2017 Woodland Quality and Extent Mapping – ACT Government Environmental Offsets

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1 Introduction

Capital Ecology Pty Ltd (Capital Ecology) has been commissioned by the ACT Government Parks and Conservation Service (PCS) to assess and map the quality and extent of the woodland within the following ten ACT offset reserves ('sites') (refer Figure 2.1-a):

- Horsepark North (95.20 ha) located in the north of the ACT close to the NSW border, north of Horse Park Drive;
- Isaacs Ridge (36.93 ha) located in the Jerrabomberra Valley, to the west of Mugga Lane and north of Long Gully Road;
- Kenny Broadacre (23.37 ha) located in the Gungahlin Valley, north of Horse Park Drive and bordering the southern section of Goorooyarroo Nature Reserve;
- Kinlyside (281.18 ha) located in the north of the ACT, to the west of the suburb of Casey;
- Kenny Woodland (102.45 ha) located in the Gungahlin Valley, Kenny Woodland is the woodland component of the offset reserve located north of Morisset Drive, Mitchell;
- Taylor (52.93 ha) located in the north of the ACT adjoining the NSW border, northwest of Horse Park Drive;
- Throsby East (102.46 ha) located in the Gungahlin Valley, between Goorooyarroo Nature Reserve and the developing suburb of Throsby;
- Throsby North (172.38 ha) located in the Gungahlin Valley, between Goorooyarroo Nature Reserve, Mulligans Flat Nature Reserve, and the developing suburb of Throsby;
- The Pinnacle (19.53 ha) located in the Molonglo Valley, north of William Hovell Drive and between Kama Nature Reserve and The Pinnacle Nature Reserve; and
- Watson Woodland (18.63 ha) located in the suburb of Watson, to the west of Antill Street and north of Roma Mitchell Crescent.

The sites are managed by PCS for their biodiversity conservation values. Each site is known to support woodland which meets the definition for the 'White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland' ('Box-Gum Woodland' or 'BGW') threatened ecological community (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the ACT *Nature Conservation Act 2014* (NC Act), and/or habitat for threatened fauna species (e.g. Golden Sun Moth *Synemon plana*, Striped Legless Lizard *Delma impar*, Pink-tailed Worm-lizard *Aprasia parapulchella,* numerous woodland birds). Box-Gum Woodland is listed as 'critically endangered' pursuant to the EPBC Act and 'endangered' pursuant to the NC Act.

The quality and extent of the woodland in each of the sites has been mapped previously, however the mapping has been undertaken across several seasons, by numerous practitioners, and using various methods and scales. The objective of this study was to develop a logical and repeatable Geographic Information System (GIS) supported assessment methodology and apply this to produce fine-scale baseline mapping of the current on-ground quality and extent of the woodland within each site. The mapping presented herein is consistent across the ten sites and provides an accurate

and reliable foundation for PCS's ongoing management and future monitoring of the significant biodiversity values within.

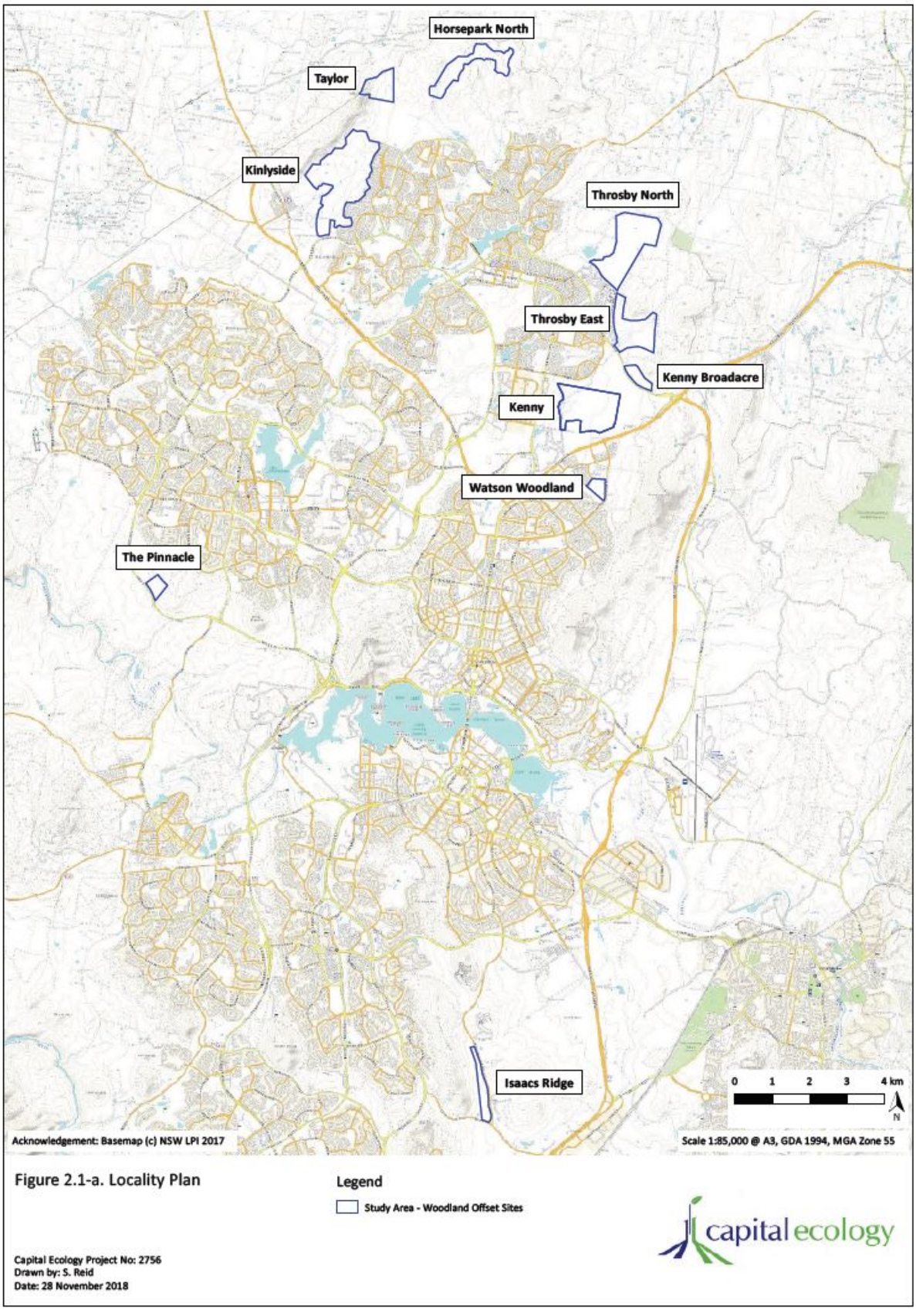
Note: The previous mapping was provided to Capital Ecology by PCS, however to avoid influencing the mapping results, it was deliberately not reviewed until the report preparation stage of the study.

This report is structured in the following manner.

- Section 2 – Methods. Section 2 provides a detailed description of the mapping methodology.
- Section 3 – Results. Section 3 provides the results of the mapping study, presented as text, tables and GIS-prepared figures. The results are presented as a sub-section for each site such that each may be considered in a standalone manner. Notwithstanding this, the results are presented in a consistent manner across sites to facilitate comparison between sites. A brief discussion is provided for each site describing any interesting observations from the data, or otherwise observed, together with notes comparing the current mapping to previous mapping.
- Section 4 – Summary and Conclusion. Section 4 provides an overview of the study and outline of the key 'project-scale' conclusions and recommendations.
- References – A list of the studies, guidelines, and other documents reviewed and considered during development of the mapping methodology and its on-ground application.

Appendices – Appendix 1 and Appendix 2 provide the study data presented as summary tables. Appendix 3 provides the PCS Excel Spreadsheets (excel files in separate .zip folder) and Appendix 4 provides the GIS Data (shapefiles in separate .zip folder).

Figure 2.1-a. Locality Plan



2 Methods

2.1 Four-step temperate vegetation mapping method

The four-step method employed for this study was developed by Capital Ecology in 2015 and has been trialled and improved during its subsequent application at numerous sites across the Southern Tablelands of NSW and the ACT. The method was employed to map areas of natural grassland in spring 2016, together with the woodland and derived grassland at Mulangarri and Gungaderra offset reserves (Capital Ecology 2017[1]). The four-step method can be used to assess and map each of the Plant Community Types (PCTs) occurring in the lowland areas of the Southern Tablelands of NSW and the ACT. As detailed below, the four-step method draws upon elements of the relevant contemporary Commonwealth Government (Commonwealth of Australia 2006[2]), ACT Government (ACT Government 2015a[3]; ACT Government 2015b[4]), and NSW Government (NSW Government 2014[5] 2017[6]) vegetation mapping guidelines, together with other technical guidelines. Each step of the four-step method has a specific purpose and must achieve a specific outcome which generally becomes the foundation for the subsequent step.

Repeatability is a key element of vegetation mapping methodologies when applied to offset sites which are to be periodically monitored. Accordingly, the four-step method is described in full below.

2.1.2 Step 1. Plant Community Type (PCT) mapping

Purpose = to identify and delineate the boundaries of each PCT within the site.

Outcome = GIS mapping of PCT boundaries.

The on-ground boundaries of each of the PCTs (as defined in ACT Government 2015c[7]) present within the site were accurately mapped using either hand-held GPS or by marking boundaries directly onto high resolution orthorectified aerial photograph field maps (displaying the ACT Government's May 2017 aerial imagery available under CC.4.0) with one metre contours. PCT boundary delineation was undertaken by walking or driving (as deemed most suitable), carefully determining and recording the boundary alignment.

The vegetation within each of the sites has undergone various types and degrees of modification over the last 150 years. This modification often removes or disguises the elements which would have once clearly defined the PCT boundaries (noting that ecotones are usually gradual transitions between vegetation communities, often in excess of 50 m in width). As such, the PCT boundary

[1] Capital Ecology (2017a). *ACT Environmental Offsets – 2016 Grassland Mapping Report*. Prepared for ACT Government Parks and Conservation Service.
[2] Commonwealth of Australia (2006). *Policy Statement 3.5: White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands.* Commonwealth Department of Environment and Heritage.
[3] ACT Government (2015a). *Monitoring Guidelines for Box-Gum Woodlands*. Conservation Research, October 2015.
[4] ACT Government (2015b). *ACT Environmental Offsets Calculator Assessment Methodology*. Environment and Planning. May 2015.
[5] NSW Government (2014). *BioBanking Assessment Methodology 2014.* NSW Government Office of Environment and Heritage.
[6] NSW Government (2017). *Biodiversity Assessment Method.* Office of Environment and Heritage.
[7] ACT Government (2015c). *ACT Vegetation Types Database – Attachment to the ACT Environmental Offsets Calculator Assessment Methodology.* 18 May 2015.

delineation involved carefully reading the landscape, considering numerous less conspicuous landscape elements, such as the:

- presence, species, growth form and density of remnant canopy trees and/or stags or stumps of these;
- presence and species of midstorey shrubs and trees;
- floristic composition of the groundstorey; and
- the landscape position and other geographical features (elevation, aspect, soils, apparent hydrology etc.).

Step 1 is critical to the accurate mapping of temperate vegetation communities and was completed and mapped in GIS prior to moving on to Step 2.

Note: The portions of the Kenny site identified as supporting a natural grassland PCT (primarily PCT-ACT01) have been mapped applying this method and are presented in the concurrently prepared report (Capital Ecology 2018[8]).

2.1.3 Step 2. Vegetation zone definition and mapping

Purpose = to identify and delineate the boundaries of each vegetation zone within the site.

Outcome = GIS mapping of vegetation zone boundaries.

The mapped PCTs were further divided into vegetation zones based on the structure, floristic composition and overall quality ('intactness') of the vegetation. As described above for Step 1, each patch of each discernible (generally homogenous) vegetation zone was accurately mapped using either hand-held GPS or by marking boundaries directly onto recent high resolution orthorectified aerial photograph field maps with one metre contours. Vegetation zone boundary delineation was undertaken by walking or driving (as deemed most suitable), carefully determining and recording the boundary alignment.

Table 2.1-a and Table 2.1-b outline the vegetation zones which were defined for PCTs 'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland' and 'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest'.

[8] Capital Ecology (2018). *2017 Grassland Quality and Extent Mapping – ACT Government Environmental Offsets.* Prepared for the ACT Government Parks and Conservation Service.

Table 2.1-a. Vegetation zones for PCT ACT16

PCT	Groundstorey Dominance (perennial) Native or Exotic	Mature characteristic canopy sp./spp. Present or Absent	Regeneration of characteristic canopy sp./spp. Present or Absent	Native Forb Diversity Low, Mod-High Low = < 12 sp. (disturbance tolerant spp. only) Mod-High = ≥12 sp.; incl. ≥ 1 important sp.; +/- disturbance sensitive spp.	Vegetation Zone ID Colour as per mapping
ACT16 Eucalyptus *melliodora* – *E. blakelyi* Tableland Grassy Woodland	Native	Present	Present	Mod-High	**16.1 (EPBC BGW)**
				Low	**16.2 (EPBC BGW)**
		Absent	Present	Mod-High	**16.3 (EPBC BGW)**
			Absent	Mod-High	**16.4 (EPBC BGW)**
			Absent	Low	**16.5**
	Exotic	Present	Present	Low	**16.6**
		Present	Absent	Low	**16.7**
		Absent	Absent	Low	**16.8**

Table 2.1-b. Vegetation zones for PCT ACT25

PCT	Groundstorey Dominance (perennial) Native or Exotic	Mature characteristic canopy sp./spp. Present or Absent	Regeneration of characteristic canopy sp./spp. Present or Absent	Native Forb Diversity Low, Mod-High Low = few or none (disturbance tolerant spp. only) Mod-High = ≥12 sp; incl. ≥ 1 important sp.; +/- disturbance sensitive spp.	Vegetation Zone ID Colour as per mapping
ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest	Native	Present	Present	Mod-High	**25.1**
				Low	**25.2**
		Absent	Present	Mod-High	25.3 (none present)
			Absent	Mod-High	**25.4**
			Absent	Low	**25.5**
	Exotic	Present	Present	Low	**25.6**
		Present	Absent	Low	**25.7**
		Absent	Absent	Low	**25.8**

The vegetation zones defined are consistent across all sites. This permits direct comparison between offset sites and the values within and assists in determining the type and prioritisation of management activities.

Patches of Kinlyside, Taylor, and Horsepark North were planted with native eucalypts in the 1970s and 1980s. These plantings were undertaken by/for the ACT Government in order to provide future sources of firewood for Canberra. The rip lines and uplifted rocks from the deep ripping carried out to facilitate the planting are evident throughout the patches. Whilst some of the eucalypts planted are characteristic of the relevant PCT, many of the planted trees are the more rapidly growing species characteristic of the higher elevation areas of the ACT and elsewhere (i.e. Ribbon Gum *E. viminalis*, Blue Gum *E. globulus*). The plantation patches were delineated and mapped based on the relevant PCT, however they were not included in the vegetation zones as they do not constitute remnant vegetation.

Step 2 was completed and mapped in draft form in GIS prior to moving on to Step 3. GIS mapping of vegetation zones allows for accurate calculations of the total area of each vegetation zone within the site.

As detailed in Table 2.1-c, an additional mapping layer was developed for the combined zones with exotic groundstorey dominance to differentiate areas by the key reason for the exotic dominance (i.e. Stock Camp, Noxious Weed Species, Pasture and Agricultural Weed Species). This additional mapping layer was developed to assist PCS in managing the sites given that the required management measures differ depending upon the reason for the exotic dominance.

Table 2.1-c. Reason for Exotic Dominance

Reason for Exotic Dominance	
	Pasture and Agricultural Weed Species (cultivation or pasture improvement, such as Phalaris pasture)
	Stock camp (soil nutrification, annual weed dominance)
	Noxious weed Species (e.g. dense Serrated Tussock or Chilean Needle Grass)

With regard to the above, it is important to note that the exotic dominance category mapping does not reflect the extent to which any exotic species (or group of exotic species) occurs within a site. Many of the exotic species (notable Serrated Tussock) occur more broadly within the sites, including within vegetation zones with a native dominant understorey.

2.1.4 Step 3. Data collection (plot-transects) – Woodland and Dry Sclerophyll Forest PCTs

Purpose = to record the floristic composition and structure of each vegetation zone.

Outcome = recorded floristic composition and structure data.

Step 3 for woodland and dry sclerophyll forest PCTs was developed based on the methodology provided in Chapter 3 of the *ACT Environmental Offsets Calculator Assessment Methodology* (ACT Government 2015b).

A series of a vegetation assessment plot-transects were completed to adequately sample each vegetation zone, the required number of which was as stipulated in Table 2 of ACT Government (2015b) (extract provided below). Generally, a woodland or dry sclerophyll forest vegetation zone is only considered to be in 'low condition' if it lacks the characteristic canopy, lacks regeneration of the canopy, and has an exotic dominant groundstorey (i.e. it is exotic pasture).

Extract from *ACT Environmental Offsets Calculator Assessment Methodology* (ACT Government 2015b).

Table 2 sets out the minimum number of plots/transects that are required in each vegetation zone. If the condition of the vegetation is more variable across the zone, more transects and plots may be needed than the number in **Table 2,** particularly where the area of the vegetation zone is large.

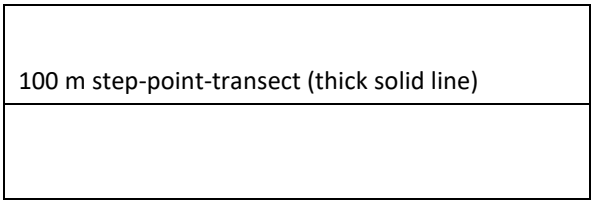
Table 2: Minimum number of transects/plots required per zone area

Vegetation zone area (ha)	Minimum number of transects/plots
0 – 4	1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition.
> 4 – 20	3 transects/plots or 2 transects/plots if vegetation is in low condition.
> 20 – 50	4 transects/plots or 3 transects/plots if vegetation is in low condition.
> 50 – 100	5 transects/plots or 3 transects/plots if vegetation is in low condition.
> 100 – 250	6 transects/plots or 4 transects/plots if vegetation is in low condition.
> 250 – 1000	7 transects/plots or 5 transects/plots if vegetation is in low condition. More transects/plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 transects/plots or 5 transects/plots if vegetation is in low condition. More transects/plots may be needed if the condition of the vegetation is variable across the zone.

As illustrated in Diagram 1, in order to better align the method with the *EPBC Act Policy Statement 3.5 – White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands* (Commonwealth of Australia 2006), the dimensions of each plot-transect were 100 x 20 m (2,000 m^2, 0.2 ha), the centreline of which is the 100 m step-point transect. Plot-transects were completed in locations deemed via observation during Steps 1 and 2 to be representative of the vegetation zone.

Diagram 1. Vegetation survey plot-transect

Outer line forms 100 x 20 m plot



Each plot-transect was allocated a four-part identification code as per the below example.

i. Site = Kinlyside → Code Part 1 = **Ki**

ii. PCT = ACT16 → Code Part 2 = **16**

iii. Vegetation zone = 3 → Code Part 3 = **3**

iv. Plot-transect number = 2 → Code Part 4 = **2**

↓

- Plot-transect identification code = **Ki_16.3.2.**

The of each plot-transect is displayed on the vegetation mapping prepared for each site, and GPS coordinates (GDA94 Zone 55) and all GIS shapefiles (GDA94 Zone 55) of the start and end points (recorded with a handheld GPS unit) are provided in Appendices 1 to 4.

The following floristic survey data were collected from the 100 x 20 m plot-transect.

1. At each 1 m point along the 100 m step-point transect the ground layer was allocated to one of the following options:
    - Cryptogams (Moss/Lichen)
    - Bare Earth
    - Rocks
    - Litter/Dead Vegetation
    - Annual Exotic Grass
    - Perennial Exotic Grass
    - Exotic Broadleaf
    - Perennial Native Grass
    - Other native
2. An estimate was made of the percent crown cover of each dominant species in each stratum.
3. Every vascular plant species observed in the 2000 m^2 plot was recorded.

4. The presence and abundance of natural regeneration of the dominant overstorey eucalypts of at least 15 cm circumference at 130 cm above the ground was recorded.

5. An estimate was made of the numbers of trees in the 2,000 m^2 plot that have a circumference of at least 125 cm at 130 cm above the ground.

Table 2.1-d provides the survey dates and number of plot-transects per vegetation zone at each site (total for study = 132 plot-transects). The timing of the 2017 surveys was determined in order to ensure that all plot-transects were completed during optimal seasonal conditions. Accordingly, these dates should be replicated as closely as possible for future monitoring purposes.

Table 2.1-d. Survey dates and plot-transect numbers per vegetation zone (PCTs combined)

Site	Survey Dates	Number of Plot-Transects								
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Total
Horsepark North	31/10/2017	7	-	-	7	-	-	-	1	**15**
Isaacs Ridge	03/11/2017	-	4	-	-	-	1	-	-	**5**
Kenny Broadacre	02/11/2017	-	4	-	-	4	-	-	2	**10**
Kinlyside	27-30/11/2017	10	7	-	7	2	2	-	1	**29**
Kenny Woodland	02/11/2017	-	5	-	1	3	2	-	2	**13**
Taylor	01/11/2017	6	-	-	6	-	1	1	1	**15**
Throsby East	10/11/2017		7	-	-	3	2	-	2	**14**
Throsby North	08/11/2017	4	4	-	3	2	3	-	2	**18**
The Pinnacle	25/10/2017	3	3	-	1	1	-	-	-	**8**
Watson Woodland	10/11/2017	-	3	-	-	-	2	-	-	**5**

All threatened/rare flora and fauna species observed during Steps 1 to 3 were recorded with a GPS waypoint (individual waypoint if not within a plot-transect), these records are detailed under the relevant site subsection. A photograph was also taken of each threatened/rare flora species and the record has been lodged with Canberra Nature Map.

2.1.5 Step 4. Threatened Ecological Community (TEC) determination

Purpose = to determine the areas of the site which support EPBC Act BGW.

Outcome = data supported GIS mapping of the EPBC Act BGW within each site.

The data recorded during Step 3 for each of the native vegetation zones was analysed to determine whether the vegetation zone meets the listing criteria for the EPBC Act critically endangered ecological community 'White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland' (EPBC Act BGW). Table 2.1-e presents a flowchart of the key elements of the EPBC Act listing criteria for EPBC Act BGW, drawn from the flowchart provided in Commonwealth of Australia (2006).

Table 2.1-e. Summary of assessment of vegetation zone characteristics against the listing criteria for EPBC Act Box-Gum Woodland

Criterion		Assessment Results							
		ACT16-Zone1	ACT16-Zone2	ACT16-Zone3	ACT16-Zone4	ACT16-Zone5	ACT16-Zone6	ACT16-Zone7	ACT16-Zone8
1.	*Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Red Gum?*	Yes – Yellow Box and/or Blakely's Red Gum are/were dominant or co-dominant throughout PCT ACT16.							
2.	*Does the patch have a predominantly native understorey?*	Yes					No		
3.	*Is the patch 0.1 ha (1000 m2) or greater in size with 12 or more native understorey species present (excluding grasses)? There must be at least one important species.*	Yes	No	Yes	Yes	No	N/A – refer response to Criterion 2		
	Or								
	Is the patch 2 ha or greater in size with an average of 20 or more mature trees per hectare, or is there natural regeneration of the dominant overstorey eucalypts?	Yes	Yes	Yes (regeneration only)	No	No			
	Does the patch meet the criteria for the listed TEC?	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**		
	EPBC Act BGW - Form	**Structural Woodland**	**Structural Woodland**	**Derived Grassland**	**Derived Grassland**	**N/A**	**N/A**		

Consideration of ACT *Nature Conservation Act 2014* Box-Gum Woodland listing

Action Plan 10 and Action Plan 27 definition

In addition to the EPBC Act listing, it is relevant to note that Yellow Box – Blakely's Red Gum Grassy Woodland is also listed as 'endangered' pursuant to the ACT *Nature Conservation Act 2014* (NC Act). Remnants of the Yellow Box – Blakely's Red Gum Grassy Woodland endangered community consistent with the NC Act listed community were defined in Action Plan 10 (ACT Government 1999[9]) and Action Plan 27 (ACT Government 2004[10]) as any polygon in which:

- *the proportion of crown cover contributed by either E. melliodora or E. blakelyi or both jointly is ≥ 40%; and*
- *understorey is not exotic pasture; and*
- *remnants are not isolated trees or clumps.*

Polygons within which most or all of the trees have been cleared (referred to as secondary grassland) also constitute the NC Act listed community, provided:

- *Yellow Box and/or Blakely's Red Gum are estimated to have previously been the dominant or co-dominant species; and*
- *the groundstorey is predominately native; and*
- *a moderate diversity of native groundstorey species is present.*

Whilst the primary focus of this project was to assess and map the areas of the sites which support EPBC Act BGW, the NC Act definition was considered in the definition of vegetation zones. In this regard, the only scenario which would satisfy the NC Act definition but not the EPBC Act definition would be a substantial patch (i.e. not an isolated tree or clump) with:

- the characteristic canopy of Yellow Box and/or Blakely's Red Gum; and
- a low diversity native dominant groundstorey; and
- an absence of regeneration of the canopy species.

This scenario previously occurred across much of Kenny Woodland, Throsby East, and the southern portion of Throsby North (R. Speirs pers. obs.; Maguire and Mulvaney 2011[11]), however it was not identified within these sites or any of the others during 2017 survey season. The key reason for this is that these areas now support sufficient regeneration of the canopy species to promote them to ACT16-Zone2 (i.e. they are now EPBC Act BGW).

Consistency with an alternative definition applied by ACT Government, Conservation Research

[9] ACT Government (1999). *Yellow Box – Red Gum Grassy Woodland: An endangered ecological community. Action Plan No. 10.* Environment ACT, Canberra.
[10] ACT Government (2004). *Woodlands for Wildlife: ACT Lowland Woodland Conservation Strategy. Action Plan No. 27.* Environment ACT, Canberra.
[11] Maguire O. and Mulvaney M. (2011). *Box-Gum Woodland in the ACT. Technical Report 25.* Environment and Sustainable Development Directorate, Canberra.

