7

ecological AUSTRALIA

bluegum ECOLOGICAL CONSULTING

Canberra | Sydney

M2G Seeding (Plot) Monitoring Report

Construction Corridor (Autumn 2016)

Prepared for
Icon Water

July 2016

DOCUMENT TRACKING

Item	Detail
Project Name	M2G Seeding (Plot) Monitoring: Autumn 2016
Project Number	14CANECO-0013
Project Manager	Matthew Dowle Level 1, 101 Sussex Street Sydney NSW 2000
Prepared by	Tom O'Sullivan
Reviewed by	Matthew Dowle
Approved by	Matthew Dowle
Status	FINAL
Version Number	1
Last saved on	11 July 2016
Cover photo	Plot 03 which occurs on the McDonald property

This report should be cited as 'Eco Logical Australia and Bluegum Ecological Consulting July 2016. *M2G Seeding (Plot) Monitoring Report – Autumn 2016*. Prepared for Icon Water.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd and Bluegum Ecological Consulting with support from Icon Water.

Contents

List of figures

List of tables

Plates

Abbreviations

ABBREVIATION	DESCRIPTION
BGGW	Box Gum Grassy Woodland
KPT	Key Performance Targets
LLPS	Low Lift Pump Station
LRMP	Landscape Rehabilitation Management Plan (superseded by the LRTEMP)
LRTEMP	Landscape Rehabilitation and Terrestrial Ecology Management Plan
M2G	Murrumbidgee to Googong Water Transfer Project
NTG	Natural Temperate Grassland
ORMP	Offset Rehabilitation Management Plan
PCS	ACT Parks and Conservation Service
TEMP	Terrestrial Ecology Management Plan (superseded by the LRTEMP)

1 Executive Summary

This report presents the results of the autumn 2016 plot monitoring survey for the seeding rehabilitation of the M2G pipeline construction project. Current monitoring surveys were conducted during March 2016.

Floristic data were collected from fifteen monitoring plots located within the construction corridor (four plots in the central section could not be accessed) and two control plots situated in high conservation value vegetation.

A total of 127 herbaceous species (72 native and 55 non-native) were observed in monitoring plots with native species ranging from 15 to 31 sp./plot. (av. 23.5) and non-native species 11 to 22 sp./plot (av. 15.9). In comparison, control plots contained a total of 47 native species and 16 exotic species (av. 32.5 and 10.0, respectively).

The highest individual native species cover score in monitoring plots was 3 (25-50%) attained by *Bothriochloa macra* (Red Grass), *Panicum effusum* (Hairy Panic) and *Themeda australis* (Kangaroo Grass) in three plots, followed by five native species (including the three mentioned) with cover scores of 2 (5-25%) across fifteen plots. The remaining 67 native species had individual cover scores below 5%.

Although native species richness has remained relatively constant (about 70 sp.) total native cover abundance increased against estimates from previous monitoring periods, however, it was on average about 50% less than that recorded in control plots.

All plots associated with non-native vegetation (category 1) have met the required Key Performance Target (KPT) and are no longer monitored. Plot 17 (category 3 – high conservation value vegetation) met the required KPT in spring 2015.

Seven noxious species were recorded during the current survey. While most infestations were minor and manageable outbreaks of *Eragrostis curvula* (African Lovegrass) and *Hypericum perforatum* (St John's Wort) should be afforded additional control measures. As indicated in previous reports, the wider local occurrence of these species will pose ongoing weed management problems within the construction corridor.

The main recommendations are:

- Persist with chemical weed control though minimise the impact on non-target species;
- 'Pulse' grazing should be adopted wherever biomass is excessive and likely to restrict recovery. This should be conducted during late winter 2016 and summer/autumn 2017; and,
- Review KPTs for native vegetation with consideration given to lowering the 70% target to 50% for category 2 and 60% for category 3.

2 Introduction

2.1 Background

This report provides the results and analysis of the autumn 2016 plot monitoring survey for the seeding rehabilitation of the Murrumbidgee to Googong Water Transfer Project (M2G) construction corridor. This is the ninth in a series of bi-annual reports examining the post-construction vegetation recovery of the M2G construction corridor.

Twenty-five monitoring plots were established within the construction corridor (ten in the ACT and fifteen in the NSW sections of the corridor) following the completion of construction and re-seeding operations in autumn 2012. Two control plots, located in moderate to good condition Box Gum Grassy Woodland within the ACT, and have been monitored since spring 2013.

Background documents and information required for this study were presented in the initial M2G Rehabilitation Monitoring Autumn 2012 Report (Blue Gum Ecological Consulting, July 2012).

2.2 Study area

The M2G construction corridor (study area) extends from Angle Crossing on the Murrumbidgee River to Burra Creek at the intersection of Williamsdale and Burra Roads, a distance of about 12km.

The study area falls entirely within the Williamsdale (8726-4N) 1:25,000 Map Sheet.

2.3 Study aims

The primary purpose of the study is to monitor post-construction vegetation recovery within the M2G construction corridor and compare the results against specific Key Performance Targets (KPTs) for each vegetation category (**Table 1**).

Note: Eco Logical Australia has been requested to propose revised landscaping rehabilitation KPTs following a review of pre-construction vegetation condition data. Icon Water is expected to include the revised KPTs in a proposed new version of the Landscape Rehabilitation and Terrestrial Ecology Management Plan (LRTEMP). The proposed LRTEMP would be subject to a materiality assessment from Erwin Budde as the Independent Environment Representative before consideration by the regulators.

Table 1: Current key performance targets (KPTs) for each vegetation category within the M2G construction corridor. This table has been reproduced from Table 3.2 in the Landscape Rehabilitation and Terrestrial Ecology Management Plan (LRTEMP), January 2014.

Vegetation Category	Key Performance Targets
1. Non-native vegetation	**Ground cover -** > 70% vegetation cover of the species sown. **Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown
2. Native vegetation (low diversity)	**Ground cover -** > 70% vegetation cover of the native species sown. **Weeds** – better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown
3. High conservation value grassland and grassy woodland	**Ground cover -** > 70% vegetation cover of the native species sown and survival of native ground and tree species. **Weeds** - better than or equal to the current presence of declared weeds and < 20% cover of exotic species not sown. **Native species** (planting success) - all species listed for seeding and planting are present.

3 Methods

3.1 Monitoring regime

Twenty-five sample plots were originally established within M2G construction corridor during 2012 and have been monitored on a bi-annual basis (autumn and spring/summer periods) since that time.

The current autumn survey was conducted between 21 and 24 March 2016 with vegetation data collected from fifteeen[1] monitoring plots and two control plots (**Table 2**).

3.2 Monitoring plots

All monitoring plots are 400m^2 in size and were placed at selected locations within the M2G construction corridor (**Figures 1 – 4** in Appendix 1). Plots were located to account for differences in physical condition (i.e. elevation, slope and aspect) and former vegetation type according to three broad categories: non-native; native-low diversity and native-high conservation value, as indicated in **Table 1,** above.

Table 2: Monitoring plots listed in order of chainage from the LLPS. Also shown are pre-construction vegetation types in which plots were placed, post-construction seeding regime, vegetation category, and whether KPT was achieved and when.

Plot ID	Chainage (m)	Jurisdiction	Original vegetation	Seeding regime	Vegetation category	Was KPT met	When KPT was achieved
16	250	ACT-PCS	NTG	N	3	No	-
15	530	ACT-PCS	NTG	N	3	No	-
21	700	ACT PCS	NTG	N	3	No	-
19	1020	ACT-PCS	Degraded BGGW	N	2	No	-
20	1200	ACT-Icon	Degraded BGGW	N	2	No	-
18	1450	ACT-Icon	Degraded BGGW	N	2	No	-
23	1740	ACT-Icon	Degraded BGGW	N	3	No	-
22	2150	ACT-Icon	BGGW	N	3	No	-
24	2650	ACT-Icon	BGGW	N	3	No	-
25	2800	ACT-Locke	BGGW	N	3	No	-
01	3030	NSW-Smith	Low to moderate diversity secondary grassland	N	3	No	-
02	3220	NSW-Smith	Low to moderate diversity *E. dives - E. mannifera* dry forest	N	2	No	-
03	3320	NSW-Smith/McDonald	Degraded BGGW	N	2	No	-

[1] Five plots (07, 08, 11, 13 and 14) previously met the required KPT and are no longer monitored. Four plots (03, 04, 05 and 09) located in the central section of the corridor were not sampled due to access restrictions.

Plot ID	Chainage (m)	Jurisdiction	Original vegetation	Seeding regime	Vegetation category	Was KPT met	When KPT was achieved
09	3600	NSW-McDonald	Low to moderate diversity secondary grassland	N	3	No	-
04	4025	NSW-McDonald	Moderate to high diversity secondary grassland	N	3	No	-
05	4300	NSW-McDonald	Low diversity native pasture	N	2	No	-
06	4900	NSW-Lonergan	Low diversity native pasture	N	2	No	-
07	5200	NSW-Lonergan	Low diversity mixed pasture	M	1 [B]	**Yes**	**Autumn 2014**
08	5680	NSW-Lonergan	Poor quality mixed pasture	E	1	**Yes**	**Spring 2013**
10	6030	NSW-Codd/Howarth	Low diversity native pasture	N	2 [A]	No	-
11	6450	NSW-Johanson	Poor quality mixed pasture	E	1 [B]	**Yes**	**Spring 2014**
17	7600	NSW-Devitt	Moderate to high diversity BGGW	N	3	**Yes**	**Spring 2015**
12	8300	NSW-Bos	Poor quality mixed pasture	E	1 [B]	**Yes**	**Autumn 2015**
14	9850	NSW-Borgia	NNP	E	1	**Yes**	**Spring 2012**
13	10950	NSW-Johnston	NNP	E	1	**Yes**	**Spring 2012**

[A] KPT was revised upwards from category 1 to category 2 on the basis of the landscape seeding and planting regime in these paddocks.

[B] KPT was revised downwards from category 2 to category 1 on the basis of the landscape seeding and planting regime in these paddocks.

Key to Original Vegetation

- **NTG** = Natural Temperate Grassland.
- **BGGW** = Box Gum Grassy Woodland.
- **NNP** = Non-native Pasture

Key to Seeding Regime

- **N** = native seed mix – *Rytidosperma* (Syn. *Austrodanthonia) carphoides, Austrostipa scabra, Bothriochloa macra, Elymus scaber, Microlaena stipoides, Chloris truncata and Themeda australis.*
- **E** = exotic seed mix - As for native seed mix combined with *Lolium perenne, Phalaris aquatica, Dactylis glomerata* and *Trifolium subterraneum.* The Johanson property (Plot 11) was seeded with an 'Alpaca Pasture Mix' comprising: Tall Fescue and Au Triumph Fescue, (*Fescue* sp.), Kara Cocksfoot (*Dactylis glomerata*), Leura Sub-clover (*Trifolium subterraneum*), Prestige White Clover (*Trifolium repens*), Tonic Plantain (*Plantago lanceolata*) and Grouse Chickory (*Cichrium intybus*).
- **M** = a mixed combination of native & exotic seed.

3.3 Control plots

Control plots were established within moderate to high quality BGGW situated in paddocks adjacent to the construction corridor (**Table 3**). For practical reasons (i.e. presence of stock and potential access restrictions) both plots were located in the ACT (**Figure 1** in Appendix 1).

Table 3: Location of control plots.

Plot	Jurisdiction	Plot configuration (m)	Easting	Northing	Vegetation type/condition
Control 1	ACT	20 x 20	692162	6060624	Moderate to high floristic diversity BGGW
Control 2	ACT	20 x 20	693379	6060670	Moderate to high floristic diversity BGGW

3.4 Survey techniques

Estimates of species presence, richness and cover abundance within sample plots were determined using a modified Braun-Blanquet scale, as shown below:

- r = < 5% cover and solitary (1-3 individuals)
- + = < 5% cover and few (4-15 individuals)
- 1 = < 5% cover and numerous/scattered (>15 individuals)
- 2 = 5% – 25% cover
- 3 = 25% – 50% cover
- 4 = 50% – 75% cover
- 5 = > 75% cover.

