M2G Biodiversity Offset Monitoring Report Spring 2020

Icon Water

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Template 2.8.1

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Abbreviations

Abbreviation	Description
ACT PCS	Australian Capital Territory Parks and Conservation Service
DBH	Diameter at Breast Height
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (*Commonwealth*)*
HBT	Hollow Bearing Tree
M2G	Murrumbidgee to Googong Water Transfer Project
MU	Management Unit
ODP	Offset Delivery Plan
RFAC	Regional Feral Animal Control

1. Introduction

1.1 Background

Eco Logical Australia Pty Ltd (ELA) was commissioned by Icon Water (formerly ACTEW Water) to deliver terrestrial ecology services as required by the environmental approval process for the Murrumbidgee to Googong Water Transfer Project (M2G).

The M2G projects falls under the jurisdiction of the Commonwealth (Department of the Environment and Energy, previously Department of Sustainability, Environment, Water, Population and Communities), NSW (Department of Planning), and ACT (ACT Planning and Land Authority) Governments and has been subject to assessment and environmental approval processes in all three jurisdictions. Project approval (granted in 2010) has been attained from all three governments, with a considerable number of approval conditions and commitments applied.

Under the environmental approvals process, Icon Water (conditioned as ACTEW Water) was required to provide compensatory habitat as an offset for vegetation and habitat losses arising from the construction activities for the M2G pipeline. The offset was required to be delivered to meet the conditions outlined in a range of documents, including but not limited to the Environmental Impact Statement (EIS) and Public Environment Report (PER) prepared for the development and relevant approval conditions.

1.2 Purpose of document

Under Condition 2.9b of the NSW Approval and Condition 3.1 of the Commonwealth approval conditions for the M2G Project (see Offset Delivery Plan (ODP) for further information), management and monitoring of the offset site is required. The ODP prepared by ELA (April 2012) describes the actions to be taken in establishing and managing the offset site according to the approval conditions and commitments, including the provision of monitoring actions (ELA, 2012).

This report details the spring monitoring surveys for 2020 that were undertaken in accordance with the methodology and aims established in the ODP. The purpose of this document is to report on the ecological condition of the site and the management actions conducted throughout the previous year/s in order to guide future actions within the offset site.

1.3 Study area

Icon Water own a land parcel in southern ACT (Block 1675), referred to here as the Williamsdale property (or 'the property'). The property is approximately 208 hectares in size and is located just south of Williamsdale. The property is bounded by the Monaro Highway to the east, the NSW border to the south, Angle Crossing Road to the north, and the Murrumbidgee River corridor to the west (**Figure 1**)**.** The monitoring surveys were conducted within the offset site (study area of approximately 110 ha), which is wholly contained within the property.

The offset site has been set aside for conservation due to its high biodiversity value, including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Woodland), threatened flora and fauna species, and/or threatened species habitat.

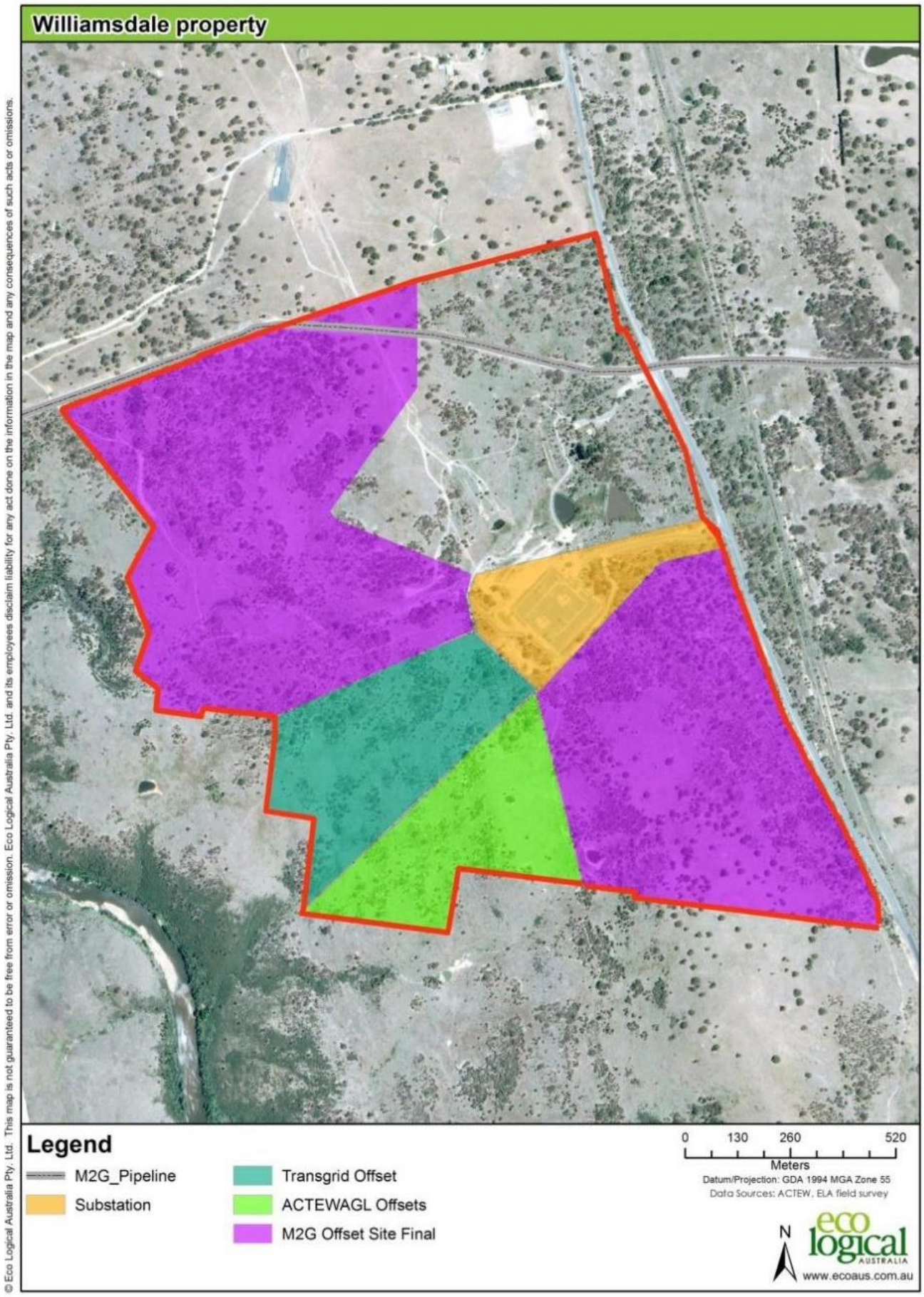

Figure 1: Study area

2. Methodology

The native vegetation and biodiversity values present within the offset site are managed under the ODP and its sub-plans. The ODP establishes the monitoring methodology for each of these values. A summary of the monitoring methodology outlined in the ODP and previous monitoring reports (ELA, 2013; ELA, 2014; ELA, 2015; ELA, 2016; ELA, 2018) is presented below, and is followed by the results of the spring 2020 monitoring surveys. It is noted that biennial monitoring has occurred since 2016.

2.1 Vegetation plot monitoring

The monitoring methodology has been adapted from the NSW Biobanking methodology to suit the offset site management requirements. The modified Biobanking methodology proforma uses a combination of quadrat and transect surveys to establish vegetation condition, and this approach is mirrored under the monitoring methodology.

Vegetation surveys have been designed to collect the following data:

- Species diversity, including native and exotic species.
- Cover abundance of native and exotic species.
- Identification of any threatened flora.
- Condition of the vegetation community.

2.1.1 Floristic quadrats

Eight 20 m x 20 m monitoring quadrats (plots) were established in 2011 and 2012 to collect baseline data on the condition and species composition of the offset site during autumn and spring each year (**Figure 2**). The quadrats are permanently erected and marked using a star picket at each corner tagged with flagging tape. The location of each quadrat has been recorded using a hand-held GPS device (north-west corner) (**Figure 2**).

Each quadrat was surveyed by walking back and forth along 10 parallel transects approximately 2 metres (m) apart. A cumulative list of flora species within each quadrat was recorded and assigned a cover abundance score using the Braun-Blanquet scale.

Two of the eight plots (control plots) were chosen in order to observe natural changes in species composition over time. Both plots were located in areas of good quality EPBC Act listed Box-Gum Woodland and were free from noxious weeds at the time of establishment. Where possible, management actions, such as erosion control or rehabilitation will not occur within these monitoring plots over the duration of the monitoring period. It is noted that some actions such as feral animal control occurs on an offset site scale. Also, if noxious weeds are observed within the control plots during the biannual monitoring surveys, the weeds will be identified, recorded and then removed. The removal of noxious weeds from the control plots is required to maintain the overall conservation principles of the offset site. However, it noted that these control plots appear indistinguishable from the other monitoring plots, and that management actions are completed on the offset site scale.

The other six monitoring plots were located in units where management actions were planned or likely to occur as outlined in the management sub-plans, in order to observe the effect that the actions have on ecological values and species composition over the course of the monitoring program.

The GPS co-ordinates of the north-west corner of each monitoring plot are provided below in **Table 1**. A species list for each of the monitoring plots is included in **Appendix A**.

Table 1: Monitoring plot co-ordinates (GDA 1994 MGA Zone 55)

Monitoring plot	Plot location	Established	North-west corner		Transect	
			Easting	Northing	Easting	Northing
1	MU1A	October 2011	693669.49	6059272.51	693674.98	6059300.56
2	MU2B	March 2012	693529.99	6059555.34	693541.22	6059504.10
3	MU3	October 2011	693872.06	6059467.44	693874.65	6059490.73
4	MU4	October 2011	692349.35	6060568.08	692365.82	6060517.43
5	MU5	October 2011	692559.98	6059906.52	692526.40	6059902.85
6*	MU6	March 2012	692576.25	6060344.05	692622.53	6060358.54
7	MU7	March 2012	692860.59	6060583.39	692874.01	6060542.87
8*	MU3	October 2011	693414.37	6059863.02	693445.95	6059828.31

* Refers to the intended control plots

2.1.2 Point transects

A 50 m transect (50 m length of tape) was established at each of the monitoring plots to compliment the floristic quadrat surveys and to determine the projective foliage cover of various structural components of the community. Each transect was referenced using a GPS device and three photos were taken from the start of the transect (left side, centre, and right side). The 50 m transect was surveyed as follows:

- At every 1 m along the 50 m tape, the understorey layer was assessed (50 survey points per transect). The presence of native grass, native shrubs (<1m high), native other or exotic species was recorded at each point. For each group the number of hits was then tallied and doubled, and presented as a percentage cover for the whole site.
- At every 5 m along the 50 m tape, the percentage projective foliage cover of native and exotic species in the mid and overstorey layer was recorded (10 survey points per transect). For each group the cover values were then summed and divided by ten, and presented as a percentage cover for the whole site.

2.1.3 Flora inventory methodology

A cumulative list of species has been maintained since the initial baseline surveys were conducted. Species on the list include those recorded within the eight monitoring plots and those encountered whilst traversing the sites during the weed, fence line and erosion monitoring surveys. A species list for offset site is provided in **Appendix A**.

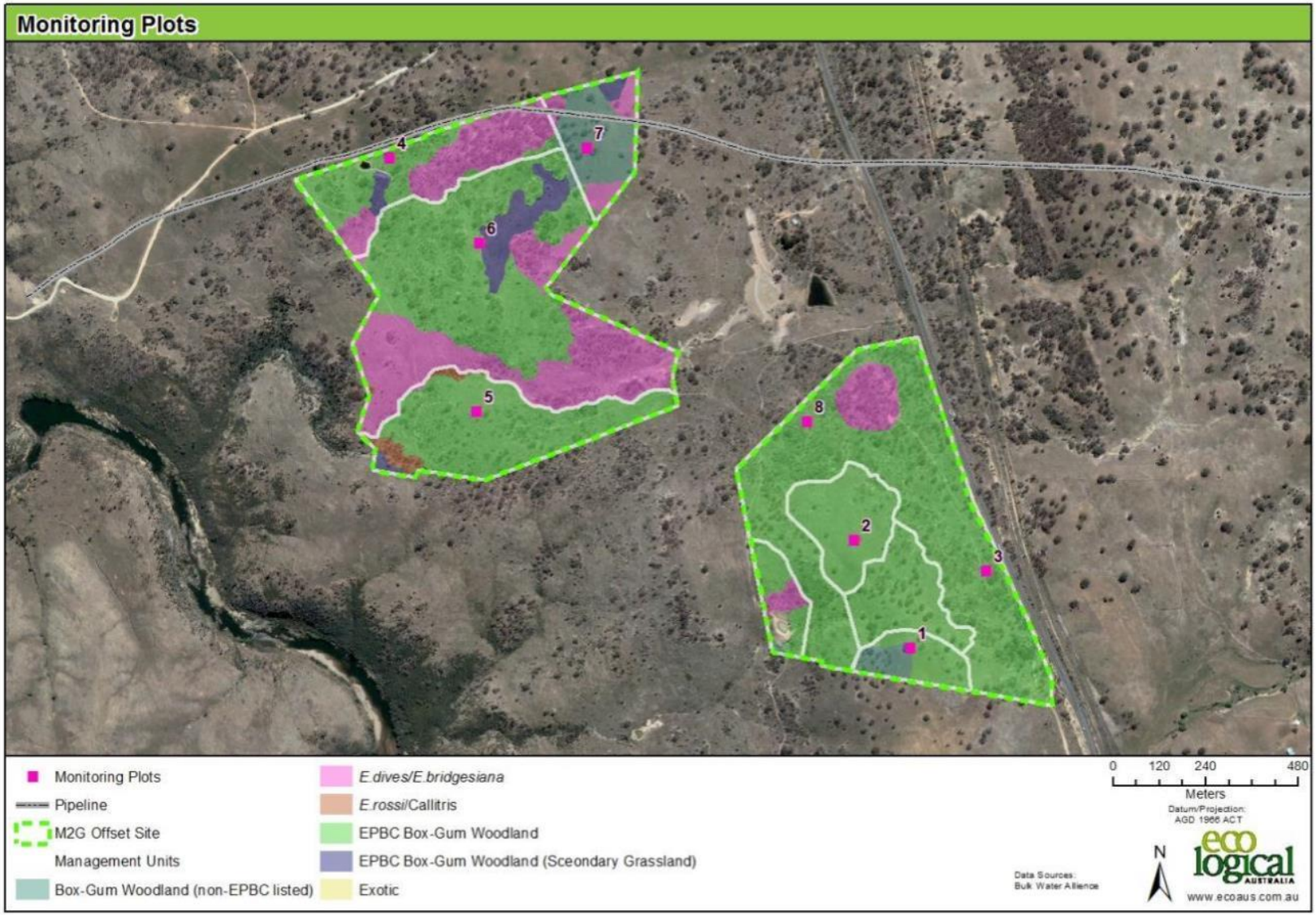

Figure 2: Monitoring plots, management units and baseline offset site ecological values

2.2 Fauna monitoring

2.2.1 Bird surveys

A quantitative bird survey methodology was established in spring 2015 and was undertaken again in spring 2016 and spring 2020 to gather quantitative information on species abundance and species richness. Bird surveys were undertaken along two transects: one in each of the offset sites. Each transect comprised five points located approximately 100 m apart. The transects were oriented to follow areas of suitable habitat (**Figure 3**).

At each point along the transect the abundance and species richness of bird species was surveyed in a circle with a 50 m radius over a 10 minute survey period (total of 50 minutes per transect, covering an area of 0.07ha). Birds were recorded in the following distance classes from the survey point:

- 0-15 m
- 15-30 m
- 30-50 m

Any other species observed during the survey period either outside of 50 m, flying over the site or between points was recorded as opportunistic.

2.2.2 Fauna habitat assessment

During the baseline survey a fauna habitat assessment was conducted within each 20 m x 50 m vegetation monitoring plot to observe the number of hollow bearing trees, length of fallen logs (greater than 10 cm width) and dominant habitat features present. In addition, a qualitative assessment of fauna habitat features was undertaken for each of the northern and southern offsets. This assessment included features such as hollow-bearing trees, logs, litter, fallen timber, stags, surface or outcropping rocks, termite mounds, mistletoe presence, large trees, natural regeneration, and exotic or native shrub thickets. These features were checked during each monitoring period to ensure they remained applicable, as habitat features are unlikely to change significantly year to year.

The results of fauna habitat assessments are outlined in **Section 5.2**.

