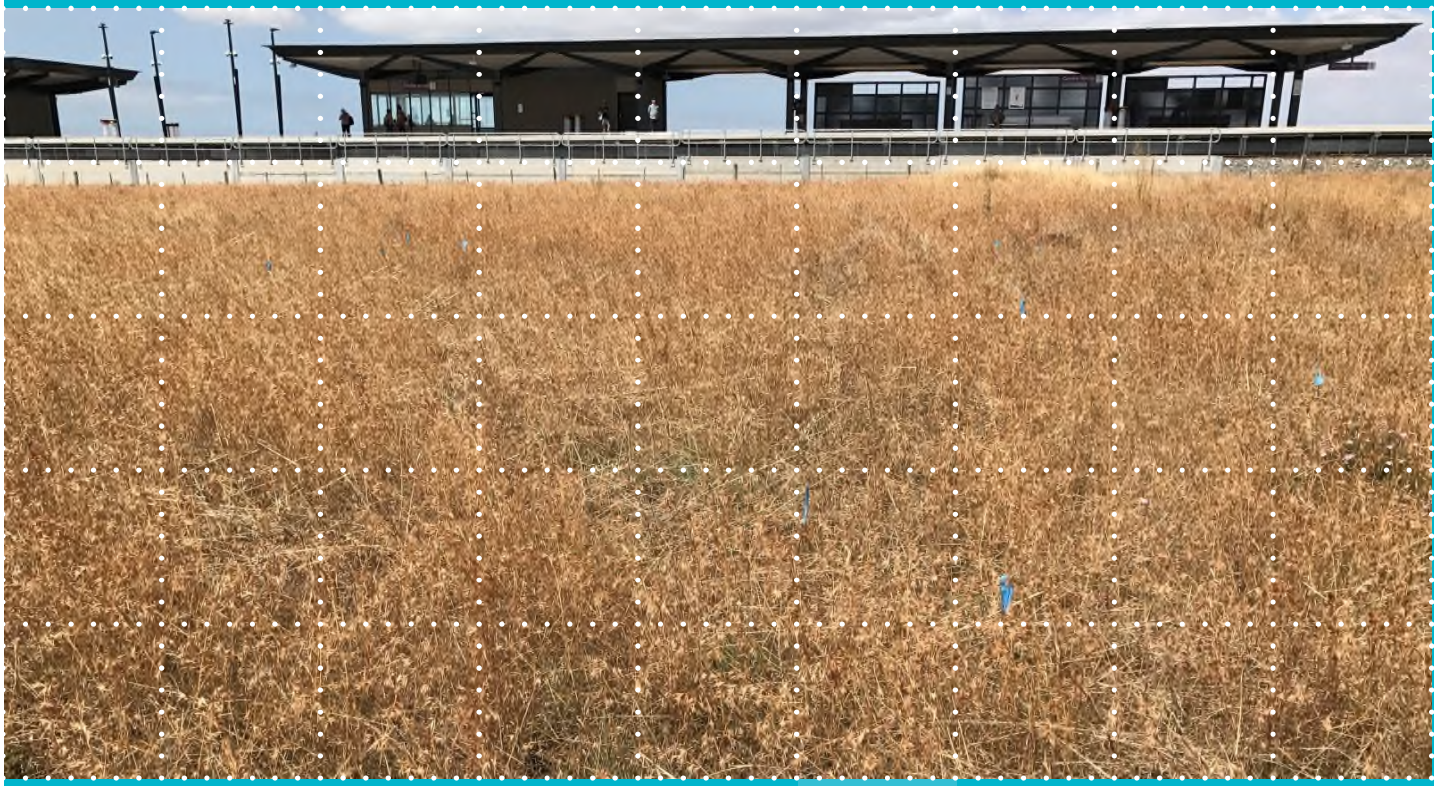
FINAL REPORT

Annual Report for the Caroline Springs Railway Station Grassland – Year 4

PREPARED FOR

Public Transport Victoria

August 2018



Ecology and Heritage Partners Pty Ltd

MELBOURNE: 292 Mt Alexander Road, Ascot Vale VIC 3032 **GEELONG:** 230 Latrobe Terrace, Geelong West Vic 3218
BRISBANE: Level 22, 127 Creek Street, Brisbane QLD 4000 **ADELAIDE:** 22 Greenhill Road, Wayville SA 5034
CANBERRA: PO Box 6067, O'Connor ACT 2602 **SYDNEY:** Level 5, 616 Harris Street, Ultimo, NSW, 2007
www.ehpartners.com.au | (03) 9377 0100

DOCUMENT CONTROL

Assessment	Annual Report for the Caroline Springs Railway Station Grassland – Year 4
Address	Christies Road, Caroline Springs
Project number	10974
Project manager	Shannon LeBel (Senior Ecologist)
Report author(s)	Thorin Robertson (Zoologist); Shannon LeBel (Senior Ecologist)
Other EHP staff	Chelsy Maloney (Zoologist), Mel McGregor (Ecologist), Brigette Gwynne (Consultant Zoologist); Jordan Whitmore (Botanist).
Mapping	Monique Elsley (GIS Officer)
File name	10974_EHP_Year4_AnnualReport_Final_22082018
Client	Public Transport Victoria
Bioregion	Victorian Volcanic Plain
CMA	Port Phillip and Westernport
Council	Melton City Council

Report versions	Comments	Comments updated by	Date submitted
Draft	Draft prepared for review by PTV		15/08/2018
Final	No comments provided by PTV		22/08/2018

ACKNOWLEDGEMENTS

We thank the following people for their contribution to the project.

- Manuelito Mitra (Project Manager) – Public Transport Victoria;
- Linda Neilson (Advisor – Natural Resource Management) – V/Line Pty Ltd;
- Steve Hammond and the crew from Western Land Services for management works;
- Department of the Environment (Commonwealth) and the Department of Environment, Land, Water, and Planning (Victoria) for legislative advice and the provision of databases and mapping programs used to inform these works;
- *Pimelea spinescens* Recovery Team (PsRT).

GLOSSARY

Acronym	Description
CMP	Conservation Management Plan
DELWP	Victorian Department of Environment, Land, Water and Planning
DoEE	Commonwealth Department of Environment and Energy
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
OMP	Offset Management Plan
PsRT	*Pimelea spinescens* Recovery Team
PTV	Public Transport Victoria
SLL	Striped Legless Lizard *Delma impar*
SRF	Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*
WLS	Western Land Services

CONTENTS

1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by Public Transport Victoria (PTV) to undertake and oversee management and monitoring works relating to a 2.04 hectare conservation reserve area, and associated areas of retained grassland at the site of the Caroline Springs Railway Station, located on Christies Road, Caroline Springs (Figure 1).

The management, monitoring and auditing works required to be undertaken at Caroline Springs are detailed in the Conservation Management Plan (CMP) (Ecology and Heritage Partners 2014a) and Offset Management Plan (OMP) (Ecology and Heritage Partners 2014b) prepared for the site, and approved by the Commonwealth Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2010/5463), and the Victorian Department of Environment, Land, Water and Planning (DELWP) (formerly the Department of Environment and Primary Industries [DEPI]).

The action was approved by the Commonwealth with conditions on 5 November 2010. Requested variations to these conditions were approved on 5 May 2011, 15 April 2015, 29 June 2017 and 29 January 2018. It should be noted that based on the conditions of the approved variation of 15 April 2015, the Conservation Management Plan (CMP) was subsequently updated in May 2015, and is henceforth referenced as Ecology and Heritage Partners Pty Ltd (2015a).

Specifically, the works relate to the protection and ecological monitoring of the quality of the EPBC Act-listed community Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP), weed and pest control works, biomass control methods such as prescribed ecological burns, and management and monitoring of the existing populations of the EPBC Act-listed Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* and Striped Legless Lizard *Delma impar*.

Ecology and Heritage Partners subcontracted Western Land Services Pty Ltd (WLS) in June 2014 to implement pest plant and animal control, biomass reduction, revegetation and fencing works for the ecological management works between Years 1-4.

The annual monitoring report presented below, outlines the management and monitoring actions undertaken throughout the conservation area (referred to herein as the offset site) and the other area of retained grassland between 24 June 2017 and 23 June 2018 (i.e. the fourth year of the overarching CMP and OMP), with the beginning of Year 1 being 24 June 2014 (being the date of approval of the CMP and OMP) (Figure 2). The monitoring report for Year 1, Year 2 and Year 3 is detailed in Ecology and Heritage Partners (2015b; 2016; 2017). The methods utilised for the monitoring and management actions follow those set out in the CMP (Ecology and Heritage Partners 2015a) and the OMP (Ecology and Heritage Partners 2014).

Sections 2.1 and 2.2 predominately relate to the monitoring and management of the Striped Legless Lizard and Spiny Rice-flower as prescribed by the CMP, while Section 2.3 relates to the monitoring and management of the offset site as a whole as required by the OMP.

1.2 Vegetation and Site Condition

Biomass and vegetation condition across the offset site is consistent with that from Year 3, with vegetation condition ranging from moderate to high (Appendix 1). The western half of the offset site was subject to an ecological burn in June 2018, and as such, at the time of this report, biomass is significantly reduced compared to the remainder of the site.

Within the eastern half of the site, native vegetaion cover is high, with weeds comprising approximately 25% cover. Prior to the ecological burn, the western half of the site, both native vegetation and weed cover was at 50% respectively. Weeds of national significance are present, including Chilean Needle-grass *Nassella neesiana* and Serrated Tussock *Nassella trichotoma.* These species were previously present in high abundance, however, weed management works between Year 1 and Year 4 has resulted in a significant decrease in the cover abundance of these two species. Other weed species present throughout the offset site and retained grassland include Galenia *Galenia pubescens* var. *pubescens,* Spear Thistle *Cirsium vulgare,* Common Sow-thistle *Sonchus oleraceus*, Patterson's Curse *Echium plantagineum* and Artichoke Thistle *Cynara cardunculus.* Although formerly present in high abundance, African Boxthorn *Lycium ferocissimum* has almost been eliminated from the site since the inception of the management plan. Only occasional, scattered seedlings were observed during Year 3.