3.5 Limitations and observations

Access to the central section (Plots 03, 04, 05 and 09) of the construction corridor was not approved prior to spring 2015, consequently, reducing the number of native vegetation plots that could be monitored.

The ability of the observer to detect all species may be inhibited by the cryptic habit and/or early stage growth of some species, particularly if they occur at low densities or are obscured by dense groundcover foliage.

4 Results

Results and analysis of the current monitoring survey are provided in the following sub-sections: *4.1 Overview: All monitoring plots; 4.2 Control plots; 4.3 Monitoring plots – category 3: high conservation value vegetation*; *4.4 Monitoring plots – category 2: low diversity native vegetation*; and, *4.5 Monitoring plots – category 3: non-native vegetation*.

Plot data sets for the current survey are presented in **Table 8** and **Table 9** in **Appendix 2**.

4.1 Monitoring plots

4.1.1 Overview

A total of 127 herbaceous species comprising 72 native species and 55 exotic species (ratio of 1:0.76)[2] were recorded from fifteen monitoring plots during the current monitoring period (**Chart 1**). Native cover abundance increased and exotic cover declined relative to spring 2015.

There has been no significant change in native species richness over past five monitoring periods, whereas exotic species have exhibited repetitive seasonal fluctuation (spring 2013 the exception) together with a sustained decline in total richness (**Chart 1**).

4.1.2 Species Frequency

Thirteen native species and 6 exotic species were present in ten or more monitoring plots. This compared with 14 native and 11 exotic sp., respectively, for the previous survey.

Of the ten most commonly recorded species (or genus) eight were native and two exotic (7 and 3 sp., respectively, for the previous survey). Natives comprised *Bothriochloa macra* (Red Grass), *Chloris truncata* (Windmill Grass), *Oxalis perennans* (Wood Sorrel), *Panicum effusum* (Hairy Panic), *Rytidosperma* spp. (Wallaby Grass) and *Themeda australis* (Kangaroo Grass) in 15 plots and *Austrostipa scabra* (Speargrass*)* and *Elymus scaber* (Common Wheatgrass) in 14 plots. The two exotic species were *Hypochaeris radicata* (Flatweed) in 14 plots and *Plantago lanceolata* (Lamb's Tongue) in 13 plots.

4.1.3 Species Diversity (richness)

The number of native species recorded within monitoring plots ranged from 15 to 34 species (12 to 35 sp. in spring 2015) at an average of 23.5 sp./plot.

Native species averaged 15.8 sp./plot at the commencement of the study (autumn 2012) and grew to 23.7 sp./plot in spring 2013. It then fluctuated between 20 and 22 sp./plot over the next three sessions before increasing once again to 23.7 sp./plot in spring 2015 (**Chart 2**).

Non-native species ranged from 11 to 22 species (11 to 28 sp. in spring 2015) at an average of 15.9 sp./plot, which is the lowest recorded to date.

[2] Previous native/exotic species ratios were: **1:1.23** (autumn 2012); **1:1.27** (spring 2012); **1:1.25** (autumn 2013); **1:0.98** (spring 2013); **1:0.99** (autumn 2014), **1:1.07** (spring 2014), **1:0.84** (autumn 2015) and **1:0.96** (spring 2015).

Chart 1: Total herbaceous species richness during all monitoring periods.

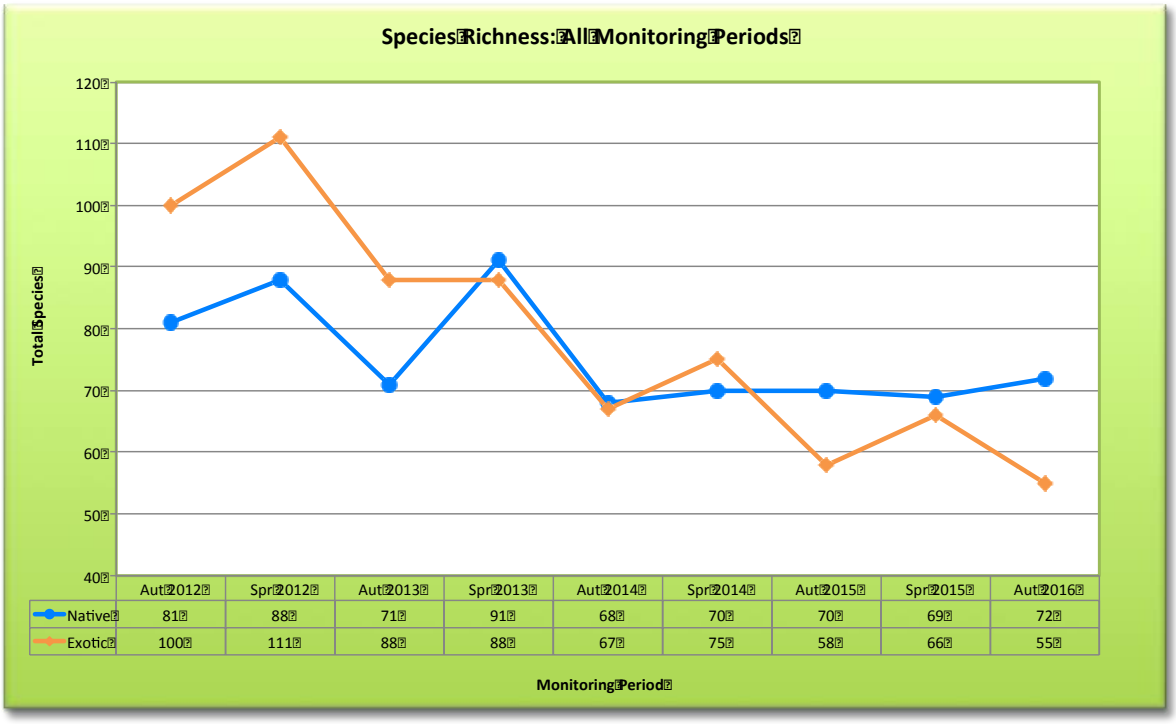
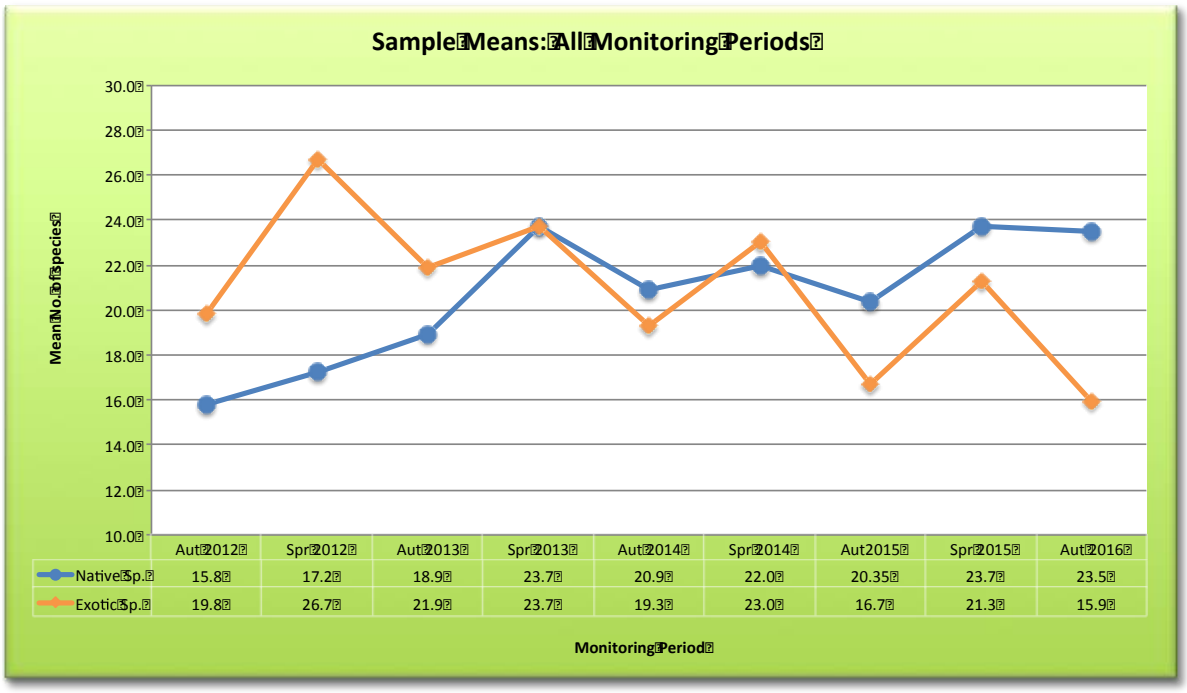


Chart 2: Species means from all plots during all monitoring periods.



4.1.4 Cover Abundance - native vegetation plots

Of the fifteen native vegetation plots sampled three had native cover abundances in the 50-75% range, eleven in the 25-50% range and one was below 25% (**Table 4**).

The estimated total native species cover abundance increased against the previous monitoring period and is now at the higher end of the 25-50% cover range.

Exotic cover abundance fell from the high end of 25-50% cover range in spring 2015 to below 25% in the current session (**Table 4**). This decline is largely attributed to the seasonal changes in annual grass cover, primarily *Bromus* spp.

4.1.5 Cover Abundance - non-native vegetation plots

All non-native vegetation plots (07, 08, 11, 12, 13 and 14) have met the required KPT and are no longer monitored**.**

Table 4: Estimated cover abundances and KPT performance for spring 2015 and autumn 2016 monitoring periods. In the estimated vegetation columns Red text indicates an increase in cover, blue a decrease and black no change compared to previous monitoring periods. The last two columns provide estimated outcomes for modified KPTs for category 3 (60%) and category 2 (50%) plots.

Plot No.	Chainage	Location	Estimated total vegetation cover				KPT Category	70% KPT	Adjusted KPT	
			Spring 2015		Autumn 2016				Cat 3 60% KPT achieved?	Cat 2 50% KPT achieved?
			Native	Exotic	Native	Exotic				
16	250	ACT	25-50	5-25+	25-50-	5-25-	3	M	M	-
15	530	ACT	5-25+	25-50-	25-50-	25-50	3	M	M	-
21	700	ACT	5-25	5-25-	25-50-	25-50	3	M	M	-
19	1020	ACT	25-50-	5-25-	25-50+	5-25-	2	M	-	Near
20	1200	ACT	25-50+	25-50+	50-75-	5-25-	2	Near	-	Yes
18	1450	ACT	25-50+	25-50+	25-50+	25-50-	2	M	-	Near
23	1740	ACT	25-50+	5-25+	25-50+	5-25-	3	M	Near	-
22	2150	ACT	2-25+	25-50-	25-50+	<5	3	M	Near	-
24	2650	ACT	5-25+	5-25+	25-50-	5-25-	3	M	M	-
25	2800	ACT	5-25+	25-50-	5-25+	5-25	3	No	No	-
1	3030	Smith	5-25	25-50-	25-50-	5-25	3	M	M	-
2	3220	Smith	25-50-	5-25- [1]	25-50-	5-25	2	M	-	M
3	3320	MacDonald	-	-	-	-	2	?	-	?
9	3600	MacDonald	-	-	-	-	3	?	?	-
4	4025	MacDonald	-	-	-	-	3	?	?	-
5	4300	MacDonald	-	-	-	-	2	?	-	?
6	4900	Lonergan	25-50-	50-75-	50-75-	25-50-	2	Near	-	Yes
7	5200	Lonergan	-	-	-	-	1 [B]	Yes	-	-
8	5680	Lonergan	-	-	-	-	1	Yes	-	-
10	6030	Codd-Howath	25-50	25-50	25-50+	25-50-	2 [A]	M	-	Near
11	6450	Johanson	-	-	-	-	1 [B]	Yes	-	-
17	7600	Devitt	50-75+	5-25+	50-75+	5-25	3	Yes	-	-
12	8300	Bos	-	-	-	-	1 [B]	Yes	-	-
14	9850	Borgia	-	-	-	-	1	Yes	-	-
13	10950	Johnston	-	-	-	-	1	Yes	-	-
Total cover estimate all plots			25-50	25-50+	25-50+	5-25+		No		

Estimated total vegetation cover

\+ = cover estimated at the upper end of range

\- = cover estimated at the lower end of range

[1] = Spring 2015 cover estimate for Plot 02 was revised down from 5-23 to 5-25-

KPT Category

[A] KPT was revised upwards from category 1 to category 2 on the basis of the landscape seeding and planting regime in these paddocks.

