umwelt

Inspired people | Dedicated team
Quality outcomes

Australian Government
Department of Finance

YEAR 2 / BASELINE VEGETATION CONDITION MONITORING REPORT

Block 48 Wallaroo Road, Hall ACT

FINAL

January 2016

Australian Government
Department of Finance

YEAR 2 / BASELINE VEGETATION CONDITION MONITORING REPORT

Block 48 Wallaroo Road, Hall ACT

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Department of Finance

Project Director:	Peter Cower
Project Manager:	Rob Armstrong
Report No.	8018C/R04/V1
Date:	January 2016

Canberra

PO Box 6135
56 Bluebell Street
O'Connor ACT 2602

Ph. 02 6262 9484

www.umwelt.com.au

Table of Contents

Figures

Appendices

1.0 Introduction

1.1 Background

Umwelt (Australia) Pty Ltd (Umwelt) was commissioned by the Commonwealth Department of Finance ('Finance') to undertake 'Year 2' vegetation condition monitoring for Block 48 Wallaroo Road, Hall, ACT (the 'Project Area').

The Project Area is approximately 66 hectares. As determined by Umwelt (2016[1]), it contains approximately 14 hectares of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland (Box Gum Woodland), an ecological community listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and endangered under the ACT *Nature Conservation Act 2014* (NC Act). The Project Area also contains approximately 2.3 hectares of the ecological community 'Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT' (NTG) (Umwelt, 2016), listed as endangered under the EPBC Act and the NC Act.

A Vegetation Management Plan (VMP) was developed for the Project Area by Kellogg Brown & Root Pty Ltd (KBR) in 2014 (KBR, 2014[2]), updated by Umwelt (2016). The VMP stipulates the need for monitoring of fixed vegetation quadrats, the locations of which were determined during the 2013 Vegetation Condition Assessments.

This report presents the following:

- The methodology and results of baseline monitoring using methods outlined in the ACT Vegwatch manual (Sharp and Gould, 2014[3]) and the Floristic Value Scores method (Rehwinkel, 2007[4]).
- The methodology and results of Year 2 monitoring using the methodology applied by Biosis (2015[5]), completed as per the requirements of the VMP.

The results of this monitoring will inform Finance in prioritising management measures aimed at ensuring the long term preservation of significant ecological values.

1.2 Objectives of the Project

The primary objectives of the project are to:

- undertake the baseline and Year 2 monitoring of the Project Area
- collate the data, analyse it against the performance indicators and provide the data and analysis to Finance (not possible for Year 2 data, baseline data is presented for future monitoring purposes)
- review mitigation actions recommended by Biosis (2015), and apply where threats to Box Gum Woodland or NTG are identified.

[1] Umwelt (2016) Vegetation Management Plan: Block 48 Wallaroo Road. Draft Report prepared for Department of Finance, January 2016.

[2] KBR (2014) Block 48 Wallaroo Road, Vegetation Management Plan. Prepared for Department of Finance by Kellogg Brown and Root Pty Ltd, 5 March 2014.

[3] Sharp. S. and Gould, L. (2014) ACT Region Vegwatch Manual: Vegetation and habitat condition assessment and monitoring for community. Molonglo Catchment Group, 2014

[4] Rehwinkel, R (2007) A Method to Assess Grassy Ecosystem Sites: Using Floristic Information to Assess a Site's Quality. NSW Department of Environment and Climate Change, November 2007.

[5] Biosis (2015) Block 48, Hall ACT – Year 1 Vegetation Condition Monitoring Report. Prepared for the Commonwealth Department of Finance, Final V2, March 2015.

1.3 Acknowledgements

The monitoring report for Block 48 Wallaroo Road has relied on the following previous work:

- the Biosis (2015) vegetation monitoring report, of which much of the original text have been adopted (noting that the methodology has largely changed since this report based on the current project brief)
- the KBR (2014) VMP, which provides guidance on the initial methodology.

2.0 Methodology

As stipulated in the project brief, monitoring was undertaken using a quadrat-based method applied by KBR (2014) and Biosis (2015), as well as quadrat methods outlined by Sharp and Gould (2014). The monitoring was undertaken by two ecologists on 2 November 2015, covering:

- two 20 x 20 metre quadrats in NTG, with 50 metre step-point transects and 10 x 10 metre nested quadrats
- eight 20 x 20 metre Box Gum Woodland quadrats, with 50 metre step-point transects and with 10 x 10 metre nested quadrats.

Twenty by twenty metre quadrats were required to satisfy the methodology outlined in Sharp and Gould (2014) (baseline monitoring), with 10 x 10 metre quadrats nested within to satisfy the methodology outlined in KBR (2014) (Year 2 monitoring).

Note that one quadrat mapped by KBR (2014) as occurring in Box Gum Woodland was resolved by Umwelt (2016) to actually be occurring within NTG (Refer to **Section 4**).

The location of these quadrats is shown in **Figure 2.1.**

2.1 Year 2 Monitoring

2.1.1 Data Collected for Each Quadrat

Each 10 x 10 metre quadrat was marked out with survey flags using a hand-held GPS, nested within 20 x 20 metre quadrats used for baseline monitoring. For each quadrat, in addition to recording soil damage from stock and presence of threatened flora and fauna, the percentage cover for each the following variables was collected using the field sheets provided with the KBR (2014) VMP:

- all indigenous species
- all indigenous grass species
- key grass species (NTG Quadrat only) (*Themeda triandra*, *Poa labillardierei* var. *labillardierei*, *Rytidosperma* spp. and *Austrostipa* spp.)
- herbs and forbs
- sedges and rushes
- exotic species
- weeds of national significance (WoNS) and noxious weeds
- bare ground
- surface rock
- moss, lichens and soil crust
- organic litter
- canopy, immature canopy and recruiting canopy (Box Gum Woodland quadrats only).

