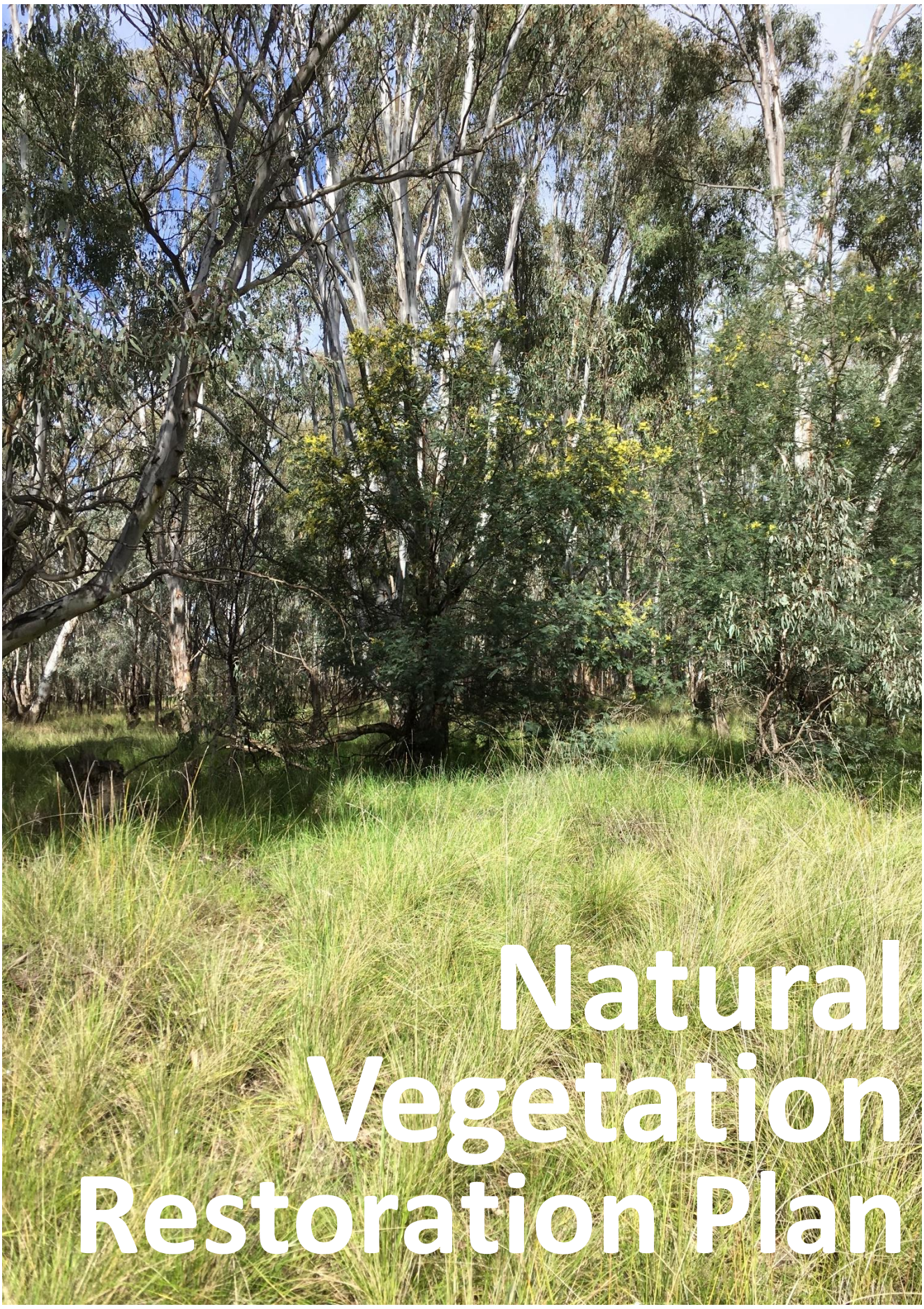

Natural Vegetation Restoration Plan

Guidelines for the restoration and care of the bushland for

Friends of the Australian Botanic Gardens Shepparton

For the Friends of the Australian Botanic Gardens Shepparton, June 2018

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Contents

1. Bushland Restoration Principles

1.1 Why do we have to do anything?

Australia has an exceptionally diverse and unique biota because of its long uninterrupted and isolated evolutionary development.

Unfortunately, following British possession and settlement, our bushland has also undergone rapid degradation, especially in agricultural, urban and riparian environments. Human-induced climate-change now imposes additional stresses making it even harder for habitat recovery to occur.

Deliberate interventions to reverse the damage of the past are now required to repair bushland and restore its ecological functions.

Healthy ecological processes underpin our survival. Ecological restoration therefore is an ethical imperative. It can preserve our environmental history and provide the essential basis for a healthy future for our community.

1.2 How do we know what to do?

There are several broad approaches to understanding what the vegetation used to be like before it became degraded and what might be done to restore it to a state more like its original condition.

1.2.1 Ask what physical attributes have changed since British settlement. Then, aim to reverse them or to compensate for those changes that can't be reversed.

Useful sources of information about our landscape prior to white settlement include early drawings and diary entries, recollections of pioneers and more recent recollections. Bill Gammage's *The Greatest Estate on Earth* (2012) contains a wealth of early descriptions and images of Australian vegetation prior to its transformation by settlers.

Aboriginal fishing camp on the River Murray near Lake Moira

Samuel Calvert
1872

In 1836, after crossing the Goulburn River south of Shepparton and heading eastwards, Major Thomas Mitchell noted how open the forest was.

The forest country traversed by the party this day (Arcadia district) *was in general grassy and good and, as it was open enough to afford a prospect of about a mile around us, we travelled on in a straight line with unwonted ease and facility.*

Goulburn River near Shepparton Eugene von Guerard 1865. Courtesy State Library of Victoria

Edward Curr (1883), a pastoral pioneer of the country to the west of the Goulburn River in the 1840s remarked upon

"... some changes which have occurred with the flora and fauna ...

... the grass originally grew in large tussocks standing from two to twenty feet apart according to circumstances ...

The most nutritious grasses were originally the most common ... stocking has almost entirely destroyed it. ...

The blackfellow was constantly setting fire to the grass and trees ... he tilled his land and cultivated his pastures with fire ... [causing the] ... remarkable absence of mould... bountiful growth from the comparative unproductiveness of our soils [and] the retention within bounds of insect life... "

One can glean from the many such records that:

Woodland trees were once very large and widely spaced with only sparse undergrowth.

> There are few old trees at ABGS, most trees are young, close together and appear stressed. This suggests it might be useful to protect old trees and thin out young trees to reduce competition for moisture and increase their growth.

Natural ground layer vegetation once had widely spaced grass tussocks with the inter-tussock spaces filled with diverse herbs and lilies (p1 in McIntyre, McIvor & Heard, 2002).

> At ABGS there is a quite low diversity in the ground layer. Palatable species have been destroyed by stock grazing. To increase diversity, remove weeds, stimulate germination of soil-stored seed, reduce herbivory and reintroduce species if appropriate.

Temperate grassy woodlands in south-eastern Australia were once dominated by tall summer-growing grasses.

> They have generally been destroyed by stock grazing and replaced by shorter winter-growing grasses (Lunt 2002). Restore indigenous summer-growing grasses (Prober & Lunt 2009).

There were no weeds before stock were introduced and, by many accounts, few insect pests (eg. pp 181-3 in Gammage 2012).

> There are many weed and insect pests at ABGS. We should remove weeds as far as possible. Weeds can change soil nutrient cycling. Weeds are often also habitat for introduced insects. Restore habitat for native insect *predators.*

Medium-sized mammals dug and burrowed. Kangaroos were controlled by aboriginal hunting and dingo predation.

> At ABGS medium-sized mammals and predators are extinct. Macropods are uncontrolled. Feral hares and rabbits target palatable plants. Feral cats and foxes prey on reptiles and small birds. We should try to control rabbits, hares, kangaroos, foxes and cats.

Aborigines farmed their land with fire. Fire was used to remove unwanted trees and shrubs, rejuvenate palatable grasses and herbs, increase soil fertility, stimulate seed germination, control insects, protect trees from wildfire, and for a myriad of other land management purposes.

> The ABGS has not been burnt for a very long time. Unfortunately, we are not able to use fire for restoration and management purposes at ABGS.

By local account (Ray Watt, pers. comm), ***even in recent times, floods were previously more regular, often deeper than now and slower to rise and to fall.***

> Because of river regulation, extraction and other changes to the catchment, floods are now less frequent, and often arrive rapidly and depart rapidly. We should explore ways to retain flood water on site for longer if possible. We can reduce competition for moisture by removing some of the young trees.

Our climate has changed. Predictions suggest it will continue to become hotter, rainfall will decline even more over winter and spring and there will be more frequent and more violent summer storms.

We can increase the resilience of vegetation to a more extreme climate by improving its health. Healthier trees have more foliage which creates more shade which creates cooler conditions at ground level. We can also retain Grey Box in preference to River Red Gum saplings as they are likely to be more tolerant of moisture stress than River Red Gums and we can increase populations of summer-growing (C4) grasses such as Kangaroo Grass and Warrego Summer-grass which can utilise summer rain.

More changes will become apparent with further research and appropriate responses, like those above, can be devised.

1.2.2 Find local examples of similar vegetation in better condition and search historical plant records.
Then, infer what features have been lost that could be replaced.

Nearby bushland can often provide clues as to what similar vegetation in better condition might look like.

For example***, Boulevard Park*** in north Shepparton has similar Riverine Grassy Woodland but has extensive areas of Kangaroo Grass with Yellow Grass-lilies in its better-drained areas. ABGS has only two Kangaroo Grass plants and one Yellow Grass-lily plant. We know that both species are knocked out by heavy grazing so we can infer that probably both were once at least as common in similar areas at ABGS.

In the Goulburn Valley, the best remaining areas of bushland such as ***Katamatite Bushland Reserve, Numurkah Rifle Range, Murchison East Golf Course*** have around 100 different plant species in the ground layer of just one or two vegetation types. At ABGS we have so far found only 65 across all five of the vegetation types. This suggests ABGS retains less than two thirds of the original plant species and that we need to consider what species are missing that might have been present in the past.