2.2.3 Opportunistic observations

Visual and aural observations of all vertebrate fauna species (including signs of feral animal activity) were recorded opportunistically whilst conducting targeted monitoring surveys across the offset site and using random meander techniques. A full list of all fauna observed during spring 2020 monitoring is presented in **Appendix B**. Locations of rare or threatened fauna and signs of feral animal presence were recorded using a handheld GPS device.

Opportunistic herpetology searches were also undertaken in areas of good quality habitat, such as partially embedded rock.

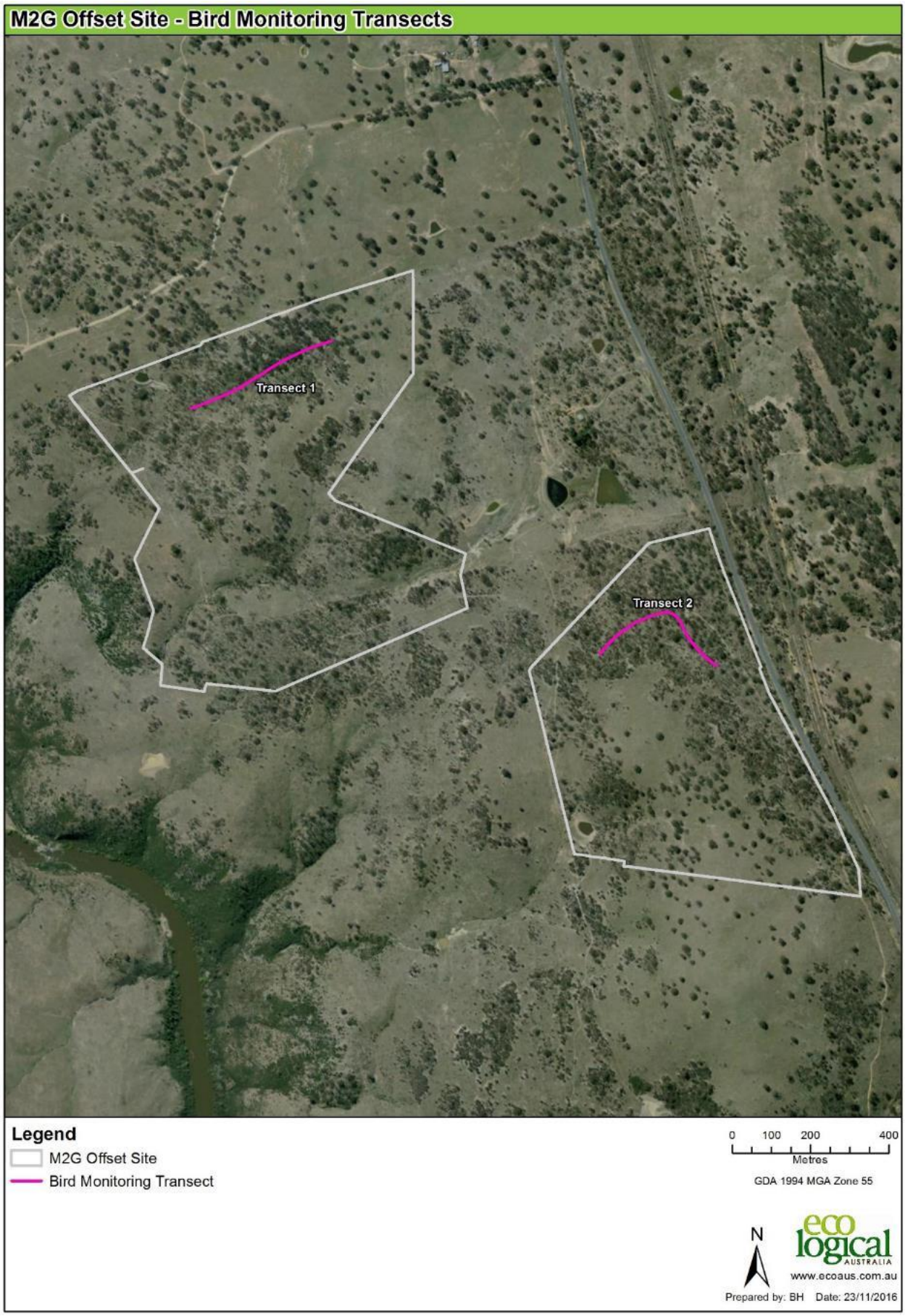

Figure 3: Bird monitoring transects

2.3 *Swainsona recta* monitoring

Monitoring of translocated *Swainsona recta* plants is conducted during the peak flowering period in October to November each year. The location of the three translocation plots is shown in **Figure 4**. Full details of the propagation and translocation program are provided in ELA (2013). Information relevant to the interpretation of monitoring results is summarized below.

Plants translocated were initially raised from seed sourced from Mt. Taylor, Williamsdale and Burra, and grown in containers filled with either:

- Potting mix (standard nursery mix), or
- Soil mix containing a 1:1 ratio of potting mix and local soil from the seed collection sites.

A total of 112 individuals were planted across the three translocation plots, of which 66 were translocated in June 2012 and a further 46 translocated in September 2013. Each translocation plot was designed to accommodate up to 40 plants. Individuals were planted in blocks according to provenance and growing media to facilitate comparison. A key to the planting design and other relevant data is provided in **Table 2**.

Table 2: Planting key

Collection location	Growing media	Year planted	Water crystals	Key
Mt Taylor	Potting mix	2012	No	
Mt Taylor	Soil and potting mix	2012	No	
Williamsdale	Potting mix	2013	Yes	
Burra	Potting mix	2013	Yes	

Individuals were planted at one metre spacing in a grid format (8 x 5 plants) with a one metre buffer from the outer most plants. Plots were established with the longest axis orientated in a north-south direction. Fencing was erected around the plots to incorporate a one metre buffer from the outer most plants. Fencing consisted of rabbit proof fencing (1.2 m high) with steel pickets at least every three metres.

At planting, all competition (e.g. grasses and other forbs) was removed in the immediate area of each individual (creating a cleared patch approximately 20 cm in diameter). For the 2013 plantings, a small handful or water crystals were also planted with each individual. All plants were watered on the day of planting and subsequently watered one week after planting.

Each individual plant translocated is assessed annually for its survivorship and reproductive condition. The follow is recorded:

- Presence or absence of *Swainsona recta* at each planting location.
- Presence or absence of flowers or developing seed pods.

In addition, the translocation plots are inspected for signs of recruitment. The results allow a comparison of survivorship, condition and recruitment events at the end of each monitoring period and provide a picture of the overall success of the translocation program.

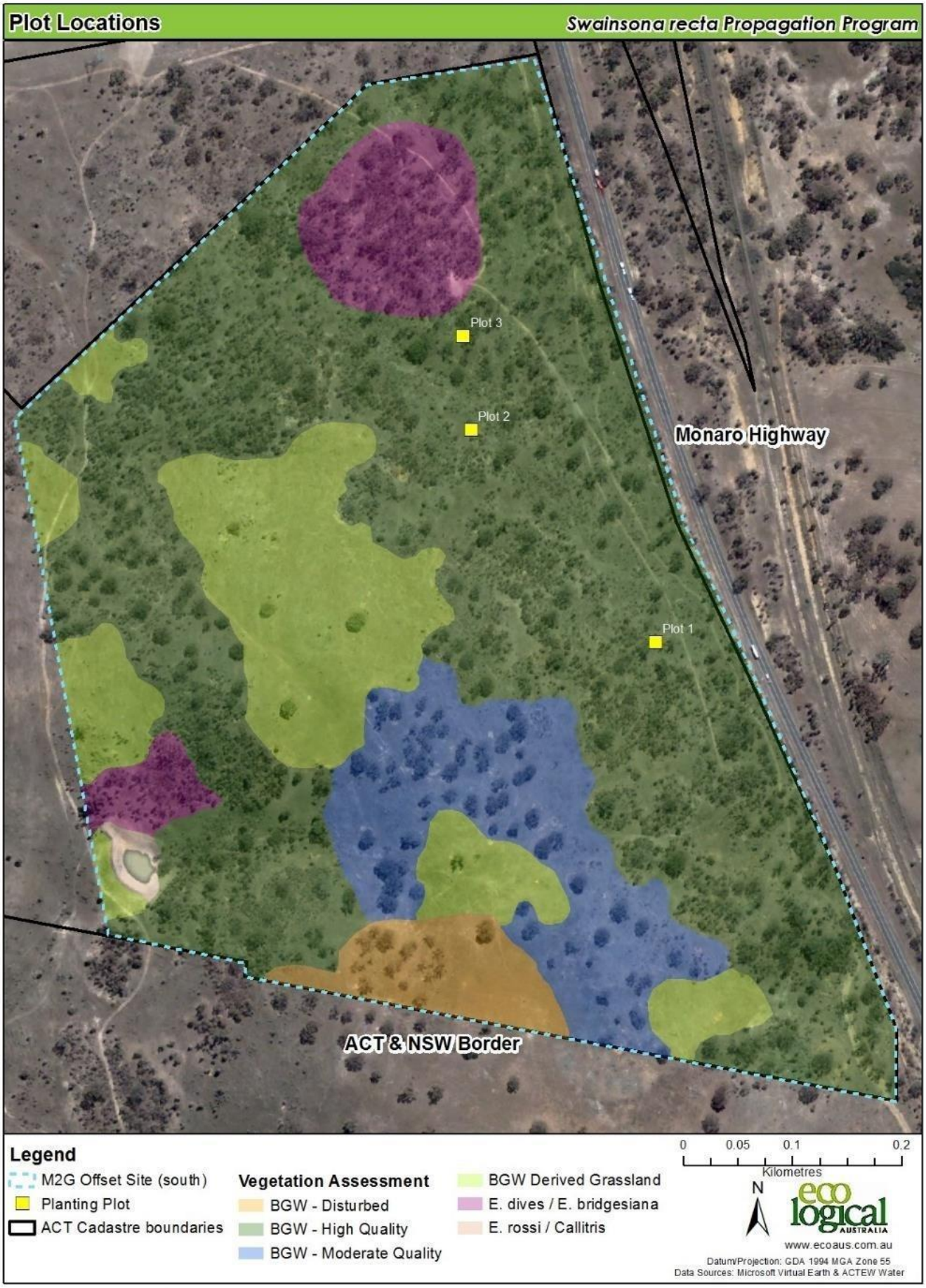

Figure 4: *Swainsona recta* translocation plots

2.4 Weed monitoring

The management of weeds within the M2G offset site is undertaken in accordance with the Weed Monitoring Sub-Plan. The sub-plan outlines the weed management activities to be undertaken to satisfy relevant approval conditions and commitments. As an action under the sub-plan, the monitoring of weeds within the offset is required on a biannual basis to incorporate the seasonal changes in weed abundance and weed control activities.

Weed monitoring in spring 2020 was undertaken opportunistically with an overall assessment of each management unit focussed on occurrences of declared species (*Cotoneaster* spp., *Crataegus monogyna*, *Eragrostis curvula*, *Hypericum perforatum*, *Nassella trichotoma*, *Pyracantha* spp., *Rosa rubiginosa*, *Rubus fruticosus* and various species of thistle), non-declared woody weeds and species not previously recorded for the site.

2.5 Erosion monitoring

Erosion monitoring sites were established during autumn 2012 monitoring surveys. A representative sample of erosion points within each of the main drainage lines were selected for future monitoring. For each erosion point selected, notes were made on their size, their location was recorded using a GPS and a photo was taken in order to observe any changes over time. Several erosion monitoring points were discontinued from spring 2013 onwards, as these points did not shown signs of erosion since the baseline surveys, despite large rain events occurring over this two-year period. Erosion monitoring point locations for the spring 2020 surveys are mapped in **Figure 5** and **Figure 6**.

When each monitoring survey is undertaken, a set of baseline photographs are taken into the field to facilitate accurate relocation of erosion monitoring photo points and assessment of change.

2.6 Fencing monitoring

Fence monitoring was undertaken by traversing the Williamsdale property border and assessing the condition of the fence. Any damaged areas observed along the fence line were noted and a GPS point taken. Fence damage was categorised into three categories to represent the level of risk of unwanted grazers (such as cattle) entering the offset site:

- *Low risk*– Small holes observed at the bottom of the fence that do not require immediate attention and allows native fauna (e.g. wombats) to pass through.
- *Moderate risk* – Small to moderate sized holes or fence damage that require monitoring, but no immediate action. Often observed along the fence line bordering the Murrumbidgee River corridor and represents a potential goat or sheep access point. Note; there can be a small difference between the low and moderate categories. However, other evidence such as tracks and scats that may represent feral presence was used to inform the level of risk.
- *High risk* – Represents points along the fence line requiring attention. These points represent a high risk of cattle and sheep entering the property.

2.7 Rehabilitation survival assessment

During winter 2016, 2,000 native shrubs were planted across two locations within the property;1,400 in the large gully near the TransGrid substation; and 600 along a smaller gully within the northern offset site (additional plantings and locations have been added since 2016). Rapid survival counts were undertaken in each of these locations during the spring 2020 survey. This involved walking down the planting row from a random start point and assessing each individual as live (identified to genus)

or dead. One hundred individuals were assessed across two survey points along the planting in the northern offset, and 50 individuals were assessed along the large gully near the substation. Since the original plantings in 2016

Figure 5: Erosion monitoring points in southern offset

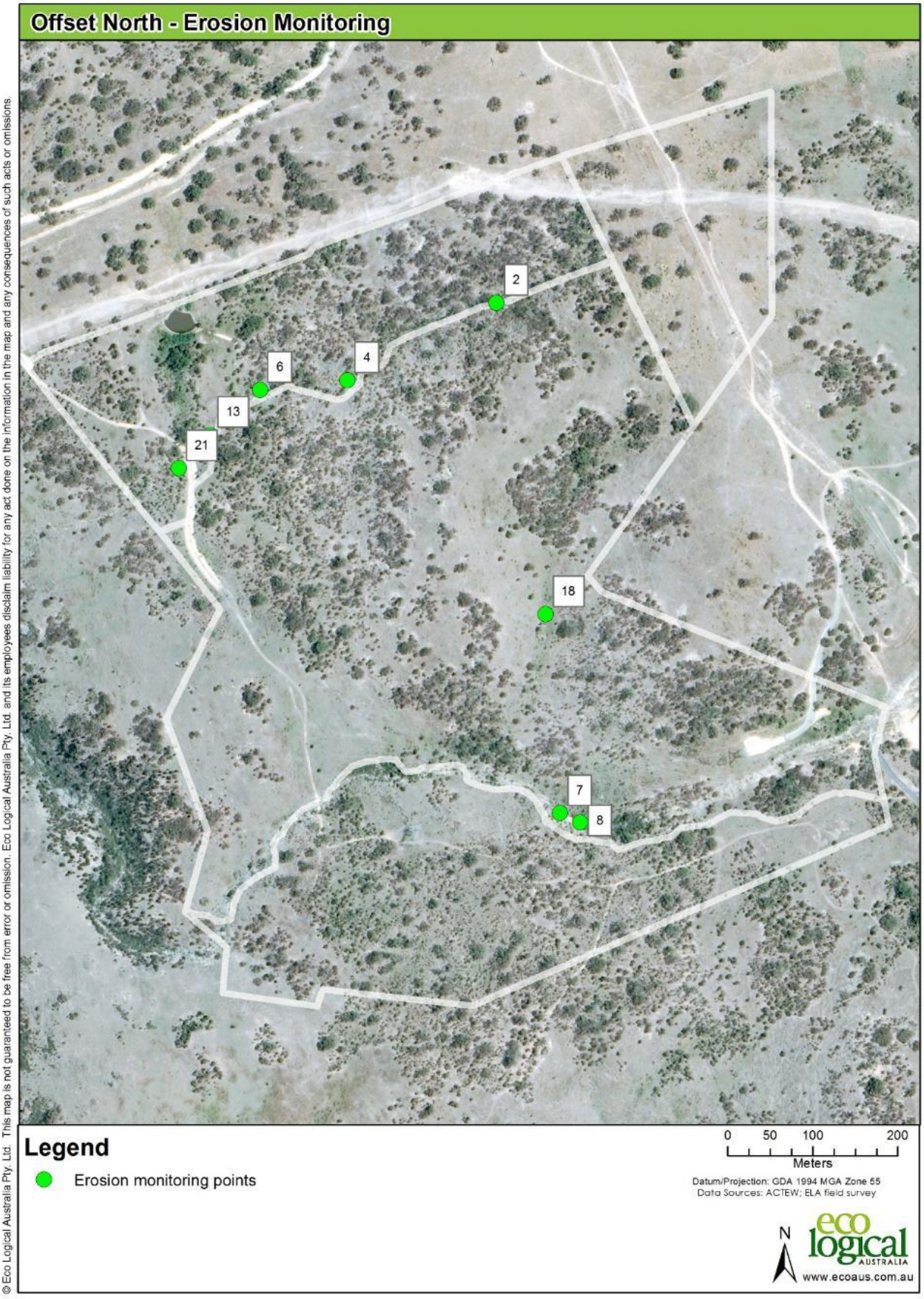

Figure 6: Erosion monitoring points in northern offset

3. Vegetation plots

Species diversity has remained relatively stable across most monitoring plots since the baseline monitoring was undertaken in 2011 (**Figure 7**). In all plots except Plot 6, native species richness was higher in 2020 than during the baseline monitoring, and all plots increased on 2018 species richness scores. It is likely that dry conditions in 2018 lead to below average plant diversity, and that consistently better rainfall during winter and spring 2020 has created a boom year for native species. This has brought all sites above the benchmark for native species richness in Box-Gum Woodland for the region, except for Plot 1 and Plot 7 (Sharp & Milner 2014).