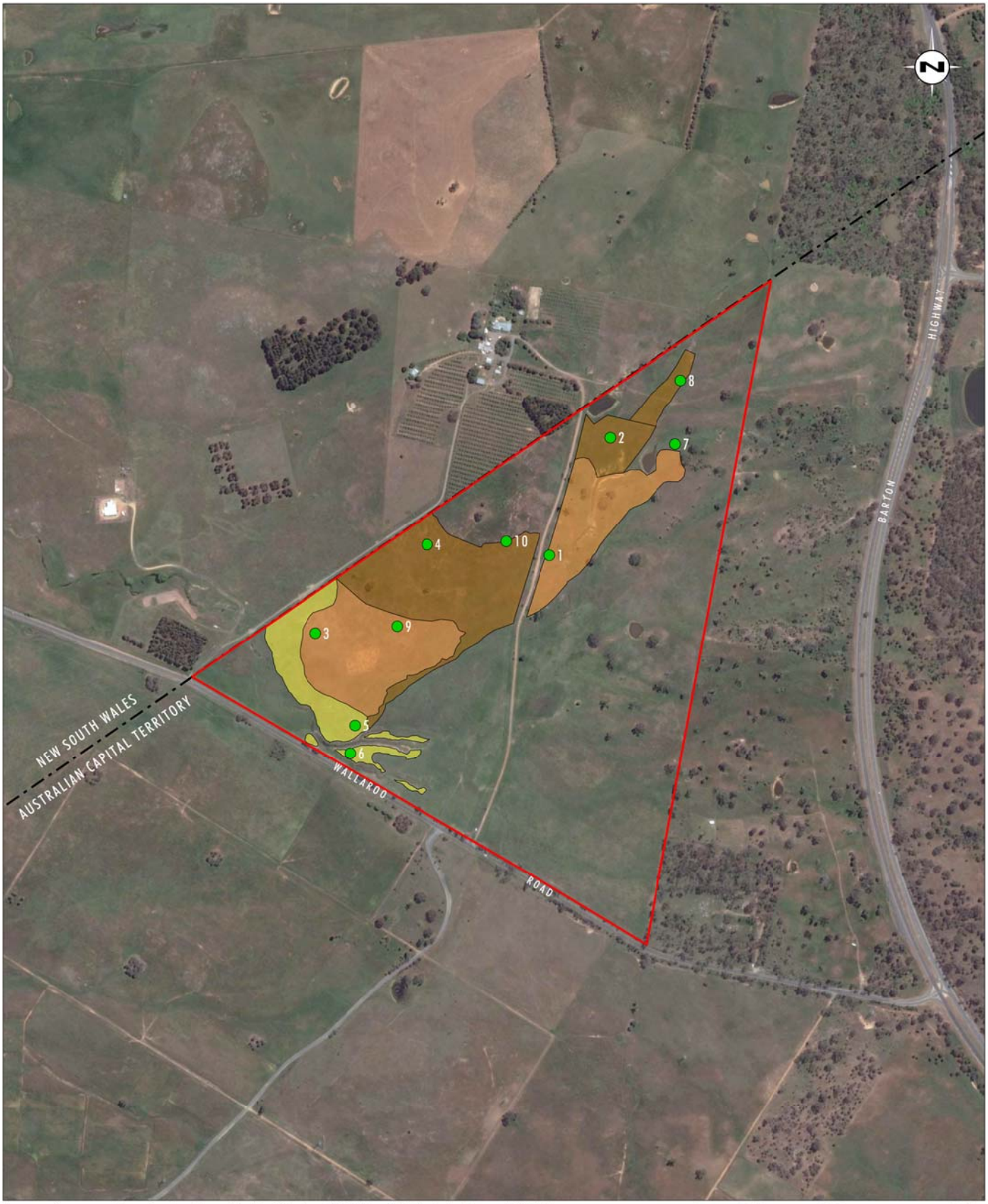


Image Source: Google Earth - DigitalGlobe (2015), CNES / Astrium (2015)

0 100 250 500m

1:10 000

Legend

- Project Area (Block 48)
- State Boundary
- Box Gum Grassy Woodland and Derived Grassland
- Box Gum Grassy Woodland and Derived Grassland HQ
- Natural Temperate Grassland
- Plot Location

FIGURE 2.1

Plot Locations and Vegetation

File Name (A4): R04/8018_011.dgn
20160115 14.55

All percentage cover metrics were estimated through visual subjective assessment. In addition to the above data, an inventory of the native species present was made for each quadrat. For the Box Gum Woodland quadrats, the number of native non-grass species and the number of 'important species' (from EPBC Act Policy Statement 3.5) was also noted. Dominant pasture weeds, significant weeds and impacts of pest animals were recorded where relevant to management actions.

With regards to the methods of recording cover, as per KBR's methodology, percentage cover of most features (indigenous species, exotic species, surface rock, moss, lichen and soil crust, litter, and bare ground) was recorded in a manner which allowed for overlap. Recording percentage cover in this manner often results in the total adding to considerably more than 100. Within the 'per cent cover of indigenous species' and the 'per cent cover of exotic species' categories, the constituent groups were required to equal the total for the category. Accordingly, this report determines whether Year 1 targets have been met.

2.1.2 Analysis

The quadrat results were compared to the Year 1 targets which are presented in the KBR (2014) VMP. These targets are shown in **Table 2.1** below. The results were also compared to the baseline monitoring data presented in the Vegetation Condition Assessment. The results are presented in **Section 3**.

Note that the KBR (2014) report has targets for Year 1, 3 and 5. As such, there are no Year 2 targets to compare with. Accordingly, this report determines whether Year 1 targets have been met.

A comment on targets

On Commonwealth land, the Australian Government is obliged to maintain MNES rather than seek an increase in value. Accordingly, targets should be set to ensure that that each MNES is *maintained* rather than *improved* with respect to extent and condition indicators. The only exceptions to this are:

- for the establishment of an advance offset site in accordance with the EPBC Act offset policy for which a known baseline of quality will be determined and targets for improvements in relevant MNES are established in order to demonstrate early delivery of environmental gain, or
- in the event of a site being used as an offset, in which case improvement criteria would be set out in an Offset Management Plan in accordance with targets for quality, distribution or population improvements established through an approval from the Minister for the Environment under the EPBC Act.

