

416 Berrima Road, New Berrima VMP

Vegetation Management Plan

Brickworks Land and Development

28 May 2020

Final



Report No. 19164RP2

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Glossary

Term / Abbreviation	Definition
BAM	Biodiversity Assessment Method
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
EEC	Endangered Ecological Community
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
LGA	Local Government Area
NSW	New South Wales
MNES	Matters of National Environmental Significance
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
the Project	New Berrima Brickworks
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SHSW	Southern Highlands Shale Woodland
SSD	State Significant Development
Study Area	The area within the subject land where surveys and observations were conducted
Subject land	The land proposed as a development site (see Figure 1)
TEC	Threatened Ecological Community
VMP	Vegetation Management Plan
VMP Area	The land which is the subject of this VMP
WM Act	Water Management Act 2000

1. Introduction

Cumberland Ecology has been commissioned by Brickworks Land & Development on behalf of Bowral Bricks (the 'client') to prepare a Vegetation Management Plan (VMP) to support a Development Application (DA) for construction of a Brickworks Plant (the Project) at 416 Berrima Road, New Berrima (the 'study area') (**Figure 1**).

It is understood that the Secretary's Environmental Assessment Requirements (SEARs) received for the project require a VMP to be submitted along with the DA. This is a standard requirement for development occurring on waterfront land which is designated to be a Controlled Activity under the NSW *Water Management Act 2000*. This VMP has been prepared according to the requirements of the former NSW Office of Water's *Guidelines for Vegetation Management Plans on Land (DPI 2012a)*.

Cumberland Ecology is also currently preparing a Biodiversity Development Assessment Report (BDAR) for the study area, to support an application for State Significant Development Consent under Division 4.1 of Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

The study area is located within land zoned IN1 General Industrial under the Wingecarribee *Local Environmental Plan 2010* (LEP). The watercourse 'Stony Creek' runs through the study area which is classified as Riparian Land according to the NSW Government Planning Portal (DPI 2012b) (**Figure 2**). In addition a second order stream is present within the VMP Area, and a first order stream present within the east of the development site.

The purpose of this document is to present a VMP that provides for the management of the vegetation outside of the development footprint of the Brickworks Plant for conservation. Earthworks will be undertaken through the majority of the VMP Area in order to realign a first order and second order stream to avoid drainage/flooding issues for the proposed Brickworks Plant. These areas of earthworks within the VMP area are proposed to be revegetated, along with the restoration of small areas of retained vegetation in the western and eastern extents of the VMP Area.

1.1. Location and Description of the Study Area and VMP Area

The study area is located at 416 Berrima Road, New Berrima, NSW, and is also known as Lot 1 DP785111. The study area is located within the Wingecarribee Local Government Area (LGA). The closest regional centres are Berrima, located approximately 2 km north-west from the study area, and Moss Vale, located approximately 4 km south-east of the study area. The study area is bounded to the west by Berrima Road, and agricultural lands on the remaining borders. The Berrima rail line occurs parallel to the southern boundary.

Vegetation within the study area includes remnant canopy trees, planted vegetation and cleared areas. The study area has had a history of agricultural development which has resulted in the degradation and clearing of the vast majority of the native vegetation present. Remnant canopy remaining within the study area is dominated by *Eucalyptus macarthurii* (Camden Woollybutt). Planted areas within the study area include screening vegetation, windbreaks and garden vegetation.

The study area occurs within the Hawkesbury–Nepean catchment and contains two surface drainage systems that flow in a southeast to northwest direction into Stony Creek, which eventually flows into the Wingecarribee River and the Wollondilly River.

The topography of the study area is undulating with topographic high of 670 m Australian Height Datum (AHD) and a topographic low of 660 m AHD.

The VMP Area is defined as the area outside of the development footprint that will be managed and rehabilitated for conservation and is approximately 2.65 ha in area (see **Figure 1**). Only small areas of vegetation are to be retained at the eastern and western extent of the VMP Area (see **Figure 2**). The remainder of the VMP Area in which earthworks are proposed to be undertaken will be revegetated, and retained areas of vegetation which currently do not have a shrub layer and have a ground layer comprised of exotic species will be restored.

This VMP provides guidelines for the revegetation, regeneration, and management of vegetation to be conserved within the VMP Area.

1.2. Aims

The aims of this VMP are to manage and reinstate vegetation within the VMP Area to a state approximating the condition it was in before the land was historically cleared in an environmentally sensitive manner. This includes:

- Protection of the existing biodiversity values of the VMP area during clearing (**Chapter 5**);
- Weed management measures to enhance the biodiversity values of the VMP area (**Chapter 6**);
- Revegetation of cleared areas with native vegetation that is broadly representative of the original plant community, comprising all three strata (ground, shrub and canopy) (**Chapter 7**);
- Provide for ongoing monitoring to maintain the ecological values of the VMP Area in the long term (**Chapter 8**)

1.3. Relevant Legislation

Legislation relevant to this VMP includes:

- The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- The NSW *Biodiversity Conservation Act 2016* (BC Act);
- The NSW *Biosecurity Act 2015* (Biosecurity Act);
- The NSW *Pesticides Act 1999*;
- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- *Water Management Act 2000* (WM Act)

1.4. Guidelines for controlled activities on waterfront land

Controlled activities carried out in, on or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40

metres of the highest bank of the river, lake or estuary. The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land. This means that a controlled activity approval must be obtained from the NSW Office of Water before commencing development on waterfront land.

When a proposed controlled activity disturbs or substantially modifies a riparian corridor, its restoration or rehabilitation will be a requirement of the controlled activity approval. A vegetation management plan (VMP) details how the restoration or rehabilitation will be carried out. The main objective of a VMP is to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities (Raine 1995).

This VMP has been prepared according to the requirements of the former NSW Office of Water's Guidelines for *Vegetation Management Plans on Waterfront Land* (DPI 2012b).

2. Methodology

2.1. Literature Review and Database Analysis

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 the VMP area. This literature review involved a variety of sources including government fact sheets and websites. Cumberland Ecology staff with expertise in bushland maintenance were also consulted regarding current best practice weed control methods and techniques, as well as determining suitable native plant species for planting, as required for revegetation.

Previously prepared reports by Cumberland Ecology were reviewed to evaluate the flora and fauna values associated with the VMP area. Key documents reviewed for this VMP included:

- The Biodiversity Development Assessment Report (BDAR) for 416 Berrima Road, New Berrima;
- Guidelines for vegetation management plans on waterfront land - Controlled activities on waterfront land; DPI Office of Water; and
- Tozer *et al.* (2010): Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands

2.2. Flora and Fauna Surveys

This VMP is informed by flora and fauna desktop assessments and field surveys undertaken by Cumberland Ecology for the BDAR accompanying the DA in 2020, and an Ecological Impact Assessment for a previous DA in the west of the site in 2018. Flora surveys were undertaken in February and March 2018 and 11 November 2019, and included vegetation mapping, random meander surveys and targeted threatened flora surveys.