Maguire and Mulvaney (2011) introduced the following recommended alterations to the criteria provided in Action Plan 10 and Action Plan 27 and applied them for their woodland mapping study:

- *areas with a greater than 30% shrub cover were excluded;*
- *the 'greater than 50% cover of native ground layer species' was changed to '50% or more of the perennial ground cover must be native'; and*
- *patches containing at least 20 mature Yellow Box or Blakely's red Gum trees that have a continuous canopy cover, but may have an exotic understorey, were included.*

This alteration considerably broadens the definition from that provided in Action Plan 10 (ACT Government 1999) and Action Plan 27 (ACT Government 2004). It includes substantially sized polygons with an exotic understorey but a largely intact canopy. It also provides a greater focus on the composition of the perennial ground cover by excluding consideration of annuals, meaning that areas dominated by annuals could still be considered the NC Act listed community. Maguire and Mulvaney (2011) noted the appropriateness of including these areas due to their observed ability to regenerate naturally in a relatively short time if grazing is removed or significantly reduced. In this regard, Maguire and Mulvaney (2011) note that the condition may improve to the extent that such patches would meet the EPBC Act listing criteria.

In addition to the area mapped using the Action Plan 10 and Action Plan 27 definition, the application of the above alternative definition would result in the inclusion of patches of ACT16-Zone6 and ACT16-Zone7 which contain at least 20 mature Yellow Box and/or Blakely's red Gum trees with a continuous canopy cover. Whilst this alternative definition was not considered for this study, it is noted that it would not have applied to substantial areas of the sites given that the retained remnant trees in ACT16-Zone6 and ACT16-Zone7 are generally quite scattered, thus creating a largely discontinuous canopy.

3 Results

A summary of results for each site is provided in the following subsections 3.1 to 3.12, together with a table and representative photograph for each vegetation zone ('zone').

Significant weeds were identified as those listed as ACT Pest Plants (ACT Government 2015d[12]) and Weeds of National Significance (WoNS)[13] and are highlighted in the following subsections.

3.1 Horsepark North

3.1.1 Woodland mapping results

Figure 3.1-a shows the extent of the PCTs and zones for Horsepark North and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Horsepark North was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 12.85 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 25.31 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 3.75 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 0.58 ha of Plantation (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 31.22 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity.
- 14.90 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity.
- 5.72 ha of Plantation.

In total, 38.16 ha of woodland in Horsepark North meets the EPBC Act BGW criteria (Figure 3.1-b).

Native understorey species richness ranged from 12 native species (HN_16.8.1) to 42 native species (HN_25.1.2). These two plots also set the range for the number of important species, which varied from 2 (HN_16.8.1) to 15 (HN_25.1.2).

[12] ACT Government (2015d). *Pest Plants and Animals (Pest Plants) Declaration 2015 (no 1).* Authorised by the ACT Parliamentary Counsel. 16 April 2015.
[13] Available from http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html

Significant weeds were found throughout the site, including Serrated Tussock *Nassella trichotoma* (all zones). Other pest plants that were widespread include Briar Rose *Rosa rubiginosa*.

Figure 3.1-b shows the exotic dominance categories for Horsepark North. The majority of the exotic areas were classified as 'Pasture and Agricultural Weed Species'. Large portions of Horsepark North are severely infested by Serrated Tussock. At the time of survey, the majority of the mature Serrated Tussock plants had been sprayed and the areas were therefore classified according to their native dominant groundlayer. If the Serrated Tussock is not aggressively controlled over the coming years, it is likely that this weed will threated the native groundlayer dominance over large portions of the site.

One rare species, Dwarf Milkwort *Polygala japonica*, was recorded *(Species location removed)*.

Tables 3.1a-3.1e provide summaries of the plot-transect results for each zone (excluding plantations). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.1-a. Horsepark North ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Largely intact condition with a canopy representative of the climax community. Midstorey present, with a moderate to high diversity native groundlayer. Threatened flora – Dwarf Milkwort *Polygala japonica* (*Species location removed*).
Size	12.85 ha (3 plot-transects).
Overstorey Species	*E. bridgesiana* and *E. melliodora.*
Overstorey Cover	5 - 15%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 6.
Perennial Groundlayer	77 - 90% native.
Understorey	23-33 total native species, 21-27 native non-grass species, 9-13 important species.
Exotic Species Richness	5 - 13 species.
Significant Weeds	Serrated Tussock (dense cover in some areas, mostly sprayed). Paterson's Curse *Echium plantagineum* and Briar Rose also present.

Table 3.1-b. Horsepark North ACT016 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	25.31 ha (4 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	53 - 87% native.
Understorey	20-35 total native species, 17-30 native non-grass species, 5-12 important species.
Exotic Species Richness	9 - 20 species.
Significant Weeds	Serrated Tussock (dense cover in some areas, mostly sprayed). St John's Wort *Hypericum perforatum* and Briar Rose also present.

Table 3.1-c. Horsepark North ACT016 Zone 8 results summary

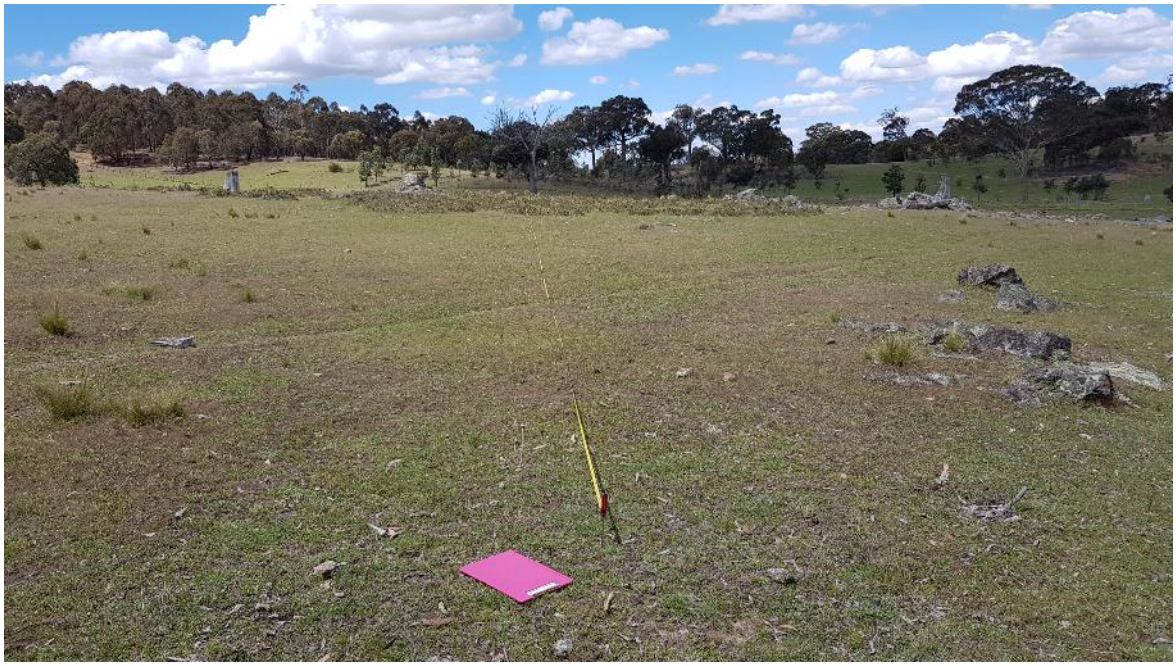
	ACT16 Zone 8
Description	Exotic Pasture Overstorey and midstorey absent. Low diversity exotic groundlayer dominated by Phalaris *Phalaris aquatica* and exotic forbs.
Size	3.75 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	7% native.
Understorey	12 total native species, 11 native non-grass species, 2 important species.
Exotic Species Richness	21 species.
Significant Weeds	Serrated Tussock (mostly sprayed). Briar Rose also present.

Table 3.1-d. Horsepark North ACT025 Zone 1 results summary

	ACT25 Zone 1
Description	Tableland Grass/Shrub Forest Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	31.22 ha (4 plot-transects).
Overstorey Species	*E. macrorhyncha* and *E. nortonii.*
Overstorey Cover	5 - 22%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 8.
Perennial Groundlayer	94 - 100% native.
Understorey	21-42 total native species, 13-32 native non-grass species, 6-15 important species.
Exotic Species Richness	1 - 12 species.
Significant Weeds	Serrated Tussock (dense cover in some areas, mostly sprayed). Briar Rose also present.

Table 3.1-e. Horsepark North ACT025 Zone 4 results summary

	ACT25 Zone 4
Description	Tableland Grass/Shrub Forest – Derived Grassland Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	14.90 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	88 - 94% native.
Understorey	18-31 total native species, 17-26 native non-grass species, 6-9 important species.
Exotic Species Richness	5 - 7 species.
Significant Weeds	Serrated Tussock (dense cover in some areas, mostly sprayed).



3.1.2 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

Horsepark North contains high quality vegetation which is comprised of moderate to high diversity BGW in both structural woodland form and derived grassland form and moderate to high diversity Tableland Grass/Shrub Forest. The BGW groundlayer is dominated by Kangaroo Grass *Themeda triandra* and Red-leg Grass *Bothriochloa macra* and includes a diverse array of native forbs. The main ecological values of the site are the 38.16 ha of EPBC Act BGW, the 46.12 ha of moderate to high diversity Tableland Grass/Shrub Forest, and the site's connectivity with the surrounding reserves in the north of the ACT.

The site has been used for sheep and cattle grazing under rural lease for many years. Whilst stock have been rotated between paddocks to allow the groundlayer to recover, this rotation appears to have been applied with a primarily pastoral productivity focus rather than a conservation focus. As a result, there are signs that the stock are having a negative impact on the quality of the site as evidenced by the low herbage mass and the observed grazing of native forbs during the spring flowering season. This grazing will prevent or substantially hinder the reproduction of these species. The impact of stock is not currently sufficient to reduce the quality of the vegetation below moderate, however sustained grazing pressure is likely to progressively reduce the floristic diversity of the site over the medium to long term.

Of greatest threat to the values of the site is the infestation of Serrated Tussock which is now widespread and severe across much of the site. At the time of survey, the majority of the mature Serrated Tussock plants had been sprayed and appeared to be dead. The dead tussocks were not included as perennial vegetation and the subject areas were therefore classified according to their living groundlayer vegetation (resulting in most tussock infested areas still displaying native perennial dominance). However, numerous scattered Serrated Tussock plants had not been sprayed, and in some instances substantial patches of Serrated Tussock had been missed entirely. In addition, the properties which neighbour the site are also heavily infested with Serrated Tussock and show no signs of weed control. Given that the Serrated Tussock is so widespread, has been unmanaged for a long period of time, and can build large seedbanks in the soil that remain viable for many years, the infestation throughout Horsepark North will remain the foremost threat to the significant biodiversity values of the site for the foreseeable future.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priorities of the site are the control of Serrated Tussock and the control of stocking rates and timing. The Serrated Tussock should be managed by targeted spraying before seed-set over several consecutive years. Spraying should not be carried out via boom-spraying, as this will also destroy the native groundlayer (as observed in some areas during the current surveys). Any control measures should occur in conjunction with the neighbouring properties and appropriate fencing should be considered downwind of those properties which are heavily infested (small aperture mesh fencing can reduce the movement of wind-dispersed Serrated Tussock seed). Stock should be removed from the high value areas during the spring flowering season, and stocking rates should be managed to maintain appropriate herbage mass and to encourage the natural regeneration of the overstorey species.

Comparison to previous mapping

EcoLogical Australia (2011[14]) mapped over 2,400 ha of vegetation in the north of Canberra, including the area now known as Horsepark North offset reserve. The field surveys were conducted in accordance with ACT Government (2010[15]) and were *'undertaken within vegetation polygons identified by a combination of ACT Government vegetation mapping, aerial photograph interpretation and mapping by the Conservation Council (2008)'.* However, the vegetation mapping presented in EcoLogical Australia (2011) was later found to be quite inaccurate (Biosis 2012[16]). Biosis (2012) undertook a program of vegetation community mapping confidence testing in portions of Kinlyside and Taylor. They found that, based on the identified areas of EPBC Act BGW, the accuracy of the mapping presented in Ecological Australia (2011) ranged from 23% to 80%, averaging 61.25% accuracy/ha. Biosis (2012) attributed this inaccuracy to seasonal timing (conducting surveys in autumn instead of late spring/early summer), scale (very broad), and inadequate survey effort. Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Horsepark North, EcoLogical Australia (2011) mapped the northern half of the site as predominantly BGW. In comparison, the current study places the majority of BGW (ACT16) in the southern half of the site, with the northern areas largely dominated by *E. macrorhyncha* (ACT25) and associated derived grasslands. Indeed, the mapping between the two studies is almost completely opposite. The data presented in the current study clearly demonstrates that the PCTs and zones have been correctly identified. The misidentification of the vegetation presented by EcoLogical Australia (2011) for Horsepark North does not have any clear explanation.

[14] EcoLogical Australia (2011). *Gungahlin Vegetation Survey and Mapping Report. Ecological Communities and Threatened Species within the Gungahlin Strategic Assessment Area.* Prepared for Conservation Planning and Research, ACT Government.

[15] ACT Government (2010). *Survey guidelines for determining lowland vegetation classification and condition in the ACT*. Environment and Sustainable Development Directorate – Conservation Planning and Research.

[16] Biosis (2012). *Vegetation Community Mapping – Confidence Testing within the Gungahlin Strategic Environmental Assessment Area.* Survey Report for the Land Development Agency. Project no. 15800.

Figure 3.1-a. Horsepark North Vegetation Mapping Results

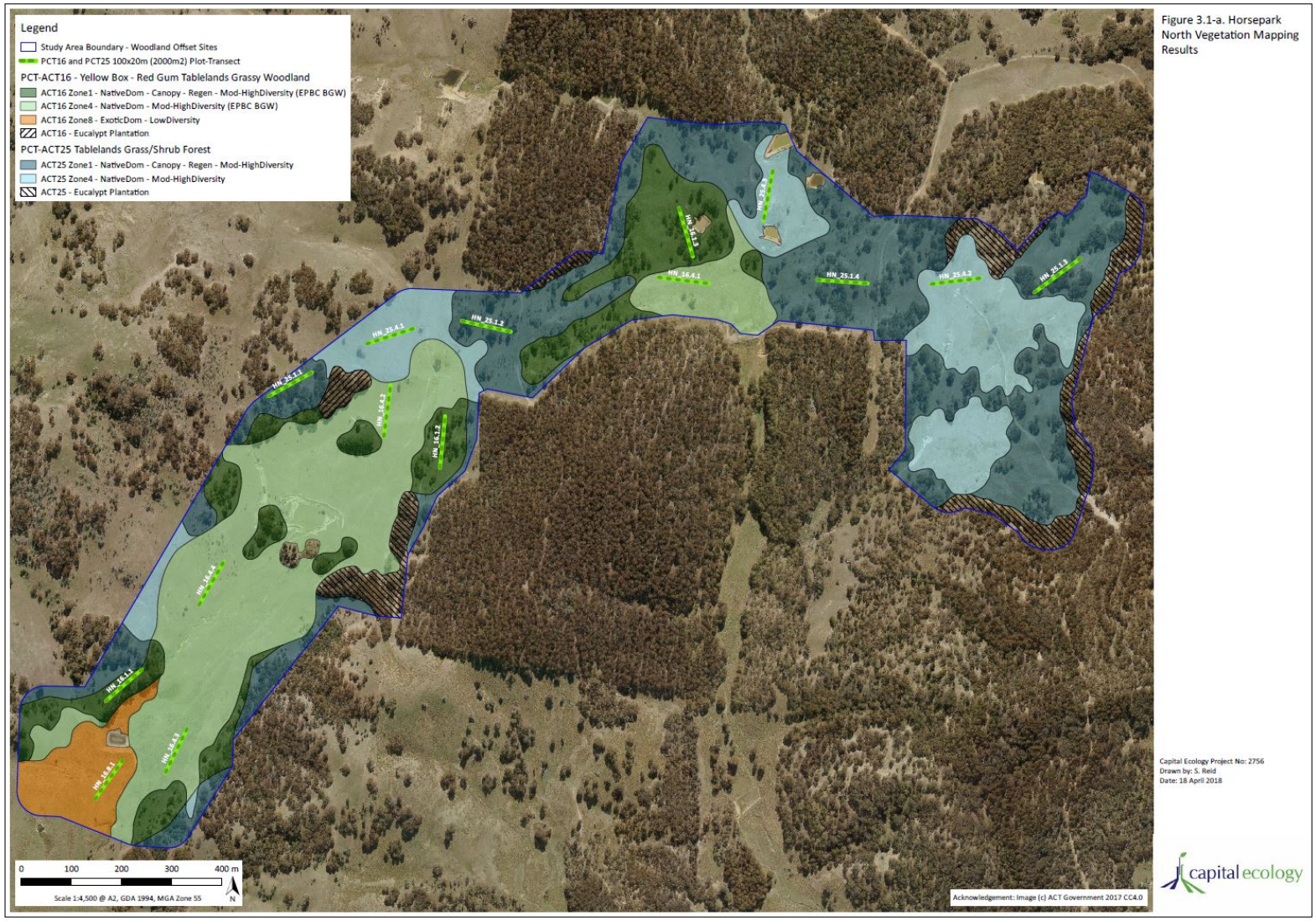
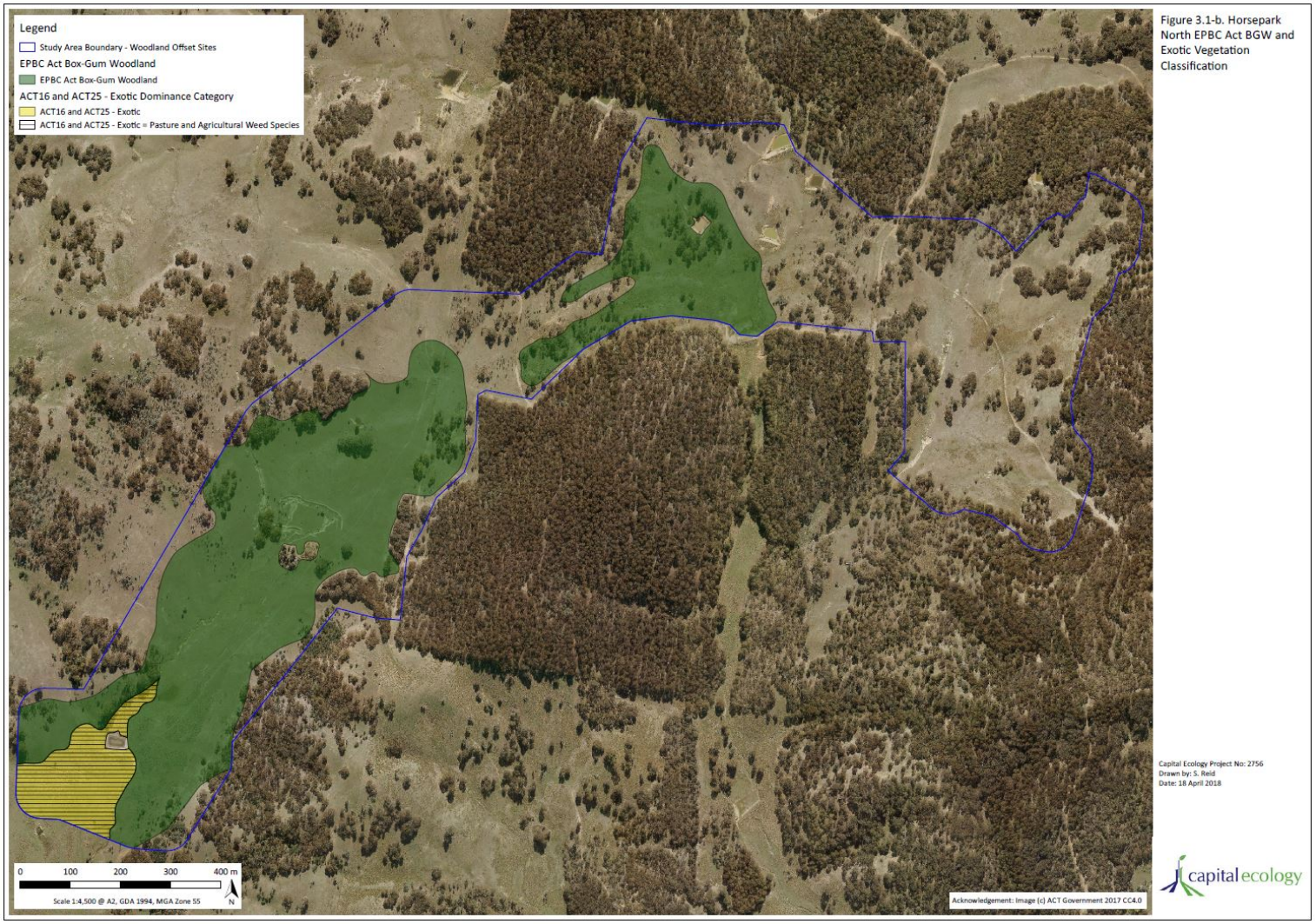


Figure 3.1-b. Horsepark North EPBC Act BGW and Exotic Vegetation Classification



3.2 Isaacs Ridge

3.2.2 Woodland mapping results

Figure 3.2-a shows the extent of the woodland PCT and zones for Isaacs Ridge and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Isaacs Ridge was found to support one PCT:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 35.26 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 1.67 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

In total, 35.26 ha of woodland in Isaacs Ridge meets the EPBC Act BGW criteria (Figure 3.2-b).

Native understorey species richness ranged from 6 native species (IR_16.6.1) to 25 native species (IR_16.1.2). These two plots also set the range for the number of important species, which varied from 0 (IR_16.6.1) to 7 (IR_16.1.2).

Significant weeds found within the site include Serrated Tussock (Zone 16.1) and Blackberry *Rubus fruticosus* (Zone 16.1). Other pest plants that were widespread include Briar Rose, Paterson's Curse and St John's Wort.

Figure 3.2-b shows the exotic dominance categories for Isaacs Ridge, the exotic areas mostly being restricted to a small drainage area in the south of the site. This exotic area was dominated by Phalaris and classified as 'Pasture and Agricultural Weed Species'.

No threatened or rare species were recorded.

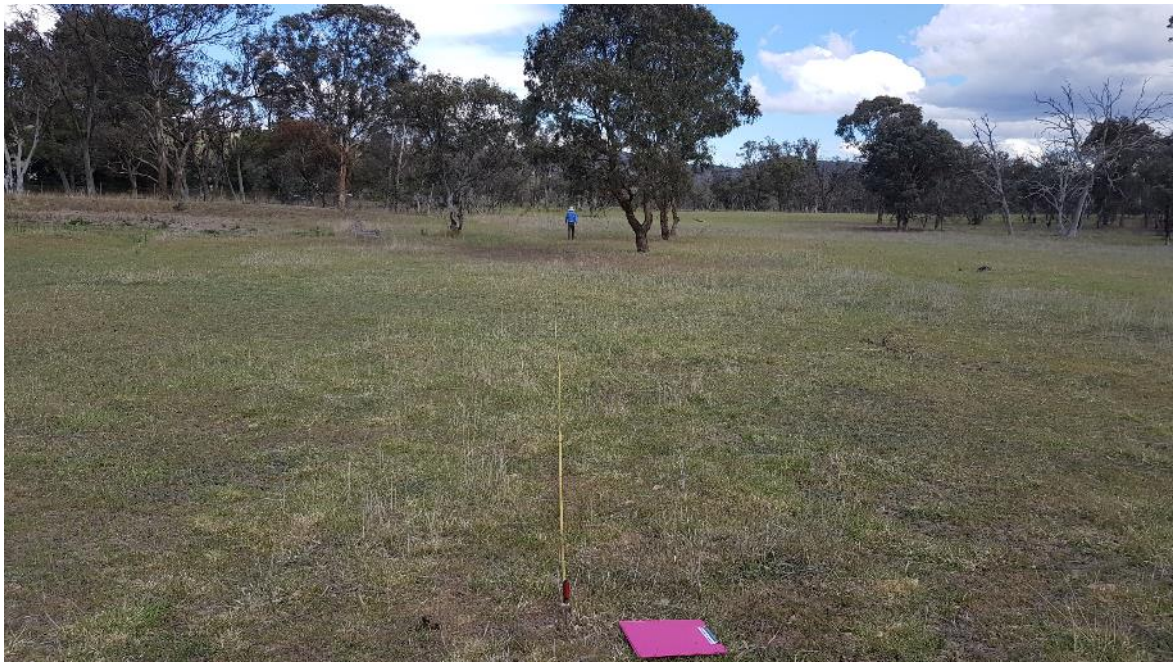
Tables 3.2a-3.2b provide summaries of the plot-transect results for each zone. Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.2-a. Isaacs Ridge ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Largely intact condition with a canopy representative of the climax community. There is evidence of selective clearing of Yellow Box and Red Gum in some areas. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	32.26 ha (4 plot-transects).
Overstorey Species	*E. blakelyi*, *E. melliodora*, *E. nortonii* and *E. polyanthemos*.
Overstorey Cover	2 - 10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 4.
Perennial Groundlayer	57 - 80% native.
Understorey	12-25 total native species, 9-19 native non-grass species, 0-7 important species.
Exotic Species Richness	15 - 16 species.
Significant Weeds	Serrated Tussock and Blackberry. Briar Rose, Paterson's Curse, St John's Wort and Cootamundra Wattle *Acacia baileyana* also present.

Table 3.2-b. Isaacs Ridge ACT16 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer) Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	1.67 ha (1 plot-transect).
Overstorey Species	*E. melliodora.*
Overstorey Cover	0.2%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1.
Perennial Groundlayer	18% native.
Understorey	6 total native species, 5 native non-grass species, 0 important species.
Exotic Species Richness	15 species.
Significant Weeds	Paterson's Curse and St John's Wort present.



3.2.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation across Isaacs Ridge is comprised almost entirely of BGW in a moderate to high condition, the only exception being an area of exotic pasture in the south of the site. Across the site there is evidence of selective clearing of BGW overstorey species, and that PCT inappropriate species such as *E. polyanthemos* and *E. nortonii* have been planted in their place. However, these plantings are not significant enough to alter the classification of zones within the site. The BGW groundlayer is dominated by Red-leg Grass and Weeping Grass *Microlaena stipoides* and includes a moderate diversity of native forbs. The main ecological values of the site are the 35.26 ha of EPBC Act BGW. Isaacs Ridge adjoins Isaacs Ridge Nature Reserve and represents a logical and valuable addition to the ACT nature reserve network.