The VMP prepared by KBR (2014) described its objective as seeking to maintain MNES however also included targets for the enhancement of natural values (apart from the targets for controlling threatening processes such as weeds). As demonstrated by Biosis (2015) and subsequently Umwelt (2016), the monitoring methods and baseline described by KBR (2014) were inappropriate for ongoing comparison. Accordingly application of targets for improvement are meaningless in terms of Finance's statutory obligations under the EPBC Act, the objectives for the VMP as stated and utility of the baseline data.

Notwithstanding the above, basic analysis has been undertaken and is presented in **Table 3.1**.

2.1.3 Additional Information

Prior to engagement and based on a recommendation from the Biosis (2015) report, Finance determined that methods developed by Sharp and Gould (2014) should be applied for future monitoring. Based on the experience of Biosis (2015) and Umwelt's review, it was apparent that methods applied by KBR (2014) were not repeatable for the purpose of monitoring changes in condition. For instance, the percentage of vegetation cover variables was estimated in a subjective fashion, and there was no separation between

annual and perennial exotic vegetation considered important for grassy ecosystem management. The methods outlined in **Section 2.2** are well-accepted and broadly applied in grassy ecosystem monitoring programs in the region, and as such are more appropriate to determine changes in condition over time with regards to EPBC Act listed matters.

2.2 Baseline Monitoring

Following two years of data collection using the methods outlined above (**Section 2.1**), a simpler and more repeatable technique commonly used in the Southern Tablelands was adopted, based on the recommendation of Biosis (2015) and Finance. Given the lack of relationship with the previous highly qualitative methods, assessment undertaken by Umwelt in spring 2015 should be considered as baseline.

Georeference information for each quadrat is shown in **Table 2.2**. Georeference information is in MGA55, with eastings and northings taken from the start of the transect. The quadrat/transect design is shown in **Figure 2.2**.

Table 2.1 Targets at Year 1, from KBR (2014) VMP

Management Unit	Variable	Target at Year 1[1]
high quality Box Gum Woodland quadrats	native grass cover	50%
	species richness*	10% increase
degraded Box Gum Woodland quadrats	native grass cover	50%
	species richness*	2% increase
NTG quadrat	native grass cover	60%
	extent**	no reduction in extent
all Box Gum Woodland quadrats	eucalypt cover (recruits, saplings, and mature trees)	1% total cover
	number of non-grass species	12
	length of logs	0.5 metres
all monitoring quadrats	herb, forb, rush, and sedge cover	10% cover
	bare ground	10% cover
	organic litter	5% cover
	total exotic species cover	<25% cover

[1] No year 2 targets available for comparison.
*Interpreted by Biosis (2015) and this project as 'native species richness'. The only measure of native species richness that KBR recorded was non-grass species (assumed to be native non-grass species).

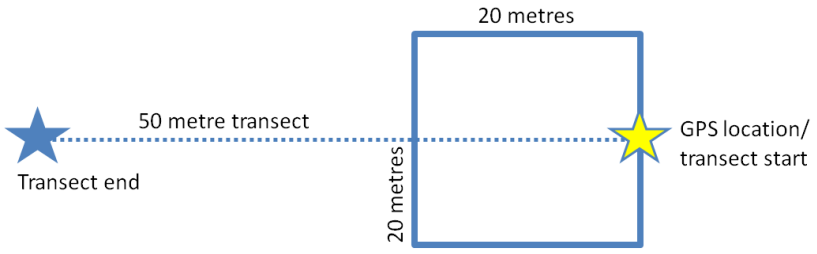


Figure 2.2

Quadrat and transect design

Table 2.2 Quadrat Locations and Transect Bearings

Quadrat	Easting	Northing	Transect Bearing
Q1	687024	6106563	09°
Q2	687137	6106782	215°
Q3	686588	6106418	195°
Q4	686796	6106583	157°
Q5	686662	6106246	265°
Q6	686653	6106194	67°
Q7	687258	6106770	195°
Q8	687268	6106889	10°
Q9	686740	6106431	95°
Q10	686943	6106589	51°

2.2.1 Data Collected for Each Quadrat/Transect

Table 2.3 Data Collected for Each Quadrat and Transect

Variable	Method
20 x 20 metre quadrat	
Native plant species richness	Native plant species refers to vascular species local to the area which, if planted, come from a local seed source. Systematically walk the plot counting the number of native plant species for all vascular plants (i.e. the species do not have to be identified).
Native midstorey cover	The mid-storey contains all vegetation between the overstorey stratum and 1m in height (typically tall shrubs, under-storey trees and tree regeneration) and includes all species native to the ACT (i.e. native species not local to the area can contribute to mid-storey structure). Foliage cover of the mid-storey is expressed as a % and can be measured using the following method: At 10 points along the 50m transect (i.e. every 5m) estimate per cent foliage cover in the mid-storey. Divide the total by the number of points (i.e. 10) measured along the transect (e.g. 50%, 0%, 0%, 40%, 0%, 45%, 50%, 55%, 0%, 0% = 240/10 =24% foliage cover).
At 10 points along 50 metre transects	
Native overstorey cover	Native over-storey is the tallest woody stratum present (including emergent trees) above 1m and includes all species native to the ACT (i.e. native species not local to the area can contribute to overstorey structure). In a woodland community the over-storey stratum is the tree layer, and in a shrubland community the over-storey stratum is the tallest shrub layer. Some vegetation types (e.g. grasslands) may not have an over-storey stratum. Over-storey cover is estimated as per cent foliage cover, which is equivalent to the amount of shadow that would be cast on the ground if there were a light source directly overhead and can be estimated using the following method: At 10 points along the 50 m transect (i.e. every 5 m) estimate per cent foliage cover directly overhead using the images provided on Page 4. Divide the total by the number of points (i.e. 10) measured along the transect (e.g. 50%, 0%, 0%, 40%, 0%, 45%, 50%, 55%, 0%, 0% = 240/10 =24% foliage cover).
At 50 points along 50 metre transects	
Native ground cover (grasses)	The ground stratum contains all native vegetation below 1m in height and includes all species native to the ACT (i.e. is not confined to species indigenous to the area). The ground stratum (grasses) refers to native grasses (i.e. plants belonging to the family Poaceae). The ground stratum (forbs) refers to native forbs. The ground stratum (sedges) refers to native sedges. The ground stratum (rushes) refers to native rushes.
Native ground cover (shrubs)	
Native ground cover (forbs)	
Native ground cover (sedges)	