The Victorian Biodiversity Atlas and other databases contain records of species that have been found in similar habitat nearby. For example, there are records of **Floodplain Violet** (*Viola betonicifolia* ssp*. nova-guinensis*) and **Small Scurf-pea** (*Cullen parvum*) scattered through similar Riverine Grassy Woodland along the Goulburn River at Shepparton and Toolamba - although when I searched for them in 2017 many of these previously recorded plants could no longer be found. There are likely to be records in the VBA of other species now gone that might have once grown here. I remember finding **Pale Everlasting** (*Coronidium gunnianum*) growing on an island in the Seven Creeks at Archer Road more than 20 years ago. Missing plants, if local sources can be found, could be added to the vegetation at ABGS.

Before we start adding species to the ABGS bushland, however, we should thoroughly understand what plants are present. To date, we have only looked at the site during two of the driest springs in recent times. There are likely to be dormant underground parts and seed of additional species. We can encourage the germination and growth of these by removing weeds, by stimulating germination and by protecting seedlings from herbivores. Diversity will naturally improve over time as vegetation recovers from stock grazing (which ceased only seven years ago) and with more wet seasons, so long as the gains can be maintained.

1.2.3 Traditional management, traditional knowledge

For many thousands of years aborigines have manipulated vegetation in Australia using fire to produce a mosaic of different structural types, floristic compositions and ages to maximise the diversity of resources available to them (Latz 1995, Gammage 2012).

The grassy woodlands around Shepparton were also managed in this way but have been neglected since white settlement.

There has been a revival of interest in using traditional burning to restore degraded bushland, with many indications of success (for example McIntyre *et al* 2002, Prober *et al* 2005, Williams *et al* 2015, Stol & Prober 2015, Glen Johnson DELWP, pers. comm.).

We are fortunate that local indigenous people still have some knowledge of what the bush used to be like around Shepparton and how their old people used and managed the land. We would also benefit by inviting them to give direction to our management activities.

Unfortunately, because the nearby "Honeysuckle Rise" is a capped land-fill, we are proscribed from using any type of fire as a vegetation management tool due to the risk of methane ignition.

1.3 Some general rules of thumb for successful restoration

- We should not destroy any more bush as it can't be re-created. At ABGS this means:
  NO more paths or structures,
  NO non-indigenous plantings,
  NO introduction of soil,
  NO modifications such as mowing and
  NO use of vehicles off-track in bushland areas.
- Our approach should be to get to know our bush and learn from it rather than to impose ideas on it.
- It is most effective and efficient restore the health of the best condition areas first, then expand our efforts.
  (Kaluna Park on the King River in Wangaratta is a successful example of this approach. See Curtis & Curtis 2008).
- Slow and subtle interventions can be more powerful than quick brutal ones.
- Minimise the damage when weeding as weeds will colonise damaged ground before natives can.
- Avoid herbicide overspray as it will kill the soil's algal crust - making it easier for weeds to germinate and harder for natives.
- All actions should be able to be justified.
- Trial small areas first.
- Record actions, monitor responses and adapt future actions accordingly.
- Ultimately extend improved management to bushland on adjacent properties, as this will have a positive impact on the ecological function of the bush at ABGS.
- Work with others to educate the broader community. Bushland restoration has become an increasingly necessary part of nature conservation. The more knowledgeable people there are, the better chance we have to save what's left.

2. Restoration Program

2.1 Setting Priorities for action

Where do we start?

The ABGS Natural Vegetation Survey (2017) identified five Ecological Vegetation Classes. The vegetation was also classified according to one of six condition categories. (See Map 1 and Map 2 in that document).

The highest value vegetation, that is, vegetation in near natural condition - Condition 1 - and the EVCs of highest conservation value in the Goulburn-Broken catchment - Plains Woodland (which is Endangered) - must set the priorities for restoration work.

We should also make the area in best condition of every EVC a high priority (even if it is Condition 2 or 3), so that we retain the opportunity to create good examples of all five EVCs at the ABGS.

As explained in The ABGS Natural Vegetation Survey, it also makes sense to start on the better-quality areas because less effort will be required to create relatively stable vegetation and because these areas will become the source of seed and plant material for introduction into poorer condition areas.

Map 1: Management Zones in this document combines these values to show First, Second and Third priorities for restoration activities in the ABGS bushland.

2.2 Defining Goals, Targets, Indicators

We also need to decide what ecological characteristics we are trying to restore and to what degree.

2.2.1 Goals and Targets

Our broad goal is to improve the condition of the current vegetation, to move the current condition towards what we think existed before it was cleared and degraded by European land management (Condition 0). This process will require a profound understanding of ecological processes, considerable resources and a very long time.

A potentially achievable target is to attempt to improve the quality of the vegetation by just one or two Condition Classes. This doesn't preclude future action to lift vegetation into an even higher class in the future as knowledge, resources and time allow.

I have recommended suitable targets in the following table. Some Condition 3 areas will be easier to move to Condition 1 than some Condition 2 areas. Condition 0 is potentially achievable in Condition 1 areas of Riverine Grassy Woodland and Riverine Swampy Woodland because the work required is not too complex. I have not nominated Condition 0 as a target for Sedgey Riverine Forest or Floodway Pond Herbland, however, as flooding regimes have fundamentally changed and weeds will invade the site every time flooding does occur.

2.2.2 Indicators

Using historical information, reference ecosystems and benchmark EVCs, measurable indicators can be devised to identify the restoration works required and to assess progress towards targets.

Benchmarks for EVCs are a concept created for comparison in assessing the quality of natural vegetation. They are the "average characteristics of a mature and long-undisturbed example of the same vegetation type" BUT they are generated from measurements of existing vegetation (DSE 2004). They contain some useful measurements to use for restoration targets, however major shortcomings are:

- tree diameters are generally far too small at 0.9m diameter at breast height (mature River Red Gums are typically considerably more than 2m dbh),
- species lists include weeds and
- there are no estimates of species richness (the number of different species).

The DSE benchmarks for the ABGS EVCs are set out below. Potential reference communities are included for each. These can be investigated when more detailed information is required.

2.2.2.1 Plains Woodland (EVC 55)

Plains Woodland occurs on medium to heavy soils of the plains that are not normally flooded. It forms an open woodland (about 15 trees per hectare) dominated by Grey Box (15m tall 0.7m diameter at breast height) with scattered Buloke. The ground layer is grassy and herb-rich with scattered shrubs and fallen timber. Typical species include Golden Wattle, Gold-dust Wattle, Sweet Bursaria, Weeping Pittosporum, Kangaroo Grass, Curly Windmill Grass, Grey Tussock-grass, Common Wheat-grass, various Wallaby-grasses, various Spear-grasses, a few chenopods and numerous lilies and herbs. Bryophytes and litter cover about 30%. Fallen timber is about 100m per hectare.

Reference examples: ***Nine Mile Creek at Gordon's Bridge, Drumanure and the reserves south of the town at Katamatite, all in Broken-Boosey State Park.***

2.2.2.2 Riverine Grassy Woodland (EVC 295)

Riverine Grassy Woodland occurs on occasionally flooded upper river terraces. It forms an open woodland of River Red Gum (20m tall, 0.8m dbh, 15 trees/ha) with occasional shrubs such as Silver Wattle, Grey Parrot-pea and Pale-fruit Ballart. The ground layer is dominated by tall grasses such as Common Tussock-grass, Silky Brown-top and Kangaroo Grass with various sedges, lilies, herbs in the inter-tussock spaces. Bryophytes and litter cover about 20%. Fallen timber is about 200m/ha.

Reference examples: ***Boulevarde Park on the Goulburn River in North Shepparton, Daunts Bend at Toolamba.***

2.2.2.3 Riverine Swampy Woodland (EVC 815)

Riverine Swampy Woodland occurs in shallow depressions where there is periodic waterlogging from only the higher-level flooding. It is a River Red Gum woodland (15m tall, 0.8m dbh, 15 trees/ha) with semi-aquatic sedges, grasses and herbs in the ground layer. There are no shrubs. Typical species include Rush Sedge, spike sedges, Narrow-leaf Nardoo, Swamp Billy-buttons, Wetland Wallaby-grass and Moira Grass. Litter cover is about 10%. Fallen timber is about 100m/ha.

Reference examples: ***Swampy woodland at Daunts Bend at Toolamba***

2.2.2.4 Sedgey Riverine Forest (EVC 816)

Sedgey Riverine Forest occurs on regularly flooded margins of major rivers. River Red Gum forest (25m tall, 0.9m dbh, 25 trees/ha) dominates a tall shrubby understorey and a ground layer dominated by flood-dependent sedges and grasses. Typical shrubs are River Tea-tree and River Bottlebrush at the waterline and Silver Wattle and Pale-fruit Ballart on higher ground. Typical ground

layer species are River Sedge, Rush Sedge, Warrego Summer-grass, Common Tussock-grass and a range of semi-aquatic herbs, sedges and grasses. Bryophytes and litter cover about 20%. Fallen timber is about 200m/ha.

Reference examples: ***Broken River at Caniambo, Goulburn River at Arcadia***.

2.2.2.5 Floodway Pond Herbland (EVC 810)

Floodway Pond Herbland occurs on the floor of billabongs that have a regular flooding and drying cycle. Most vegetation is ephemeral with typical species being knotweeds, sneezeweeds, joyweeds and Common Blown-grass. Perennial species such as River Red Gums, rushes, sedges and grasses occur at the perimeter. Litter is about 5%, bare ground about 30%. Fallen timber is about 50m/ha.

Reference examples: **Billabongs in *Mooroopna Common***

2.2.3 Recommended Targets and Indicators

The goals, targets and indicators recommended for the management zones are summarized below.