In general, the site does not have any immediately threatening processes. Some significant weeds are present at low densities, such as Serrated Tussock and Blackberry, and should be controlled by targeted spraying. A few other widespread pest plants within the site should also be controlled, such as Paterson's Curse, St John's Wort and Briar Rose, but these weeds do not currently occur at a density that pose a high threat to the biodiversity values of the site.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the targeted weed control works and other focused measures that will be applied to protect and enhance the BGW conservation values of the site.

Comparison to previous mapping

Umwelt (2012[17]) mapped the vegetation in Isaacs Ridge offset reserve following the EPBC Act Policy Statement guidelines (Commonwealth of Australia 2006). The criteria for determining EPBC Act BGW were therefore the same as that used in the current study. Umwelt (2012) distinguished between structural woodland and derived grassland patches and surveyed them separately. They concluded that the wooded areas were consistent with the EPBC Act Policy Statement, but that only some areas contained the necessary 12 native understorey species and one important species. The remainder contained a lower-diversity understorey. In addition, they found that the derived grassland areas were not consistent with the EPBC Act listed Box-Gum Woodland CEEC as there were less than 12 native understorey species present in a 0.1 hectare area. However, as they acknowledge in their report, when considered against the assessment guidelines the entire study area is consistent with the definition of a 'patch' (defined as five or more trees in which no tree is greater than 75 m from another tree). They therefore concluded that the entire 36.8 ha site conforms to the EPBC Act definition of Box-Gum Woodland. The results from Umwelt (2012) are consistent with those presented in the current study, the main difference being the 1.67 ha of exotic ACT16-Zone6 identified in the current study in the south of the site.

[17] Umwelt (2012). *Ecological Assessment of Proposed Offset Site for the Mugga Land Resource Management Centre*. Prepared for ACT NoWaste. March 2012.

Figure 3.2-a. Isaacs Ridge Vegetation Mapping Results

Figure 3.2-b. Isaacs Ridge EPBC Act BGW and Exotic Vegetation Classification

3.3 Kenny Broadacre

3.3.2 Woodland mapping results

Figure 3.3-a shows the extent of the PCTs and zones for Kenny Broadacre and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Kenny Broadacre was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 3.22 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 6.67 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 0.19 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 5.05 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 2.57 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity.
- 6.47 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity.

In total, 3.22 ha of woodland in Kenny Broadacre meets the EPBC Act BGW criteria (Figure 3.3-b).

Native understorey species richness ranged from 0 native species (KB_16.8.1) to 13 native species (KB_16.5.1). The number of important species varied from 0 (multiple plots) to 2 (KB_16.2.3 and KB_16.5.1).

Significant weeds found within the site include Serrated Tussock (Zones 16.2, 16.5 and 16.8).

Figure 3.3-b shows the exotic dominance categories for Kenny Broadacre. All of the exotic areas were classified as 'Pasture and Agricultural Weed Species'.

No threatened or rare species were recorded.

Tables 3.3a-3.3e provide summaries of the plot-transect results for each zone (excluding ACT16 Zone 6, due to its small area). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.3-a. Kenny Broadacre ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Contains a canopy representative of the climax community. Midstorey present, but sparse. Low diversity native groundlayer.
Size	3.22 ha (3 plot-transects).
Overstorey Species	*E. melliodora, E. macrorhyncha, E. mannifera,* and *E. dives*.
Overstorey Cover	10 - 25%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	4 - 8.
Perennial Groundlayer	60 - 75% native.
Understorey	8-11 total native species, 2-6 native non-grass species, 0-2 important species.
Exotic Species Richness	0 - 1 species.
Significant Weeds	Serrated Tussock.

Table 3.3-b. Kenny Broadacre ACT016 Zone 5 results summary

	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	6.67 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	51 - 95% native.
Understorey	6-13 total native species, 1-5 native non-grass species, 0-2 important species.
Exotic Species Richness	7 - 8 species.
Significant Weeds	Serrated Tussock.

Table 3.3-c. Kenny Broadacre ACT016 Zone 8 results summary

	ACT16 Zone 8
Description	Exotic Pasture Overstorey and midstorey absent. Low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	5.05 ha (2 plots and 2 transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	0 - 5% native.
Understorey	0-2 total native species, 0 native non-grass species, 0 important species.
Exotic Species Richness	7 species.
Significant Weeds	Serrated Tussock.

Table 3.3-d. Kenny Broadacre ACT025 Zone 2 results summary

	ACT25 Zone 2
Description	Tableland Grass/Shrub Forest Contains a canopy representative of the climax community. Midstorey and shrubstorey absent, with a low diversity native groundlayer.
Size	2.57 ha (1 plot-transect).
Overstorey Species	*E. macrorhyncha.*
Overstorey Cover	10%.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	5.
Perennial Groundlayer	48% native.
Understorey	5 total native species, 1 native non-grass species, 0 important species.
Exotic Species Richness	8 species.
Significant Weeds	No significant weeds.

Table 3.3-e. Kenny Broadacre ACT025 Zone 5 results summary

	ACT25 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	6.47 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	50 - 72% native.
Understorey	11 total native species, 4-5 native non-grass species, 0 important species.
Exotic Species Richness	8 - 9 species.
Significant Weeds	No significant weeds.

3.3.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation in Kenny Broadacre is a mix of low diversity BGW and derived grassland, low diversity Tableland Grass/Shrub Forest, and two paddocks of exotic pasture. The wooded areas contain a sparse midstorey and an understorey which lacks shrubs. The BGW groundlayer is dominated by Spear Grasses *Austrostipa* spp., Wallaby Grass *Rytidosperma* sp. and Weeping Grass, with a low diversity of native forbs. The site has relatively limited ecological values, these being the 3.22 ha of EPBC Act BGW and a small population of *D. impar* persisting in the exotic pasture in the south of the site[18]. However, the main value of the site is its connectivity with the surrounding areas, including Goorooyarroo Nature Reserve, Throsby East offset reserve and Kenny offset reserve. The Mulligans Flat Nature Reserve – Goorooyarroo Nature Reserve complex represent the largest, most intact remaining example the BGW ecological community in Australia. The proposed offset reserves of Throsby East, Throsby North and Kenny Broadacre will add to this continuous patch of BGW and will be included in the extended Mulligans Flat Woodland Sanctuary[19]. This extension will encircle most of Goorooyarroo Nature Reserve and the three proposed offset reserves with specialised fencing, thereby providing protection from numerous threats and allowing reintroduction programs to be expanded.

Kenny Broadacre has been used for sheep and cattle grazing for many years and, given the uniform and dense cover of Phalaris in the exotic areas, these paddocks appear to have been sown in the past for pasture improvement. The history of stock on the site, combined with other land management practices such as widescale clearing, has impacted upon the vegetation throughout the site and contributed to the current sparse midstorey and lack of shrubstorey. Some sparsely distributed significant weeds, such as Serrated Tussock, are present and require control.

Conservation-targeted management should be directed towards the improvement of the midstorey and understorey of the wooded areas and conservation of habitat values for the Striped Legless Lizard in those areas where the species is known to occur. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priority of the site is the control of stocking rates. These rates should be determined to best encourage the natural regeneration of the overstorey in the wooded areas of the site, and to ensure appropriate levels of grass herbage mass and tussock structure for the Striped Legless Lizard in those areas where the species is known to occur. With respect to the natural regeneration of the overstorey, techniques such as 'ripping' the ground should be considered to encourage regeneration, where appropriate.

Comparison to previous mapping

As described in Section 3.1.2, EcoLogical Australia (2011) mapped over 2,400 ha of vegetation in the north of Canberra, including the area now known as Kenny Broadacre offset reserve. However, the

[18] Biosis Research (2012). *Kenny and Throsby – Striped Legless Lizard (Delma impar) Survey Report*. Author: R. Speirs. Unpublished report to the ACT Government.
[19] Capital Ecology (2017b). *Mulligans Flat Woodland Sanctuary – Goorooyarroo Extension of Predator-proof Fence – Ecological Impact Assessment and Environmental Significance Opinion Supporting Document.* Capital Ecology project no. 2709.

vegetation mapping presented in EcoLogical Australia (2011) was later found to be only 23% to 80% accurate, averaging 61.25% accuracy/ha (Biosis 2012). Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Kenny Broadacre, EcoLogical Australia (2011) mapped a small patch of EPBC Act BGW in the centre of the site. This broadly agrees with the current study. However, they mapped the vast majority of the site as having a Box-Gum Woodland climax community, with only one small patch of Red Stringybark – Scribbly Gum Tableland Forest. In comparison, the current study mapped over one third of the site as dominated by *E. macrorhyncha* (ACT25), which the data clearly supports.

Figure 3.3-a. Kenny Broadacre Vegetation Mapping Results

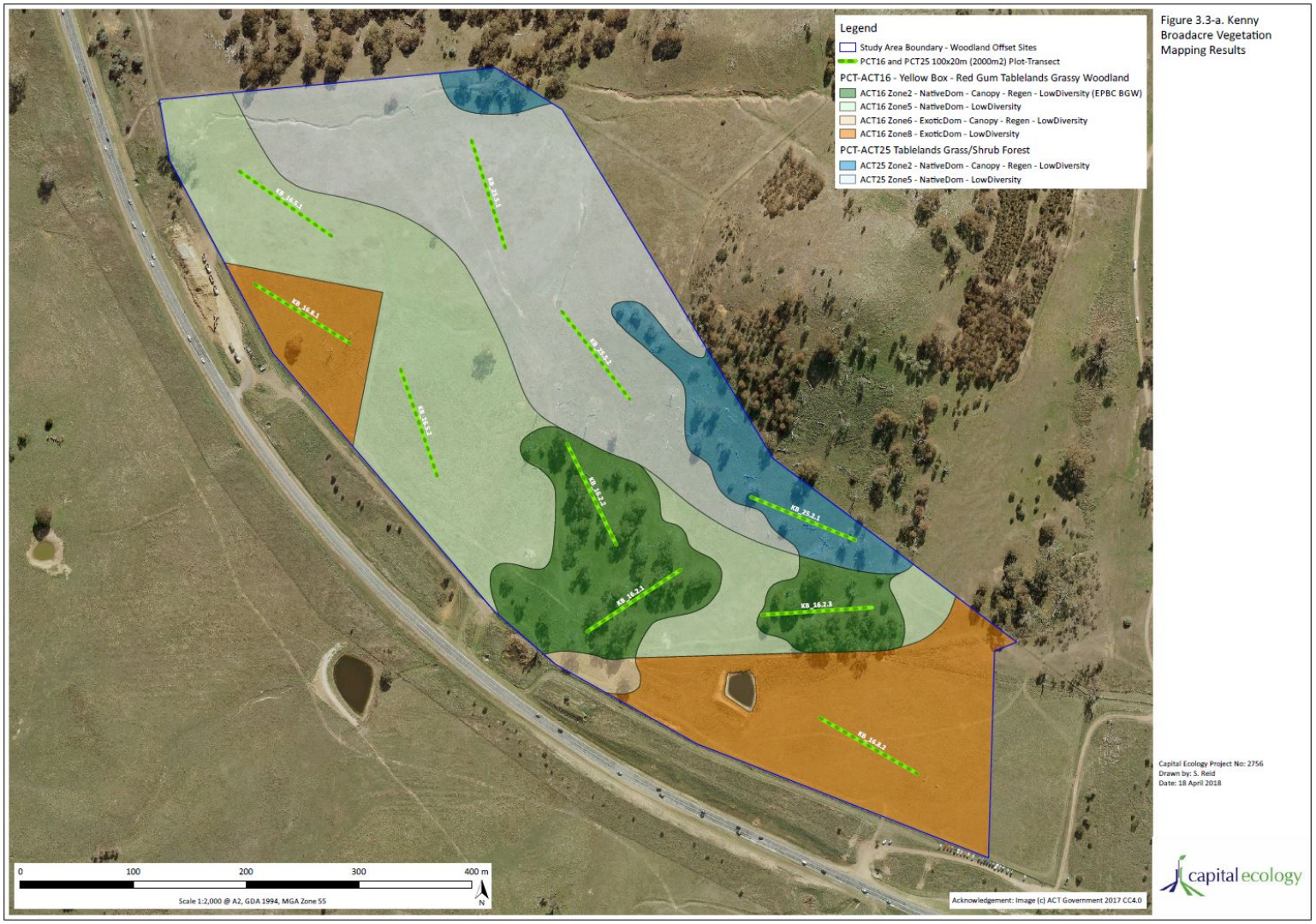
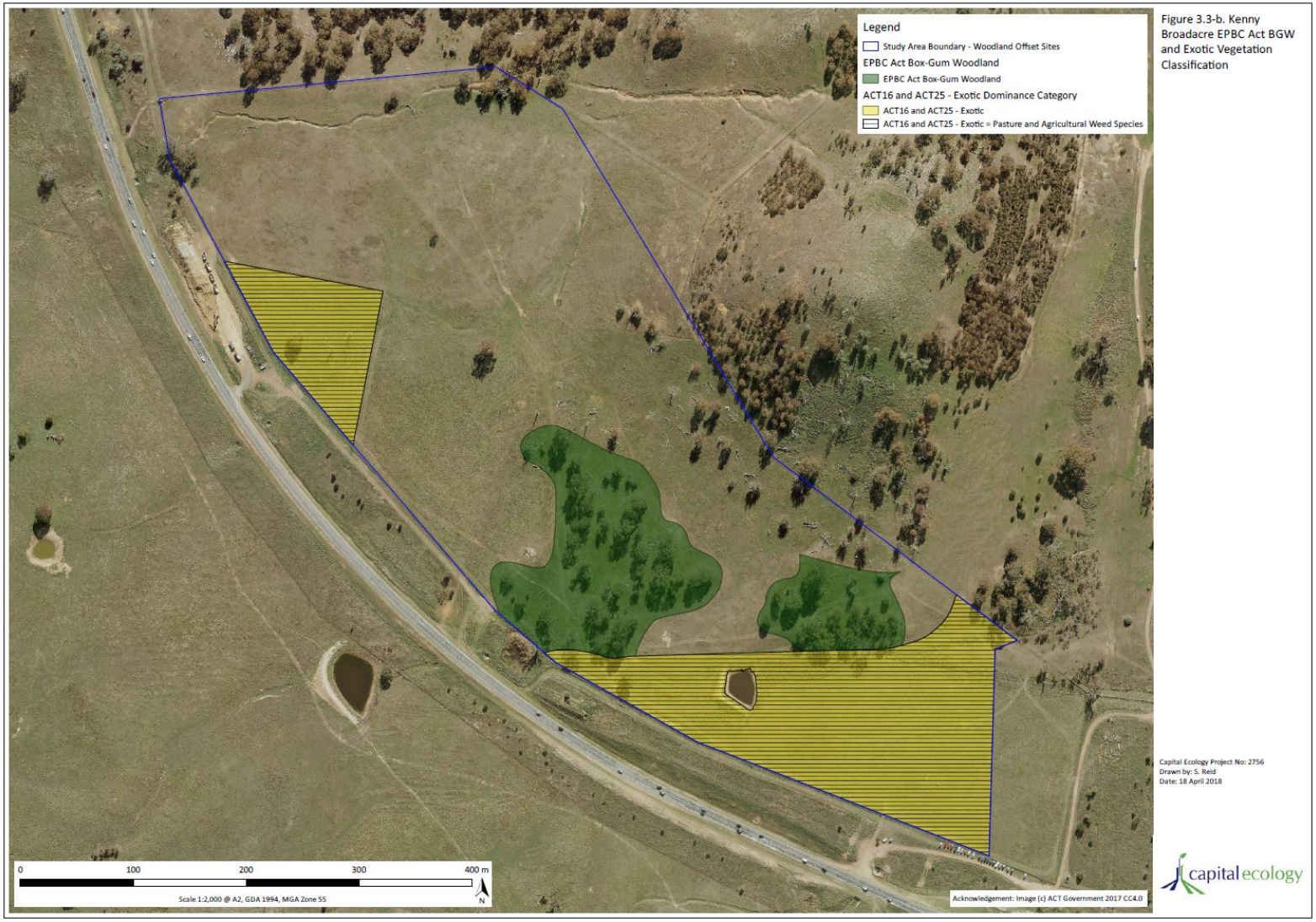


Figure 3.3-b. Kenny Broadacre EPBC Act BGW and Exotic Vegetation Classification



3.4 Kinlyside

3.4.2 Woodland mapping results

Figure 3.4-a shows the extent of the PCTs and zones for Kinlyside and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Kinlyside was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 90.73 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 30.04 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 20.33 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 12.30 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 1.79 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 0.85 ha of Plantation (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 76.38 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity.
- 8.06 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity.
- 23.05 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity.
- 2.16 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity
- 0.15 ha of Zone 7: Exotic dominant understorey – Mature canopy – No Regeneration of overstorey – Low native forb diversity
- 2.42 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity.
- 11.79 ha of Plantation.

In total 141.10 ha of woodland in Kinlyside meets the EPBC Act BGW criteria (Figure 3.4-b**Figure 3.1-b**).

Native understorey species richness ranged from 5 native species (Ki_25.8.1) to 44 native species (Ki_16.1.1 and Ki_25.1.5). The range of important species was from 0 (Ki_16.2.1 and Ki_16.6.1) to 20 (Ki_25.1.5).

Significant weeds were found throughout the site, including Serrated Tussock (Zones 16.1, 16.2, 16.4, 25.1, 25.4 and 25.6). In comparison to nearby sites, Serrated Tussock is being well controlled. Other pest plants that were widespread include Briar Rose, Paterson's Curse and St John's Wort.

Figure 3.4-b shows the exotic dominance categories for Kinlyside. The majority of the exotic areas in Kinlyside were classified as 'Stock Camps', with some 'Pasture and Agricultural Weed Species' in the lower-lying drainage lines.

Two rare species were recorded in Kinlyside, Hoary Sunray *Leucochrysum albicans* var. *albicans* and Twining Fringe Lily *Thysanotus patersonii*[20]. Neither were in monitoring plots.

Tables 3.4a-3.4j provide summaries of the plot-transect results for each zone (excluding ACT25 Zone 7, due to its small area). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

[20] https://canberra.naturemapr.org/Community/Sighting/3383472

Table 3.4-a. Kinlyside ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	90.73 ha (5 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora.*
Overstorey Cover	5 - 20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	0 - 6.
Perennial Groundlayer	60 - 91% native.
Understorey	34-44 total native species, 27-40 native non-grass species, 10-15 important species.
Exotic Species Richness	5 - 22 species.
Significant Weeds	Serrated Tussock. Paterson's Curse, St John's Wort, Briar Rose and Hawthorn *Crataegus monogyna* also present.

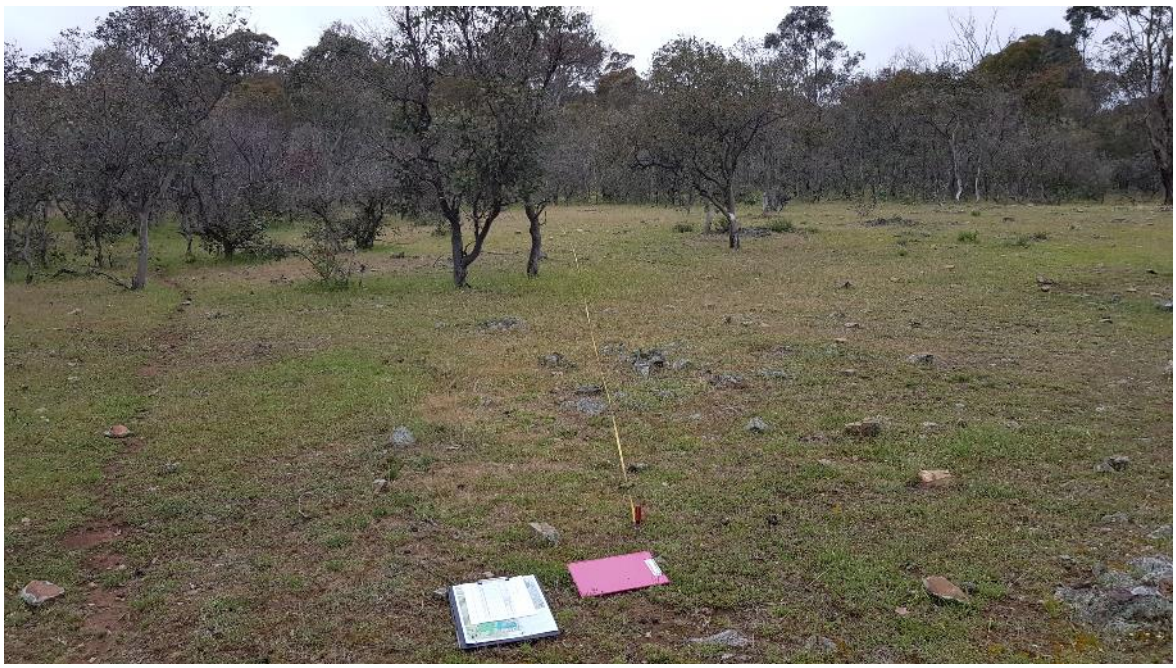


Table 3.4-b. Kinlyside ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Contains a canopy representative of the climax community. Midstorey present, with a low diversity native groundlayer.
Size	30.04 ha (4 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	10 - 15%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 5.
Perennial Groundlayer	53 - 81% native.
Understorey	11-21 total native species, 7-15 native non-grass species, 0-9 important species.
Exotic Species Richness	1 - 5 species.
Significant Weeds	Serrated Tussock. Briar Rose, Paterson's Curse, St John's Wort and Scotch Thistle *Onopordum acanthium* also present.

Table 3.4-c. Kinlyside ACT16 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland. Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	20.33 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	61 - 88% native.
Understorey	24-33 total native species, 17-29 native non-grass species, 4-13 important species.
Exotic Species Richness	14 - 26 species.
Significant Weeds	Serrated Tussock. Briar Rose and Paterson's Curse also present.

Table 3.4-d. Kinlyside ACT16 Zone 5 results summary

	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	12.30 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	53 - 58% native.
Understorey	11-14 total native species, 6-8 native non-grass species, 1-3 important species.
Exotic Species Richness	11 - 16 species.
Significant Weeds	Briar Rose and Paterson's Curse present.

Table 3.4-e. Kinlyside ACT16 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer). Stock camp. Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs.
Size	1.79 ha (1 plot-transect).
Overstorey Species	*E. blakelyi* and *E. macrorhyncha.*
Overstorey Cover	10%.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	9.
Perennial Groundlayer	47% native.
Understorey	7 total native species, 6 native non-grass species, 0 important species.
Exotic Species Richness	14 species.
Significant Weeds	Paterson's Curse, St John's Wort, Scotch Thistle and Briar Rose present.

Table 3.4-f. Kinlyside ACT25 Zone 1 results summary

	ACT25 Zone 1
Description	Tableland Grass/Shrub Forest Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	76.38 ha (5 plot-transects).
Overstorey Species	*E. macrorhyncha, E. mannifera* and *E. nortonii.*
Overstorey Cover	10 - 20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 6.
Perennial Groundlayer	87 - 100% native.
Understorey	23-44 total native species, 20-36 native non-grass species, 10-20 important species.
Exotic Species Richness	3 - 10 species.
Significant Weeds	Serrated Tussock. Briar Rose also present.

Table 3.4-g. Kinlyside ACT25 Zone 2 results summary

	ACT25 Zone 2
Description	Tableland Grass/Shrub Forest Contains a canopy representative of the climax community. Midstorey present, with a low diversity native groundlayer.
Size	8.06 ha (3 plot-transects).
Overstorey Species	*E. macrorhyncha* and *E. nortonii*.
Overstorey Cover	5 - 15%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 8.
Perennial Groundlayer	54 - 62% native.
Understorey	14-16 total native species, 9-10 native non-grass species, 2-4 important species.
Exotic Species Richness	8 - 17 species.
Significant Weeds	Briar Rose, Paterson's Curse and Saffron Thistle *Carthamus lanatus* present.

Table 3.4-h. Kinlyside ACT25 Zone 4 results summary

	ACT25 Zone 4
Description	Tableland Grass/Shrub Forest – Derived Grassland Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	23.05 ha (4 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	58 - 86% native.
Understorey	15-28 total native species, 10-24 native non-grass species, 3-11 important species.
Exotic Species Richness	11 - 15 species.
Significant Weeds	Serrated Tussock. Briar Rose, St John's Wort and Saffron Thistle also present.

Table 3.4-i. Kinlyside ACT25 Zone 6 results summary

	ACT25 Zone 6
Description	Tableland Grass/Shrub Forest (exotic groundlayer) Stock camp. Contains a canopy representative of the climax community. Midstorey and shrubstorey present but sparse, with a low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs.
Size	2.16 ha (1 plot-transect).
Overstorey Species	*E. macrorhyncha* and *E. nortonii*.
Overstorey Cover	20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	5.
Perennial Groundlayer	32% native.
Understorey	9 total native species, 7 native non-grass species, 1 important species.
Exotic Species Richness	13 species.
Significant Weeds	Serrated Tussock. Paterson's Curse, Saffron Thistle and Briar Rose also present.

Table 3.4-j. Kinlyside ACT25 Zone 8 results summary

	ACT25 Zone 8
Description	Exotic Pasture Stock camp. Overstorey, midstorey and shrubstorey absent. Low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs.
Size	2.42 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	24% native.
Understorey	5 total native species, 2 native non-grass species, 1 important species.
Exotic Species Richness	19 species.
Significant Weeds	Paterson's Curse, Saffron Thistle and Briar Rose present.

3.4.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

Kinlyside contains a large area of high-quality vegetation, which is largely comprised of moderate to high diversity BGW and derived grassland and moderate to high diversity Tableland Grass/Shrub Forest and derived grassland. The southern areas of the site do contain lower diversity areas, which likely reflects a history of higher stocking rates due to their proximity to nearby sheering sheds. In addition, there are a number of scattered stock camps within the site. The moderate to high diversity areas contain a healthy midstorey and understorey, and the BGW groundlayer is generally dominated by Kangaroo Grass and Red-leg Grass with a diverse array of native forbs. The main ecological values of the site are the 141.10 ha of EPBC Act BGW, the 99.43 ha of moderate to high diversity Tableland Grass/Shrub Forest, the only known population of Pink-tailed Worm-lizard in the Gungahlin region (R. Speirs pers. obs.) and the site's connectivity with the surrounding reserves in the north of the ACT. Kinlyside is a logical and highly valuable addition to the ACT nature reserve network.