Variable	Method
Native ground cover (rushes)	The ground stratum (ferns) refers to native ferns. Foliage cover of the ground stratum (grasses) is expressed as a % and can be measured using the following method: At 50 points along the 50m transect (i.e. every 1 m) record whether native grass intersects that point. Divide the total of 'hits' by the number of points measured along the transect (i.e. 50).
Native ground cover (ferns)	
Perennial Exotic plant cover	Perennial exotic plants are vascular perennial plants not native to Australia. Perennial exotic cover is measured as a % of total ground cover vegetation.
Annual Exotic plant cover	Perennial exotic plants are vascular perennial plants not native to Australia. Perennial exotic cover is measured as a % of total ground cover vegetation.
Additional Variables (not collected, may be relevant pending future restoration of Box Gum Woodland)	
Over-storey regeneration	*Collected across entire zone.* Regeneration is measured as the proportion of over-storey species present at the site that is regenerating (i.e. with dbh < 5cm). For example if there are three tree species present at the site but only one of these species is regenerating, then the value is 0.33. The maximum value for this measure is 1.
Total length of fallen logs	*Collected in 20 x 50 metre quadrat.* This is the total length of logs at least 10cm diameter and at least 0.5 metres long. The diameter is estimated with a measuring tape (or callipers if available) held horizontally immediately above the log and the length is estimated to the nearest metre by measuring with a tape, or pacing, along the part of the log that is at least 10cm diameter. If estimating length by pacing then the actual length of a sample of logs should be measured regularly with a tape so the assessor can calibrate their estimate derived from pacing. Only those parts of logs lying within the plot are measured.
Number of large trees	*Collected in 20 x 50 metre quadrat.* This is a count of the number of living and dead trees within a 50mx20m plot which have a circumference of 150cm, 1m above ground height.

2.2.2 Floristic Value Score

Full-floristic data was also entered into the Floristic Value Score spreadsheet (Rehwinkel, 2007) in order to determine its floristic quality. The method is based upon the 'significant species' concept, which provides increased value to sites containing a variety of rare or grazing sensitive species. This is preferable over simple indicators such as floristic richness (or species count), which can provide value to sites with a number of unpalatable species.

2.2.3 Target Setting

On Commonwealth land, the Australian Government is obliged to maintain MNES rather than seek an increase in value. Accordingly, the only target required is to ensure that each MNES is maintained with respect to extent and condition indicators (variables in **Table 2.3**).

Should the Project Area be managed as an Offset in the future, improvement criteria should be set out in an Offset Management Plan.

2.2.4 Analysis

As a baseline survey, no analysis has been undertake. However, in future years it is recommended to undertake simple regression analysis of:

- Floristic Value Score
- each of the variables outlined in **Table 2.2**.

3.0 Results

3.1 Year 2

A comparison of the performance of 10 x 10 metre quadrats in comparison to previous years and targets set out in the original VMP (KBR, 2014; **Table 2.1**) are presented in **Table 3.1**. All entries are percentages except for 'number of non-grass species', 'number of important species', and 'number of native species', which are species counts.

Trends across years are difficult to determine as any variables related to percentage cover are estimates only, and are likely to vary between observers (a phenomenon known as observer bias). As monitoring has been undertaken by three separate ecologists (or groups thereof), interpretation of these results needs to account for observer bias. For such a subjective method, this is also true across years, albeit to a lesser extent.

Notwithstanding this, each quadrat is currently considered to be meeting some targets set out in the original VMP (KBR, 2014). **Table 3.1** highlights targets that are currently being met in green, with targets currently not being met in red. Non-highlighted cells do not have targets, or are from previous years.

Perhaps the best result is in the notable increase in vegetation cover. Approximately three months prior to the 2015 survey, stock was removed from Block 48 to allow for recovery. For the most part, vegetation cover has increased and is currently at levels considered acceptable based on local observations (note there are no metrics for comparison). Importantly, vegetation cover within golden sun moth (*Synemon plana*; critically endangered under the EPBC Act) habitat is at an acceptable level, although an upper threshold of c. 80 per cent should be set as exceedingly high vegetation cover will reduce opportunities for breeding within intertussock spaces.

Numerous noxious weeds were observed, and the location of these have been marked and provided in the updated VMP (Umwelt, 2016). These include serrated tussock (*Nassella trichotoma*), St John's wort (*Hypericum perforatum*) and blackberry (*Rubus fruticosus* agg.). These should be controlled in line with the VMP to ensure they do not degrade higher conservation value landscapes.

Table 2.1 targets an increase in the extent of NTG. The extent of NTG within the Project Area has increased, but not as a result of management. A small area of approximately 0.5 hectares of NTG was identified by KBR (2014) along the southern boundary surrounding the drainage lines, with an additional area of 1.8 hectares identified by Umwelt (2015), bringing the total to 2.3 hectares. The additional area was identified in the south-east is immediately north of the creek near Wallaroo Road and extends to an area adjacent to the NSW boundary, scaling the slope of the west-facing hill to about the 600 metre contour, a common scenario on exposed west-facing hills (Armstrong et al, 2013[6]). Accordingly, the extent of Box Gum Woodland has decreased by 1.8 hectares however this should not be considered a function of management failure but a consequence of more appropriate interpretation of landform, floristics and condition in comparison to published and legal definitions of the community.