[B] KPT was revised downwards from category 2 to category 1 on the basis of the landscape seeding and planting regime in associated paddocks.

KPT

M = Cover score falls in the mid-range of the KPT

4.2 Control plots

Control Plots, C1 and C2 (**Plate 1**), had moderate to high native species richness with 36 and 29 herbaceous species, respectively. Cumulative native cover abundances was above 80% in C1 (slightly less than the previous session) and at least 90% in C2. Exotic species richness and cover abundance remained low in both plots (see **Table 8 in Appendix 2**).

Native groundcover within control plots approximately doubled that recorded in monitoring plots (**Table 4, above**).

Plate 1: Control plots in high diversity BGGW for the current autumn 2016 monitoring period. The image on the left shows control plot 1 and the right control plot 2.

Control Plot 1

Control Plot 2

4.3 Plots in high-diversity native vegetation (KPT category 3)

Eleven[3] monitoring plots were established in areas of former high conservation value vegetation (category 3) and were set the highest KPT, see **Section 2.3 above**.

Summaries of survey results are provided in **Table 5**, below, with additional descriptions of each sample plot presented in the succeeding sub-sections.

Species richness

Native species ranged from 15 to 34 sp./plot at an average of 22.8 sp. (23.1 sp. in spring 2015), and non-native species ranged from 11 to 22 sp./plot at an average of 15.9 sp. (20.8 sp. in spring 2015).

Individual species cover abundance scores

The highest individual native species cover score was 3 (25-50%) obtained by Kangaroo Grass *Themeda australis* (Plot 17). This was followed by five species with cover scores of 2 (5-25%) that were recorded on twenty separate occasions from nine plots.

The highest individual non-native species (or genus) cover score was 3 (25-50%) obtained by *Conyza sp.* in Plot 21. This was followed by five species (or genus) with cover scores of 2 (5-25%) that were recorded on five separate occasions from four plots.

Cumulative cover abundance scores

While Plot 17 met the 70% KPT in spring 2015 it was included in the current monitoring survey for the purpose of maintaining consistent comparisons across native vegetation plots and against previous monitoring seasons.

Seven plots achieved native cover scores of 3 (25-50%) and are in the mid-range of the target. The remaining plot had a cover score of 2+(5-25%) and is (**Table 5**).

The current results indicate an overall increase in native cover in this category compared to the previous spring survey and is now positioned at the mid-point of the 25-50% range.

Cumulative non-native cover declined relative to the previous spring survey and is now at the mid-point of the 5-25% range.

[3] *Plots 04 and 09 located in the central section of the corridor were not sampled during this monitoring period*.

Table 5: Summary of category 3 plot results for the current autumn 2016 survey. The table provides plot data on current species richness and changes compared to spring 2015, native species cover scores and cumulative cover abundance estimates for native and exotic species.

Parentheses ( ) enclose results from autumn 2015 and red text identifies an increase in species, blue a decrease and black no change.

Plot No.	Chainage	Location	Native sp.	Exotic sp.	Total sp.	Change native sp.*	Change exotic sp.*	Native sp. with cover score of 1	Native sp. with cover score of 2 or >	Total native cover %	Total exotic cover %
16	250	ACT	**28**	**19**	**47**	4 (6)	9 (6)	11 (9)	2 (3)	25-50-	5-25-
15	530	ACT	**21**	**18**	**39**	1 (0)	8 (4)	7 (10)	2 (1)	25-50-	25-50
21	700	ACT	**15**	**11**	**26**	3 (0)	**0** (2)	5 (9)	2 (0)	25-50-	25-50
23	1740	ACT	**24**	**22**	**46**	4 (4)	3 (6)	10 (13)	3 (2)	**25-50+**	5-25-
22	2150	ACT	**26**	**14**	**40**	1 (0)	7 (6)	8 (15)	4 (0)	25-50+	<5
24	2650	ACT	**17**	**18**	**35**	7 (5)	6 (11)	**7** (7)	2 (1)	25-50-	5-25-
25	2800	ACT	**23**	**16**	**39**	6 (0)	2 (2)	5 (7)	2 (1)	**5-25+**	5-25
01	3030	NSW-Smith	**17**	**11**	**28**	3 (3)	7 (3)	8 (9)	2 (0)	25-50-	5-25
09	3600	NSW-McDonald	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
04	4025	NSW-McDonald	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
17	7600	NSW-Devitt	**34**	**14**	**48**	1 (1)	2 (2)	12 (16)	**2** [A] (2 [A])	**50-75+**	5-25
Average autumn 2016			**22.8**	**15.9**	**38.7**					**25-50**	**5-25**
Av. spring 2015			23.1	20.8	43.9					25-50-	25-50-
Av. autumn 2015			21.0	15.8	36.8					25-50-	5-25-
Av. spring 2014			23.6	22.9	46.5					25-50-	25-50-
Av. autumn 2014			20.7	18.5	39.2					5-25+	5-25

* Change in species richness in the period between spring 2015 and autumn 2016.

+ cover estimated at the upper end of range

- cover estimated at the lower end of range

[A] =includes species with cover score of 3 (25-50%)

4.3.1 Monitoring Plot 16

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50-** (25-50)
No. Native sp. with cover score of 1	**11** (9)
No. Native sp. with cover score of 2 or more	**2** (3)
Non-native cover %	**5-25-** (5-25+)
Bare Ground %	**30** (30)
Mulch Cover %	<1
KPT	High Conservation Vegetation
Was KPT met	**No – mid range**

Monitoring plot 16 is situated 250 m east of the LLPS in the Murrumbidgee River corridor within former high conservation value natural temperate grassland.

Native sp. decreased from **32 to 28**. Non-native species decreased from **28 to 19**.

Noxious species: *Hypericum perforatum*, *Echium vulgare* and *Marrubium vulgare* occur at low densities.

Recommendation: Control noxious and broad-leaved weeds throughout this section of the construction corridor.

Plate 2: Monitoring Plot 16 - left spring 2015, right autumn 2016.

4.3.2 Monitoring Plot 15

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50-** (5-25+)
No. Native sp. with cover score of 1	**7** (10)
No. Native sp. with cover score of 2 or more	**2** (1)
Non-native cover %	**25-50** (25-50-)
Bare Ground %	**20** (20-30)
Mulch Cover %	<1
KPT	High Conservation Vegetation
Was KPT met	**No – mid range**

Monitoring plot 15 is situated 530 m east of the LLPS in the Murrumbidgee River Corridor ACT within former high conservation value natural temperate grassland.

Native sp. increased from **20 to 21**. Non-native species decreased from **26 to 18**. Broad-leaf weeds remain dominant but have moderated slightly.

Noxious species: *Hypericum perforatum* has increased in cover with *Echium vulgare* persisting at low density.

Recommendation: Control noxious and broad-leaf weeds throughout this section of the construction corridor.

Plate 3: Monitoring Plot 15 - left spring 2015, right autumn 2016.

4.3.3 Monitoring Plot 21

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50-** (5-25)
No. Native sp. with cover score of 1	**5** (9)
No. Native sp. with cover score of 2 or more	**2** (0)
Non-native cover %	**25-50** (5-25-)
Bare Ground %	**20** (20-30)
Mulch Cover %	<1
KPT	High Conservation Vegetation
Was KPT met	**No – mid range**

Monitoring plot 21 is located 700 m east of the LLPS in the Murrumbidgee River Corridor ACT within former high conservation value natural temperate grassland.

Native species increased from **12 to 15**. Non-native species remained at **11**. **Native recovery has improved since broad-scale herbicide application in 2015, however, a variety of exotic species (primarily *Conyza* sp.) have also increased cover.**

Noxious species: *Echium vulgare* and *Hypericum perforatum* have re-emerged at low-moderate density.

Recommendation: Control noxious and broad-leaf weeds but avoid broad-scale herbicide application.

Plate 4: Monitoring Plot 21 - left spring 2015, right autumn 2016.

4.3.4 Monitoring Plot 23

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50+ (**25-50+)
No. Native sp. with cover score of 1	**10** (10)
No. Native sp. with cover score of 2 or more	**3** (2)
Non-native cover %	**5-25-** (5-25+)
Bare Ground %	**15** (5-10)
Mulch Cover %	<1
KPT	High Conservation Vegetation
Was KPT met	**No - mid range**

Monitoring plot 23 is situated 1740 m east of the LLPS in the ACT within former high conservation value Box Gum Grassy Woodland.

Native species declined from **28 to 24.** Non-native species also declined from **25 to 22**.

Noxious species: *Hypericum perforatum* and *Echium vulgare* occur at low densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 5: Monitoring Plot 23 - left spring 2015, right autumn 2016.

4.3.5 Monitoring Plot 22

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50+** (5-25+)
No. Native sp. with cover score of 1	**8** (15)
No. Native sp. with cover score of 2 or more	**4** (0)
Non-native cover %	**<5** (25-50-)
Bare Ground %	**15** (10)
Mulch Cover %	<5
KPT	High Conservation Vegetation
Was KPT met	**No - mid range**

Monitoring plot 22 is situated 2150 m east of the LLPS in the ACT within former high conservation value Box Gum Grassy Woodland.

Native species declined from **27 to 26**. Non-native species also declined from **21 to 14.**

Note: Poor quality top-soil. Significant reduction in non-native cover, primarily due to a seasonal decline of annual *Bromus* spp.

Noxious species: *Nassella trichotoma*, *Eragrostis curvula* occur at low densities and *Hypericum perforatum* at moderate density.

Recommendation: Control of noxious and broad-leaf weeds.

Plate 6: Monitoring Plot 22 - left spring 2015, right autumn 2016.

4.3.6 Monitoring Plot 24

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50-** (5-25+)
No. Native sp. with cover score of 1	**7** (6)
No. Native sp. with cover score of 2 or more	**1** (1)
Non-native cover %	**5-25-** (5-25+)
Bare Ground %	**30** (40-50)
Mulch Cover %	**<1** (<1)
KPT	High Conservation Vegetation
KPT met	**No – mid range**

Monitoring plot 24 is situated 2650 m east of the LLPS on the west side of the Monaro Hwy in the ACT within former high conservation value Box Gum Grassy Woodland.

Native species declined from **19 to 17**. Non-native species also declined from **24 to 18**. **The section of corridor either side of the Monaro Highway has been slow to improve but is showing signs of improvement. Poor quality top-soil.**

Noxious species: *Eragrostis curvula*, *Hypericum perforatum* and *Nassella trichotoma* at low density.

Recommendation: Control noxious and broad-leaf weeds.

Plate 7: Monitoring Plot 24 - left spring 2015, right autumn 2016.