The site has been used for sheep and cattle grazing under rural lease for many years. Based on the high density of overstorey regeneration, the healthy shrubstorey and the diverse array of native forbs across the site, the current lessees appear to be doing a good job in terms of stocking rates and grazing rotation. However, it is likely that lighter stocking rates, particularly during the spring flowering season, would have a beneficial effect across the site. Stocking rates should also be reduced in the lower diversity areas to improve floristic diversity and promote and the health and regeneration of the understorey. While weeds such as Serrated Tussock and Briar Rose are present in many of the recorded vegetation zones, their severity is far lower than the surrounding areas and it appears that they are being adequately managed by the lessees. This management should continue.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priorities of the site are the control of stocking rates and timing. Stocking rates should be lowered in general across the site, and particularly in the higher diversity areas, to ensure appropriate levels of herbage mass and floristic diversity. This is particularly important during the spring flowering season.

Comparison to previous mapping

As described in Section 3.1.2, EcoLogical Australia (2011) mapped over 2,400 ha of vegetation in the north of Canberra, including the area now known as Kinlyside offset reserve. However, the vegetation mapping presented in EcoLogical Australia (2011) was later found to be only 23% to 80% accurate, averaging 61.25% accuracy/ha (Biosis 2012). Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Kinlyside, the mapping presented in EcoLogical Australia (2011) broadly agrees with that of the current study (refer Biosis 2012). The most striking difference between the two studies is a large section of woodland and derived grassland in the western portion of the site, which EcoLogical Australia (2011) identified as BGW and

the current study identified as dominated by *E. macrorhyncha* and *E. nortonii* (ACT25). The data collected in the current study clearly demonstrates that the current PCT is ACT25.

Figure 3.4-a. Kinlyside Vegetation Mapping Results

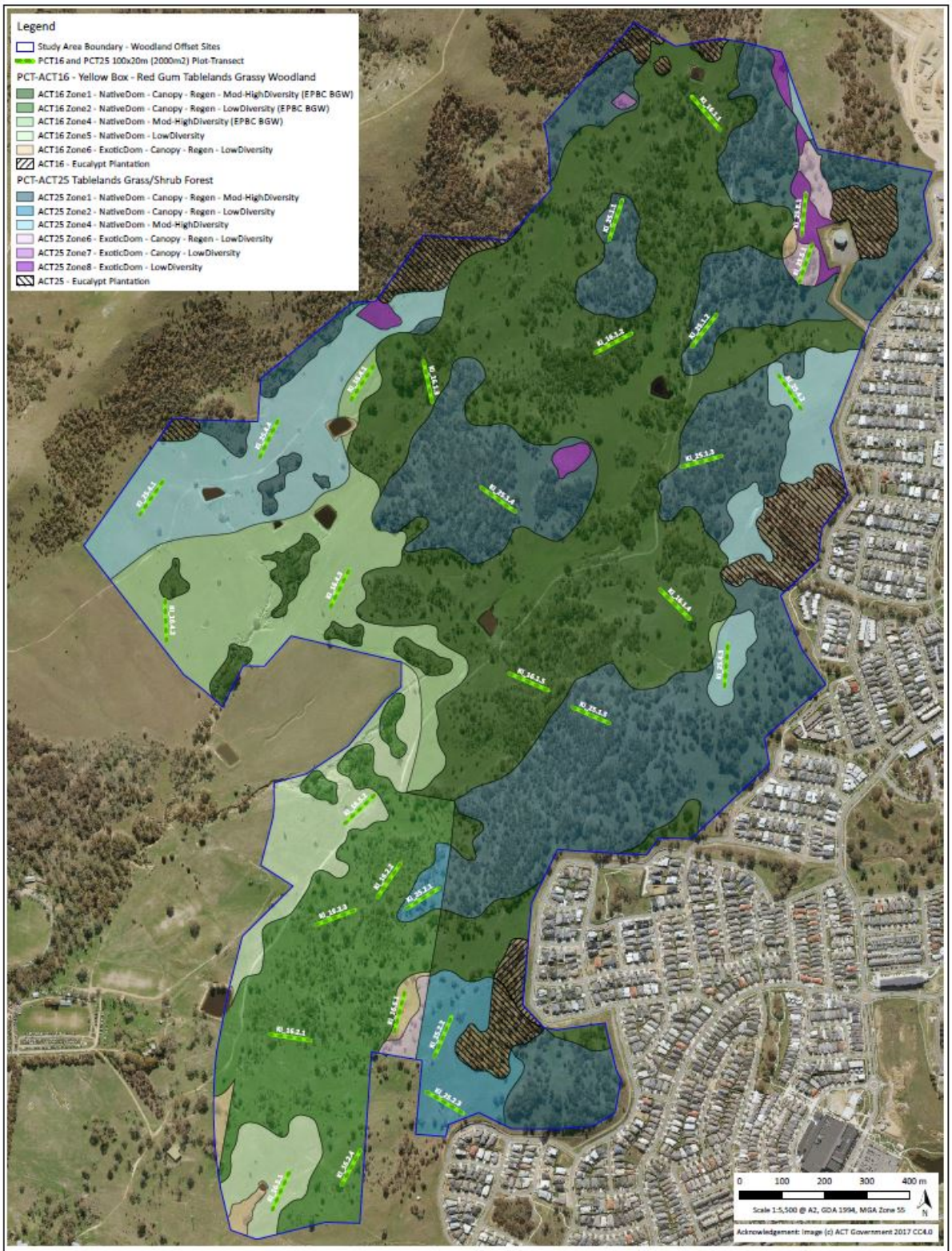


Figure 3.4-b. Kinlyside EPBC Act BGW and Exotic Vegetation Classification

3.5 Kenny Woodland

3.5.2 Woodland mapping results

Figure 3.5-a shows the extent of the woodland PCT and zones for Kenny Woodland and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Kenny Woodland was found to support one PCT:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 53.49 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 0.43 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 34.48 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 8.60 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 5.44 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

In total, 53.92 ha of woodland in Kenny Woodland meets the EPBC Act BGW criteria (Figure 3.5-b).

Native understorey species richness ranged from 2 native species (KW_16.2.1) to 20 native species (KW_16.4.1). The number of important species varied from 0 (multiple plots) to 5 (KB_16.4.1).

Significant weeds found within the site include Serrated Tussock (all zones except 16.4) and African Boxthorn *Lycium ferocissimum* (Zone 16.5). In some areas the infestation of Serrated Tussock is significant. Other pest plants that were widespread include Briar Rose, Paterson's Curse and Scotch Thistle.

Figure 3.5-b shows the exotic dominance categories for Kenny Woodland. All of the exotic areas were classified as 'Pasture and Agricultural Weed Species', except for one small 'Stock Camp'. Whilst the Serrated Tussock density was high in some areas, it did not reach the level necessary for classification as 'Noxious Weeds'.

No threatened or rare species were recorded.

Tables 3.5a-3.5e provide summaries of the plot-transect results for each zone. Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.5-a. Kenny Woodland ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Contains a canopy representative of the climax community. Midstorey present, but relatively sparse. Low diversity native groundlayer.
Size	53.49 ha (5 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	4 - 15%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 3.
Perennial Groundlayer	55 - 75% native.
Understorey	2-4 total native species, 1-3 native non-grass species, 0 important species.
Exotic Species Richness	8 - 14 species.
Significant Weeds	Serrated Tussock. Paterson's Curse, Scotch Thistle and Briar Rose also present.

Table 3.5-b. Kenny Woodland ACT016 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	0.43 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	74% native.
Understorey	20 total native species, 14 native non-grass species, 5 important species.
Exotic Species Richness	10 species.
Significant Weeds	Briar Rose and Paterson's Curse present.

Table 3.5-c. Kenny Woodland ACT016 Zone 5 results summary

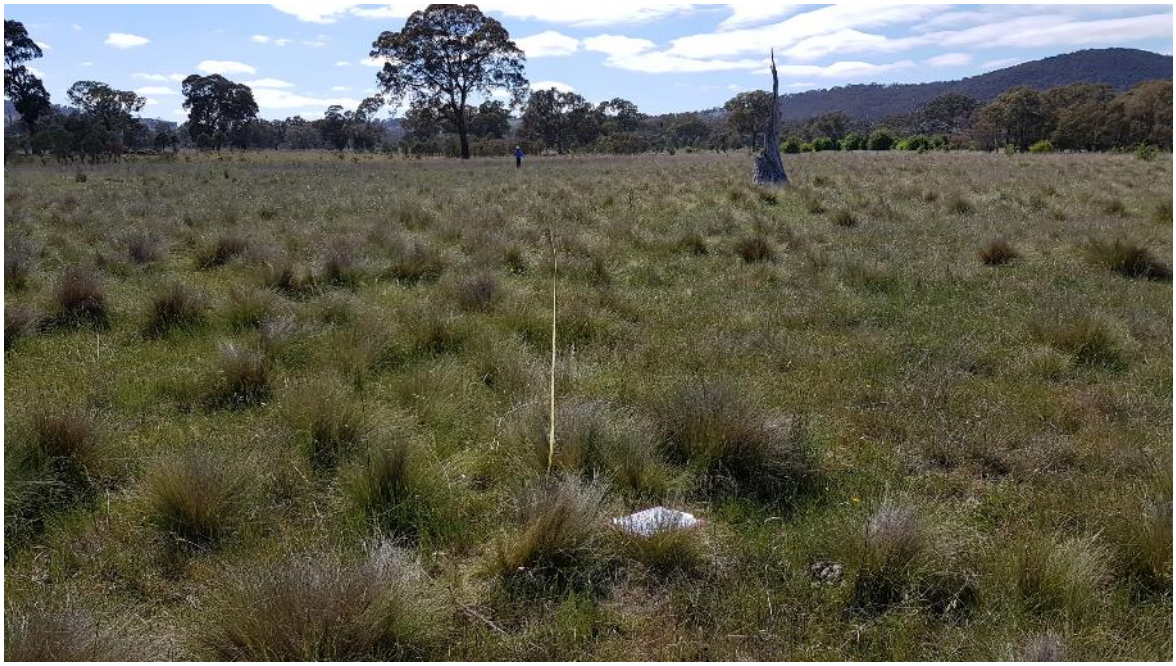
	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	34.48 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	59 - 67% native.
Understorey	3-5 total native species, 2-4 native non-grass species, 0 important species.
Exotic Species Richness	10 - 13 species.
Significant Weeds	Serrated Tussock and African Boxthorn. Paterson's Curse, Scotch Thistle and Briar Rose also present.

Table 3.5-d. Kenny Woodland ACT016 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer) Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	8.60 ha (2 plot-transects).
Overstorey Species	*E. blakelyi*.
Overstorey Cover	10 - 20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	4 - 6.
Perennial Groundlayer	2 - 13% native.
Understorey	4-4 total native species, 3-4 native non-grass species, 0-1 important species.
Exotic Species Richness	5 - 10 species.
Significant Weeds	Serrated Tussock. Paterson's Curse and Hawthorn also present.

Table 3.5-e. Kenny Broadacre ACT016 Zone 8 results summary

	ACT16 Zone 8
Description	Exotic Pasture Overstorey and midstorey absent. Low diversity exotic groundlayer dominated by Phalaris, Paspalum, Serrated Tussock and exotic forbs.
Size	5.44 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	9% native.
Understorey	3-4 total native species, 2-3 native non-grass species, 0 important species.
Exotic Species Richness	9 - 14 species.
Significant Weeds	Serrated Tussock (severe infestation in plot KW_16.8.2, pictured below). Paterson's Curse and Scotch Thistle also present.



3.5.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation in Kenny Woodland is a mix of low diversity native or exotic BGW and derived grassland, with one small patch of moderate to high quality BGW derived grassland in the south of the site. The structural woodland areas contain a sparse midstorey and an understorey which lacks shrubs. The groundlayer in the native BGW areas is dominated by Tall Spear Grass *Austrostipa bigeniculata* and contains a low diversity of native forbs. The main ecological values of the site are the 53.92 ha of EPBC Act BGW, the large number of hollow bearing canopy trees that provide nesting and foraging habitat for woodland birds, and the site's connectivity with the grassland component of Kenny which contains one of the largest and most densely occupied remaining patches of Striped Legless Lizard habitat (Biosis Research 2012).

The western portions of Kenny Woodland, together with much of the adjoining Kenny Grassland, has undergone a history of prolonged and intensive pasture improvement via the sowing of Phalaris and addition of superphosphate (R. Speirs 2010 discussion with former lessee, John McKinnon). This pasture improvement, together with a history of low-intensity cattle grazing under a set-stocking arrangement, has undoubtedly encouraged the dominance of native and exotic tussock-forming grasses, reduced the density of the midstorey, removed the shrubstorey, and led to the loss of all but the most disturbance tolerant native forbs from the site. The areas of native dominance (PCT16-Zone2 and Zone5) are generally associated with the higher elevated ridges, and the drainage lines support Phalaris dominated exotic pasture (PCT16-Zone6 and Zone8). Serrated Tussock occurred in only scattered patches and at only low density in Kenny in 2010-11 (R. Speirs pers. obs.), however it has since spread throughout much of the site. The Serrated Tussock was not found to thus far occur at a density that warranted classification of areas as 'Noxious Weed Species' dominance (refer Table 2.1-c), although it was recorded as a substantial component of some step-point transects. The Serrated Tussock infestation throughout Kenny is now a significant threat to the biodiversity values of the site.

Conservation-targeted management should be directed towards the improvement of the midstorey and understorey of the structural woodland areas and conservation of habitat values for the Striped Legless Lizard. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priority of the site is the control of stocking rates and the control of Serrated Tussock. The stocking should be determined to best encourage the natural regeneration of the overstorey in the wooded areas of the site, and to ensure appropriate levels of grass herbage mass and tussock structure for the Striped Legless Lizard in those areas where they are known to occur. With respect to the natural regeneration of the overstorey, techniques such as 'ripping' the ground should be considered to encourage regeneration, where appropriate.

Comparison to previous mapping

The structure and floristic composition of the vegetation within Kenny was broadly assessed and mapped by Biosis Research (2011[21]) and David Hogg Pty Ltd (2011[22]).

The primary purpose of Biosis Research (2011) was to determine the portions of the study area which possess the grassland attributes of potential habitat for the Striped Legless Lizard. Section 4.1.1.2 of the Biosis report provides a detailed description of the vegetation type and quality within the site as observed during spring 2010, this being categorised as either 'Native Pasture' or 'Exotic Pasture – Tussock Formation Present'. Consistent with the purpose of the Biosis study, the vegetation assessment was based on observations only (i.e. no data collection) and the mapping was prepared at a very broad scale. Notwithstanding this, Biosis' categorisation of the vegetation quality within the site is quite similar to that of this study (i.e. 'Native Pasture' ~ ACT16-Zone2 and Zone5; 'Exotic Pasture – Tussock Formation Present' ~ ACT16-Zone6 and Zone8).

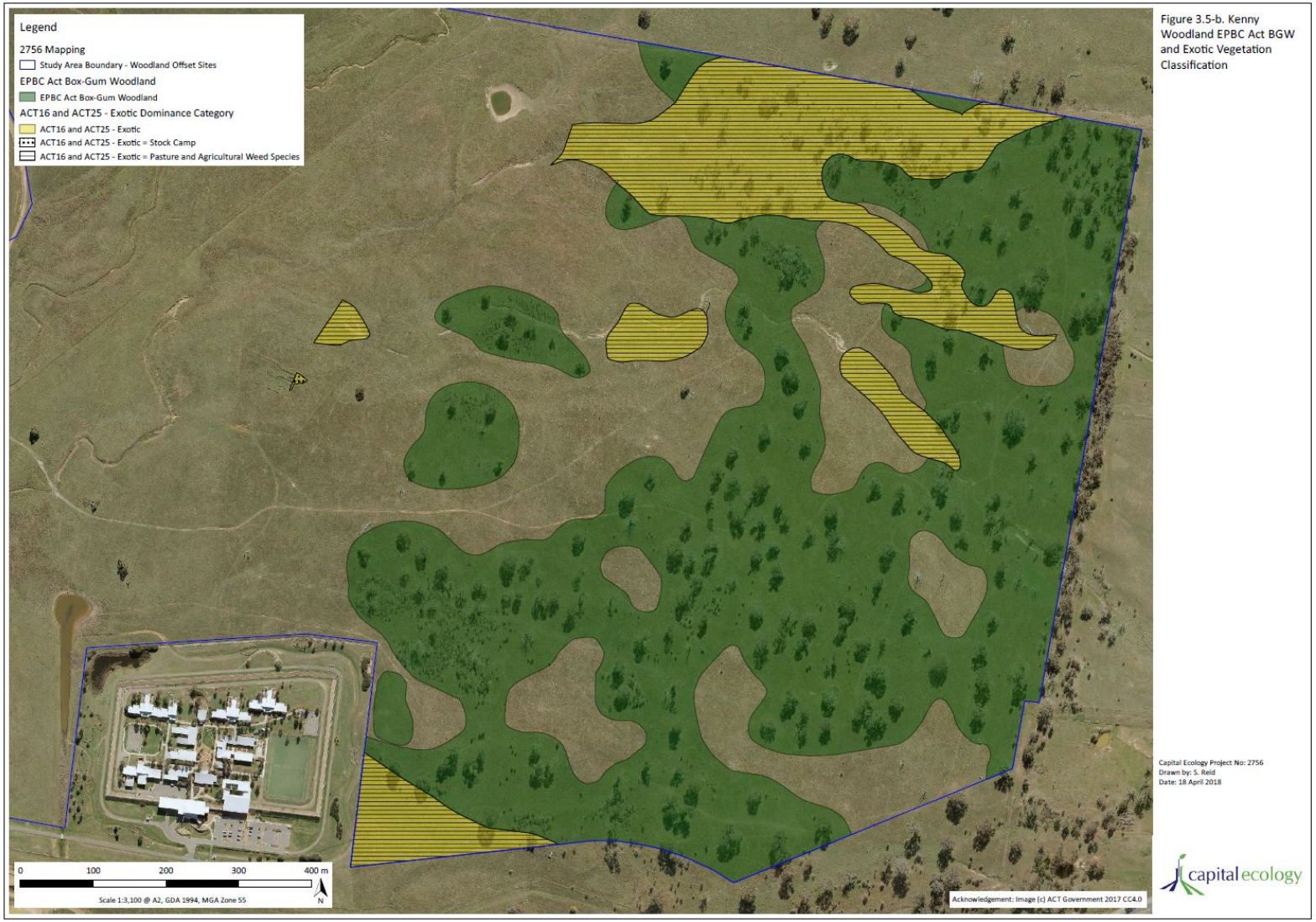
David Hogg Pty Ltd (2011) surveyed for Golden Sun Moth and threatened or uncommon woodland birds and plants. The authors also surveyed the vegetation within areas previously identified as BGW using 20 x 20 m quadrats based on methodologies outlined in Rehwinkel (2007[23]) and Sharp and Gould (2010[24]). They did not map the PCTs and zones in Kenny, but their floristic surveys agree with the current study, finding that:

> '*The floristic surveys confirm that, with the exception of the Area G (Quadrat 3), the woodland area at Kenny has very low diversity of native species and is highly homogeneous. As identified in the previous report the main woodland area and nearby secondary grasslands are dominated by tall spear grass and characterised by very poor diversity of native forbs (Figure 4.2). Given the survey effort invested in these surveys, the presence of only 27 (19 excluding Quadrat 3) native forb species, all disturbance tolerant, indicates that the site has very low diversity. The native groundcover appears to have regenerated after having been disturbed by pasture improvement and intensive grazing (Ref. 1). This has resulted in a predominantly native groundcover across the site with limited forb diversity. This survey does not provide additional information relating to the extent of the box – gum woodland ecological community, as at Kenny this is determined primarily by the extent of native-dominated understorey rather than by the diversity of native plant species…'*

[21] Biosis Research (2011). *Kenny – Striped Legless Lizard (Delma impar) Survey Report*. Author: R. Speirs Unpublished report to the ACT Government.
[22] David Hogg Pty Ltd (2011). *Kenny Ecological Surveys*. Report prepared for ACT Planning and Land Authority. February 2011.
[23] Rehwinkel (2007). *A Method to Assess Grassy Ecosystem Sites: Using floristic information to assess a site's quality*. NSW Department of Environment and Climate Change.
[24] Sharp and Gould (2010). *ACT Vegetation Monitoring Manual, A step by step guide to monitoring native vegetation in the ACT*. Environment ACT, Canberra.

Figure 3.5-a. Kenny Woodland Vegetation Mapping Results

Figure 3.5-b. Kenny Woodland EPBC Act BGW and Exotic Vegetation Classification



3.6 Taylor

3.6.2 Woodland mapping results

Figure 3.6-a shows the extent of the PCTs and zones for Taylor and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Taylor was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 5.35 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 4.85 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 0.53 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 0.28 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 17.83 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity.
- 10.76 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity.
- 0.77 ha of Zone 7: Exotic dominant understorey – Mature canopy – No Regeneration of overstorey – Low native forb diversity
- 1.10 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity.
- 11.34 ha of Plantation.

In total 10.20 ha of woodland in Taylor meets the EPBC Act BGW criteria (Figure 3.6-b).

Native understorey species richness ranged from 5 native species (Ta_25.7.1 and Ta_25.8.1) to 42 native species (Ta_25.4.1). The range of important species was from 0 (Ta_25.7.1 and Ta_25.8.1) to 17 (Ta_25.1.3).

Significant weeds were found throughout the site, including Serrated Tussock (all zones). Other pest plants that were widespread include St John's Wort and Briar Rose.

Figure 3.8-b shows the exotic dominance categories for Taylor. All of the exotic areas in Taylor were classified as 'Pasture and Agricultural Weed Species'.

One rare species, Dwarf Milkwort, was recorded *(Species location removed)*.

Tables 3.6a-3.6g provide summaries of the plot-transect results for each zone (excluding plantations and ACT16 Zone 8, due to its small area). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.6-a. Taylor ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Contains a canopy representative of the climax community. There is evidence of selective clearing of Yellow Box and Red Gum in some areas. Midstorey present, with a moderate to high diversity native groundlayer.
Size	5.35 ha (3 plot-transects).
Overstorey Species	*E. blakelyi.*
Overstorey Cover	0 - 2%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	0 - 1.
Perennial Groundlayer	57 - 84% native.
Understorey	19-30 total native species, 16-26 native non-grass species, 12-12 important species.
Exotic Species Richness	16 - 19 species.
Significant Weeds	Serrated Tussock. St John's Wort and Briar Rose also present.

Table 3.6-b. Taylor ACT016 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland. Overstorey and midstorey absent. Moderate to high diversity native groundlayer. Threatened flora – Dwarf Milkwort *Polygala japonica* (*Species location removed*).
Size	4.85 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	61 - 66% native.
Understorey	15-23 total native species, 12-17 native non-grass species, 4-8 important species.
Exotic Species Richness	17 - 19 species.
Significant Weeds	Serrated Tussock. St John's Wort, Saffron Thistle and Briar Rose also present.

Table 3.6-c. Taylor ACT016 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer). Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs.
Size	0.53 ha (1 plot-transect).
Overstorey Species	*E. blakelyi* and *E. melliodora.*
Overstorey Cover	10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	12.
Perennial Groundlayer	8% native.
Understorey	16 total native species, 10 native non-grass species, 4 important species.
Exotic Species Richness	18 species.
Significant Weeds	Serrated Tussock. St John's Wort and Briar Rose also present.

Table 3.6-d. Taylor ACT025 Zone 1 results summary

	ACT25 Zone 1
Description	Tableland Grass/Shrub Forest Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	17.83 ha (3 plot-transects).
Overstorey Species	*E. bridgesiana, E. macrorhyncha* and *E. rossii.*
Overstorey Cover	5 - 30%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 15.
Perennial Groundlayer	62 - 96% native
Understorey	20-40 total native species, 16-35 native non-grass species, 2-17 important species.
Exotic Species Richness	5 - 14 species.
Significant Weeds	Serrated Tussock. St John's Wort and Briar Rose also present.

Table 3.6-e. Taylor ACT025 Zone 4 results summary

	ACT25 Zone 4
Description	Tableland Grass/Shrub Forest – Derived Grassland Overstorey absent. Acacia dominated midstorey present, with a moderate to high diversity native groundlayer.
Size	10.76 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	63 - 73% native.
Understorey	27-42 total native species, 17-34 native non-grass species, 4-14 important species.
Exotic Species Richness	15 - 17 species.
Significant Weeds	Serrated Tussock. St John's Wort, Saffron Thistle, Paterson's Curse and Briar Rose also present.

Table 3.6-f. Taylor ACT25 Zone 7 results summary

	ACT25 Zone 7
Description	Tableland Grass/Shrub Forest (exotic groundlayer) Overstorey present but sparse, midstorey and shrubstorey absent. Low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs. A small section of this area is a likely stock camp. However, the majority is dominated by exotic pastural grasses and exotic forbs.
Size	0.77 ha (1 plot-transect).
Overstorey Species	*E. bridgesiana.*
Overstorey Cover	5.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	3.
Perennial Groundlayer	27% native.
Understorey	5 total native species, 3 native non-grass species, 0 important species.
Exotic Species Richness	17 species.
Significant Weeds	Serrated Tussock. St John's Wort, Paterson's Curse and Briar Rose also present.

Table 3.6-g. Taylor ACT25 Zone 8 results summary

	ACT25 Zone 8
Description	Exotic Pasture Overstorey, midstorey and shrubstorey absent. Low diversity exotic groundlayer dominated by exotic annual and perennial grasses and exotic forbs. A small section of this area is a likely stock camp. However, the majority is dominated by exotic pastural grasses and exotic forbs.
Size	1.10 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	9% native.
Understorey	5 total native species, 3 native non-grass species, 0 important species.
Exotic Species Richness	15 species.
Significant Weeds	Serrated Tussock. St John's Wort, Paterson's Curse and Briar Rose also present.