During surveys vegetation within the study area was ground-truthed to examine and verify the mapping of the condition and extent of the different plant communities. Mapping of plant communities within the study area was undertaken by random meander searches throughout each patch of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these.

Records of plant community boundaries were made using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs. The resultant information was synthesised using Geographical Information Systems (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the study area.

Fauna surveys included a general fauna habitat assessment which considered indicators of habitat conditions and complexity as well as the occurrence of micro-habitats such as tree hollows, fallen logs and riparian areas. Targeted threatened flora searches were also undertaken within the study area for *Pterostylis pulchella* and *Eucalyptus macarthurii* which are listed as Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act). The random meander survey and plot survey was undertaken by a botanist and ecologist.

Both targeted species were surveyed within the recommended survey period. Further details of the flora and fauna survey undertaken in the study area are provided in the accompanying BDAR (Cumberland Ecology 2020).

3. Existing Biodiversity Values

3.1. Vegetation Communities

Vegetation within the study area (**Figure 3**) consists predominantly of the endangered ecological community (EEC) Southern Highlands Shale woodland vegetation (SHSW), which occurs throughout rural land in the locality as a number of isolated and degraded patches.

Several vegetation mapping studies have been undertaken across the study area and surrounds, including broad scale mapping Tozer *et al.* (2010), and mapping of study area by Cumberland Ecology (Cumberland Ecology 2018), which is the most recent detailed vegetation mapping that included the study area. The mapping by Cumberland Ecology (2018) was undertaken to support a separate DA in the west of the study area, however it included survey of the entire study area.

3.1.1. EEC - Southern Highlands Shale Woodland (SHSW)

Remnant Southern Highlands Shale Woodland occurs in the study area, containing canopy, shrub and ground layer vegetation.

The canopy is nearly exclusively characterised by the endangered *Eucalyptus macarthurii* (Camden Woollybutt) with scattered occurrences of *Eucalyptus radiata* subsp. *radiata* (Narrow-leaved Peppermint). The community lacks a shrub layer with the exception of isolated occurrences of exotic species such as *Pyracantha angustifolia* (Orange Firethorn), *Rubus fruticosus* (Blackberry), and *Crataegus monogyna* (Hawthorn). No regeneration of native canopy species of a shrub size is present in any of the patches.

The ground layer across the study area has been heavily degraded by past agricultural land use. Very few native species are present which generally only occur as scattered grasses. Native species recorded include *Cynodon dactylon* (Common Couch), *Bothriochloa macra* (Red-leg Grass), and *Themeda triandra* (Kangaroo Grass). A small number of native forbs are present in some locations and include *Dysphania pumilio* (Small Crumbweed) and *Portulaca oleracea* (Pigweed).

The ground layer in all woodland patches is dominated by exotic species. Dominant species include the grasses *Dactylis glomerata* (Cocksfoot), *Festuca pratensis* (Meadow Fescue), and *Phalaris aquatica* (Phalaris). The exotic sedge *Carex divulsa* (currently only known to occur in this area within NSW) comprises a significant portion of the layer, and exotic forbs such as *Hypochaeris radicata* (Catsear), *Cirsium vulgare* (Spear Thistle), and *Plantago lanceolata* (Lambs Tongues) are common.

4. Vegetation Management Zones

The VMP Area comprises an unnamed second order stream and a buffer of 20 m on either side. A total of 2 management zones have been identified for the VMP Area comprising the following:

- Zone 1 – The centre of the drainage corridor that will be planted with water tolerant vegetation; and
- Zone 2 – A 20 m riparian buffer on either side of the drainage corridor that will be planted with canopy trees, shrubs and groundcover

The location of each management zone is shown in **Figure 4**. The management objectives of each management zone are summarised below.

4.1. Zone 1: Water tolerant plantings

Zone 1 is approximately 0.48 ha in area and comprises a four metre wide strip on the either side of a two metre wide rock-lined flow channel that occurs in the centre of the riparian channel. Zone 1 extends along the entire length of the drainage corridor. Native, water tolerant vegetation will be planted within Zone 1 of the riparian corridor according to the VMP requirements.

The objectives for Zone 1 include:

- Water tolerant species such as native rushes and sedges to be planted and maintained;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control;
- Undertake weed control to facilitate natural regeneration of native species; and
- Enhance habitat for fauna species.

4.2. Zone 2: Native canopy, Shrub and groundcover plantings

Zone 2 is approximately 2.06 ha in area and consists of an area 15-20 m wide on either side of Zone 1 that will be managed as a Structured Riparian Buffer (SRB). Vegetation within Zone 2 will be planted according to the VMP requirements.

The objectives for Zone 2 include:

- Establishment of a structured riparian buffer 40 m in width;
- Upper slope of riparian corridor to be planted with native trees, shrubs and groundcover;
- Planting with native and endemic species found typically in the Southern Highlands and Shale Woodlands;
- Where possible retain existing native vegetation and native vegetative character;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control;
- Undertake weed control to facilitate natural regeneration of native species; and

- Enhance habitat for fauna species.

5. Vegetation Clearing Plan

This chapter provides protocols for vegetation clearing and other site works associated with the proposed development, to avoid impacts to retained native vegetation in the VMP Area. Other specific VMP works such as weed control and revegetation are detailed in later chapters.

5.1. 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 (SMCMA) will be followed (Botanic Gardens Trust 2008).

This will involve all machinery, clothing (such as boots and gloves), and tools, which will have contact with soil to be disinfected with a spray prior to entering and leaving the VMP area.

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.

5.2. Environmental Inductions

Inductions will be undertaken for all personnel who will work within the VMP Area prior to the commencement of any works. The induction will specify in detail which areas of vegetation are approved to be removed and the importance of not damaging retained vegetation as it comprises an EEC. The induction will specify that unauthorised personnel are not permitted to enter retained vegetation areas, and that no machinery or stockpiling of materials is permitted within the VMP Area, unless approved under a future DA.

5.3. Protection of Vegetation during Construction Phase

Where vegetation clearing is proposed to occur adjacent to areas of vegetation to be retained, appropriate measures are needed to protect retained native vegetation. Prior to clearing being undertaken, the boundaries of clearing are to be delineated. Clearing limits must be marked with appropriate signage. 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 is to take place beyond delineated boundaries within areas of the VMP Area.

In addition, to ensure the retained plants are not impacted by the proposed development these trees must be identified prior to clearing activities commencing. Appropriate fencing should be installed around these trees to ensure that they are not impacted during clearing activities. Fencing should be of a metal construction fencing that physically protects trees from inadvertent damage.