4.3.7 Monitoring Plot 25

Jurisdiction	NSW
Native sp. cumulative cover %	**5-25+** (5-25+)
No. Native sp. with cover score of 1	**5** (7)
No. Native sp. with cover score of 2 or more	**2** (1)
Non-native cover %	**5-25** (25-50-)
Bare Ground %	**20** (20)
Mulch Cover %	**<5 (leaf litter)**
KPT	High Conservation Vegetation
Was KPT met	**No**

Monitoring plot 25 is situated 2800 m east of the LLPS on the east side of the Monaro Hwy in the ACT within former high conservation value Box Gum Grassy Woodland.

Native species increased from **17 to 23**. Non-native species declined from **18 to 16**.

Noxious species: *Hypericum perforatum* and *Eragrostis curvula* at moderate densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 8: Monitoring Plot 25 - left spring 2015, right autumn 2016.

4.3.8 Monitoring Plot 01

Jurisdiction	NSW
Native sp. cumulative cover %	**25-50-** (5-25)
No. Native sp. with cover score of 1	**8** (9)
No. Native sp. with cover score of 2 or more	**2** (0)
Non-native cover %	**5-25** (25-50-)
Bare Ground %	**10** (10)
Mulch Cover %	**10 (litter)**
KPT	High Conservation Vegetation
Was KPT met	**No – mid range**

Monitoring plot 01 is situated 3030 m east of the LLPS in NSW (Smith) within former moderate to high conservation value Box Gum Grassy Woodland.

Native species remained at **17**. Non-native species declined from **18 to 11**.

Noxious species: *Eragrostis curvula and Rosa rubiginosa* at low densities and *Hypericum perforatum* at moderate density.

Recommendation: Control noxious and broad-leaf weeds.

Plate 9: Monitoring Plot 01 - left spring 2015, right autumn 2016.

4.3.9 Monitoring Plot 09

Jurisdiction	NSW
Native sp. cumulative cover %	-
No. Native sp. with cover score of 1	-
No. Native sp. with cover score of 2 or more	-
Non-native cover %	-
Bare Ground %	-
Mulch Cover %	-
KPT	High Conservation Vegetation
Was KPT met	-

Monitoring plot 09 is situated 3600 m east of the LLPS in NSW (McDonald) within former moderate to high conservation value Box Gum Grassy Woodland.

No access, site not sampled.

Plate 10: Monitoring Plot 09 - autumn 2015.

4.3.10 Monitoring Plot 04

Jurisdiction	NSW
Native sp. cumulative cover %	-
No. Native sp. with cover score of 1	-
No. Native sp. with cover score of 2 or more	-
Non-native cover %	-
Bare Ground %	-
Mulch Cover %	-
KPT	High Conservation Vegetation
Was KPT met	-

Monitoring plot 04 is situated 4025 m east of the LLPS in NSW (McDonald) within former moderate to high conservation value Box Gum Grassy Woodland.

No access, site not sampled.

Plate 11: Monitoring Plot 04 - autumn 2015.

4.3.11 Monitoring Plot 17

Jurisdiction	NSW
Native sp. cumulative cover	**50-75+** (50-75+)
No. Native sp. with cover score of 1	**12** (16)
No. Native sp. with cover score of 2 or more	**2*** (2*)
Non-native cover %	**5-25** (5-25+)
Bare Ground %	**<1**
Mulch Cover %	**<5 (leaf litter)**
KPT	High Conservation Vegetation
Was KPT met	**Yes**

Monitoring plot 17 is situated 7600 m east of the LLPS in NSW (Devitt) within former moderate to high conservation value Box Gum Grassy Woodland.

This site met the KPT in the last monitoring session. Native species increased from **33** to **34**. Non-native species declined from **16** to **14**.

Noxious species: *Rosa rubiginosa* recorded at low density.

Recommendation: Biomass should be reduced. Control of broad-leaf weeds and perennial exotic grasses such as *Phalaris aquatica*.

Plate 12: Monitoring Plot 17 - left spring 2015, right autumn 2016 (* includes one species with a cover score of 3).

4.4 Plots in low-diversity native vegetation (KPT category 2)

Eight[4] plots were established in areas of former low-diversity native vegetation - KPT category 2 (see **Table 1**). Performance targets for category 2 are at present similar to those imposed for category 3 and are provided in **Section 2.3, above**.

Summaries of category 2 results are provided in **Table 6,** below, with additional descriptions of each plot presented in the succeeding sub-sections.

Species diversity

Native species ranged from 19 to 31 sp./plot at an average of 24.7 sp. (24.7 sp. in spring 2015) and non-native species ranged from 11 to 22 at an average of 16.0 sp. (22.0 in spring 2015).

Individual species cover abundance scores

The highest individual native species cover score was 3 (25-50% cover range) obtained by *Bothriochloa macra* (Plot 06) and *Panicum effusum* (Plot 20). This was followed by five species with cover scores of 2 (5-25%) that were recorded on twelve separate occasions from six plots.

The highest individual non-native species (or genus) cover score was 2 (5-25%) obtained by six species on eight separate occasions from five plots. All other species had less than 5% cover.

Cumulative cover abundance scores

While no plot in category 2 met the required KPT two plots (06 and 20) obtained native cover scores of 4- (low end of 50-75%) and are considered to be near the target. The remaining four plots (02, 10, 18 and 19) had cover scores of 3 (25-50) and are in the middle range of the target (**Table 6**).

The current results indicate an overall increase in native cover in this category compared to the previous spring survey and is now positioned at the high end of the 25-50% range.

Cumulative non-native cover declined relative to the previous spring survey and is now at the high end of the 5-25% range.

[4] *Plots 03 and 05 located in the central section of the corridor were not sampled during this monitoring period*.

Table 6: Summary of category 2 plot results for the current autumn 2016 survey. Table provides plot data on current species richness and changes compared to spring 2015, native species cover scores and cumulative cover abundance estimates for native and exotic species.

Parentheses ( ) enclose results from spring 2014 and red text identifies an increase, blue a decrease and black no change.

Plot No.	Chainage	Location	Native sp.	Exotic sp.	Total sp.	Change native sp.*	Change exotic sp. *	Native sp. cover score of 1	Native sp. cover score of 2 or >	Total native cover %	Total exotic cover %
19	1020	ACT	**20**	**19**	**39**	**5** (2)	**3** (7)	**2** (7)	**4** (2)	**25-50+**	**5-25-**
20	1200	ACT	**30**	**15**	**45**	**5** (3)	**7** (8)	**12** (16)	**2**[A] (2 [A])	**50-75-**	**5-25-**
18	1450	ACT	**27**	**22**	**49**	**1** (5)	**5** (7)	**12** (14)	**2** (1)	**25-50+**	**25-50-**
02	3220	NSW-Smith	**31**	**11**	**42**	**4** (0)	4 (2)	**13** (10)	**1** (2)	**25-50-**	**5-25**
03[P]	3320	NSW-McDonald	-	-	-	-	-	-	-	-	-
05 [P]	4300	NSW-McDonald	-	-	-	-	-	-	-	-	-
06	4900	NSW-Lonergan	**19**	**17**	**36**	**2** (5)	**8** (4)	**8** (10)	**2** [A] (1)	**50-75-**	**25-50-**
10	6030	NSW-Codd / Howarth	**21**	**12**	**33**	**1** (8)	**9** (5)	**6** (10)	**3** (2)	**25-50+**	**25-50-**
Av autumn 2016			**24.7**	**16.0**	**40.7**					**25-50+**	**5-25+**
Av spring 2015			24.7	22.0	46.7					25-50	25-50-
Av autumn 2015			20.7	16.9	37.6					25-50	5-25+
Av spring 2014			23.0	21.9	39.9					5-25+	25-50
Av autumn 2014			23.6	19.6	38.4					25-50-	25-50-

* Change in species richness in the period between spring 2015 and autumn 2016.

[P] Pulse grazed prior to autumn 2014 sampling. (Note: Plot 03 is divided by fencing and only half the plot was grazed).

\+ Total cover estimated at the upper end of range

\- Total cover estimated at the lower end of range

[A] = includes species with cover score of 3 (25-50%)

4.4.1 Monitoring Plot 19

Jurisdiction	NSW
Native sp. cumulative cover %	**25-50+** (25-50-)
No. Native sp. with cover score of 1	**2** (7)
No. Native sp. with cover score of 2 or more	**4** (2)
Non-native cover %	**5-25-** (5-25-)
Bare Ground %	**30** (30)
Mulch Cover %	**<1**
KPT	Low diversity native vegetation
Was KPT met	**No - mid-range**

Monitoring plot 19 is situated 1020 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland.

Native species increased from **15 to 20**. Non-native species declined from **22 to 19.**

Noxious species: *Echium vulgare* and *Hypericum perforatum* occur at low densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 13: Monitoring Plot 19 - left spring 2015, right autumn 2016.

4.4.2 Monitoring Plot 20

Jurisdiction	ACT
Native sp. cumulative cover %	**50-75-** (25-50+)
No. Native sp. with cover score of 1	**12** (16)
No. Native sp. with cover score of 2 or more	**2*** (2*)
Non-native cover %	**5-25-** (25-50+)
Bare Ground %	**<1**
Mulch Cover %	**<1** (leaf litter)
KPT	Low diversity native vegetation
Was KPT met	**Near**

Monitoring plot 20 is situated 1200 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland. The plot retains a small component of the original vegetation along the N boundary.

Native species declined from **35 to 30**. Non-native also declined from **22 to 15.**

Seasonal decline of *Bromus* spp.

Noxious species: *Carthamus lanatus*, *Echium vulgare and Eragrostis curvula* occur at low densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 14: Monitoring Plot 20 - left spring 2015, right autumn 2016. *includes one species of with a cover score of 3 (25-50%)

4.4.3 Monitoring Plot 18

Jurisdiction	ACT
Native sp. cumulative cover %	**25-50+** (25-50+)
No. Native sp. with cover score of 1	**12** (14)
No. Native sp. with cover score of 2 or more	**2** (1)
Non-native cover %	**25-50-** (25-50+)
Bare Ground %	**<5** (<5)
Mulch Cover %	**<1** (grass stems)
KPT	Low diversity native vegetation
Was KPT met	**No - mid range**

Monitoring plot 18 is situated 1450 m east of the LLPS in the ACT within former low diversity Box Gum Grassy Woodland. Trees/shrubs have been planted within the plot.

Native species declined from **28 to 27**. Non-native species also declined from **27 to 22.**

Seasonal decrease in annual *Bromus* spp. and *Trifolium* spp.

Noxious species: *Echium vulgare, Eragrostis curvula* and *Hypericum perforatum* occurred at low densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 15: Monitoring Plot 18 - left spring 2015, right autumn 2016.

4.4.4 Monitoring Plot 02

Jurisdiction	NSW
Native sp. cumulative cover %	**25-50-** (25-50-)
No. Native sp. with cover score of 1	**13** (10)
No. Native sp. with cover score of 2 or more	**1** (2)
Non-native cover %	**5-25** (5-25-*)
Bare Ground %	**20** (15)
Mulch Cover %	**<1%**
KPT	Low diversity native vegetation
Was KPT met	**Mid range**

Monitoring plot 02 is situated 3220 m east of the LLPS in NSW (Smith) within former Brittle Gum / Broadleaf Peppermint Dry Woodland.

Native species increased from **27 to 31**. Non-native species declined from **15 to 11**.

Noxious species: *Eragrostis curvula*, *Hypericum perforatum* and *Rosa rubiginosa* at low densities.

Recommendation: Control noxious and broad-leaf weeds.

Plate 16: Monitoring Plot 02 – left spring 2015, right autumn 2016. * spring 2015 exotic cover score was revised down from mid 5-25.

4.4.5 Monitoring Plot 03

Jurisdiction	NSW
Native sp. cumulative cover %	-
No. Native sp. with cover score of 1	-
No. Native sp. with cover score of 2 or more	-
Non-native cover %	-
Bare Ground %	-
Mulch Cover %	-
KPT	Low diversity native vegetation
Was KPT met	-

Monitoring plot 03 is situated 3320 m east of the LLPS in NSW (McDonald) within low diversity pasture at the interface of Brittle Gum / Broadleaf Peppermint Woodland and Box Gum Grassy Woodland.

