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Vegetation Management Plan



**Lot 39 DP // 1215451 Major Roberts Avenue,
Tahmoor, NSW**

Planning Proposal

Prepared for ABAX Contracting Pty Ltd

18 December 2018

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Glossary and abbreviations

Abbreviation	Description
*	Denotes exotic species
BC Act	<i>Biodiversity Conservation Act 2016</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	Hectares
LGA	Local Government Area
MZ	Management Zone
VMP	Vegetation Management Plan
WLEP	Wollondilly Local Environmental Plan
WoNS	Weeds of National Significance

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1. Introduction

1.1 Description of project and purpose of Vegetation Management Plan

Ecoplanning were commissioned by ABAX Contracting Pty Ltd to prepare a Vegetation Management Plan (VMP) for vegetation within Lot 39 // DP 1215451, Major Roberts Avenue, Tahmoor, NSW, (**Figure 1.1**) on land that is proposed to be zoned E2 Environmental living. The study area is proposed to be subdivided to create 13 residential lots. Vegetation along the northern boundary of the study area will be zoned E2 Environmental Conservation and will be retained within a 30 m strip along the Myrtle Creek riparian buffer (**Figure 1.2**).

This VMP outlines management methods for managing and restoring native vegetation retained along the riparian buffer within the study area. The primary objectives of the plan are weed management, regeneration of native vegetation and planting, where required. Therefore, primary removal of weeds will be the main management focus to achieve the VMP's primary objectives, including:

- Reduce the abundance and cover of all exotic species, particularly woody weeds, which prevent the establishment and further succession of native plant species,
- Actively promote regeneration of native vegetation across all structural layers (midstorey, overstorey and grasses/groundcovers).

1.2 Previous assessment

A Flora and Fauna Assessment (Ecoplanning 2018) has been prepared for the planning proposal which has been used to inform the VMP.

1.3 Site description

The study area is approximately 280 masl, relatively flat and dropping away at the northern end of the study area towards Myrtle Creek. The vegetation in the **study area** comprises approximately 2.5 ha and contains remnant forest along Myrtle Creek, scattered trees, exotic plantings, a water detention basin, a modified drainage line entering Myrtle Creek and cleared land (**Figure 1.3**). Intact Shale Sandstone Transition Forest (SSTF) remains on the banks of Myrtle Creek which forms the northern boundary of the site. Patches of disturbed SSTF are located in the cleared areas within the study area. The VMP **subject site** is a 30 m wide strip along the northern boundary of the site adjacent to Myrtle Creek (**Figure 1.2** and **Figure 1.4**). The total area of the study area is 2.48 ha.

The remnant native vegetation constitutes a moderately intact form of SSTF (**Figure 1.3**). This community (SSTF) is listed as a Critically Endangered Ecological Community (CEEC) under the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Shale Sandstone Transition Forest (SSTF) is described by OEH (2014) as occupying the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include *Eucalyptus tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. globoidea* (White Stringybark), *E. eugenoides* (Thin-leaved Stringybark), *E. fibrosa* (Red Ironbark) and *E. crebra* (Narrow-leaved Ironbark). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland.

Within the study area the SSTF is dominated by *E. tereticornis* and *Angophora floribunda* (Rough-barked Apple) along the creek and *E. moluccana* (Grey Box) and *E. globoidea* in higher areas along the bank (Biosis 2011). Other canopy species occurring along Myrtle Creek include *E. crebra* (Narrow-leaved Ironbark) and *E. punctata* (Grey Gum) (Ecoplanning 2015a). This vegetation is in an intact condition and contains a mid-storey and ground layer dominated by native shrubs, grasses forbs and herbs (Ecoplanning 2015a).

Ecoplanning (2015a) recorded a total of 180 flora species, including 67 exotic species, within the area between Myrtle Creek and Thirlmere Way. In the riparian area along Myrtle Creek (i.e. the intact SSTF), Ecoplanning (2015a) recorded a total of 102 species, including 38 exotic species. Of the exotic species, Ecoplanning (2015a) identified eight weeds listed under the NSW Biosecurity Act 2015, seven of which are recognised as Weeds of National Significance (Table 5). The most common weeds within the riparian area along Myrtle Creek include *Ligustrum lucidum** (Large-leaved Privet), *Ligustrum sinense** (Small-leaved Privet) and *Lantana camara** (Lantana).



Figure 1.1: The study area and lot layout.



Figure 1.2: Study area and VMP subject site.