Table 1: Targets and Indicators

EVC & Status	Current Condition	Priority	Target Condition	Indicators	Time to achieve
Plains Woodland ENDANGERED	2	1	1	River Red Gum saplings removed. Perennial weeds removed Annual weeds reduced to minor component of vegetation. Patches of Kangaroo Grass established. Species diversity increased from about 20 to about 40 (later). Fallen timber added.	5 + years
	3	1	1	River Red Gum saplings removed. Dense young trees thinned. Timber on ground increased. Perennial weeds removed. Annual weeds reduced to minor component of vegetation. Scattered Kangaroo Grass established. Species diversity increased from about 15 to about 40.	5 + years
	4	2	3	River Red Gum saplings removed. Dense young trees thinned. Perennial weeds controlled. Annual weeds reduced. Scattered Kangaroo Grass established. More natives than weeds in the ground layer.	2 years
	5	3	3	River Red Gum saplings removed. Perennial weeds removed Annual weeds reduced. Native grass cover increased.	2 - 5 years
	6	3	3	River Red Gum saplings removed. Perennial weeds removed. Annual weeds reduced. Competitive species established across area (grasses or shrubs)	3 - 5 years

EVC & Status	Current Condition	Priority	Target Condition	Indicators	Time to achieve
Riverine Grassy woodland VULNERABLE	1	1	0	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Weeds reduced to insignificant species only. Patches of Kangaroo Grass established. Species diversity increased from about 30 to 40 or more.	5 + years
	2	2	1	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds removed. Annual weeds reduced to minor component of vegetation. Patches of Kangaroo Grass established. Species diversity increased from about 20 to 30.	3 - 5 years
	3	2	1	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds reduced to minor component of vegetation. Annual weeds reduced. Kangaroo Grass established in cleaned areas.	2 - 5 years
	4	3	3	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds reduced. Kangaroo Grass established in cleaned areas.	4 years
	5	3	3	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds removed. Native perennial grasses established in cleaned areas.	4 years
	6	3	3	Fallen timber removed to better condition areas. Perennial weeds mostly removed. Native perennial grasses established in cleaned areas.	4 years

EVC & Status	Current Condition	Priority	Target Condition	Indicators	Time to achieve
Swampy Riverine Woodland VULNERABLE	1	1	0	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Weeds reduced to insignificant species only. Species diversity increased from about 20 to 40.	5 + years
	3	2	1	Trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds removed. Annual weeds reduced to minor component of vegetation. Additional species introduced and established.	2 - 3 years

EVC & Status	Current Condition	Priority	Target Condition	Indicators	Time to achieve
Sedgey Riverine Forest VULNERABLE	3	1	1	Dense stands of young trees thinned to 50 per hectare. Timber on ground increased (by felling). Perennial weeds reduced to new arrivals. Annual weeds reduced to insignificant. Extent and diversity of sedges and grasses increased. Some additional shrubs and herbs introduced and established.	3 - 5 years
	4	3	3	Perennial weeds reduced to few. Annual weeds reduced to minor component of vegetation. Extent and diversity of sedges and grasses increased.	3 - 5 years
	5	3	3	Perennial weeds reduced to new arrivals. Annual weeds reduced to a minor component of the vegetation. Extent and diversity of sedges and grasses increased.	3 - 5 years
	6	3	3	Perennial weeds reduced to few. Annual weeds reduced to minor component of vegetation. Competitive sedges and grasses established.	2 - 5 years

EVC & Status	Current Condition	Priority	Target Condition	Indicators	Time to achieve
Floodway Pond Herbland VULNERABLE	3	1	1	Perennial weeds reduced to new arrivals. Annual weeds reduced to minor component of vegetation.	2 - 5 years
	4	3	3	Perennial weeds reduced to few. Annual weeds reduced to minor component of vegetation.	2 - 5 years
	6	3	3	Perennial weeds reduced to few. Annual weeds reduced to minor component of vegetation. Competitive sedges or grasses established.	3 - 5 years

2.3 Scheduling restoration activities

2.3.1 Long Term Planning

From the priority given to each management zone (see *Map 1*) and an estimate of the time it will take to achieve the nominated targets (see *Table 1: Recommended Targets and Indicators*), a long-term timetable of proposed works can be generated. So, for example, the table below suggests work in 2018/19 should focus on Condition 2 and 3 Plains Woodland management zones, Condition 1 Riverine Grassy Woodland and Condition 1 Riverine Swampy Woodland.

Table 2: Long-term Planning

Management Zones	Year 1	2	3	4	5	6	7	8
PW2	x	x	x	x	x			
PW3	x	x	x	x	x			
PW4			x	x	x	x	x	
PW5				x	x	x	x	x
PW6				x	x	x	x	x
RGW1	x	x	x	x	x	x	x	x
RGW2		x	x	x	x	x		
RGW3		x	x	x	x	x		
RGW4				x	x	x	x	
RGW5				x	x	x	x	
RGW6					x	x	x	x
RSW1	x	x	x	x	x	x	x	x
RSW3			x	x	x			
SRF3		x	x	x	x	x		
SRF4			x	x	x	x	x	
SRF5			x	x	x	x	x	
SRF6				x	x	x	x	x
FPH3		x	x	x	x	x		
FPH4			x	x	x	x	x	
FPH6					x	x	x	x

Table 2: Long-term Planning

2.3.2 Seasonal planning

Many restoration activities are best undertaken at certain times of year because of plant growth cycles or weather conditions. *Table 3: Jobs Calendar* describes when to schedule specific tasks.

The following tasks should always be done in the aftermath of flooding:

- Collect rubbish.
- Check debris for live wood, weeds, roots and bulbs, collect and bag.
- Kill young weeds.
- Spot-spray perennials if they establish.

Table 3: Jobs Calendar

July	August	September	October	November	December
		Search for and remove new woody weed seedlings.	Search for and remove new woody weed seedlings	Search for and remove new woody weed seedlings	Cut and paint woody weeds.
Spot spray perennial weeds as soon as growing strongly, especially after burning.	Spot spray perennial weeds before flowering	Spot spray perennial weeds before flowering.	Spot spray perennial weeds before flowering	Spray Lippia. Spray Paspalum	Spray St. John's Wort & at early flowering. Spray Lippia. Spray Paspalum before seed set.
Spray Snowdrops & Jonquils at flowering.	Spray Bridal Creeper at flowering. Spray Snowdrops & Jonquils at flowering. Spray Soursob at flowering.	Spray Soursob at flowering.	Spot spray False Onion at flowering	Spot spray False Onion at flowering	
			Erect fencing to protect native seedlings from herbivores		
Poison rabbits in their burrows. Collapse burrows.	Poison rabbits in their burrows. Collapse burrows.				
		Shoot hares if permitted			
					Cut and paint excess eucalypts.
		Survey site to check for new species.	Collect seed of herbs and C3 grasses	Collect seed of herbs and C3 grasses	Collect seed of herbs, sedges, Flax-lilies, Kangaroo Grass.
			Sow seed of shrubs, trees, C4 grasses	Sow seed of shrubs, trees, C4 grasses. Water field sowings if required	Water field sowings if required
	Plant shrubs and trees		Water plantings if required	Water plantings if required	Water plantings if required
		Undertake significant species monitoring.	Undertake significant species monitoring.		

January	February	March	April	May	June
		Collect rubbish	Collect rubbish	Collect rubbish	
Cut & paint woody weeds.	Cut & paint woody weeds	Cut & paint woody weeds if still vigorous			
Spot-spray summer-growing perennials. Spray St. John's-wort at early flowering. Re-spray Lippia.	Re-spray Lippia				Spot spray perennial weeds as soon as growing strongly, especially after burning.
				Spray Onion Grass 6-8wks after emergence.	Spray Onion Grass 6-8wks after emergence.
			Apply sugar around autumn break time to suppress growth of annual grass weeds where burning is not possible.		
					Poison rabbits in their burrows. Collapse burrows.
Cut and paint excess eucalypts.	Cut and paint excess eucalypts.	Cut and paint excess eucalypts.	Cut and paint excess eucalypts.	Cut and paint excess eucalypts.	
Collect seed of summer-growing grasses and sedges.	Collect seed of summer-growing grasses and sedges.	Collect seed of summer-growing grasses and sedges.			
Water field sowings if required	Water field sowings if required		Sow seed of C4 grasses, sedges and winter-growing herbs		
Water plantings if required	Water plantings if required	Water plantings if required	Water plantings if required. Plant ground layer species after autumn break		

2.4 Annual activity plans

Our understanding of the conservation status of the EVCs at ABGS and the various conditions of the vegetation (see ABGS Natural Vegetation Survey) enables us to prioritise our works program (2.1) and plan when we will work on areas of the bushland over the coming years (2.3.1).

Our restoration goals and targets (2.2.1) describe the changes we are trying to bring about and therefore what the work will be (2.2.3).

Table 3: Jobs Calendar sets out when restoration tasks should be undertaken.

This enables annual work plans to be made within a framework of longer-term planning to achieve the articulated outcomes. An example Activity Plan appears at the end of this document.

Of course, review and revision of goals, targets and indicators, time targets and timing will be essential as human resources vary, seasons vary, actions have unintended consequences and new problems arise.

The next section discusses some of the practical techniques available for achieving our restoration goals.

3 Restoration techniques

3.1 Weed Management

3.1.1 General principles for weed control

Weed management is about finding ways to disadvantage weed species while not damaging native plants.

Weed populations consist of both actively growing plants and dormant parts and seed stored on or in the soil. Seeds can be short or long-lived. Weed plants can be ephemeral - germinating and setting seed rapidly any time of year when conditions allow; annual - completing their growth cycle in less than a year; biennial - only setting seed in their second year of growth or perennial - persistent plants that flower and set seed repeatedly. Some grow mostly in winter-spring, some mostly in summer-autumn and some just respond when conditions suit. Weed populations are dynamic. They change according to seasonal conditions, disturbances and what seeds are arriving from the surrounding non-indigenous vegetation. These attributes suggest that a range of strategies for weed control are required.

