Prepared for
Department of Transport
ABN: 69981208782

AECOM

Mernda Rail Extension Project

Matted Flax-lily Annual Summary Report, April 2023 - April 2024

31-July-2024

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Mernda Rail Extension Project

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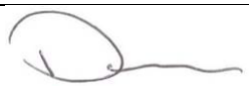
1	17/06/2024	Draft for Client	Dan Haysom Principal Environmental Planner	
2	31/07/2024	Final	Dan Haysom Principal Environmental Planner	

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Executive Summary

This report documents the results of monitoring the implementation of management actions and condition of the translocated Matted Flax-lily (MFL) populations for the reporting period 4 April 2023 to 3 April 2024.

During the reporting period, two monitoring events were conducted in July 2023 and January 2024. Monitoring activities included growth and condition quadrat monitoring, population counts at each recipient site, photo point monitoring, and general site assessments noting threats, management issues, corrective actions, and a nursery audit.

Total survivorship across both recipient sites was 491 (out of a total of 500 translocated plants), representing a 98.2% survivorship. This meets to the performance management benchmark set for the end of the fifth year after translocation was > 85% survivorship (minimum 412 plants).

Monitoring results and plant survivorship suggests that both populations are healthy and well managed.

As the survivorship is well above the performance benchmark of 85%, the translocation should be declared a success. Regardless, the Department of Transport has committed to continuing monitoring the translocated populations for an additional two years.

1.0 Introduction

AECOM was initially engaged by the Level Crossing Removal Project (LXRP) to conduct monitoring and prepare an Annual Summary Report detailing the translocation, nursery, and monitoring operations of Matted Flax-lily (MFL) *Dianella amoena* as part of the Mernda Rail Extension Project (the Project). Since October 2020, the Project has formally transferred from LXRP to the Department of Transport (DoT).

The MFL were translocated to two recipient sites, Quarry Hills Park and Plenty Gorge Parklands, as a condition of approval no. 2016/7674 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the Mernda Rail Extension Project. This Annual Summary Report is a requirement of the Matted Flax-lily Translocation Plan required as part of approval no. 2016/7674 (AECOM-GHD 2020a – Revision 9).

1.1 Purpose and scope of this report

The report documents the results of the implementation of management and monitoring actions undertaken in relation to the translocated MFL, and the condition of those populations for the period of 4 April 2023 to 3 April 2024. The scope of the report includes:

- Information on conditions at both the recipient sites and the nursery
- Discussion of the survivorship and growth of the plants
- An assessment of the status of the translocation program relative to the established performance benchmarks
- Discussion of occurring or potential threats or management issues and any maintenance or corrective actions taken or proposed
- Rainfall and watering data
- Monitoring forms for each monitoring event
- Quarterly/biannual or yearly photos taken from each established photo point.

Noting that Winter 2024 signifies 5 years post translocation, the scope of this annual report further includes:

- A summary of the translocation program to date
- Analysis of the success of the translocation program in achieving long-term performance benchmarks and consideration of the need for ongoing management and monitoring
- Lessons learned and recommendations for future translocation programs.

1.2 Assumptions and limitations

The following assumptions and limitations apply to the operations outlined in this report:

- It is assumed from conversations with ABZECO (nursery managers) that 250 individuals were translocated into each recipient site in July/August 2019.
- The locations of MFL provided in **Appendix A** have accuracies of sub-1m (Quarry Hills Park) and <5m (Plenty Gorge Parklands) respectively. Quarry Hills Park required the use of a sub-1m DGPS unit due to the random nature of planting and to allow the monitoring team to re-locate any MFL that had potentially been missed. The <5m accuracy at Plenty Gorge Parklands was suitable as they are planted in clear clusters, making them easy to re-locate.