Figure 1.3: Vegetation communities within the study area and subject site

Table 1.1: Priority weeds and Weeds of National Significance (WoNS)

Common name	Scientific name	WoNS ¹	Duty under the Biosecurity Act 2015
Asparagus Fern	<i>Asparagus aethiopicus</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Bridal Creeper	<i>Asparagus asparagoides</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold (this requirement also applies to the Western Cape form of bridal creeper)
Fireweed	<i>Senecio madagascariensis</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Prickly Pear	<i>Opuntia stricta</i> *	Yes	Prohibition on dealing Must not be imported into the State or sold
Blackberry	<i>Rubus fruticosus</i> species aggregate	Yes	Prohibition on dealing Must not be imported into the State or sold (All species in the <i>Rubus fruticosus</i> species aggregate have this requirement, except for the varieties Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree)
African Olive	<i>Olea europea</i> subsp. <i>cuspidata</i>	No	Regional Recommended Measure An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.
Lantana	<i>Lantana camara</i>	Yes	Prohibition on dealing Must not be imported into the State or sold
African Boxthorn	<i>Lycium ferocissimum</i>	Yes	Prohibition on dealing Must not be imported into the State or sold

¹ <http://www.weeds.org.au/WoNS/>

A range of fauna habitat features are present in the study area (Ecoplanning 2015a) including vegetated areas of tall open forest, hollow bearing and stag trees and fallen timber including

hollow logs. Hollow bearing and stag trees are present within the subject site and provide limited roosting habitat for threatened microbats.



Figure 1.4: Vegetation along the northern boundary, within the riparian zone of Myrtle creek.

1.3.1 Site resilience

Field assessment determined that a large portion of the VMP subject site has good potential for natural regeneration to occur. Native groundcovers are likely to populate disturbed areas following the primary removal of woody and herbaceous weeds. In more degraded areas, natural regeneration may be dependent on the deposition of seed from native patches surrounding the area, as opposed to an established native seedbank. The overall aim should be to improve and consolidate resilient areas of native groundlayer species throughout the site.

Revegetation of midstorey and canopy species may be necessary across a small portion of the subject site. This can occur at relatively low densities given that establishing canopy species and areas of midstorey are already present (see **Section 2.4**). It may be necessary to plant native grasses and groundcovers in areas that show little potential for natural regeneration following primary and secondary works. Ample time should be allowed to determine the ability for areas of the site to regenerate naturally, prior to resorting to revegetation. Revegetation is scheduled mid-way through the second year of the contract, which will allow sufficient time for natural recruitment to occur following the completion of primary woody and herbaceous works at the end of year one.

2. VMP weed management and revegetation

Vegetation management works outlined below should be implemented for the subject site. Weed management should begin upon the initiation of works proposed under the DA. A suitably qualified and experienced bush regeneration contractor as per **Section 3.3** must be engaged to carry out vegetation management works.

2.1 Preliminary works

Seed collection

Given the relatively intact condition of vegetation within the subject site limited seed collection is required. It is however recommended that seed is collected from native vegetation within portions of the study area in which native vegetation is proposed for removal.

If planting is required to supplement natural regeneration (as natural regeneration is absent or slow) all plantings should be of local provenance, collected from adjacent patches of vegetation. However, nurseries that supply indigenous seedling stock (not horticultural varieties) may also be used to supplement the plantings.

Record keeping of seed collection and planting locations is to be as per the Flora Bank guidelines (Mortlock 2000), the bush regeneration contractor is responsible for recording this information. A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works outside the study area.

Fencing

Appropriate fencing should be erected around the perimeter of the subject site. Fencing is necessary during all phase of the works (during and post construction) in order to prevent unauthorised access and disturbance to vegetation. No vegetation clearing, stockpiling or equipment storage is to occur within the subject site. Fencing should establish the subject site as a 'no-go' area for people and machinery. The type of fencing utilised may vary throughout the project timeline (i.e. temporary fencing during the construction phase with more aesthetically pleasing fencing installed following the construction phase). Additionally, trunks of large trees proposed for removal may be used to delineate the margins of the subject site in addition to other fencing types.

All fencing should be regularly maintained and monitored for damage and entry points.

2.2 Weed management techniques

Weed management will be carried out using primary and secondary weed control followed by ongoing maintenance. Weed control will include mechanical removal techniques, herbicide application and natural shading techniques. Disturbance of the soil during the weed management process should be minimised at all times (Buchanan 2000, Bradley 2002). Weed control objectives and treatment techniques are outlined below (**Appendix C**) in accordance with weed type.