For short-lived weeds: ephemerals, annuals, biennials

(such as Sharp Buttercup, Spear Thistle, Flax-leaf Fleabane, Wild Oat)

- prevent seed from germinating,
- prevent plants from setting seed

For perennial weeds: trees, shrubs and herbaceous plants that grow all year round and herbaceous plants that die back to underground roots, tubers and corms

(such as Olive, Madeira Winter Cherry, St. John's Wort, Soursob, Paspalum)

- prevent seed from germinating,
- prevent plants from setting seed
- AND kill the plant.

Shed seed lies either on top of the soil, where it is generally short-lived or finds its way under the soil where it can persist for long periods. Seeds under the soil should be left to slowly die which they will do unless brought to the surface by soil disturbance.

Preventing plants from setting seed minimises future occurrences but it is especially important for plants with long-lived seed (eg. Paterson's Curse) or very mobile seed (eg. Spear Thistle) to prevent the worsening of the weed problem over time or space. Prevention of seed set can be done by chipping or pulling seedlings or by removing flowering stems.

Perennial weeds also need to be killed.

The basic strategy for weed control is to cause minimum damage by focussing on prevention, acting early when weeds appear and using targeted herbicide application as a last resort.

The methods used should always minimise damage to non-target plants and the broader environment.

Some weeds will require follow-up work for several years. Failure to commit to follow up work will mean the initial treatment was a waste of resources.

Where natives are present, natural regeneration in the gaps will occur in time. Where only weeds are present, treatments should continue until no more weeds germinate and excess nutrients are removed before establishing competitive native species (See 3.6).

3.1.2 Priorities for control

Priority 1 weeds that are a serious threat to natural vegetation (see Table 4 below) are a priority for removal across the **whole site**. These weeds are perennials, are difficult to kill, have long-lived seed, are quick to spread, out-compete indigenous plants or might be obvious in the landscape which detracts from the visual character of the natural vegetation.

Weed Works Phase 1
Start by controlling priority 1 weeds across the whole site. Many of these are spread by wind, birds and floodwater, so ideally, should also be controlled on adjacent land to minimise future infestations. Follow up will be required to ensure regrowth does not occur. Annual searches will be required to find and remove newly arrived weeds.

Priority 2 weeds that are a serious threat to natural vegetation (see Table 4 below) are mostly perennials but are either a less immediate threat to natural vegetation (such as Phalaris) or are so widespread, that they can't realistically be tackled across the whole site (such as Ribwort). Annual grasses are included here because, where they are abundant, they exclude indigenous plants by dramatically changing soil chemistry and moisture availability.

Weed Works Phase 2
Target specific areas for weed work starting with best areas (see Map 1). Remove Priority 2 weeds. Priority 3 weeds should be controlled progressively as areas are restored (see Table 4 below) as far as practical. Work outwards from the cleaned areas to maintain the work already undertaken.

3.1.3 Weed Control Methods

Table 4: Weed Species - Recommended Controls (below) suggests a range of control methods for specific weeds. Unlisted weeds can be treated by using methods recommended for plants with similar characteristics or external advice can be sought.

Hand weeding

Because it is labour-intensive, hand weeding is only suitable for targeting isolated weeds amongst native vegetation. Soil disturbance must be minimised to prevent new weeds germinating and no roots must remain that can regrow. Some weeds such as Fleabane and Ribwort will pull out easily at certain growth stages but not others. A paint scraper or knife can be used to cut taproots of seedlings such as Paterson's Curse, Spear Thistle, Wireweed and the soil pressed back to cause very little soil disturbance.

Removal of seed heads

Weeds should be prevented from setting seed whenever possible. Any seed heads that do develop should be removed by cutting and bagging to prevent the expansion of those populations. This should be done for all Priority 1 weeds but will also be useful for other weeds to prevent patches from expanding until they can be destroyed. For example, Coolah Grass patches could be slashed to prevent seed set.
Patches of annuals such as grasses might be able to be prevented from setting seed by whipper-snippering.

Solarisation

Extensive weed patches and soil-stored seed can be destroyed by heat generated by clear (not black) plastic pinned down to damp soil over the summer months. This could be useful for Chilean Needle-grass. Some limitations of this technique are that all plants under the plastic will be destroyed, that high temperatures won't be achieved if there is shading and that the risk of the plastic being lost in a flood should be considered.

Nutrient removal

Elevated levels of soil nutrients such as nitrogen and phosphorous can promote weeds at the expense of natives. The former use of the site for grazing has elevated nutrients generally across the site and the dumping of soil, garden waste and carcasses and the burning of rubbish in hot fires during its rubbish tip days has left nutrient hot spots.

Cool burning can instantly reduce nitrogen in smoke, but also over time by reducing the accumulation of biomass from annual plants. As burning here is not appropriate, high carbon materials can be applied to lock up nitrogen. Sugar applied to native seedlings at the rate of 0.5kg per square metre can help establishment by suppressing annual weed growth (Prober *et al* 2005). Sawdust mulch applied to plantings has a similar effect.

Where there are severe concentrations, the careful removal of imported soil piles or topsoil with weed seed can sometimes be the best long-term solution.

Cut & paint with herbicide

Woody weeds can be cut and left if the material is not likely to regrow however any seed, pods, fruit or twigs capable of growth should be bagged. Herbicide should be applied to the freshly-cut stump and basal bark to kill the roots of plants that are capable of re-growth (these are indicated in Table 4). The trees or shrubs must be growing strongly for the herbicide to be effective.

Spot spray with herbicide

Herbicide is often the only way to kill perennial weeds without soil disturbance. Herbicides should not be used unless conditions are ideal:

- Plants must be growing strongly for effective uptake.
- Application at flowering will be too late for some species which will go on to produce seed.
- Conditions must not be too hot or too windy, or wet or about to rain. Dry, cool, calm conditions are ideal.

A low-pressure knapsack sprayer with a diaphragm pump is ideal for Metsulfuron methyl, which tends to wear out piston pumps. Use an adjustable nozzle that delivers a circular spray pattern. Use a fine spray and spray as close as possible to the target, covering the foliage until it starts to drip.

High-pressure hand guns and boom sprayers are not suitable for use in bushland.

3.1.4 Herbicides

The most useful herbicides will be systemic selective herbicides that are least hazardous to the environment and to the user. There are no low-hazard grass-selective herbicides available. Flooding of the site after herbicide application is a real concern. Ideally, herbicides should not be mobile in the soil, should have a short soil half-life and should have low toxicity to aquatic organisms.

Risk to the environment can also be reduced by minimising the volume of herbicide applied (so apply to a cut stump rather than to bulky foliage) and the number of occasions on which herbicides are used (so apply only once under optimum conditions).

Glyphosate (Group M)

is a non-selective herbicide that will kill most grasses and herbs.

- It is useful for killing perennial grass weeds but must be applied accurately as it will kill everything.
- Half-life in the soil is 1 - 130 days with a mean of 30 days, depending on soils and climate. However, residues are tightly bound to soil particles and are biologically degraded.
- Toxicity to aquatic organisms is low.
- Although widely used, great care should be taken with personal protective equipment as the World Health Organisation has recently declared it a probable carcinogen (Kelland 2017).

Metsulfuron methyl (Group B)

is a broadleaf selective herbicide useful for killing perennials with rhizomes or corms such as Soursob.

- It won't affect perennial grasses.
- It is used elsewhere for foliar spraying of woody weeds however this is not recommended here as we are aiming to minimise the volumes of herbicides applied.
- Half-life in the soil is 7 - 28 days.
- Toxicity to aquatic organisms is low.

MCPA (Group I)

is a broadleaf selective herbicide useful for killing perennials such as Ribwort.

- It won't affect grasses.
- It has a soil half-life of only 7 days.
- It is moderately toxic to aquatic organisms. MCPA should not be used when there is any possibility of flooding within the next seven days.

Triclopyr (Group I)

is a broadleaf selective herbicide for killing woody weeds.

- It won't affect grasses.
- Mixed with diesel it is recommended for painting on the cut stems of difficult to kill woody weeds such as Olive and Briar Rose.
- Triclopyr mixed with water is recommended for spot spraying St. John's Wort.
- It has a soil half -life of 1 - 90 days.
- It is toxic to aquatic life, so must not be used near water or when there is any possibility of flooding within the next three months.

Additives

Always use a **dye** so that the operator can work systematically and to alert others to herbicide use. Dye is also useful to alert the operator to accidental spills.

Metsulfuron always requires a **non-ionic surfactant** such as Nufarm "Activator", Apparent "Wetter" or Bayer "Agridex" to improve spread and adhesion to foliage.

A **penetrant** such Nufarm "Pulse" will be required for weeds with waxy or shiny leaves.

Read the chemical label (booklet) to see if additives are recommended for use with particular weeds.

Chemical preparation

Only prepare the amount of chemical that can be used before the end of the work session. In winter, the spray day can be as short as three hours (after dew dries and two hours before dew falls).

Measure chemicals and fill containers over the drip tray provided, so that any spills are contained and can be disposed of safely.

Mixing order:

1. Half fill tank with water.
2. Add any dry herbicide (eg. Metsulfuron)
3. Add any emulsifiable concentrate (eg. Triclopyr)
4. Add solutions (eg. MCPA)
5. Add glyphosate if using.
6. Add surfactant or penetrant and dye.
7. Triple rinse measuring containers and pour into the tank.
8. Top up tank to the required level.

Every time chemicals are used the details should be recorded. This provides a reference for when results are not as expected so that adjustments can be made. Use the Chemical Record sheet in the chemical records folder.

Chemical Handling Safety

The chemicals, additives and measuring equipment are all stored in a cabinet as specified in the National Agvet Chemical Users Course. Also in the cabinet will be the Labels and the Safety Data sheets for any chemicals stored there and the Chemical Records folder.

The operator should use the Personal Protective Equipment recommended for the chemicals being used during preparation. PPE will be stored on the top shelf of the cabinet, measuring equipment and applicators on the second shelf and all chemicals on the bottom shelf.

After use the equipment should be triple-washed and the operator should remove washed gloves last. After using chemicals, the operator should shower as soon as possible and clothing should be washed.