1.3 Site background

This section provides a brief summary of salvage, nursery and translocation operations to date. More information is provided in the Salvage, Translocation and Monitoring Report (AECOM-GHD JV 2020b) in **Appendix C** (MFL 2023 Nursery Audit):

- MFLs were salvaged from within the construction footprint of the Mernda Rail Extension Project with the majority of the salvage occurring between 4 and 6 April 2017, with further salvage required on 18 April 2017. The total number of salvaged plants was 121.
- During nursery operations, excess salvaged MFL material of mixed progeny was potted and cloned, resulting in a total number of 125 individual MFL (ABZECO 2020). Each plant was cloned six times, resulting in 750 plants (AECOM-GHD JV 2019). Nursery audits have been conducted by qualified botanists in May 2017, October 2018, April 2019, April 2020, June 2021, April 2022 and April 2023. Further details of the 2023 audit are provided in **Section 2.1** and **Appendix C.**
- Translocation to the two recipient sites, Quarry Hills Park and Plenty Gorge Parklands, were carried out on 23 July 2019 and 30 July 2019 respectively. 250 MFL were translocated at each recipient site (500 pots in total).

1.4 Method

Monitoring activities followed the method set out in Section 7.4 of the Translocation Plan (AECOM-GHD JV 2020a - Revision 9). City of Whittlesea (Sophie Baker pers. comm., 17/05/2024) provided information regarding management actions undertaken for both recipient sites for the reporting period.

Monitoring schedule

During the reporting period, 4 April 2023 to 3 April 2024, two monitoring events were conducted as per the modified monitoring timeline set out in the Translocation Plan (AECOM-GHD JV, 2020a - Revision 9), and these are listed below. Raw monitoring sheets are provided in Appendix B.

- 4 July 2023
- 11-12 January 2024

Monitoring methodology

Monitoring activities followed the method set out in **Section 7.4** of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9). Additional notes around methodology used for the growth and condition monitoring quadrats and total population counts are provided below.

Annual growth and condition monitoring quadrats

For the growth and condition monitoring quadrats, the following parameters were used, and modifications made to the original monitoring sheet provided in the Translocation Plan (AECOM-GHD JV 2020a – Revision 9). These are noted for consistency between future annual monitoring events:

- All measurements were taken in mm
- ‘No. shoots’ was removed and replaced by ‘No. leaves/shoots’ with a range where: 1 = 0 - <5 shoots; 2 = 5 – 10 shoots; 3 = >10 shoots
- ‘Buds’ were removed as it was felt that it overlapped with ‘Flowering (1 - 3)’

All other parameters remain the same.

During the January 2022 quadrat monitoring, it was noted that due to the MFL at Plenty Gorge Parklands being planted in close clusters of approximately six plants, the plants over time had begun to spread and mat together, particularly Quadrat 2 (Cluster 9). During the January 2023 quadrat monitoring, the same observation was made of Quadrat 3 (Cluster 37). Matted Flax-lily is a mat-forming perennial lily that typically forms loose clumps up to 5 m wide (Carter, 2010). The observation at Plenty Gorge Parklands reflects the natural growth habitat of the species. This made it difficult and sometimes impossible to differentiate individual plants, as is required by the assessment method. Due to this, the assessment method had to be adjusted and the extent of the mat within the quadrat has been considered rather than individual plants. This method was applied at Quadrat 2 (Cluster 9) and Quadrat 3 (Cluster 37) during the 2022 and 2023 monitoring events. This adjustment was not deemed necessary during January 2024 as plants and their ramets were more distinct than in previous years. This method will be applied to other quadrats in the future where necessary.

Total population count

Several measures were taken to improve the chances of re-locating MFL at each site including:

- Placing wooden stakes next to MFL that did not have one
- Using marker spray paint to mark the induvial stake of each MFL to indicate which MFL had been counted
- The use of a DGPS with sub 1 m accuracy at Quarry Hills Park to mark the locations of each MFL
- Carrying paper maps with MFL locations marked in the field.
- During the January 2023 quadrat monitoring at Plenty Gorge Parklands, efforts were made to locate and move tags that were concealed deep within MFL mats. The tags were moved to the outer edge of the MFL plant so they would be easier to locate in future without damaging the plants.
- During the January 2024 quadrat monitoring at Quarry Hills Parklands and Plenty Gorge Parklands, plants missing tags but confidentially identified were re-tagged (**Plate 1**).Re-tagged plants were identified by comparing their location to the mapping and surrounding tagged plants.