Primary Weed Control

Primary weed control is the initial removal of weed species. Mechanical removal techniques relevant to the weed being removed (Buchanan 2000; Bradley 2002; DPI 2015) should be used

for all woody weeds and herbaceous plants. Herbicide application, such as backpack spraying should be avoided where off target loss of native species is likely to occur.

Secondary Weed Control

Secondary weed control involves follow-up weed control to remove seedlings that have emerged after primary control and treatment of any existing plants that reshoot. Any new weed infestation areas identified must also be treated.

Maintenance

Maintenance is the long-term management of a site to prevent weeds from becoming re-established after primary and secondary work. Substantial effort should be focussed on reducing the weed seed bank, eradicating problematic weeds and supporting the growth of native vegetation. Areas of higher resilience should be the focus of intensive maintenance works, which will include fine hand weeding. A structured maintenance regime following primary and secondary work will reduce the time taken for the site to reach a reasonable level of stability.

Weed Disposal

All seeding herbaceous/grass material and tubers should be bagged, removed from site and disposed of at an appropriate green waste facility. Woody weeds, such as *Ligustrum lucidum* and *Ligustrum sinense*, can be neatly piled in small quantities as fauna habitat. However, some woody weed material should be removed offsite, given the relatively small size of the site.

2.3 Vegetation Management Zones

The VMP subject site has been classified as two management zones (MZ); the intact woodland (MZ1) and small areas of adjacent cleared grassland (MZ2; **Figure 2.1**).

2.3.1 Management Zone 1 – Intact woodland

This zone (MZ1) encompasses the vast majority of the subject site (0.75 ha and 91% of the subject site) and the most intact vegetation. The dominant weed issues in the subject site are woody weeds, including *Ligustrum lucidum*, *Ligustrum sinense*, *Lantana camara* and *Rubus fruticosus* (Blackberry), where they have become established in the midstorey, and are currently inhibiting the germination and establishment of native species. Treatment of woody weeds will be achieved by cut and painting the stems at ground level with neat Roundup Biactive®. Smaller individuals should be hand removed, only if minimal soil disturbance will occur.

Herbaceous weeds and grasses occur through the site in moderate densities. In most instances, these species occur at manageable levels. However, for species that occur extensively through the site, substantial effort should be focussed on the removing these species by hand weeding. The removal of herbaceous weeds should be conducted prior to seeding where possible, with all material bagged and removed from site.

2.3.2 Management Zone 2 – Cleared grassland

This MZ includes narrow strips of cleared land along the southern boundary of the subject site. This zone includes areas previously cleared and with a moderate to high cover of exotic understorey species (**Figure 2.1**). While this zone currently supports a high cover of exotic species, the proximity to areas of intact woodland will provide a source for native seed and natural regeneration is expected to occur across this zone following a reduction in exotic cover.



Figure 2.1: Management zones within the study area.

2.4 Revegetation

Revegetation of native midstorey and species may be necessary in MZ2 once ample time has been allowed to determine site resilience. A small amount of grasses and groundcovers should also be installed, depending on the response of restoration work. This management zone has not been divided into revegetation zone, given its small size and the relative homogeneity of resilience across the site.

Staging and logic

Native midstorey and understorey species will be planted within MZ2 (if required) following the completion of primary works, whilst allowing ample time to determine whether natural recruitment is likely. No canopy planting is proposed given that this management zone occurs in proximity to existing native canopy cover and regeneration from this layer is anticipated. All primary work on woody weeds will have been completed by the end of the first year of the contract. Revegetation will be conducted approximately 6 months – one year after the completion of primary woody weed works. This will allow enough time to determine where revegetation will need to occur at lower or higher densities, given the recruitment of native midstorey and canopy species. Supplementary revegetation should be conducted if more than 10% attenuation occurs and will be conducted one year after the initial planting.

Planting densities and species

Plantings will be installed at a density resembling the vegetation community SSTF in an 'unmodified' condition. Planting densities should achieve quick vegetative cover. The native species used for revegetation should be consistent with the planting palette provided (**Appendix B**), with the aim of reconstructing the floristics of the site to be representative of SSTF. Planting densities have been determined based on site condition:

- 1 shrub species per 10 m²
- 1 groundcover (grass, fern, forb or sedge) per 1 m²

The planting densities above are based on site resilience and are an estimate of plants required to achieve a cover representative of SSTF. Field assessment determined the subject site to have a moderate resilience, therefore, a reasonable capacity for native species to recruit following primary works. Should native midstorey and canopy species recruit extensively through the site the densities listed above can be altered to reflect a desirable number of plants for revegetation.

Table 2.1. Planting density table for revegetation works.