Chemicals must be transported, stored and disposed of in accordance with the legislation and industry standards which are set out in *National AgVet Chemical Users Course Resource Manual 2017.*

Table 4: Weed Species - Recommended Controls

1. Weeds that are a serious threat to natural vegetation - priority for removal across the whole site

Common Name	*Scientific Name*	Distribution	Abundance	Life form	Vector	Issues	Strategy	Techniques	Chemicals and rates
African Boxthorn	***Lycium ferocissimum***	properties to west and southeast	few	perennial, dry dormant, woody	eaten by birds	Suckering, poisonous thorns. Unsightly	Liase with neighbours to remove all	During Feb-May, cut and pull away branches being careful to avoid scratches. Recut stumps and paint immediately. Spray regrowth. Check annually and spray regrowth and seedlings for up to 5 years.	Paint stump with Triclopyr 600g/L @ 20ml in 600ml diesel. Spray regrowth with Glysophate 360g/L @ 100ml + NIS @ 2ml in 10L water.
Bridal Creeper	***Asparagus asparagoides***	PV reserve to west	few	perennial, dry dormant, twiner	eaten by birds	Climbing & smothering. Deep tubers	Remove all	Foliar spray at flowering.	Metsulfuron methyl @ 0.5g + adhesive 40ml in 10L water
Bathurst Burr	***Xanthium spinosum***	billabong	100s	annual, herb	in fur of mammals, floodwater	Seed long-lived	Remove as they appear	Pull seedlings as they appear. Cut and bag any fruiting plants.	
Canary Island Palm	***Phoenix canariensis***	west	few	perennial, woody	birds, floodwater	Eventually smothering. Unsightly	Remove all	Dig out seedlings. Cut older plants and paint stems. NB: Acid sap might damage equipment - wash promptly.	Triclopyr 600g/L @ 20ml in 600ml diesel
Cherry Plum	***Prunus cerasifera***	north edge	few	perennial, cold dormant, woody	eaten by birds	Eventually smothering. Unsightly	Remove all	Hand pull seedlings. Bag any fruit of mature plants, cut and paint stump.	Triclopyr 600g/L @ 10ml in 600ml diesel

Chilean Needlegrass	***Nassella neesiana***	river walk northeast end	10s	perennial, dry dormant, grass	in fur of mammals, floodwater	Long-lived seed. Competitive	Remove all	Hand pull before seed set. Bag any seed heads. Spot spray patches in Autumn. Clearly mark where treated. Check annually and pull or spray new seedlings.	Glyphosate 360g/L @ 100ml + NIS @ 2ml in 10L water
Cootamundra Wattle	***Acacia baileyana***	PV to west	few	perennial, woody	dumping, floodwater	Eventually smothering. Long-lived seeds.	Remove	Cut down mature plants before seed set. Patrol area subsequently and hand-pull seedlings.	
Desert Ash	***Fraxinus angustifolia***	all	100s	perennial, cold dormant, woody	wind	Eventually smothering. Unsightly	Remove all	Hand pull small seedlings. Cut and paint stems of more mature plants in late spring and summer.	Triclopyr 600g/L @ 10ml in 600ml diesel
Lippia, Fog Fruit, Condamine Couch, Carpet Weed	***Phyla canescens***	flood-prone areas	100s	perennial, cold dormant, herb	seed and pieces in floodwater	Allelopathic. Abundant long-lived seed. Re-establishes from stem pieces.	Progressively remove all.	Spot spray plants in late spring when plants are flowering and there is good soil moisture. Clearly mark where treated. Re-spray again as soon as vigorous regrowth is flowering following rain. Spray a third time if necessary and conditions allow. Avoid herbicide contact with river water.	Glyphosate 360g/L @ 100ml + Metsulfuron methyl 1g + NIS @ 8ml in 10L water
Madeira Winter Cherry	***Solanum pseudocapsicum***	riverbank, billabong, northwest	10s	perennial, dry dormant, woody	eaten by birds	deep-rooted	Remove all	Hand pull young seedlings. Cut and bag any fruiting plants. Spot spray regrowth before flowering.	Glysophate 360g/L @ 100ml + Metsulfuron methyl @ 1g + NIS @ 2ml in 10L water
Noogoora Burr	***Xanthium occidentale***	billabong	10s	annual, herb	floodwater, mammal fur	Seed long-lived	Remove as they appear.	Hand pull seedlings. Cut and bag plants after seed set.	
Olive	***Olea europaea***	northeast corner	few	perennial, woody	eaten by birds	Invasive	Remove all	Hand pull small seedlings. Cut and paint stems of more mature plants in late spring to early summer.	Triclopyr 600g/L @ 20ml in 600ml diesel

Paspalum	***Paspalum dilatatum***	disturbed areas, flood-prone areas	1 patch	perennial, cold dormant, grass	in fur of mammals, floodwater	Smothers competitors.	Remove all	Cut and bag all heads. Spot spray in October and November. Follow up on new seedlings.	Glyphosate 360g/L @ 100ml per 10L
Blue Periwinkle	***Vinca major***	PV to west	few	perennial, dry dormant, herb	dumping, floodwater	deep-rooted, smothering	Remove	Foliar spray while actively growing. Check for regrowth and retreat if needed.	Glyphosate 360g/L @ 100ml + Metsulfuron methyl @ 1g + Pulse penetrant @ 25ml in 10L water
Prickly Pear	***Opuntia sp.***	PV to west	10s of patches	perennial, succulent	dumping, floodwater		Remove	Pull or dig out and remove all material.	
Soursob	***Oxalis pes-caprae***	disturbed areas	100s	perennial, dry dormant, bulb	earthworks, floodwater	Excludes competitors. Bulbils can be missed	Remove all	Spot spray at bulb exhaustion just on flowering. Check annually and respray until gone.	Metsulfuron methyl @ 0.2g + NIS @ 2ml in 10L water
St. John's Wort	***Hypericum perforatum***	northwest and northeast	10s	perennial, cold dormant, herbaceous	in fur of mammals	Highly invasive, rhizotomous & Glyphosate resistant.	Progressively remove all	Spot spray at early flowering. Remove heads if unable to spray.	Triclopyr 600g/L @ 17ml in 10L water
Sweet Briar	***Rosa rubiginosa***	northeast, northwest, west			eaten by birds	Eventually smothering. Unsightly	Remove all	Hand pull new seedlings. Cut mature plants before fruit set. Spray basal bark. Check for regrowth and re-treat if needed.	Triclopyr 600g/L @ 10ml in 600ml diesel.

2. Weeds that are a serious threat to natural vegetation - Priority for control

Common Name	*Scientific Name*	Distribution	Abundance	Life form	Vector	Issues	Strategy	Techniques	Chemicals and rates
annual grasses	***Aira, Avena, Briza, Bromus, Lolium, Vulpia,* etc**	all	10,000s	annual, dry dormant, grasses	wind, water, ingestion by mammals	Competitive, allelopathic, smothering, alters soil nitrates	Reduce extent, density	Hand-weed if scarce in Condition 1 or 3. Whippersnip to reduce seed set where there are patches next to areas being restored.	
Annual Veldt-grass	***Ehrharta longiflora***	disturbed areas	100s	annual, dry dormant, grass	herbivores	quickly smothering	Progressively remove	Hand-weed if scarce in Condition 1 or 3.	
Asparagus	***Asparagus officianalis***	all	10s	perennial, cold dormant, tubers	eaten by birds	Long-lived seed	Remove all	Spot spray seedlings or paint new shoots or cut and paint stems when flowering. Bag any fronds with berries.	Glysophate 360g/L @ 100ml + Metsulfuron methyl @ 1g + NIS @ 2ml in 10L water
Aster Weed	***Symphyotrichum subulatum***	billabong	10s	biennial, dry dormant, herb	wind		Remove as they appear	Hand pull before seed set. Bag any seed heads.	
Bindyi, Caltrop	***Tribulus terrestris***	path edges	10s	annual or perennial, winter dormant, herb	shoes, vehicles, in fur of mammals	painful thorny burrs. Seed long-lived.	Remove	Hand pull seedlings. Spot spray before flowering. Dig out) and bag after seed set.	MCPA 750g/L @ 27ml/10L water

Black Nightshade	***Solanum nigrum***	all	100s	perennial, dry dormant, herb	eaten by birds		Remove as they appear	Hand pull older plants before fruit set.	
Curled Dock	***Rumex crispus***	disturbed areas northwest, west	100s	perennial, dry dormant, herb	water	deep-rooted	Remove	Spot spray before flowering. Cut and bag heads after seed set.	MCPA 750g/L @ 27ml/10L water
False Onion Weed	***Nothoscordum borbonicum***	billabong rise	100s	perennial, dry dormant, bulb	floodwater	Numerous bulbils	Progressively remove all	Spot spray at bulb exhaustion just on flowering.	Glyphosate 360g/L @ 100ml + Metsulfuron methyl @ 0.2g + NIS @ 2ml in 10L water
Ivy-leaf Speedwell	***Veronica hederifolia***	disturbed areas	100s	annual, herb	in fur of mammals, water		Remove	Solarise patches of young plants. Hand pull and bag older plants.	
Kapok Vine, Moth Vine	***Araujia hortorum***	northwest corner	1	perennial, woody	wind	Potentially smothering	Remove as they appear	Hand pull seedlings. Bag any pods of mature plants, cut and paint stump.	Triclopyr 600g/L @ 10ml in 600ml diesel
Nut Grass	***Cyperus eragrostis***	flooded areas	100s	perennial, summer dormant, sedge	floodwater	abundant long-lived seed	Progressively remove	Cut and bag all heads - preferably before seed set. Spot spray plants while young if possible. Dig out older plants if area is already damaged.	Glysophate 360g/l @ 120ml + 25 ml Pulse in 10L water
Paterson's Curse	***Echium plantagineum***	flooded areas	100s	biennial, dry dormant, herb	in fur of mammals, floodwater	Long-lived seed. Rosettes smother seedlings	Remove all	Chip out small rosettes. Hand-pull and bag plants with flower heads. Spray large patches before they flower.	Metsulfuron methyl @ 0.5g in 10L water
Phalaris, Canary Grass	***Phalaris aquatica***	northwest corner & river walk	2 patches	perennial, dry dormant, grass	floodwater	Smothers competitors.	Remove all	Slash. Spray regrowth when vigorous in cooler months. Follow up on re-sprouting rhizomes	Glyphosate 360g/L @ 100ml per 10l