During the total population count, each plant was marked as either ‘Alive’, ‘Stressed’, or ‘Dead’

Plate 1 Re-tagged plant.

2.0 Results

2.1 Summary

Monitoring of the translocated MFL identified a survival rate of 98.8% (494 of 500) across both sites indicating that the plants are healthy and well managed. No replacement planting is required.

This section summarises the results of the monitoring during the reporting period. Raw field data sheets are provided in **Appendix B**.

2.2 Nursery conditions

During the reporting period one nursery audit was undertaken by qualified AECOM botanists at the ABZECO nursery in Research, Victoria.

The audit, undertaken on the 11 April 2023, found that all criteria within the translocation plan were being met and that the MFL were observed to be in a healthy condition and well managed. Specifically, the audit identified that:

- Pots of live, healthy MFL representing the required number of clones were observed.

- Individuals were clearly labelled and potted in appropriate pots and potting medium, and
- No diseased individuals were observed.

The full audit report for 2023 is provided in **Appendix C**.

2.3 Site conditions potential threats and management issues

2.3.1 Quarry Hills Park

The translocation area totals 0.42 ha and is fenced by a chain wire mesh exclusion fence with horizontal skirt at base to exclude kangaroos, hares, and rabbits. Monitoring has re-located 245 individuals planted in a rough, unevenly spaced, grid-like pattern; however, it is assumed 250 individuals in total were planted (**Section 1.2**). During the January 2021 monitoring event, one MFL was not able to be located and was assumed to be dead. This individual plant continued to not be located in subsequent monitoring events and thus is considered to be dead. Locations of monitoring quadrats and photo monitoring points are provided in **Figure 1 Appendix A**.

The site is in good condition and is well managed, with relatively minor management issues identified during the course of the monitoring including:

- Discrete instances where Sweet Vernal-grass *Anthoxanthum odoratum* was noted to be smothering some MFL, but this has subsequently been well managed.
- Uncapped, discarded needles were observed within the fenced area.
- As the MFL grow and spread, some ID tags have been hard to find so the tags and pegs have been moved slightly to the outside of the MFL, closer to the stakes.
- Plants missing tags but confidently located and identified using the paper map, were re-tagged.

A summary of management actions required by the Translocation Plan (Rev 9), excluding watering, have been included in **Table 1**. Management actions, such as weed control is undertaken by a contractor engaged by City of Whittlesea.

Table 1 Management actions undertaken at Quarry Hills Park

Date	Management action
3/07/2023	Weed control - Knapsack spray, Handweed
26/07/2023	Weed control - Handweed
7/09/2023	Weed control - General Brushcutting works, Handweed
26/09/2023	Weed control - Knapsack spray, General Brushcutting works
28/09/2023	Scorch, Watering plants
2/11/2023	Weed control - General Brushcutting works, Knapsack spray
1/12/2023	Weed control - General Brushcutting works, Handweed
19/01/2024	Weed control - Knapsack spray, Handweed, General Brushcutting works
13/03/2024	Watering plants
13/05/2024	Weed control - Knapsack spray, Handweed

In previous years the key issues impacting the Quarry Hills Park recipient site, was dryness impacting a small number of plants in the eastern portion of the site, and grassy and shrubby weeds smothering MFL. Dryness continues to be noted within the eastern portion of the site, but this is considered to be a natural response to changes in the seasons. Weeds have been well managed in the last year and smothering of planted by exotic weeds was no longer identified to be an issue, resulting in a high survivorship at the site. As of the January 2024 monitoring event, dryness is particularly high in the south-eastern portion of the site, around Quadrat 4. The plants here (039-001 and 039-002) are very small and stressed (**Plate 2**).

Plate 2 Plant 039-001 is small and water stressed.