Zone	Area (ha)	No. of plants			Zone total
		Ground	Shrub	Canopy	
2	0.07	700	70	0	770

G = groundcover, S = shrubs and C= canopy.

Equipment, installation and timing

Plantings should be planned for late winter leading up to spring when regular rainfall is naturally occurring and growth conditions are ideal. Planting of tube-stock (shrub species) and Hiko or Viro cells (grasses and other groundcover species) will be favoured over broad scale seed application, such as direct seeding or brush matting.

A water retaining and fertilising product (e.g. Terraform™) should be applied to each hole, to assist in the establishment of the plants. Each plant should be sufficiently watered on the same

day as installation and regular watering should continue in lieu of rainfall for a period of 6 weeks, or until plantings have taken.

Mulch and re-use of logs

Mulch generated from the removal of native trees associated with the development can be used in restoration works on site, where appropriate. Similarly, logs and coarse woody debris from the development area can be used to enhance habitat in MZ1.

2.5 Concurrent works

When vegetation management works in MZ1 are to be carried out concurrently with civil construction works, planning between the bush regeneration contractor and civil works supervisor must be undertaken.

The civil works team will install environmental management controls across the site including exclusion zone fencing and erosion and sediment control. It is the responsibility of the bush regeneration contractor not to damage these controls and if any damage is observed or inadvertently caused it must be notified to the civil works supervisor immediately.

2.6 Maintenance

The maintenance phase must continue for three years in MZ1, following an initial year of primary and secondary works. Regular inspections of site condition will be conducted, including general site monitoring for potential new infestation areas and subsequent weed control of any identified weed species. Inspections and site monitoring must occur bimonthly in the first year, then quarterly thereafter. This schedule could be revised depending on performance criteria recorded.

Weed maintenance works will include:

- Removal of all exotic species prior to establishment and seeding.

Re-vegetation maintenance works will include:

- Replacement of poorly growing or diseased individuals consistent with the prescribed planting
- Management of insect damage, if necessary
- Watering during dry periods
- Augmenting past planting areas where attenuation has occurred.

2.7 Cost of implementation

The costing for the VMP has been calculated over a three-year period and is estimated at a total of \$20,745 (**Table 2.2**), including the cost of reporting following each treatment and annually. This figure reflects a first year cost of \$7,890, second year costs of \$7,165 and third year costs of \$5,690. The costs have been calculated based on the employment of trained bush regenerators at a rate of \$400 pp/day (\$50 pp/hr for an 8 hour working day), which covers crew and supervisor wages, equipment, herbicides, and all other associated business costs.

The costing indicates how many crew members are required to attend bimonthly in the first year then quarterly visits over the three year contract, based on the size of the site, extent of weed infestation and expected timeframes for the completion of primary, secondary works and initiation of maintenance works. The costs are indicative of commercial bush regeneration

charge out rates, and some variation is expected depending on the bush regeneration company used and their associated charge out rates.

Plantings

The cost of revegetation is a reasonable onsite expense, which is incurred in the second year of the contract. Additional plantings may be required to augment previous plantings if some are lost to natural attenuation. The cost of revegetation was based on \$2.50 per plant, including purchasing and installation costs (see **Section 3.7b**). Supplementary plantings have been calculated based on a 10% attenuation rate from original installation numbers.

Table 2.2: Cost of VMP implementation over the three year contract period.

Timing	Task	Cost (ex GST)
Year 1	<u>Primary and secondary weed control</u> based on the cost of employing a team of 2 bush regenerators at \$480 (\$60 per hour for 8 hours) pp/day to attend site bimonthly.	\$5,760
Initiation of contact	Install fencing along the perimeter of the VMP subject site.	\$500
	Year 1 total	\$6,260*
Year 2	<u>Maintenance weed control</u> throughout based on the cost of employing a team of 2 bush regenerators at \$480 (\$60 per hour for 8 hours) pp/day quarterly.	\$3,840
Mid-way through year 2	Revegetation of the site with 770 plants (see Table 2.1 . Planting density table for revegetation works.) at \$2.50 per plant.	\$1,925
	Year 2 total	\$8,355*
Year 3	<u>Final year of maintenance weed control</u> based on the cost of employing a team of 2 bush regenerators at \$480 pp/day on a quarterly basis.	\$3,840
Mid-way through year 2	Revegetation of the site based on a ~10% attenuation of the initial plantings (~180 plants) at \$2.50 per plant.	\$450
	Year 3 total	\$4,290*
Bimonthly/ quarterly	Cost of reporting over the 3 year contract period. Report should consist of a one - two page report detailing the works conducted onsite (\$100 per treatment).	1,400
Annually	Annual report detailing all works conducted onsite, weed treatment methods, planting success and failures etc. (\$1,000 annually)	3,000
	Reporting costs total	\$4,400
Grand Total		\$20,745