Despite the high biomass of vegetation and density of weeds within sections of the conservation reserve and retained grassland, a range of native herbaceous flora species persist throughout, including the nationally significant Spiny Rice-flower, Smooth Rice-flower *Pimelea glauca,* Slender Bindweed *Convolvulus angustissimus* subsp. *omnigracilis*, Cotton Fireweed *Senecio quadridentatus*, Narrow-leaf Plantain *Plantago gaudichaudii*, Berry Saltbush *Atriplex semibaccata*, Cotton Fireweed *Senecio quadridentalis*, Common Woodruff *Asperula conferta*, and Plains Candles *Stackhousia subterranea*. In addition to Kangaroo grass, other native grasses present throughout include Kneed Spear-grass *Austrostipa bigeniculata,* Rigid Panic *Walwhalleya proluta*, Windmill Grass *Chloris truncata*, Common Wallaby-grass *Rytidosperma caespitosa* and the State-significant Rye Beetle-grass *Tripogon loliiformis*.

As with Year 3, three habitat zones of differing quality were recorded in the offset site. Habitat zone PG1 was present along the eastern boundary of the offset site and is dominated by Kneed Spear-grass, with a low diversity of other grasses and herbs. Zone PG2 is located in the eastern half of the offset site and is dominated by Kangaroo Grass, but also contains occurrences of Kneed Spear-grass, Wallaby-grasses, Windmill Grass, and a wide range of herbs within the understory. Weed cover is relatively low in this habitat zone. Habitat zone PG3, present across the western half of the offset site comprises a similar species composition to PG2. However, a greater cover of weeds is present which results in reduced recruitment opportunities and lower herb diversity within the understory (Figure 2).

1.3 Security

Condition 1 of the EPBC Act approval specifies that the land identified in Annexure 1 of approval 2010/5463 (the protected land) adjacent to the clearing site must be protected in perpetuity to compensate for impacts to the nationally significant Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP), Spiny Rice-flower and Striped Legless Lizard using a conservation covenant under the *Victorian Conservation Trust Act*

1972. This conservation covenant was agreed between the Public Transport Development Authority and Trust for Nature (TfN) and signed on 27 June 2014.

The offset site is a total of 2.04 hectares, comprising 1.92 hectares of Plains Grassland vegetation, and 0.12 hectares of exotic vegetation.

2 ANNUAL REPORT 2017/2018

2.1 Striped Legless Lizard Monitoring

Monitoring is required of both the status of the Striped Legless Lizard (SLL) population and their habitat for a period of ten years within the offset site. Monitoring will determine if management actions and habitats are suitable for the longevity of a viable Striped Legless Lizard population, and determine when remedial actions are required. Two tile grids have been established within the offset site to assist with population monitoring for the species (Figure 3).

Monitoring of the SLL population and habitat was undertaken in accordance with Section 8.8.2 of the CMP (Ecology and Heritage Partners 2014a).

2.1.1 Population Monitoring Results

A total of 18 Striped Legless Lizard (SLL) captures were recorded within the study area during targeted surveys (Plate 1; Plate 2) (Table 1). In addition, two sloughed skins were also observed during the surveys. This is in contrast to Years 1 and 2 when no more than three individuals were observed during the targeted surveys; and Year 3 where a total of fourteen individuals were recorded. Overall, these results suggest an increasing trend in the overall population size for the study area, although it is possible that some of the individuals recorded during Year 4 were recaptures.

Table 1. Summary of targeted survey results

Date	Observer	Time (am)	Air Temp	Cloud Cover	Wind Direction and Spd	Above Tile Temp	Under Tile Temp	Grid 1 (east)	Grid 2 (west)
12/09/2017	BG	11.2	17.3	100%	NNW (20km/hr)	15.2	14.8	**1 x SLL**, 1 x House Mouse	-
26/09/2017	MM/BG	-	12	20%	W (6km/hr)	20.7	13.6	**3 x SLL**	**4 x SLL**
5/10/2017	MM	-	18.7	100%	N (1km/hr)	13.8	12.8	**2 x SLL**	**4 x SLL**
13/10/2017	MM	8:00	13	100%	W (14km/hr)	16.2	14.4	**1 x SLL**, 1 x House Mouse	
26/10/2017	MM	8:00	13	100%	S (23km/hr)	11.6	12.4	**2 x SLL**	-
3/11/2017	MM	8:00	10	20%	W (16km/hr)	8.7	10.3	-	**1 x SLL**
10/11/2017	MM	8:00	14	25%	NW (8km/hr)	17.2	17.9	-	-

The common rodent species House Mouse *Mus musculus* was also recorded in the study area during tile grid checks (Table 1). No other vertebrate fauna species of note were recorded during targeted surveys.

Plate 1. Grid 2 – Striped Legless Lizard (Ecology and Heritage Partners 26/10/2017)

Plate 2. Grid 1 – Striped Legless Lizard (Ecology and Heritage Partners 12/09/2017)

2.1.2 Habitat Monitoring Results

The CMP details the requirements for Striped Legless Lizard habitat rehabilitation and management. For each habitat variable the recorded value must be compared to the trigger value to determine if a management response is triggered and the nature of the response required. Table 2 summarises the monitoring categories and trigger thresholds for Striped Legless Lizard monitoring, while Table 3 summarises the results of Year 4 habitat monitoring (Plate 3; Plate 4). No trigger values were exceeded, and no management response is required following Year 4 of Striped Legless Lizard habitat monitoring (Table 3).

Table 2. Striped Legless Lizard habitat monitoring criteria.

Habitat variable	Ideal level^	Trigger level for action	Response if triggered	Response Triggered?
Native clumping grass cover	50%	<30%	Plant native clumping species	**No**
Introduced grass cover	<10%	>20%	Remove weeds	**No**
Bare ground	20%	<5%	Removal of vegetation	**No**
		>50%	Plant native clumping species	**No**
Exposed rock	10%	<5%	Removal of vegetation	**No**
Inter-tussock spacing	30 centimetres	<10 cms	Removal of vegetation	**No**
		>50 cms	Plant native clumping species	**No**

Note. ^The ideal level value is the average value for each tile grid.

Plate 3. Grid 1 Habitat (Ecology and Heritage Partners 08/06/2018)

Plate 4. Grid 2 Habitat (Ecology and Heritage Partners 30/04/2018)

Table 3. Striped Legless Lizard habitat monitoring results

Habitat Variable	Grid 1 (East)					Grid 2 (West)					Response Triggered
	Q 1	Q 2	Q 3	Q 4	Ave	Q 1	Q 2	Q 3	Q 4*	Ave	
Native clumping grass cover	60%	65%	75%	75%	**70%**	60%	50%	60%	10%	**45%**	**No**
Introduced grass cover	5%	25%	5%	10%	**11%**	20%	45%	15%	0%	**20%**	**No**
Bare ground	15%	5%	10%	10%	**10%**	15%	0%	15%	80%	**28%**	**No**
Exposed rock	10%	5%	10%	5%	**8%**	5%	5%	10%	10%	**8%**	**No**
Inter-tussock spacing	10 cm	10 cm	10 cm	10 cm	**10 cm**	25 cm	10 cm	35 cm	60 cm	**33 cm%**	**No**

Note. * Values after ecological burn. Q1 = Jul – Sep; Q2 =Oct – Dec; Q3 = Jan – Mar; Q4= Apr - Jun

2.1.3 Conclusion

A population of Striped Legless Lizard is still present in the study area, with the species being recorded during six of the seven tile grid checks.

Striped Legless Lizard is a highly cryptic species and as such there is currently no reliable method for assessing the size of a given Striped Legless Lizard population (O'Shea 2013). However, it is noted that there was a total of 18 individuals recorded during Year 4, up from 14 individuals recorded during Year 3, and two and three individuals in Year 1 and Year 2 respectively. Continued monitoring in accordance with the CMP will

improve this data over time and photographs of dorsal head scale pattern of individuals captured in subsequent monitoring years will continue to be undertaken to assist in identifying individual lizards.

Monitoring indicated habitat within the offset site remains in good condition for Striped Legless Lizard and no trigger values were exceeded for any of the measured habitat components. No management responses are currently required at the site for Striped Legless Lizard habitat. Continued monitoring in line with the CMP will ensure habitat for the Striped Legless Lizard is maintained or improved within the site over the coming years.

2.2 Spiny Rice-flower Monitoring

Monitoring is required of both the status of the translocated Spiny Rice-flower (SRF) population within the designated recipient site, and a sample of the existing *in-situ* population and their habitat for a period of ten years within the offset site. Monitoring will determine if management actions to improve habitat are suitable for the longevity of a viable Spiny Rice-flower population, and determine when remedial actions are required.

2.2.1 Monitoring Methods

Long-term independent monitoring of translocated plants within the recipient site is crucial to ensuring ongoing survival (Vallee *et al.* 2004). Monitoring must be undertaken in accordance with the current PSRT protocols (PSRT 2013) which are summarised in Section 8 of the CMP (Ecology and Heritage Partners 2014a).

Monitoring was undertaken by a qualified botanist, familiar with the ecology and growth habits of Spiny Rice-flower. The 55 SRF (#1-55) transplanted in June 2014 and June 2015 were monitoried on a quarterly basis over the course of the Year 4 monitoring period, while the three SRF (#56-58) transplanted in June 2017 were monitored on a monthly basis between July and December 2017, and bi-monthly until June 2018.

Where required, additional visits during summer were undertaken to ensure translocated specimens were watered during periods of high drought stress where the watering requirements were triggered.

To ensure that monitoring provided an accurate and ongoing assessment of the health of the translocated plants, the following variables were measured on each plant:

- Sex (Male or Female);
- Presence of flowering material and percentage of the plant in flower;
- % Foliage;
- Survival;
- Presence of germinants (recruitment); and,
- Health.

In addition to the indicators of growth and reproductive success, monitoring looked at drought stress, pest plant and animal impacts, biomass and other site disturbances that may negatively impact the translocated plants.

A subset of 25 individuals from the existing *in* situ SRF population was monitored concurrently with the translocated specimens. These plants were monitored on a quarterly basis.