Sediment control measures will be installed to prevent run-off of soil, weed propagules, excess nutrients, and pollutants into adjacent vegetated areas. Sediment fencing should be installed along the entire perimeter of the lowest boundary of clearing areas in order to protect all retained vegetation.

5.4. Salvage of Habitat Items

Where present, fauna habitat features including hollow-bearing trees, hollow-bearing logs, other woody material and bushrock will be salvaged from the development footprint during clearing and stockpiled for future use in restoration of the VMP Area. The placement of salvaged items will increase habitat complexity as such items are used by a variety of invertebrate and vertebrate species as microhabitat areas.

Habitat features are to be stored until such time as restoration of the VMP Area commences. Storage must be undertaken within designated stockpile areas within the VMP Area, with onsite contractors made aware material is to be retained, to prevent loss of stored habitat features prior to utilisation. Placement of stored habitat features within the VMP Area will be undertaken in co-ordination with an ecologist.

Trees and stags containing hollows felled during the clearing process will be relocated within the VMP Area. These will be used for habitat reconstruction within the VMP Area. Hollows will be trimmed by a tree removal specialist and will be relocated to trees within the VMP Area. When the relocation of a hollow is not possible, a nest box will be placed in a tree to ensure that all lost arboreal habitat is either relocated or replaced. Nest boxes should be installed at a ratio of 2:1 for each hollow-bearing tree removed. Two hollow-bearing trees have been identified for removal and this will require the installation of up to four nest boxes.

Hollows to be translocated will be those that are structurally sound to the extent that they survive the trees felling and subsequent translocation. The suitability of each hollow is to be determined during pre-clearance surveys by an ecologist.

5.5. Salvage of *Eucalyptus macarthurii* Propagules

As *Eucalyptus macarthurii* is an endangered species, propagules for the species should be collected where present on any felled trees and used to grow seedlings in a specialist native nursery for replanting in the VMP Area.

5.6. Weed Management

Numerous weed species have been recorded from both zones in the VMP Area, and if left uncontrolled these may threaten the objectives of each zone. In addition, disturbance during development works can create opportunities for weed invasion, and therefore appropriate weed control activities will be undertaken during clearing. In order to minimise weed establishment. The amount of bare soil exposed at any one time will be minimised, and sediment fencing will be installed along the lower boundary of any areas proposed to be cleared, and downslope of any activities involving earthworks to prevent the spread of weeds into the area from clearing works.

Prior to clearing, all plant equipment entering the site will be inspected and recommended for wash down (in designated wash down areas) as required to ensure weed material from off-site locations do not establish or spread into native vegetation within the VMP Area. Any weed materials will need to be carefully removed off

site in a manner appropriate to the species so as to prevent the spread of propagules to uncleared areas of native vegetation, both on and off site. More detailed weed control measures for implementation in the VMP Area are presented in **Chapter 6**.

While not a Priority Weed species, the ground layer within the Study Area contains abundant occurrences of the exotic weed *Carex divulsa*. This species is not currently known to occur outside of this property (Botanic Gardens Trust 2020) within NSW (besides an old record from Lane Cove, the first record for this species in NSW was collected by Cumberland Ecology at this site in 2018). This species has the potential to occur in nearby properties which have not been surveyed, however as the species is not known to occur elsewhere, and is likely limited to the locality, it is important that propagules for the species are not spread offsite.

5.7. Fauna Relocation and Clearing Protocols

Pre-clearing surveys will be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs and bush rock within one week of the proposed clearing activities.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection.

An ecologist should investigate all fallen trees for the presence of hollows not detected prior to clearing. Inspections should be undertaken of these hollows for native fauna.

Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on vegetation clearing will be briefed about the possible fauna present and should avoid injuring any fauna;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

5.8. Erosion and Sediment Control

Potential impacts to flora and fauna occurring in the construction phase that can be managed include run-off, sedimentation, erosion and pollution. To reduce sedimentation of the VMP Area, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall.

Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

Clearing should not take place during periods of heavy rain in order to minimise erosion and sediment run-off.

6. Weed Management Plan

6.1. Introduction

6.1.1. Objectives

The VMP Area contains weeds including several Priority Weed species (see **Section 6.1.2** and **Table 1.** below). In addition, future development within the VMP Area has the potential to contribute to the spread of exotic species, including garden escapees into the VMP Area. The objectives of weed management in the VMP Area are to control the existing weeds that occur in order to facilitate the recovery of the native vegetation present and to prevent the establishment of any additional weed species, through ongoing maintenance.

6.1.2. Relevant Legislation

Under the NSW *Biosecurity Act 2015* (Biosecurity Act) all weeds are required to be controlled by all persons under a “General Biosecurity Duty”. The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017). The power for enforcement of penalties relating to compliance with the legislation is given to Local Control Authorities (i.e. Local Governments).

State-wide management of weeds under the Biosecurity Act is directed by the NSW Invasive Species Plan (LLS: Greater Sydney 2017). Weed responses are assigned to four categories:

- Prevention of new weeds establishing;
- Eradication of small and localised infestations where feasible;
- Containment of larger infestation to stop wider spread; and
- Protection of key assets, such as threatened plants and agricultural land, to prevent their damage or degradation by weed invasion.

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the Act. These are known as State Level Priority Weeds. Specific legal requirements exist for how these weeds are managed.

All land within the VMP Area is within the South East Local Land Services region, and weed management within the region is be undertaken under the direction of the South East Regional Strategic Weed Management Plan (LLS: South East 2017). Appendix 1 of the plan outlines the State Listed Priority Weeds and Regional Priority Weeds, and Appendix 2 outlines other weeds of concern in the region and species subject to local management programs.

Of the exotic species recorded within the study area, Serrated Tussock (*Nassella trichotoma*) is listed as a State Priority Weed within the South East Regional Strategic Weed Management Plan 2017 – 2022 and a Weed of National Significance (WONS) under the National Weeds Strategy. State-listed Priority weeds have specific legal requirements for management and have higher management priorities. This weed is required to be controlled in every management zone that it occurs in.

Priority Weeds recorded within the Study Area are detailed in **Table 1**.

Table 1. Priority Weeds identified within the study area

Scientific name	Common Name	Status
<i>Hypericum perforatum</i>	St. John's Wort	SSLMP
<i>Nassella trichotoma</i>	Serrated Tussock	WoNS + SP + RP
<i>Rubus fruticosus</i> sp. agg.	Blackberry complex	SP + WoNS

Table Key: SP = State Priority Weed, RP = Regional Priority Weed, SSLMP = Species Subject to Local Management Programs, WoNS = Weed of National Significance.