No threatened flora or fauna species were recorded opportunistically within the Project Area during the survey. A native and exotic species list is presented as **Appendix 1**.

[6] Armstrong RC, Turner K, McDougall KL, Rehwinkel R & Crooks J (2013) Plant Communities of the Upper Murrumbidgee Catchment in New South Wales and the Australian Capital Territory. *Cunninghamia* **13**:125-265. http://www.rbgsyd.nsw.gov.au/__data/assets/pdf_file/0019/128521/Cun131arm125.pdf.

Table 3.1 Block 48 Vegetation Quadrat Data, Baseline (KBR 2014), Year 1 (Biosis), and Year 2 (Umwelt)

Variable	Q 1 (Box Gum HQ)			Q 2 (Box Gum LQ)			Q 3 (NTG)			Q 4 (Box Gum LQ)			Q 5 (NTG)		
	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2
total indigenous cover	65	50	**75**	50	40	**70**	80	80	**70**	55	30	**35**	75	80	**55**
indigenous grass cover	55	40	**65**	45	35	**75**	45	50	**60**	54	30	**30**	60	70	**35**
indigenous non-grass cover	10	15	**5**	5	5	**5**	35	30	**10**	1	0	**5**	15	10	**35**
sedge and rush cover	1	4	**x***	2	2	**x***	2	4	**x***	0.5	0	**x***	5	5	**x***
herb and forb cover	9	1	**5**	3	3	**5**	33	26	**10**	0.5	0	**5**	10	5	**20**
total exotic cover	25	65	**20**	35	80	**10**	2	18	**10**	35	75	**30**	20	25	**15**
WoNS cover	0	0	**<1**	0.5	1	**0**	0	0	**0**	0	0	**0**	0	0	**0**
noxious weed cover	1	0.5	**<5**	0.5	3	**0**	0	0	**0**	0	0.5	**0**	3	0.5	**0**
bare ground	25	15	**2**	15	5	**5**	25	25	**5**	15	20	**1**	5	1	**10**
rock cover	3	3	**3**	0	0	**0**	5	15	**5**	1	1	**1**	0.5	0.5	**5**
moss and lichen cover	3	3	**2**	0	0	**0**	7	18	**5**	1	1	**1**	0.5	1	**0.5**
organic litter	2	5	**3**	2	5	**5**	1	1	**5**	2	2	**1**	5	5	**15**
logs	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
characteristic grass cover	55	40	**65**	45	35	**75**	45	50	**60**	54	30	**30**	60	70	**35**
no. of native non-grass species	18	16	**18**	15	10	**14**	18	5	**16**	3	1	**6**	13	9	**10**
no. of important species	7	7	**6**	5	5	**5**	8	4	**7**	1	0	**2**	6	5	**5**
no. of native species	-	21	**26**	-	13	**18**	-	9	**21**	-	4	**12**	-	13	**14**
canopy cover	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
immature canopy cover	0	0	**1**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
recruiting eucalypt cover	0.5	0.5	**1**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
total eucalypt cover	0.5	0.5	**2**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**

***** Information not collected, not included on original proforma.

Table 3.1 (continued) Block 48 Vegetation Quadrat Data, Baseline (KBR 2014), Year 1 (Biosis), and Year 2 (Umwelt)

Variable	Q 6 (NTG)			Q 7 (Box Gum HQ)			Q 8 (Box Gum LQ)			Q 9 (Box Gum HQ)			Q 10 (Box Gum LQ)		
	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2	B	Y 1	Y 2
total indigenous cover	80	80	**75**	65	40	**50**	60	45	**45**	70	65	**45**	45	15	**40**
indigenous grass cover	65	65	**65**	55	25	**50**	45	30	**44**	55	50	**40**	43	15	**40**
indigenous non-grass cover	10	15	**5**	10	15	**1**	15	15	**1**	15	15	**5**	1	0	**0.5**
sedge and rush cover	5	1	**x***	5	11	**x***	8	13	**x***	5	5	**x***	0.5	0	**x***
herb and forb cover	15	14	**10**	5	4	**1**	7	2	**1**	10	10	**5**	0.5	0	**0.5**
total exotic cover	10	15	**20**	35	70	**20**	40	50	**45**	15	30	**1**	45	85	**40**
WoNS cover	0	0	**0**	0	0	**0**	0	0	**0**	0.5	0.5	**0**	0	0	**0**
noxious weed cover	0.5	0	**0**	0	0	**0**	0.5	0.5	**0**	2	3	**0**	5	5	**0**
bare ground	15	2	**1**	3	2	**5**	10	25	**5**	20	25	**10**	15	5	**10**
rock cover	0	0	**0**	0	0	**0**	1	2	**0**	5	3	**1**	7	7	**1**
moss and lichen cover	0	0	**0**	0	0	**0**	1	2	**0**	10	12	**3**	5	5	**1**
organic litter	3	8	**1**	15	9	**5**	5	5	**5**	3	4	**10**	5	2	**10**
logs	0	0	**0**	0.5	0.5	**0**	0	0	**0**	0	0	**0**	0	0	**0**
characteristic grass cover	63	65	**65**	55	25	**50**	45	30	**44**	55	50	**40**	43	15	**40**
no. of native non-grass species	n/a	n/a	**13**	12	6	**17**	14	7	**12**	16	6	**12**	6	1	**5**
no. of important species	n/a	n/a	**5**	4	2	**3**	5	3	**2**	3	4	**5**	1	0	**1**
no. of native species	n/a	n/a	**20**	-	12	**21**	-	12	**16**	-	10	**17**	-	4	**9**
canopy cover	0	0	**0**	1	1	**0**	0	0	**0**	0	0	**0**	0	0	**0**
immature canopy cover	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**
recruiting eucalypt cover	0	0	**0**	0	0.5	**0**	0	0	**0**	0	0	**0**	0	0	**0**
total eucalypt cover	0	0	**0**	1	1.5	**2**	0	0	**0**	0	0	**0**	0	0	**0**

3.2 Baseline

No analysis was undertaken on the baseline data due to a lack of comparison datasets. **Table 3.2** provides a summary of the data collected, which may be used for trend analysis in future years.