2.2.2 Recipient Site Conditions

Kangaroo Grass is dominant within the recipient site as well as Kneed Spear-grass *Austrostipa bigeniculata* and Windmill Grass. However, relative to other areas within PG2 elsewhere within the offset site, the recipient site contains low to moderate levels of exotic grasses and herbs including Wild Oat, Common Sow-thistle, and isolated occurrences of Chilean Needle-grass.

The majority of perennial weeds having been eliminated between Years 1 to 3 due to regular herbicide treatment. No 'floating rock' is present within the recipient site, and no rocks were disturbed or removed as part of the translocation process.

A remnant population of Spiny Rice-flower is present within the southern section of the recipient site, and care was taken to ensure these plants were not disturbed as part of the translocation, and ongoing monitoring and management activities.

Overall, due to the ongoing weed control taking place, the recipient site is considered to be in good condition.

2.2.3 Plant Deaths and Disturbances

2.2.3.1 June 2014 Transplants

As of the most recent monitoring event of Year 4 (30 April 2018), there were three (3) deaths (#2, 9 and 13) during Year 4 from the original 23 SRF salvaged specimens, and one (1) specimen formerly thought dead that exhibited regrowth from the base. In total, the remaining 14 specimens remain in good to excellent health at the end of Year 4. Of this cohort of SRF transplanted individuals, six (6) specimens perished in Year 1, with no plant deaths in Year 2 or Year 3.

The three plant deaths occurred between October and January, suggesting drought stress was a major factor in the loss of these specimens despite a watering event being undertaken in December 2017.

2.2.3.2 June 2015 Transplants

As of 30 April 2018, there was a total of five (5) deaths (#25, 29, 30, 32 and 35) during Year 4 from the original 32 SRF salvaged specimens, and two specimens previously though dead exhibiting regrowth and showing signs of vigour (#41 and 51) with a total of 15 of the 32 SRF specimens transplanted in June 2015 appearing dead, and the remaining 17 specimens in moderate condition (Appendix 2).

At several times during the year, various individual plants appeared to decline in health, only to rapidly recover following a watering event. This indicates that drought stress was likely a major factor in plant death and growth rate on the transplanted individuals.

2.2.3.3 June 2017 Transplants

Of the three specimens transplanted in June 2017, all remain alive, albeit in poor health. These specimens are small in size, likely have only a small taproot, and are considered more susceptible to disturbance and drought stress.

Without a watering event in December 2017 and February 2018, it is possible that all three of these specimens may have perished.

2.2.3.4 In-situ monitoring

All 25 in-situ SRF specimens are in excellent condition at the end of Year 4 despite not being subject to the watering regime applied to the translocated plants.

2.2.4 General Health and Growth

The health of all SRF plants was assessed at each monitoring event in accordance with the metric detailed in Table 4.

2.2.4.1 June 2014 Transplants

Of the 14 plants (of the original 23) to survive Year 4, 13 are in at least very good health (i.e. – a health score of 2.5 or better [Figure A2.1]), with one specimen with a health rating of 4.5 (#3) as of 30 April 2018.

Five of the 14 plants were flowering at the date of the most recent monitoring event (30 April 2018), with a moderate number of germinants (18) observed throughout spring and summer of 2017. Monitoring also recorded an increase in biomass over Year 3, with new several new shoots of regrowth observed sprouting from the base of most plants. This may indicate that these specimens have successfully re-established since the transplant event and are now able to redirect resources to continued growth and reproduction.

2.2.4.2 June 2015 Transplants

Of the 17 plants (of the original 32) to survive Year 4, 16 are in good health (i.e. – a health score of between 1-3, with only one specimen in poor health (score of 4.5) [Figure A2.2.1]), as of 30 April 2018.

Eleven of the 17 plants were flowering at the date of the most recent monitoring event, with a moderate number of germinants observed. Several new shoots of regrowth were observed sprouting from the base of some plants, with an overall increase in biomass recorded.

Table 4. Health Rating Metric for Spiny Rice-flower

Health Rating	Description	Health Indicator
1	Excellent	Less than 5% dieback
2	Good	Between 15 < 30% dieback
3	Moderate	Between 30 < 75% dieback
4	Poor	Between 75 < 99% dieback
5	Dead	No evidence of live biomass

2.2.4.3 June 2017 Transplants

All three specimens from this cohort are in poor health (rating of 4 or above) as of 30 April 2018. No germinants were recorded, and only one specimen was flowering.

Ongoing monitoring of these specimens will be undertaken to ensure disturbance and drought stress are minimised in future.

2.2.4.4 General Comments

Overall, the Year 4 results indicate a lower level of survivorship compared to Year 3, but higher than Year 2. A total of six specimens perished during Year 4 , with a total of 34 out of 58 translocated specimens still alive.

The risk of mortality appears to be highly influenced by the absence of significant rainfall events in the Caroline Springs locality. The surviving individuals from the 2014 and 2015 cohorts are generally in good to excellent health, with germinants regularly observed, although these end to perish over summer due to drought stress.

Summaries of the 2016/2017 recorded data are presented in Appendix 2.

2.2.5 Threatening Processes

Weed invasion, biomass accumulation and drought stress present the greatest threats to the health and survival of translocated plants at the recipient site. In all cases, remedial actions to mitigate these threats were undertaken throughout the year, and these actions are summarised below in Section 2.4.

Weeds such as Serrated Tussock, Common Sow-thistle, Patterson's Curse and Spear Thistle, and native grasses including Kangaroo-grass have the potential to out-compete or smother translocated Spiny Rice-flower plants and prevent recruitment. However, ongoing weed control, biomass removal and implementation of the watering regime are anticipated to continue to mitigate these threats as the translocated plants further establish.

2.2.6 Management Actions

Given the threats posed by weed invasion and biomass accumulation, Ecology and Heritage Partners botanists undertook maintenance activities when required during each monitoring event. The activities predominantly comprised hand weeding, and biomass removal around each of the translocated specimens to open inter-tussock spaces, reduce competition for resources and space, and encourage growth and establishment. Western Land Services also conducted selective herbicide application on those high-threat weeds within the recipient site and surrounds (with a particular focus on Serrated Tussock, thistles, and Patterson's Curse) that have a higher potential to impact the Spiny Rice-flower population.

As undertaken in previous years, to mitigate against potential drought stress, additional watering was undertaken for all SRF translocated individuals in December 2017, and February 2018.

An ecological burn was conducted in June 2018 in the western half of the offset site. Additional details are provided in Section 2.3.5.

As per the contingency measures detailed in the CMP (Ecology and Heritage Partners 2014a), seed is proposed to be collected from the translocated SRF specimens following the 2018 flowering season.

Collected seed will be used for propagation purposes should the performance targets specified in the CMP at the end of Year 5 not be met, and the contingency plan is enacted.

2.2.6.1 Performance Targets

The ultimate aim of translocation is to ensure the conservation of the genetic diversity of a species. The conservation of genetics is especially critical for endangered species and the loss of genetics from even a single plant can be seen as a failure of the translocation process.

Vallee *et al.* (2004) and the PRs have detailed stringent criteria for determining the success of translocated plant species. The outlined criteria are detailed in the CMP.

In order to meet the short-term performance target of 50% survival, a total of 28 plants should be alive at the end of Year 5. As of the end of Year 4, 34 plants are alive.

Monitoring indicated that the condition and structure of habitat within the recipient site, and offset site in general remains in good condition for Spiny Rice-flower persistence and no trigger values were exceeded for any of the measured habitat components. Aside from monitoring for cracks around each 'plug', ongoing weed control and additional watering during the summer months, no further management responses are currently required at the site for Spiny Rice-flower. Continued monitoring in line with the CMP will ensure habitat for the Spiny Rice-flower and survival rates for translocated and *in-situ* individuals is maintained or improved within the site over the coming years.

2.3 Management Actions for Year 4 (as per Table 12 of the OMP)

The following section relates to the management actions and targets summarised in Table 12 of the OMP prepared for the offset site (Ecology and Heritage Partners 2014b).

2.3.1 Undertake control of woody weeds

2.3.1.1 Timing of Action and key performance target

Before seed heads mature in summer. Ensure cover of woody weeds is <1%.

Status – Year 4

Action Completed**.** Western Land Services mechanically removed all woody weed infestations during Year 1 and Year 2, with woody weed control works during Year 4 focussed on the control of small numbers of African Box-thorn *Lycium ferocissimum* recruits that were observed re-sprouting from previously removed infestations. Emergent Box-thorn was treated via cut and paint method, herbicide (Tricopyr), and ecological burning.

Based on the removal of existing infestations within the offset site and areas of retained grassland, woody weed cover is now considered to be at approximately 1%.

Actions Required

The performance target for the cover of woody weeds is being met. Due to the existing stored soil seedbank, further monitoring and control will be required over the coming years to ensure additional woody weed infestations do not re-establish within the site.

2.3.2 Undertake control of exotic grasses and herbaceous broadleaves

2.3.2.1 Timing of Action and key performance target

Before seed heads mature in spring/summer. Eliminate (<1%) perennial weeds and grasses and ensure cover of annual grasses/broadleaves is <5%.

Status – Year 4

Action Completed. Western Land Services undertook four visits (July and October 2018; and January and April 2018) during the Year 4 management works to control grassy and herbaceous weeds, with a particular focus on exotic C4 grasses (Couch, Paspalum, Kikuyu, Seteria), particularly in the area subjected to the June 2017 ecological burn. The offset site and retained grassland formerly contained large infestations of Serrated Tussock; however, much of the Serrated Tussock has been successfully treated, and Year 4 efforts focussed on monitoring for, and treating new infestations.

Exotic grasses were sprayed multiple times with Glyphosate bi-active and selective herbicide was used for Broadleaf weeds, particularly Patterson's Curse, Oxtongue, Galenia and Brassica. Paterson's Curse and Artichoke Thistle were a particular problem again in Year 4 during late Spring and Summer, and additional effort was made during this period to treat any observed individuals of these species prior to seed set**Error! Reference source not found.**.