No access site not sampled.

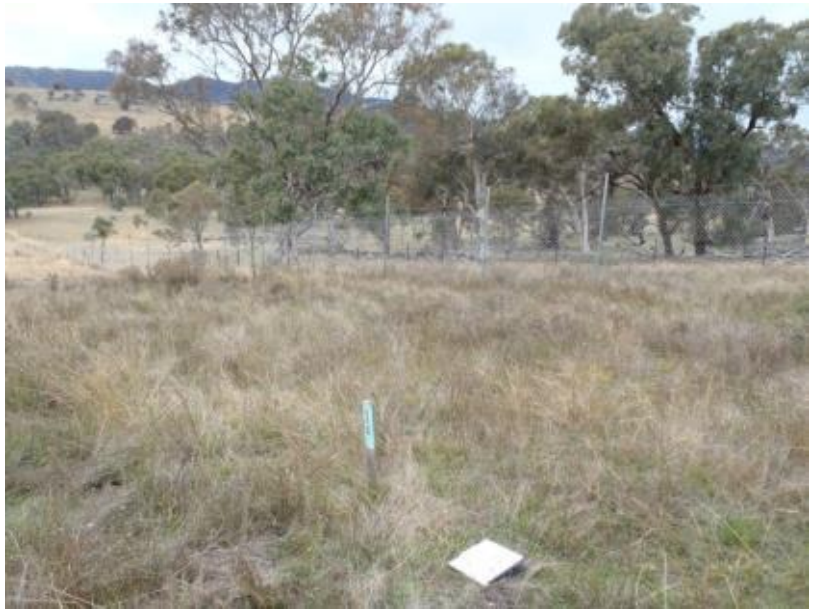


Plate 17: Monitoring Plot 03 - autumn 2015.

4.4.6 Monitoring Plot 05

Jurisdiction	NSW
Native sp. cumulative cover %	-
No. Native sp. with cover score of 1	-
No. Native sp. with cover score of 2 or more	-
Non-native cover %	-
Bare Ground %	-
Mulch Cover %	-
KPT	Low diversity native vegetation
Was KPT met	-

Monitoring plot 05 is situated 4300 m east of the LLPS in NSW (McDonald) within former low diversity Box Gum Grassy Woodland.

No access site not sampled.

Plate 18: Monitoring Plot 05 - autumn 2015.

4.4.7 Monitoring Plot 06

Jurisdiction	NSW
Native sp. cumulative cover %	**50-75-** (25-50-)
No. Native sp. with cover score of 1	**8** (10)
No. Native sp. with cover score of 2 or more	**2*** (1)
Non-native cover %	**25-50-** (50-75-)
Bare Ground %	**<1**
Mulch Cover %	**<5**
KPT	Low diversity native vegetation
Was KPT met	**Near**

Monitoring plot 06 is situated 4900 m east of the LLPS in NSW (Lonergan) within former low diversity Box Gum Grassy Woodland.

Native species declined from **21 to 19**. Non-native species also declined from **25 to 17.**

The increase in native cover was largely attributed to *Bothriochloa macra*

Noxious species: *Carthamus lanatus* at low density. *Eragrostis curvula* near Valve 5007 to east.

Recommendation: Control noxious and broad-leaf weeds and reduce biomass preferably through grazing.

Plate 19: Monitoring Plot 06 - left spring 2015, right autumn 2016. *includes one species of with a cover score of 3 (25-50%)

4.4.8 Monitoring Plot 10

Jurisdiction	NSW
Native sp. cumulative cover %	**25-50+** (25-50)
No. Native sp. with cover score of 1	**6** (7)
No. Native sp. with cover score of 2 or more	**3** (3)
Non-native cumulative cover %	**25-50-** (25-50)
Bare Ground %	**<5**
Mulch Cover %	**<5**
KPT	Low diversity native vegetation (mixed pasture)
Was KPT met	**No - mid range**

Monitoring plot 10 is situated 6030 m east of the LLPS in NSW (Codd/Howarth) within former low diversity mixed pasture.

Native species declined from **22 to 21.** Non-native species also declined from **21 to 12.**

Noxious species: *Echium vulgare* at low density.

Recommendation: Control noxious and broad-leaf weeds. Consider biomass control through stock grazing.

Plate 20: Monitoring Plot 10 - left spring 2015, right autumn 2016.

4.5 Plots in non-native vegetation (KPT category 1)

All plots in category 1 (07, 08, 11, 12, 13 and 14) have met the required KPT and no longer require monitoring.

All plots in this category were located in the central and eastern sections (NSW) of the construction corridor.

4.6 Rare and threatened plants

No additional rare plant observations were recorded during the current survey period.

4.7 Rare and threatened animals

No additional rare animal observations were recorded during the current survey period.

4.8 Other observations

There was a typical autumnal decline in the cover abundance of exotic annual species, including clover *Trifolium* spp. and pasture grasses such as *Bromus* spp. and *Vulpia* sp. The decline of *Bromus* spp. was more pronounced, both in distribution and cover abundance, than during any previous season, and while data from excluded plots (03, 04, 05 and 09) may have added to this component it remains that all other plots where these species previously recorded have exhibited substantial declines in cover abundance.

4.9 Noxious weeds

Nine species of noxious plant have been recorded within or adjacent to sample plots during the course of the monitoring study (**Table 7**). Of these seven were re-recorded during the current survey: they are: *Carthamus lanatus* (Saffron Thistle), *Echium vulgare* (Viper's Bugloss), *Eragrostis curvula* (African Love Grass), *Hypericum perforatum* (St. John's Wort), *Marrubium vulgare* (Horehound), *Nassella trichotoma* (Serrated Tussock) and *Rosa rubiginosa* (Briar Rose).

The infestation of *Eragrostis curvula* is widespread through the central and western sections of the construction corridor, though at this stage densities remain low.

Table 7: Noxious weeds recorded within the construction corridor.

Noxious Species	Declared in NSW	Declared in ACT	WONS	Plot / Location	Estimated density.
Carthamus lanatus (Saffron Thistle)	Yes	Yes		01	Not re-recorded
				03	*No access*
				06	<15 individuals **v**
				18	Not re-recorded
				19	Not re-recorded
				20	<15 individuals **^**
Echium plantagineum (Paterson's Curse)	Yes	Yes		06	Not re-recorded
				10	Not re-recorded
Echium vulgare (Viper's Bugloss)	Yes	Yes		10	<4 individuals **N**
				15	>15 individuals
				16	>15 individuals **^**
				18	<15 individuals **^**
				19	<15 individuals **^**
				20	<4 individuals **^**
				21	>15 individuals **^**
				23	<4 individuals **^**
				24	Not re-recorded
				25	Not re-recorded
Eragrostis curvula (African Love Grass)	Yes	Yes		01*	<15 individuals
				02*	<4 individuals
				06*	Not re-recorded **v**
				17	Not re-recorded
				18	<15 individuals
				19	Not re-recorded
				20	<15 individuals
				22	<4 individuals
				24	<4 individuals **v**
				25*	>15 individuals
				Either side of Angle Crossing Rd. near cattle grid	50+ individuals
				Nth of construction corridor b/w Monaro Hwy and Railway corridor	+1000 of individuals
				S. of Plot 24	<20 individual plants
				Low numbers though widespread east of plot 24 to Valve 3279	unknown
Hypericum perforatum (St. John's Wort)	Yes	Yes		01	>15 individuals **^**
				02	<15 individuals
				10	Not re-recorded
				15	>15 individuals (^ cover) **^**

Noxious Species	Declared in NSW	Declared in ACT	WONS	Plot / Location	Estimated density.
				16	>15 individuals
				17	Not re-recorded
				18	<15 individuals
				19	<15 individuals
				20	Not re-recorded ᵛ
				21	>15 individuals ^
				22	>15 individuals ^
				23	<15 individuals
				24	<15 individuals
				25*	>15 individuals
Marrubium vulgare (Horehound)	Yes	No		06	Not re-recorded
				E. of Plot 07	Not re-recorded
				16	<4 individuals ^
Nassella trichotoma (Serrated Tussock)	Yes	Yes	Yes	04	*No access*
				22	<4 individuals ^
				24	<4 individuals
				25	Not re-recorded ᵛ
Rosa rubiginosa (Briar Rose)	Yes	Yes		01	<15 individuals
				02	<4 individuals
				05	*No access*
				17	<4 individuals ^
				18	Not re-recorded
				22	Not re-recorded
				23	Not re-recorded
Rubus sp. (Blackberry)	Yes	Yes	Yes	18	Not re-recorded

N = new record
^ = increase from previous survey period;
ᵛ = decrease from previous survey period
* = also recorded in low numbers within adjacent sections of the construction corridor.
WONS = Weed of National Significance, see
<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

5 Management actions & recommendations

5.1 Weeds

Weed control measures have been implemented in accordance with the Weed Management Sub-plan in some problem areas previously identified. While treatment has had some success many infestations persist throughout the construction corridor (**Table 7, above**).

There are a variety of relatively small exotic herbs recorded within the construction corridor that have minor limiting effects on the germination and survival of native herbaceous species and therefore do not require any specific management action. Species in this group include annual grasses such as *Vulpia* sp., *Aira* sp., *Briza* spp. and small annual herbs such as *Linaria* spp., *Centaurium* sp., *Erodium botrys*, *Juncus bufonius*, *Spergularia rubra*, *Trifolium arvense*, *T. angustifolium* and *Galium divaricatum*.

In contrast, exotic perennial pasture grasses, perennial clovers and broad-leaf weeds still impose considerable barriers to the recruitment and vigour of native herbaceous groundcovers, which is most apparent in the western section of the construction corridor. Species that pose greater restriction on native development are exotic perennial grasses such as *Paspalum dilatatum*, *Phalaris aquatica*, *Lolium perenne and Bromus catharticus* (initial perennial forms are replaced by annual or short-lived perennial forms), annual and perennial clovers *Trifolium sp.* and a variety of broad-leaf weeds including *Conyza* sp., *Echium* spp., *Hypochaeris radicata*, *Verbena bonariensis, Hirschfeldia incana, Plantago lanceolata, Cirsium vulgare* and *Acetosella vulgaris*.

The following measures, previously recommended, should continue as required under the weed management sub-plan:

- Maintain chemical weed control in problem areas though care should be taken to minimise losses of non-target native species.
- Develop a strategic and coordinated approach to reduce the incidence of noxious species such as *Eragrostis curvula* and *Hypericum perforatum* not just within the construction corridor but also within the Monaro Highway and Goulburn-Cooma railway corridors. The efficacy of these measures can only be achieved through engagement with the ACT Government (Territory and Municipal Services) to address infestations within the Monaro Hwy and Goulburn-Cooma railway corridors. *This has been frequently recommended, but up to this point little or no action has taken place.*

5.2 Biomass control

Pulse grazing should be undertaken in sections where biomass levels are high, this would preferably done during late winter 2016 and late summer / early autumn 2017. The main areas for consideration are in the ACT section between Angle Crossing Road (850m chainage) and Plot 23 (1700 m chainage) and the NSW section from Plot 06 (4900 m chainage) to Plot 11 (6425 chainage).

5.3 Poor quality top-soil

Refer to comments in the spring 2013 plot monitoring report.

5.4 Bare ground

Refer to comments in the spring 2013 plot monitoring report.

5.5 Re-seeding

Refer to comments in the autumn 2015 plot monitoring report.