6.2. Best Management Practice

Contractors for weed removal within the VMP area will have to be mindful with 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;
- Proximity to watercourses and swampy areas; and
- Presence of native fauna or nesting/breeding sites.

6.3. Weed Control Methods

All weed removal works in the VMP Area should be approached using the strategies outlined below.

6.3.1. Manual Weed Removal

Manual removal, or hand weeding, is an effective form of weed control when all viable parts of the plant are removed from the soil (roots, fruiting material and rhizomes) and site. All weeds removed by hand will be handled according to best practice bush regeneration techniques to prevent subsequent seed set from the removed weeds, and the unviable plant material will be retained on site to provide mulch and natural leaf litter to protect the soil surface.

6.3.2. 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. In areas near water courses, an appropriate form of the herbicide should be used to minimise impact to aquatic life and amphibians. Herbicide use should be avoided within 2 m of the riparian edges. Examples of appropriate herbicide forms are Roundup Biactive and Clearup Bio 360 which have surfactants that are formulated to minimise harm to amphibians. As runoff is a likely way for herbicide residue to enter watercourses, chemical treatment should be avoided prior to or directly after rains.

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. The relevant permit numbers are PER9907, and PER11916. These permits need to be obtained from the Federal Government body, the Australian Pesticides and Veterinary Management Authority.

Manual removal will be an appropriate form of control for some species, and all chemical treatment should be carried out according to best practice guidelines. Planting should not occur within 10 days of herbicide application.

6.4. Weed Management in the VMP Area

6.4.1. Initial Weed Control

After installation of sediment fencing has been completed, and earth works have been completed, initial weed treatment in the VMP Area will commence. This will consist of spraying with Glyphosate 360g/L at a concentration of 10 mL herbicide to 1 L of water. This strength is commonly used in bushland regeneration works as it will effectively kill most herbaceous weed species. A marker dye should be used in the herbicide solution to ensure no areas are missed. Knapsack sprayers with a spray cone to direct the spray towards the ground are recommended to be used to prevent herbicide drift into adjacent vegetated areas. Spraying should be adjusted based on on-ground conditions and should target areas with weed infestations.

Following the initial spraying, the site should be left for three weeks to allow time for any treated weeds to die back. After this period the treated areas should be resprayed with Glyphosate again, with a focus made on treating any exotic plant species that still have green colouring left in foliage, and any juvenile germinated exotic grasses.

6.4.2. Ongoing Weed Maintenance

Weed suppression methods such as mulching/matting will suppress mass regrowth of weeds within the study area, but not entirely prevent regrowth of weeds. The most cost and time effective method of controlling weed regrowth will be by spraying a non-selective Glyphosate herbicide. This is only to be used for large infestations. If targeting individual weeds, then wick wiping/direct press techniques are advisable.

Ongoing maintenance of the study area should occur for a five-year period by the contracted bushland regeneration company, and the study area 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, otherwise progress on the site will not be made.

Tree guards should remain around all native planted trees and shrubs, for at least 18 months to protect them from herbivory. Rabbits can devastate revegetation areas soon after planting, if tree guards are not used. Tree guards will also allow herbicide to be used for control of the majority of regrowth weeds, without damage to native plants by herbicide drift.

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

- Initially the bushland regeneration team visiting the site should sweep from one end of each area to the other. During this sweep weeds occurring within each tree guard 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).
- 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 weed species as possible are controlled. This will minimise maturity and set seed of weeds between site visits. Some weed species 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 occurrences of exotic species it is important that individuals are not allowed to set seed.

During site visits for weed control, Priority Weeds and Weeds of National Significance (WONS) must be prioritised for control. Individual plants of these species on site should not be allowed to achieve a reproductive stage in their life cycles. Temporary sediment fencing should be retained until it is determined plants have sufficiently established to prevent surface soil erosion.

It is recommended that signs of rabbit herbivory be noted during site visits, and control measures undertaken if significant impacts to planted vegetation are occurring threatening the long-term viability of the VMP Area.

6.5. Specific Management for *Carex divulsa*

As mentioned in **Section 5.5**, while not a Priority Weed species, the ground layer within the Study Area contains abundant occurrences of the exotic weed *Carex divulsa*. This species is not currently known to occur outside of this property (Botanic Gardens Trust 2020) within NSW (besides an old record from Lane Cove, the first record for this species in NSW was collected by Cumberland Ecology at this site in 2018). This species has the potential to occur in nearby properties which have not been surveyed, however as the species is not known to occur elsewhere, and is likely limited to the locality, it is important that propagules for the species are not spread offsite. Any offsite spread of the species is likely to be expanding the range of the species within NSW.

Bushland Regenerators should take specific precautions regarding the species such as ensuring any vegetative waste is bagged, and transported and disposed of adequately to prevent spread.

Boots and clothing should be brushed off before leaving the site and entering vehicles, and any vehicles driven across paddocks or outside of hard stand areas and roads should be washed before leaving site.

7. Revegetation and Restoration Plan

7.1. Introduction

7.1.1. Objectives

This chapter provides details for the restoration of the native vegetation within the VMP Area. This comprises areas that have been previously completely cleared of native vegetation during earthworks for realignment of the streams, and for patches of retained native vegetation that have had the understorey and ground layer cleared of weeds and which are required by Council or the NSW Office of Water to be revegetated (see **Figure 2**). A total of 2.65 ha of land is in the VMP area.

The objectives of this revegetation plan are to provide details of the measures that will be implemented to replace and rehabilitate the fully and partly cleared areas of the VMP Area back to high quality examples of SHSW that will remain in the long term.

7.2. Revegetation Preparation

The revegetation of the VMP area will require the treatment of soils, the installation of protective plant fencing, and ongoing maintenance treatments such as watering and weeding. Recommended revegetation strategies include:

- Initial and ongoing control of weeds and competing grasses using bushland regeneration techniques and conventional best practice chemical and physical strategies as outlined in **Chapter 6**;
- Use of local provenance plants;
- Treatment of soils within each planted tube stock plant hole with a plant establishment aid that contains a mix of materials such as slow and quick release fertilisers, water holding crystals, rooting hormones and wetting agents, (i.e. products such as Terra Cotten by TC Advantage Pty Ltd or Sure Start by Barmac). These agents assist in establishing newly installed plants and can reduce establishment watering resources by up to 50%;
- Stabilising soils and suppressing weeds around individual reconstruction plantings using products, such as 40 cm square jute fibre mats or woodchip leaf mulch to a 50 cm diameter and 75 mm depth;
- Protecting individual tree and shrub plantings with a tree guard from feral animal grazing, frost and maintenance herbicide spraying overspray. Bamboo stakes 3 x 10-12 mm x 750 mm and 1 x 350 mm x 450 mm plastic tree guards are suitable for this purpose; and
- Maintaining reconstruction treatments (including watering, weeding, replacing dead plant material and repairing / replacing weed mat/mulch), as a part of an ongoing maintenance.