Based on management actions undertaken during Years 1-3, the cover of exotic perennial grasses is now considered to be at approximately 15%, with the majority of this located in the western half of the offset site. As the western section of the site has been subjected to an ecological burn, follow-up spot spraying is required to ensure recruiting exotic grasses are promptly treated.

Broadleaf weed cover is low and is estimated at 5%. Annual grass cover demonstrated considerable variation across the year, with the cover negligible between February to early October. Between mid-October and February, the cover of annual grasses is high (approximately 50%) predominantly due to the presence of Oat *Avena* spp., and the Spring-growing perennial species, Toowoomba Canary-grass *Phalaris aquatica*. It has not been possible to adequately control these species without unacceptable off-target damage to native species.

Actions Required.

Based on the initial extent of annual grassy and herbaceous weed cover in the offset site, and the high cover of these species in land immediately adjacent to the offset site, cover will be difficult to reduce to the target level of <5% as stated in the OMP (Ecology and Heritage Partners 2014). Continued intensive weed control will be required in Year 5 to ensure the current levels of annual weeds to not increase. Serrated Tussock, Chilean Needle Grass *Nassella neesiana* and Patterson's Course will continue to be a priority, and it is anticipated that the ongoing ecological burning regime will assist in controlling these, and other weeds currently present.

Future management of annual grasses within the offset site should be re-visited in consultation with the management contractor to determine an appropriate technique to successfully reduce the cover of annual grass within the offset site.

The cover of perennial exotic grass is estimated to have been reduced to 10%, and this will be maintained and/or reduced in coming years via the existing management regime.

2.3.3 Conduct Rabbit Control

2.3.3.1 Timing of Action and key performance target

Peak breeding season: late summer/early autumn. Significant reduction in number/signs of rabbits

Status – Year 4

Action Completed. All harbour has been removed from the site during Year 1. No pest animals were observed in Year 4 of monitoring with the pest-animal proof fence appearing to be successfully excluding pest fauna from the offset site.

Actions Required

Continued monitoring for the presence of pest fauna during Year 5 is required. If pest fauna (rabbits, foxes) are observed, or signs thereof, appropriate control measures should be undertaken.

2.3.4 Maintain Perimeter Fence

2.3.4.1 Timing of Action and key performance target

Ongoing; Fence is maintained and repaired if broken.

Status – Year 4

Action Completed. Western Land Services and Ecology and Heritage Partners regularly check on the fencing during site visits.

Western Land Services installed new signage on the fences to replace old/damaged signs, and maintained existing signs as per the requirements of the CMP. At the end of Year 4, two signs appeared to be damaged and will be repaired early in Year 5. All fences and access gates are currently in good order. No other maintenance is currently required.

Action Required.

Continued monitoring of fence condition to ensure signage and the integrity of the pest fauna-proof fence is maintained during Year 4 of the management plan.

2.3.5 Undertake biomass reduction via mosaic burning/weeding in selected areas

2.3.5.1 Timing of Action and key performance target

Autumn; Areas of inter-tussock space opened up to allow for recruitment.

Status – Year 4

Action Completed. Hand weeding has been undertaken around all transplanted Spiny Rice-flower to ensure that the presence and/or recruitment of grasses do not limit the growth, or detrimentally impact the Spiny Rice-flower plants. This was undertaken by Ecology and Heritage Partners during monitoring visits, and also undertaken by Western Land Services during management visits.

An ecological burn was undertaken on 1 June 2018, and focused on the western half of the offset area (Figure 5), with the aim of reducing biomass. (Plate 5).

The ecological burn was a success, and resulted in biomass levels being reduced, and created recruitment areas for native herbs and grasses to recruit, and the opened up inter-tussock space between perennial tussock-grasses which would ultimately assist with weed control and improve habitat for Striped Legless Lizard (Plate 6).

Actions Required

Ongoing weed control in areas subject to the ecological burn will be undertaken throughout Year 5 to reduce the prevalence of exotic flora in the offset site.

Plate 5. Ecological burn (Western Land Services 01/06/2018).

Plate 6. Western section of the offset site after ecological burn (Ecology and Heritage Partners July 2018).

2.3.6 Monitor survivorship of supplementary herb planting

2.3.6.1 Timing of Action and key performance target

October. 80% survival rate

Status – Year 4

Action Completed. A total of 436 herbs were planted during Year 3, with survivorship monitored in October 2017.

In total, 257 herbs were still alive, resulting in a survivorship of 59%.

Actions Required

As survivorship is below 80%, another 200 herbs are proposed to be planted in September 2018.

2.3.7 Monitor status of vegetation condition, Spiny Rice-flower and Striped Legless Lizard.

2.3.7.1 Timing of Action and key performance target

Progress report to the satisfaction of DELWP/DoE

Status – Year 4

Action Completed**.** This report satisfies this requirement.

2.3.8 Removal of all existing rubbish from site

2.3.8.1 Timing of Action and key performance target

At least every 2 months. All rubbished removed and removed immediately if dumping occurs.

Status – Year 4

Action Completed. Western Land Services undertake bi-monthly inspections across the year to monitor and remove rubbish from the offset site and areas of retained grassland. The majority of rubbish removed from within the site was windblown.

Actions Required

Continued monitoring of rubbish within the site, and immediate removal where appropriate during Year 4 of management.

3 CONCLUSION

Following the management and monitoring activities undertaken during Year 4 of the works as required under the approval conditions of EPBC 2010/5463, no trigger thresholds have been activated, and no contingency measures are currently required to mitigate impacts to Spiny Rice-flower and/or Striped Legless Lizard.

A total of 34 Spiny Rice-flower are alive out of a total of 58 translocated individuals, and it is anticipated that providing the current management and monitoring regime is continued, the survival target for Spiny Rice-flower of 50% survival at the end of Year 5 will be achieved.

Monitoring indicated habitat within the offset site remains in good condition for Striped Legless Lizard and no trigger values were exceeded for any of the measured habitat components. No management responses are currently required at the site for Striped Legless Lizard habitat

The condition of the offset site and retained grassland is good, with perennial and woody weeds intensively managed during Years 1-3, resulting in the current cover of these species below the performance targets at the end of Year 4.

Based on management actions undertaken during Years 1-4, the cover of exotic perennial grasses is now considered to be at approximately 10%, with the majority of this located in the western half of the offset site. Broadleaf weed cover is low and is estimated at 5%. Annual grass cover demonstrated considerable variation across the year, with the cover negligible between February to early October. Future management of annual grasses should be re-visited in consultation with the management contractor to determine an appropriate technique to successfully reduce the cover of annual grass within the offset site.

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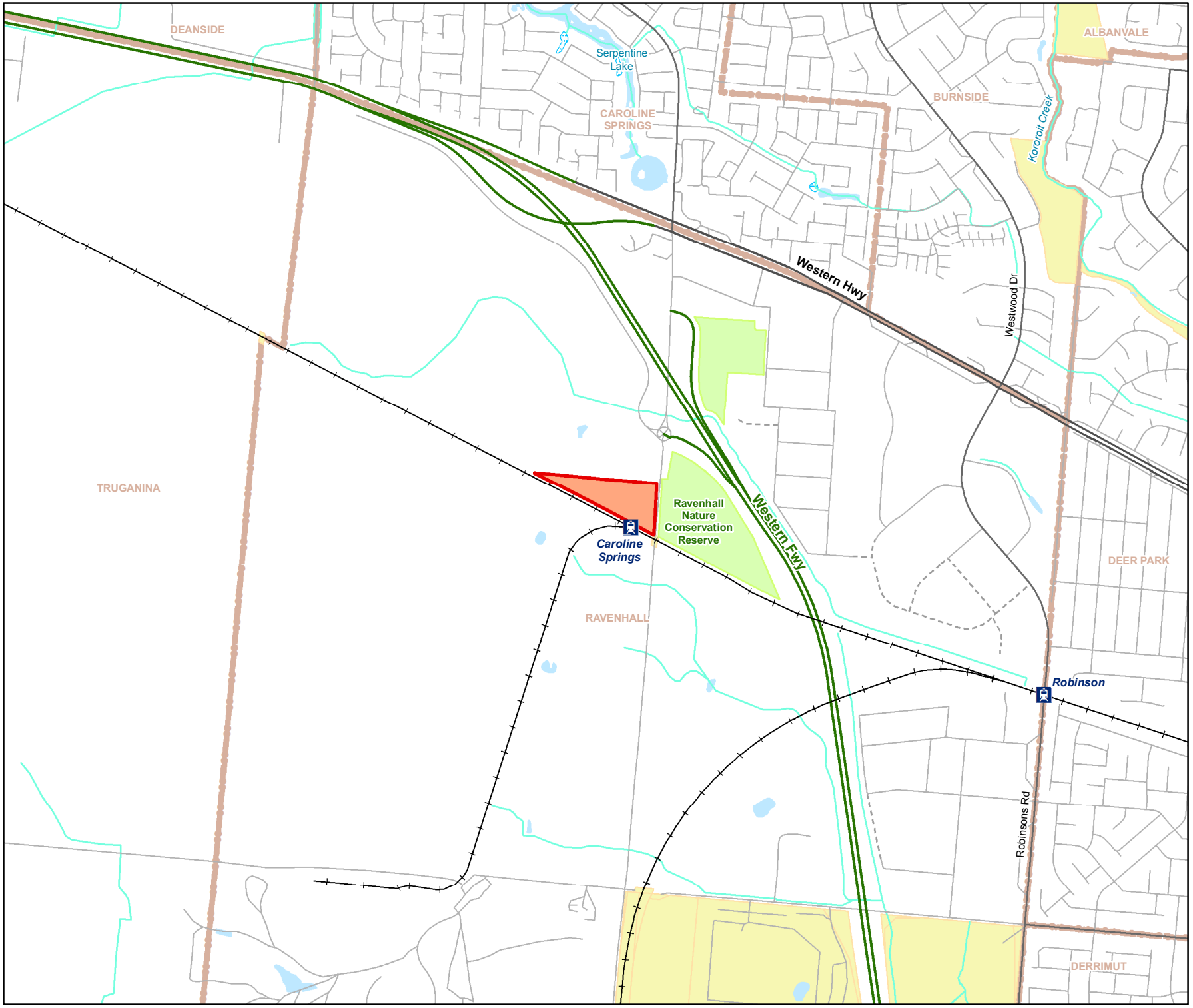