5.6 KPTs

Despite encouraging improvements in native groundcover it is doubtful that the current 70% KPT would be achieved in the short to medium term in some sections of the construction corridor (i.e. the area either side of the Monaro Highway and the steep slopes within the Murrumbidgee corridor). Furthermore, in order to reach this target it is likely that a considerably greater effort in biomass and weed control and supplementary re-seeding would be required.

As has been stated previously the current KPT for category 2 and 3 vegetation should be lowered to 50% and 60%, respectively (with the condition that Icon Water commit to all management obligations until these targets are met).

6 Conclusion

All plots in category 1 (non-native vegetation) have met the required KPT.

Apart for Plot 17 no other plot associated with native vegetation (categories 2 and 3) has achieved the required target. Two plots (06 and 20) had native cover scores at the lower end of the 50-75% range and are considered to be near the KPT, and eleven plots were within the 25-50% cover range and are at the mid-point of the target.

Nine plots increased their native cover, five exhibited no change (including Plots 17) and one plot declined relative to the previous monitoring period.

Recommendations continue from previous reports and relate to the control of noxious and broad-leaf weed and biomass in the central and western sections of the construction corridor. Measures include the cautious application of herbicide and 'pulse' grazing.

The current 70% KPT should be reduced to 60% for category 3 and 50% for category 2 vegetation.

References

Biosis Research (June 2009). *Murrumbidgee River to Googong Dam Water Transfer Pipeline: Terrestrial Flora & Fauna Impact Assessment*. Biosis Research Pty Ltd, Queanbeyan NSW.

Eco Logical Australia (November 2010). *Murrumbidgee to Googong Pipeline: Pre-clearance Surveys.* Prepared for Bulk Water Alliance Joint Venture.

Eco Logical Australia (March 2011). *M2G Rapid Vegetation Assessment of the Hard Rock Re-alignment Route*. Prepared for Bulk Water Alliance Joint Venture.

Eco Logical Australia & Blue Gum Ecological Consulting (August 2013). *M2G Seeding (Plot) Monitoring Report. Construction Corridor (Autumn 2013)*. Prepared for ACTEW Water.

Landscape Rehabilitation and Terrestrial Ecology Management Plan (2014). ACTEW Corporation, Canberra.

M2G Work as Executed (WAE) Landscape Drawings.

Appendix 1: Maps

Figures 1 – 4, below, display the locations of the plot monitoring sites within the M2G construction corridor:

- **Figure 1**: Western section
- **Figure 2**: Central-western section
- **Figure 3**: Central-eastern section
- **Figure 4**: Eastern section

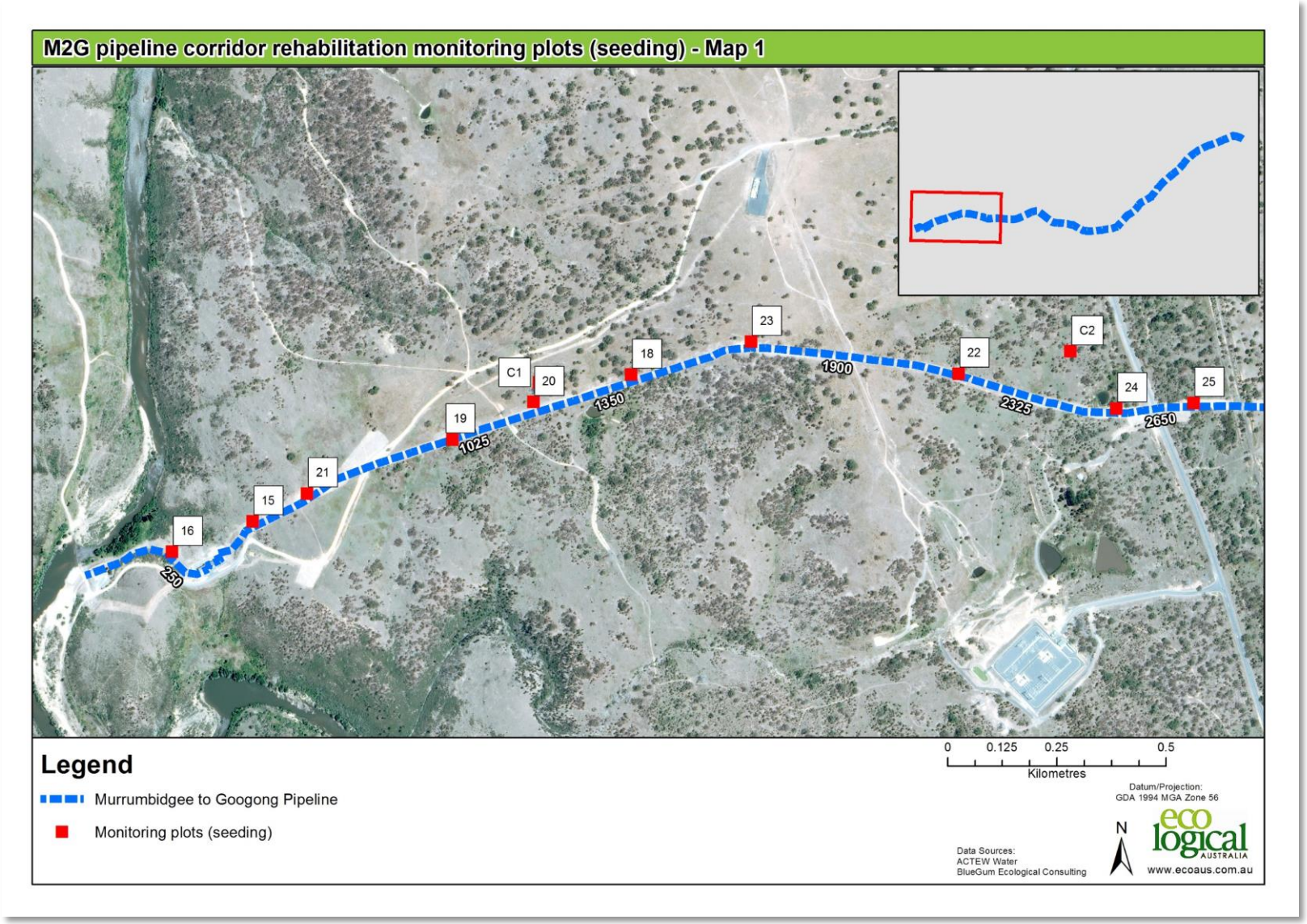


Figure 1: Monitoring sites within the western section of the M2G construction corridor.

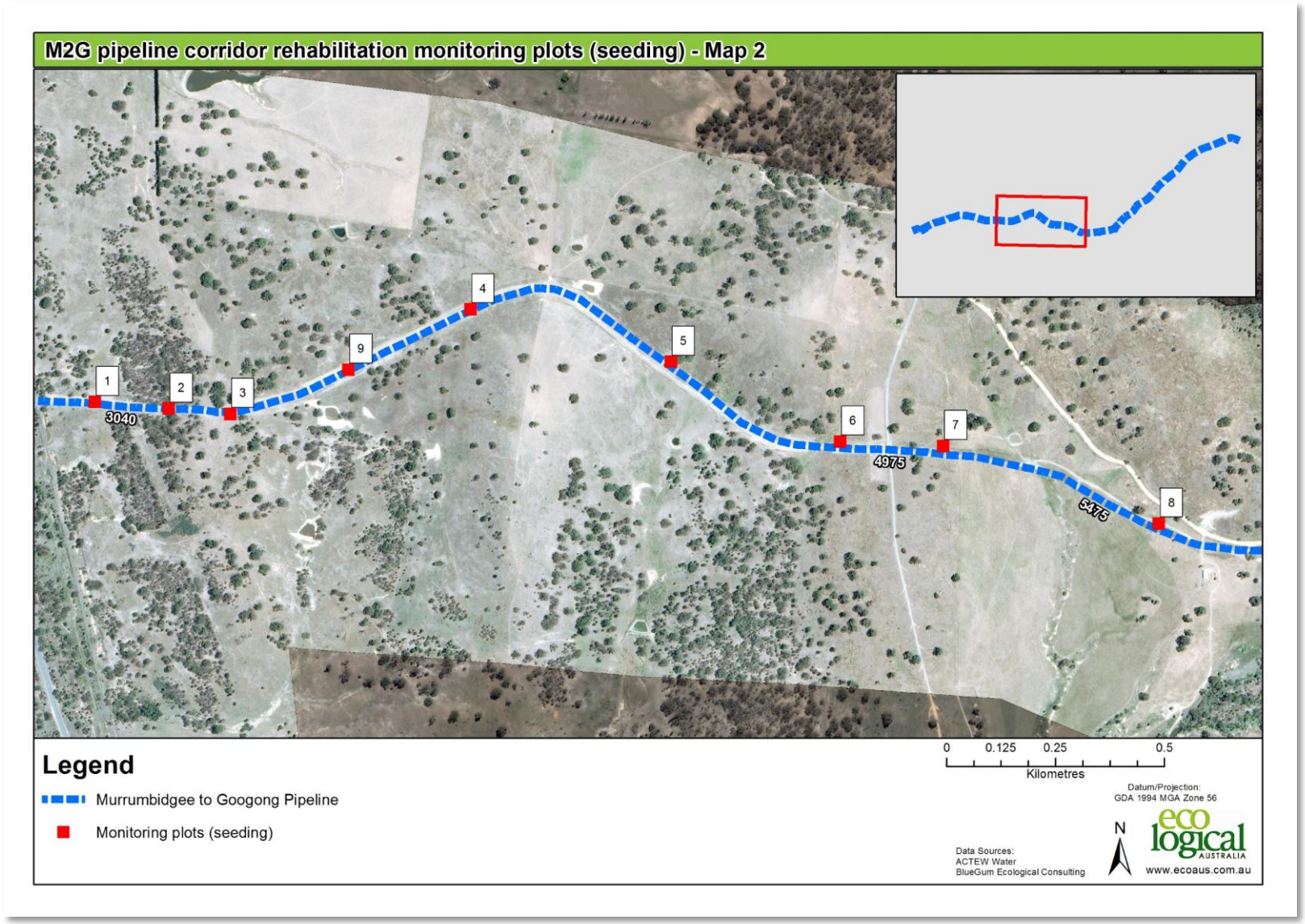


Figure 2: Monitoring sites within the central-western section of the M2G construction corridor. ***Note: Plots 03, 04, 05 and 09 could not sampled.***

