senecio madagascariensis* (Fireweed), *Solanum* sp. and *Bidens pilosa* (Cobbler's Peg) are found, they will be hand pulled prior to flowering. Where large swaths of these species occur, they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. *Cirsium vulgare* (Spear Thistle) will not be hand-pulled due to its thorns and instead will be treated using cut and paint methods or spot sprayed for larger infestations using a non-selective herbicide. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from site.

Management of weed waste

All weed propagules, especially priority weeds, will be bagged and disposed of as directed by legislation at facility licensed to receive green waste. All weed waste without propagules will be composted onsite

Reporting notifiable weeds

A notifiable weed is a weed which lists a notification requirement in the guidelines for its management under Schedules 1, 2 and 3. You can report weeds of concern or priority weeds to open.space@campbelltown.nsw.gov.au or directly to Council's Open Space Team on 02 4645 4601.

For any enquiries please supply the following:

- Close up photo of the leaves/ fruit
- A picture of the whole plant
- A location of the weed

These details will assist Council officers to quickly respond to enquiries.

Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999.* Herbicide use should assess potential long-term impacts of the technique, including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method for the control and eventual eradications of some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. A glyphosate-based herbicide, formulated for use near waterways, will be used if works require herbicide application near waterways, a (e.g. Roundup Biactive®).

Broad-leaf selective herbicide may be used as per the NSW Weed Control Handbook (DPI 2018). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways.

Registration and records must be kept in accordance with the NSW *Pesticides Regulation 2017*.

Revegetation works

Revegetation has the dual aim of both re-establishing the original native vegetation community at the site and reducing erosion.

Revegetation works within the Managed Ecological Zone must be undertaken in accordance with NSW Rural Fire Service's *Planning for Bushfire Protection* (2006). Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance works. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been

completed. A maximum rate of attrition of 10% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds, nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm.

Jute matting is to be installed in any areas of potential erosion i.e. steep creek banks. Jute matting, where required, must be comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m2 and each roll overlapped by 100 mm.

Seed collection

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within close proximity (i.e. <20km) to the site. However, soil type, climate and aspect of the collection site(s) should also be considered. Native grasses and wetland species typically have much larger dispersal mechanisms and are to be collected from within the Sydney Basin.

Where species identified in this VMP cannot be sourced, they may be substituted for other SSTF species as identified by Tozer (2003). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to Camn Council

Bush regeneration contractors

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

Hygiene protocols

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (Root rot disease) onto site a hygiene protocol should be undertaken as per the guidelines developed by the Royal Botanic Gardens in '*Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority'*.

For Bush Regenerators all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to undertaking works onsite. All machinery should be thoroughly cleaned of all soil / mud / debris prior to working within the VMP area.

Rabbit exclusion fencing

Rabbit proof fencing may be required to be installed to the guidelines in the Commonwealth Department of the Environment Catalogue of fence designs. The fencing will need to be a minimum of 90mm high, with a 180 mm skirt as per the figure below.