Ribwort	***Plantago lanceolata***	all, especially disturbed	1000s	perennial, dry dormant, herb	earthworks, wind	deep-rooted	Progressively reduce population.	Spot spray healthy rosettes before flowering. In extensive damaged areas where there appear to be few native herbs, check thoroughly, hand weed around any natives and cover them before spraying.	MCPA 750g/L @ 27ml/10L water
Coolah Grass	***Panicum coloratum***	riverbank	4+ patches	perennial, cold dormant, grass	floodwater	Smothers competitors.	Progressively remove.	Hand pull isolated plants before flowering. Cut and bag seed heads. slash patches, then spray regrowth. Follow up until clear.	Glyphosate 360g/L @ 100ml per 10l
Slender Vetch	***Vicia tetrasperma***	north east	100s	annual, herb	ingested by mammals, ants?	Seed long-lived	Progressively remove.	Pull and bag older plants.	
Spear Thistle	***Cirsium vulgare***	disturbed areas, flooded areas	100s	annual, herb	wind, floodwater	long-lived seed, unsightly	Remove as they appear	Spot-spray large rosettes. Cut off flowering stems. Cut off and bag seed heads.	Glysophate 360/l @ 70ml in 10L water
Verbena Weed	***Verbena litoralis***	disturbed areas	10s	perennial, dry dormant, herb	dumping, wind, floodwater		Remove all	Spot-spray at rosette stage. Pull and bag older plants.	MCPA 750g/L @ 27ml/10L water
Wireweed	***Polygonum aviculare***	billabong	100s	annual, herb	earthworks, in fur of animals	smothering	Remove	Spot spray young plants. Cut tap root to remove and bag older plants.	MCPA 750g/L @ 27ml/10L water

3. Weeds that should be controlled progressively as areas are restored

Common Name	*Scientific Name*	Distribution	Abundance	Life form	Vector	Issues	Strategy	Techniques	Chemicals and rates
Capeweed	***Arctotheca calendula***	disturbed areas	100s	annual, herb	wind	can prevent establishment of native species	Remove as they appear	Hand-weed if scarce in Condition 1 or 3. Large areas of young seedlings can be sprayed with selective herbicide if no native *Asteraceae* are present.	MCPA 750g/L @ 27ml/10L water
Cleavers	***Galium aparine***	northwest	few	annual, herb	in fur of mammals, floodwater	briefly smothering, clinging seed	Remove	Hand pull and bag larger plants.	
Common Pepper-cress	***Lepidium africanum***	disturbed areas	10s	annual, herb	wind	abundant seed, taproot	Reduce population	Chip young rosettes. Hand-pull at early flowering.	
Common Sow-thistle	***Sonchus oleraceous***	disturbed areas	10s	annual, herb	wind	trivial	Reduce population	Hand pull. Bag after seed set.	
Ferny Cotula	***Cotula bipinnata***	disturbed areas	100s	annual, herb	wind	trivial	Reduce population		
Flat Weed	***Hypochoeris radicata***	all	100s	perennial, dry dormant, herb	wind	Prevents germination of other species.	Progressively remove	Spot spray rosettes up to early flowering.	MCPA 750g/L @ 27ml/10L water
Flax-leaf Fleabane	***Erigeron bonariensis***	disturbed areas	10s	annual, herb	wind	trivial	Reduce population	Hand pull before seed set. Remove and bag heads of missed plants.	

Hairy Willow-herb	***Epilobium hirtigerum***	disturbed areas	10s	perennial, dry dormant, herb	wind	Although native, can become weedy and dominant	Remove dense patches in disturbed areas	Hand pull when young. Cut and bag seed heads. Spot spray before seed set.	MCPA 750g/L @ 27ml/10L water
Jonquil	***Narcissus jonquilla***	disturbed areas	few	perennial, dry dormant, bulb	dumping, floodwater	eventually smothering	Remove	Spot spray at start of flowering.	Glyphosate 360g/L @ 100ml + Metsulfuron methyl @ 0.2g + NIS @ 2ml in 10L water
Lesser Chickweed	***Stellaria pallida***	disturbed areas	100s	annual, herb	in fur of mammals	smothering	Remove	Hand pull & bag after seed set.	
Pink Sand-spurrey	***Spergularia rubra***	drier areas	10s	perennial, dry dormant, herb	wind	deep-rooted	Reduce population	Spot spray before flowering. Cut tap root and bag after flowering.	MCPA 750g/L @ 27ml/10L water
Prickly Lettuce	***Lactuca serriola***	disturbed areas	few	annual, herb	wind	competitive	Reduce population.	Hand pull at early flowering.	
Ramping Fumitory	***Fumaria capreolata***	northern	10s	annual, herb	wind	briefly smothering	Remove as they appear	Hand pull and bag larger plants.	
Red-flowered Mallow	***Modiola caroliniana***	disturbed areas	10s	perennial, dry dormant, herb	floodwater	smothering	Remove	Spot spray while young. Dig out and bag after flowering.	MCPA 750g/L @ 27ml/10L water
Rhodes Grass	***Chloris gayana***	at start of billabong walk	few	perennial, cold dormant, grass	wind	Competitive	Remove as they appear	Hand pull before seed set. Bag any seed heads.	
Sharp Buttercup	***Ranunculus muricatus***	damaged wetland areas	10s	annual, herb	water	Long-lived seed	Progressively remove	Spot spray before flowering. Hand pull and bag after seed set.	MCPA 750g/L @ 27ml/10L water

Small-flowered Mallow	***Malva parviflora***	billabong margin	few	annual, herb	floodwater, wind	smothering	Remove	Spot spray while young. Hand pull and bag after flowering.	MCPA 750g/L @ 27ml/10L water
Snowdrop	***Galanthus nivalis***	northeast corner	few	perennial, dry dormant, bulb	dumping, floodwater	eventually smothering, expanding via bulbils	Remove all	Spot spray at start of flowering	Glyphosate 360g/L @ 100ml + Metsulfuron methyl @ 0.2g + NIS @ 2ml in 10L water
Twining Toadflax	***Kickxia elatine* ssp. *crinita***	billabong	10s	perennial, dry dormant herb	?	briefly smothering	Remove all	Spot spray before flowering. Hand pull and bag after seed set.	MCPA 750g/L @ 27ml/10L water

3.2 Tree thinning

Most areas have far too high a density of trees as a result of many years of timber harvesting. We have suggested a conservative cutting target of 50 trees per hectare for woodland areas (see 2.2.3) which is 15m between trees on average.

- Choose areas with good quality ground layer (Condition 1) to thin first. Very dense saplings suppress the ground layer with fierce competition for moisture and heavy leaf fall.
- This suppression is useful however in weedy areas (Conditions 4,5,6), so leave saplings there until resources are available to deal with weeds.
- Choose the largest, healthiest trees to leave. Look at the canopy and choose trees with the most foliage and fewest dead branches.
- Trees need to be treated with herbicide to prevent regrowth. Regrowth after cutting (coppicing) is even less likely to form healthy trees.
- Trees should be cut when they are growing strongly for best herbicide uptake - look for new foliage. This is from about December to March for River Red Gums, but growth flushes may occur at other times after flooding. It is important to minimise the volume of herbicide used in the environment, so we should maximize the chance of a kill with one application.
- Cut trees either very close to the ground or about 1m high. The higher stumps can provide perches for insectivorous birds.
- Paint stumps immediately after cutting with herbicide (see 3.1.3 Weed Control Methods). Check treated stumps within 4 weeks and re-apply herbicide to any new growth before it attains any height.

3.3 Pest animal control

Control activities should be undertaken jointly with neighbours as far as possible as pest animals range widely.

Herbivores are the main concern of a vegetation management plan however it would greatly benefit wildlife if feral cat and fox control are also undertaken. An experienced and authorised person should be engaged to undertake this work on a regular basis.

Observations suggest that hares and kangaroos cause most damage to vegetation currently. Rabbits and Swamp Wallabies might become a threat to restoration in the future.

3.3.1 Exclosures to measure herbivore impacts

Animal droppings and chewed vegetation can be observed but does not always give a clear understanding of the effects of grazing by different animals on different plants.

Exclosures are an easy way to qualitatively measure and demonstrate the impacts of grazing animals on vegetation. They are structures that prevent grazing by the target animal and can target vulnerable vegetation. The idea is to only exclude one type of animal so that a comparison of the grazed vegetation (outside) with the ungrazed vegetation (inside) will show what grazing impact that animal has.

For example, to measure rabbit impact, erect a low rabbit-netting fence around a large area so that kangaroos and wallabies are not discouraged from entering. To measure kangaroo and wallaby impact, erect a high fence around a small area with openings large enough to admit rabbits and hares.

At least one exclosure for each type of grazing animal should be established so that grazing impacts can be observed, and actions taken if grazing is clearly inhibiting regeneration.

3.3.2 Rabbits

1. If burrows are found they should be marked. An efficient method of destruction is to fill the openings and fumigate the burrow using Phostoxin. This chemical requires an accredited user.
2. If rabbit numbers significantly increase, we should investigate the use of K5 calicivirus.

3.3.3 Hares

It would be useful to investigate the possibility of a brief site closure once a year at mating time to allow a professional shooter to cull hares to control the population.

3.3.4 Kangaroos

Kangaroos are prolific breeders and are seriously impacting ground layer vegetation in bushland across our region. Kangaroos may be shot under an Authority to Control Wildlife permit where they are deemed to be causing damage. However, this is unlikely to be permitted within town boundaries. Their impacts here are not yet great, but they should be monitored using exclosures and some action taken to reduce or prevent overgrazing if it occurs.