Legend

- Study Area
- Freeway
- Major Road
- Collector Road
- Minor Road
- Proposed Road
- Minor Watercourse
- Permanent Waterbody
- Wetland/Swamp
- Parks and Reserves
- Crown Land
- Localities

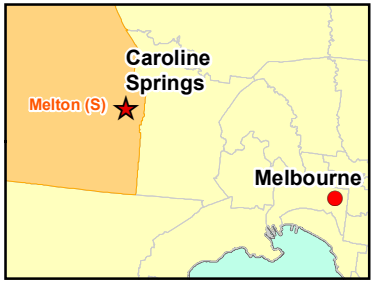

Figure 1

Location of the study area

Caroline Springs Year 4 Management

0 250 500

Metres

ecology & heritage partners

Legend

- Offset site
- Spiny Rice-flower recipient site
- Retained areas of NTGVVP and SLL habitat
- Removed areas of NTGVVP and SLL habitat

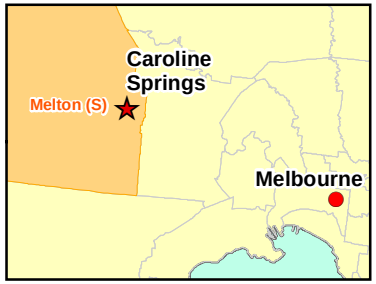

Figure 2

Ecological features and extent of NTGVVP and Striped Legless Lizard habitat

Caroline Springs Year 4 Management

N

0 30 60

Metres

ecology & heritage partners

10974_Fig02_EcoFeat_NTGVVP_SLL 15/08/2018 jyuan

Aerial source: Nearmap 2018

Legend

- Study Area
- Recorded Striped Legless Lizards (18 records in total)
- Tile grids

Figure 3

Striped Legless Lizard grid locations and records

Caroline Springs Year 4 Management

N

0 30 60

Metres

ecology & heritage partners

10974_Fig03_SLL_GridLoc 15/08/2018 jyuan

Aerial source: Nearmap 2018

Legend

- Spiny Rice-flower recipient site
- Monitored *In-situ* Spiny Rice-flower
- Translocated Spiny Rice-flower (2017)
- Translocated Spiny Rice-flower (2015)
- *In-situ* Spiny Rice-flower population (August 2014)
- *In-situ* Spiny Rice-flower population (August 2015)
- Translocated Spiny Rice-flower (2014)
- Offset site
- Retained areas of Grassland

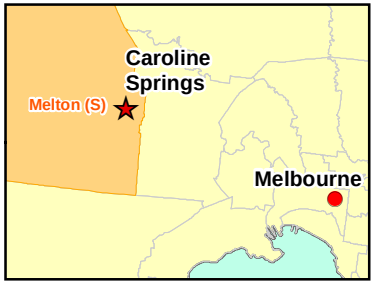

Figure 4a

Spiny Rice-flower recipient site, and monitored and translocated Spiny Rice-flowers

Caroline Springs Year 4 Management

N

0 30 60

Metres

ecology & heritage partners

10974_Fig04a_SRF 15/08/2018 jyuan

Aerial source: Nearmap 2018

Legend

- Spiny Rice-flower recipient site
- Monitored *In-situ* Spiny Rice-flower
- Translocated Spiny Rice-flower (2017)
- Translocated Spiny Rice-flower (2015)
- Translocated Spiny Rice-flower (2014)
- Offset site
- Ecological burn

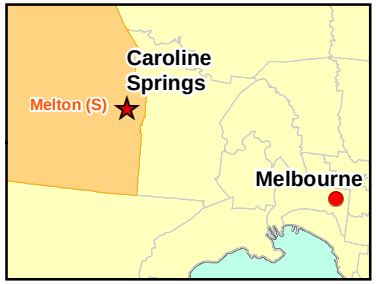

Figure 4b

Spiny Rice-flower recipient site, and monitored and translocated Spiny Rice-flowers

Caroline Springs Year 4 Management

N

0 5 10

Metres

ecology & heritage partners

10974_Fig04b_SRF_ReipientSite 15/08/2018 jyuan

Aerial source: Nearmap 2018

Legend

- Photo points
- Ecological burn 2018
- Offset site
- Spiny Rice-flower recipient site
- Herb plantings

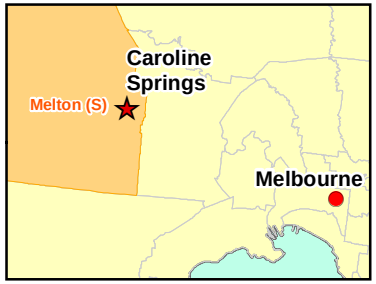

Figure 5

Location of photo points and ecological burn

Caroline Springs Year 4 Management

N

0 20 40

Metres

ecology & heritage partners

10974_Fig05_Photopoints_Ecoburn 15/08/2018 jyuan

Aerial source: Nearmap 2018

APPENDICES

Appendix 1. Habitat Hectare Assessment

Table A1.1. Year 4 Habitat hectare assessment

Vegetation Zone		PG1	PG2	PG3
Bioregion		Victorian Volcanic Plain	Victorian Volcanic Plain	Victorian Volcanic Plain
EVC / Tree		Plains Grassland (Heavier Soils)	Plains Grassland (Heavier Soils)	Plains Grassland (Heavier Soils)
EVC Number		132_61	132_61	132_61
EVC Conservation Status		Endangered	Endangered	Endangered
Patch Condition	Large Old Trees /10			
	Canopy Cover /5			
	Under storey /25	5	15	15
	Lack of Weeds /15	9	9	6
	Recruitment /10	6	6	3
	Organic Matter /5	5	5	3
	Logs /5			
	Treeless EVC Multiplier	1.36	1.36	1.36
	Subtotal =	34.00	47.60	36.72
Landscape Value /25		16	16	16
Habitat Points /100		50	64	53
Habitat Score		**0.50**	**0.64**	**0.53**

Note: Habitat zones are shown in Figure 2.

Appendix 2. Spiny Rice-flower Monitoring Data

A2.1. 2014/2015 Transplant Cohort - Year 4 of CMP

Table A2.1. Sex of translocated Spiny Rice-flower.

Plant #	Sex	End of Year 4Status
#1	Female	Dead
#2	Male	Dead
#3	Female	Dead
#4	Female	Alive
#5	Female	Alive
#6	Female	Alive
#7	Female	Dead
#8	Female	Alive
#9	Female	Dead
#10	Male	Alive
#11	Male	Alive
#12	Male	Dead
#13	Female	Dead
#14	Female	Alive
#15	Male	Alive
#16	Male	Alive
#17	Male	Alive
#18	Female	Alive
#19	Male	Alive
#20	Male	Dead
#21	Female	Dead
#22	Female	Alive
#23	Male	Alive

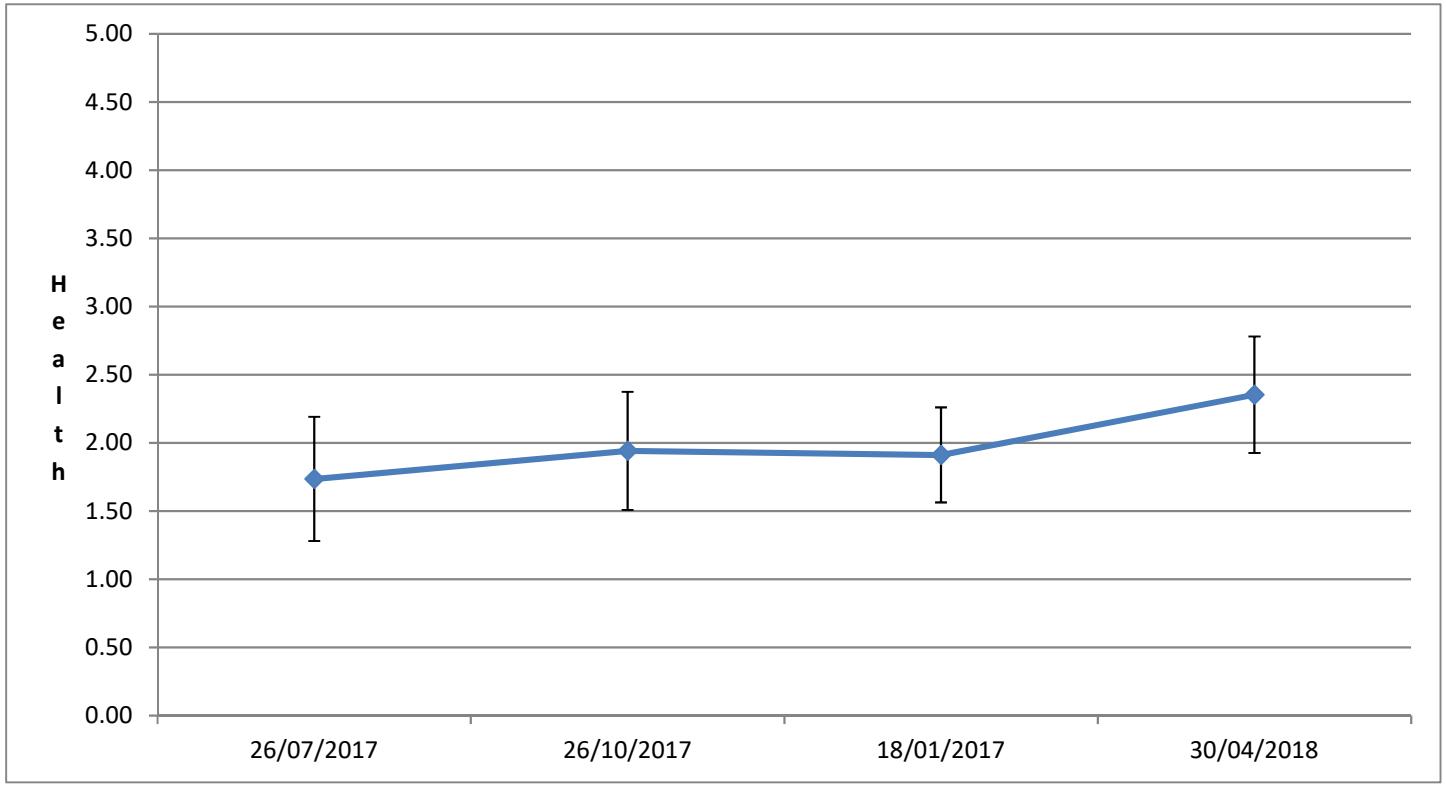

Figure A2.1.1 Average Spiny Rice-flower Health Year 4 (+/- 1 standard deviation) (refer to Table 3 for Health metric)