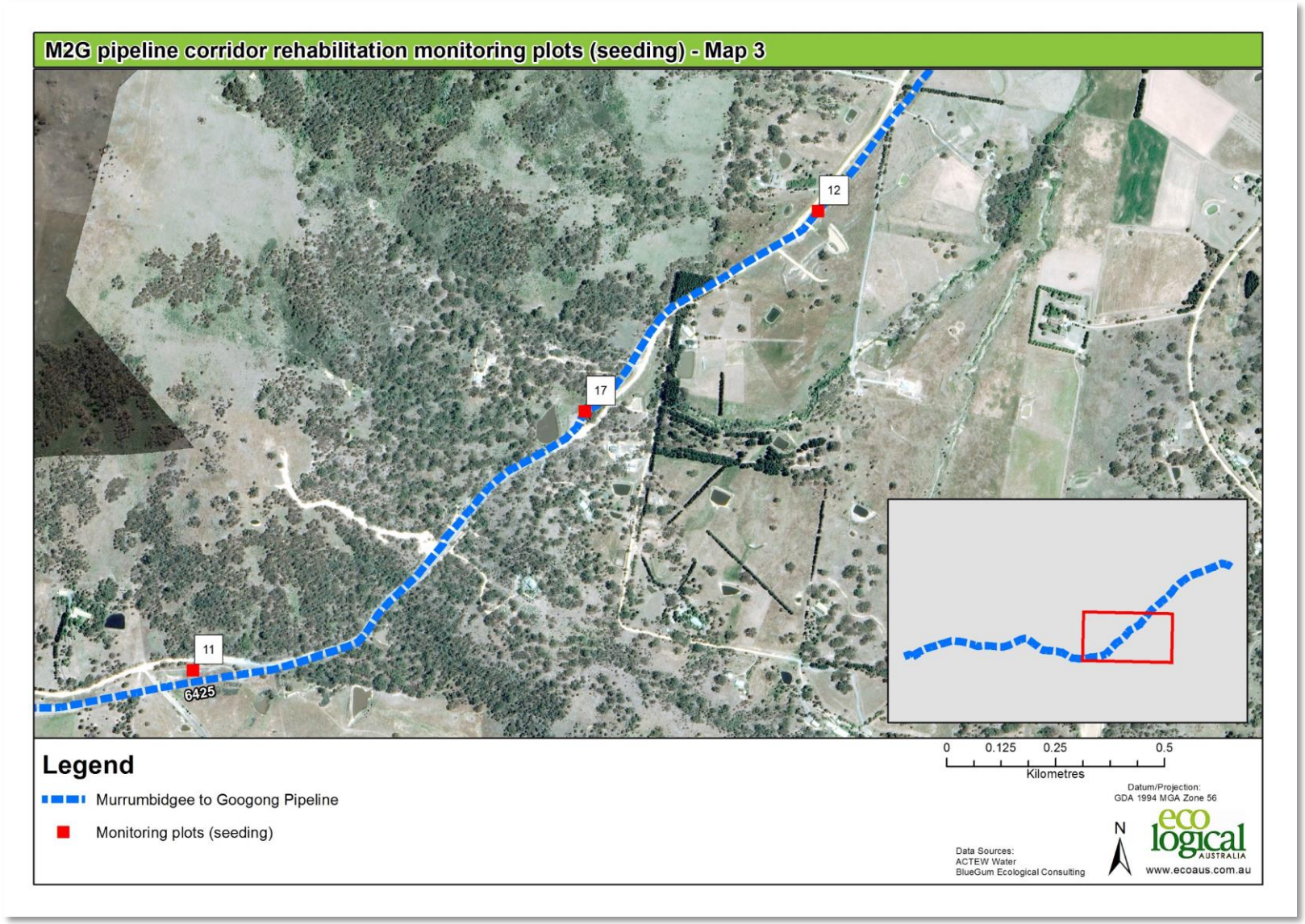


Figure 3: Monitoring sites within the central-eastern section of the M2G construction corridor.

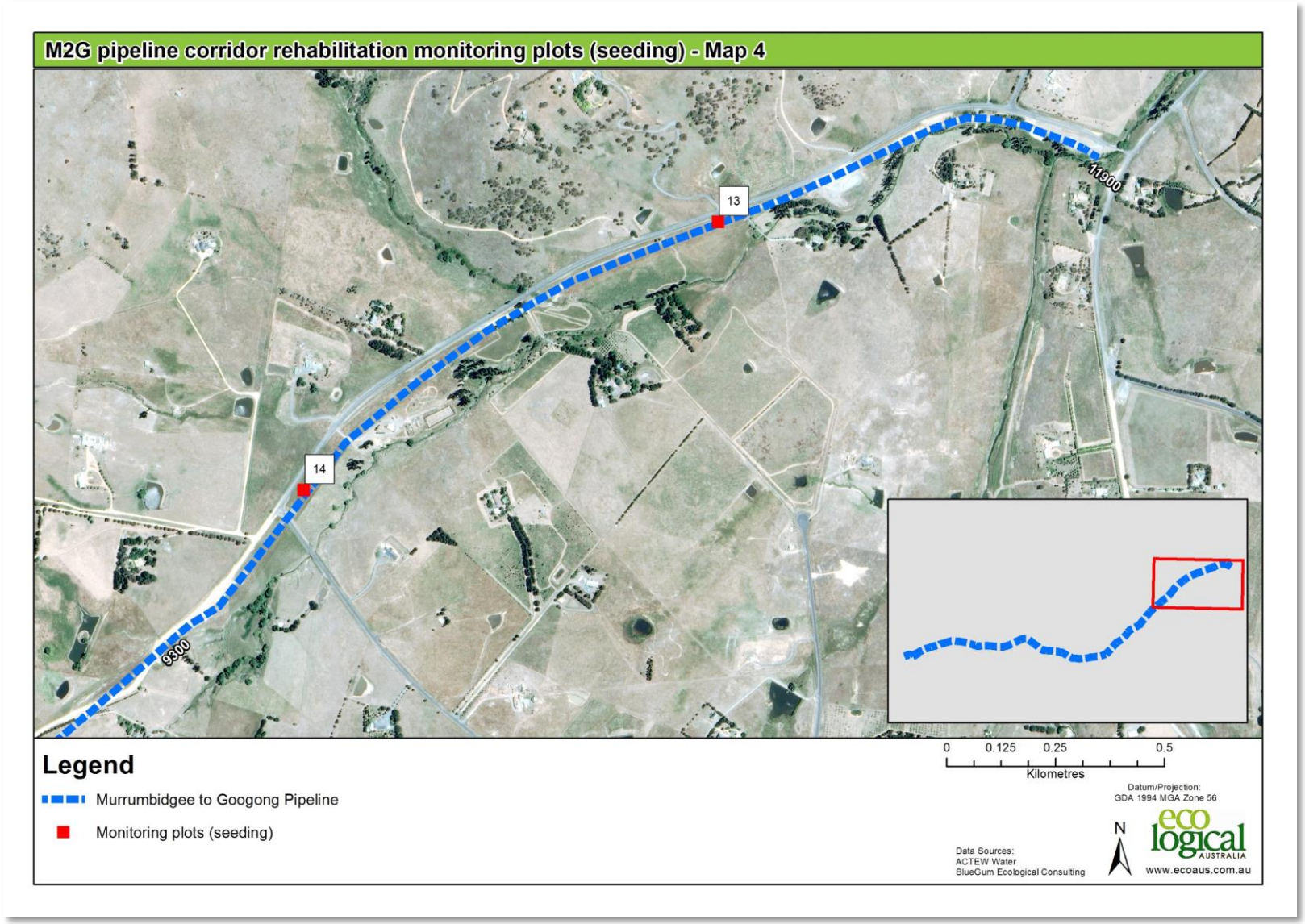


Figure 4: Monitoring sites within the eastern section of the M2G construction corridor.

Appendix 2: Plot floristic data

Plot data for the M2G plot (seeding) monitoring study for autumn 2016.

Data sets for control plots and monitoring plots are provide in Table 8 and Table 9, respectively.

The tables give estimated species cover abundance according to the modified Braun-Blanquet scale below. Species are listed alphabetically and have been separated into native and non-native groups.

Naturally recruiting eucalypt and other woody shrubs are included in the species lists below, but were not considered in the analysis of cover abundance or species tallies.

Modified Braun-Blanquet cover abundance scores

- r = < 5% cover and solitary (< 4 individuals)
- + = < 5% cover and few (4-15 individuals)
- 1 = < 5% cover and numerous/scattered (>15 individuals)
- 2 = 5% – 25% cover
- 3 = 25% – 50% cover
- 4 = 50% – 75% cover
- 5 = > 75% cover

Table 8: Floristic data: Control plots autumn 2016.

*According to Rehwinkel (2007) indicator species are referred to as 'grazing intolerant' or 'declining' species. An indicator species score of '1' identifies a site as having conservation value and indicator species score of '2' are highly significant and are given the highest value. The more of these species present at a site the greater its conservation value. *Themeda australis* is treated as a level 2 indicator species when dominant, as is the case at Control Site 2.

Species	Sp. cover score	Sp. with cover score of 1	Sp. with cover score of 2	Sp. with cover score of 3	Sp. with cover score of 4	Indicator score*
CONTROL PLOT 1						
Exotic						
*Chondrilla juncea**	+					
*Cirsium vulgare**	+					
*Conyza sp.**	r					
*Eragrostis curvula**	1	1				
*Hypericum perforatum**	+					
*Hypochaeris radicata**	1	1				
*Lactuca serriola**	r					
*Rosa rubiginosa**	+					
*Rubus sp.**	r					
*Tragapogon sp.**	r					
*Trifolium arvense**	1	1				
*Trifolium sp.**	+					
Total exotic species	**12**	**3**	**0**	**0**	**0**	
Cumulative cover	**5-10%**					
Native						
Aristida ramosa	1	1				
Arthropodium milleflorum	+					2
Austrodanthonia sp. (Rytidosperma) s	2		1			
Austrostipa bigeniculata	1	1				
Austrostipa scabra	1	1				
Bossiaea buxifolia	+					2
Bothriochloa macra	2		1			

Species	Sp. cover score	Sp. with cover score of 1	Sp. with cover score of 2	Sp. with cover score of 3	Sp. with cover score of 4	Indicator score*
Chamaesyce drummondii	1	1				
Chenopodium pumilio	r					
Chloris truncata	1	1				
Chrysocephalum apiculatum	2		1			1
Chrysocephalum semipaposum	r					2
Cymbonotus lawsonianus	+					
Desmodium varians	1	1				2
Einadia nutans	r					
Elymus scaber	1	1				
Enneapogon nigricans	1	1				
*Eragrostis sp.***	2-		1			
Eucalyptus bridgesiana	3			1		
Geranium solanderi	1	1				
Glycine clandestine	r					2
Gonocarpus tetragynus	+					1
Hydrocotyle laxiflora	+					2
Lomandra filliformis	+					1
Oreomyrrhis eriopoda	+					2
Oxalis perennans	+					
Panicum effusum	2-		1			
Plantago varia	1	1				2
Poa meionectes	+					
Rumex brownii	r					
Scleranthus diander	1	1				2
Solenogyne dominii	+					
Swainsona sericea	1	1				2
Themeda australis	1	1				
Vittadinia cuneata	r					

Species	Sp. cover score	Sp. with cover score of 1	Sp. with cover score of 2	Sp. with cover score of 3	Sp. with cover score of 4	Indicator score*
Vittadinia muelleri	1	1				
Wahlenbergia sp.	1	1				
Total native species	**36**	**15**	**5**	**1**	**0**	**13**
Cumulative cover	**+80%**					
CONTROL PLOT 2						
Exotic						
*Centaurium sp.**	1	1				
*Conyza sp.**	+					
*Gamochaeta purpurea**	r					
*Hypericum perforatum**	1	1				
*Hypochaeris radicata**	+					
*Plantago lanceolata**	r					
*Rosa rubiginosa**	r					
*Vulpia sp.**	+					
Total exotic species	**8**	**2**	**0**	**0**	**0**	
Cumulative cover	**<5%**					
Native						
Acaena ovina	r					
Aristida ramosa	+					
Arthropodium milleflorum	r					2
Austrostipa scabra	+					
Bothriochloa macra	r					
Cheilanthes sieberi	r					2
Chrysocephalum apiculatum	2-		1			2
Desmodium varians	1	1				2
Dianella sp.	r					2
Elymus scarber	+					
Enneapogon nigricans	r					

Species	Sp. cover score	Sp. with cover score of 1	Sp. with cover score of 2	Sp. with cover score of 3	Sp. with cover score of 4	Indicator score*
*Eragrostis sp.***	r					
Eucalyptus blakelyi	r					
Eucalyptus melliodora	+					
Eucalyptus bridgesiana	r					
Euchiton sp.	+					
Geranium solanderi	r					
Gonocarpus tetragynus	1	1				1
Hypericum gramineum	r					2
Kunzea ericoides	r					
Leptorhynchos squamatus	1	1				2
Lomandra filliformis	+					1
Luzula densiflora	+					2
Melichrus urceolatus	r					2
Panicum effusum	+					
Poa ? meionectes	+					
Solenogyne dominii	r					
Stackhousia monogyna	+					2
Themeda australis	4				1	2*
Tricoryne elatior	r					2
Vittadinia muelleri	1	1				
Wahlenbergia sp.	+					
Total native species	**34**	**4**	**1**	**0**	**1**	**14**
Cumulative cover	**90%**					

Note: *Eucalypt* species not included in cover score tally.