Exotic groundcover was high at all sites compared to 2018. As with native species richness, this is likely due to favourable conditions created by rainfall events throughout the year. Since monitoring began, exotic groundcover has fluctuated between years but overall, there has been a slight increasing trend at all plots except Plot 1 (**Figure 8**). The dominant species listed below include Saffron Thistle and a number of clover species.

The degraded condition of Plot 7 is seen in the consistently high cover of exotic species (Saffron Thistle) throughout all the years of monitoring, however during the spring 2020 survey it was noted that control actions have been recently taken to reduce exotic species in the north-west area of the site, and the initial effects can be seen, especially in the Saffron Thistle.

Rainfall for the region was above average during the winter and spring preceding the survey period (BOM 2020a). Average daily temperatures for spring 2020 were also slightly lower than the historical average (BOM 2020b). These wet and mild conditions would have contributed to the boom in growth for both native and exotic species, especially in the ground layer. Grazing pressure by macropods was noted as being low, which would also have allowed for good growth of native and exotic ground species. Macropod numbers within the site appeared to be significantly lower than in previous years, contributing to the low grazing pressure.

All monitoring plots remain below the benchmark values for overstorey cover established for the ACT (Sharp & Milner 2014), except for Plot 4, which has reached 11% cover for the first time since monitoring began (**Table 6**). This low canopy cover reflects the fact that sites are either in regenerating or cleared formations of Box-Gum Woodland, rather than mature remnants. Canopy cover remains comparable to that recorded in 2018, with a few plots increasing slightly. Saplings of overstorey species are present at most sites and in time will likely contribute to an increase in overstorey cover as they grow and develop fuller canopies. Native mid-storey cover for plots remains at the lower end of the benchmark range.

The results of the vegetation monitoring are provided **Section 3.1** to **3.8** below, with a summary of the floristic data and site photos from baseline (2011) and 2020 (**Figure 9** to **16**; **Table 3** to **10**). The raw floristic data for each plot are provided in **Appendix A**.

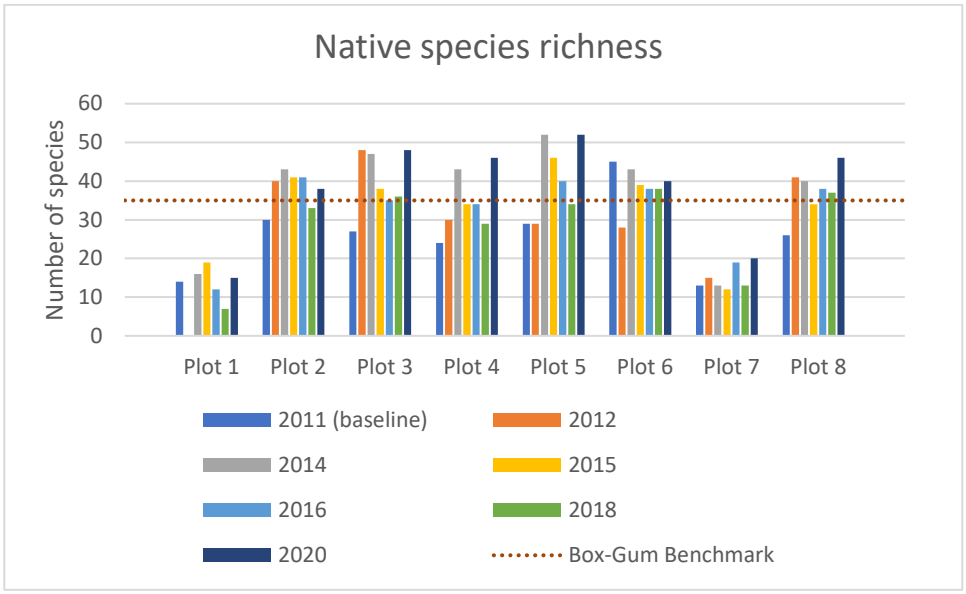

Figure 7: Native species richness (diversity) within the floristic monitoring plots, 2011-2020

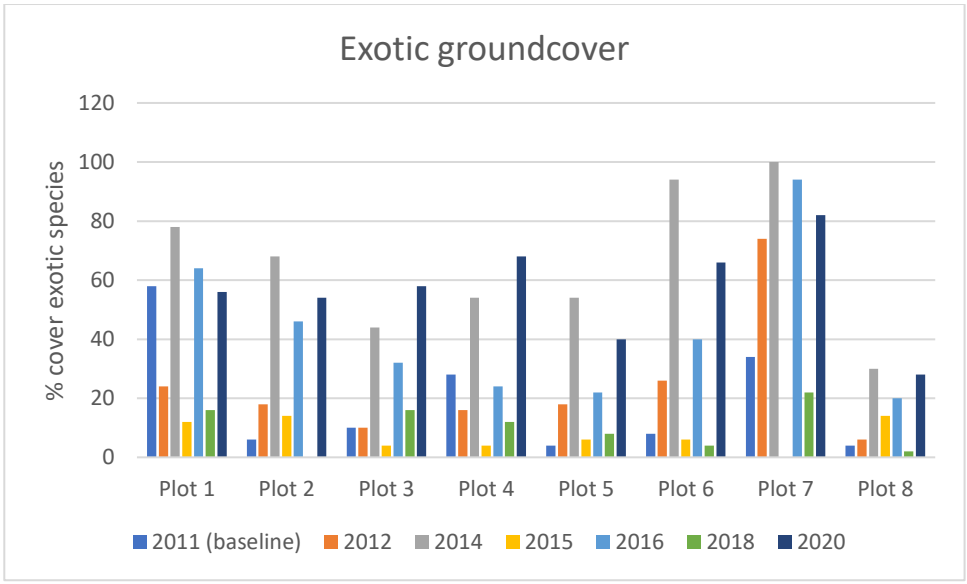

Figure 8: Groundcover of exotic species within the floristic monitoring plots, 2011-2020

3.1 Monitoring plot 1

Monitoring plot 1 is located within MU1A in the southern offset area and is composed of lower condition Box-Gum Woodland. Native species diversity was higher in 2020 that the previous two spring monitoring periods, increasing to 15, and the cover of native grasses such as *Rytidosperma racemosum* (Wallaby Grass), *Bothriochloa macra* (Red Leg Grass) and *Austrostipa scabra* (Speargrass) remains high. However, cover of exotic species was also high (56%), which a significant amount of *Carthamus lanatus* (Saffron Thistle) present. It was clear that the thistle was being controlled, as dieback was occurring in it and other species. Native plant species richness and overstorey cover remain below benchmark values (Sharp & Milner 2014).

Figure 9: Monitoring Plot 1. (Left: Baseline monitoring photo, October 2011. Right: monitoring photo November 2020)

Table 3: Summary statistics for spring 2020 floristic surveys within Plot 1

Plot Description		
Management unit	MU1A	
Vegetation type	Box-Gum Woodland	
Plot number	1	
Condition	Low-Mod	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	0	0
Native midstorey cover	0	0
Native understorey cover (grass)	40	40
Native understorey cover (other)	6	0
Exotic midstorey plant cover	0	0
Exotic understorey plant cover	58	56
Native species diversity	14	15
Overstorey		
Regeneration		No
Species		-
Leaf litter		24%

3.2 Monitoring plot 2

Monitoring plot 2 is located within MU2B in the southern offset area. It is situated on a rocky hill containing areas of potential Pink-tailed Worm Lizard habitat. It contains moderate-good condition mature Box-Gum Woodland with scattered eucalypt saplings present, including some well-established saplings not present in 2018 (**Figure 10**). Monitoring plot 2 continues to have a high native species richness, with 38 species recorded in spring 2020. The dominant species were *Rytidosperma carphoides* (Short Wallaby Grass), *Chrysocephalum apiculatum* (Yellow Buttons), and *Austrostipa scabra* (Speargrass), with a total native grass cover of 52%. There has been a considerable increase in both the number of exotic species within the plot, and the total exotic groundcover, with many exotic annuals recorded. However, exotic perennial species were absent. Exotic groundcover increased from 0% in 2018 to 54% in 2020. Recent growth within the plot has been high overall. Native plant species richness scores remain above benchmark values (Sharp & Milner 2014). However, overstorey cover and the total length of fallen logs are both below benchmark due to previous clearing.

Figure 10: Monitoring Plot 2. (Left: Baseline monitoring photo, March 2012. Right: monitoring photo November 2020)

Table 4: Summary statistics for spring 2020 floristic surveys within Plot 2

Plot Description		
Management unit	MU2B	
Vegetation type	Box-Gum Woodland	
Plot number	2	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	0	2
Native midstorey cover	0	0
Native understorey cover (grass)	80	52
Native understorey cover (other)	4	14
Exotic midstorey plant cover	0	0
Exotic understorey plant cover	6	54
Native species diversity	30	38
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		24%

3.3 Monitoring plot 3

Monitoring plot 3 is located within MU3 in the southern offset. The plot is located in moderate to good quality Box-Gum Woodland. A large number of eucalypt saplings are present both within and adjacent to the plot. Both native species richness and cover of native species has increased since 2018 monitoring. *Rytidosperma* sp. (Wallaby Grass) and *Themeda triandra* (Kangaroo Grass) were the dominant species, contributing to a total cover of native grasses of 44%. Exotic groundcover has also increased significantly on both 2016 and 2018. There was found to be a considerable amount of the exotic perennial *Hypochaeris radicata* (Catsear) and annual *Tolpis barbata* (Yellow Hawkweed); between 5-25% of each in the plot. Native plant species richness for the plot remains above benchmark values (Sharp & Milner 2014).

Figure 11: Monitoring Plot 3. (Left: Baseline monitoring photo, October 2011. Right: monitoring photo November 2020)

Table 5: Summary statistics for spring 2020 floristic surveys within Plot 3

Plot Description		
Management unit	MU3	
Vegetation type	Box-Gum Woodland	
Plot number	3	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	3.7	5.4
Native midstorey cover	5.2	0.8
Native understorey cover	80	44
Native understorey cover	16	20
Exotic midstorey plant	0.2	0
Exotic understorey plant	10	58
Native species diversity	27	48
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		48%

3.4 Monitoring plot 4

Monitoring plot 4 is located in the northern offset in MU4. It is located in moderate to good quality Box-Gum Woodland with an overstorey dominated by *Eucalyptus blakelyi* (Blakely's Red Gum). Overall species richness was extremely high at Monitoring plot 4 during the spring 2020 monitoring; a total of 46 native and 29 exotic species were recorded. The site was dominated by native grasses, including a high cover of *Themeda triandra* (Kangaroo Grass), and the exotic annual *Trifolium arvense* (Haresfoot Clover). The noxious weed *Rosa rubiginosa* (Sweet Briar) was absent in 2018 after control efforts but was recorded again in 2020 with a cover of less than 5%. For the first time, native overstorey cover has reached the benchmark range at 11% (Sharp & Milner 2014).

Figure 12: Monitoring Plot 4. (Left: Baseline monitoring photo, October 2011. Right: monitoring photo November 2020)

Table 6: Summary statistics for spring 2020 floristic surveys within Plot 4

Plot Description		
Management unit	MU4	
Vegetation type	Box-Gum Woodland	
Plot number	4	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	4.7	11
Native midstorey cover	11.5	0
Native understorey cover (grass)	74	48
Native understorey cover (other)	18	4
Exotic midstorey plant cover	2	0
Exotic understorey plant cover	28	68
Native species diversity	24	46
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		30%

3.5 Monitoring plot 5

Monitoring plot 5 is a plot located in MU5 in moderate-good quality Box-Gum Woodland with an overstorey dominated by *Eucalyptus blakelyi*. A record number of native species for this site were recorded, and the most of any plot during the spring 2020 monitoring, with a total of 52, including a high diversity of gasses and forbs. The dominant native species were *Rytidosperma carphoides* (Short Wallaby Grass), *Chrysocephalum apiculatum* (Yellow Buttons), and *Themeda triandra* (Kangaroo Grass), while the annual *Trifolium arvense* made up a large proportion of the exotic cover. The number of exotic species was higher than in 2018 (11 and 23 respectively). The overstorey appears to be recovering from the dieback noted in 2018, and natural regeneration of *Eucalyptus blakelyi* is occurring.

Figure 13: Monitoring Plot 5. (Left: Baseline monitoring photo, October 2011. Right: monitoring photo November 2020)

Table 7: Summary statistics for spring 2020 floristic surveys within Plot 5

Plot Description		
Management unit	MU5	
Vegetation type	Box-Gum Woodland	
Plot number	5	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	0	7
Native midstorey cover	11	1
Native understorey cover	76	64
Native understorey cover	14	24
Exotic midstorey plant	0	0
Exotic understorey plant	4	40
Native species diversity	29	52
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		48%

3.6 Monitoring plot 6

Monitoring plot 6 is a control plot located in MU6, in moderate-good quality Box-Gum Woodland with an overstorey dominated by *Eucalyptus blakelyi.* The plot is situated in a transition zone between the woodland and derived grassland forms of the ecological community. No management actions are meant to be undertaken within the boundaries of the plot. Native species richness has not increased as much as was seen at the other plots (38 species in 2018 and 40 species in 2020), but exotic groundcover has increased considerably from 4% to 66%, with especially high cover of *Trifolium* (Clover species). A reasonably good (50%) cover of native grasses was also recorded. Fewer individuals of regenerating *E. blakelyi* were observed than previous monitoring seasons.

Figure 14: Monitoring Plot 6. (Left: Baseline monitoring photo, March 2012. Right: monitoring photo November 2020)

Table 8: Summary statistics for spring 2020 floristic surveys within Plot 6

Plot Description		
Management unit	MU6	
Vegetation type	Box-Gum Woodland	
Plot number	6	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	5.3	3
Native midstorey cover	0	0
Native understorey cover (grass)	80	50
Native understorey cover (other)	10	8
Exotic midstorey plant cover	0	0
Exotic understorey plant cover	8	66
Native species diversity	28	40
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		40%

3.7 Monitoring plot 7

Monitoring plot 7 is located within MU7 in the northern offset area. The management unit is composed of degraded Box-Gum Woodland with the overstorey dominated by scattered remnant *Eucalyptus blakelyi.* No recruitment of *E. blakelyi* was observed within the plot. Exotic groundcover was the highest of any site at 82%, up from 22% in 2018. *Trifolium subterraneum* (Subterranean Clover) was the most dominant species. Native species richness showed an increase since 2018 monitoring, with 20 species recorded. This included the highest cover of native groundcover (other) of any site in 2020 at 36%, with *Erodium crinitum* (Blue Storksbill) and *Rumex brownii* (Swamp Dock) dominating.