7.3. Recommended Revegetation Techniques

7.3.1. Species Selection

Appropriate plant species for SHSW are provided in **Appendix C** and are to be used for revegetation of the VMP Area as well as for supplementary planting as required. Plants will be sourced from local provenance stock and may be sourced from seed collections or cuttings from within the existing remnant vegetation within the study area or from commercially attainable tube stock.

It is recommended that a mix of local native trees, shrubs, and ground layer plants are replanted at the specified densities outlined below. All plants will 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. They must have good root development and a sturdy shoot system.

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.

As many species as are able to be sourced should be planted to maximise the species richness within the VMP Area. The minimum numbers of species to be used in the initial establishment phase of the revegetation are:

- Four tree species;
- Six shrub species; and
- Twelve groundcover species.

As *Eucalyptus macarthurii* is the dominant species in SHSW across the site, and is a threatened species which is evidently not naturally regenerating on site, likely due to compaction from grazing, this species should comprise a significant portion of plantings of canopy species. A native nursery or bushland regeneration company with the correct scientific licence for managing material of threatened species should collect seed from retained *Eucalyptus macarthurii* individuals within the study area, and grow seedlings for use in the VMP Area. In addition seedlings grown from any propagules collected from felled trees as directed in **Section**

7.3.2. Planting Densities

The recommended planting densities for aquatic species in Zone 1 of the VMP Area are:

- Groundcovers @ 4-6 units / 1 m²

The recommended planting specifications for SHSW in Zone 2 of the VMP Area are:

- Canopy Trees @ 1 unit / 30 m²

- Shrubs @ 2 units / 10 m² (can be differentially spaced across the VMP Area in thickets)
- Groundcovers @ 4 units / 1 m² planted in clumps/thickets or singly.

Differential cover of shrubs will also provide a greater diversity of fauna habitat, particularly for some small, woodland birds which forage in grassy areas and shelter in shrub thickets. Trees and shrubs should be planted unevenly in patches to mimic natural distribution.

Planting of trees should be avoided within 10 metres of existing (retained) canopy. In areas of Zone 2 in which retained canopy trees occur planting of understorey and ground layer species will be required only.

7.3.3. Characteristic Planting Units

Species should be planted in characteristic planting units to correspond with the topology, aspect, soil type and proximity to water.

Grasses may be planted in clumps of 3+ (spaced 15–20 cm apart within clumps) to generate physical / structural support for each other and microclimates. Wind pollinated grasses such as *Themeda australis* may be particularly planted in clumps to aid fertilisation and to create a natural grassland understorey within the restoration areas. Trees and shrubs should be planted unevenly in patches to mimic natural distribution.

7.3.4. Plant Supply

Any tube stock will be purchased of local provenance native plants identified in **Appendix B**. In the event that the required quantities of tube stock are not available then it may be necessary to collect or source suitable quantities of local native seed for the propagation.

Local native plant propagules 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 from within the Wingecarribee Shire LGA, preferably from within 10 km of the study area. Material should be propagated in a local commercial or community nursery, with well-established plants used for revegetation, for trees and shrub species particularly. 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 "Hiko" tube, maxi cell or viro-tube, or Forestry Tube-type containers.

7.4. Maintenance

After planting works have been completed, treated areas in both zones should be maintained by appropriately qualified personnel, selectively spot spraying and hand weeding around native plants, watering plants and replacing dead plants as needed.

Provision should be made to irrigate areas, as required, in the first 3 months after installation, (on at least 4-5 occasions, depending on rainfall conditions, more watering if required). Irrigation water may be sourced by

pumping from the river and local dams. A permit from the NSW Office of Water may be sought to use water for watering-in newly installed plants.

Re-growing environmental weeds such as vines, woody trees and shrubs, broadleaf annuals and naturalised grasses should be closely monitored and controlled using ecologically sensitive bushland regeneration hand weeding and spot-spraying methods, to ensure adequate weed control and native plant establishment (refer to **Chapter 6**). Weeding inside each planting bag by hand or selective herbicides will be required, as well as in an approximate 50 cm radius around the outside of each plant and tree guard.

Plants that have died due to drought or pest and disease damage should be replaced as required. Plants that are observed to have died should be replaced by the bushland maintenance team with a planting of the same form.

Maintenance should extend for a minimum of two years after the completion of works or until such time as a minimum 80 per cent survival rate of each species planted and a maximum 5 per cent weed cover for the treated riparian corridor controlled activity is achieved (*DPI 2012a*).

8. Monitoring and Reporting

8.1. Responsibilities

It is recommended that a project manager/supervisor with the Bushland Regeneration Contractor (BRC) be assigned to coordinate, supervise, and manage all works and correspondence with respect to the management of the VMP Area. The consultant will be responsible for ensuring the measures outlined in this VMP are implemented and that plant stock is replaced, as needed. The project manager will become familiar with the VMP Area and surrounds, and progress of all aspects of works undertaken.

The project manager will be responsible for allocation of maintenance tasks to personnel in response to ongoing monitoring results as well as reporting. Regular monitoring and feedback from personnel will assist in the allocation of labour relative to available funds.

8.2. Monitoring

A qualified bushland management or ecological consultant will carry out a program of regular monitoring of the implementation of the VMP. The monitoring program will be carried out for the duration of the VMP and a monitoring survey will be completed every six months for the five-year management period of the VMP.

General observations of the nature and condition of the revegetation areas will be collected along with the collection of quantitative data within four 4 x 20 m monitoring plots (**Figure 5**). Photo reference points should be established in the VMP Area at one corner of each monitoring plot (**Figure 5**) and a photograph shall be taken at each photo reference point facing north for a visual assessment of site progress, and diagonally across the plot to the opposite corner. Within each monitoring plot the following will be collected:

- Estimates of the success rate of plantings and natural regeneration, and assessment of plant replacement requirements;
- Weed coverage;
- Exotic to native understorey ratio; and
- Recommendations for corrective measures and/or vegetation management.

8.3. Reporting

A brief and concise report will be prepared annually based on the findings of the two monitoring visits per year. The report will be prepared by the ecological consultant or bushland management consultant and forwarded to Council for approval at the end of each yearly period for the duration of the VMP maintenance period.

Each annual report will:

- Describe the revegetation works undertaken;
- State the findings of the monitoring surveys;

- Discuss any problems encountered in implementing the VMP; and
- Recommend any adaptations or additions to the VMP.