3.3.5 Invertebrate pests

Common pests of native vegetation seedlings are slugs and Red-legged Earth-mites.
Slugs can be treated when needed with Multiguard Slug Pellets (which are not harmful to other animals). Most herbs are susceptible to RLEMs, so defer sowing or planting until predator habitat (native grasses) is well-established and RLEMs are absent.
Larvae of moths can destroy seed of herbaceous peas (Swainsona, Glycine, Cullen, etc). Dipel spray is an effective biological larvicide.

3.4 Re-establishment of native vegetation

Where weeds are removed from natural vegetation with a good diversity of native species still present, natural regeneration should occur.

In areas where the vegetation is mostly weeds, regeneration of native plants after weed control is far less likely.

Where no natural regeneration occurs, seed should be sown to establish native ground cover to prevent further weed growth.

3.4.1 First establish grasses

Grasses are the most useful pioneer species for our needs.

- Enough seed can be easily collected.
- Most grasses establish reliably from direct-seeding.
- Grasses generally establish rapidly and are more competitive with weeds than most herbs.
- Grasses can reduce nitrogen availability (see below) which can suppress weed growth.
- When established, grasses can be weeded using broad-leaf herbicides if necessary.
- Grasses can host native predators of introduced Red-legged Earth-mites which can decimate native herbs.

Kangaroo Grass (*Themeda triandra*) is particularly useful.

- It is likely to have been previously far more common at our site.
- It is a vigorous competitor.
- When established, seedling weeds can be destroyed with herbicides as Kangaroo Grass is dormant in the cool season.
- It has been shown to suppress annual weeds in the long term by reducing the availability of nitrogen in the soil (Prober & Thiele 2005).

3.4.2 How to sow grasses

- The summer-active C4 grasses Kangaroo Grass, Silky Brown-top, Warrego Summer-grass, Rigid Panic, and Curly Windmill Grass should be sown in October/November.
- The winter-active C3 grasses Common Tussock-grass, Reed Bent-grass, Common Wheat-grass, Short-awned Wheat-grass, the wallaby grasses and the spear grasses should be sown soon after the autumn break in April/May.
- Prior to sowing, destroy any new annual weeds.
- Scatter grass seed thickly (say a minimum of 20 seeds per 10cm x 10cm). The awns will help drill the seed into the soil. Small sticks, clean straw, hardwood sawdust and watering can be useful if seed is likely to be blown away. Ideally soil should not be cultivated to bury seed as it will stimulate weed germination.
- Seedling establishment will be greatly improved if irrigation can be supplied during germination and followed up occasionally through the first summer.
- During seedling establishment, sprinkle sugar at 0.5kg per square metre to help bacteria lock up nitrogen and prevent the growth of more annuals (Prober & Lunt 2009).

- Sugar can be reapplied to suppress annuals when required (it lasts about 3 months) until grass plants are mature enough to tolerate selective herbicide use (after about two years).
- Grass seed should be collected each season on site and from nearby sources so that plenty is available when needed. Note that most summer-active grasses have a dormancy period and won't germinate until the next warm season after collection.

3.4.3 Then add herbs

Herbs can be added **after** grass cover is established, soil nitrogen is reduced, weeds are minimal and habitat for predatory mites and spiders is established.
Sow seed directly if enough is available.
Some plants are better cultivated in the nursery because seed is scarce, germination is uncertain or because they can be more easily grown from cuttings or division. Plantings of these species are worth trying, but evidence suggests that the survival of planted tube stock of ground layer plants is often poor (Morgan 1999). As well, the soil disturbed by planting will usually create new weed problems.

3.4.4 What species to add?

Species that are already present in the ABGS bushland are the clear priority for seed collection for use in revegetation or supplementation of existing vegetation.

From a conservation perspective it will be useful to increase the numbers and spread of species with small populations for example Blue Grass-lily and Kangaroo Grass. Insufficient seed of these will be available on site, so locating nearby populations in similar habitat from which to collect will be necessary. Kangaroo Grass could be collected from Boulevarde Park in North Shepparton and Blue Grass-lily could be collected from the Murchison East Golf Course for example. Permits from DELWP and site managers will be required for all off-site seed collection.

Another important plant conservation action will be to re-introduce to the site species that we think were once present, especially those that are now rare and threatened in our region. This is not always easy to determine, and good evidence is required to justify a re-introduction. Examples of possible candidates are Small Scurf-pea, Floodplain Violet and Pale Everlasting (see 1.1.2). The BGANZ "Care for the Rare" project will hopefully provide technical support for this project.

Table 5: Native species establishment lists the species known to be local that can be used for revegetation and the best methods for establishing them.

3.4.5 Documentation of introduced plants

Any seed, divisions or propagated plant material used for revegetation that is sourced off-site should be carefully documented. It is **important** to be clear about what is indigenous to the site and what has been reintroduced as we might later change our understanding of what truly belongs there. Once the site is contaminated and undocumented it loses its value as a reliable source of information about past vegetation.

Location, numbers and establishment method at ABGS should also be recorded. Plant Collection Record and Plant Introduction Record sheets appear at the end of this document.

Table 5: Native species establishment

1. Plants already present in ABGS bushland

DS =direct seed

P = plant

s = propagate from seed

c = propagate from cuttings

d = propagate by division

Scientific name	Common name	Plains Woodland	Riverine Grassy Woodland	Riverine Swampy Woodland	Sedgey Riverine Forest	Floodway Pond Herbland	Propagation method	Possible outside sources
Woody plants								
Acacia dealbata	Silver Wattle		x		x		P s	Nearby bushland
Acacia pycnantha	Golden Wattle	x					P s	Nearby bushland
Callistemon sieberi	River Bottlebrush				x		P s	Nearby bushland
Dillwynia cinerascens	Grey Parrot-pea		x		x		DS P s	Nearby bushland
Eucalyptus camaldulensis	River Red Gum		x	x	x		P s	Nearby bushland
Eucalyptus microcarpa	Grey Box	x					P s	Nearby bushland
Grasses C3								
Anthosachne scabra	Common Wheat-grass	x					DS	Nearby bushland
Anthosachne kingiana multiflora	Short-awned Wheat-grass	x	x				DS	Nearby bushland
Deyeuxia quadriseta	Reed Bent-grass		x		x		DS	Nearby bushland
Lachnagrostis filiformis	Blown Grass			x			DS	Nearby bushland
Poa labillardierei	Common Tussock-grass		x		x		DS	Nearby bushland
Rytidosperma duttonianum	Brown-back Wallaby-grass	x		x			DS	Nearby bushland
Rytidosperma fulvum	Copper-awn Wallaby-grass	x	x				DS	Nearby bushland
Rytidosperma semiannulare	Wetland Wallaby-grass		x				DS	Nearby bushland
Rytidosperma setaceum	Bristly Wallaby-grass	x			x		DS	Nearby bushland
Grasses C4								
Chloris truncata	Windmill Grass	x					DS	Nearby bushland
Enteropogon acicularis	Curly Windmill-grass	x					DS	Nearby bushland
Eulalia aurea	Silky Brown-top		x				DS	Nearby bushland
Paspalidium jubiflorum	Warrego Summer-grass		x	x	x	x	DS	Nearby bushland
Pseudoraphis spinescens	Moira Grass			x		x	P d	Nearby bushland
Themeda triandra	Kangaroo Grass	x	x				DS	Boulevarde Park
Sedges and Rushes								
Carex appressa	Tall Sedge		x		x		DS	Nearby bushland
Carex gaudichaudiana	River Sedge	x			x		DS P d	Nearby bushland
Carex inversa	Knob Sedge	x	x				DS	Nearby bushland
Carex tereticaulis	Rush Sedge			x	x	x	DS	Nearby bushland
Eleocharis acuta	Common Spike-sedge			x			DS	Nearby bushland
Eleocharis pusilla	Small Spike-sedge			x			DS	Nearby bushland

Juncus subsecundus	Finger Rush	x	x				DS	Nearby bushland
Juncus amabilis	Rush					x	DS	Nearby bushland
Juncus sp3	Rush					x	DS	Nearby bushland
Juncus sp4	Rush				x		DS	Nearby bushland
Herbs								
Alternanthera denticulata	Lesser Joyweed				x	x	DS	Nearby bushland
Arthropodium fimbriatum	Nodding Chocolate-lily	x	x				DS	Murchison Golf Course
Arthropodium minus	Small Vanilla-lily	x	x				DS	Nearby bushland
Atriplex semibaccata	Berry Saltbush	x			x	x	DS	Nearby bushland
Brachyscome paludicola	Swamp Daisy			x			DS	Murchison Golf Course
Bulbine bulbosa	Bulbine Lily		x				DS	Murchison Golf Course
Caesia calliantha	Blue Grass-Lily		x				DS	Murchison Golf Course
Calotis scapigera	Tufted Burr-daisy	x	x	x	x	x	DS P d	Nearby bushland
Cardamine moirensis	Slender Bitter-cress			x		?	DS	Nearby bushland
Centella cordifolia	Centella			x			P d	?
Centipeda cunninghamiana	Old Man Weed			x		x	DS	Nearby bushland
Centipeda minima	Spreading Sneezeweed					x	DS	Upstream of ABGS
Craspedia paludicola	Swamp Billy-buttons			x			DS	?
Dianella admixta	Black-anthered Flax-lily	x					P s	Mooroopna Cemetery
Dianella tarda	Late-flowering Flax-lily	x	x		x		P s	Boulevarde Park
Dichondra repens	Kidney Weed				x		P d	?
Dysphania pumilio	Crumb Weed					x	DS	Nearby bushland
Einadia nutans	Nodding Saltbush	x					P s	Nearby bushland
Eryngium ovinum	Blue Devils	x	x		x		DS	Murchison Golf Course
Euchiton sphaericus	Star Cudweed		x			x	DS	Nearby bushland
Euphorbia dallachyana	Caustic Weed	x					DS	Nearby bushland
Haloragis heterophylla	Varied Raspwort		x				DS P d	Boulevarde Park
Hypericum gramineum	Small St. John's Wort		x				DS	Nearby bushland
Laphangium luteoalbum	Jersey Cudweed	x	x		x	x	DS	Nearby bushland
Linum marginale	Austral Flax		x	x			DS	Boulevarde Park
Lobelia concolor	Poison Pratia	x					P d	Nearby bushland
Lomandra filiformis	Wattle Mat-rush	x					P s	Mooroopna Cemetery
Lycopus australis	Austral Gypsywort					x	P c	Nearby bushland
Marsilea costulifera	Narrow-leaf Nardoo			x			P d	?
Mentha australis	River Mint				x		P d	Nearby bushland
Mentha satureioides	Native Pennyroyal	x	x		x		P d	Nearby bushland
Oxalis perennans	Grassland Wood-sorrel		x				DS	Nearby bushland
Oxalis exilis	Shade Wood-Sorrel				x	x	DS	Nearby bushland
Persicaria decipiens	Slender Knotweed					x	P c	Nearby bushland
Persicaria hydropiper	Water Pepper					x	P c	Nearby bushland
Persicaria prostrata	Creeping Knotweed					x	P c	Nearby bushland
Pimelea curviflora	Slender Riceflower	x			x		DS	Boulevarde Park
Ranunculus lappaceus	Australian Buttercup		x				P s	Boulevarde Park
Ranunculus sessiliflorus var. pilulifer	Annual Buttercup		x				DS	Nearby bushland