2.3.2 Plenty Gorge Parklands

The translocation area totals 0.42 ha and is fenced by a chain wire mesh exclusion fence with horizontal skirt at base to exclude kangaroos, hares and rabbits. Monitoring has re-located 249 individuals planted in 43 clusters consisting of between four and seven plants; however, it is assumed 250 individuals in total were planted (**Section 1.2**).

The site is in good condition and is well managed with relatively minor management issues. Biomass levels were higher than usual during the January 2024 monitoring event, having seemingly increased with wet conditions over winter and spring.

There are discrete instances where Sweet Vernal-grass *Anthoxanthum odoratum*, Spiny-headed Mat-rush *Lomandra filiformis*, Blackberry *Rubus fruticosus* was noted to be smothering some MFL, but this has subsequently been well managed.

A summary of management actions (excluding watering) undertaken during the monitoring period have been included in **Table 2**.

Table 2 Management actions undertaken at Plenty Gorge Parklands

Date	Management action
3/07/2023	Weed control - Knapsack spray, Handweed, Cut & Paint using hand tools
3/08/2023	Weed control - Knapsack spray, Handweed
7/09/2023	Weed control - General Brushcutting works, Handweed
26/09/2023	Weed control - Knapsack spray, General Brushcutting works
2/11/2023	Weed control - General Brushcutting works, Handweed, Knapsack spray
1/12/2023	Weed control - Knapsack spray, Handweed
5/12/2023	Weed control - Knapsack spray, Handweed
19/01/2024	Weed control - Knapsack spray, Handweed, Cut & Paint using hand tools, General Brushcutting works
1/03/2024	Watering and handweeding
13/03/2024	Watering plants
21/03/2024	Weed control - Knapsack spray, Cut & Paint using hand tools Planting/ guard maintenance
13/05/2024	Weed control - Knapsack spray, Handweed, Cut & Paint using hand tools, General Brushcutting works

2.4 Survivorship and growth of plants

2.4.1 Total population count

Total population counts were undertaken twice during the reporting period in July 2023 and January 2024. Individual plants were recorded as either 'Alive' or 'Dead' and it was further noted whether 'Alive' plants were 'Stressed'. In each monitoring event:

- At Quarry Hills Park, 245 plants were re-located and alive, 5 plants were not re-located and considered dead, and approximately 0 to 8 plants were stressed during each monitoring event. As of the January 2024 monitoring, specific plants previously recorded as 'Dead' have been deemed as 'Alive'. As older MFL leaves dies back as each individual ages, it is not unusual for plants to die back and remain dormant, recovering after good growth periods (e.g. wet growing seasons). Thus, plants previously deemed 'Dead' may have in fact been dormant, and now produced new leaves during this monitoring period. Furthermore, one plant 118-002 was found alive. This plant was not previously listed on the monitoring template, but was found in the site and contains the same tag type as others. This plant may have potentially been accidentally removed from the planting list. It has since been added to the list and will be geo-located at the next monitoring event.
- At Plenty Gorge Parklands, 249 plants were re-located and alive, 1 plant was not re-located and considered dead, and between 0 and 25 plants were stressed during each monitoring event. The higher number of plants considered stressed during the January 2022 monitoring event is not unusual given the hot and dry conditions over the summer period. Subsequent visits to Plenty Gorge Parklands, including the most recent January 2023 monitoring event have noted the plants are in good condition following milder conditions.

Table 3 Summary of total population count data at both sites.

Population health (%)	Monitoring Event												
	April 2020	May 2020	June 2020	July 2020	November 2020	January 2021	April 2021	July 2021	January 2022	July 2022	January 2023	July 2023	January 2024
Quarry Hills Park													
Alive	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.4% (*n* = 246)	98.0% (*n* = 245)	98.0% (*n* = 245)	98.0% (*n* = 245)	98.0% (*n* = 245)	98.0% (*n* = 245)
Alive, but stressed	0.81% (*n* = 2)	1.63% (*n* = 4)	0.41% (*n* = 1)	0.0% (*n* = 0)	1.63% (*n* = 4)	2.03% (*n* = 5)	2.03% (*n* = 5)	1.63% (*n* = 4)	2.03% (*n* = 5)	0.82% (*n* = 2)	3.27% (*n* = 8)	0.82% (*n* = 2)	1.22% (*n* = 3)
Dead	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	1.6% (*n* = 4)	2.0% (*n* = 5)	2.0% (*n* = 5)	2.0% (*n* = 5)	2.0% (*n* = 5)	2.0% (*n* = 5)
Plenty Gorge Parklands													