The report will contain site photographs, as well as a short description of weeds in each management zone and a short comparison to the photographs to the previous years. Any other notable occurrences of weeds will also be reported. The report will also recommend and prioritise areas where weed control should be targeted for the following maintenance period.

9. Timing and Responsibilities

This VMP covers work to be carried out on site over a five-year period. The VMP Area is to be managed in a series of phases as follows:

- Phase 1 – Site establishment;
- Phase 2 – Revegetation and primary weeding;
- Phase 3 – Maintenance; and
- Phase 4 – Monitoring and Reporting

Timing and responsibilities at each phase of management within the VMP Area are shown within **Table 2**. This table assigns each activity within each phase to those responsible.

Table 2. Timing and responsibilities

Management	Action	Responsibility	Performance Criteria	Timing
Phase 1: Site Establishment				
Extent of clearing boundary	Installation of sediment/erosion controls	Construction Contractor	Sediment/erosion controls have been installed around the perimeters of all clearance works.	Prior to commencement of clearing works.
Extent of clearing boundary	Delineation of clearing boundary	Construction Contractor	Temporary fencing has been installed around the perimeters of all clearance works.	Prior to commencement of clearing works.
Extent of clearing boundary	Vegetation Clearance	Construction Contractor	Vegetation removed following completion of pre-clearance surveys. Any logs removed have been placed within the VMP Area.	During Construction Works
Phase 2: Revegetation and Primary Weeding				
VMP Area	Revegetation of cleared areas	Construction Contractor	Cleared areas have been planted to the specifications outlined in Chapter 7 , using the species in Appendix B .	During Construction Works

Management	Action	Responsibility	Performance Criteria	Timing
VMP Area	Primary weeding conducted across entire VMP	Construction Contractor	All woody weeds have been removed from entire VMP Area and all other weeds have been treated	During Construction Works
Phase 3: Maintenance				
VMP Area	Monitoring	Bush Regeneration Contractor	Increase in ground layer and mid layer cover in The VMP area	Biannually for the 5 year maintenance period of the VMP.
VMP Area	Carry out weed control.	Bush Regeneration Contractor	Ensure no new weeds establish	Site visits quarterly for the 5 year maintenance period of the VMP; annually thereafter.
VMP Area	Rubbish removal	Bush Regeneration Contractor	Ensure any rubbish is removed	Site visits annually for the 5 year maintenance period of the VMP.
Phase 4: Monitoring and reporting				
VMP Area	Biannual inspection of site.	Bush Regeneration Contractor or Ecologist	Site inspection completed as outlined in Chapter 8 .	Biannually for the 5 year maintenance period of the VMP.
VMP Area	Progress report preparation	Bush Regeneration Contractor or Ecologist	Annual Report prepared on progress of VMP.	Annually for the 5 year maintenance period of the VMP.

10. VMP Costing

Cost estimates for implementation of this VMP are included in **Table 3.** on the next page.

All estimations are based on previous projects and prices quoted during the writing of this report and are subject to a high degree of variability based on the availability of resources and other unforeseen economic factors. Therefore, the costing provided should be used only as a high-level general guide as totals may vary over the life of the VMP. The estimates provided are approximate only and accurate costing must be obtained by putting the project to tender with Bushland Regeneration companies. Bush regenerators must be either be a member of the Australian Association of Bush Regenerators or be suitable qualified with relevant specialist skills.

Costings for seed collection have not been included in these estimates as the full extent of area from which seed is to be collected is currently unknown as the collection of an adequate supply of seeds will vary with seasons and plant conditions.

Table 3. Cost estimates for implementation of the VMP

Task	Establishment	Year 1	Year 2	Year 3	Year 4	Year 5	Yearly after year 5
Site Preparation (Initial Weeding) 2 days @ \$2,500.00 per day	\$5,000.00						
4 Star Pickets including post cap (Photo reference points)	\$50.00						
Temporary Fencing	\$9,000.00						
Sediment Fence	\$2,500.00						
Tree guards (if used)	\$600.00						
1600m ² Jute matting (if used)	\$5,700.00						
Groundcovers (based on planting of 106 425 units)	\$212,850.00						
Shrubs (based on planting of 1030 units)	\$2,060.00						
Canopy Trees (based on planting of 687 units)	\$1,374.00						
Maintenance Visits Weeding, photo monitoring, and reporting		\$4,500.00	\$4,500.00	\$4,500.00	\$4,000.00	\$4,000.00	\$4,000.00
Total Establishment Costs	\$239,134.00	4 Visits	4 Visits	4 Visits	4 Visits	4 Visits	1 Visit

11. References

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APPENDIX A :

Landscape Plan



LEGEND

SITE BOUNDARY

FENCE TO ARCHITECT'S DETAILS

EXISTING PASTURE LAND TO BE RETAINED

PROPOSED HARDSTAND

PROPOSED INDICATIVE FLOW SPREADER. REFER TO CIVIL DWGS.

40M RIPARIAN CORRIDOR BUFFER SETBACK

ASSET PROTECTION ZONE BOUNDARY AS PER BUSHFIRE REPORT

APPENDIX B :

Flora Species Recorded



Table 4. Flora species recorded within the study area

Species Name	Common Name	Exotic
<i>Acer negundo</i>	Box Elder	YES
<i>Agapanthus praecox subsp. orientalis</i>		YES
<i>Agapanthus praecox subsp. orientalis</i>		YES
<i>Agave americana</i>	Century Plant	YES
<i>Agrostis capillaris</i>	Browntop Bent	YES
<i>Anthosachne scabra</i>	Wheatgrass, Common Wheatgrass	
<i>Bothriochloa macra</i>	Red Grass	
<i>Bromus catharticus</i>	Praire Grass	YES
<i>Bromus hordeaceus</i>	Soft Brome	YES
<i>Carduus nutans subsp. nutans</i>	Nodding Thistle	YES
<i>Carex divulsa</i>	#N/A	Yes
<i>Cedrus spp.</i>		YES
<i>Cenchrus clandestinus</i>	Kikuyu Grass	YES
<i>Cirsium vulgare</i>	Spear Thistle	YES
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	YES
<i>Cotoneaster glaucophyllus</i>		YES
<i>Crataegus monogyna</i>	Hawthorn	YES
<i>Cupressus spp.</i>		YES
<i>Cynodon dactylon</i>	Common Couch	
<i>Dactylis glomerata</i>	Cocksfoot	YES
<i>Dysphania pumilio</i>	Small Crumbweed	
<i>Ehrharta erecta</i>	Panic Veldtgrass	YES
<i>Eleusine indica</i>	Crowsfoot Grass	YES