3.6.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

Taylor contains high-quality vegetation which is comprised of moderate to high diversity BGW and derived grassland, and moderate to high diversity Tableland Grass/Shrub Forest and derived grassland. A small area dominated by pastural and agricultural weeds occurs in the south-west corner of the site, and there is a large 11.34 ha patch of eucalypt plantation in the centre of the site. The BGW groundlayer is dominated by Kangaroo Grass, Red-leg Grass and Wallaby Grasses, and includes a diverse array of native forbs. The significant ecological values of the site are the 10.20 ha of EPBC Act BGW, habitat for woodland birds, and the site's connectivity with the surrounding reserves in the north of the ACT. Taylor is a logical and valuable addition to the ACT nature reserve network.

The site has been used to graze stock for many years. As a result, there are signs that the stock are having a negative impact on the quality of the site as evidenced by the low herbage mass and the observed grazing of native forbs during the spring flowering season. This grazing will prevent or substantially hider the reproduction of these species. The impact of stock is not currently sufficient to reduce the quality of the vegetation below moderate, however sustained grazing pressure is likely to progressively reduce the floristic diversity of the site over the medium to long term.

Of greatest threat to the values of the site are the weeds, which include Serrated Tussock and African Lovegrass (not recorded in any plot, but present in the west of the site). These weeds are more prevalent on the higher aspects in the west of the site, where the prevailing winds from west to east have the potential to spread seed over a wide area and thereby threaten the condition of the woodlands and derived grasslands of Taylor and beyond. Other widespread weeds, such as Briar Rose and St John's Wort, also require control.

It is recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priorities of the site are the control of stocking rates and the control of weeds. Stocking rates should be lowered in general across the site to ensure appropriate levels of grass herbage mass and floristic diversity. This is particularly important during the spring flowering season.

Comparison to previous mapping

As described in Section 3.1.2, EcoLogical Australia (2011) mapped over 2,400 ha of vegetation in the north of Canberra, including the area encompassed by Taylor offset reserve. However, the vegetation mapping presented in EcoLogical Australia (2011) was later found to be only 23% to 80% accurate, averaging 61.25% accuracy/ha (Biosis 2012). Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Taylor, the mapping presented in EcoLogical Australia (2011) broadly agrees with that of the current study in terms of the identified PCTs. However, EcoLogical Australia (2011) classified the entire western half of the site as eucalypt

plantations. The current study mapped those areas as remnant woodland dominated by *E. bridgesiana* and *E. rossii,* a classification which the data clearly supports.

Figure 3.6-a. Taylor Vegetation Mapping Results

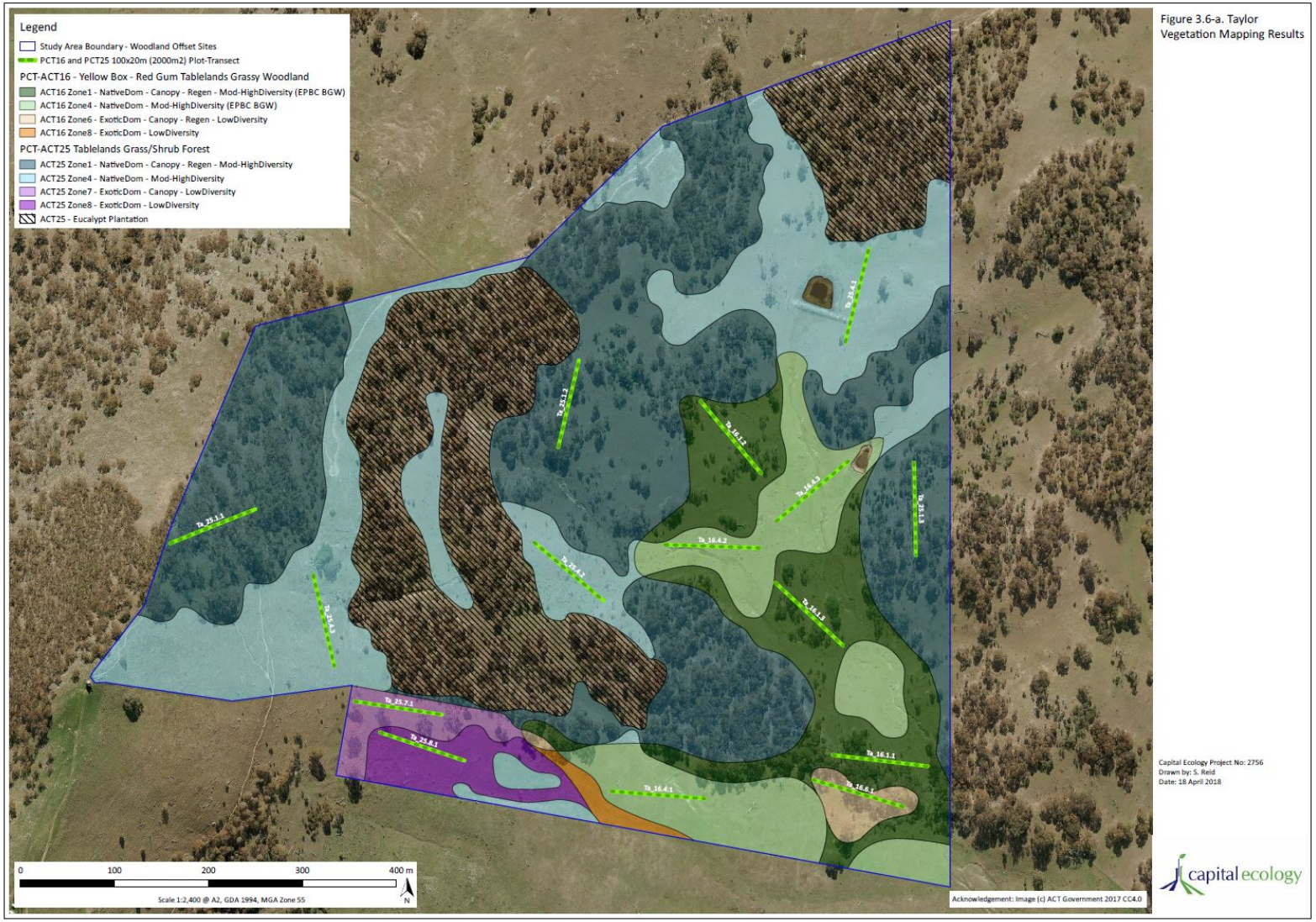
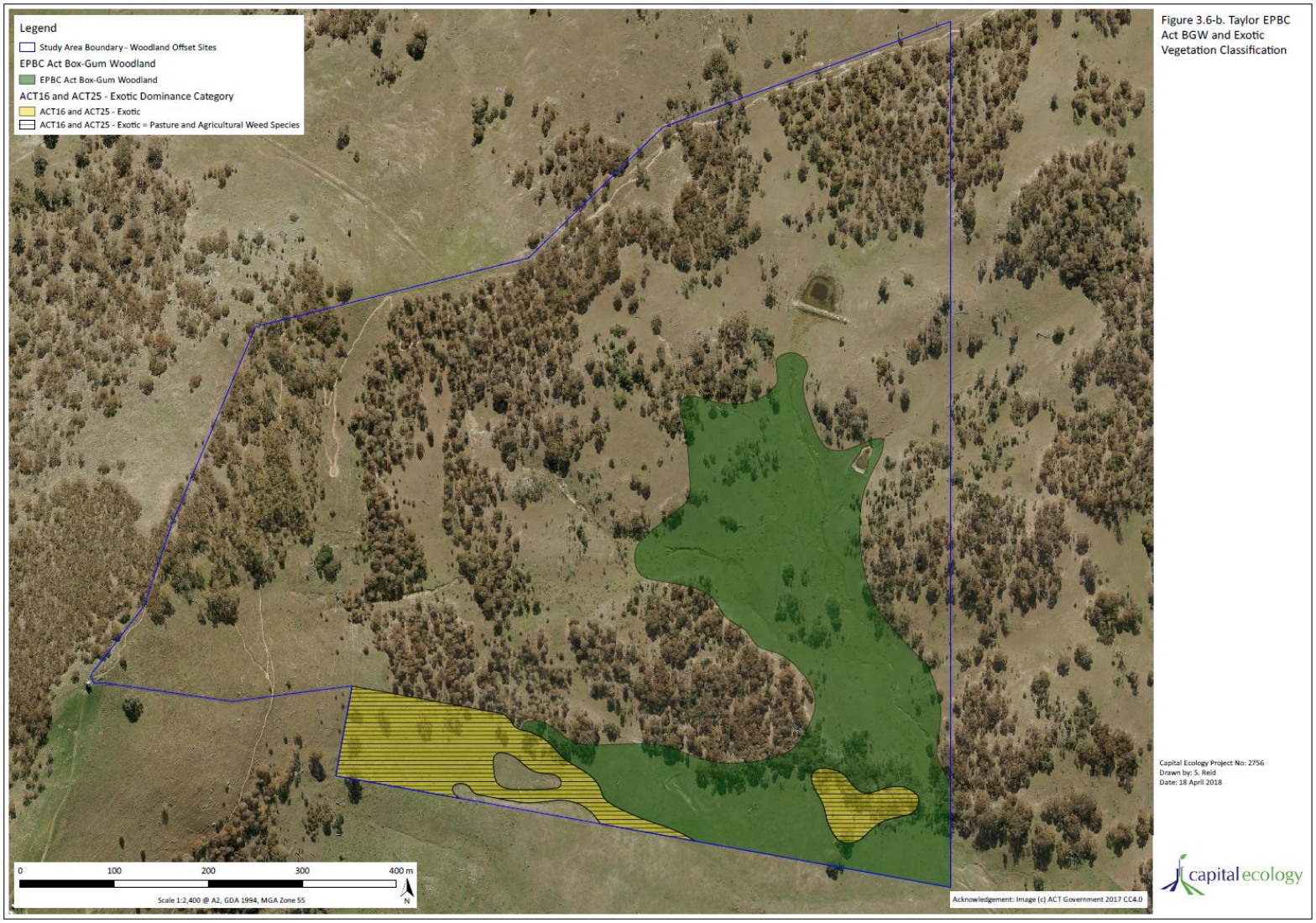


Figure 3.6-b. Taylor EPBC Act BGW and Exotic Vegetation Classification



3.7 Throsby East

3.7.2 Woodland mapping results

Figure 3.7-a shows the extent of the PCTs and zones for Throsby East and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Throsby East was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 38.36 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 27.71 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 10.39 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 1.09 ha of Zone 7: Exotic dominant understorey – Mature canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 13.69 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 10.97 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity.
- 0.25 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity.

In total, 38.36 ha of woodland in Throsby East meets the EPBC Act BGW criteria (Figure 3.7-b).

Native understorey species richness ranged from 4 native species (TE_16.6.1) to 23 native species (TE_25.2.2). The number of important species varied from 0 (multiple plots) to 4 (TE_25.2.2).

Significant weeds found within the site include Serrated Tussock (Zones 16.2, 16.6 and 16.8). Other pest plants that were widespread include Paterson's Curse.

Figure 3.7-b shows the exotic dominance categories for Throsby East. The majority of the exotic areas were classified as 'Pasture and Agricultural Weed Species', with a number of 'Stock Camps' located under paddock trees.

No threatened or rare species were recorded.

Tables 3.7a-3.7e provide summaries of the plot-transect results for each zone (excluding ACT16 Zone 7 and ACT25 Zone 5, due to its small areas). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.7-a. Throsby East ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Contains a canopy representative of the climax community. Midstorey present but sparse, with a low diversity native groundlayer.
Size	38.36 ha (4 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 2.
Perennial Groundlayer	52 - 58% native.
Understorey	7-15 total native species, 1-9 native non-grass species, 0-3 important species.
Exotic Species Richness	0 - 1 species.
Significant Weeds	Serrated Tussock.

Table 3.7-b. Throsby East ACT016 Zone 5 results summary

	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	27.71 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	52 - 58% native.
Understorey	8-12 total native species, 3-6 native non-grass species, 0-1 important species.
Exotic Species Richness	11 - 16 species.
Significant Weeds	Saffron Thistle, Paterson's Curse and Briar Rose present.

Table 3.7-c. Throsby East ACT016 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer) Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	10.39 ha (2 plot-transects).
Overstorey Species	*E. melliodora.*
Overstorey Cover	5%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 1.
Perennial Groundlayer	0 - 19% native.
Understorey	4-12 total native species, 0-5 native non-grass species, 0-1 important species.
Exotic Species Richness	6 - 13 species.
Significant Weeds	Serrated Tussock. Scotch Thistle also present.

Table 3.7-d. Throsby East ACT016 Zone 8 results summary

	ACT16 Zone 8
Description	Exotic Pasture Overstorey and midstorey absent. Low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	13.69 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	20 - 21% native.
Understorey	5-8 total native species, 0-4 native non-grass species, 0 important species.
Exotic Species Richness	9 - 12 species.
Significant Weeds	Serrated Tussock. Paterson's Curse also present.

Table 3.7-e. Throsby East ACT025 Zone 2 results summary

	ACT25 Zone 2
Description	Tableland Grass/Shrub Forest Contains a canopy representative of the climax community. Midstorey present, with a low diversity native groundlayer.
Size	10.97 ha (3 plots-transects).
Overstorey Species	*E. rossii.*
Overstorey Cover	10 - 25%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 5.
Perennial Groundlayer	54 - 84% native.
Understorey	8-23 total native species, 4-12 native non-grass species, 0-4 important species.
Exotic Species Richness	0 - 1 species.
Significant Weeds	Paterson's Curse present.

3.7.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation in Throsby East is a mix of low diversity native or exotic BGW and derived grassland, with only one patch of low diversity Tableland Grass/Shrub Forest in the north of the site. The structural woodland areas contain a sparse midstorey and an understorey which lacks shrubs. The BGW groundlayer is dominated by Spear Grasses, Weeping Grass and Red-leg Grass, and contains a low diversity of native forbs. The exotic areas are largely dominated by Phalaris and occur in the drainage lines and lower-lying areas of the site. There are numerous stock camps scattered throughout the site, generally extending only a short distance from a large remnant eucalypt. The significant ecological values of the site are the 38.36 ha of EPBC Act BGW, the large number of hollow bearing canopy trees that provide habitat for birds (including the threatened Superb Parrot *Polytelis swainsonii*), and the site's connectivity with the surrounding areas, including Goorooyarroo Nature Reserve, Throsby North offset reserve and Kenny Broadacre offset reserve. As mentioned in Section 3.3.3, Throsby East will be included in the extended Mulligans Flat Woodland Sanctuary and add to Australia's largest remaining patch of reserved relatively intact BGW.

The history of stock on the site, combined with other land management practices such as broad scale clearing, has impacted upon the vegetation throughout the site and contributed to the current sparse midstorey and lack of shrubstorey. Some sparsely distributed significant weeds, such as Serrated Tussock, are present and require control.

Conservation-targeted management should be directed towards the improvement of the midstorey and understorey of the structural woodland areas and conservation of habitat values for woodland birds, particularly the Superb Parrot. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priority of the site is the control of stocking rates. These rates should be determined to best encourage the natural regeneration of the overstorey in the structural woodland areas of the site, and to ensure appropriate levels of grass herbage mass in the Phalaris dominated areas. With respect to the natural regeneration of the overstorey, techniques such as 'ripping' the ground should be considered to encourage regeneration, where appropriate.

Comparison to previous mapping

As described in Section 3.1.2, EcoLogical Australia (2011) mapped over 2,400 ha of vegetation in the north of Canberra, including the area now known as Throsby East offset reserve. However, the vegetation mapping presented in EcoLogical Australia (2011) was later found to be only 23% to 80% accurate, averaging 61.25% accuracy/ha (Biosis 2012). Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Throsby East, EcoLogical Australia (2011) mapped the majority of the site as BGW, classifying almost all of that (both the structural woodland areas and the derived grassland) as meeting the criteria for EBPC Act BGW. For the derived grasslands to meet the criteria for EPBC Act BGW, EcoLogical Australia (2011) must have

assessed the diversity of those areas to be moderate or higher. In contrast, the current study identified all native areas as low diversity, a classification which the data clearly support. As a result only those areas containing structural woodland over a native groundlayer were classified as EPBC Act BGW. In addition, EcoLogical Australia (2011) incorrectly classified the northern part of the site as dominated by Red Stringybark – Scribbly Gum Tableland Forrest, where as it is in fact low diversity BGW (ACT16-Zone2).

Figure 3.7-a. Throsby East Vegetation Mapping Results

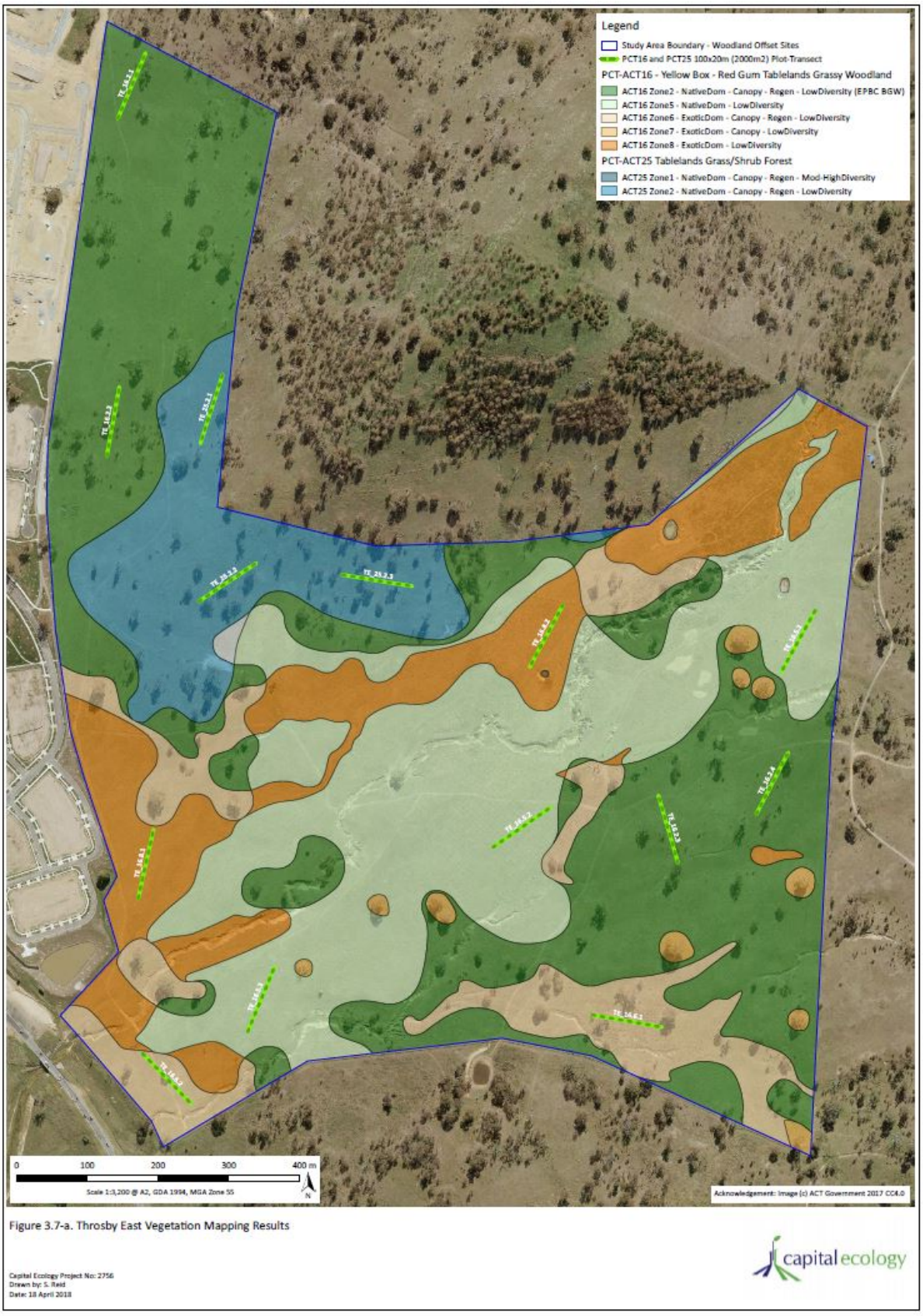
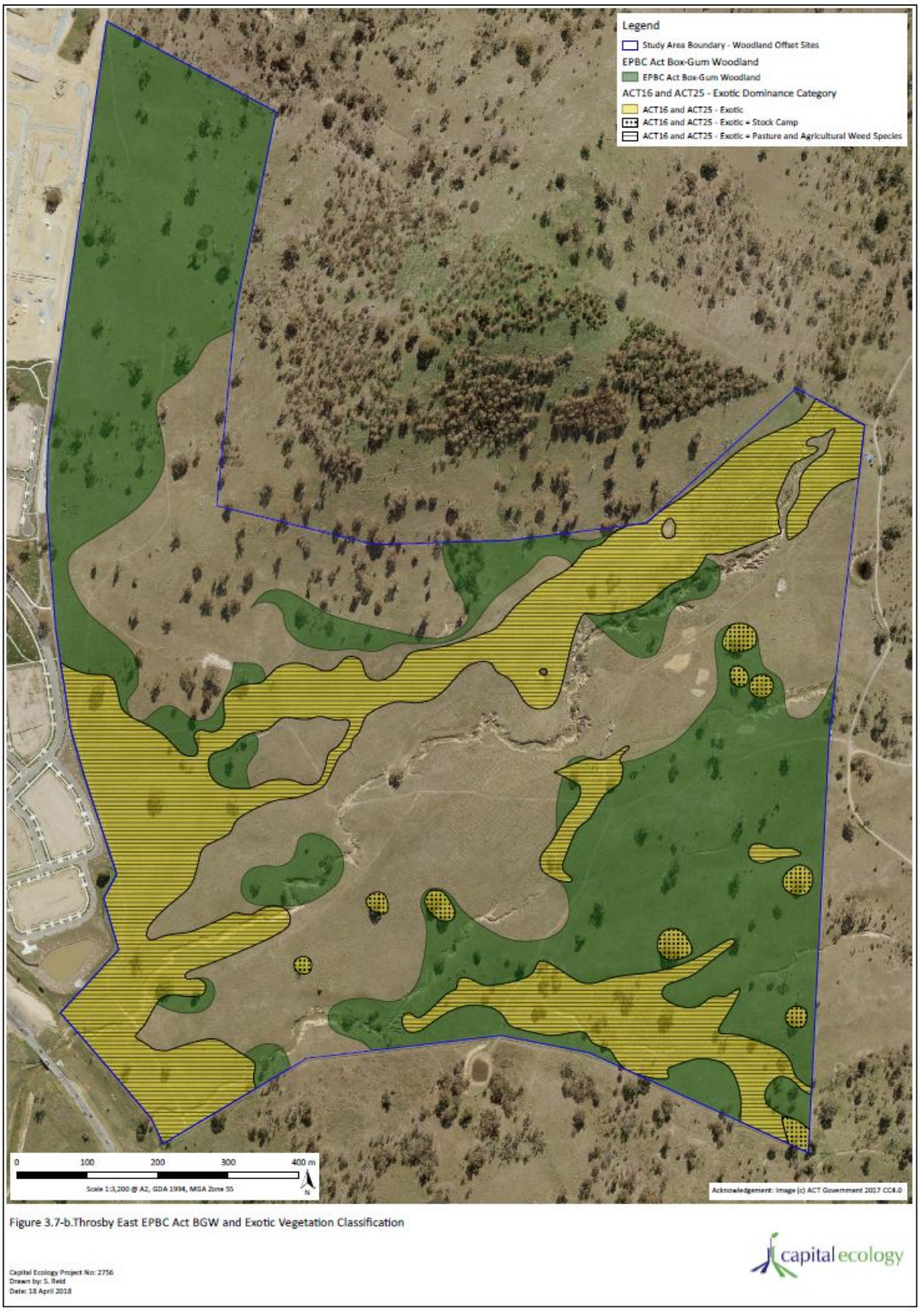


Figure 3.7-b. Throsby East EPBC Act BGW and Exotic Vegetation Classification



3.8 Throsby North

3.8.2 Woodland mapping results

Figure 3.8-a shows the extent of the woodland PCT and zones for Throsby North and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Throsby North was found to support one PCT:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 45.67 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 40.83 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 11.73 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 13.72 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 54.51 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 5.41 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

In total 98.23 ha of woodland in Throsby North meets the EPBC Act BGW criteria (Figure 3.8-b).

Native understorey species richness ranged from 5 native species (TN_16.8.1) to 39 native species (TN_16.1.1). The range of important species was from 0 (multiple plots) to 13 (TN_16.1.1 and TN_16.1.4).

Significant weeds were found throughout the site, including Serrated Tussock (Zones 16.1, 16.2 and 16.4). Other pest plants that were widespread include Briar Rose, Paterson's Curse and St John's Wort.

Figure 3.8-b shows the exotic dominance categories for Throsby North. All of the exotic areas in Throsby North were classified as 'Pasture and Agricultural Weed Species'.

No threatened or rare species were recorded.

Tables 3.8a-3.8f provide summaries of the plot-transect results for each zone. Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.8-a. Throsby North ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland. Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	45.67 ha (4 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora.*
Overstorey Cover	10 - 20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	0 - 4.
Perennial Groundlayer	70 - 88% native.
Understorey	17-39 total native species, 10-31 native non-grass species, 4-13 important species.
Exotic Species Richness	7 - 13 species.
Significant Weeds	Serrated Tussock. Paterson's Curse, St John's Wort and Briar Rose also present.

Table 3.8-b. Throsby North ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Contains a canopy representative of the climax community. Midstorey present, with a low diversity native groundlayer.
Size	40.83 ha (4 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	2 - 10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 4.
Perennial Groundlayer	52 - 63% native.
Understorey	13-17 total native species, 5-8 native non-grass species, 1-3 important species.
Exotic Species Richness	9 - 16 species.
Significant Weeds	Serrated Tussock. Briar Rose, Paterson's Curse and St John's Wort also present.

Table 3.8-c. Throsby North ACT016 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland. Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	11.73 ha (3 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	69 - 77% native.
Understorey	25-34 total native species, 16-25 native non-grass species, 9-12 important species.
Exotic Species Richness	9 - 17 species.
Significant Weeds	Serrated Tussock. Briar Rose, Paterson's Curse and St John's Wort also present.