*** *Themeda australis* is considered to be an indicator species level 2 if the cover score is 3 or greater.**

Table 9: Floristic data: Monitoring plots autumn 2016. *=Plots not accessible.

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
NATIVE SPECIES																										
Acacia dealbata		r																								1
Acaena ovina															+	+	r	+				r			r	6
Agrostis avenacea						r																				1
Alternanthera nana		r								r							r						r			4
Aristida ramosa		+																		1		+				3
Asperula conferta																+										1
Austrodanthonia sp. (Rytidosperma)	1	1				1				1					1	2	1	1	2-	1	1	2-	2	1	2-	15
Austrostipa bigeniculata	+	+				1														1			+	+	+	7
Austrostipa scabra	1	1				1				1					+	1		1	+	1	1	1	1	1	+	14
Bossiaea buxifolia		r																								1
Bossiaea prostrata																				r						1
Bothriochloa macra	1	1				3+				2					2	2	2	2-	2-	2-	1	2-	1	2	2-	15
Brachyloma daphnoides																+				r						2
Carex appressa	+																								r	2
Carex inversa		1				+				r						r				r	r		1			7
Cassinia sp.																r										1
Chamaesyce drummondii						+									1	1		1	+	1		+	+	r		9
Cheilanthes sieberi		+													r					1						3
Chenopodium pumilio																		1	r	1		1				4
Chloris truncata	1	1				1				2-					1	1	1	1	2-	1	2-	2	2-	2-	1	15
Chrysocephalum apiculatum																r	+	+		1		+			r	6
Convolvulus erubescens																+					r				r	3
Cryptandra amara																r										1
Cymbonotus lawsonianus	r	r				r										+	+	+		+	+	+	+		r	11
Desmodium varians																+	+	r		+						4

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
Dichelachne sp.																	r									1
Dichondra repens																	+		r		+					3
Dillwynia sericea		r																								1
Einadia nutans		r																								1
Elymus scaber	1	1				1				+					1	1	1	1	1		1	1	1	1	1	14
Enneapogon nigricans																				1						1
Epilobium billardierianum																	+									1
Eragrostis brownii		1															+	1				1		+	+	6
Eragrostis sp.																		1		1			1	1		4
Eragrostis sp. 1																			+							1
Eragrostis sp. 2																			+							1
Eragrostis trachycarpa	1	1								1							1		+		+	1	1		1	9
Erodium crinitum																						r	r			2
Eryngium ovinum																		r								1
Eucalyptus bridgesiana		r																r								2
Eucalyptus mannifera		r																								1
Eucalyptus melliodora		r								r							r					r		r	r	6
Euchiton sp.		r				+												r	+	r	r	r	+	r	r	10
Galium gaudichaudii																	1			+						2
Geranium solanderi						+				r					+		1	+	+	+		+	+	r	+	11
Glycine tabacina																	r									1
Gonocarpus tetragynus		1													+	1		+		+		1				6
Haloragis heterophylla		r															+									2
Hibbertia obtusifolia		+														+										2
Hydrocotyle laxiflora		1														+	+	r					1			5
Hypericum gramineum		r								r					r	+	1			r						6
Indigofera australis		r																								1

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
Juncus ? fockei																		+								1
Juncus australis										r							r						r		r	4
Juncus filicaulis		r				r				+							+		r				+		r	7
Kunzea ericoides		r													r											2
Leptorhynchos squamatus																				r						1
Lomandra filiformis																		+		r		+		r		4
Microlaena stipoides	1	1				1				1					1	1	1	1	1			1	1	1		12
Oxalis perennans	r	r				1				1					+	1	+	+	+	+	+	+	r	+		15
Panicum effusum	2-	1				1				1					1	1	1	2	2-	3	2	2	2-	1	1	15
Persicaria prostrata										r					1										+	3
Plantago varia																		1		r		+				3
Poa labillardierei	+																1									2
Poa sieberiana						r				r								+								3
Pseudognaphalium luteoalbum	r														r		r									3
Rumex brownii						+				r					+	+	+			r						6
Schoenus apogon																	r					r				2
Senecio quadridentatus	r									r							+									3
Solenogyne dominii																							r			1
Swainsona sericea																r										1
Themeda australis	2	2-				2-				2+					2-	1	3+	1	+	1	1	1	1	1	1	15
Veronica gracilis																	1									1
Vittadinia muelleri															+	1	1		+		r	r			+	7
Wahlenbergia sp.	1	1								+					+	1	+	1	+	+		+	1	+	+	13
Sp. with score of 1	**8**	**13**	**-**	**-**	**-**	**8**	**-**	**-**	**-**	**6**	**-**	**-**	**-**	**-**	**7**	**11**	**12**	**12**	**2**	**12**	**5**	**8**	**10**	**7**	**5**	
Sp. with score of 2	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**2**	**4**	**1**	**2**	**4**	**3**	**2**	**2**	
Sp. with score of 3	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	
Sp. with score of 4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
Sp. with score of 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
TOTAL native herb	**17**	**31**	**0**	**0**	**0**	**19**	**0**	**0**	**0**	**21**	**0**	**0**	**0**	**0**	**21**	**28**	**34**	**27**	**20**	**30**	**15**	**26**	**24**	**17**	**23**	
Est. cover Autumn 2016	**3-**	**3-**	**-**	**-**	**-**	**4-**	**-**	**-**	**-**	**3+**	**-**	**-**	**-**	**-**	**3-**	**3-**	**4+**	**3+**	**3+**	**4-**	**3-**	**3+**	**3+**	**3**	**2+**	
Est. cover Spring 2015	2	3-	-	-	-	3-	-	-	-	3	-	-	-	-	2+	3	4+	3+	3-	3+	2	2+	3+	2+	2+	
Est. cover Autumn 2015	2+	3-	3	3+	3+	3-	-	-	3+	3-		1	-	-	2+	3-	4	3+	3-	3+	2	3-	3-	2+	2+	
Est. cover Spring 2014	2	2+	2+	3	3-	2+	2	-	3	3-	2-	1	-	-	2	3-	4-	3-	2+	3-	2+	2+	2+	2	2+	
Est. cover Autumn 2014	2+	2+	2+	2*	3+^	3	2	-	3*	3	2	2	-	-	2	2+	4-	3-	2	3+	2	2	3-	2	2	

EXOTIC SPECIES

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
*Acetosella vulgaris**	1	1				1									+	+		1		+		r	1			9
*Aira sp.**										1																1
*Anagallis arvensis**	r														+	+	r	+	+			1	r	+		9
*Arctotheca calendula**																									+	1
*Avena sp.**						1				1														r	+	4
*Bromus sp.**						1				1								2-		+			1	1	1	7
*Carthamus lanatus**						+														+						2
*Centaurium sp.**	1	1				1									+	+	1				+	+	1		+	10
*Cerastium sp.**										+																1
*Chondrilla juncea**															1	+		r		+						4
*Cirsium vulgare**	+	r				+									1	r	+	+	1		+	r	r	1		12
*Conyza sp.**	1	+				1									1	1		1	+	r	3	r	+	1	1	13
*Cynodon dactylon**										1														1		2
*Cyperus eragrostis**																			r							1
*Dactylis glomerata**																	+									1
*Echium vulgare**										r					1	1		+	+	r	1		r			8
*Eleusine tristachya**						+												1	1					1	1	5
*Eragrostis curvula**	+	r																+		+		r		r	1	7
*Eragrostis mexicana**																							1			1
*Erodium cicutarium**																		1	+	2-	+		1			5
*Gamochaeta purpurea**																+										1
*Gamochaeta sp.**	+	+								+							+	r								5
*Hirschfeldia incana**																		r	+				+			3
*Hypericum perforatum**	1	+													2	1		+	+		1	1	+	+	1	11
*Hypochaeris radicata**	2	2-				2				2-					+	+	1	1	+	1		+	+	+	+	14
*Lolium perenne**										+									+							2

EXOTIC SPECIES

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
*Malva sp.**																		r								1
*Marrubium vulgare**																r										1
*Modiola caroliniana**															1				+					r	+	4
*Nassella trichotoma**																						r		r		2
Oenothera sp.															1	+										2
*Panicum capillare**																		2-	+				+	r		4
*Panicum sp.**						+																		r		2
*Paronychia brasiliana**																r			+			r	r			4
*Paspalum dilatatum**										1					r		1		r		r			+	2-	7
*Phalaris aquatica**						2-				1							1								1	4
*Plantago lanceolata**	1					1				2-					1	r	2-	1	1	1		+	+	1	1	13
*Polygonum aviculare**						1													1							2
*Rosa rubiginosa**	+	r															r									3
*Salvia verbenaca**																		1								1
*Sanguisorba minor**															+										r	2
*Setaria sp.**																	r							r		2
*Solanum chenopodioides**																					+					1
*Solanum nigrum**															+	+							r			3
Solanum triflorum																					r					1
*Sonchus sp.**															+			r			+		r			4
*Spergularia rubra**						1													r				r			3
*Taraxacum officinale**		r															+						r			3
*Tolpis umbellata**						r										+				r		+				4
*Trifolium arvense**																	+	+		+		+			r	5
*Trifolium sp.**																	1	1	+	+			+	r		6
*Trifolium subterraneum**		r				1												1		+		+	1			6

EXOTIC SPECIES

Species	Plot 01	Plot 02	Plot 03*	Plot 04*	Plot 05*	Plot 06	Plot 07	Plot 08	Plot 09*	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	No. of plots in which sp. occurs
*Verbascum thapsus**						1									1	1				r			r			*5*
*Verbena bonariensis**															2+	+					+				r	4
*Vulpia sp.**																+										1
Sp. with score of 1	**5**	**2**	–	–	–	**10**	–	–	–	**6**	–	–	–	–	**8**	**4**	**5**	**9**	**4**	**2**	**2**	**2**	**6**	**6**	**7**	
Sp. with score of 2	**1**	**1**	–	–	–	**2**	–	–	–	**2**	–	–	–	–	**2**		**1**	**2**	–	**1**	–	–	–	–	**1**	
Sp. with score of 3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**	–	–	–	–	
Sp. with score of 4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Sp. with score of 5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
TOTAL EXOTIC	**11**	**11**	**0**	**0**	**0**	**17**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**18**	**19**	**14**	**22**	**19**	**15**	**11**	**14**	**22**	**18**	**16**	
Est. cover Autumn 2016	**2**	**2**	**-**	**-**	**-**	**3-**	**-**	**-**	**-**	**3-**	**-**	**-**	**-**	**-**	**3**	**2-**	**2**	**3-**	**2-**	**2-**	**3**	**1**	**2-**	**2-**	**2**	
Est. cover Spring 2015	3-	2-	-	-	-	4-	-	-	-	3	-	-	-	-	3-	2+	2+	3+	2-	3+	2-	3-	2+	2+	3-	
Est. cover Autumn 2015	2	2	3+	2-	3-	2+	-	-	2-	3+	-	4+	-	-	3	1	2-	2+	1	2+	1	1	2+	2-	2	
Est. cover Spring 2014	2+	2	3+	3	4	3+	4+	-	4-	3	4+	4	-	-	3	2	2	4	2	4	3	3	3	2	3	
Est. cover Autumn 2014	1	2	3	2*	3	3	4-	-	2	2	4-	4+	-	-	3+	2-	2-	3+	2	4-	4-	2-	2	2-	3-	

2- = Spring 2015 score reduced from 2 to 2-

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601

BRISBANE
PO Box 1422
Fortitude Valley QLD 4006
T 0400 494 366

1300 646 131
www.ecoaus.com.au