* does not include reporting costs

3. Performance criteria and monitoring

3.1 Performance criteria

The progress and compliance with the VMP will be monitored and reviewed annually. This process will involve the bush regeneration contractor and land manager. The performance criteria listed in **Table 3.1** below are considered to be best practice and are not linked with any specific legislation. The bush regeneration contractor, in consultation with Wollondilly Shire Council, can adapt these criteria as required in response to the success of restoration works. Based on the success of the management works, further performance criteria may need to be developed for the maintenance phase.

Performance monitoring will also be conducted using two photo points in MZ1.

Table 3.1. Revegetation performance monitoring criteria.

Treatment Zones	Year 1	Year 2	Year 3
MZ1	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation.		
	A demonstrated decrease in exotic species cover and diversity by the end of the 3 rd year.		
	A visible improvement of soil stability along the riparian zone.		
	A 50% reduction in herbaceous weeds and exotic grass cover.	A 50-70% reduction in herbaceous weeds and exotic grass cover.	Herbaceous weeds and exotic grass cover maintained at <5% cover.
	A 95% reduction in woody weed cover.	Woody weeds retained at low levels (<5% cover).	No individuals >10cm remaining and maintained at <5% cover by end of year 3
MZ2	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation.		
	A demonstrated increase in native cover and diversity and a demonstrated decrease in exotic species cover and diversity by the end of the 3 rd year.		
	A minimum of 90% survival rate of all revegetation.		
	A 30% reduction in herbaceous weeds and exotic grass cover.	A 30-50% reduction in herbaceous weeds and exotic grass cover.	Herbaceous weeds and exotic grass cover maintained at <10% cover.

3.2 Monitoring reports

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. The objective of the monitoring and reporting program is to record changes to the vegetation as a result of vegetation management works. Monitoring works will require liaison with the land manager, the bush regeneration contractor and Wollondilly Shire Council.

Monitoring and reporting must be documented and compiled into an annual report to determine the effectiveness of the works undertaken. Site conditions should be recorded on the work plan template at the beginning and end of on-ground works. This data should be included in the annual report. Monitoring photo points should be established at two permanent reference points.

An example report is detailed in **Table 3.2**, the report should include:

- Works carried out, including weed species targeted and their location
- An approximation of the time spent on each task
- Any observations, such as the occurrence of new weed species
- Rates of regeneration of native species
- A description of any problems encountered and how they were overcome
- A summary of how the site-specific objectives have been met (or not)
- Herbicide and other chemicals used, including quantity, dilution rate and other relevant information
- Weed control mechanisms used during the period
- Climatic conditions which may have influenced weed germination and growth
- Performance criteria and success; and
- If required, maps of weed distribution and density.

3.3 Bush regeneration contractors

Suitably qualified and experienced bush regeneration contractors that are members of the Australian Association of Bush Regenerators or fulfil the membership criteria must undertake all vegetation management works. In addition to this, team leaders should hold a Certificate IV in Conservation & Land Management or possess equivalent field experience (3 years) and certification. The contractor should carry out best practice bush regeneration techniques as described by Buchanan (2009).

Table 3.2. Example monitoring report template.

Date			
Name of Contractor:			
Hours worked on site since last monitoring report:			
Site Condition:	Zone		
	Weed cover %		
	Seedling survival %		
	Planting numbers		
	Herbicide used (in Litres)		
	Other		
Describe relevant weed management techniques:			
Describe problems; e.g. weed invasions, damage to planted material, etc.:			
Photographic evidence:			
Planned work before next monitoring report:			

4. References

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- Standards Australia (2009). Australian Standard: protection of trees on development sites, AS 4970 – 2009, Standards Australia, Sydney.