Figure 15: Monitoring Plot 7. (Left: Baseline monitoring photo, March 2012. Right: monitoring photo November 2020)

Table 9: Summary statistics for spring 2020 floristic surveys within Plot 7

Plot Description		
Management unit	MU7	
Vegetation type	Box-Gum Woodland	
Plot number	7	
Condition	Low	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	0	0
Native midstorey cover	0	0
Native understorey cover (grass)	74	14
Native understorey cover (other)	0	36
Exotic midstorey plant cover	0	0
Exotic understorey plant cover	34	82
Native species diversity	13	20
Overstorey		
Regeneration		No
Species		-
Leaf litter		0%

3.8 Monitoring Plot 8

Monitoring plot 8 is a control plot located in MU3. No management actions are proposed to occur within the bounds of the plot. The plot is located in moderate-good quality Box-Gum Woodland with an

overstorey dominated by regenerating *Eucalyptus blakelyi.* Considerable *E. blakelyi* regeneration is present within the plot. As with the other sites, the number of native species and the cover of exotic species increased between 2018 and 2020. Native species diversity was recorded at 46, while 17 exotic species were recorded within the plot. A high cover of *Themeda triandra* (Kangaroo Grass) was present, as well as other dominant native grasses including *Austrostipa scabra* (Speargrass), and the native forb *Chrysocephalum apiculatum* (Yellow Buttons). Good recent growth of natives can be seen at the site.

Figure 16: Monitoring Plot 8. (Left: Baseline monitoring photo, October 2011. Right: monitoring photo November 2020)

Table 10: Summary statistics for spring 2020 floristic surveys within Plot 8

Plot Description		
Management unit	MU3	
Vegetation type	Box-Gum Woodland	
Plot number	8	
Condition	Mod-Good	
Plot Statistics (%)	**Baseline**	**Spring 2020**
Native overstorey cover	0	6.5
Native midstorey cover	8.5	0
Native understorey cover (grass)	80	58
Native understorey cover (other)	14	20
Exotic midstorey plant cover	0	0
Exotic understorey plant cover	4	28
Native species diversity	26	46
Overstorey		
Regeneration		Yes
Species		*E. blakelyi*
Leaf litter		36%

4. Biodiversity values

4.1 Ecosystem health

Overall plant growth across the site was good, due to consistent and above average rainfall, and mild temperatures in the region during the preceding months. Thus, grazing pressure was lowered by these factors, as well as the reduction in Eastern Grey Kangaroo densities. This is discussed further in **Section 5.4**.

It has been noted that some dieback of *Eucalyptus blakelyi* (Blakely's Red Gum) has occurred within the study area in previous years due to leaf attack psyllids. During the 2020 surveys, lerps was not observed in high numbers, an indicator that psyllid infestation is not a significant problem at this time. We will continue to monitor the canopy for evidence of lerps, defoliation and dieback.

While there was an increase in *Hypericum perforatum* (St. John's Wort) and *Carthamus lanatus* (Saffron Thistle) in some parts of the site since 2018 (see **Section 7**), it is noted that St. John's Wort has occurred at this level and higher in previous years, and the infestation of Saffron Thistle is mostly confined to the southern boundary. Few signs of feral animals were observed within the offset areas.

4.2 Flora

A total of 227 native plant species and 126 exotic species have been recorded for the M2G offset site since the baseline surveys were undertaken, including those observed opportunistically, not within plots (**Appendix A**). The list has continued to grow with each survey. The detection of new records for the site is influenced by factors such as time since cessation of grazing, seasonal conditions, and the varying meander routes chosen by the ecologists undertaking the surveys. A total of 157 flora species (111 native and 46 exotic) were opportunistically recorded during spring 2020 surveys.

The flora recorded since baseline surveys includes a range of widely distributed characteristic woodland species, several rare and uncommon species in the ACT, and four threatened species listed under the EPBC Act (**Table 11** and **Table 12**).

4.2.1 Threatened flora species

An annotated list of nationally threatened species occurring, or known to have occurred on the offset, is provided in **Table 11** below.

Table 11: Threatened flora species within the offset site

Species	EPBC Act Status	NC Act Status	Notes
***Leucochrysum albicans* var. *tricolor* (Hoary Sunray)**	Endangered	Not listed	Endangered herbaceous perennial. Noted as rare in the offset site in spring 2014. The species is abundant within the offset site. It is also present in the adjacent land managed by Transgrid, where it was planted in 2010 on the batters and has been noted as growing profusely. It is considered likely that the individuals within the offset site have originated from the adjacent population. This species was observed within plot 8 and opportunistically across the site in many locations during the spring 2020 survey.
***Pomaderris pallida* (Pale Pomaderris)**	Vulnerable	Not listed	Vulnerable shrub to about 1.5 m high. Located in the central western part of the northern offset. A solitary flowering adult plant approximately 90 cm high was found in spring 2014 and was again located in spring 2016, along with approximately 5 juveniles and 2 sub-adults (flowering but only about 30-40 cm high). Multiple individuals were again observed during the 2020 survey. The species is known to occur within the Murrumbidgee River corridor, and it appears that the population within the offset site has established as an outlier.
***Swainsona recta* (Small Purple-pea)**	Endangered	Endangered	Endangered herbaceous perennial. This species was found on the M2G offset site during initial surveys of the site in 2010 but has not been encountered since. Three translocation enclosure plots have been established on site (refer to Section 5.1) with varying success.
***Thesium australe* (Austral Toadflax, Toadflax)**	Vulnerable	Not listed	Austral Toadflax is a hairless, yellowish-green perennial herb with slender, wiry stems to 40 cm high. The species is semi-parasitic on roots of a range of grass species, notably *Themeda triandra* (Kangaroo Grass). Approximately 4 individuals were recorded in spring 2015 within the northern offset, but have not been recorded since. The species is only known from a few records within the Canberra region.

4.2.2 Rare and uncommon ACT species

A number of species considered to be rare or uncommon within the ACT have also been recorded within the offset site to date. These species are outlined in **Table 12** below. The detection of these species in some years and not others is likely due to a number of factors including, but not limited to, preceding environmental conditions, flowering period, timing of monitoring surveys and competition for space with other plants.

Table 12: Rare and uncommon species recorded within the offset site

Species	Notes
Austrostipa setacea **(Corkscrew Grass)**	Tufted perennial grass. Noted in the south-eastern corner of the southern offset in spring 2014, and was observed again in multiple locations during the 2020 survey.
Bossiaea prostrata **(Creeping Bossiaea)**	Prostrate perennial subshrub. This species has been recorded in monitoring plot 5 in the northern offset in 2018 and 2020.
Desmodium brachypodum **(Large Tick-trefoil)**	Large pea-flowered herb. Although it was previously recorded in the south-eastern part of the southern offset, it was not observed in 2020.
Dillwynia **sp. Yetholme**	Decumbent to erect shrub. This species has been recorded previously but was not seen opportunistically during the 2020 survey.
Discaria pubescens **(Australian Anchor Plant)**	Rigid shrub with prominent paired stem spines. A localised patch of approximately 26 plants occurs in the northern offset. Observed in the 2020 surveys.
Glossostigma elatinoides	Prostrate perennial wetland forb. A localised patch was noted in spring 2014 on the banks of the dam in the northern offset but was not seen in 2020.
Limosella australis **(Australian Mudwort)**	Diminutive perennial wetland forb. Localised plants were noted in spring 2014 on the banks of the dam in the northern offset. It was not recorded in 2020.
Microseris lanceolata **(Yam Daisy)**	Perennial forb with fleshy tuberous roots. Previously recorded in monitoring plot 3 in the southern offset and present in high abundance (patches of greater than 100 individuals) at various locations throughout the southern offset in 2016. This species was recorded in 2020, but in low numbers (possibly due to surveys conducted late in the flowering season).
Plantago gaudichaudii **(Narrow Plantain)**	Perennial forb with thick fleshy taproot. Recorded in monitoring plot 3 (southern offset) and opportunistically in spring 2020 and has previously been recorded in monitoring plot 4 (northern offset).
Stylidium despectum **(Dwarf Triggerplant)**	Erect diminutive annual forb occurring in moist situations. Localised plants were noted in spring 2014 along a moist drainage line in the northern part of the southern offset. It was not recorded in 2020.
Swainsona monticola **(Notched Swainson-pea)**	Low spreading herbaceous perennial. Noted in the south-eastern corner of the southern offset in spring 2014 and recorded again in 2016. This species was recorded in multiple locations 2020.
Swainsona sericea **(Silky Swainson-pea)**	Low spreading herbaceous perennial. Recorded in monitoring plots 3 (southern offset) and 5 (northern offset) since spring 2016, occurring at these sites again in 2020 and opportunistically elsewhere. This species is widespread across the site.
Zornia dyctiocarpa	Low herbaceous perennial. Previously noted in the north eastern corner of the southern offset but not recorded in 2020.

5. Fauna

A broad range of fauna species have been recorded within the offset site since establishment, including 87 bird species, 14 mammal species, 10 reptiles, and 6 amphibians. A cumulative list of species recorded is provided in **Appendix B**. A total of 33 fauna species were recorded, either opportunistically or through bird surveys, across the offset site in spring 2020. This consisted of 27 bird species, two native mammal species, three introduced mammal species, and one amphibian species.

5.1 Bird monitoring

During the bird surveys, a total of 27 species were recorded (**Table 13**). A further six species were opportunistically observed across the study area. While the number of species recorded during the surveys increased from previous years' monitoring, it is slightly below average when compared to previous years (**Figure 17**). This difference which may be attributed to surveys being conducted later in the season, therefore conditions were not as favourable, and potential observer variation.

Noisy Miner (*Manorina melanocephala*) was the most abundant and commonly occurring species recorded during the surveys, with records at six of the ten sites, mostly along Transect 2 (table). Their abundance index was higher than in 2018, which may have also contributed to the lower numbers of other bird species. The second most abundant species were Eastern Rosella (*Platycercus eximius*) and Noisy Friarbird (*Philemon corniculatus*). It was noted that there were fewer rare woodland bird species recorded in 2020 than have been in past years, such as Speckled Warbler (*Chthonicola sagittatus*) and Hooded Robin (*Melanodryas cucullata cucullata*).

Table 13: Bird species abundance index (highest to lowest)

Species name	Scientific name	No. sites recorded	Total abundance	Abundance index
Noisy miner	*Manorina melanocephala*	6	21	0.70
Eastern rosella	*Platycercus eximius*	4	11	0.37
Noisy friarbird	*Philemon corniculatus*	4	11	0.37
Leaden flycatcher	*Myiagra rubecula*	3	10	0.33
Rufous whistler	*Pachycephala rufiventris*	4	9	0.30
Red-rumped parrot	*Psephotus haematonotus*	2	8	0.27
Australian raven	*Corvus coronoides*	3	7	0.23
Rufous songlark	*Megalurus mathewsi*	6	7	0.23
White-throated gerygone	*Gerygone olivacea*	5	7	0.23
Yellow-faced honeyeater	*Lichenostomus chrysops*	3	7	0.23
Red wattlebird	*Anthochaera carunculata*	2	6	0.20
Striated pardalote	*Pardalotus striatus*	4	6	0.20
Australian magpie	*Cracticus tibicen*	3	5	0.17
Magpie lark	*Grallina cyanoleuca*	2	5	0.17
Satin flycatcher	*Myiagra cyanoleuca*	3	5	0.17
Weebill	*Smicrornis brevirostris*	3	5	0.17
Willie wagtail	*Rhipidura leucophrys*	3	5	0.17
Galah	*Platycercus eximius*	2	4	0.13
Olive-backed oriole	*Oriolus sagittatus*	2	3	0.10
Spotted pardalote	*Pardalotus punctatus*	3	3	0.10
Striated thornbill	*Acanthiza lineata*	1	3	0.10
White-winged chough	*Corcorax melanorhamphos*	1	3	0.10

Species name	Scientific name	No. sites recorded	Total abundance	Abundance index
Pallid cuckoo	*Cacomantis pallidus*	1	2	0.07
Wedge-tailed eagle	*Aquila audax*	1	2	0.07
Crested pigeon	*Ocyphaps lophotes*	1	1	0.03
Grey fantail	*Rhipidura albiscapa*	1	1	0.03
Laughing kookaburra	*Dacelo novaeguineae*	1	1	0.03

Across all years and seasons of monitoring, a slight upward trend can be seen for bird species richness (**Figure 17**) for the whole study area. This may be a result of local factors, such as improved habitat on site and regeneration of overstorey species, or processes at the wider landscape level, such as clearing of habitat causing limited dispersal to other patches. Over the last four years of monitoring, there has been little difference in bird species richness between the two transects, indicating that birds are reasonably well distributed across the study area (**Figure 18**).

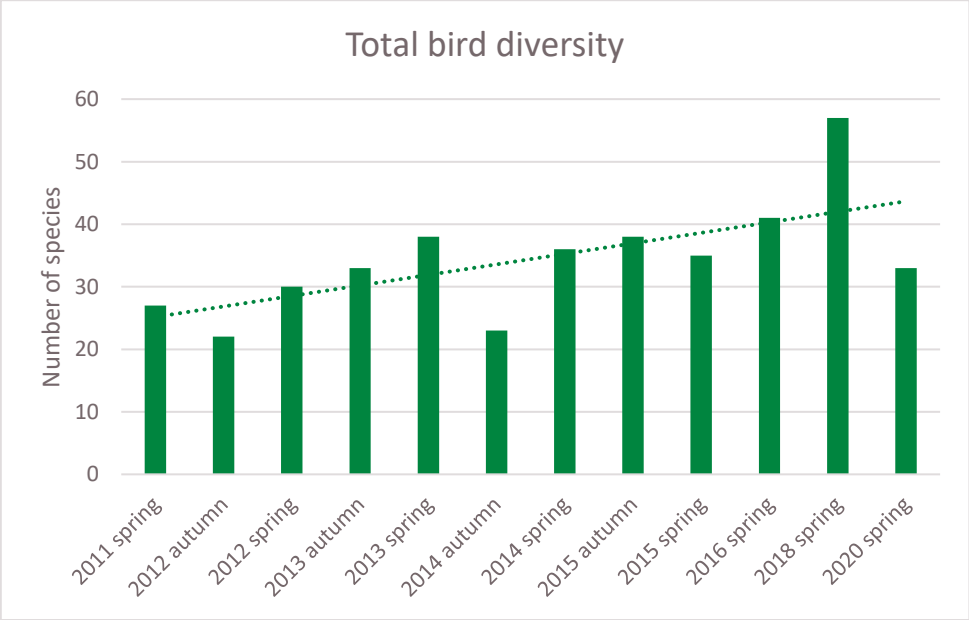

Figure 17: Bird species richness (diversity) over the course of the monitoring, 2011-2020

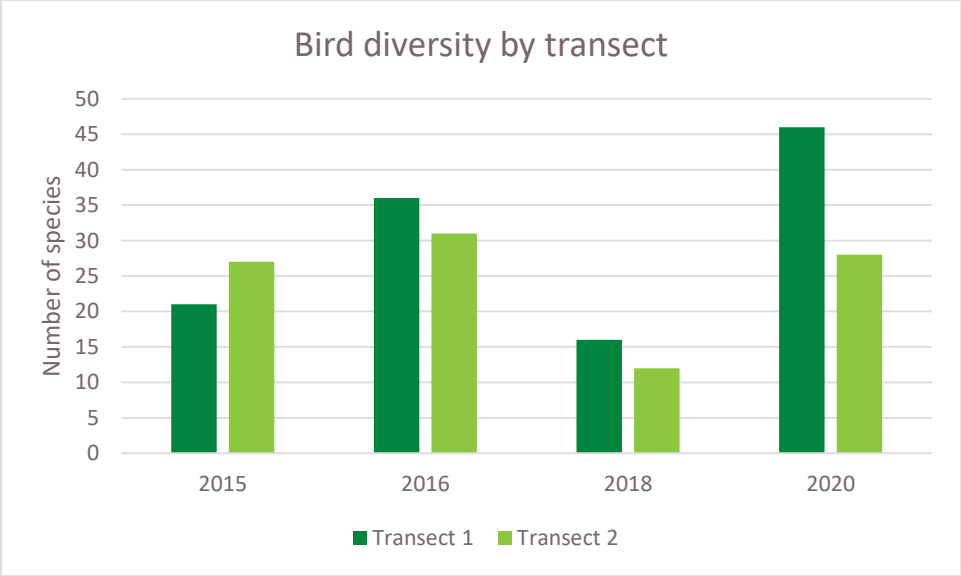

Figure 18: Bird species richness (diversity) across the two monitoring transects, 2015-2020

5.2 Fauna habitat assessment

A rapid assessment of the range of fauna habitat features present across the offset site and their abundance was undertaken during the baseline surveys. These values were subsequently confirmed during surveys in spring 2020 and are presented below in **Table 14**. No changes in habitat features was observed in comparison to 2018. It's noted these features are unlikely to change in the short to medium term. The following categories were used to identify abundance or frequency of each feature:

- *Abundan*t = feature occurs in an almost continuous manner.
- *Common* = feature encountered commonly, i.e. without having to search for it.
- *Occasional* = feature occurs in more than a few cases, but not encountered frequently.
- *Rare* = feature observed very infrequently, one to a few cases at most.