Population health (%)	Monitoring Event												
	April 2020	May 2020	June 2020	July 2020	November 2020	January 2021	April 2021	July 2021	January 2022	July 2022	January 2023	July 2023	January 2024
Alive	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)	99.6% (*n* = 249)
Alive, but stressed	0.00% (*n* = 0)	0.00% (*n* = 0)	0.40% (*n* = 1)	0.0% (*n* = 0)	0.00% (*n* = 0)	0.40% (*n* = 1)	0.40% (*n* = 1)	0.80% (*n* = 2)	10.04% (*n* = 25)	2.41 (*n* = 6)	0.00% (*n* = 0)	0.00% (*n* = 0)	0.00% (*n* = 0)
Dead	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)	0.4% (*n* = 1)

2.4.2 Annual growth and condition monitoring

Annual quadrat monitoring for growth and condition was undertaken once during the reporting period in January 2024, as per the requirements of **Section 7.4** of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9).

A summary of average annual growth and condition data for the quadrats at each site is provided in **Table 4** and raw data is provided in **Appendix B**.

The next annual quadrat monitoring event is due to occur in January 2025.

Table 4 Summary of average annual growth and condition monitoring at both sites.

Quadrat no.	Cover abundance (%)	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoots	Flowering?	Height (mm)	Number of flowers per plant	Number of fruits per plant	Herbivory	Water Stress	Weed encroachment / competition
Quarry Hills Park											
Year 1 (2019-2020)											
Quadrat 1	20	810	392	10+	Yes	650	5-10	5-10	No	Yes	No
Quadrat 2	14	670	393	10+	Yes	607	10+	10+	No	Yes	No
Quadrat 3	15	700	383	10+	Yes	708	10+	5-10	No	No	No
Quadrat 4	2	410	290	0 - <5	Yes	583	0 - <5	0 - <5	No	Yes	No
Year 2 (2020-2021)											
Quadrat 1	23	973	507	10+	No	1013	5-10	5-10	No	No	No
Quadrat 2	17	797	353	10+	No	690	10+	10+	No	No	No
Quadrat 3	20	1085	498	10+	No	693	5-10	10+	No	No	Yes
Quadrat 4	2	585	240	5-10	No	690	5-10	0 - <5	No	Yes	No
Year 3 (2021-2022)											
Quadrat 1	22	1113	346	10+	No	810	10+	10+	No	No	No
Quadrat 2	10	799	296	10+	No	531	5-10	5-10	No	No	No
Quadrat 3	19	875	324	10+	No	535	5-10	5-10	No	No	No
Quadrat 4	2	485	235	10+	No	675	0 - <5	0 - <5	No	Yes	No
Year 4 (2022-2023)											