Appendix A: Flora inventory

Family	Species	Common name	Native/ Exotic
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	native
Acanthaceae	<i>Pseuderanthemum variabile</i>		native
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair	native
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joy weed	native
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort	native
Apocynaceae	<i>Araujia sericifera</i>	Moth Vine	exotic
Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	exotic
Asparagaceae	<i>Asparagus asparagoides</i>	Bridal Creeper	exotic
Asteraceae	<i>Ageratina adenophora</i>	Crofton Weed	exotic
Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	exotic
Asteraceae	<i>Cirsium vulgare</i>	Thistle	exotic
Asteraceae	<i>Conyza sp.</i>	Fleabane	exotic
Asteraceae	<i>Hypochaeris radicata</i>	Cat sear	exotic
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood	native
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	exotic
Asteraceae	<i>Taraxacum officinale</i>	Dandelion	exotic
Caprifoliaceae	<i>Lonicera japonica</i>	Japanese Honeysuckle	exotic
Caryophyllaceae	<i>Cerastium glomeratum</i>	Mouse-ear Chickweed	exotic
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed	exotic
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	native
Clusiaceae	<i>Hypericum gramineum</i>	Small St. John's Wort	native
Clusiaceae	<i>Hypericum perforatum</i>	St. John's Wort	exotic
Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew	native
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	native
Cyperaceae	<i>Carex appressa</i>		native
Cyperaceae	<i>Carex inversa</i>		native
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	native
Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella Sedge	exotic
Cyperaceae	<i>Gahnia sieberiana</i>	Sword Sedge	native
Cyperaceae	<i>Lepidosperma laterale</i>		native
Ericaceae	<i>Lissanthe strigosa subsp. strigosa</i>		native
Fabaceae - Faboideae	<i>Desmodium varians</i>	Slender Tick-trefoil	native
Fabaceae - Faboideae	<i>Glycine clandestina</i>	Glycine	native
Fabaceae - Faboideae	<i>Glycine tabacina</i>	Glycine	native

Family	Species	Common name	Native/ Exotic
Fabaceae - Mimosoideae	<i>Acacia binervata</i>	Two-veined Hickory	native
Fabaceae - Mimosoideae	<i>Acacia decurrens</i>	Black Wattle	native
Fabaceae - Mimosoideae	<i>Acacia floribunda</i>		native
Fabaceae - Mimosoideae	<i>Acacia implexa</i>	Hickory	native
Gentianaceae	<i>Centaurium tenuiflorum</i>		exotic
Geraniaceae	<i>Geranium solanderi</i> subsp. <i>solanderi</i>	Native Geranium	native
Juncaceae	<i>Juncus usitatus</i>		native
Lamiaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	native
Lamiaceae	<i>Mentha</i> sp.		native
Lobeliaceae	<i>Pratia purpurascens</i>		native
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush	native
Lomandraceae	<i>Lomandra longifolia</i>		native
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry	native
Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow	exotic
Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	exotic
Myrsinaceae	<i>Anagallis arvensis</i>	Scarlet Pimpernel	exotic
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	native
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum	native
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum	native
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	native
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	native
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	native
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush	native
Myrtaceae	<i>Melaleuca styphelioides</i>		native
Nephrolepidaceae	<i>Nephrolepis cordifolia</i>	Fishbone Fern	native
Oleaceae	<i>Ligustrum lucidum</i>	Large-leaved Privet	exotic
Oleaceae	<i>Ligustrum sinense</i>	Small Leaved Privet	exotic
Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	exotic
Oxalidaceae	<i>Oxalis perennans</i>		native
Phormiaceae	<i>Stypandra glauca</i>		native
Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Boxthorn	native
Pittosporaceae	<i>Pittosporum undulatum</i>		native
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongue	exotic
Plantaginaceae	<i>Plantago</i> sp.		native
Poaceae	<i>Anisopogon avenaceus</i>	Oat Spear grass	native

Family	Species	Common name	Native/ Exotic
Poaceae	<i>Aristida vagans</i>	Three awn Spear grass	native
Poaceae	<i>Axonopus fissifolius</i>	Narrow-leafed Carpet Grass	exotic
Poaceae	<i>Bromus catharticus</i>	Rescue Grass	exotic
Poaceae	<i>Cynodon dactylon</i>	Couch	native
Poaceae	<i>Echinopogon caespitosus</i> subsp. <i>caespitosus</i>	Bushy Hedgehog Grass	native
Poaceae	<i>Ehrharta erecta</i>	Panic Veldt grass	exotic
Poaceae	<i>Entolasia stricta</i>		native
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	native
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	Baldy Grass	native
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	native
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass	native
Poaceae	<i>Paspalum dilatatum</i>	Paspalum	exotic
Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu	exotic
Poaceae	<i>Rytidosperma</i> sp.	Wallaby Grass	native
Poaceae	<i>Setaria parviflora</i>	Slender Pigeon Grass	exotic
Poaceae	<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass	native
Poaceae	<i>Themeda australis</i>	Kangaroo Grass	native
Pteridaceae	<i>Cheilanthes sieberi</i>	Rock Fern	native
Pteridaceae	<i>Pteridium esculentum</i>	Bracken Fern	native
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard	native
Rosaceae	<i>Rubus fruticosus</i>	Blackberry	exotic
Scrophulariaceae	<i>Veronica plebeia</i>	Trailing Speedwell	native
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	exotic
Solanaceae	<i>Solanum nigrum</i>	Blackberry Nightshade	exotic
Solanaceae	<i>Solanum linnaeanum</i>	Apple of Sodom	exotic
Solanaceae	<i>Solanum prinophyllum</i>	Forest Nightshade	native
Solanaceae	<i>Solanum pseudocapsicum</i>		exotic
Ulmaceae	<i>Trema tomentosa</i> var. <i>viridis</i>		native
Urticaceae	<i>Urtica dioica</i>	Stinging Nettle	exotic
Verbenaceae	<i>Lantana camara</i>	Lantana	exotic
Verbenaceae	<i>Verbena bonariensis</i>	Purple top	exotic
Verbenaceae	<i>Verbena rigida</i>		exotic
Violaceae	<i>Viola betonicifolia</i>	Arrowhead Violet	native