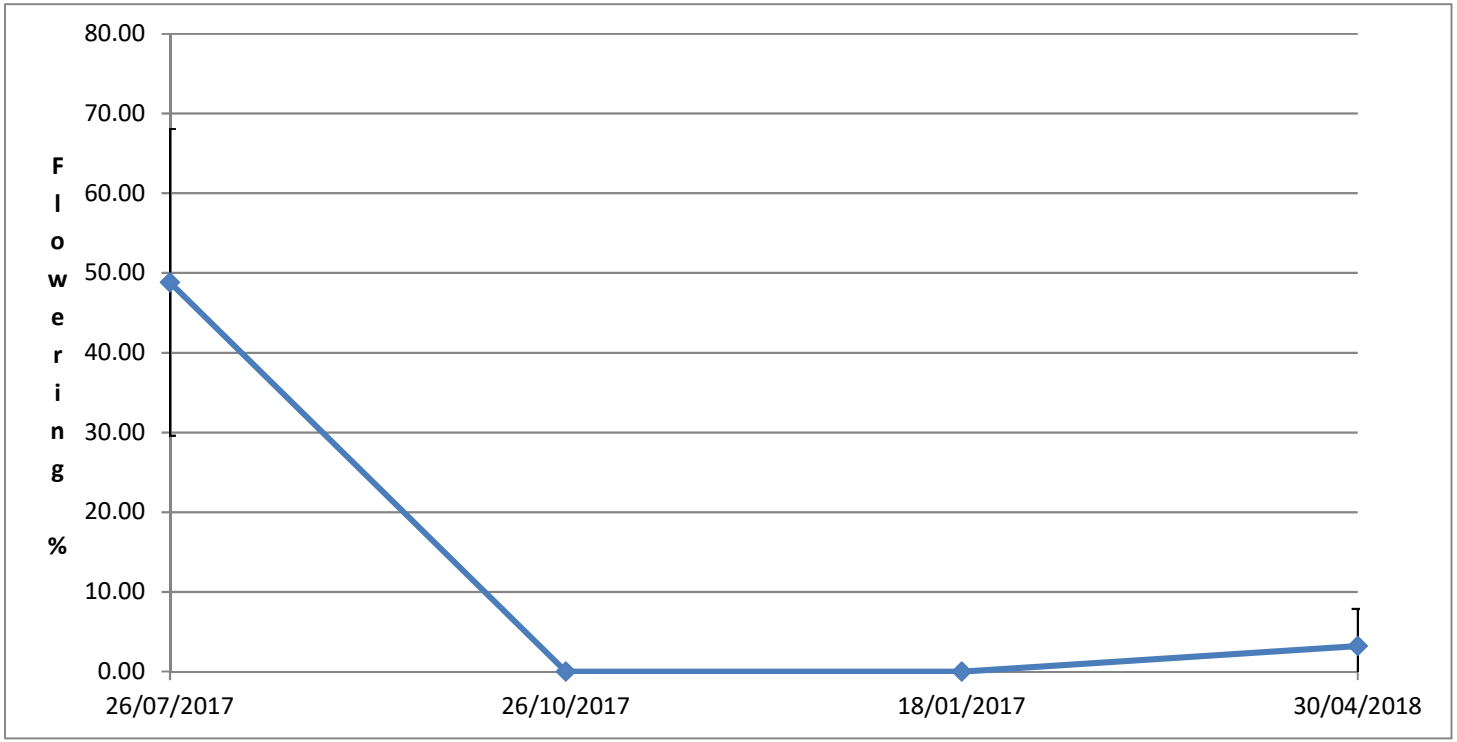

Figure A2.1.2. Average percentage of Spiny Rice-flower plant in flower (+/- 1 standard deviation).

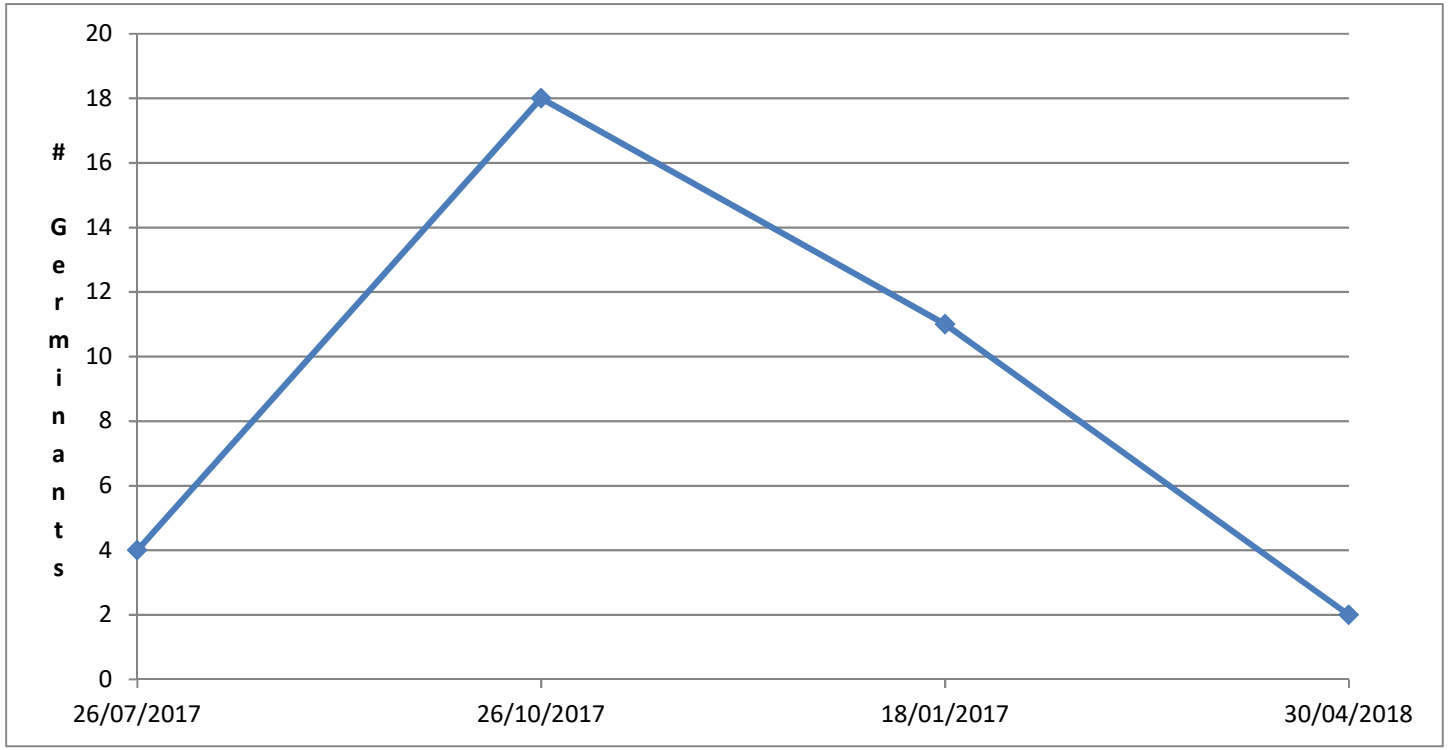

Figure A2.1.3. # Total germinants observed within the 2014/2015 transplant cohort – Year 4.

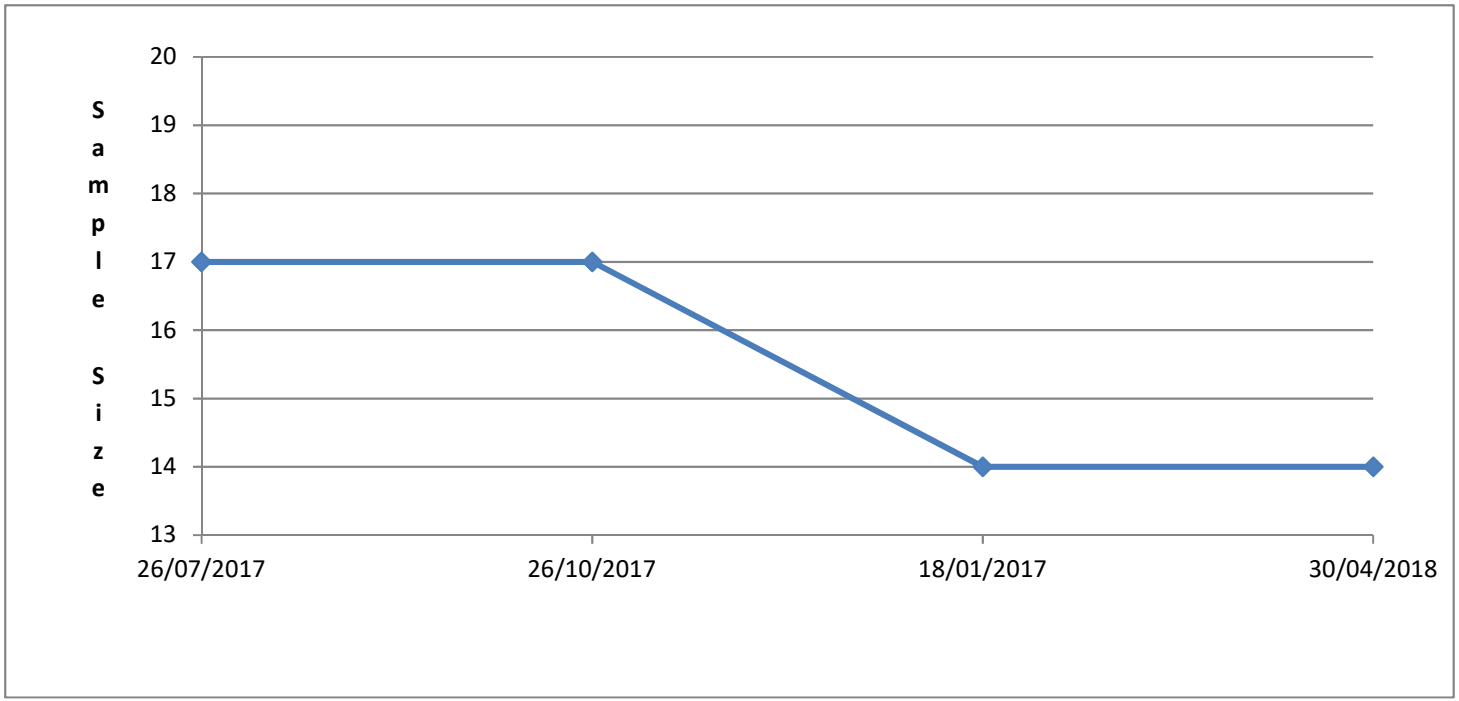

Figure A2.1.4. Sample size of (live) Spiny Rice-flower during each sampling event in Year 4 (Out of 23)