Table 3.2 Benchmark Data

Variable	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Floristic Value Score	29	15	24	5	14	17	11	9	15	4
Native plant species richness	26	18	21	12	14	20	21	16	17	9
Native overstorey cover	0	0	0	0	0	0	0	0	0	0
Native midstorey cover	1	0	0	0	0	0	0	0	0	0
Native ground cover (grass)	64	48	58	30	48	74	50	54	50	50
Native ground cover (shrubs)	0	0	0	0	0	0	0	0	0	0
Native ground cover (forbs)	0	4	4	0	4	0	2	16	6	0
Native ground cover (sedges)	0	0	0	0	0	0	0	0	0	0
Native ground cover (rushes)	0	0	0	0	0	0	0	0	0	0
Native ground cover (ferns)	0	0	0	0	0	0	0	0	0	0
Perennial Exotic plant cover	10	24	8	30	4	4	24	10	10	2
Annual Exotic plant cover	12	16	24	30	28	20	14	16	28	32

4.0 Conclusion

As discussed in **Section 3.1**, determining trends in subjectively collected data is limited by observer bias and a lack of continuum three separate ecologists (or groups thereof) undertaking the assessment. As such, it is difficult to determine whether the site is changing in condition with any confidence. A combination of monitoring weeds as per the VMP (Umwelt, 2016) monitoring floristic values in 20 x 20 metre quadrats and 50 metre transects using more repeatable methods will increase confidence in observations. Adhering to the following recommendations will provide for a more robust monitoring program:

- Marking each 20 x 20 metre quadrat corner with permanent markers, as well as the start and end of each transect.
- Discontinuing original data collection methods as outlined in **Section 2.1**, and continuing with methods outlined in **Section 2.2**.
- Ensuring that conservation management actions outlined in the VMP (Umwelt, 2016) are undertaken.

5.0 References

Armstrong RC, Turner K, McDougall KL, Rehwinkel R & Crooks J (2013) Plant Communities of the Upper Murrumbidgee Catchment in New South Wales and the Australian Capital Territory. *Cunninghamia* **13**:125-265. http://www.rbgsyd.nsw.gov.au/__data/assets/ pdf_file/0019/128521/Cun131arm125.pdf.

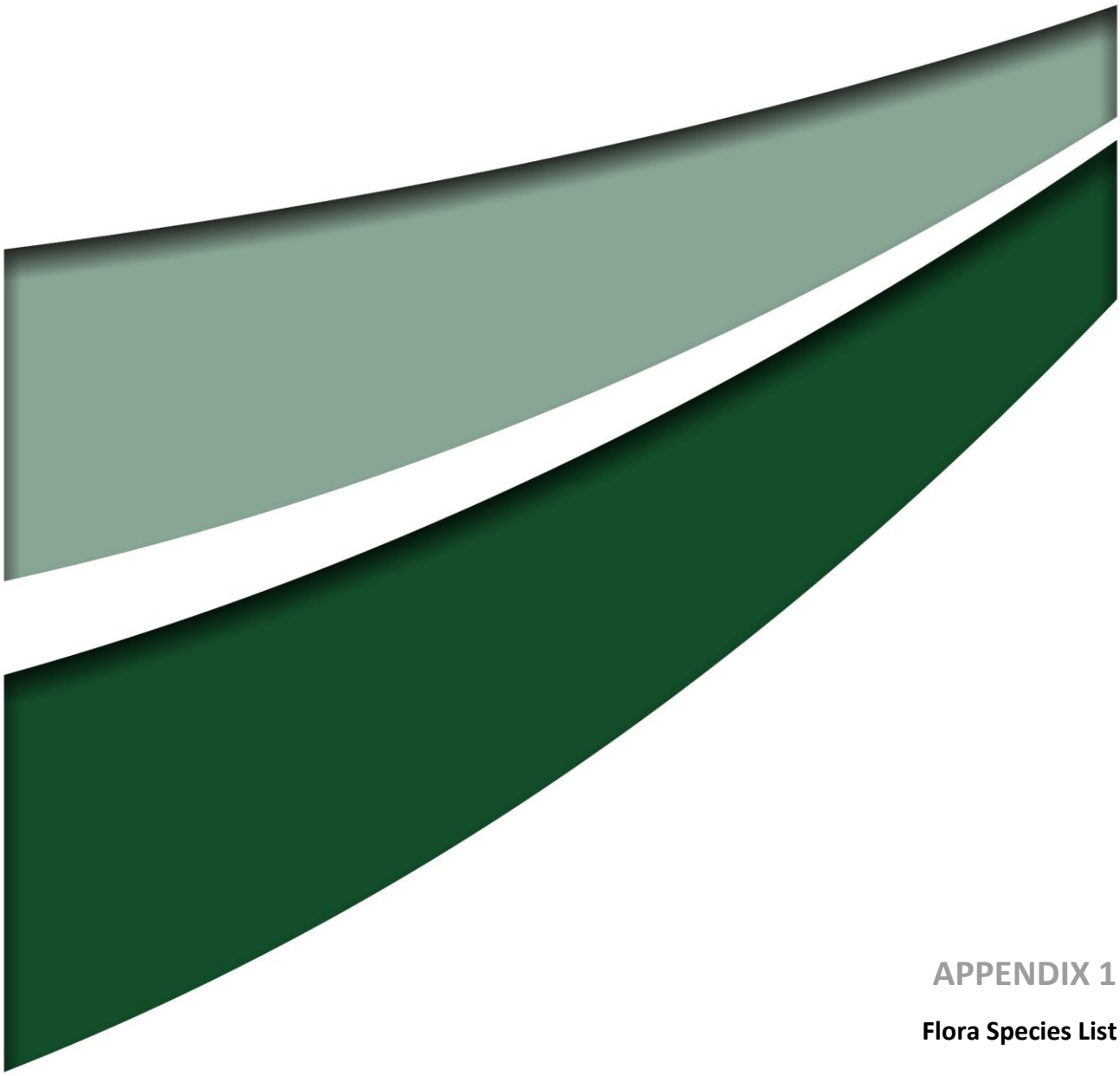
Biosis (2015) Block 48, Hall ACT – Year 1 Vegetation Condition Monitoring Report. Prepared for the Commonwealth Department of Finance, Final V2, March 2015.