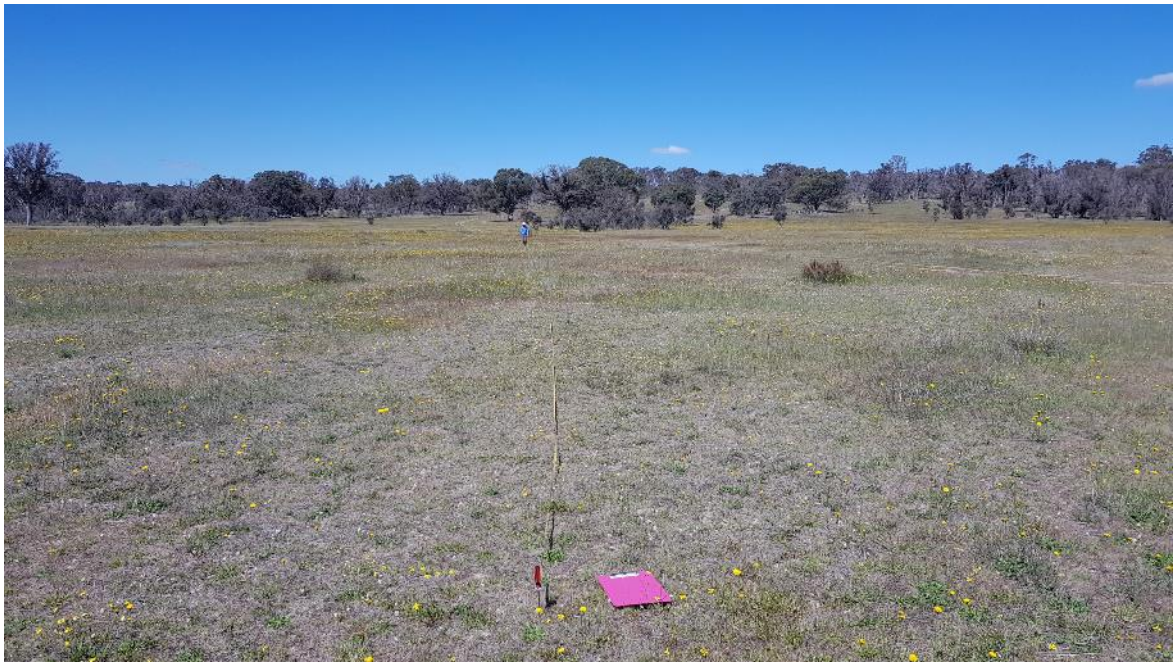


Table 3.8-d. Throsby North ACT016 Zone 5 results summary

	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	13.72 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	51 - 60% native.
Understorey	14-15 total native species, 6-8 native non-grass species, 0-2 important species.
Exotic Species Richness	8 - 13 species.
Significant Weeds	No significant weeds recorded.

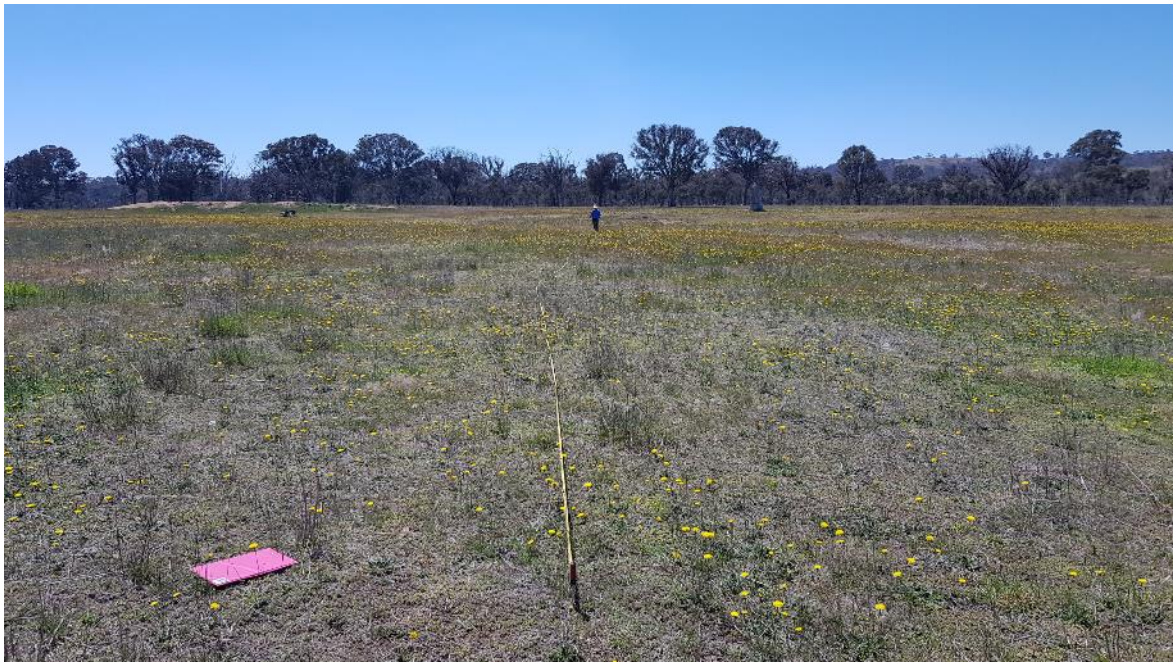


Table 3.8-e. Throsby North ACT016 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer). Contains a canopy representative of the climax community. Midstorey present, with a low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	54.51 ha (3 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora.*
Overstorey Cover	10 - 30%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 7.
Perennial Groundlayer	7 - 38% native.
Understorey	6-8 total native species, 2-3 native non-grass species, 0-2 important species.
Exotic Species Richness	9 - 11 species.
Significant Weeds	Paterson's Curse present.

Table 3.8-f. Throsby North ACT016 Zone 8 results summary

	ACT16 Zone 8
Description	Exotic Pasture Overstorey and midstorey absent. Low diversity exotic groundlayer dominated by Phalaris and exotic forbs.
Size	5.41 ha (2 plot-transects).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	5 - 16% native.
Understorey	5-7 total native species, 2-2 native non-grass species, 0 important species.
Exotic Species Richness	6 - 10 species.
Significant Weeds	Scotch Thistle present.

3.8.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation of Throsby North is comprised of moderate to high diversity BGW and derived grassland in the north, low diversity BGW and derived grassland in the south-east, and low diversity BGW with an exotic groundlayer in the south-west. The moderate to high diversity areas contain a healthy midstorey and understorey and a groundlayer dominated by Kangaroo Grass, Wallaby Grass, Spear Grasses and Red-leg Grass, which includes a diverse array of native forbs. The low diversity areas contain a sparse midstorey, an understorey which lacks shrubs and a groundlayer dominated by Spear Grasses, Wallaby Grass and Kangaroo Grass, with a low diversity of native forbs. The low diversity areas with an exotic groundlayer also contain a sparse midstorey, an understorey lacking shrubs, and a groundlayer which is dominated by Phalaris. The significant ecological values of the site are the 98.23 ha of EPBC Act BGW, significant habitat for woodland birds, and the site's connectivity with the surrounding areas, including providing a vital link between Mulligan's Flat Nature Reserve and Goorooyarroo Nature Reserve. As mentioned in Section 3.3.3, Throsby North will be included in the extended Mulligans Flat Woodland Sanctuary and add to Australia's largest remaining patch of reserved relatively intact BGW.

The history of stock on parts of Throsby North, combined with other land management practices such as clearing, has impacted upon the vegetation in parts of the site and contributed to the current sparse midstorey, lack of shrubstorey and low diversity of native forbs. Some sparsely distributed significant weeds, such as Serrated Tussock, are present and require control. St John's Wort, Paterson's Curse and Briar Rose are also present across much of the site and should be controlled before they spread further.

Conservation-targeted management should be directed towards the improvement of the midstorey and understorey of the low diversity structural woodland areas, conservation of habitat values for woodland birds, and control of weeds. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the stocking rates, stocking timing, rotational grazing, targeted weed control works, and other focused measures that will be applied to protect and enhance the conservation values of the site. The key management priority of the site is the control of stocking rates and the control of weeds. Stocking rates should be determined to best encourage the natural regeneration of the overstorey in the structural woodland areas of the site, and to ensure appropriate levels of grass herbage mass in the Phalaris dominated areas. With respect to the natural regeneration of the overstorey, techniques such as 'ripping' the ground should be considered to encourage regeneration in the low diversity areas, where appropriate.

Comparison to previous mapping

As described in Section 3.1.2, EcoLogical Australia (2011) mapped over 2,400 ha of vegetation in the north of Canberra, including the area encompassed by Throsby North offset reserve. However, the vegetation mapping presented in EcoLogical Australia (2011) was later found to be only 23% to 80% accurate, averaging 61.25% accuracy/ha (Biosis 2012). Such inaccuracies make direct comparisons with the current study difficult.

EcoLogical Australia (2011) do not provide a site-by-site description of, or total areas for, the vegetation they mapped in 2011. Therefore, only a qualitative comparison is possible between their mapping and that produced by the current study. With respect to Throsby North, EcoLogical

Australia (2011) mapped almost the entirety of the site as BGW, but only classified the northern section (both the structural woodland areas and derived grassland) as meeting the criteria for EBPC Act BGW. From their report it is difficult to determine why the remainder of the site was excluded, but the most likely explanation is that the groundlayer was recorded as exotic. If this was indeed the case, the mapping reported by EcoLogical Australia (2011) is broadly similar to that of the current study.

Figure 3.8-a. Throsby North Vegetation Mapping Results

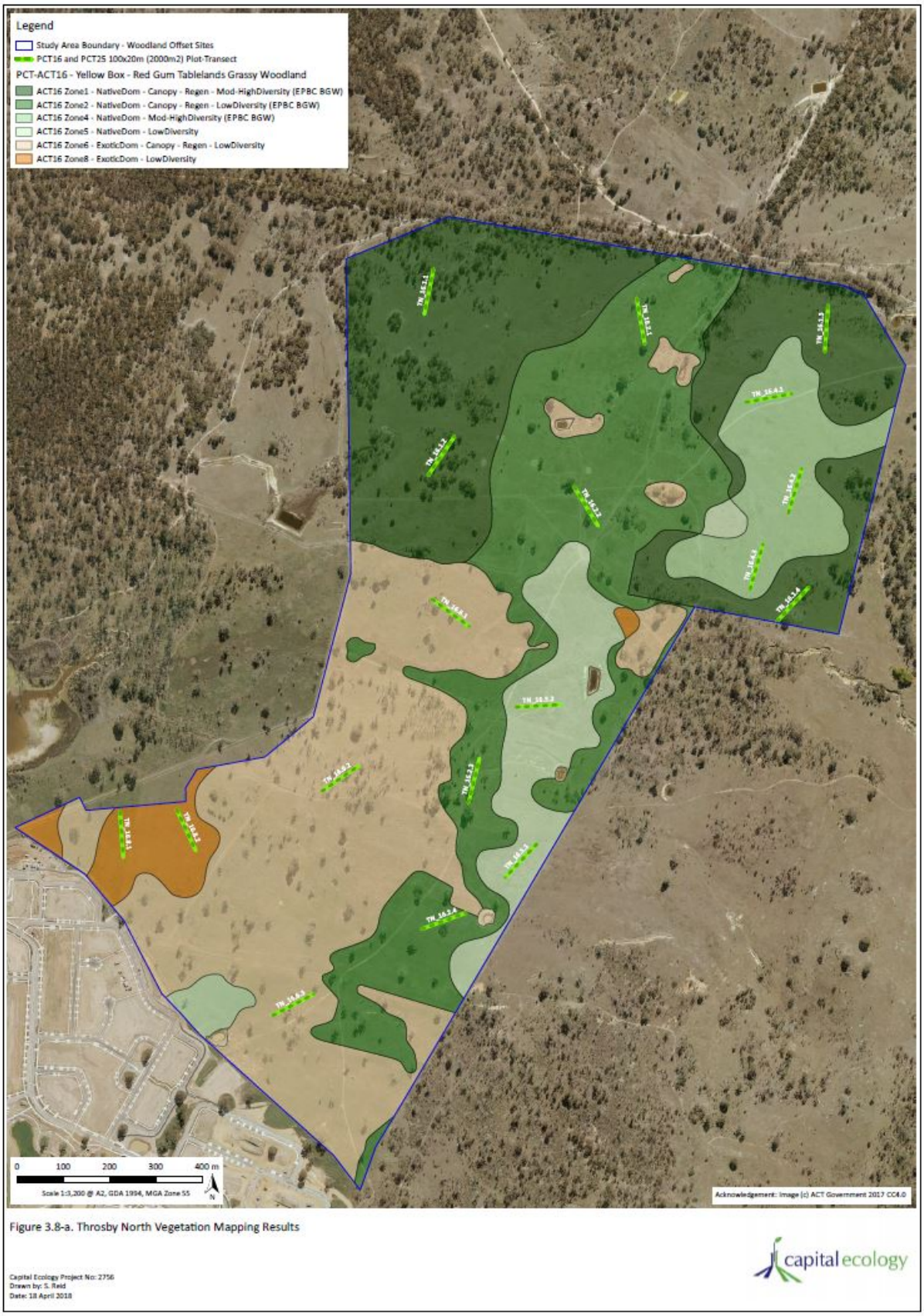
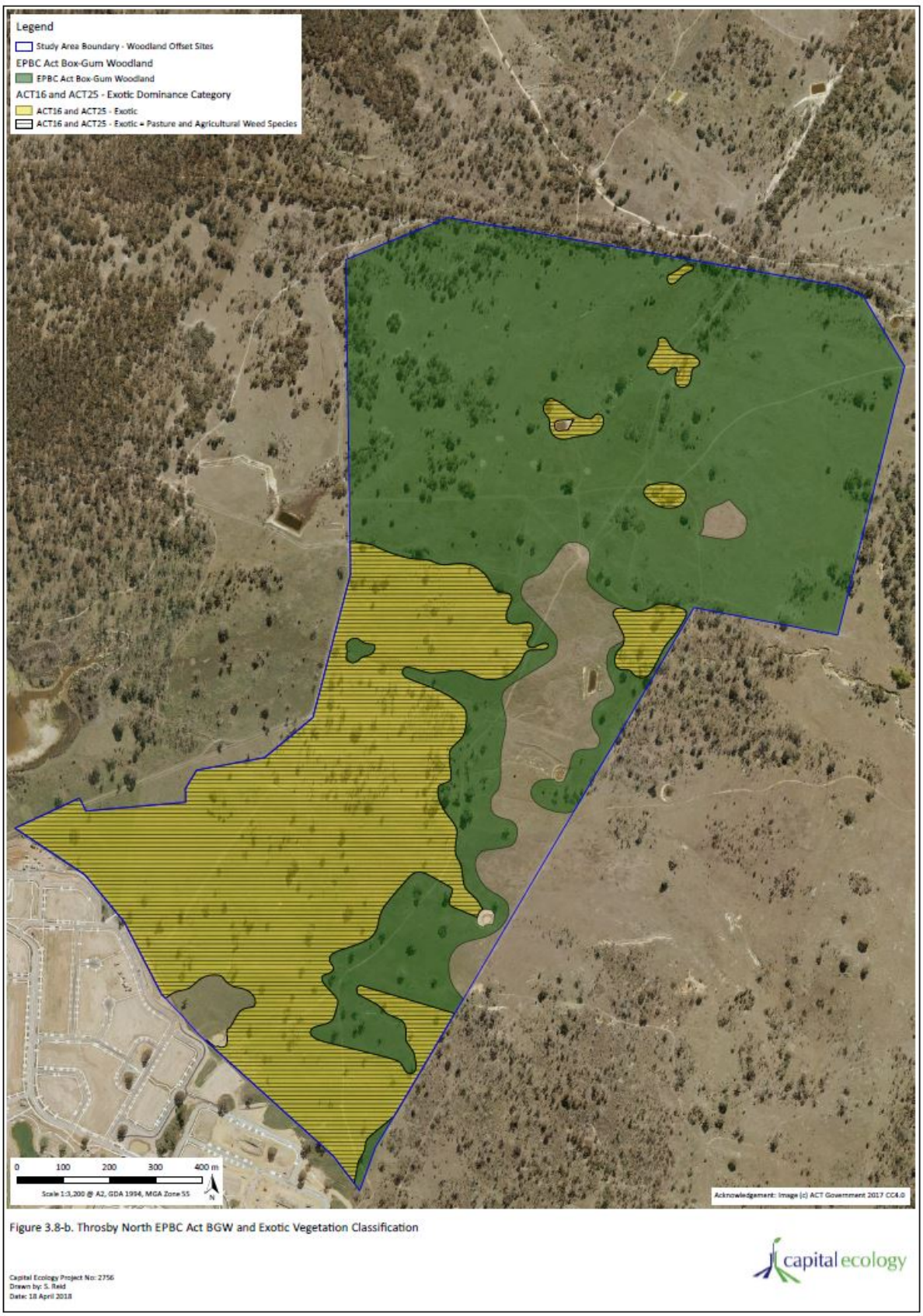


Figure 3.8-b. Throsby North EPBC Act BGW and Exotic Vegetation Classification



3.9 The Pinnacle

3.9.2 Woodland mapping results

Figure 3.9-a shows the extent of the PCTs and zones for The Pinnacle and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

The Pinnacle was found to support two PCTs:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 3.67 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 10.83 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 1.72 ha of Zone 4: Native dominant understorey – No canopy – No Regeneration of overstorey – Moderate to high native forb diversity (meeting the EPBC Act BGW criteria).
- 1.67 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 0.18 ha of Zone 8: Exotic dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

'ACT25 *Eucalyptus macrorhyncha* Tableland Grass/Shrub Forest', with the following zones.

- 1.45 ha of Zone 1: Native dominant understorey – Mature canopy – Regeneration of overstorey – Moderate to high native forb diversity.

In total 16.22 ha of woodland in The Pinnacle meets the EPBC Act BGW criteria (Figure 3.9-b).

Native understorey species richness ranged from 15 native species (TP_16.2.1) to 45 native species (TP_25.1.1). These two plots also set the range for the number of important species, which varied from 1 (TP_16.2.1) to 22 (TP_25.1.1).

No significant weeds were found within the site. Other pest plants that were widespread include Saffron Thistle, Paterson's Curse, St John's Wort and Briar Rose.

Figure 3.9-b shows the exotic dominance categories for The Pinnacle. The one exotic area in The Pinnacle was classified as 'Pasture and Agricultural Weed Species', being a Phalaris dominated drainage line.

One rare species, Pale Flax Lily *Dianella longifolia* var. *longifolia,* was recorded (*Species location removed*).

Tables 3.9a-3.9e provide summaries of the plot-transect results for each zone (excluding ACT16 Zone 8, due to its small area). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.9-a. The Pinnacle ACT16 Zone 1 results summary

	ACT16 Zone 1
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Largely intact condition with a canopy representative of the climax community. Midstorey present, with a moderate to high diversity native groundlayer. Threatened flora – Pale Flax Lily *Dianella longifolia* var. *longifolia* (*Species location removed*).
Size	3.67 ha (2 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora.*
Overstorey Cover	5 - 10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 2.
Perennial Groundlayer	75 - 99% native.
Understorey	25-44 total native species, 18-35 native non-grass species, 8-17 important species.
Exotic Species Richness	12 - 16 species.
Significant Weeds	Paterson's Curse, Saffron Thistle and St John's Wort present.

Table 3.9-b. The Pinnacle ACT16 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box - Red Gum Grassy Woodland Contains a canopy representative of the climax community. Midstorey present, with a low diversity native groundlayer.
Size	10.83 ha (3 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	4 - 10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	2 - 3.
Perennial Groundlayer	60 - 77% native.
Understorey	15-28 total native species, 8-18 native non-grass species, 1-4 important species.
Exotic Species Richness	14 - 17 species.
Significant Weeds	Paterson's Curse, St John's Wort and Saffron Thistle present.

Table 3.9-c. The Pinnacle ACT016 Zone 4 results summary

	ACT16 Zone 4
Description	EPBC Act Yellow Box – Red Gum Woodland – Derived Grassland. Overstorey and midstorey absent. Moderate to high diversity native groundlayer.
Size	1.72 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	82% native.
Understorey	30 total native species, 22 native non-grass species, 8 important species.
Exotic Species Richness	23 species.
Significant Weeds	Saffron Thistle, Paterson's Curse, St John's Wort and Briar Rose present.

Table 3.9-d. The Pinnacle ACT016 Zone 5 results summary

	ACT16 Zone 5
Description	Native Pasture Overstorey and midstorey absent. Low diversity native groundlayer.
Size	1.67 ha (1 plot-transect).
Overstorey Species	Overstorey absent.
Overstorey Cover	Overstorey absent.
Overstorey Regeneration	No.
No. of Trees > 125 cm DBH per 0.2 ha plot	0.
Perennial Groundlayer	67% native.
Understorey	20 total native species, 12 native non-grass species, 6 important species.
Exotic Species Richness	14 species.
Significant Weeds	Saffron Thistle and Paterson's Curse present.

Table 3.9-e. The Pinnacle ACT025 Zone 1 results summary

	ACT25 Zone 1
Description	Tableland Grass/Shrub Forest Largely intact condition with a canopy representative of the climax community. Midstorey and shrubstorey present, with a moderate to high diversity native groundlayer.
Size	1.45 ha (1 plot-transect).
Overstorey Species	*E. dives* and *E. rossii*.
Overstorey Cover	20%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	3.
Perennial Groundlayer	93% native.
Understorey	45 total native species, 38 native non-grass species, 22 important species.
Exotic Species Richness	11 species.
Significant Weeds	St John's Wort and Briar Rose present.

3.9.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation across The Pinnacle is comprised of moderate to high diversity BGW and derived grassland, low diversity BGW and derived grassland, and two small patches of Tableland Grass/Shrub Forest. A small drainage line in the east of the site is characterised by Phalaris. The BGW groundlayer is dominated by Kangaroo Grass, Red-leg Grass, Wallaby Grasses and Spear Grasses, and includes a diverse array of native forbs. The significant ecological values of the site are the 16.22 ha of EPBC Act BGW, habitat for woodland birds, likely Pink-tailed Worm-lizard habitat[25] and the site's connectivity with The Pinnacle Nature Reserve to the north and Kama Nature Reserve to the south. The Pinnacle is one of the only sites in the ACT that links dry sclerophyll forest (in The Pinnacle Nature Reserve) through woodland and grassland (Kama Nature Reserve) to riparian ecosystems in the Molonglo River[26], and is a logical and valuable addition to the ACT nature reserve network.

The site is in a good condition and lacks many of the significant weeds that are present elsewhere in the ACT. The low diversity structural woodland areas only contain a sparse midstorey and low diversity understorey. These areas could benefit from management actions directed towards encouraging natural regeneration of the overstorey.

Conservation-targeted management should be directed towards the improvement of the midstorey and understorey of the low diversity wooded areas and conservation of habitat values for woodland birds and Pink-tailed Worm-lizard. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the targeted works and other focused measures that will be applied to protect and enhance the conservation values of the site. With respect to the natural regeneration of the overstorey, techniques such as 'ripping' the ground should be considered to encourage regeneration in the low diversity areas, where appropriate.

Comparison to previous mapping

Umwelt (Australia) Pty Ltd mapped the vegetation in The Pinnacle offset reserve in 2013 (described in Umwelt 2014[27]). The site was selected and assessed applying the Commonwealth biodiversity offset policy and associated calculator (Commonwealth of Australia 2012a[28],2012b[29]). Vegetation survey effort was limited to one 20x20 m quadrat and a meandering walk through the site to map PCT boundaries and assess general site condition. Umwelt (2014) found that the site was of a high quality, contained high floristic diversity and structural integrity, a low abundance of exotic grasses, forbs and significant weeds, and was an important site in terms of landscape connectivity. This agrees well with the current study. Umwelt (2014) reported 15.5 ha of BGW, which again agrees well

[25] Capital Ecology (2015). *William Hovell Drive investigation area – Pink-tailed Worm-lizard survey and habitat mapping*. Prepared for ACT Government – Treasury and Economic Development Directorate. Author: R. Speirs. Project no. 2692.
[26] Capital Ecology (2016). *Kama Nature Reserve Interface Management Strategy*. Final 02 – December 2016. Prepared for ACT Government – Environment, Planning and Sustainable Development Directorate. Author: R. Speirs. Project no. 2717.
[27] Umwelt (2014). *University of Canberra Public Hospital.* EPBC Act Referral Preliminary Documentation. EPBC Ref. 2013/6987. August 2014.
[28] Commonwealth of Australia (2012a). *Environment Protection and Biodiversity Conservation Act 1999 Environmental offset Policy*.
[29] Commonwealth of Australia (2012b). *Guide to the use of offsets under the EPBC Act*.

with the 16.22 ha identified in the current study. However, this 15.5 ha was comprised of 5 ha of BGW structural woodland and 10 ha of BGW derived grassland. In contrast, the current study identifies 14.5 ha of BGW structural woodland (ACT16-Zone1 and ACT16-Zone2) and 1.74 ha of BGW derived grassland (ACT16-Zone4). The current study identified more areas of structural woodland as groups of trees were determined to be separated by no more than 75 m, thereby forming a continuous patch as outlined in the EPBC Act Policy Statement guidelines (Commonwealth of Australia 2006). Despite these differences, the two studies broadly agree on the condition of the site, the PCT boundaries, and the site's importance in the broader landscape.

Figure 3.9-a. The Pinnacle Vegetation Mapping Results

Figure 3.9-b. The Pinnacle EPBC Act BGW and Exotic Vegetation Classification

3.10 Watson Woodland

3.10.2 Woodland mapping results

Figure 3.10-a shows the extent of the woodland PCT and zones for Watson Woodland and the locations of the plot-transects. The start/end locations of the plot-transects are provided in Appendix 1 and Appendix 2.

Watson Woodland was found to support one PCT:

'ACT16 *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland', with the following zones.

- 7.35 ha of Zone 2: Native dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (meeting the EPBC Act BGW criteria).
- 0.35 ha of Zone 5: Native dominant understorey – No canopy – No Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).
- 10.33 ha of Zone 6: Exotic dominant understorey – Mature canopy – Regeneration of overstorey – Low native forb diversity (not meeting the EPBC Act BGW criteria).

In total, 7.35 ha of woodland in Watson Woodland meets the EPBC Act BGW criteria (Figure 3.10-b).