A2.2. 2015/2016 Transplant Cohort – Year 4 of CMP

Table A2.2. Sex of translocated Spiny Rice-flower.

Plant #	Sex	End of Year 4 Status
#24	Male	Dead
#25	Male	Dead
#26	Female	Alive
#27	Female	Alive
#28	Male	Alive
#29	Female	Dead
#30	Male	Dead
#31	Male	Dead
#32	Female	Dead
#33	Male	Dead
#34	Male	Alive
#35	Female	Dead
#36	Male	Dead
#37	Female	Alive
#38	Male	Alive
#39	Female	Dead
#40	Male	Alive
#41	Male	Alive
#42	Female	Alive
#43	Male	Alive
#44	Female	Alive
#45	Male	Alive
#46	Female	Alive
#47	Female	Alive
#48	Male	Dead
#49	Male	Alive
#50	Male	Dead
#51	Male	Alive
#52	Female	Dead
#53	Female	Alive
#54	Female	Dead
#55	Female	Dead

2015/2016 Transplant Cohort

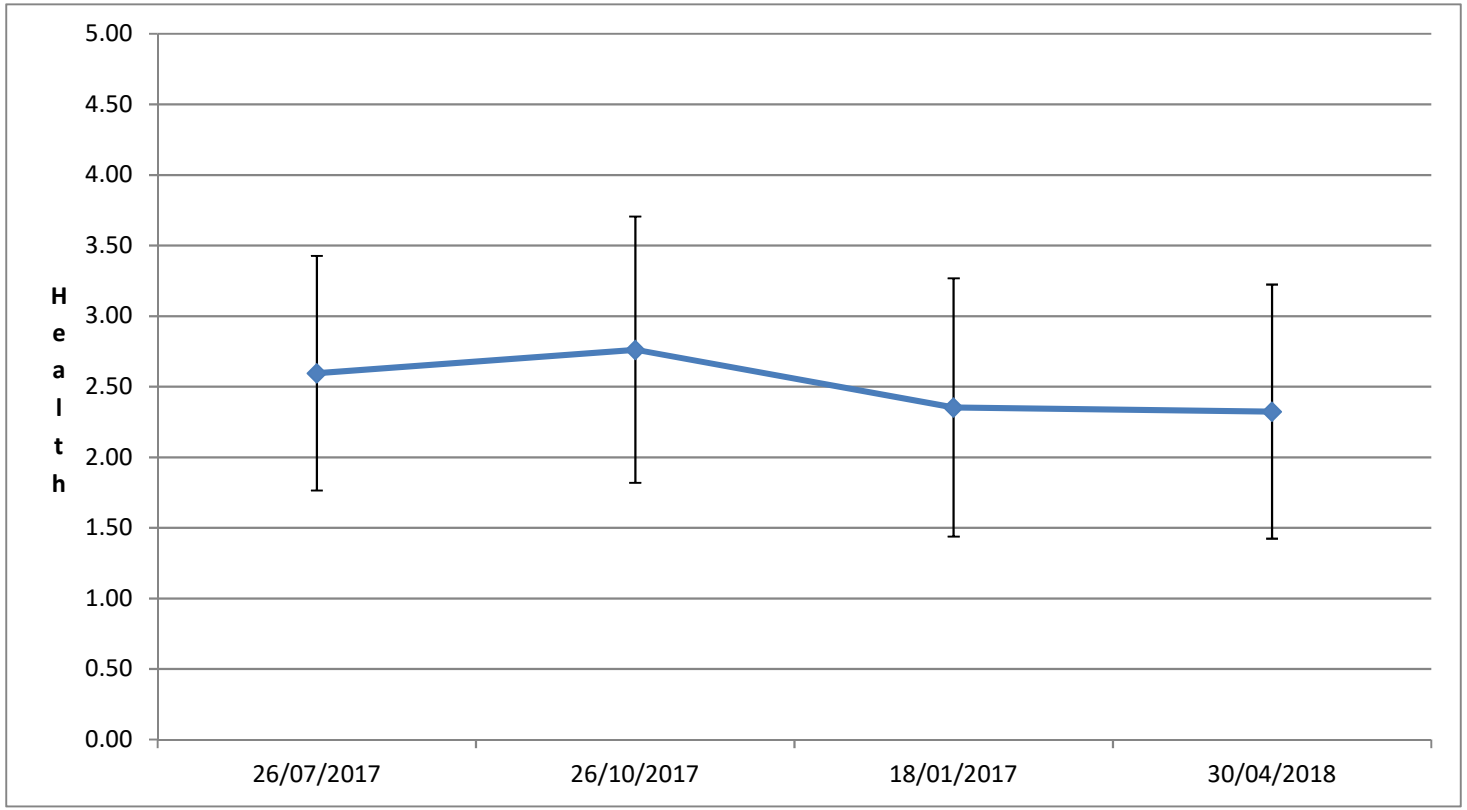

Figure A2.2.1 Average Spiny Rice-flower Health Year 4 (+/- 1 standard deviation) (refer to Table 3 for Health metric)

2015/2016 Transplant Cohort

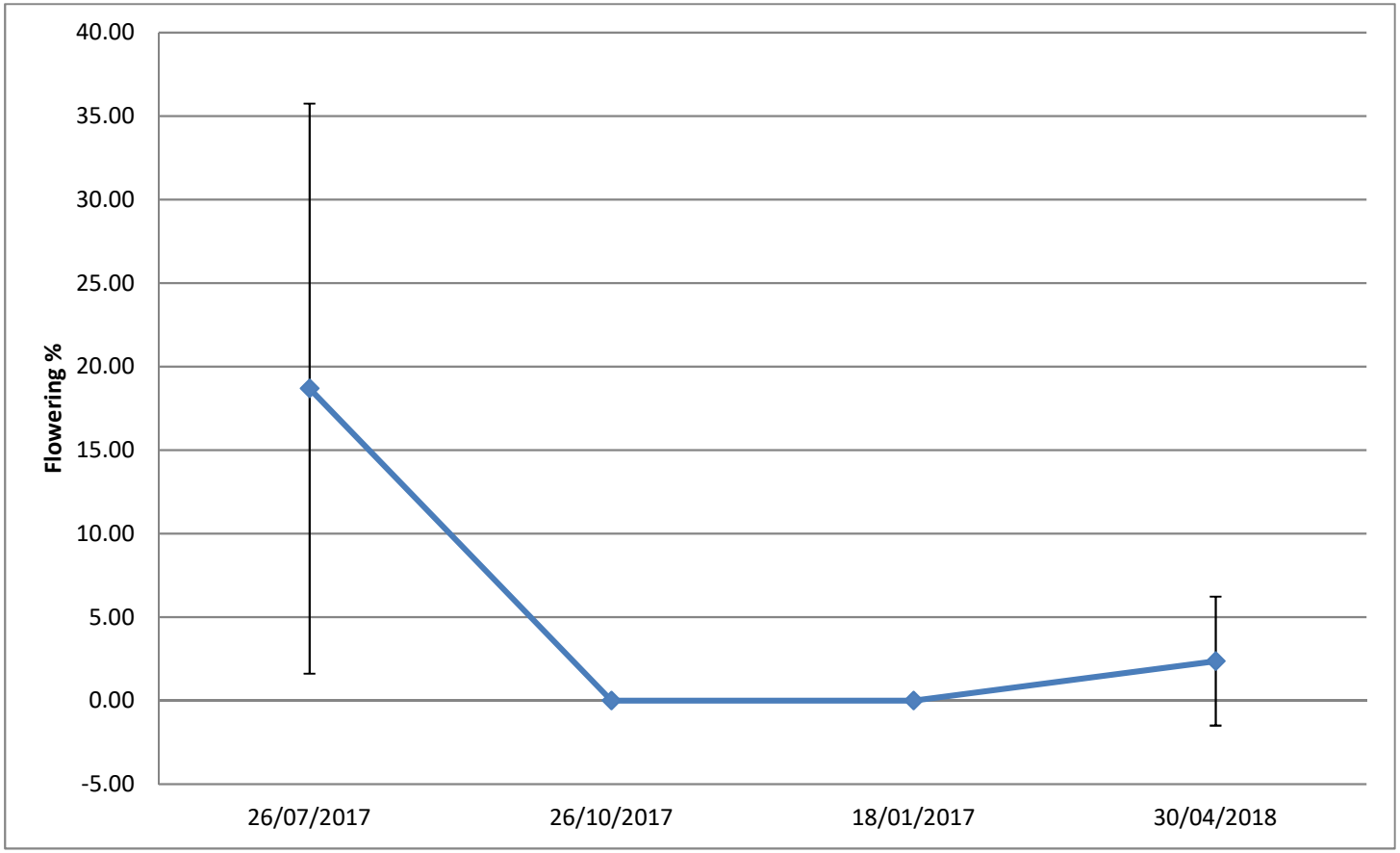

Figure A2.2.2. Average percentage of Spiny Rice-flower plant in flower (+/- 1 standard deviation).