Table 14: Fauna habitat features observed across the offset site

Fauna habitat feature	Northern	Southern
Tree hollows	Occasional	Occasional
Large trees > 60 cm DBH	Occasional	Occasional
Dead standing trees	Occasional	Rare
Stumps (<2 m)	Rare	Rare
Mistletoes	Occasional	Occasional
Regenerating tree thickets	Abundant	Abundant
Native shrub thickets	Common	Occasional
Exotic shrub thickets	Rare	Rare
Logs (fallen)	Occasional	Occasional
Timber (fallen)	Occasional	Occasional
Litter (leaf, twig, bark)	Common	Common
Loose rocks	Common	Common
Outcropping rocks	Common	Common
Termite mounds	Rare	Rare
Meat ant nests	Occasional	Occasional
Earth banks/deep gully walls	Rare	Rare

The plantings of mixed native shrubs, along the gullies within the northern offset will further enhance habitat values for a range of native woodland birds that forage and nest in mid-canopies of forests and woodlands.

An assessment of the dominant habitat features recorded within each 50 m x 20 m vegetation monitoring plot was also undertaken during the baseline surveys (**Table 15**). These features were not reassessed in spring 2020. No substantial change in these features relative to the baseline conditions are expected to occur over the short to medium term. For example, the establishment of hollows and maturity of regenerating eucalypts will take tens of years.

Table 15: Habitat assessment within 50 m x 20 m vegetation monitoring plots

Plot	HBT	Logs	Comment	Dominant habitat features present within each 50 m x 20 m plot
1	0	0 m	No change	Limited surface rocks; abundant exotic annuals
2	1	2 m	No change	Surface and outcropping rocks abundant; minor course woody debris
3	0	15 m	No change	Litter common; minor coarse woody debris
4	0	0 m	No change	Developing canopy regeneration; course woody debris
5	0	16 m	No change	Developing canopy regeneration; limited surface rocks
6	0	0 m	No change	Developing canopy regeneration
7	0	0 m	No change	Minor surface rocks and course woody debris; abundant exotic annuals
8	0	12 m	No change	Litter; course woody debris; hollow logs; surface rocks

5.3 Threatened fauna

Black-chinned Honeyeater (*Melithreptus gularis*) was recorded opportunistically in the northern offset. This is the first time Black-chinned honeyeater has been seen in the study area since monitoring began. It is listed as vulnerable in NSW, but not listed in the ACT.

5.4 Macropod grazing

As per the recommendation after previous years' monitoring, Icon Water engaged ELA to conduct a kangaroo density study in 2019 (ELA 2019). It was found that the population of Eastern Grey Kangaroos on the study area was approximately 739 at the time of analysis, much higher than the estimates made during offset monitoring, including previous monitoring years. The ACT Kangaroo Management Plan (ACT Government 2010) indicates that a property can support a density of between 0.6 and 1.5 kangaroos per hectare. The kangaroo density study revealed that the study area supports approximately 3.6 kangaroos per hectare.

In 2019 Icon Water received license to perform a cull of Eastern Grey Kangaroos across the Williamsdale property. A total of 395 kangaroos were removed from the ACT section of the property (including the offset area) and 125 from the NSW section of the property (Icon Water pers. comm.). A further 125 kangaroos were culled within the NSW section in 2020. This will have reduced the per hectare density of kangaroos considerably.

The combination of these culls and the mild temperatures and higher than average rainfall during 2020 have likely contributed to the high diversity and cover of native species and exotic annuals within the floristic plots. As well, the grazing exclusion plots established in the northern offset area were showing very little difference between inside and outside. For example, the cover of *Themeda triandra* (Kangaroo Grass) and other native grasses was high on both sides of the fence in Grazing plots 2 and 3 (see **Figure 19** and **Figure 20**).

Eastern Grey Kangaroos were seen across the study area during monitoring in mobs of up to 30 individuals. However, it appears that the recent macropod controls have been successful in reducing grazing pressure as the mobs were seen only occasionally and not on every day.

Grazing pressure is at a level that can be sustained by the ecosystem, and it is likely that a small-moderate increase in pressure could also be sustained. There is potential for a lagged increase in kangaroo density as a result of the high plant growth in 2020, but it is hoped that the culling program has created a buffer and grazing will remain at an acceptable level.

Figure 19: Grazing plot 2

Figure 20: Grazing plot 3

6. *Swainsona recta* monitoring

The spring 2020 *Swainsona recta* census was undertaken on 18 November 2020. Of the 112 individuals planted within the three translocation plots, 14 were present in spring 2020, a decrease of ten compared to spring 2018. This represents an overall survivorship of 12.5%, which is down substantially from the 79% overall survivorship recorded in spring 2013.

Of the 14 plants present in spring 2020, 12 were in flower or fruit. While in 2018 all living plants were of Mt Taylor provenance, in 2020 the living plants were from all four origin locations, of which 64% were from Williamsdale or Burra. These results align more with the results prior to the 2016 monitoring, which indicated a stronger survival of Burra and Williamsdale individuals, however it can be seen over the course of the monitoring program that survival varies across origin locations and years.

Six of the 14 individuals recorded during spring 2020 were not recorded in the 2018 surveys. As discussed in previous monitoring reports (ELA, 2014; ELA, 2015; ELA 2016; ELA 2018), and as demonstrated by these fluctuating year-on-year results, it is difficult to accurately quantify survivorship in planted *Swainsona recta* individuals in only a single season, due to the species' ability to die back to below ground root stock and develop above ground growth only when conditions are favourable. Monitoring was conducted slightly later (by 13 days) than in 2018, and therefore the peak flowing/fruiting period had mostly passed, with potential for an earlier flowering period due to good conditions. Additionally, grass cover in the plots was high so it was difficult to find the *S. recta* plants in the grass without flowers present.

With the installation of gates in the *S. recta* plots, it may be worthwhile allowing grazing for a portion of the year, ideally before the growing season for *S. recta,* to reduce shading by *Themeda australis* and encourage growth. This is outlined under the Rehabilitation Sub-plan in **Section 13**.

6.1 Plot 1

Plot 1 occurs within Box-Gum Woodland with a *Themeda triandra* (Kangaroo Grass) dominated groundcover. A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot contains some open ground and inter-tussock spacing between *Themeda* tussocks and is on a slight east facing slope. *Eucalyptus blakelyi* surrounds the plot as the dominant overstorey with natural regeneration present. Shading from the overstorey is low.

Forty individuals were planted within plot 1, of which 26 were from Mt. Taylor (ten potting mix and 16 soil plus potting mix) and seven each were from the Williamsdale and Burra populations.

Of the 40 plants, ten were present in spring 2020 (five from 2012 plantings and five from 2013) (**Table 16**; **Figure 21**). No recruitment was observed within the plot. A high percentage of grass cover was observed within the plot (**Figure** 22).

Table 16: Plot 1 monitoring results

Key	Results	Comments
◯	**Present** - in flower or immature fruit	8 fertile plants, from 2012 and 2013 plantings
□	**Present** – lacking flowers and fruits	1 from 2012 and 1 from 2013
△	**Absent** - not observed	21 from 2012 and 9 from 2013 plantings not observed

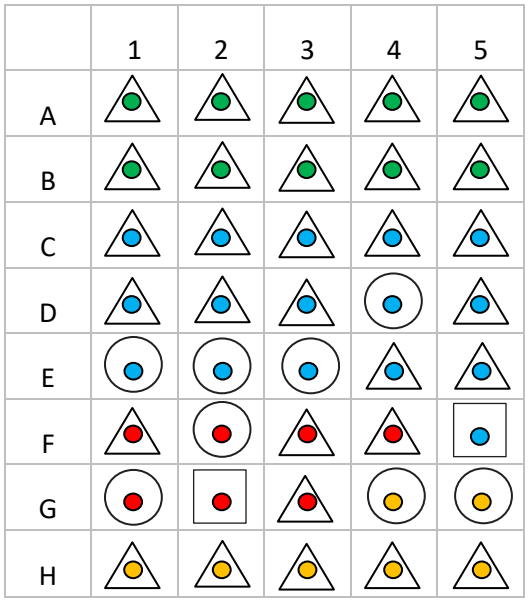

Figure 21: Visual representation of plot 1 results. Refer to Table 2 for key.

Figure 22: *Swainsona recta* plot 1 in spring 2020, from the north

6.2 Plot 2

Plot 2 occurs within *E. blakelyi* dominated Box-Gum Woodland with the understorey dominated by *Austrostipa* spp. (Speargrass) and *Themeda triandra* (Kangaroo Grass). A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot is established on a slight north-east facing slope. Natural regeneration is present in the general area, but no shading of the overstorey trees is likely to occur. Some rocky habitat occurs adjacent to the plot, but not within the plot.

Thirty-six individuals were planted within plot 2, of which 20 were from Mt. Taylor (six potting mix and 14 soil plus potting mix) and eight were from each of the Williamsdale and Burra populations. Fourteen individuals are located outside the fenced boundary of the plot (columns one and two).

Of the 36 individuals planted, three were present in spring 2020, all from 2013 plantings. No recruitment was observed within the plot (**Table 17**; **Figure 23**). However, all the plants observed were in flower and/or fruit. High grass cover was observed in the north end of the plot, but the south end was more open (

Figure 24).

Table 17: Plot 2 monitoring results

Key	Results	Comments
◯	**Present** - in flower or immature fruit	3 plants fertile, all from 2013 plantings
□	**Present** - lacking flowers and fruits	None
△	**Absent** - not observed	21 from 2012 & 13 from 2013 plantings not observed

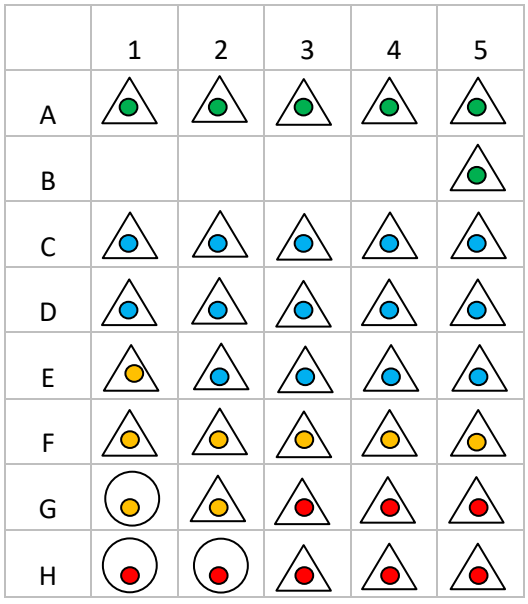

Figure 23: Visual representation of plot 2 results. Refer to Table 2 for key.

Figure 24: *Swainsona recta* plot 2 in spring 2020, from the south

6.3 Plot 3

Plot 3 occurs in *Eucalyptus bridgesiana* (Apple-box) / *E. dives* (Peppermint) woodland with an understorey dominated by *Themeda triandra*. A high diversity of native species and a low abundance of exotic species have been recorded within the surrounding area. The plot was established on a flat area on top of a small knoll. Limited surface rocks were observed within and immediately adjacent to the plot. Plot 3 is likely to experience moderate shading throughout the day from surrounding overstorey.

Thirty-six individuals have been planted within plot 2, of which 20 were from Mt. Taylor (nine potting mix and 11 soil plus potting mix), seven of which were from the Williamsdale population and nine of which were from the Burra population.

Of the 36 individuals, one was present in spring 2020, from 2013 plantings (**Table 18**; **Figure 25**). No recruitment was observed within the plot. High cover of *Themeda triandra* was observed in the plot, as well as the EPBC listed *Leucochrysum albicans* var. *tricolor* (Hoary Sunray) (**Figure** 26).

Table 18: Plot 3 monitoring results

Key	Results	Comments
◯	**Present** - in flower or immature fruit	1 fertile plant, from 2013
□	**Present** - lacking flowers and fruits	None
△	**Absent** - not observed	None

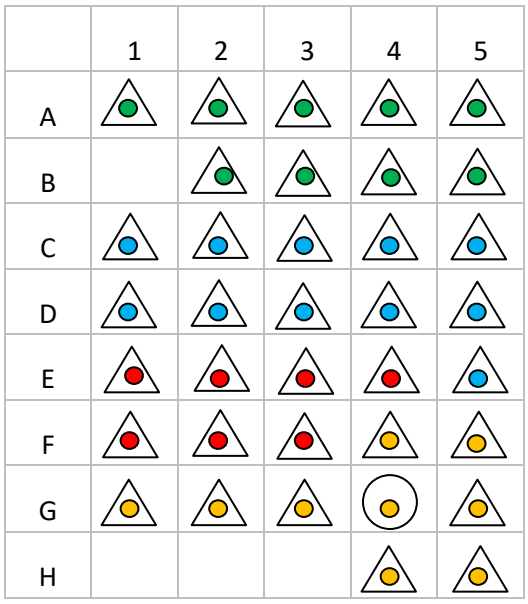

Figure 25: Visual representation of plot 3. Refer to Table 2 for key.

Figure 26: *Swainsona recta* plot 3 in spring 2020, from the north

7. Weed monitoring

7.1 Weed management actions undertaken to date

Weed management on site has included control of the perennial grasses *Eragrostis curvula* (African Lovegrass) and *Nassella trichotoma* (Serrated Tussock) in mid-2012 and mid to late-2013, and control of the perennial broad-leaved species *Rosa rubiginosa* (Sweet Briar), *Rubus* sp. (Blackberry), and *Hypericum perforatum* (St. John's Wort) over the summer 2012 / 2013 and summer 2013 / 2014 periods. Follow up control was also undertaken in December 2014.

Additional weed spraying operations targeting Sweet Briar and Blackberry were undertaken in spring 2015; these predominantly involved spot spraying of re-shooting Sweet Briar.

A biological control program (St. John's Wort Beetle) for this species is being implemented in the region by ACT Parks and Conservation Service (PSC). As a result of discussion between Icon Water and ACT PSC, targeted spraying of St. John's Wort has continued on the Williamsdale property, where access allows. St. John's Wort Beetle was observed opportunistically during the 2020 monitoring.

Weed control has occurred regularly since 2012 within the offset site and across the broader Williamsdale property. Species targeted include those listed above and other species (see Section 2.4), with priority species for each year dependent on prevalence within the site.

As previously mentioned, control of *Carthamus lanatus* (Saffron Thistle) was observed in the southern portion of the southern offset, around floristic plot 1. Saffron Thistle was prolific across this part of the site (and sporadic in other areas) during spring 2020 monitoring, and some dense patches of St John's Wort were also recorded across the whole study area.

7.2 Priority areas for weed control works

A summary of weed occurrences across the offset site is provided in **Table 19**. Priority areas for weed control works have also been identified across the offset site, with priority areas defined by management units. The priority areas for works have been assessed for six different species or groups of species as shown in **Figure 27** and **Figure 28**, with the overall priority for each species across the offset site summarised in **Table 19**.