Species Name	Common Name	Exotic
<i>Eleusine tristachya</i>	Goose Grass	YES
<i>Erodium cicutarium</i>	Common Crowfoot	YES
<i>Eucalyptus cinerea</i>	Argyle Apple	
<i>Eucalyptus cypellocarpa</i>	Monkey Gum	
<i>Eucalyptus dives</i>	Broad-leaved Peppermint	
<i>Eucalyptus elata</i>	River Peppermint	
<i>Eucalyptus macarthurii</i>	Paddys River Box, Camden Woollybutt	
<i>Eucalyptus mannifera subsp. mannifera</i>	Brittle Gum	
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	
<i>Eucalyptus ovata</i>	Swamp Gum	
<i>Eucalyptus pauciflora</i>	White Sally	
<i>Eucalyptus radiata subsp. radiata</i>	Narrow-leaved Peppermint	
<i>Eucalyptus scoparia</i>	Wallangarra White Gum	
<i>Eucalyptus viminalis</i>	Ribbon Gum	
<i>Euphorbia terracina</i>	False Caper	YES
<i>Festuca pratensis</i>	Meadow Fescue	YES
<i>Fraxinus spp.</i>		YES
<i>Geranium molle subsp. molle</i>	Cranesbill Geranium	YES
<i>Hirschfeldia incana</i>	Buchan Weed	YES
<i>Hypericum perforatum</i>	St. John's Wort	YES
<i>Hypochaeris radicata</i>	Catsear	YES
<i>Juncus usitatus</i>		
<i>Lepidium africanum</i>	Common Peppergrass	YES
<i>Ligustrum lucidum</i>	Large-leaved Privet	YES

Species Name	Common Name	Exotic
<i>Liquidambar styraciflua</i>	Sweetgum	YES
<i>Lolium perenne</i>	Perennial Ryegrass	YES
<i>Lysimachia arvensis</i>	Scarlet Pimpernel	YES
<i>Malva parviflora</i>	Small-flowered Mallow	YES
<i>Medicago arabica</i>	Spotted Burr Medic	YES
<i>Medicago minima</i>	Woolly Burr Medic	YES
<i>Medicago polymorpha</i>	Burr Medic	YES
<i>Nassella trichotoma</i>	Serrated Tussock	YES
<i>Oxalis pes-caprae</i>	Soursob	YES
<i>Paspalum dilatatum</i>	Paspalum	YES
<i>Paspalum distichum</i>		
<i>Phalaris aquatica</i>	Phalaris	YES
<i>Photinia serratifolia</i>	Chinese Photinia	YES
<i>Pinus spp.</i>		YES
<i>Plantago lanceolata</i>	Lamb's Tongues	YES
<i>Poa annua</i>	Winter Grass	YES
<i>Poa sieberiana</i>	Snowgrass	
<i>Polygonum aviculare</i>	Wireweed	YES
<i>Portulaca oleracea</i>	Pigweed	
<i>Prunus spp.</i>		YES
<i>Pyracantha angustifolia</i>	Orange Firethorn	YES
<i>Quercus robur</i>	English Oak	YES
<i>Rubus fruticosus sp. agg.</i>	Blackberry complex	YES
<i>Rumex conglomeratus</i>	Clustered Dock	YES

Species Name	Common Name	Exotic
<i>Rytidosperma bipartitum</i>	Wallaby Grass	
<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Wallaby Grass	
<i>Setaria parviflora</i>		YES
<i>Silybum marianum</i>	Variegated Thistle	YES
<i>Sporobolus africanus</i>	Parramatta Grass	YES
<i>Taraxacum officinale</i>	Dandelion	YES
<i>Themeda triandra</i>		
<i>Ulmus glabra</i>		YES
<i>Ulmus parvifolia</i>	Chinese Elm	YES
<i>Urtica urens</i>	Small Nettle	YES
<i>Verbascum virgatum</i>	Twiggy Mullein	YES
<i>Vinca major</i>	Periwinkle	YES

APPENDIX C :

Native Planting Lists

Table 5. Water-tolerant flora species suitable for Zone 1

Family Name	Species Name	Common Name
Araliaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
Asteraceae	<i>Centipeda cunninghamii</i>	Common Sneezeweed
Cyperaceae	<i>Carex appressa</i>	Tall Sedge
Cyperaceae	<i>Schoenoplectus validus</i>	Soft Stem Bulrush
Juncaceae	<i>Juncus planifolius</i>	
Juncaceae	<i>Juncus usitatus</i>	Common Rush
Plantaginaceae	<i>Plantago debilis</i>	
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow Plantain
Poaceae	<i>Lachnagrostis filiformis</i>	
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass
Poaceae	<i>Poa labillardierei</i>	Common Tussock-grass
Poaceae	<i>Phragmites australis</i>	Common Reed
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock
Ranunculaceae	<i>Ranunculus inundatus</i>	River Buttercup
Violaceae	<i>Viola betonicifolia</i>	Showy Violet
Violaceae	<i>Viola hederacea</i>	Ivy-leaved Violet

Table 6. Canopy, shrub and groundcover flora species suitable for Zone 2

Family Name	Species Name	Common Name
Canopy Trees		
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Myrtaceae	<i>Eucalyptus amplifolia</i>	Cabbage Gum
Myrtaceae	<i>Eucalyptus cinerea</i>	Argyle Apple
Myrtaceae	<i>Eucalyptus cypellocarpa</i>	Monkey Gum
Myrtaceae	<i>Eucalyptus dives</i>	Broad-leaved Peppermint
Myrtaceae	<i>Eucalyptus elata</i>	River Peppermint
Myrtaceae	<i>Eucalyptus fastigata</i>	Brown Barrel or Cut-tail, Stringybark)
Myrtaceae	<i>Eucalyptus globoidea</i>	White Stringybark
Myrtaceae	<i>Eucalyptus macarthurii</i>	Paddys River Box, Camden Woollybutt
Myrtaceae	<i>Eucalyptus mannifera</i>	Brittle Gum
Myrtaceae	<i>Eucalyptus obliqua</i>	Messmate Stringybark
Myrtaceae	<i>Eucalyptus ovata</i>	Swamp Gum
Myrtaceae	<i>Eucalyptus pauciflora</i>	White Sally
Myrtaceae	<i>Eucalyptus piperita</i>	Sydney Peppermint