Native understorey species richness ranged from 4 native species (WW_16.6.2) to 12 native species (WW_16.2.2 and WW_16.2.3). The number of important species varied from 0 (WW_16.6.1 and WW_16.6.2) to 5 (WW_16.2.3).

Significant weeds found within the site include Serrated Tussock (Zone 16.2). Other pest plants that were widespread include Paterson's Curse and Briar Rose.

Figure 3.10-b shows the exotic dominance categories for Watson Woodland. All of the exotic areas were classified as 'Pasture and Agricultural Weed Species'.

One rare species, Hoary Sunray, was recorded in numerous locations in Watson Woodland. None were in monitoring plots. Based on the history of the site it is likely that these were deliberately planted in Watson Woodland and are not naturally occurring.

Tables 3.10a-3.10b provide summaries of the plot-transect results for each zone (excluding ACT16 Zone 5, due to its small area). Detailed summaries of the floristics diversity (plot) and structure (step-point transect) data for each plot-transect are provided in Appendix 1 and 2, respectively.

Table 3.10-a. Watson Woodland ACT016 Zone 2 results summary

	ACT16 Zone 2
Description	EPBC Act Yellow Box – Red Gum Grassy Woodland Contains a canopy representative of the climax community. Midstorey present, which is partly made up of planted trees. Low diversity native groundlayer.
Size	7.35 ha (3 plot-transects).
Overstorey Species	*E. melliodora*.
Overstorey Cover	10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	1 - 1.
Perennial Groundlayer	64 - 73% native.
Understorey	11-12 total native species, 6-9 native non-grass species, 1-5 important species.
Exotic Species Richness	10 - 12 species.
Significant Weeds	Serrated Tussock. Paterson's Curse, Scotch Thistle and Briar Rose also present.

Table 3.10-b. Watson Woodlands ACT016 Zone 6 results summary

	ACT16 Zone 6
Description	Yellow Box – Red Gum Woodland (exotic groundlayer). Contains a canopy representative of the climax community. Midstorey present, which is partly made up of planted trees. Low diversity exotic groundlayer dominated by Phalaris, exotic annual grasses and exotic forbs.
Size	10.33 ha (2 plot-transects).
Overstorey Species	*E. blakelyi* and *E. melliodora*.
Overstorey Cover	0 - 10%.
Overstorey Regeneration	Yes.
No. of Trees > 125 cm DBH per 0.2 ha plot	0 - 2.
Perennial Groundlayer	16 - 24% native.
Understorey	4-8 total native species, 3-6 native non-grass species, 0 important species.
Exotic Species Richness	12 - 12 species.
Significant Weeds	Paterson's Curse, St John's Wort and Briar Rose present.

3.10.3 Discussion and comparison to previous mapping

Discussion and recommendations to improve woodland quality

The vegetation in Watson Woodland is a mix of low diversity or exotic BGW and contains a midstorey and understorey which is partly comprised of planted trees, shrubs, forbs and grasses. The low diversity BGW groundlayer is dominated by Tall Spear Grass and contains a low diversity of native forbs. The exotic areas are dominated by exotic annual grasses and Phalaris. The site's significant ecological values include 7.35 ha of EPBC Act BGW and habitat for woodland birds. The Watson Woodland Working Group has added significant value to the site through their plantings, weed control and other management actions.

Conservation-targeted management should be conducted in conjunction with the Watson Woodland Working Group and be directed towards the continued improvement of the midstorey and understorey and conservation of habitat values for woodland birds. It is therefore recommended that a conservation-targeted management plan be prepared which prescribes a management regime for the site. This management regime should stipulate the targeted works and other focused measures that will be applied to protect and enhance the conservation values of the site.

Comparison to previous mapping

The vegetation within Watson Woodland (also known as Justice Robert Hope Park) was broadly assessed by David Hogg Pty Ltd (2012[30]) during a more detailed assessment of an adjoining area. Vegetation surveys were based on guidelines set out in ACT Government (2010). Watson Woodland was found to support substantially modified Yellow Box – Red Gum woodland, dense patches of regrowth, and a mixed groundlayer where areas were either dominated by native grasses or introduced grasses (the estimated proportion of groundcover dominated by Phalaris was 10 percent). It was also noted that, as a result of management actions by the Watson Woodland Working Group, there were greater diversity planted patches of native forbs and grasses scattered throughout the site. David Hogg Pty Ltd (2012) concluded that:

> *'The overall quality of the habitat throughout the Watson Woodlands…is relatively poor due to limited habitat structure, poor native groundcover content and species diversity, and proximity to urban development. The habitat within Justice Robert Hope Park is similar to that within the project site, although it has slightly improved structural diversity as the result of regeneration and rehabilitation activities.'*

The description of the vegetation in Watson Woodland by David Hogg Pty Ltd (2012) is consistent with that of the current study. The current mapping goes further by mapping and quantifying the areas dominated by native or exotic groundcover, and by recording full species lists and structure information across the site.

[30] David Hogg Pty Ltd (2012). *Block 9 Section 94 Watson and Negus Crescent Extension Ecological Surveys and Assessment.* Report prepared for ACT Land Development Agency. May 2012.

Figure 3.10-a. Watson Woodland Vegetation Mapping Results

Figure 3.10-b. Watson Woodland EPBC Act BGW and Exotic Vegetation Classification

4 Summary and Conclusion

Capital Ecology was commissioned by PCS to assess and map the quality and extent of the woodland within ten ACT offset reserves ('sites'). Each site is known to support woodland which meets the definition for the BGW threatened ecological community, and/or habitat for significant fauna species such as the Golden Sun Moth and Striped Legless Lizard. The results presented in this report provide fine-scale mapping of the ten sites and establishes an accurate and reliable baseline assessment from which ongoing management and monitoring of the significant biodiversity values can be achieved. This report also establishes a reliable and repeatable four-step methodology which can be used to determine future changes in woodland quality and extent, and which will further aid management decisions by differentiating areas of exotic dominance based on the category of exotic species that this dominance is attributed to.

The field surveys and mapping were timed to occur when the greatest number of woodland forbs were in full flower. This was determined from observations of known reference sites throughout the season. The weather conditions in 2017 (a dry start to winter with cold nights[31] and average spring rainfall with warm days[32]) resulted in average conditions during the survey period (i.e. normal conditions). The only effects of the weather we noted were a low annual grass cover due to the later than usual spring rains, and poor orchid and lily emergence due to particularly cold winter nights. The low lily and orchid emergence was also observed by other practitioners in the field (Greg Baines pers. comm.; Sarah Sharp pers. comm. Nicholas Wilson pers. comm.; Rob Armstrong pers. comm.). In general, weather conditions are unlikely to have substantially influenced the results.

The quality and extent of woodland in each of the sites has been mapped previously, and comparisons to the results of those studies are discussed in the subsection for each site. In general, the mapping prepared via this study is broadly consistent with that prepared previously. However, it must be noted that this was not always the case when compared to the mapping prepared by EcoLogical Australia (2011), which is discussed in detail in Section 3.1.3. In addition, the four-step mapping method employed for this study, applied with a focus on accuracy rather than time constraints, has resulted in the development of a mapping product which is far more detailed and fine-scale than that prepared previously. In this regard, it is difficult to make direct comparisons with previous mapping and thereby form conclusions regarding changes in woodland quality and extent. Such comparisons will be possible in the future providing that the four-step mapping method is employed, and survey/mapping effort are sufficient to produce appropriately accurate mapping.

Table 4-a summarises the areas of EPBC Act BGW (PCT16-Zone1 to Zone4) for each site. Of the ten sites, Kinlyside and Throsby North support the greatest total area of BGW (141.1 ha and 98.23 ha, respectively), and Kenny Broadacre and Watson Woodland the least (3.22 ha and 7.35 ha, respectively). Management recommendations are provided in the subsection for each site, however common recommendations across the sites include management of grazing intensity and timing via varied stocking rates and rotational grazing, and management of noxious and/or prolific weeds.

[31] Commonwealth of Australia (2017). *Australian Capital Territory in winter 2017: dry season with warm days and cool nights.* Bureau of Meteorology Seasonal Climate Summary for Canberra.
[32] Commonwealth of Australia (2017). *Australian Capital Territory in spring 2017: warmer than average days.* Bureau of Meteorology Seasonal Climate Summary for Canberra.

Table 4-a. Summary of the areas of EPBC Act BGW structural woodland and derived grassland

Site	EPBC Act BGW structural woodland (ha) Zones 1, 2 & 3	EPBC Act BGW derived grassland (ha) Zone 4	EPBC Act BGW Total (ha) Zones 1, 2, 3 & 4
Horsepark North	12.85	25.31	38.16
Isaacs Ridge	35.26	0	35.26
Kenny Broadacre	3.22	0	3.22
Kinlyside	120.77	20.33	141.10
Kenny Woodland	53.49	0.43	53.92
Taylor	5.35	4.85	10.20
Throsby East	38.36	0	38.36
Throsby North	86.50	11.73	98.23
The Pinnacle	14.50	1.72	16.22
Watson Woodland	7.35	0	7.35

Table 4-b and 4-c summarise the native characteristics of the four EPBC Act BGW zones (PCT16-Zone1 to Zone4) for each site. The benchmark scores provided by PCS for 'ACT16: *Eucalyptus melliodora – E. blakelyi* Tableland Grassy Woodland' are:

- Native Species Richness (SR) = 35 species
- Native Ground Cover Grass (GCG) = 23% to 63% Projected Foliage Cover (PFC)
- Native Ground Cover Other (GCO) = 8% to 21% PFC. For comparison to the data presented in the current study, values for Native Ground Cover Shrub were added to the benchmark scores of GCO
- Native Overstorey (NOS) = 11% to 32 % PFC; and
- Native Midstorey (NMS) = 0% to 12.5% PFC.

Some general conclusions can be drawn from the presented data. Apart from Kinlyside (ACT16-Zone1) and The Pinnacle (ACT16-Zone1), no other zone across any site reached the prescribed benchmarks for Native Species Richness. A similar situation occurs with respect to Native Overstorey cover for ACT16-Zone1. These results reflect the historical land management practices that have occurred across the sites (such as vegetation clearing, pasture improvement and grazing), which have impacted upon the diversity and structure of the vegetation. The Native Ground Cover Grass achieved the prescribed bench marks across all sites and zones. Apart from ACT16-Zone2, this is also true with respect to the Native Ground Cover Other. The fact that ACT16-Zone2 has values for Native Ground Cover Other far below the benchmarks is not surprising given that this zone is characterised by low diversity and indicates that these areas have been appropriately distinguished from ACT16-Zone1. To improve the current site values to the benchmarks, we recommend that management focus on preserving those areas currently of the highest quality and improving areas which have the potential to substantially improve.

In general, the results presented throughout this report, and partly summarised in Table 4-b and 4-c, show that the four-step mapping method and vegetation zone classifications are appropriate for recording the quality and extent of the lowland woodland vegetation in the ACT.

Significant weeds such as Serrated Tussock and Chilean Needle Grass are present at many of the sites. Serrated Tussock is particularly prolific within sections of Horsepark North and Kenny Woodland. In general, these weeds represent the foremost threat to the integrity of the botanical and fauna habitat values of the BGW in the sites. Accordingly, diligent and systematic control of these weeds (together with Briar Rose) is required to conserve and enhance the values of the sites. Also of concern are other pest plants, such as St John's Wort, Paterson's Curse and Saffron Thistle, which are often widespread and at high densities. These prolific weeds are likely to be having a detrimental impact in addition to that of the identified significant weeds. These weeds are often very difficult to effectively control, particularly as the targeted control method for one species may exacerbate the spread and density of other herbaceous weeds and/or the three significant grass weeds. Methods such as controlled grazing should be considered in low-diversity areas, and ecological burns in high-diversity areas.

Table 4-b. Summary of average native aspects of EPBC Act BGW zones (zones 1 to 4), including Species Richness (SR), Ground Cover Grass (GCG) and Ground Cover Other (GCO).

Red filled cells highlight values below the benchmark, while green filled cells indicated values that reach or exceed benchmark values. Benchmark values are presented in the main body of the text above.

Site	ACT16 - Zone 1			ACT16 - Zone 2			ACT16 - Zone 3			ACT16 - Zone 4		
	SR	GCG	GCO	SR	GCG	GCO	SR	GCG	GCO	SR	GCG	GCO
Horsepark North	31	34	11							30	59	7
Isaacs Ridge	21	34	8									
Kenny Broadacre				13	39	0						
Kinlyside	40	46	11	16	35	6				28	54	10
Kenny Woodland				6	40	1				20	46	10
Taylor	27	43	10							20	44	19
Throsby East				14	35	3						
Throsby North	32	43	13	17	36	1				30	52	6
The Pinnacle	37	45	9	25	31	3				30	59	1
Watson Woodland				13	32	4						

Table 4-c. Summary of average Native Overstorey (NOS) and Native Midstorey (NMS) aspects of EPBC Act BGW zones (zones 1 to 4).

Red filled cells highlight values below the benchmark, while green filled cells indicated values that reach or exceed benchmark values. Benchmark values are presented in the main body of the text above.

Site	ACT16 - Zone 1		ACT16 - Zone 2		ACT16 - Zone 3	
	NOS	NMS	NOS	NMS	NOS	NMS
Horsepark North	8	14				
Isaacs Ridge	6	20				
Kenny Broadacre			15	0		
Kinlyside	11	11	11	15		
Kenny Woodland			10	7		
Taylor	1	18				
Throsby East			10	9		
Throsby North	13	12	6	2		
The Pinnacle	8	10	6	2		
Watson Woodland			10	27		

References

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Appendices

Appendix 1. Plot Data Summary Tables

Table A1-0-a. Horsepark North plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Horsepark North	16	1	HN_16.1.1	692576	6109371	692649	6109436	*E. bridgesiana*	15	Y	33	27	12	13	2	***N. trichotoma*** *E. plantagineum*	Yes
			HN_16.1.2	693253	6109941	693243	6109838	*E. melliodora*	5	Y	30	25	13	5	1	***N. trichotoma***	
			HN_16.1.3	693748	6110260	693720	6110357	*E. melliodora*	5	Y	23	21	9	11	3	***N. trichotoma*** *E. vulgare* *R. rubiginosa*	
		4	HN_16.4.1	693679	6110219	693780	6110206		0	N	32	26	10	11	2	***N. trichotoma*** *H. perforatum*	Yes
			HN_16.4.2	693145	6110004	693131	6109900		0	N	31	27	11	9	2	***N. trichotoma*** *R. rubiginosa*	
			HN_16.4.3	692739	6109317	692695	6109227		0	N	20	17	5	20	3	***N. trichotoma*** *H. perforatum* *R. rubiginosa*	
			HN_16.4.4	692762	6109563	692812	6109651		0	N	35	30	12	10	1	*R. rubiginosa*	
		8	HN_16.8.1	692611	6109255	692555	6109175		0	N	12	11	2	21	2	***N. trichotoma*** *R. rubiginosa*	No
	25	1	HN_25.1.1	692989	6110029	692901	6109981	*E. nortonii*	20	Y	29	24	12	12	2	***N. trichotoma*** *R. rubiginosa*	No
			HN_25.1.2	693287	6110132	693385	6110110	*E. macrorhyncha*	22	Y	42	32	15	7	2	***N. trichotoma*** *R. rubiginosa*	
			HN_25.1.3	694429	6110188	694522	6110257	*E. macrorhyncha*	5	Y	21	13	6	3	1	***N. trichotoma***	
			HN_25.1.4	693996	6110214	694097	6110206	*E. macrorhyncha*	10	Y	23	16	8	1	1	***N. trichotoma***	
		4	HN_25.4.1	693097	6110086	693191	6110116		0	N	25	20	8	7	1	***N. trichotoma***	No
			HN_25.4.2	694223	6110205	694323	6110217		0	N	18	17	6	5	1	***N. trichotoma***	
			HN_25.4.3	693889	6110332	693907	6110432		0	N	31	26	9	6	1	***N. trichotoma***	

Table A1-0-b. Isaacs Ridge plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Isaacs Ridge	16	1	IR_16.1.1	693815	6081916	693803	6082018	*E. melliodora*	2	Y	19	13	4	16	4	*E. plantagineum* *H. perforatum* *R. rubiginosa*	Yes
			IR_16.1.2	693930	6082269	693828	6082270	*E. melliodora*	5	Y	25	19	7	15	4	***R. fruticosus*** *A. baileyana* *E. plantagineum* *H. perforatum* *R. rubiginosa*	
			IR_16.1.3	693712	6082942	693747	6082848	*E. nortonii* *E. polyanthemos*	10	Y	19	14	5	16	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	
			IR_16.1.4	693561	6083634	693573	6083536	*E. blakelyi* *E. melliodora*	6	Y	12	9	0	15	4	***R. fruticosus*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	
		6	IR_16.6.1	693929	6082015	693989	6081936	*E. melliodora*	0.2	Y	6	5	0	15	2	*E. plantagineum* *H. perforatum*	No

Table A1-0-c. Kenny Broadacre plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Kenny Broadacre	16	2	KB_16.2.1	698002	6101431	698085	6101486	*E. mannifera* *E. melliodora*	10	Y	10	3	0	6	0		Yes
			KB_16.2.2	697984	6101598	698028	6101508	*E. macrorhyncha* *E. melliodora*	10	Y	8	2	0	6	0		
			KB_16.2.3	698157	6101446	698254	6101452	*E. melliodora* *E. dives*	25	Y	11	6	2	7	1	***N. trichotoma***	
		5	KB_16.5.1	697693	6101839	697776	6101781		0	N	13	5	2	8	1	***N. trichotoma***	No
			KB_16.5.2	697837	6101663	697869	6101569		0	N	6	1	0	7	0		
		8	KB_16.8.1	697707	6101739	697792	6101686		0	N	0	0	0	7	0		No
			KB_16.8.2	698295	6101305	698208	6101355		0	N	2	0	0	7	1	***N. trichotoma***	
	25	2	KB_25.2.1	698147	6101550	698240	6101512	*E. macrorhyncha*	10	N	5	1	0	8	0		No
		5	KB_25.5.1	697899	6101866	697929	6101771		0	N	11	5	0	8	0		No
			KB_25.5.2	697979	6101715	698040	6101637		0	N	11	4	0	9	0		

Table A1-0-d. Kinlyside plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Kinlyside	16	1	Ki_16.1.1	690559	6107988	690493	6108067	*E. blakelyi*	10	Y	44	40	15	20	3	***N. trichotoma*** *C. monogyna* *R. rubiginosa*	Yes
			Ki_16.1.2	690352	6107509	690264	6107462	*E. melliodora*	15	Y	40	33	15	5	1	*H. perforatum*	
			Ki_16.1.3	689881	6107346	689860	6107443	*E. blakelyi* *E. melliodora*	20	Y	34	29	14	22	2	***N. trichotoma*** *R. rubiginosa*	
			Ki_16.1.4	690418	6106905	690489	6106835	*E. melliodora*	5	Y	34	27	10	19	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	
			Ki_16.1.5	690062	6106707	690155	6106667	*E. blakelyi*	5	Y	38	30	16	12	2	***N. trichotoma*** *R. rubiginosa*	
		2	Ki_16.2.1	689497	6105857	689594	6105842	*E. blakelyi* *E. melliodora*	10	Y	11	7	0	10	3	*E. plantagineum* *O. acanthium* *R. rubiginosa*	Yes
			Ki_16.2.2	689751	6106179	689806	6106260	*E. blakelyi*	10	Y	21	15	9	10	2	*E. plantagineum* *R. rubiginosa*	
			Ki_16.2.3	689700	6106150	689605	6106114	*E. blakelyi* *E. melliodora*	10	Y	11	9	3	13	5	***N. trichotoma*** *E. plantagineum* *H. perforatum* *O. acanthium* *R. rubiginosa*	
			Ki_16.2.4	689667	6105501	689712	6105584	*E. blakelyi*	15	Y	13	9	2	13	1	*R. rubiginosa*	
		4	Ki_16.4.1	689689	6107351	689744	6107434		0	N	24	17	4	26	3	***N. trichotoma*** *E. plantagineum* *R. rubiginosa*	Yes
			Ki_16.4.2	689254	6106782	689251	6106881		0	N	33	29	13	14	0		
			Ki_16.4.3	689640	6106863	689685	6106953		0	N	26	19	6	16	3	***N. trichotoma*** *E. plantagineum* *R. rubiginosa*	
		5	Ki_16.5.1	689544	6105533	689503	6105442		0	N	14	8	1	16	2	*E. plantagineum* *R. rubiginosa*	No
			Ki_16.5.2	689674	6106353	689746	6106422		0	N	11	6	3	11	2	*E. plantagineum* *R. rubiginosa*	

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
		6	Ki_16.6.1	689791	6105862	689816	6105958	*E. blakelyi* *E. macrorhyncha*	10	N	7	6	0	14	4	*E. plantagineum* *H. perforatum* *O. acanthium* *R. rubiginosa*	No
	25	1	Ki_25.1.1	690329	6107823	690298	6107728	*E. macrorhyncha* *E. nortonii*	20	Y	23	20	10	3	0		No
			Ki_25.1.2	690493	6107477	690552	6107554	*E. macrorhyncha* *E. mannifera*	20	Y	33	25	12	7	1	*R. rubiginosa*	
			Ki_25.1.3	690468	6107193	690564	6107219	*E. nortonii*	15	Y	35	28	13	10	1	*R. rubiginosa*	
			Ki_25.1.4	690077	6107088	689996	6107145	*E. macrorhyncha* *E. nortonii*	10	Y	33	27	16	5	0		
			Ki_25.1.5	690211	6106627	690298	6106590	*E. macrorhyncha* *E. nortonii*	10	Y	44	36	20	10	1	***N. trichotoma***	
		2	Ki_25.2.1	689897	6106201	689820	6106153	*E. macrorhyncha* *E. nortonii*	15	N	16	10	2	13	2	*E. plantagineum* *R. rubiginosa*	No
			Ki_25.2.2	689886	6105803	689926	6105898	*E. macrorhyncha*	5	Y	14	9	2	17	2	*E. plantagineum* *R. rubiginosa*	
			Ki_25.2.3	689954	6105670	689867	6105721	*E. macrorhyncha*	10	Y	15	10	4	8	1	*C. lanatus*	
		4	Ki_25.4.1	689190	6107079	689247	6107161		0	N	28	20	8	15	1	*R. rubiginosa*	No
			Ki_25.4.2	690697	6107410	690751	6107329		0	N	17	13	4	15	3	***N. trichotoma*** *C. lanatus* *H. perforatum*	
			Ki_25.4.3	690578	6106777	690570	6106675		0	N	15	10	3	15	3	*E. vulgare* *H. perforatum* *R. rubiginosa*	
			Ki_25.4.4	689474	6107216	689518	6107305		0	N	28	24	11	11	0		
		6	Ki_25.6.1	690747	6107628	690777	6107718	*E. macrorhyncha* *E. nortonii*	20	N	9	7	1	13	4	***N. trichotoma*** *C. lanatus* *E. plantagineum* *R. rubiginosa*	No
		8	Ki_25.8.1	690752	6107740	690762	6107839		0	N	5	2	1	19	3	*C. lanatus* *E. plantagineum* *R. rubiginosa*	No

Table A1-0-e. Kenny Woodland plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Kenny Woodland	16	2	KW_16.2.1	697430	6101101	697349	6101042	*E. blakelyi* *E. melliodora*	10	Y	2	1	0	8	2	***N. trichotoma*** *O. acanthium*	Yes
			KW_16.2.2	697361	6100682	697381	6100781	*E. blakelyi* *E. melliodora*	4	Y	4	3	0	14	3	***N. trichotoma*** *E. plantagineum* *R. rubiginosa*	
			KW_16.2.3	697010	6100616	696956	6100530	*E. melliodora*	10	Y	3	2	0	9	3	***N. trichotoma*** *E. plantagineum* *O. acanthium*	
			KW_16.2.4	696828	6100260	696918	6100220	*E. melliodora*	15	N	4	3	0	9	2	***N. trichotoma*** *O. acanthium*	
			KW_16.2.5	696515	6100535	696569	6100455	*E. blakelyi*	10	Y	11	7	2	12	2	***N. trichotoma*** *E. plantagineum*	
		4	KW_16.4.1	696471	6100290	696495	6100388		0	N	20	14	5	10	2	*E. plantagineum* *R. rubiginosa*	Yes
		5	KW_16.5.1	696723	6100933	696782	6101011		0	N	3	2	0	10	2	***N. trichotoma*** *R. rubiginosa*	No
			KW_16.5.2	696902	6100724	696809	6100758		0	N	5	4	0	10	3	***N. trichotoma*** *E. plantagineum* *O. acanthium*	
			KW_16.5.3	697089	6100264	697188	6100284		0	N	4	3	0	13	4	***L. ferocissimum*** ***N. trichotoma*** *E. plantagineum* *R. rubiginosa*	
		6	KW_16.6.1	697059	6101148	697154	6101114	*E. blakelyi*	20	Y	4	4	1	10	3	***N. trichotoma*** *C. monogyna* *E. plantagineum*	No
			KW_16.6.2	696890	6101057	696981	6101094	*E. blakelyi*	10	Y	4	3	0	5	0		
		8	KW_16.8.1	697191	6100746	697115	6100810		0	N	4	3	0	9	0		No
			KW_16.8.2	696444	6100183	696544	6100187		0	N	3	2	0	14	3	***N. trichotoma*** *E. plantagineum* *O. acanthium*	