Appendix B: Planting palette

Planting palette for the vegetation community Shale Sandstone Transition Forest is derived from the NSW Scientific Determination and Ecoplanning (2018).

Scientific Name	Common Name
Tree	
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
<i>Eucalyptus fibrosa</i>	Broad-leaved Ironbark
<i>Eucalyptus eugenioides</i>	Narrow-leaved Stringybark
<i>Eucalyptus globoidea</i>	Brown Stringybark
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus tereticornis</i>	Forest Reg Gum
<i>Syncarpia glomulifera</i>	Turpentine
Small Tree	
<i>Acacia decurrens</i>	Black Wattle
<i>Acacia implexa</i>	Hickory wattle
<i>Acacia parramattensis</i>	Sydney Green Wattle
<i>Allocasuarina littoralis</i>	Black She-oak
<i>Allocasuarina torulosa</i>	Forest Oak
<i>Angophora bakeri</i>	Narrow-leaved Apple
<i>Exocarpos cupressiformis</i>	Cherry Ballart
Shrub	
<i>Acacia falcata</i>	Hickory wattle
<i>Breynia oblongifolia</i>	Coffee Bush
<i>Bursaria spinosa</i>	Blackthorn
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea
<i>Dodonaea triquetra</i>	Hopbush
<i>Jacksonia scoparia</i>	Winged Broom-pea
<i>Kunzea ambigua</i>	Tickbush
<i>Leucopogon juniperinus</i>	Prickly Beard-heath
<i>Lissanthe strigosa</i>	Peach Heath
<i>Notelaea longifolia f. longifolia</i>	Mock Olive
<i>Olearia microphylla</i>	
<i>Ozothamnus diosmifolius</i>	Rice Flower
<i>Persoonia linearis</i>	Narrow-leaved Geebung
Grasses	
<i>Aristida vagans</i>	Threeawn Speargrass
<i>Austrostipa pubescens</i>	
<i>Cymbopogon refractus</i>	Barbed wire grass
<i>Dichelachne micrantha</i>	Shorthair Plumegrass

Scientific Name	Common Name
<i>Digitaria parviflora</i>	Small-flowered Finger Grass
<i>Digitaria ramularis</i>	
<i>Echinopogon caespitosus</i>	Hedgehog Grass
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass
<i>Entolasia marginata</i>	Bordered Panic
<i>Entolasia stricta</i>	Wiry Panic
<i>Eragrostis brownii</i>	Brown's Lovegrass
<i>Eragrostis leptostachya</i>	Paddock Lovegrass
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Panicum simile</i>	Two-colour Panic
<i>Paspalidium distans</i>	
<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock
<i>Rytidosperma fulvum</i>	
<i>Themeda triandra</i>	Kangaroo Grass
Fern	
<i>Cheilanthes sieberi</i>	Poison rock fern
Climber	
<i>Billardiera scandens</i>	Hairy Apple Berry
<i>Cassytha glabella</i>	
<i>Glycine clandestina</i>	
<i>Glycine microphyllus</i>	Small-leaf glycine
<i>Glycine tabacina</i>	
<i>Hardenbergia violacea</i>	Purple Coral Pea
Other	
<i>Arthropodium milleflorum</i>	Pale Vanilla-lily
<i>Astroloma humifusum</i>	Native Cranberry
<i>Bossiaea prostrata</i>	
<i>Brunoniella australis</i>	Blue Trumpet
<i>Brunoniella pumilio</i>	Dwarf Brunoniella
<i>Calotis dentex</i>	
<i>Desmodium varians</i>	Slender Tick-trefoil
<i>Dianella caerulea</i>	Blue Flax-lily
<i>Dianella revoluta</i> var. <i>revoluta</i>	
<i>Dichondra repens</i>	Kidney Weed
<i>Gahnia aspera</i>	Rough Saw-sedge
<i>Gonocarpus tetragynus</i>	
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Ivy Goodenia
<i>Hibbertia aspera</i> subsp. <i>aspera</i>	Rough Guinea Flower
<i>Hibbertia diffusa</i>	Wedge Guinea Flower
<i>Lagenophora gracilis</i>	Slender Lagenophora
<i>Laxmannia gracilis</i>	Slender Wire Lily