Rumex brownii	Slender Dock	x			x		DS	Nearby bushland
Senecio quadridentatus	Cotton Fireweed	x	x	x	x	x	DS	Nearby bushland
Sida corrugata	Variable Sida	x					DS P s	Mooroopna Cemetery
Solenogyne dominii	Smooth Solenogyne	x	x				DS	Murchison Golf Course
Tricoryne elatior	Yellow Rush-lily	x					?	Murchison Golf Course
Wahlenbergia fluminalis	River Bluebell		x	x			DS	Nearby bushland
Wahlenbergia luteola	Yellowish Bluebell	x	x				DS	Mooroopna Cemetery
Wurmbea dioica	Early Nancy	x					?	Murchison Golf Course

Plants present nearby in similar habitat that could be re-introduced

Woody plants								
Acacia acinacea	Gold-dust Wattle	x					P s	Watts Rd PV Reserve
Allocasuarina luehmannii	Buloke	x					P s	Kialla roadsides
Bursaria spinosa	Sweet Bursaria	x					P s	Kialla roadsides
Leptospermum obovatum	River Tea-tree				x		P s	Nearby riverbanks
Pittosporum angustifolium	Weeping Pittosporum				x		P s	Nearby riverbanks
Herbs								
Chrysocephalum apiculatum	Common Everlasting	x	x				DS P s	Watts Rd PV Reserve
Veronica gracilis	Slender Speedwell		x		x		P d	Boulevarde Park
Coronidium gunnianum	Pale Everlasting				x		P s	Sevens Ck, Archer Rd
Viola betonicifolia ssp. novaguinensis	Floodplain Violet		x				P s	Daunts Bend & Barmah NP

Table 5: Native species establishment

Refer to the appendix in Gibson-Roy & Delpratt (2015) for more information on propagation these species.

4 Monitoring

Monitoring is record-keeping for the purpose of learning how environments change over time. A monitoring program will be useful to help understand the impacts of our interventions and to improve what we do over time.

It is important to keep monitoring focussed on what we are hoping to improve (our restoration targets) and what we need to learn about plant and animal responses to the actions we take.

Monitoring should be a useful activity, so the information collected needs to be targeted, simple to collect, simple to understand and easy to access.

4.1 Recording management actions

- Some simple way to record weed control work, pest control, seed spreading, plant introductions, sapling thinning and other management actions is required before monitoring can be useful. We should:
- keep a works diary,
- use standard recording forms,
- use a GPS to mark point locations and
- make a site map to record works areas on and to indicate named areas that can be referred to in written records.
- Results can be collated in spreadsheets.

Methods can be refined over time as necessary.

4.2 Photo-points

Photo-point monitoring is useful for general communication about how a site is changing over time. For this we need to establish a fixed point from which to take the photo (usually a labelled metal stake) and a focal point (either another stake with the top being the centre of the photo or a distinctive permanent landscape feature) so that the exact same view can be replicated on each occasion. The main advantages are that it is quick and can be done by anyone, the disadvantage is that unless changes are extreme, it can be difficult to collect meaningful information - sometimes changes in seasonal conditions are far more prominent in the photo than changes that occur because of management actions.

4.4 Quadrats

Area or quadrat-based monitoring can provide a more detailed record of changes to vegetation. We don’t need to do this in a scientifically valid way, we just need to give ourselves a framework for close observation of the vegetation to improve our understanding of how it responds to what we are doing. In this way we can improve our management over time.

To establish a quadrat, we need to

- place permanent markers (steel posts) and a permanent label,
- count the type and abundance (a description, an approximate number or % cover) of the plants of interest BEFORE the management intervention.

- record the same information in subsequent years (in the same season), noting what and when further interventions are made.

Already several quadrats have been established to record vegetation changes over time.

Quadrat 1 was established in Condition 6 Riverine Grassy Woodland in “The Bermuda Triangle” to measure the impact of woody and perennial weed removal.

Quadrat 2 was established in Condition 1 Riverine Grassy Woodland on the mid north boundary to measure the impact of hand removal of all weeds including annuals.

Quadrats 3, 4 & 5 were established in Condition 3 Riverine Grassy Woodland in the west and north west to measure the impact of hand removal of all Ribwort.

Quadrats 6 & 7 were established as comparison sites to measure the impact of thinning saplings.

See the Quadrat Record sheet at the end of this document.

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Chemical Use Record

Date	**Start Time**
Supervisor	**Finish Time**
Operators	
Locations	
Plants treated	
Application Method	**Total volume applied**
Product	**Actives**
Carrier Volume	**Label dose rate**
Additives	**Label dose rate**
Temperature	**Wind Speed**
Moisture on foliage?	**Rain within 2 hours after?**
Post-application notes	

Quadrat Record Example

Quadrat no: 1	**Management Zone:** PGW 6 a	**Location:** Bermuda Triangle
Monitoring Purpose: Assess effect of removal of woody weeds and perennials		
Assessment Date: 26/2/18	**Record No:** 1	**Action Date/s:** 26/2/18, 20/2/18
Woody Weed saplings: 18 Desert Ash, 5 Briar Rose		All removed
Woody Weed seedlings: 74 Desert Ash, 3 Briar Rose		All removed
Perennial weeds: Verbena Weed 50+, Curled Dock 50+, Black Nightshade 50+		Dead-headed only
% Cover natives/weeds: 10/90 overall		
Native species present: * = seedlings Euca cama, Acac deal*, Poa labi, Anth king, Care tere, Dian tard*, Dill Cine, Menth satu, Sene quad, Oxal pere		
Weeds: Annual grasses, Ribwort, Verbena weed, Curled Dock, Spear Thistle, Prickly Lettuce, Cleavers, Common Sow-thistle, Flat weed, Flax-leaf Fleabane, Jonquil, black Nightshade, Slender Vetch		
Other features:		**Other actions:**

Quadrat Record

Quadrat no:	**Management Zone:**	**Location:**
Monitoring Purpose:		
Assessment Date:	**Record No:**	**Action Date/s:**
Woody Weed saplings:		
Woody Weed seedlings:		
Perennial weeds:		
% Cover natives/weeds		
Native species: **present**		*** = seedlings**
Weeds:		
Other features:		**Other actions:**

Bushland Plant Introduction Records - SOURCE POPULATION

Ref. No.	Species	District	Location description	Habitat description	Latitude Longitude	Collection dates	Total pop. size	Number collected from	Record in VBA?
001	*Minuria integerrima*	*Numurkah*	*Numurkah Rifle Range northeast corner near Kinnairds Rd*	*Occasionally damp depression. Heavy grey clay. Grey Box.*	*S 36°05'27.8" E 145°27'30.6"*	*2/11/17*	*200*	*10*	*yes*

Bushland plant introduction records - DESTINATION

Ref. no.	Species	Management Unit	Detailed location or Lat/Long	Planting date	No. planted	seed or plants	Grown by	No. alive after 1 year	Notes
001	*Minuria integerrima*	*PW6a*	*Nature Play Space on introduced clay soil on east side*	*22/5/18*	*10*	*plants*	*Andrew Sands*		*Planted in a dry season following a dry season Multiple waterings*

Activity Plan Example

Management Zone	PW2	PW3	RGW1	RSW1	Across whole site
July 2018	Set up monitoring plot Spot-spray perennial weeds	Set up monitoring plot Spot-spray perennial weeds	Set up monitoring plot Spot-spray perennial weeds	Set up monitoring plot Spot-spray perennial weeds	Destroy rabbit burrows.
August	Spot-spray perennial weeds Spray	Spot-spray perennial weeds	Spot-spray perennial weeds Set up macropod and rabbit/hare exclosures S-s Soursob Bridal Creep	Spot-spray perennial weeds	Spot-spray Bridal Creeper, Soursob, Jonquils, Snowdrops at flowering
September	s-s perennials pre-flowering	s-s perennials pre-flowering	s-s perennials pre-flowering	s-s perennials pre-flowering	S-s soursob at flowering
October	s-s perennials pre-flowering Survey for new plant species	s-s perennials pre-flowering Survey for new plant species	s-s perennials pre-flowering Survey for new plant species	s-s perennials pre-flowering Survey for new plant species	Search for and remove new woody weeds Sow seed of shrubs and C4 grasses in the nursery
November	S-s Lippia, Paspalum	S-s Lippia, Paspalum	S-s Lippia, Paspalum	S-s Lippia, Paspalum	Cut & paint remaining woody weeds Search for and remove new woody weeds S-s St. John's-Wort Collect seed of herbs & C3 grasses
December	S-s Lippia, Paspalum before seed set	S-s Lippia, Paspalum	S-s Lippia, Paspalum	S-s Lippia, Paspalum	Cut & paint remaining woody weeds S-s St. John's-wort Collect seed of shrubs, herbs, C4s