Family Name	Species Name	Common Name
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum
Myrtaceae	<i>Eucalyptus quadrangulata</i>	White-topped Box
Myrtaceae	<i>Eucalyptus radiata</i>	Narrow-leaved Peppermint
Myrtaceae	<i>Eucalyptus smithii</i>	Gully Gum, Gully Peppermint, Blackbutt Peppermint, Ironbark Peppermint
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum
Myrtaceae	<i>Eucalyptus viminalis</i>	Ribbon Gum
Understory		
Fabaceae	<i>Acacia melanoxylon</i>	Australian blackwood
Fabaceae	<i>Acacia binervata</i>	Two-veined hickory
Pittosporaceae	<i>Pittosporum undulatum</i>	Mock Orange, Sweet pittosporum
Shrub layer		
Asteraceae	<i>Olearia microphylla</i>	Small-leaved Daisy Bush
Asteraceae	<i>Ozothamnus diosmifolius</i>	Rice flower, white dogwood, pill flower and sago bush
Ericaceae	<i>Leucopogon juniperinus</i>	Prickly Beard-heath
Ericaceae	<i>Leucopogon lanceolatus</i>	Lance Beard-heath
Fabaceae	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea
Fabaceae	<i>Indigofera australis</i>	Australian indigo
Fabaceae	<i>Oxylobium ilicifolium</i>	Prickly Shaggy-pea
Myrtaceae	<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn, Boxthorn
Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung
Groundcover		
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken fern
Haloragaceae	<i>Gonocarpus tetragynus</i>	Common Raspwort.
Hypericaceae	<i>Hypericum gramineum</i>	Small or grassy St. John's wort
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-head Mat-rush
Lomandraceae	<i>Lomandra multiflora</i>	Many-flowered Mat-rush
Phyllanthaceae	<i>Poranthera microphylla</i>	Small Poranthera
Plantaginaceae	<i>Veronica plebeia</i>	Creeping- or trailing speedwell)

Family Name	Species Name	Common Name
Poaceae	<i>Anthosachne scabra</i>	Wheatgrass, Common Wheatgrass
Poaceae	<i>Austrostipa rudis</i>	Veined Spear-grass
Poaceae	<i>Bothriochloa macra</i>	Red Grass
Poaceae	<i>Hardenbergia violacea</i>	False sarsaparilla, native lilac
Poaceae	<i>Microlaena stipoides</i>	Weeping grass
Poaceae	<i>Poa sieberiana</i>	Snowgrass
Poaceae	<i>Rytidosperma bipartitum</i>	Wallaby Grass
Poaceae	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Wallaby Grass
Poaceae	<i>Themeda triandra</i>	
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed
Rubiaceae	<i>Opercularia diphylla</i>	Stinkweed
Violaceae	<i>Viola hederacea</i>	Ivy-leaved Violet

* Species lists based on descriptions of SHSW EEC composition from DPIE and Tozer.

FIGURES





Figure 1. Location of the study area and VMP area

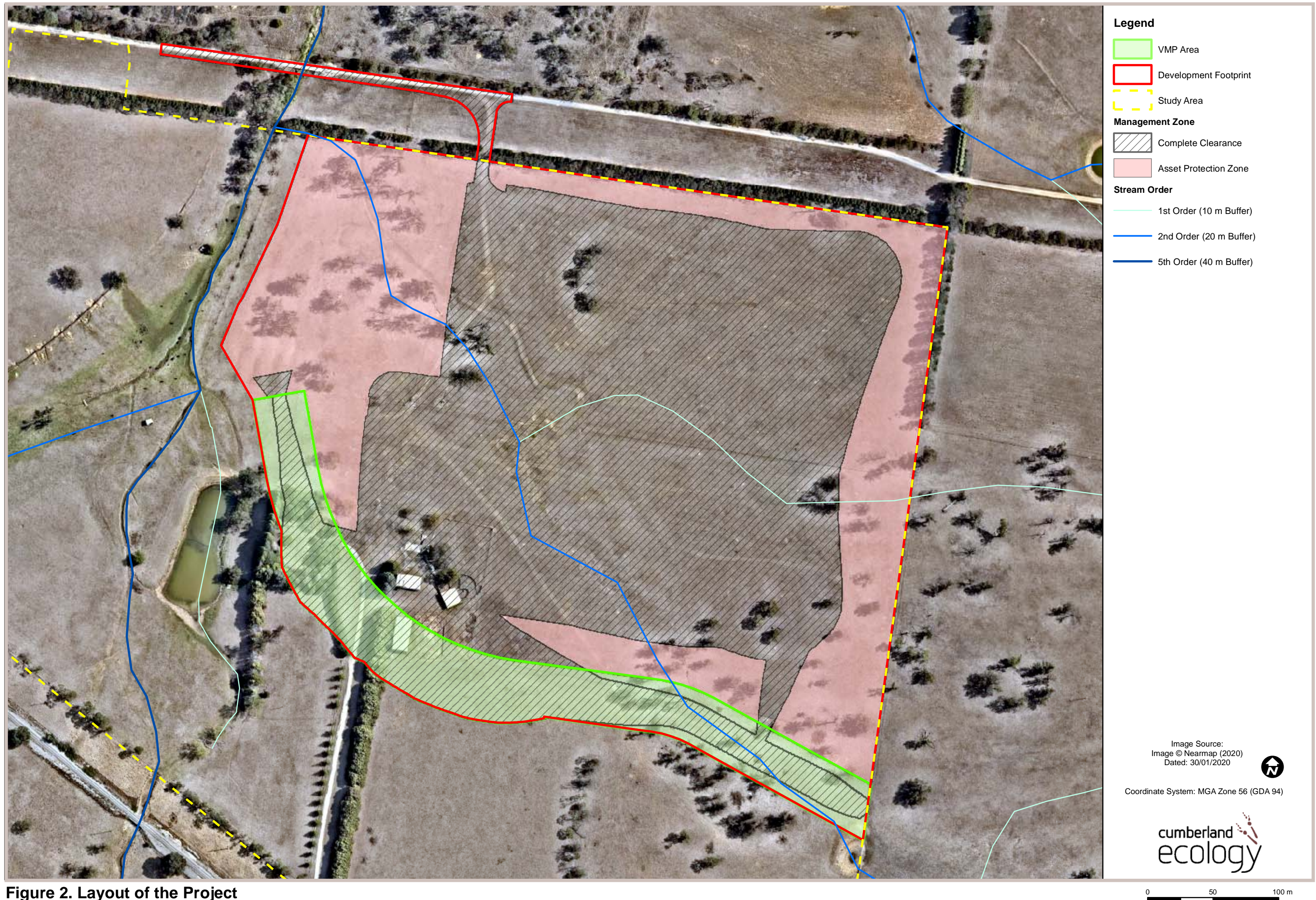


Figure 2. Layout of the Project



Figure 3. Vegetation communities within the study area

0 50 m



Figure 4. Vegetation management zones



Legend

- VMP Area
- Monitoring Plots
- Photopoints
- Signage

Management Zone

- Zone 1
- Zone 2
- Rock-lined Flow Channel

Image Source:
Image © Nearmap (2020)
Dated: 30/01/2020

Coordinate System: MGA Zone 56 (GDA 94)



Figure 5. Monitoring plots and signage within the VMP area