KBR (2014) Block 48 Wallaroo Road, Vegetation Management Plan. Prepared for Department of Finance by Kellogg Brown and Root Pty Ltd, 5 March 2014.

Rehwinkel, R (2007) A Method to Assess Grassy Ecosystem Sites: Using Floristic Information to Assess a Site's Quality. NSW Department of Environment and Climate Change, November 2007.

Sharp. S. and Gould, L. (2014) ACT Region Vegwatch Manual: Vegetation and Habitat Condition Assessment and Monitoring for Community. Molonglo Catchment Group, 2014

Umwelt (Australia) Pty Limited (2016) Vegetation Management Plan: Block 48 Wallaroo Road. Draft Report prepared for Department of Finance, January 2016.



APPENDIX 1

Flora Species List

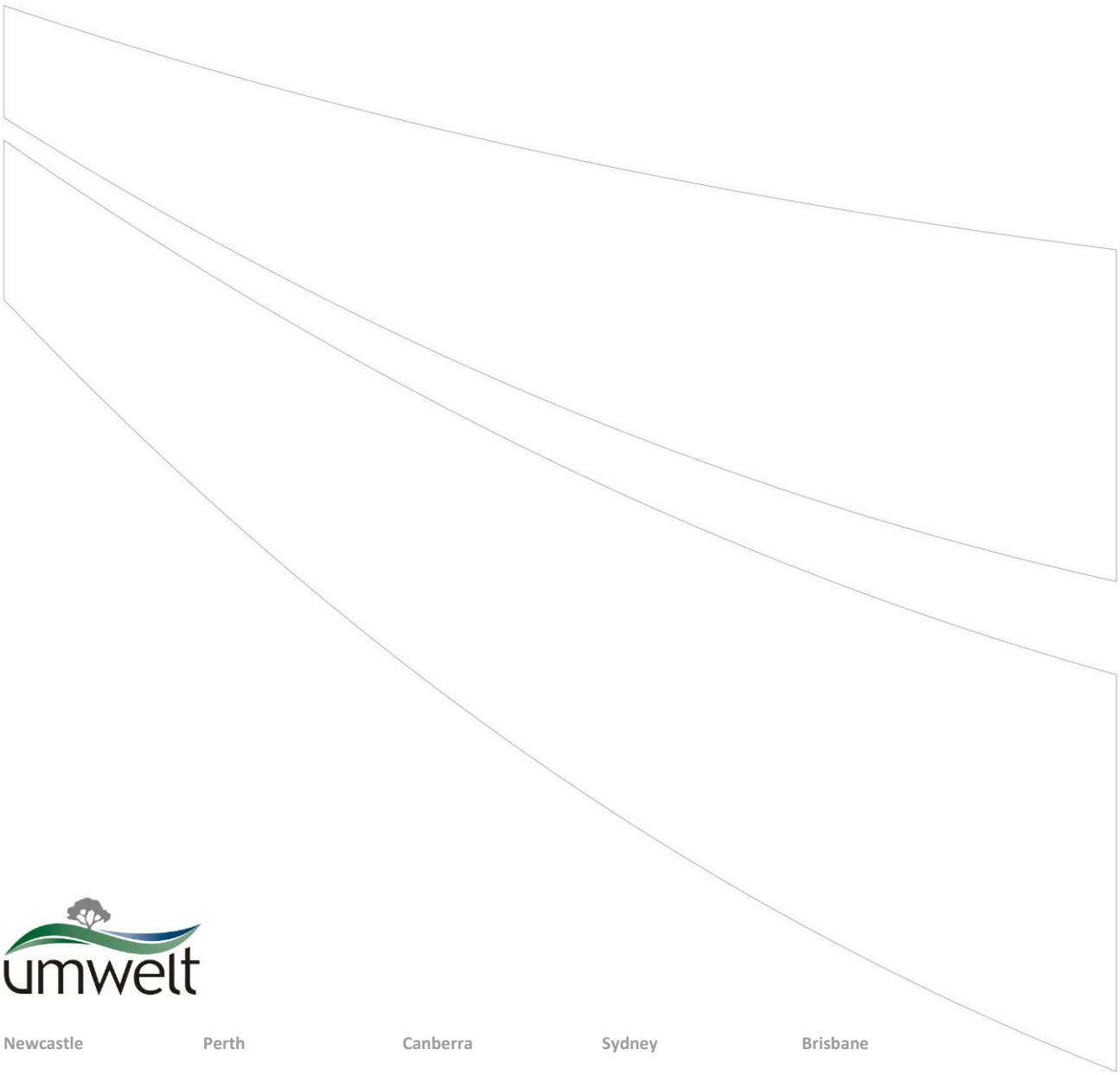
Species	1	2	3	4	5	6	7	8	9	10
*Acaena ovina**	x		x			x		x	x	
*Acetosella vulgaris**	x	x					x			
Aira sp.*	x	x	x	x	x	x	x	x	x	x
Amphibromus sp.							x			
*Arctotheca calendula**				x						x
Asperula conferta						x				
Austrostipa bigeniculata						x		x	x	
Austrostipa scabra			x	x	x	x				
Austrostipa scabra subsp. *falcata*									x	x
Avena sp.*	x	x	x	x	x		x		x	x
Bothriochloa macra	x		x	x		x			x	x
*Briza maxima**	x					x	x			
*Briza minor**	x	x			x	x	x			
*Bromus diandrus**				x					x	
*Bromus hordeaceus**		x			x			x	x	x
*Bromus molliformis**	x		x	x		x	x			
Carex appressa		x					x	x		
Carex sp.						x				
*Carthamus lanatus**	x	x	x	x	x				x	x
*Centaurium erythraea**	x	x	x		x	x		x		
Chamaesyce drummondii					x			x		
Cheilanthes sieberi	x									
*Chondrilla juncea**		x	x	x	x				x	x
Chrysocephalum apiculatum		x	x		x	x			x	
*Cirsium vulgare**	x		x		x					
Convolvulus angustissimus			x							x
Conyza sp.*			x							