Table 19: Summary of prior weed occurrence and spring 2020 monitoring results

Species	Prior weed occurrence	Current status
African Lovegrass (***Eragrostis curvula***)	Low, relatively few isolated individuals or small patches along tracks across the offset site with some heavier infestations around the main drainage line around MU5/6.	Targeted control work has been successful. This species was not recorded in the spring 2020 survey, but may occur outside of the offset site within the broader Williamsdale property. **MU occurrence**: N/A **Recommendation**: Continue monitoring **Priority**: Low
Serrated Tussock (***Nassella trichotoma***)	Low, scattered individuals in some areas. Scattered plants persist within MU1 near the southern boundary of the southern offset.	Targeted control work has been successful. This species was not recorded in the spring 2020 survey, but similar to African Lovegrass, may occur within the Williamsdale property. **MU occurrence**: N/A **Recommendation**: Continue monitoring **Priority**: Low
Blackberry (***Rubus fruticosus***)	Low, localised areas of dominance. Occasional isolated patches and scattered young individuals, particularly in MU4 along the drainage line. The species is abundant in the broader Williamsdale property, particularly close to the river corridor.	Targeted control work has been largely successful. A few isolated patches and scattered individuals were observed in 2020, predominantly near drainage lines. **MU occurrence**: MU4 **Recommendation**: Follow-up control required. **Priority**: Low
Woody Weeds (**Hawthorn, *Prunus, Pyracantha* & *Cotoneaster***)	Very low, isolated individuals. Present within the study area as isolated individuals.	Very few scattered plants persist the study area. **MU occurrence**: N/A **Recommendation**: Targeted control of isolated individuals using cut and paint or manual removal of the tree. Mostly associated with the northern drainage line **Priority**: Low

Species	Prior weed occurrence	Current status
St John's Wort **(*Hypericum perforatum*)**	Scattered and moderate occurrence across the offset site. Widely distributed across both the northern and southern offset sites, however typically with low cover.	Despite previous control efforts, the species remains widely distributed across both the northern and southern offsets and appears to have increased since 2018 in both extent and abundance. While covers of this species had previously been low, dense patches were recorded in the majority of MUs. The species is particularly prevalent in open areas of the site. **MU occurrence**: All MUs **Recommendation**: Continued spraying in conjunction with the ongoing biological control program by ACT PCS. If extent of St John's Wort on the property becomes more of a concern, discussion should be had with ACT around additional control measures. **Priority**: Moderate-High
Thistles **(*Carthamus lanatus, Carduus* spp., *Cirsium vulgare* & *Onopordum* spp.)**	Moderate, localised areas of dominance, predominantly in areas with significant history of disturbance.	Thistles were most prevalent in areas with a strong history of grazing disturbance. *Carduus* spp. *Onopordum* spp. Were observed in scattered patches. *Carthamus lanatus* (Saffron Thistle) were commonly encountered, especially in MU1a and the southern portion of MU3. *Cirsium vulgare* (Spear Thistle) was recorded as scattered patches in open areas, and at monitoring plots in MU3, MU4 and MU5. **MU occurrence**: All MUs **Recommendation**: For *Carthamus lanatus* particularly, consider control options within a broader program encompassing the adjacent property to the south. This species was very common in MU1a and has infested much of the management unit. **Priority**: High
Sweet Briar **(*Rosa rubiginosa*)**	Isolated presence scattered throughout offset site, largely present as re-sprouting or juvenile individuals.	Weed control work on *Rosa rubiginosa* appears to have been largely successful. However, some re-sprouting or recruitment from soil seed stores was observed in most Mus and it is expected that continued follow up work for the species will be necessary, but is not considered a priority at this point in time **MU occurrence**: MU1a, MU1b, MU2a, MU2b, MU3, MU4, MU5, MU7 **Recommendation**: Further spot spraying of individuals missed or re-sprouting. **Priority**: Low-Moderate

Species	Prior weed occurrence	Current status
Patterson's Curse (*Echium plantagineum*)	Scattered occurrence across the offset site. Low level of dominance.	Patterson's Curse has been prolific in the region during 2020, but occurrences within the offset were isolated and mostly around the boundaries. **MU occurrence**: MU1a, MU4, MU7 **Recommendation**: Spot spraying of individuals. **Priority**: Low

Figure 27: Relative weed distribution within the southern offset site, spring 2020

Figure 28: Relative weed distribution within the northern offset site, spring 2020

8. Erosion monitoring

8.1 Erosion management actions undertaken to date

During the ERG site visit to the M2G Biodiversity Offset on 22 October 2014, concern was expressed over potential erosion problems in two areas adjacent to the main drainage channel in the northern offset. The two sites are located along the main drainage line separating MU5 & MU6 within the northern offset. Recommendations around rehabilitation options were presented in the spring 2014 monitoring report.

On-ground erosion management activities were undertaken during winter 2016 in the form of placement of woody debris piles in active gullies in an attempt to slow erosion at the gully heads. For further detail on management actions recommended refer to the ODP and Erosion Management Sub-plan.

Furthermore, additional erosion control has been undertaken in the small drainage line in MU6 (flowing into the main drainage line) in the form of rocky debris and MU4 at the overflow point south of the dam (see erosion point 18 and 22 below). This management appears to have been effective in stabilising the two areas, and with plantings that were previously implemented in the upper drainage line in 2016, an erosion rehabilitation concept plan is no longer required.

8.2 Erosion monitoring point results – spring 2020

The majority of erosion monitoring points are located along ephemeral drainage lines in the northern offset. Vegetative ground cover has increased in many locations since spring 2018 monitoring, and this fluctuation is expected to continue with rainfall trends in future monitoring seasons. Active (minor) erosion at or adjacent to three of the erosion monitoring points was observed in the current monitoring period. Remediation works appear to have been successful in stabilising gully heads; further works of similar scope are recommended for consideration at a number of other points.

It should be noted that approval is required to undertake any remediation works within a drainage line (see Erosion Management Sub-plan) and may influence the type of work to be undertaken. A summary of the erosion points monitored within the offset property is provided below with a detailed description of each point and an accompanying photo (**Figure 29** to **Figure 39**).

Where erosion points have been noted as stable over multiple monitoring periods, or have had remediation works, it is recommended that monitoring is no longer required. No further change is expected at these locations, but this decision will be reviewed as necessary.

8.2.1 Erosion Point 2

Description: Situated within an ephemeral drainage line in MU4, northern offset.

Size: Approximately 4 m across, 0.8 m deep and 2.0 m in length.

Change: Although there has been no significant change observed since baseline monitoring survey, a small amount of head cutting has occurred since 2018. There is still little groundcover above the eroded area.

Action required: Consider erosion control such as placing woody debris at the gully head to prevent further erosion. Actions to reduce grazing may also assist in reducing erosion.

Figure 29: Erosion point 2; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.2 Erosion Point 4

Description: Located within an ephemeral drainage line within MU4, northern offset.

Size: Approximately 2.0 m wide, 0.5 m deep, 2.5 m long.

Change: No change has occurred since 2018. Lots of sitting water was observed and the area is fairly heavily vegetated.

Action required: No works required at this stage. Could remove this from future monitoring.

Figure 30: Erosion point 4; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.3 Erosion Point 6

Description: Located in an ephemeral drainage line within MU4, northern offset. Evidence of sheet erosion along bank and some rill erosion.

Size: Approximately 6 m long, 1.5 m deep and 2.5 m wide.

Change: No change since 2018. Bank is unvegetated but stable.

Action required: No change has occurred for multiple monitoring seasons, so will be removed from the monitoring program.

Figure 31: Erosion point 6; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.4 Erosion point 7

Description: Located along the main creek line within northern offset. Photo taken from Photo Point 1 (co-ordinates; 6059835, 692700) looking north-west (315º) and showing the north bank.

Size: Approximately 20 m long and 1.0 m deep.

Change: No change since 2018.

Action required: Remediation measures to slow surface water flow and stop progression of head cut could be considered.

Figure 32: Erosion point 7; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.5 Erosion Point 8

Description: Located along the main creek line within northern offset. Photo taken from Photo Point 1 (co-ordinates; 6059835, 692700) looking north-east (45°) and showing the north bank (upstream from erosion point 7).

Size: Approximately 15 m long and 1.0 m deep.

Change: No change since 2018.

Action required: None. Expected to grade out over time and naturally revegetate.

Figure 33: Erosion point 8; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.6 Erosion Point 9

Description: Situated near the western boundary of the southern offset.

Size: Approximately 20 m long and 1 m deep.

Change: Channel has been filled with rocks and appears to be stable. Surrounding area is vegetated, including with St John's Wort.

Action required: Management actions have been undertaken. Monitoring is no longer required

Figure 34: Erosion point 9; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.7 Erosion Point 10

Description: Situated along the western fence line of the southern offset. Small area of erosion due to upslope runoff.

Size: Approximately 5.0 m long and 0.5 m deep.

Change: No change since 2018. Some patches of bare ground but appears stable but overall vegetation cover is good.

Action required: No immediate action required. Monitoring is no longer required.

Figure 35: Erosion point 10; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.8 Erosion Point 13

Description: Moderately sized erosion point in northern offset. Evidence of existing slumping.

Size: Approximately 4.0 m long, 1.5 m deep and approximately 3 m wide.

Change: Some minor slumping and undercutting was observed.

Action required: Consider placement of woody debris or other stabilising materials to remediate and prevent further erosion.

Figure 36: Erosion point 13; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.9 Erosion Point 18

Description: Located along an ephemeral drainage line within the northern offset. Evidence of stream bed exposure, pooling and in-stream vegetation.

Size: Approximately1.5 m deep, 2.5 m wide, 3 m long.

Change: Area has become fully stable since the channel was filled with rocks as part of the erosion remediation in 2017. Area is well-vegetated.

Action required: No further action required. Monitoring is no longer required.

Figure 37: Erosion point 18; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.10 Erosion Point 21

Description: Located west (just downstream) from the access track running along the western boundary in the northern offset. The site has developed a plunge pool, which has exposed the bedrock in some parts.

Size: 1-2 m wide, 0.5 m deep, 2 m long.

Change: A lot of standing water present, some minor slumping was observed, possibly due to recent heavy rainfall. The surrounding area is well-vegetated.

Action required: Consider placement of woody debris or other stabilising materials to remediate and prevent further erosion.

Figure 38: Erosion point 21; as observed during baseline surveys in 2012 (left) and in 2020 (right)

8.2.11 Erosion Point 22

Description: Point established at overflow point of southern dam during the spring 2013 monitoring surveys. Southern dam overflow – flowing water causing erosion at exit point.

Size: 50 cm wide, 20 cm deep, 1.5 m long.

Change: Small rocks have been placed over the access track, so erosion is no longer visible and area is stable.

Action required: Monitoring no longer required.

Figure 39: Erosion point 22; as observed during baseline surveys in 2013 (left) and in 2020 (right)

9. Feral animals

Observations of feral animals over the course of the monitoring program are listed in

Table 20: Feral animal observations for the 2020 monitoring period, and previous sightings and management actions

Species	Prior occurrence/management	Current status
European Fox (*Vulpes vulpes*)	Individuals have been observed within the offset area in previous years. Targeted fox shooting was undertaken in 2016. Foxes appear to be in low numbers, but nocturnal surveys would be needed to be certain.	A single individual was observed during spring 2020 monitoring to the north of MU6. **MU occurrence**: MU6 **Recommendation**: Liaise with Parks and Conservation Service to expand existing fox baiting programs into the property. **Priority**: Low
European Rabbit (*Oryctolagus cuniculus*) and European Hare (*Lepus europaeus*)	Rabbit warrens have previously been recorded across the wider Williamsdale property but are not prolific. Other signs of rabbits in the form of scat have also been observed. Extensive fumigation of warrens occurred during 2020 (Icon Water pers. comm.)	Rabbit scat was observed opportunistically across the site. **MU occurrence**: N/A **Recommendation**: Continue monitoring and perform further control measures as needed. **Priority**: Low
Fallow Dear (*Dama dama*)	Fallow Deer were sighted in 2016 but not in 2018. They are likely present in low numbers. Control of deer with shooting is ongoing, with three individuals removed from the property in 2020.	Three individuals were observed in the south-west corner of the Williamsdale property, outside of the offset areas, during spring 2020. **MU occurrence**: N/A **Recommendation**: Continue monitoring and perform further control measures as needed. **Priority**: Low
Feral Goat (*Capra hircus*)	Regional Feral Animal Control removed 150 Feral Goats from the property in 2013, and further removal activities were undertaken in 2015 and 2017. Large herds of goats (approx. 40-70) were sighted opportunistically in 2016 and 2018.	Feral Goats were not observed during spring 2020. **MU occurrence**: N/A **Recommendation**: Continue monitoring **Priority**: Moderate
Feral Pig (*Sus scrofa*)	Pig diggings have been recorded in previous monitoring seasons, and control measures were taken by Regional Feral Animal Control in 2012 and 2014. Pig control was also being undertaken at the time of the 2020 monitoring surveys	Three instances of pig diggings (old and more recent) were observed within the northern offset during spring 2020. The areas were localised and reasonably small. **MU occurrence**: MU4, MU6 **Recommendation**: Continue monitoring **Priority**: Moderate (noting control undertaken in 2020).

and their locations mapped in **Figure 40**. Previous management by Regional Feral Animal Control (RFAC) has targeted European Fox (*Vulpes vulpes*), Feral Goat (*Capra hircus*) and Feral Pig (*Sus scrofa*). All species seem to be currently present in low numbers only, but continued monitoring is recommended, implementing timely control measures when necessary.

Table 20: Feral animal observations for the 2020 monitoring period, and previous sightings and management actions

Species	Prior occurrence/management	Current status
European Fox (*Vulpes vulpes*)	Individuals have been observed within the offset area in previous years. Targeted fox shooting was undertaken in 2016. Foxes appear to be in low numbers, but nocturnal surveys would be needed to be certain.	A single individual was observed during spring 2020 monitoring to the north of MU6. **MU occurrence**: MU6 **Recommendation**: Liaise with Parks and Conservation Service to expand existing fox baiting programs into the property. **Priority**: Low
European Rabbit (*Oryctolagus cuniculus*) and European Hare (*Lepus europaeus*)	Rabbit warrens have previously been recorded across the wider Williamsdale property but are not prolific. Other signs of rabbits in the form of scat have also been observed. Extensive fumigation of warrens occurred during 2020 (Icon Water pers. comm.)	Rabbit scat was observed opportunistically across the site. **MU occurrence**: N/A **Recommendation**: Continue monitoring and perform further control measures as needed. **Priority**: Low
Fallow Dear (*Dama dama*)	Fallow Deer were sighted in 2016 but not in 2018. They are likely present in low numbers. Control of deer with shooting is ongoing, with three individuals removed from the property in 2020.	Three individuals were observed in the south-west corner of the Williamsdale property, outside of the offset areas, during spring 2020. **MU occurrence**: N/A **Recommendation**: Continue monitoring and perform further control measures as needed. **Priority**: Low
Feral Goat (*Capra hircus*)	Regional Feral Animal Control removed 150 Feral Goats from the property in 2013, and further removal activities were undertaken in 2015 and 2017. Large herds of goats (approx. 40-70) were sighted opportunistically in 2016 and 2018.	Feral Goats were not observed during spring 2020. **MU occurrence**: N/A **Recommendation**: Continue monitoring **Priority**: Moderate
Feral Pig (*Sus scrofa*)	Pig diggings have been recorded in previous monitoring seasons, and control measures were taken by Regional Feral Animal Control in 2012 and 2014. Pig control was also being undertaken at the time of the 2020 monitoring surveys	Three instances of pig diggings (old and more recent) were observed within the northern offset during spring 2020. The areas were localised and reasonably small. **MU occurrence**: MU4, MU6 **Recommendation**: Continue monitoring **Priority**: Moderate (noting control undertaken in 2020).