Scientific Name	Common Name
<i>Lepidosperma laterale</i>	
<i>Lomandra confertifolia</i> subsp. <i>rubiginosa</i>	
<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	
<i>Lomandra longifolia</i>	Spiny-headed mat-rush
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
<i>Opercularia diphylla</i>	
<i>Phyllanthus hirtellus</i>	Thyme Spurge
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	Slender Rice-flower
<i>Pomax umbellata</i>	
<i>Poranthera microphylla</i>	
<i>Pratia purpurascens</i>	Whiteroot
<i>Solanum prinophyllum</i>	Forest Nightshade
<i>Solanum pungetium</i>	Eastern Nightshade
<i>Stypantra glauca</i>	Nodding Blue Lily
<i>Vernonia cinerea</i> var. <i>cinerea</i>	
<i>Veronica plebeia</i>	Trailing Speedwell

Appendix C: Weed treatment methods

Zone	Objective	Main Weeds	Method	Key Performance Indicators (KPI)
All	<ul style="list-style-type: none"> Control and suppress exotic grass species and herbaceous weeds. 	<ul style="list-style-type: none"> <i>Cirsium vulgare</i>, <i>Tradescantia fluminensis</i>, <i>Hypochaeris radicata</i>, <i>Taraxacum officinale</i>, <i>Cerastium glomeratum</i>, <i>Modiola caroliniana</i>, <i>Plantago lanceolata</i>, <i>Solanum nigrum</i>, <i>Bromus catharticus</i>, <i>Cenchrus clandestinus</i>, <i>Ehrharta erecta</i>, <i>Paspalum dilatatum</i>, 	<ul style="list-style-type: none"> Primary and secondary treatment of herbaceous weeds and exotic grasses will occur in the first year of the contract. This will be achieved by hand weeding, as spraying will not be possible across most of the site without resulting in off target damage to native groundcover and grass species. Established tall herbaceous weeds with a woody habit, should be cut and painted with neat Roundup Biactive®. Herbaceous weeds will be treated prior to seeding, bagged, removed from site and disposed at a licensed green waste facility. Maintenance works will consist of detailed hand weeding amongst developing patches of native groundcovers and grasses, with the aim of consolidating these patches. Areas of high resilience should initially be the focus of detailed maintenance work, followed by more degraded areas of the site. <i>Ehrharta erecta</i> occurs in relatively low abundance and should be targeted during the maintenance phase. <i>Cynodon dactylon</i> should be sprayed where off target damage to native species is unlikely (i.e. along the northern boundary of the site). 	<ul style="list-style-type: none"> A 50% reduction in cover by the end of year one. A 50-70% reduction by end of year two. Herbaceous weeds and exotic grass cover maintained at <5% cover

Zone	Objective	Main Weeds	Method	Key Performance Indicators (KPI)
	<ul style="list-style-type: none"> Treatment of all woody weeds. 	<ul style="list-style-type: none"> <i>Ligustrum lucidum</i>, <i>Ligustrum sinense</i>, <i>Lantana camara</i>. 	<ul style="list-style-type: none"> Primary and secondary woody weed removal will be conducted in the first year of the contract. Scattered woody weeds with a low abundance will receive primary treatment within the first 3 months of the contract. Woody weeds will be targeted on a bimonthly basis in the first year and systematically removed from the site. Treatment methods include hand removal, or cut and painting with neat Roundup Biactive®. A majority of the woody weed piles should be removed from site and taken to a licensed green waste facility. Maintenance woody work will consist of sweeps through the VMP subject site to prevent woody weeds from becoming re-established. Maintenance work should be conducted regularly, with a focus on removing woody weeds before reaching >50 cm, or prior to seeding. 	<ul style="list-style-type: none"> A 95% reduction in woody weed cover by the end of year one. Woody weeds maintained at <5% cover by end of year 2. No individuals >10cm remaining and maintained at <5% cover by end of year 3.