2015/2016 Transplant Cohort

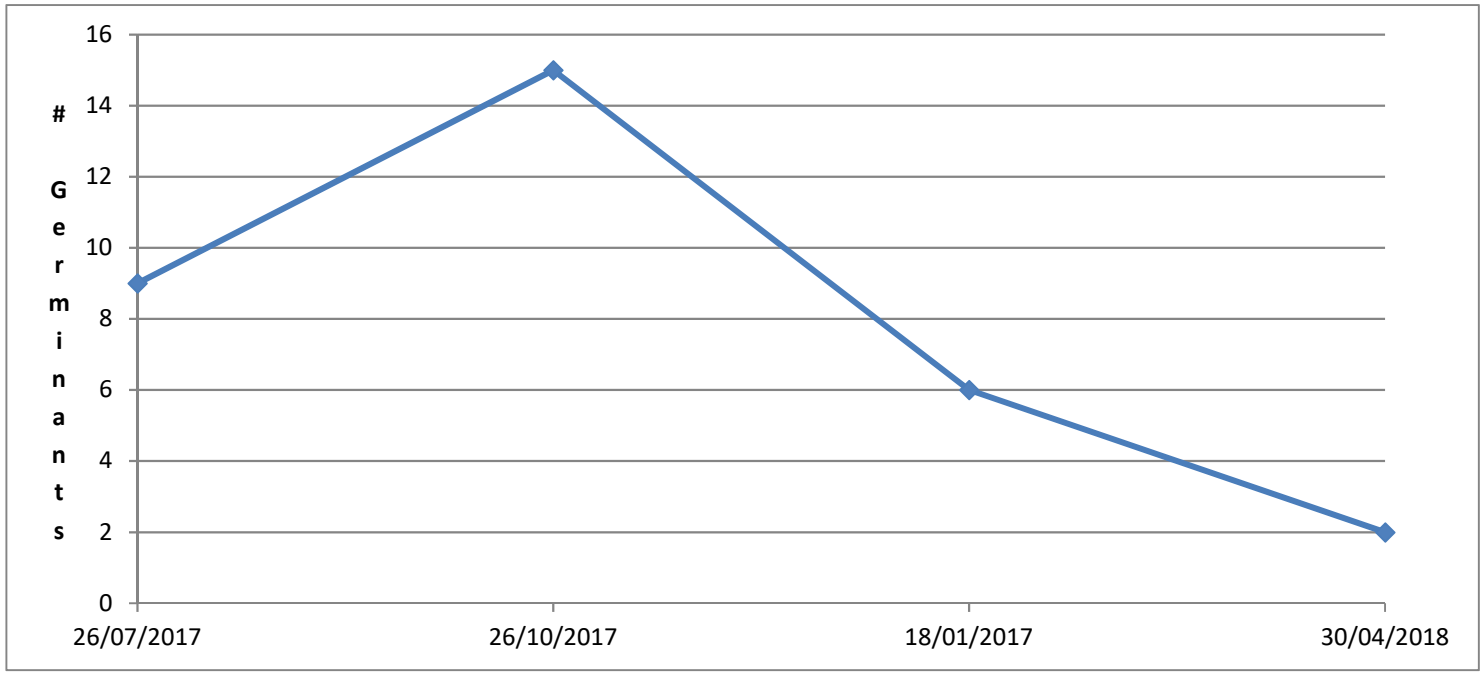

Figure A2.2.3. # Total germinants observed within the 2015/2016 transplant cohort – Year 4.

2015/2016 Transplant Cohort

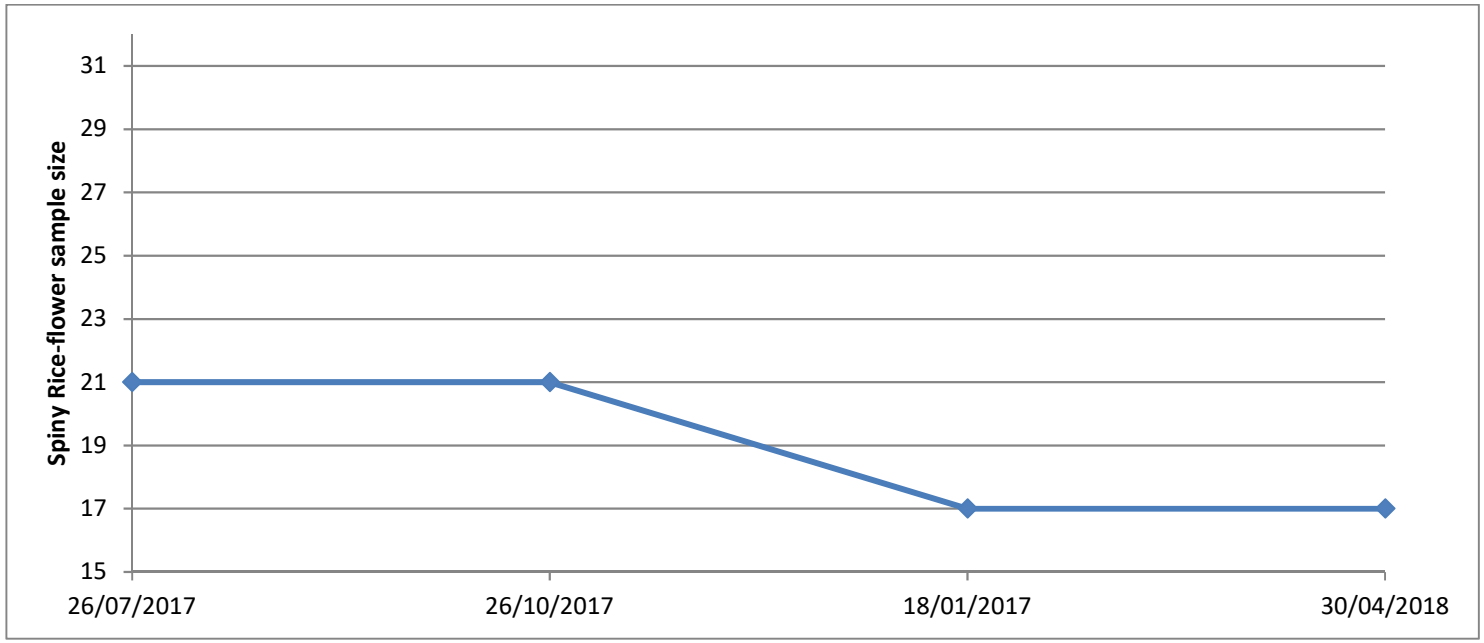

Figure A2.2.4. Sample size of (live) Spiny Rice-flower during each sampling event in Year 4 (Out of 32)

Appendix 3. Photopoints

2017/2018 (Year 4) Photopoints

Plate A2.1. Photopoint 1 (April 2018)

Plate A2.2. Photopoint 2 (April 2018)

Plate A2.3. Photopoint 3 (April 2018)

PlateA2.4. Photopoint 4 (April 2018)

Plate A2.5. Photopoint 5 (April 2018)

PlateA2.6. Photopoint 6 (April 2018)

PlateA2.7. Photopoint 7 (April 2018)

Plate A2.8. Photopoint 8 (April 2018)

Plate A2.9. Photopoint 9 (April 2018)

Plate A2.10. Photopoint 10 (April 2018)

Appendix 4. Translocated Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* photos.

All photos taken by Ecology and Heritage Partners (30/04/2018)

2014/2015 Transplant cohort

Plate A3.1. Transplant 1

Plate A3.2. Transplant 2

Plate A3.3. Transplant 3

PlateA3.4. Transplant 4

Plate A3.5. Transplant 5

PlateA3.6. Transplant 6

PlateA3.7 Transplant 7 (N/A)

Plate A3.8. Transplant 8

Plate A3.9. Transplant 9

Plate A3.10. Transplant 10

Plate A3.11. Transplant 11

PlateA3.12. Transplant 12 (N/A)

PlateA3.13. Transplant 13

Plate A3.14. Transplant 14

Plate A3.15. Transplant 15

Plate A3.16. Transplant 16

Plate A3.17. Transplant 17

PlateA3.18. Transplant 18

PlateA3.19. Transplant 19

Plate A3.20. Transplant 20 (N/A)

Plate A3.21. Transplant 21 (N/A)

Plate A3.22. Transplant 22

Plate A3.23. Transplant 23

2015/2016 Transplant cohort

Plate A3.24. Transplant 24

Plate A3.25. Transplant 25

Plate A3.26. Transplant 26

PlateA3.27. Transplant 27

Plate A3.28. Transplant 28

PlateA3.29. Transplant 29

PlateA3.30 Transplant 30 (N/A)

Plate A3.31. Transplant 31 (N/A)

Plate A3.32. Transplant 32

Plate A3.33. Transplant 33 (N/A)

Plate A3.34. Transplant 34

PlateA3.35. Transplant 35

PlateA3.36. Transplant 36 (N/A)

Plate A3.37. Transplant 37

Plate A3.38. Transplant 38

Plate A3.39. Transplant 39

Plate A3.40. Transplant 40

PlateA3.41. Transplant 41 (N/A)

PlateA3.42. Transplant 42

Plate A3.43. Transplant 43

Plate A3.44. Transplant 44

Plate A3.45. Transplant 45

Plate A3.46. Transplant 46

Plate A3.47. Transplant 47

Plate A3.48. Transplant 48 (N/A)

PlateA3.49. Transplant 49

Plate A3.50. Transplant 50 (N/A)

PlateA3.51. Transplant 51

Plate A3.52 Transplant 52

Plate A3.53. Transplant 53

Plate A3.54. Transplant 54 (N/A)

PlateA3.55. Transplant 55 (N/A)

2015/2016 Transplant cohort

Plate A3.56. Transplant 56

Plate A3.57. Transplant 57

Plate A3.58. Transplant 58