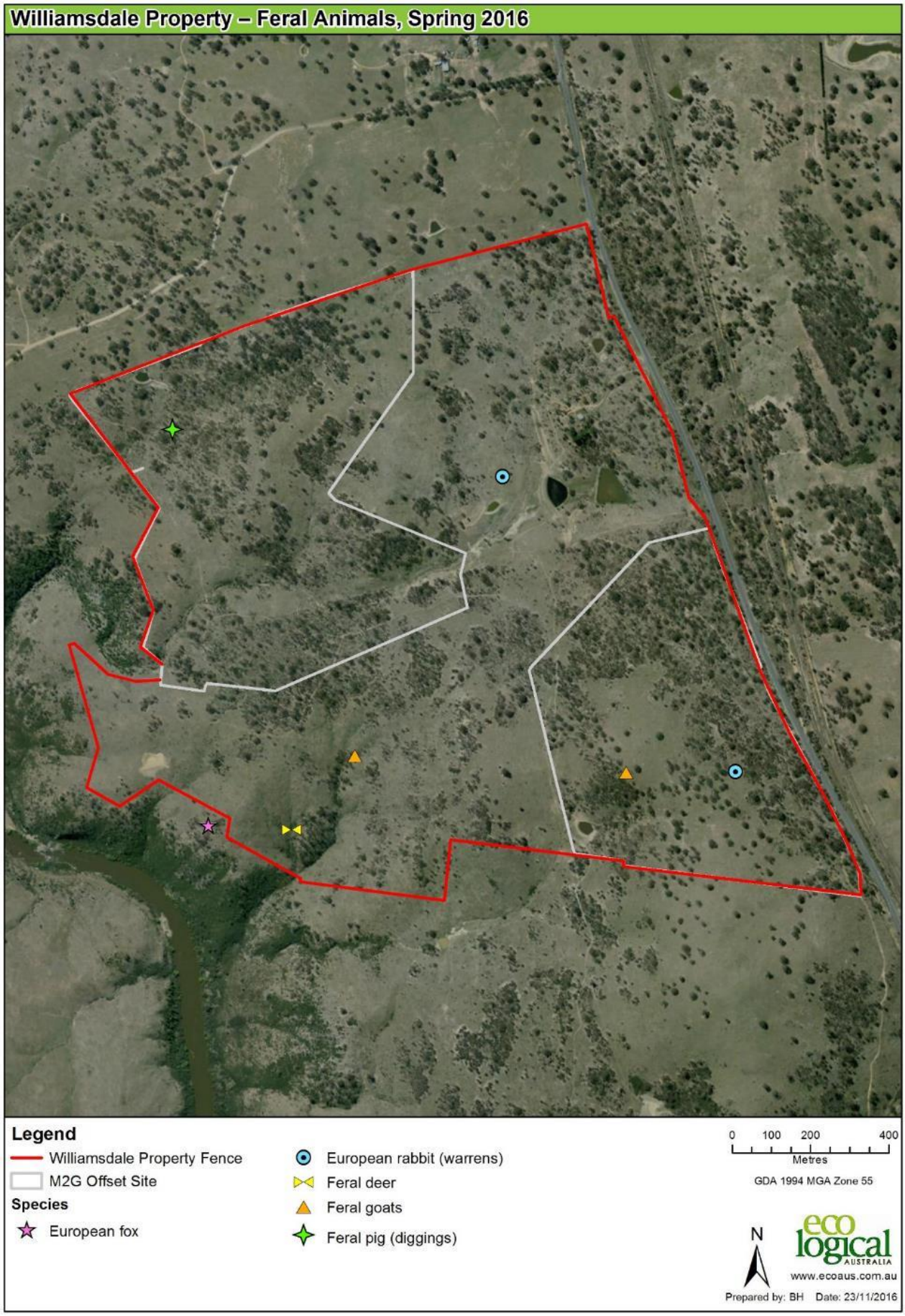

Figure 40: Opportunistic records of feral animals within the Williamsdale property, spring 2016

10. Fencing monitoring

Fencing of the offset site was one of the required actions highlighted in the ODP. Fencing is required to prevent grazers such as sheep and cattle from entering the offset site from the neighbouring properties. The primary aim of a stock proof fence is to keep grazing stock out of an area (e.g. conservation area) where it is bordered by a private rural property. This type of fencing generally consists of 4 or 5 stranded wire with wooden posts and/or star-pickets, approximately 1.2 m high. In response to recommendations in previous monitoring reports (ELA, 2012), all internal fencing within the offset site was removed in June 2013 to enhance the wildlife friendly nature of the offset site and to be consistent with the biodiversity conservation ideals of the ODP and associated sub-plans.

10.1 Fence condition spring 2020

The overall condition of the Williamsdale property and offset boundary fencing is considered good and adequate to exclude grazing by stock within the offset site. No areas of major damage (moderate or high risk) were recorded during the spring 2020 survey.

Older style boundary fencing comprising a rabbit netting base with plain wires along the top is still present along some sections of the offset site boundary. As highlighted in previous monitoring reports (ELA, 2013; ELA, 2014; ELA, 2015; ELA, 2017; ELA, 2018), this style of fencing is not wildlife friendly and can require considerable ongoing maintenance as a result of damage by fauna (wombats etc.; See **Figure 41**).

It is recommended that the fence continue to be monitored to ensure that it is maintained as an effective barrier to the movement of stock, and that boundary fencing with rabbit netting along the bottom is removed. However, no immediate action is required.

Figure 41: Example of low risk damage to fence where rabbit netting is forced up and becomes a run for animals. Eastern boundary fence, MU3

11. Rehabilitation survival assessment

Rehabilitation success was observed as being low-moderate, with many plantings over-run with weeds, especially St John's Wort. An accurate assessment of individual species survival cannot be done at this stage as without knowing what was originally planted and where.

It is noted that native plantings were done in MU7 during 2020.

12. Summary

12.1 General

We found the offset site is in moderate to good condition during the 2020 monitoring period. Of note is the high diversity of native vegetation (species and cover) resulting from favourable climatic conditions and reduced grazing by kangaroos following the 2019-2020 control program. Grazing pressure is likely at the lowest level in the history of the monitoring program. These same factors have also contributed to high cover of exotic annuals such as clover, and as such, some weed control is required, especially for Saffron Thistle infestations.

Threatened flora species were present, and the good conditions have likely also contributed to a reasonable diversity of birds on the site. Feral animal sightings were lower than in previous years, and areas of erosion are stabilising successfully.

12.2 Bushfire

The access track through the offset site is in a satisfactory condition.

Dense cover of native grasses and exotic annuals (such as Saffron Thistle), coupled with reduced grazing pressure from kangaroo culls, may have increased fuel loads, however the region is not especially dry overall.

12.3 Threatened, rare and uncommon plant species

Four nationally threatened and 12 rare and uncommon ACT plant species occur or have been known to occur on the offset site. Although no species is imminently threatened within the offset site, it is recommended that periodic monitoring be undertaken to ensure that the populations of these species within the site are at a minimum maintained over time, and ideally expanded. Factors to consider monitoring include:

- population numbers
- evidence of recruitment
- potential threats such as grazing or browsing and weed competition. This is particularly relevant for the *Swainsona recta* plots

Staff and contractors should be made aware of these species and their locations on site (i.e. provided with maps and photographs) to minimise inadvertent damage to populations. This is particularly important for personnel involved in spraying herbicides.

12.4 Weeds

Primary control of weeds across the site has reduced the abundance and distribution of key weed species such as Sweet Briar and Blackberry. However, follow up control is required to target any individuals missed or those that are re-sprouting. On-going weed control should be prioritised for Thistle species, with the infestations of Saffron Thistle in the southern offset of particular concern. St. John's Wort should continue to be monitored closely to determine if additional controls are needed. This should be discussed with ACT PCS due to biological control of ST. John's Wort that is being conducted in the region.

It is recommended that weed control within the broader Williamsdale property (including other offset areas) be considered to minimise the chance of weed propagules from surrounding land becoming established within the offset site.

12.5 Erosion

Minor active gully erosion or slumping was observed at or adjacent to three of the erosion monitoring points in the current monitoring period. Previous remediation works appear to have been successful in stabilising gully heads; further works of similar scope are recommended for a few other points, but are considered a low priority at this stage. Many erosion points are considered stable enough for ongoing monitoring to be forgone.

12.6 Feral animals

The overall incidence of feral animals within the offset site was low. The presence of Feral Pigs, foxes and rabbits was recorded, but in low numbers, particularly in comparison to previous monitoring surveys. Previous control methods appear to have been effective, but continued monitoring is recommended. It is noted that control of feral pigs, deer and rabbits was undertaken in 2020.

12.7 Fencing

The condition of the Williamsdale property and offset boundary fencing is considered good and adequate to exclude stock grazing from the offset site. No areas of major or moderate damage were observed with only a few points of minor damage. However, no immediate action is required. Some sections of the fence may require replacing in the future with a five-strand plain wire fence.

12.8 Grazing

Grazing pressure by Eastern Grey Kangaroos has decreased as a result of the culls performed in 2019 and 2020. This is evidenced by high diversity and cover of native grasses within floristic monitoring plots, and high cover of exotic annuals. At the *Swainsona recta* plots and grazing exclusion plots, little difference in groundcover was observed between inside and outside the fences, again indicating lowered grazing pressure. The native grass *Themeda triandra* (Kangaroo Grass) was especially prolific in these areas.

Opportunistic observations of kangaroos were also less frequent than in previous seasons, and the size of mobs smaller. Grazing pressure is at a level that can be sustained by the ecosystem, and it is likely that a small-moderate increase in pressure could also be sustained.

13. Management recommendations

A summary of the recommended adaptive management actions relating to the offset site is provided in **Table 21** below. The actions relate to the appropriate ODP sub-plan and are based on the results presented in the above sections.

Table 21: Summary of proposed actions relating to the ODP

ODP Sub-Plan	Action status	Recommended management actions
Weed	On-going control and monitoring.	• Target priority species and priority areas as identified in **Section 6** (St John's Wort and Thistle species). An adaptive management approach may be required in priority areas to promote growth of native grasses as competition with exotic annuals. This may include a combination of one or more of the following control measures (Prober *et. al.,* 2005; Cole *et. al.,* 2016). Note that seeding with native grass species should follow any control measure taken, as per the Weed Management Sub-plan. ○ Crash/pulse grazing with livestock. Timing is critical to ensure maximum palatability of target species, ie. Saffron thistle in early growth stages, St John's Wort in non-toxic pre-flowering phase. Fencing is also a consideration for use of this control method to limit grazing to weed-dominated areas and prevent spread of propagules to areas dominated by native species. ○ Burning. A spring burn of priority areas may create a window for establishment of native grasses that will outcompete exotic annuals, although this method is generally understood to be more effective at reducing exotic grass cover. ○ Sugar application. Application of sugar on the topsoil can be used to reduce soil nutrients that are necessary for growth of exotic broadleaf species. This method should not be used near waterways. • Continue to undertake follow up weed control as required on persistent species such as St John's Wort, Thistle species, Sweet Briar and Blackberry after priority control. • On-going weed management will be required at the site to combat the introduction of propagules from adjacent rural areas.
Rehabilitation	To be considered.	Monitoring of rehabilitation is deemed to be not necessary moving forward, as useful data can no longer be gained. In terms of the *Swainsona recta* plantings, it is recommended that either high-level slashing or macropod grazing (through the opening of gates in the plots) be applied before the growing period for *S. recta*, eg. late spring or early winter, to reduce shading and competition by the native grass *Themeda australis*, with the aim of encouraging growth. This could be applied to all or some of the plots.
Sediment and erosion Control	Partially complete, some action required.	• The majority of sites within the offset are considered to be stable and no immediate action is required. Ongoing monitoring of these sites is not required. Where remaining sites are remediated in the future, monitoring of these sites will also cease. • Minor remediation works, such as placement of woody debris, should be considered at points 2, 13 and 21.
Bushfire	Complete. On-going monitoring.	• It is recommended that the track continues to be maintained in a condition to facilitate bush fire management. If track management is required in the future, it is recommended that care is taken to ensure that the track remains in good condition and does not widen due to overuse, incorrect maintenance, or result in erosion. The track would ideally remain in a grassed condition. • Consider developing and implementing an improved bushfire management plan which specifically manages the site for conservation (in consultation with NSW and ACT Rural Fire Services). The plan should include consideration of fire as a tool to manage invasive species, increase native species diversity, maintain an open structure to the woodland and enable a mosaic of fire classes to be established across the site.
Feral animal control	Action and on-going monitoring required.	• Continue monitoring through opportunistic observation of pigs, scats and diggings. No targeted survey is required at this time. • Ongoing feral pig control program to keep numbers low.
Fencing	Completed in August 2012 and June 2013. On-going maintenance and monitoring	• No immediate major actions required. Minor repair actions are likely to be needed in the near future. • As previously recommended (ELA, 2017), replacement of older style boundary fence (rabbit netting) with a 5 strand plain wire fence should be considered.
Grazing	Complete. On-going control and monitoring	• Kangaroo culls were performed in 2019 and 2020, reducing the density of macropods and the resulting grazing pressure on the offset area. • It is recommended that monitoring continue to assess the approximate abundance of kangaroos, through opportunistic counts and assessment of grazing pressure at the grazing plots. Repeat density studies can be conducted if it is deemed necessary to inform a potential culling program. At this point in time, the site can sustain current and slightly increased grazing levels. • Undertake rapid assessment of grass cover and height at grazing plots as part of the monitoring program, using quadrats both inside and outside the plots, to give an indication of grazing pressure.

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Appendix A Flora species list – monitoring plots

D = dead	2 = 5-25%
+ = few, small cover (<5%)	3= 25-50%
r = solitary, small cover (<5%)	4= 50-75%
1 = numerous (up to 5%)	5=>75%

Note: The species cumulative list includes all species observed over all monitoring surveys.

Native species, spring 2020

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Acacia dealbata	x								
Acacia mearnsii	x								
Acacia rubida	x								
Acaena echinata									
Acaena novae-zelandiae	x								
Acaena ovina	x		+	1	1	1	1		1
Acaena sp.	x							r	
Acrotriche serrulata	x								
Ajuga australis	x								
Alternanthera denticulata									
Alternanthera sp. A									
Amphibromus nervosus									
Amyema pendula subsp. pendula	x								
Aphanes australiana									
Aristida ramosa	x								
Aristida sp.	x								
Aristida vagans									
Arthopodium milleflorum	x				x				
Arthropodium minus	x								
Arthropodium sp.	?								
Asperula conferta	x			1	+	r			+
Asplenium flabellifolium	x								
Astroloma humifusum	x								
Austrostipa bigeniculata	x	+	1		+				1
Austrostipa densiflora	x								+
Austrostipa scabra	x	1	2	1	1	1	2	+	2

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Austrostipa setacea	x								
Austrostipa sp.	x				1				
Bossiaea buxifolia	x								
Bossiaea prostrata	x					+			
Bothriochloa macra	x	1	1	+	1	1	1	+	
Brachyloma daphnoides	x								
Brachyscome dentata	x								
Bulbine bulbosa	x					r			
Bursaria spinosa subsp. lasiophylla	x			+		r			
Callistemon sieberi	x								
Callitris endlicheri	x								
Calocephalus citreus	x			+					r
Calotis scabiosifolia var. integrifolia									
Carex breviculmis									
Carex appressa	x								
Carex inversa	x	1	1	+	+	r		+	r
Carex sp.									
Cassinia aculeata	x								
Cassinia longifolia	x								
Cassinia quinquefaria	x								r
Centipeda cunninghamii									
Cheilanthes sieberi	x	r	1	1		+	1		1
Chrysocephalum apiculatum	x		2	1		2	1		2
Chrysocephalum semipapposum	x						+		
Clematis leptophylla	x			r			r		
Convolvulus angustissimus	x		+	+		+	+		+
Cotula australis	x							+	
Craspedia variabilis	x				1				
Crassula helmsii									
Crassula peduncularis									
Crassula sieberana	x	1	1		+	+			+
Crassula sp.	x						1	+	
Cryptandra amara	x					1	r		

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Cymbonotus lawsonianus	x		+	+	1	+	1	+	+
Cymbonotus preissianus	x			r	r		r	r	
Cymbonotus sp.									
Cymbopogon refractus	x								
Cynoglossum sp.					r	x	r	r	
Cynoglossum suaveolens/australe	x					r			
Cyperus lhotskyanus									
Daucus glochidiatus	x		1	1	+		+		+
Desmodium brachypodium									
Desmodium varians	x		1	1		1	+		1
Dianella revoluta	x								
Dichelachne micrantha	x		r	+	+				
Dichelachne sp.									
Dichondra repens	x		+		+	+	+		
Dichopogon fimbriatus	x			+	1				1
Dillwynia sp. Yetholme									
Discaria pubescens									
Diuris semilunulata									
Dodonaea viscosa subsp. angustissima	x								
Drosera peltata	x								+
Dysphania pumilio	x								
Einadia nutans subsp. nutans	x						+	r	
Elatine gratioloides									
Eleocharis acuta									
Elymus scaber	x		+	+			1		
Enneapogon nigricans	x								
Epilobium billardiereanum	x								
Epilobium hirtigerum									
Epilobium sp.									
Eragrostis brownii									
Erodium crinitum	x							2	
Eryngium ovinum	x			1	+				
Eucalyptus blakelyi	x		2	2	2	2	2		2

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Eucalyptus bridgesiana	x								
Eucalyptus dives	x								
Eucalyptus mannifera	x								
Eucalyptus melliodora	x								
Eucalyptus rossii	x								
Euchiton japonicus	x			+	1				r
Euchiton sp.	x								
Euchiton sphaericus	x	+	1	+	1	+	1	1	1
Euphorbia drummondii	x	r	r				r		
Exocarpus cupressiformis	x								
Fimbristylis dichotoma	x			r	r				
Galium gaudichaudii	x			+		r			r
Galium sp.					r				
Geranium retrorsum	x		+				+		
Geranium solanderi	x		+	1	1	1		r	
Geranium sp.									
Glossostigma elatinoides									
Glycine clandestina	x								
Glycine tabacina	x		r			+			
Gonocarpus tetragynus	x			+					+
Goodenia hederacea	x								
Goodenia pinnatifida	x			1					
Hardenbergia sp.	x								
Haloragis heterophylla	x				1	r			+
Hibbertia obtusifolia	x								
Hydrocotyle laxiflora	x		1	1	+	1	+	r	
Hymenochilus cynocephalus									
Hypericum gramineum	x			+			r		+
Hypoxis hygrometrica	x								
Indigofera australis	x								
Isoetopsis graminifolia									
Isolepis hookeriana									
Isotoma fluviatilis subsp. australis									
Juncus australis	x								
Juncus bufonius									