Table A1-0-f. Taylor plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Taylor	16	1	Ta_16.1.1	691410	6109098	691309	6109110		0	Y	28	23	12	16	1	***N. trichotoma***	Yes
			Ta_16.1.2	691169	6109487	691234	6109409	*E. blakelyi*	0.2	Y	30	26	12	19	2	***N. trichotoma*** *R. rubiginosa*	
			Ta_16.1.3	691321	6109226	691248	6109294	*E. blakelyi*	2	Y	19	16	12	19	3	***N. trichotoma*** *H. perforatum* *R. rubiginosa*	
		4	Ta_16.4.1	691073	6109072	691173	6109064		0	N	23	17	7	18	3	***N. trichotoma*** *H. perforatum* *R. rubiginosa*	Yes
			Ta_16.4.2	691232	6109330	691131	6109334		0	N	15	12	4	17	3	***N. trichotoma*** *H. perforatum* *R. rubiginosa*	
			Ta_16.4.3	691249	6109359	691326	6109423		0	N	22	17	8	19	3	***N. trichotoma*** *C. lanatus* *R. rubiginosa*	
		6	Ta_16.6.1	691289	6109084	691384	6109055	*E. blakelyi* *E. melliodora*	10	Y	16	10	4	18	3	***N. trichotoma*** *H. perforatum* *R. rubiginosa*	No
	25	1	Ta_25.1.1	690604	6109335	690695	6109372	*E bridgesiana* *E. rossii*	30	N	20	16	2	8	2	***N. trichotoma*** *R. rubiginosa*	No
			Ta_25.1.2	691017	6109437	691039	6109530	*E. macrorhyncha*	5	Y	40	35	16	14	2	***N. trichotoma*** *H. perforatum*	
			Ta_25.1.3	691396	6109421	691398	6109323	*E. macrorhyncha*	10	Y	36	32	17	5	1	***N. trichotoma***	
		4	Ta_25.4.1	691323	6109549	691347	6109648		0	N	42	34	14	18	3	***N. trichotoma*** *C. lanatus* *R. rubiginosa*	No
			Ta_25.4.2	690991	6109337	691066	6109274		0	N	28	23	7	15	2	*C. lanatus* *R. rubiginosa*	
			Ta_25.4.3	690756	6109302	690779	6109205		0	N	27	17	4	18	3	*C. lanatus* *H. perforatum* *R. rubiginosa*	
		7	Ta_25.7.1	690800	6109167	690893	6109153	*E bridgesiana*	5	N	5	3	0	17	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	No

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
		8	Ta_25.8.1	690828	6109134	690917	6109104		0	N	5	3	0	15	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	No

Table A1-0-g. Throsby East plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Throsby East	16	2	TE_16.2.1	697473	6103816	697433	6103724	*E. melliodora*	10	Y	15	9	3	11	0		Yes
			TE_16.2.2	697436	6103344	697418	6103246	*E. blakelyi*	10	Y	14	8	1	17	1	***N. trichotoma***	
			TE_16.2.3	698198	6102765	698226	6102670	*E. blakelyi*	10	Y	14	6	0	11	0		
			TE_16.2.4	698382	6102826	698336	6102739	*E. blakelyi*	10	Y	7	1	0	16	0		
		5	TE_16.5.1	698372	6102940	698420	6103028		0	N	8	3	0	11	0		No
			TE_16.5.2	698046	6102749	697964	6102692		0	N	12	6	1	13	1	*R. rubiginosa*	
			TE_16.5.3	697655	6102523	697617	6102431		0	N	12	6	1	16	2	*C. lanatus* *E. plantagineum*	
		6	TE_16.6.1	698203	6102437	698104	6102455	*E. melliodora*	5	Y	4	2	0	6	0		No
			TE_16.6.2	697537	6102329	697468	6102400	*E. melliodora*	5	N	12	5	1	13	2	***N. trichotoma*** *O. acanthium*	
		8	TE_16.8.1	697462	6102619	697484	6102717		0	N	5	0	0	9	1	***N. trichotoma***	No
			TE_16.8.2	698016	6102947	698063	6103036		0	N	8	4	0	12	2	***N. trichotoma*** *E. plantagineum*	
	25	2	TE_25.2.1	697550	6103264	697582	6103361	*E. rossii*	10	Y	12	5	1	10	1	*E. plantagineum*	No
			TE_25.2.2	697629	6103094	697548	6103040	*E. rossii*	25	N	23	12	4	9	0		
			TE_25.2.3	697850	6103062	697751	6103078	*E. rossii*	20	N	8	4	0	10	0		

Table A1-0-h. Throsby North plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Throsby North	16	1	TN_16.1.1	697594	6105903	697574	6105806	*E. blakelyi* *E. melliodora*	10	Y	39	31	13	10	1	*H. perforatum*	Yes
			TN_16.1.2	697640	6105541	697583	6105457	*E. melliodora*	10	Y	28	19	6	10	3	*E. plantagineum* *H. perforatum* *R. rubiginosa*	
			TN_16.1.3	698448	6105825	698441	6105725	*E. blakelyi*	10	Y	17	10	4	13	3	***N. trichotoma*** *E. plantagineum* *H. perforatum*	
			TN_16.1.4	698337	6105141	698406	6105215	*E. blakelyi* *E. melliodora*	20	Y	33	25	13	7	1	*R. rubiginosa*	
		2	TN_16.2.1	698034	6105840	698051	6105742	*E. melliodora*	2	Y	16	7	3	11	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	Yes
			TN_16.2.2	697950	6105348	697899	6105432	*E. melliodora*	5	Y	17	8	2	16	2	*E. plantagineum* *R. rubiginosa*	
			TN_16.2.3	697670	6104748	697694	6104844	*E. melliodora*	10	Y	13	6	1	9	0		
			TN_16.2.4	697569	6104475	697664	6104510	*E. blakelyi*	5	N	14	5	2	13	0		
		4	TN_16.4.1	698270	6105615	698369	6105634		0	N	25	16	9	15	2	*E. plantagineum* *H. perforatum*	Yes
			TN_16.4.2	698362	6105375	698391	6105472		0	N	31	21	9	9	2	*E. plantagineum* *R. rubiginosa*	
			TN_16.4.3	698279	6105210	698307	6105308		0	N	34	25	12	17	4	***N. trichotoma*** *E. plantagineum* *H. perforatum* *R. rubiginosa*	
		5	TN_16.5.1	697818	6104659	697749	6104586		0	N	14	6	0	8	0		No
			TN_16.5.2	697773	6104955	697871	6104961		0	N	15	8	2	13	0		
		6	TN_16.6.1	697672	6105130	697591	6105189	*E. blakelyi*	10	Y	8	2	0	9	1	*E. plantagineum*	No
			TN_16.6.2	697353	6104773	697434	6104829	*E. blakelyi* *E. melliodora*	30	Y	7	3	2	9	0		
			TN_16.6.3	697336	6104334	697247	6104288	*E. blakelyi* *E. melliodora*	10	N	6	2	0	11	0		
		8	TN_16.8.1	696916	6104730	696923	6104630		0	N	5	2	0	10	1	*O. acanthium*	No
			TN_16.8.2	697039	6104734	697080	6104645		0	N	7	2	0	6	0		

Table A1-0-i. The Pinnacle plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
The Pinnacle	16	1	TP_16.1.1	685070	6095816	685008	6095894	*E. blakelyi* *E. melliodora*	10	Y	44	35	17	12	1	*E. plantagineum*	Yes
			TP_16.1.2	685027	6095927	684926	6095932	*E. melliodora*	5	Y	25	18	8	16	3	*C. lanatus* *E. plantagineum* *H. perforatum*	
		2	TP_16.2.1	685189	6095981	685155	6095886	*E. blakelyi*	5	N	15	8	1	15	2	*C. lanatus* *E. plantagineum*	Yes
			TP_16.2.2	684994	6096088	685056	6096012	*E. blakelyi* *E. melliodora*	4	N	24	14	2	17	1	*C. lanatus*	
			TP_16.2.3	685166	6096107	685141	6096203	*E. blakelyi*	10	Y	28	18	4	14	2	*E. plantagineum* *H. perforatum*	
		4	TP_16.4.1	685131	6095740	685059	6095672		0	N	30	22	8	23	4	*C. lanatus* *E. plantagineum* *H. perforatum* *R. rubiginosa*	Yes
		5	TP_16.5.1	685040	6096150	684941	6096135		0	N	20	12	6	14	2	*C. lanatus* *E. plantagineum*	No
	25	1	TP_25.1.1	685102	6095780	685005	6095782	*E. dives* *E. rossii*	20	Y	45	38	22	11	2	*H. perforatum* *R. rubiginosa*	No

Table A1-0-j. Watson Woodland plot data summary

Site	PCT	Zone	Plot ID	Start Easting	Start Northing	End Easting	End Northing	Dominant overstorey species	Overstorey cover	Regeneration of overstory	Native understorey spp	Native understorey non-grass spp	Important spp	Exotic spp	Significant weeds	Significant weed spp. (WoNS in bold)	EPBC BGW
Watson Woodland	16	2	WW_16.2.1	696889	6098868	696932	6098779	*E. melliodora*	10	Y	11	7	1	12	2	*E. plantagineum* *R. rubiginosa*	Yes
			WW_16.2.2	696995	6098754	697075	6098814	*E. melliodora*	10	Y	12	6	1	10	2	*E. plantagineum* *O. acanthium*	
			WW_16.2.3	696987	6098677	697085	6098662	*E. melliodora*	10	Y	12	9	5	10	2	***N trichotoma*** *E. plantagineum*	
		6	WW_16.6.1	696831	6098671	696912	6098724	*E. blakelyi* *E. melliodora*	10	Y	8	6	0	12	1	*E. plantagineum*	No
			WW_16.6.2	697052	6098459	696952	6098426		0	Y	4	3	0	12	3	*E. plantagineum* *H. perforatum* *R. rubiginosa*	

Appendix 2. Step-Point Transect Data Summary Table

Table A2-0-a. Transect data summary

Site	PCT	Zone	Transect ID	Start Easting	Start Northing	End Easting	End Northing	Length (m)	Crypt	Bare	Rock	Litter	Ann Ex Grass	Per Ex Grass	Ex Broadleaf	Per Native Grass	Other Native	Percent Perennial Native
Horsepark North	16	1	HN_16.1.1	692576	6109371	692649	6109436	100	1	2	0	16	11	0	16	47	12	78.67
			HN_16.1.2	693253	6109941	693243	6109838	100	1	4	0	35	0	5	1	46	10	90.32
			HN_16.1.3	693748	6110260	693720	6110357	100	0	0	0	70	3	1	5	10	10	76.92
		4	HN_16.4.1	693679	6110219	693780	6110206	100	14	6	0	0	0	32	9	45	6	55.43
			HN_16.4.2	693145	6110004	693131	6109900	100	1	0	0	0	1	0	15	85	12	86.61
			HN_16.4.3	692739	6109317	692695	6109227	100	0	1	0	37	12	7	19	25	4	52.73
			HN_16.4.4	692762	6109563	692812	6109651	100	0	0	0	0	0	0	20	80	6	81.13
		8	HN_16.8.1	692611	6109255	692555	6109175	100	0	1	0	5	9	71	16	4	2	6.45
	25	1	HN_25.1.1	692989	6110029	692901	6109981	100	3	7	9	34	0	1	2	47	4	94.44
			HN_25.1.2	693287	6110132	693385	6110110	100	6	2	4	26	1	0	3	48	8	94.92
			HN_25.1.3	694429	6110188	694522	6110257	100	2	8	0	56	3	0	0	30	12	100.00
			HN_25.1.4	693996	6110214	694097	6110206	100	13	12	0	35	0	0	1	36	5	97.62
		4	HN_25.4.1	693097	6110086	693191	6110116	100	6	1	4	0	0	1	5	73	21	94.00
			HN_25.4.2	694223	6110205	694323	6110217	100	3	4	0	4	0	2	10	45	43	88.00
			HN_25.4.3	693889	6110332	693907	6110432	100	16	6	0	14	1	0	8	54	7	88.41
Isaacs Ridge	16	1	IR_16.1.1	693815	6081916	693803	6082018	100	1	5	0	21	12	4	14	42	1	70.49
			IR_16.1.2	693930	6082269	693828	6082270	100	0	2	0	21	12	1	11	26	21	79.66
			IR_16.1.3	693712	6082942	693747	6082848	100	7	1	0	27	5	0	14	34	7	74.55
			IR_16.1.4	693561	6083634	693573	6083536	100	0	1	0	21	9	1	26	34	1	56.45
		6	IR_16.6.1	693929	6082015	693989	6081936	100	0	0	0	5	8	66	1	15	0	18.29
Kenny Broadacre	16	2	KB_16.2.1	698002	6101431	698085	6101486	100	0	0	0	22	25	17	4	31	1	60.38
			KB_16.2.2	697984	6101598	698028	6101508	100	0	0	0	11	27	14	2	47	0	74.60
			KB_16.2.3	698157	6101446	698254	6101452	100	0	12	0	21	14	11	5	40	0	71.43
		5	KB_16.5.1	697693	6101839	697776	6101781	100	1	3	0	13	2	0	4	75	4	95.18
			KB_16.5.2	697837	6101663	697869	6101569	100	0	0	0	8	7	42	1	43	1	50.57
		8	KB_16.8.1	697707	6101739	697792	6101686	100	0	0	0	4	9	82	4	0	0	0.00
			KB_16.8.2	698295	6101305	698208	6101355	100	0	0	0	1	13	74	12	4	0	4.44
	25	2	KB_25.2.1	698147	6101550	698240	6101512	100	0	0	0	11	13	20	21	37	1	48.10
		5	KB_25.5.1	697899	6101866	697929	6101771	100	8	2	1	5	12	3	19	55	1	71.79
			KB_25.5.2	697979	6101715	698040	6101637	100	0	0	0	5	18	35	4	36	3	50.00

Site	PCT	Zone	Transect ID	Start Easting	Start Northing	End Easting	End Northing	Length (m)	Crypt	Bare	Rock	Litter	Ann Ex Grass	Per Ex Grass	Ex Broadleaf	Per Native Grass	Other Native	Percent Perennial Native
Kinlyside	16	1	Ki_16.1.1	690559	6107988	690493	6108067	100	0	0	1	4	4	8	20	54	11	69.89
			Ki_16.1.2	690352	6107509	690264	6107462	100	3	4	2	11	6	0	7	56	16	91.14
			Ki_16.1.3	689881	6107346	689860	6107443	100	3	4	2	18	11	4	19	28	6	59.65
			Ki_16.1.4	690418	6106905	690489	6106835	100	5	1	4	2	7	0	24	49	9	70.73
			Ki_16.1.5	690062	6106707	690155	6106667	100	5	3	1	20	7	0	7	45	12	89.06
		2	Ki_16.2.1	689497	6105857	689594	6105842	100	0	0	0	22	6	1	29	40	5	60.00
			Ki_16.2.2	689751	6106179	689806	6106260	100	3	2	1	23	12	1	9	34	8	80.77
			Ki_16.2.3	689700	6106150	689605	6106114	100	1	3	0	13	33	10	18	24	9	54.10
			Ki_16.2.4	689667	6105501	689712	6105584	100	0	0	0	7	7	30	11	43	3	52.87
		4	Ki_16.4.1	689689	6107351	689744	6107434	100	2	4	3	0	15	0	26	38	2	60.61
			Ki_16.4.2	689254	6106782	689251	6106881	100	0	0	0	0	9	0	10	62	11	87.95
			Ki_16.4.3	689640	6106863	689685	6106953	100	0	0	0	0	6	0	15	63	16	84.04
		5	Ki_16.5.1	689544	6105533	689503	6105442	100	1	1	2	0	10	3	43	52	0	53.06
			Ki_16.5.2	689674	6106353	689746	6106422	100	0	16	0	2	10	4	26	42	0	58.33
		6	Ki_16.6.1	689791	6105862	689816	6105958	100	0	0	5	19	17	8	26	29	1	46.88
	25	1	Ki_25.1.1	690329	6107823	690298	6107728	100	5	11	3	38	4	0	0	32	9	100.00
			Ki_25.1.2	690493	6107477	690552	6107554	100	12	9	0	32	2	0	2	27	16	95.56
			Ki_25.1.3	690468	6107193	690564	6107219	100	19	2	2	44	5	1	2	21	3	88.89
			Ki_25.1.4	690077	6107088	689996	6107145	100	8	7	3	39	7	0	0	21	13	100.00
			Ki_25.1.5	690211	6106627	690298	6106590	100	11	7	9	28	7	0	5	23	10	86.84
		2	Ki_25.2.1	689897	6106201	689820	6106153	100	0	0	9	11	26	9	14	37	1	62.30
			Ki_25.2.2	689886	6105803	689926	6105898	100	5	0	5	5	8	2	35	42	2	54.32
			Ki_25.2.3	689954	6105670	689867	6105721	100	3	0	4	7	13	0	29	48	0	62.34
		4	Ki_25.4.1	689190	6107079	689247	6107161	100	0	3	1	1	16	0	31	35	14	61.25
			Ki_25.4.2	690697	6107410	690751	6107329	100	1	1	4	0	9	0	34	44	2	57.50
			Ki_25.4.3	690578	6106777	690570	6106675	100	1	0	0	3	16	0	27	45	2	63.51
			Ki_25.4.4	689474	6107216	689518	6107305	100	0	2	0	2	7	0	13	53	25	85.71
		6	Ki_25.6.1	690747	6107628	690777	6107718	100	6	2	4	12	30	4	26	14	0	31.82
		8	Ki_25.8.1	690752	6107740	690762	6107839	100	0	1	6	4	18	10	45	17	0	23.61
Kenny Woodland	16	2	KW_16.2.1	697430	6101101	697349	6101042	100	0	0	0	10	36	12	3	44	0	74.58
			KW_16.2.2	697361	6100682	697381	6100781	100	0	0	0	15	22	25	4	35	0	54.69
			KW_16.2.3	697010	6100616	696956	6100530	100	0	1	0	7	29	12	9	42	0	66.67
			KW_16.2.4	696828	6100260	696918	6100220	100	0	0	0	8	35	16	5	34	2	63.16
			KW_16.2.5	696515	6100535	696569	6100455	100	0	0	0	12	10	24	1	47	1	65.75

Site	PCT	Zone	Transect ID	Start Easting	Start Northing	End Easting	End Northing	Length (m)	Crypt	Bare	Rock	Litter	Ann Ex Grass	Per Ex Grass	Ex Broadleaf	Per Native Grass	Other Native	Percent Perennial Native
		4	KW_16.4.1	696471	6100290	696495	6100388	100	0	0	0	0	26	8	12	46	10	73.68
		5	KW_16.5.1	696723	6100933	696782	6101011	100	0	0	0	7	24	16	8	47	1	66.67
			KW_16.5.2	696902	6100724	696809	6100758	100	0	1	0	3	35	5	19	31	3	58.62
			KW_16.5.3	697089	6100264	697188	6100284	100	0	0	0	8	40	9	11	34	0	62.96
		6	KW_16.6.1	697059	6101148	697154	6101114	100	0	0	0	1	10	76	1	9	2	12.50
			KW_16.6.2	696890	6101057	696981	6101094	100	0	1	0	1	0	93	0	1	1	2.11
		8	KW_16.8.1	697191	6100746	697115	6100810	100	0	0	0	3	7	75	4	4	4	9.20
			KW_16.8.2	696444	6100183	696544	6100187	100	0	0	0	0	32	56	8	2	4	8.57
Taylor	16	1	Ta_16.1.1	691410	6109098	691309	6109110	100	0	10	0	20	23	8	10	15	9	57.14
			Ta_16.1.2	691169	6109487	691234	6109409	100	0	0	1	0	6	10	21	57	12	69.00
			Ta_16.1.3	691321	6109226	691248	6109294	100	0	2	0	9	7	1	12	58	8	83.54
		4	Ta_16.4.1	691073	6109072	691173	6109064	100	1	6	0	0	9	5	29	57	10	66.34
			Ta_16.4.2	691232	6109330	691131	6109334	100	0	2	0	0	0	1	31	51	12	66.32
			Ta_16.4.3	691249	6109359	691326	6109423	100	0	2	0	0	0	4	35	25	36	61.00
		6	Ta_16.6.1	691289	6109084	691384	6109055	100	0	2	0	3	36	50	10	4	1	7.69
	25	1	Ta_25.1.1	690604	6109335	690695	6109372	100	0	0	9	21	24	13	5	17	12	61.70
			Ta_25.1.2	691017	6109437	691039	6109530	100	5	1	3	24	12	0	5	43	8	91.07
			Ta_25.1.3	691396	6109421	691398	6109323	100	0	6	8	18	0	0	3	46	18	95.52
		4	Ta_25.4.1	691323	6109549	691347	6109648	100	4	1	0	1	2	0	26	61	8	72.63
			Ta_25.4.2	690991	6109337	691066	6109274	100	1	0	6	0	3	8	19	57	10	71.28
			Ta_25.4.3	690756	6109302	690779	6109205	100	0	1	0	2	27	11	15	40	4	62.86
		7	Ta_25.7.1	690800	6109167	690893	6109153	100	0	0	0	1	39	38	26	24	0	27.27
		8	Ta_25.8.1	690828	6109134	690917	6109104	100	0	0	0	0	55	44	25	7	0	9.21
Throsby East	16	2	TE_16.2.1	697473	6103816	697433	6103724	100	1	0	0	8	10	0	36	42	3	55.56
			TE_16.2.2	697436	6103344	697418	6103246	100	1	0	2	22	18	8	16	22	9	56.36
			TE_16.2.3	698198	6102765	698226	6102670	100	0	1	0	5	18	19	11	40	1	57.75
			TE_16.2.4	698382	6102826	698336	6102739	100	0	1	0	15	8	6	28	37	0	52.11
		5	TE_16.5.1	698372	6102940	698420	6103028	100	0	0	0	6	25	1	27	37	0	56.92
			TE_16.5.2	698046	6102749	697964	6102692	100	0	0	0	8	28	16	10	36	0	58.06
			TE_16.5.3	697655	6102523	697617	6102431	100	0	1	0	4	20	15	21	38	1	52.00
		6	TE_16.6.1	698203	6102437	698104	6102455	100	0	0	0	4	0	89	0	0	0	0.00
			TE_16.6.2	697537	6102329	697468	6102400	100	0	0	0	5	12	59	7	14	1	18.52
		8	TE_16.8.1	697462	6102619	697484	6102717	100	0	0	0	8	22	27	25	14	0	21.21
			TE_16.8.2	698016	6102947	698063	6103036	100	0	0	0	3	24	38	14	13	0	20.00

Site	PCT	Zone	Transect ID	Start Easting	Start Northing	End Easting	End Northing	Length (m)	Crypt	Bare	Rock	Litter	Ann Ex Grass	Per Ex Grass	Ex Broadleaf	Per Native Grass	Other Native	Percent Perennial Native
	25	2	TE_25.2.1	697550	6103264	697582	6103361	100	0	1	3	20	8	1	10	40	17	83.82
			TE_25.2.2	697629	6103094	697548	6103040	100	1	0	1	19	26	2	8	29	14	81.13
			TE_25.2.3	697850	6103062	697751	6103078	100	0	0	0	22	21	14	11	26	3	53.70
Throsby North	16	1	TN_16.1.1	697594	6105903	697574	6105806	100	6	6	0	16	3	0	10	39	16	84.62
			TN_16.1.2	697640	6105541	697583	6105457	100	0	2	0	24	3	0	20	39	8	70.15
			TN_16.1.3	698448	6105825	698441	6105725	100	2	1	0	7	17	0	16	51	2	76.81
			TN_16.1.4	698337	6105141	698406	6105215	100	0	1	0	9	12	2	7	43	24	88.16
		2	TN_16.2.1	698034	6105840	698051	6105742	100	0	0	0	13	7	8	20	46	1	62.67
			TN_16.2.2	697950	6105348	697899	6105432	100	3	0	0	7	19	9	23	34	1	52.24
			TN_16.2.3	697670	6104748	697694	6104844	100	0	1	0	21	17	14	9	29	1	56.60
			TN_16.2.4	697569	6104475	697664	6104510	100	0	1	0	11	10	5	29	35	2	52.11
		4	TN_16.4.1	698270	6105615	698369	6105634	100	4	1	0	8	13	0	17	50	6	76.71
			TN_16.4.2	698362	6105375	698391	6105472	100	2	0	0	11	4	0	25	50	6	69.14
			TN_16.4.3	698279	6105210	698307	6105308	100	0	0	0	2	10	0	26	55	5	69.77
		5	TN_16.5.1	697818	6104659	697749	6104586	100	0	0	0	1	6	2	33	52	0	59.77
			TN_16.5.2	697773	6104955	697871	6104961	100	2	6	0	4	4	7	32	39	2	51.25
		6	TN_16.6.1	697672	6105130	697591	6105189	100	0	0	0	5	8	58	18	6	0	7.32
			TN_16.6.2	697353	6104773	697434	6104829	100	0	1	0	13	5	42	9	19	2	29.17
			TN_16.6.3	697336	6104334	697247	6104288	100	0	0	0	1	3	29	27	34	1	38.46
		8	TN_16.8.1	696916	6104730	696923	6104630	100	0	0	0	2	4	55	25	4	0	4.76
			TN_16.8.2	697039	6104734	697080	6104645	100	0	0	0	3	0	23	51	14	0	15.91
The Pinnacle	16	1	TP_16.1.1	685070	6095816	685008	6095894	100	2	0	5	19	22	0	13	33	6	75.00
			TP_16.1.2	685027	6095927	684926	6095932	100	0	0	3	12	16	0	1	57	11	98.55
		2	TP_16.2.1	685189	6095981	685155	6095886	100	0	0	0	3	58	12	1	22	4	66.67
			TP_16.2.2	684994	6096088	685056	6096012	100	1	0	5	2	39	9	12	27	5	60.38
			TP_16.2.3	685166	6096107	685141	6096203	100	0	0	11	3	29	0	13	44	0	77.19
		4	TP_16.4.1	685131	6095740	685059	6095672	100	4	0	8	2	13	0	13	59	1	82.19
		5	TP_16.5.1	685040	6096150	684941	6096135	100	0	0	0	0	39	1	19	39	2	67.21
	25	1	TP_25.1.1	685102	6095780	685005	6095782	100	1	2	7	29	2	0	4	35	20	93.22
Watson Woodland	16	2	WW_16.2.1	696889	6098868	696932	6098779	100	0	1	0	32	11	9	10	34	4	66.67
			WW_16.2.2	696995	6098754	697075	6098814	100	0	0	0	9	50	0	11	29	0	72.50
			WW_16.2.3	696987	6098677	697085	6098662	100	0	0	0	22	15	9	15	34	8	63.64
		6	WW_16.6.1	696831	6098671	696912	6098724	100	0	0	0	18	40	25	4	9	0	23.68
			WW_16.6.2	697052	6098459	696952	6098426	100	0	2	0	27	17	33	15	9	0	15.79

Appendix 3. PCS Excel Spreadsheets (excel files in separate .zip folder)

Appendix 4. GIS Data (shapefiles in separate .zip folder)