Species	1	2	3	4	5	6	7	8	9	10
Cotula australis		x								
Crassula sieberiana					x					x
Cynoglossum suaveolens				x						
*Cynosurus echinatus**	x									
*Cyperus eragrostis**								x		
Desmodium varians			x	x					x	x
Dichelachne sp.							x			
Drosera peltata							x			
Drosera sp.		x								
*Echium plantagineum**	x	x	x	x					x	x
Eleocharis acuta							x			
Anthosachne scabra	x			x		x	x			x
Enneapogon nigricans			x							
Enteropogon acicularis		x								
*Erodium botrys**									x	
*Erodium cicutarium**		x		x	x				x	x
Eryngium ovinum	x									
Eucalyptus blakelyi	x						x			
Eucalyptus bridgesiana							x			
Euchiton gymnocephalus	x	x							x	
Euchiton sphaericus	x		x					x		
*Festuca arundinacea**						x	x			
*Festuca pratensis**						x				
*Gamochaeta purpurea**		x				x	x	x		
Glycine tabacina					x					
Goodenia hederacea			x							
Goodenia pinnatifida						x				

Species	1	2	3	4	5	6	7	8	9	10
Haloragis heterophylla							x	x		
*Holcus lanatus**	x	x			x		x	x		
*Hordeum leporinum**										x
Hypericum gramineum	x									
*Hypericum perforatum**	x									
*Hypochaeris glabra**		x	x	x	x		x	x	x	x
*Hypochaeris radicata**	x	x	x	x	x	x	x	x	x	x
Isolepis hookeriana							x			
Juncus bufonius							x			
Juncus filicaulis	x	x				x	x	x		
Juncus sp.	x					x		x		
*Lactuca serriola**				x						
Leptorhynchos squamatus	x	x			x	x		x		
*Lolium perenne**				x				x	x	x
Lomandra bracteata						x		x		
Lomandra filiformis subsp. *coriacea*	x	x	x	x	x		x	x	x	x
Lomandra filiformis subsp. *filiformis*	x	x	x	x					x	
Lomandra multiflora subsp. *multiflora*			x		x				x	
Luzula sp.	x					x				
Lythrum hyssopifolia							x			
Microlaena stipoides	x			x		x	x	x		
*Onopordum acanthium**		x								x
Panicum effusum	x	x	x		x					
*Paspalum dilatatum**	x	x				x	x	x		x
Persicaria prostrata							x			
*Petrorhagia nanteuilii**	x	x	x	x	x		x		x	x
*Phalaris aquatica**	x	x		x		x	x	x		x

Species	1	2	3	4	5	6	7	8	9	10
Pimelea curviflora			x							
*Plantago lanceolata**	x	x	x			x	x	x	x	
Plantago varia	x									
*Poa bulbosa**				x						
Poa sieberiana	x				x	x				
Polygonum aviculare								x		
Prunus sp.*							x			
*Rosa rubiginosa**		x				x			x	
Rumex brownii	x	x		x	x	x	x	x		x
*Rumex crispus**								x		
Rytidosperma carphoides	x	x	x		x	x		x	x	x
Rytidosperma sp.	x	x	x	x						
*Salvia verbenaca**				x						
*Sanguisorba minor **								x		
Schoenus apogon		x				x	x			
*Sonchus asper**	x									
*Sonchus oleraceus**				x						
Themeda triandra	x	x	x	x	x	x	x	x	x	
*Tolpis barbata**			x						x	x
Tragopogon sp.*				x						
Tricoryne elatior	x	x	x				x		x	
*Trifolium arvense**		x	x	x	x	x		x	x	x
*Trifolium campestre**			x	x	x					
*Trifolium dubium**		x						x		
*Trifolium glomeratum **	x	x	x		x	x	x	x	x	x
*Trifolium repens**	x			x				x		
Trifolium sp.*									x	x

Species	1	2	3	4	5	6	7	8	9	10
*Trifolium subterraneum**					x					
Triptilodiscus pygmaeus	x	x	x		x		x		x	
*Verbascum thapsus**									x	
*Vulpia myuros**		x			x			x		x
Vulpia sp.*	x		x	x		x	x			
Wahlenbergia communis	x			x					x	
Wahlenbergia luteola									x	
Wahlenbergia multicaulis			x					x		
Wahlenbergia sp.						x				
Wurmbea dioica			x							



umwelt

Newcastle	Perth	Canberra	Sydney	Brisbane
75 York Street Teralba NSW 2284	PO Box 8177 Subiaco East WA 6008 33 Ventnor Avenue West Perth WA 6005	PO Box 6135 56 Bluebell Street O'Connor ACT 2602	50 York Street Sydney NSW 2000	GPO Box 459 Brisbane QLD 4001
Ph. 02 4950 5322	Ph. 08 6260 0700	Ph. 02 6262 9484	Ph. 1300 793 267	Ph. 1300 793 267

www.umwelt.com.au