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Juncus filicaulis	x			+	r				
Juncus homalocaulis									
Juncus subsecundus	x								
Juncus usitatus	x					r			
Kunzea ericoides	x								
Kunzea parvifolia									
Lachnagrostis filiformis									
Leptorhynchos squamatus	x			1	1	1			1
Leptospermum continentale									
Leucochrysum albicans var. tricolor	x								1
Limosella australis									
Linum marginale	x			+	r	+	+		
Lomandra bracteata	x								r
Lomandra filiformis subsp. coriacea	x		r	r	+	r	+		1
Lomandra filiformis subsp. filiformis	x								
Lomandra longifolia	x								
Lomandra multiflora	x								
Luzula densiflora	x					r			
Lythrum hyssopifolia									
Melichrus urceolatus	x		r			+			r
Microlaena stipoides	x	+	+	1	1	+	1	1	
Microseris lanceolata	x								
Microtis sp. (unifolia)?	x				1	+			+
Montia fontana subsp. chondrosperma									
Myosotis australis									
Ophioglossum lusitanicum	x								
Oreomyrrhis eriopoda									
Oxalis perennans	x	+	+		1	r	r	r	r
Oxalis radicosa									
Oxalis thompsoniae									
Panicum effusum	x	+			r	r	+	r	
Pellaea calidirupium									
Persicaria prostrata									

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Pimelea curviflora	x								
Plantago gaudichaudii	x			1					
Plantago varia	x		+	1	x	+	+		
Poa labillardieri	x								
Poa sieberiana var. hirtella									
Poa sieberiana var. sieberiana	x		r	+	+	+	r		+
Poa sp.									
Pomaderris angustifolia									
Pomaderris pallida	x								
Poranthera microphylla									
Potamogeton ochreatus									
Pseudognaphalium luteoalbum	x								r
Pultenaea procumbens	x								
Ranunculus lappaceus	x								
Ranunculus pumilio var. pumilio	x				r				
Ranunculus sessiliflorus var. sessiliflorus									
Rhodanthe anthemoides									
Rubus parvifolius									
Rumex brownii	x	r		+	1	r	r	2	
Rytidosperma caespitosum	x					1	2		1
Rytidosperma carphoides	x		2				1		+
Rytidosperma laeve									
Rytidosperma pallidum									
Rytidosperma racemosum	x	1	1	1	1		+	+	
Rytidosperma sp.	x	+		2	1	2		1	1
Schoenus apogon	x			r	1				
Scleranthus diander									
Scleranthus fascicularis									
Sebaea ovata									
Senecio phelleus									
Senecio quadridentatus	x			r					r
Solanum linearifolium									
Solenogyne dominii	x				1	r			r

Species (cumulative list)	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Solenogyne gunnii	x								
Sporobolus sp.	x								
Stackhousia monogyna	x		1			+			
Stellaria pungens									
Stylidium despectum									
Swainsona monticola	x								
Swainsona recta (propagated)	x								
Swainsona sericea	x			+		+			
Thelymitra pauciflora									
Thelymitra sp.									
Themeda triandra	x		2	2	2	3	1		3
Thysanotus patersonii	x								
Thysanotus tuberosus	x								
Tricoryne elatior	x					r			r
Tripogon loliiformis									
Triptilodiscus pygmaeus	x		1	1		1	1		1
Veronica calycina	x								
Veronica sp.	x	r				r			
Vittadinia cuneata	x		r						
Vittadinia gracilis	x					r			
Vittadinia muelleri	x		1		r	1	1		1
Wahlenbergia communis	x		1	1		1	1		1
Wahlenbergia gracilenta									
Wahlenbergia gracilis	x					+	+		1
Wahlenbergia multicaulis									
Wahlenbergia sp.	x		r						
Wahlenbergia stricta	x			+					
Wurmbea dioica	x		r	r	r	r			r
Xerochrysum viscosum	x								r
Zornia dyctiocarpa									
Total	154	15	38	48	45	52	40	20	46

Exotic species, spring 2020

Plot Number	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Acetosella vulgaris	x		r				+	r	
Aira caryophyllea									
Aira elegantissima			1						1
Aira sp.	x	1		1	1	1	1	r	
Anagallis arvensis	x	r	+	1	1	+	+		+
Arctotheca calendula	x								
Avena barbata	x			1					
Briza maxima									
Briza minor				r	+				r
Bromus diandrus	x			+			+	r	
Bromus hordeaceus	x	1	1		1		1	1	
Bromus rubens									
Bromus sp.			r						
Caardus sp.									
Capsella bursa-pastoris	x							r	
Carduus pycnocephalus									
Carduus sp.	x							1	
Carduus tenuiflorus									
Carthamus lanatus	x	3	+	+		r			
Centaurea melitensis									
Centaurium erythraea	x					r			
Cerastium glomeratum								r	
Chondrilla juncea	x						r		
Cicendia quadrangularis									
Cirsium vulgare	x			+	+	r		+	
Conyza bonariensis	x								
Conyza sp.				r					
Conyza sumatrensis									
Cotoneaster sp.									
Crataegus monogyna	x								
Cynodon dactylon									
Cynosurus echinatus	x			1					
Cyperus eragrostis									
Cyperus lhotskyanus									

Plot Number	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Cyperus sp.	x								
Echium plantagineum	x	+			+			r	
Eleusine tristachya									
Eragrostis cilianensis									
Eragrostis curvula	x							r	
Eragrostis minor									
Erodium botrys		+							
Erodium cicutarium	x							+	
Erodium moschatum									
Erodium sp.			+						
Festuca arundinacea									
Galium aparine									
Galium divaricatum									
Geranium molle									
Hedypnois rhagadioloides subsp. cretica									
Hirschfeldia incana	x				+			r	
Holcus lanatus									
Hordeum glaucum								1	
Hordeum leporinum									
Hypericum perforatum	x	r	1	1	1	+	+	r	r
Hypochaeris glabra	x								
Hypochaeris radicata	x	r	1	2	1	1	1	+	+
Isolepis levynsiana									
Isolepis marginata									
Juncus capitatus									
Lactuca serriola	x				r	r	r		
Lepidium sp.		r					r	r	
Linaria arvense			1		r		+		r
Linaria pelisseriana				+		r			1
Linum trigynum			+	+		+			
Lolium perenne	x								
Lolium rigidum				+	1				
Malva nicaeensis									
Malva parviflora	x								
Malva sp.								+	

Plot Number	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Marrubium vulgare									
Medicago arabica									1
Modiola caroliniana	x				+				
Moenchia erecta				r				+	
Nassella trichotoma	x								
Onopordum acanthium	x								
Orobanche minor			r	r		r			
Parentucellia latifolia				r	r	r			
Paronychia brasiliana	x	1	1	+			+	1	
Paspalum dilatatum									
Pentaschistis airoides									
Petrorhagia nanteuilii	x		1	1	1	1	1	r	1
Phalaris aquatica									
Plantago lanceolata	x		+		x	1	+	1	+
Poa annua									
Poa pratensis									
Polygonum aviculare									
Prunus sp.									
Reseda luteola									
Romulea rosea var. australis									
Rosa rubiginosa	x	r	r	r	r	r		r	r
Rubus fruticosus	x				r				
Sanguisorba minor									
Setaria parviflora									
Sherardia arvensis									
Silene sp.					x				
Sisymbrium orientale					r				
Sisyrinchium sp. A									
Solanum nigrum									
Sonchus asper	x		r	+	+				
Sonchus oleraceus						r	r	1	
Spergularia rubra									
Stellaria media									
Taraxacum officinale	x								

Plot Number	Opportunistic	1 (MU1a)	2 (MU2b)	3 (MU3)	4 (MU4)	5 (MU5)	6 (MU6)	7 (MU7)	8 (MU3)
Tolpis barbata			1	2	1	1	+		1
Tragopogon dubius									
Trifolium angustifolium	x		+	1	+	r	+	+	1
Trifolium arvense	x	+	1	1	1	2	3	1	2
Trifolium campestre		r	+	1		1	1		+
Trifolium cernuum									
Trifolium dubium	x			r	1			1	
Trifolium glomeratum	x	+	1	1	2	1	2	2	
Trifolium repens	x		r		1				
Trifolium sp.									
Trifolium subterraneum	x	2						4	
Urtica urens								r	
Verbascum thapsus	x	r		r			r	r	
Verbena incompta									
Verbena sp.									
Veronica anagallis-aquatica									
Veronica arvensis									
Vicia sativa									
Vulpia bromoides			+	1	1		r	r	1
Vulpia muralis						1			
Vulpia myuros									
Vulpia sp.	x	1	1	1	1	1	1	1	1
Total	46	17	25	30	29	23	23	32	17

Appendix B Fauna lists

Fauna observations

Fauna species recorded during the monitoring surveys from spring 2011 to spring 2020, either through opportunistic observations or targeted survey are outlined below.

A = autumn, B = spring.

Cumulative bird species

Common Name	Scientific Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B	2016B	2018B	2020B
Australasian Grebe	*Tachybaptus novaehollandiae*		x		x	x	x		x		x	x	
Australasian Pipit	*Anthus australis*											x	
Australian King Parrot	*Alisterus scapularis*								x				
Australian Magpie	*Gymnorhina tibicen*	x	x	x	x	x	x	x	x	x	x	x	x
Australian Raven	*Corvus coronoides*	x	x	x	x	x	x	x	x		x	x	x
Australian Reed Warbler	*Acrocephalus australis*											x	
Australian Wood Duck	*Chenonetta jubata*			x	x	x			x	x		x	x
Black-chinned Honeyeater	*Melithreptus gularis*												x
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*		x	x		x		x		x	x	x	x
Black-shouldered Kite	*Elanus axillaris*										x		
Brown Falcon	*Falco berigora*					x		x	x				
Brown Thornbill	*Acanthiza pusilla*	x		x	x	x		x	x				
Brown-headed Honeyeater	*Melithreptus brevirostris*											x	
Common Blackbird	*Turdus merula*											x	
Common Bronzewing	*Phaps chalcoptera*	x			x		x					x	x
Common Starling	*Sturnus vulgaris*									x	x	x	
Crested Pigeon	*Ocyphaps lophotes*				x	x	x		x		x	x	x

Common Name	Scientific Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B	2016B	2018B	2020B
Crimson Rosella	*Platycercus elegans*	x	x	x	x	x	x	x	x	x	x	x	x
Diamond Firetail	*Stagonopleura guttata*	x			x								
Dollarbird	*Eurystomus orientalis*										x		
Double Barred Finch	*Taeniopygia bichenovii*				x								
Eastern Rosella	*Platycercus adscitus*	x	x	x	x	x		x	x	x	x	x	x
Eastern Yellow Robin	*Eopsaltria australis*						x			x	x	x	
Eurasian Coot	*Fulica atra*										x	x	
European Goldfinch	*Carduelis carduelis*				x					x		x	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*					x		x		x		x	
Flame Robin	*Petroica phoenicea*	x					x						
Galah	*Eolophus roseicapillus*	x		x		x		x	x	x	x	x	x
Golden Whistler	*Pachycephala pectoralis*	x	x			x							
Grey Butcherbird	*Cracticus torquatus*		x	x					x	x		x	
Grey Currawong	*Strepera versicolor*									x	x	x	
Grey Fantail	*Rhipidura albiscapa*	x	x	x		x	x	x	x	x	x	x	x
Grey Shrike-Thrush	*Colluricincla harmonica*		x		x	x	x	x	x			x	
Hardhead	*Aythya australis*			x	x							x	
Hooded Robin	*Melanodryas cucullata cucullata*	x								x			
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*							x			x		
Jacky Winter	*Microeca fascinans*	x		x		x				x			
Laughing Kookaburra	*Dacelo novaeguineae*	x		x					x	x	x	x	x
Leaden Flycatcher	*Myiagra rubecula*			x								x	x
Little Corella	*Cacatua sanguinea*											x	

Common Name	Scientific Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B	2016B	2018B	2020B
Magpie-lark	*Grallina cyanoleuca*	x	x	x	x	x	x	x	x	x	x	x	x
Masked Lapwing	*Vanellus miles*					x		x			x		
Nankeen Kestrel	*Falco cenchroides*					x		x				x	x
Noisy Friarbird	*Philemon corniculatus*			x		x		x		x	x		x
Noisy Miner	*Manorina melanocephala*	x	x	x	x	x	x	x	x	x	x	x	x
Olive-backed Oriole	*Oriolous sagittatus*											x	x
Owlet Nightjar	*Aegotheles cristatus*										x		
Pacific Black Duck	*Anas superciliosa*			x	x	x		x	x			x	
Pallid Cuckoo	Cuculus pallidus									x		x	x
Pied Butcherbird	*Cracticus nigrogularis*							x		x	x		
Pied Currawong	*Strepera graculina*	x	x	x	x	x	x	x	x	x	x	x	
Quail	*Coturnix sp.*	x				x							
Red Wattlebird	*Anthochaera carunculata*					x		x	x	x	x	x	x
Red-browed Finch	*Neochmia temporalis*			x	x	x		x					
Red-rumped Parrot	*Psephotus haematonotus*								x				x
Rufous Songlark	*Megalurus mathewsi*												x
Rufous Whistler	*Pachycephala rufiventris*			x	x	x		x		x	x	x	x
Sacred Kingfisher	*Todiramphus sanctus*			x								x	
Satin Flycatcher	*Myiagra cyanoleuca*												x
Scarlet Robin	*Petroica boodang*		x		x		x		x				
Shining Bronze Cuckoo	*Chrysococcyx lucidus*							x					
Silvereye	*Zosterops lateralis*								x			x	
Southern Whiteface	*Aphelocephala leucopsis*						x						
Speckled Warbler	*Chthonicola sagittatus*				x		x						

Common Name	Scientific Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B	2016B	2018B	2020B
Spotted Pardalote	*Pardalotus punctatus*	x	x	x	x		x	x	x	x	x	x	x
Striated Pardalote	*Pardalotus striatus*	x		x	x	x	x	x	x	x	x	x	x
Striated Thornbill	*Acanthiza lineata*											x	x
Sulphur-Crested Cockatoo	*Cacatua galerita*	x				x	x	x		x	x	x	
Superb Fairy Wren	*Malurus cyaneus*	x	x	x	x	x	x	x	x	x	x	x	
Tree Martin	*Petrochelidon nigricans*					x						x	
Wedge-tailed Eagle	*Aquila audax*	x	x		x		x		x			x	x
Weebill	*Smicrornis brevirostris*				x			x	x	x	x	x	x
Welcome Swallow	*Hirundo neoxena*								x		x	x	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*					x							
White-browed Scrubwren	*Sericornis frontalis*											x	
White-browed Woodswallow	*Artamus superciliosus*											x	
White-eared Honeyeater	*Lichenostomus penicillatus*	x	x		x				x		x	x	
White-faced Heron	*Egretta novaehollandiae*								x	x			
White-naped Honeyeater	*Melithreptus lunatus*								x				
White-plumed Honeyeater	*Lichenostomus penicillatus*				x	x					x		
White-throated Gerygone	*Gerygone olivacea*			x		x		x		x	x	x	x
White-throated Treecreeper	*Cormobates leucophaeus*	x	x	x	x	x	x	x	x		x	x	
White-winged Chough	*Corcorax melanorhamphos*		x	x		x		x	x	x	x	x	x
White-winged Triller	*Lalage sueurii*							x					
Willie Wagtail	*Rhipidura leucophrys*	x	x		x	x		x	x	x	x	x	x
Yellow Thornbill	*Acanthiza nana*								x				
Yellow-faced Honeyeater	*Lichenostomus chrysops*			x				x	x	x	x	x	x

Common Name	Scientific Name	2011	2012A	2012B	2013A	2013B	2014A	2014B	2015A	2015B	2016B	2018B	2020B
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	x	x	x	x	x	x	x	x	x	x	x	
Yellow-tailed Black-cockatoo	*Calyptorhynchus funereus*				x						x	x	
Total		30	24	33	35	40	25	39	39	38	43	58	36

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