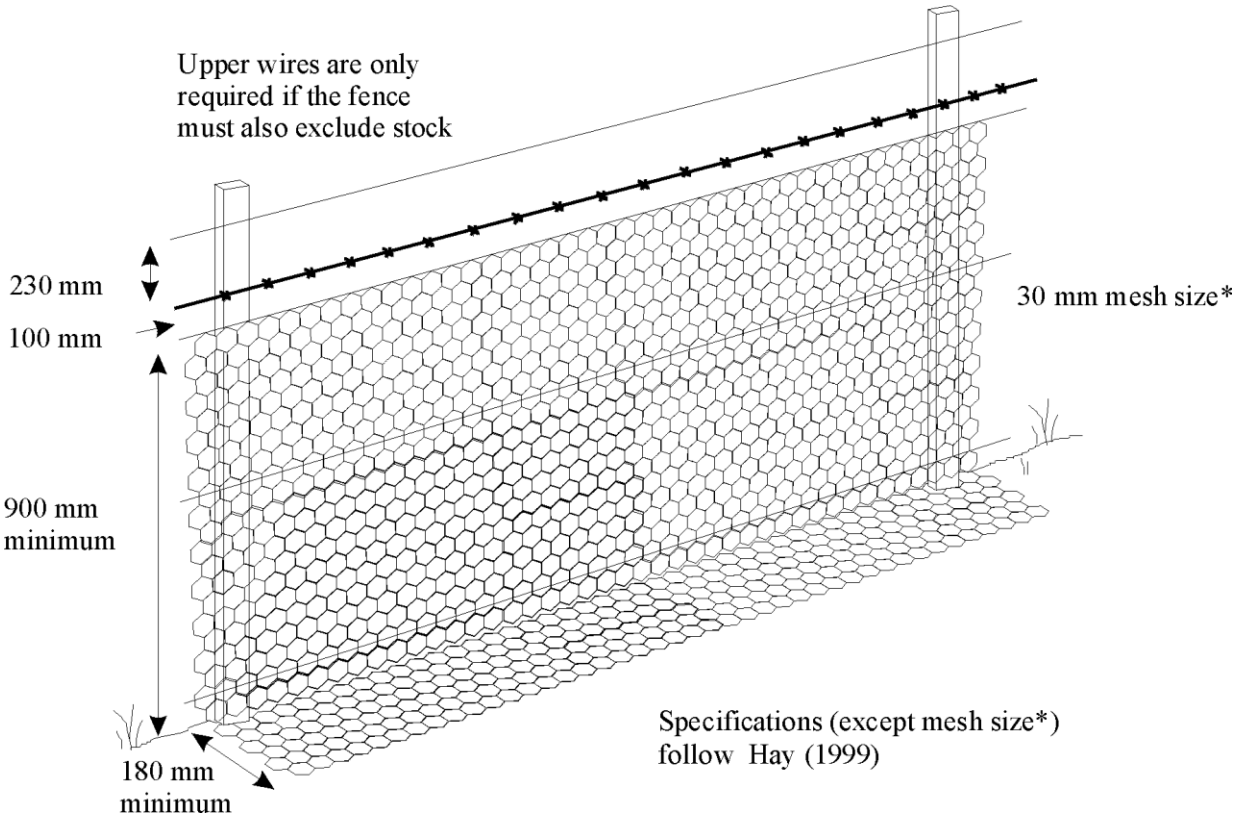

Figure C1: Recommended fencing for rabbit exclusion (DoEE 2004)

Appendix C : Recommended Revegetation List

Stratum	Scientific Name	Common Name
Canopy species	*Eucalyptus crebra*	Narrow-leaved Ironbark
	*Eucalyptus punc*tata	Grey Gum
	Eucalyptus tereticornis	Forest Red Gum
	Eucalyptus moluccana	Grey Box
	Eucalyptus amplifolia	Eucalyptus amplifolia
	Angophora floribunda	Angophora floribunda
Shrubs	*Acacia falcata*	
	Acacia implexa	Hickory Wattle
	Acacia longifolia	Sydney Golden Wattle
	Bursaria spinosa	Bursaria spinosa
	Acacia parramattensis	Parramatta Wattle
	Daviesia ulicifolia	Gorse Bitter Pea
	Indigofera australis	Australian Indigo
	Melaleuca decora	-
	Melaleuca styphelioides	Prickly-leaved Tea Tree
	Ozothamnus diosmifolius	Rice Flower
Grasses, Sedges, Rushes	*Aristida ramosa*	Purple Wiregrass
	Aristida vagans	Threeawn Speargrass
	Arthropodium milleflorum	Pale Vanilla-lily
	Billardiera scandens	Hairy Apple Berry
	Bolboschoenus caldwellii	Salt Club-rush
	Bolboschoenus fluviatilis	Marsh Club-rush
	Boronia ledifolia	Showy Boronia
	Bossiaea obcordata	Spiny Bossiaea
	Bossiaea prostrata	Spiny Bossiaea
	Brunoniella pumilio	Dwarf Brunoniella
	Carex appressa	Tall sedge
	Cassytha glabella	-
	Cassytha pubescens	-
	Chloris truncata	Windmill Grass
	Cymbopogon refractus	Barbed-wire Grass
	Cyperus gracilis	Slender Flat-sedge
	Dianella caerulea	Blue Flax-Lily

Stratum	Scientific Name	Common Name
	Dianella longifolia	Blueberry Lily
	Dianella revoluta	Blueberry Lily
	Dichelachne micrantha	Shorthair Plumegrass
	Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
	Echinopogon ovatus	Forest Hedgehog Grass
	Entolasia stricta	Wiry Panic
	Eragrostis brownii	Brown's Love Grass
	Glycine clandestina	Twining Glycine
	Imperata cylindrica	Blady Grass
	Juncus usitatus	Common Rush
	Lobelia purpurascens	Whiteroot
	Lomandra cylindrica	Needle Mat-rush
	Lomandra filiformis	-
	Lomandra filiformis subsp. *coriacea*	-
	Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush
	Lomandra gracilis	
	Lomandra longifolia	Spiny-head Mat-rush
	Lomandra multiflora	Many-flowered Mat-rush
	Lomandra multiflora subsp. *multiflora*	-
	Microlaena stipoides var. *stipoides*	Weeping Meadow Grass
	Panicum simile	Two-colour Panic
	Persicaria decipiens	Slender knotweed
	Poa labillardieri var. *labillardieri*	Tussock Grass
	Schoenoplectus mucronatus	-
	Themeda triandra	Kangaroo Grass
	Typha orientalis	Broadleaf Cumbungi
Groundcover Species (~0-1.5m) & Vines/Scramblers	*Brunoniella australis*	Blue Trumpet
	Centella asiatica	Indian Pennywort
	Clematis glycinoides	Old Man's Beard
	Commelina cyanea	Creeping Christian
	Desmodium varians	Slender Tick-trefoil
	Dichondra repens	Kidney Weed
	Einadia hastata	Berry Saltbush
	Einadia polygonoides	-
	Einadia trigonos	Fishweed

Stratum	Scientific Name	Common Name
	Eremophila debilis	Winter Apple
	Geranium solanderi	Native Geranium
	Glycine clandestina	Twining Glycine
	Hardenbergia violacea	Purple Coral Pea
	Plectranthus parviflorus	Cockspur flower
	Pratia purpurascens	Whiteroot
	Veronica plebeia	Creeping Speedwell
	Wahlenbergia gracilis	Sprawling Bluebell

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