Quadrat no.	Cover abundance (%)	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoots	Flowering?	Height (mm)	Number of flowers per plant	Number of fruits per plant	Herbivory	Water Stress	Weed encroachment / competition
Quarry Hills Park											
Quadrat 1	23	803	333	10+	No	638	0 - <5	0 - <5	No	No	No
Quadrat 2	28	905	333	10+	No	488	5-10	5-10	No	No	No
Quadrat 3	26	914	391	10+	No	519	0 - <5	5-10	No	No	No
Quadrat 4	4	517	273	10+	No	180	0 - <5	0 - <5	No	Yes	No
Year 5 (2023-2024)											
Quadrat 1	37	787	350	10+	No	433	0 - <5	10+	No	No	No
Quadrat 2	27	883	317	10+	Yes	440	0 - <5	10+	No	No	No
Quadrat 3	41	750	450	10+	Yes	463	5-10	10+	No	No	Yes
Quadrat 4	8	313	237	5-10	No	270	0 - <5	0 - <5	No	Yes	Yes
Plenty Gorge Parkland											
Year 1 (2019-2020)											
Quadrat 1	19	739	370	10+	Yes	476	10+	10+	No	No	No
Quadrat 2	17	803	358.4	10+	Yes	627	10+	5-10	No	Yes	No
Quadrat 3	12	484	331	10+	Yes	606	5-10	5-10	No	Yes	No
Quadrat 4	12	510	321	5-10	Yes	586	5-10	0 - <5	No	Yes	No
Year 2 (2020-2021)											
Quadrat 1	28	958	512	10+	No	873	10+	5-10	No	No	No
Quadrat 2	29	1206	590	10+	No	922	10+	5-10	No	No	No
Quadrat 3	18	1073	468	10+	No	867	10+	5-10	No	No	No
Quadrat 4	18	933	468	10+	No	942	0 - <5	0 - <5	No	No	No
Year 3 (2021-2022)											
Quadrat 1	25	863	388	10+	No	837	5-10	0 - <5	No	No	No

Quadrat no.	Cover abundance (%)	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoots	Flowering?	Height (mm)	Number of flowers per plant	Number of fruits per plant	Herbivory	Water Stress	Weed encroachment / competition
Quarry Hills Park											
Quadrat 2*	100	2205	551	10+	No	1115	10+	10+	No	No	No
Quadrat 3	23	1023	416	10+	No	787	0 - <5	5-10	No	No	No
Quadrat 4	13	715	352	10+	No	815	5-10	0 - <5	No	No	No
Year 4 (2022-2023)											
Quadrat 1	27	885	392	10+	No	733	5-10	0 - <5	No	No	No
Quadrat 2*	100	2130	640	10+	No	1050	10+	10+	No	No	No
Quadrat 3*	40	2860	440	10+	No	920	0 - <5	5-10	No	No	No
Quadrat 4	14	660	372	10+	No	563	5-10	0 - <5	No	No	No
Year 5 (2023-2024)											
Quadrat 1	28	730	365	10+	No	722	0 - <5	10+	No	No	Yes
Quadrat 2	25	580	470	10+	Yes	620	5-10	10+	No	No	Yes
Quadrat 3	8	575	313	10+	No	533	0 - <5	10+	No	No	Yes
Quadrat 4	13	467	383	10+	No	617	0 - <5	5-10	No	No	Yes

*During the January 2022 quadrat monitoring, it was noted that due to the MFL at Plenty Gorge Parklands being planted in close clusters of approximately six plants, the plants over time had begun to spread and mat together, particularly Quadrat 2 (Cluster 9) and Quadrat 3 (Cluster 37). Matted Flax-lily typically forms loose clumps up to 5 m wide which was observed at Plenty Gorge Parklands and reflects the natural growth habitat of the species. This made it difficult and sometimes impossible to differentiate individual plants, as per the assessment method. Due to this, the assessment method had to be adjusted and the extent of the mat within the quadrat was considered rather than individual plants during the 2022 and 2023 monitoring events. This adjustment was not deemed necessary during January 2024, but will be applied to other quadrats in the future where necessary.

2.5 Assessment against performance benchmarks

Across both sites, 98.8% (or 494 of 500) of translocated MFLs are surviving, with:

- 245 at Quarry Hills Park; and
- 249 at Plenty Gorge Parklands.

These survival rates exceed the performance standard of 85% (or 412 of 500), as defined in Section 7.2 of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9).

2.6 Rainfall and watering data

Suggested watering frequency from the Translocation Plan (AECOM-GHD JV 2020a – Revision 9) was based around the time between 'significant rainfall events', i.e. where ≥20 mm of rainfall was received within a 24-hour period. Rainfall data was collected from Yan Yean weather station, located approximately 4.5km from the recipient sites. Dates where rainfall was ≥20 mm include:

- 16th April 2023
- 8th Jun 2023
- 4th October 2023
- 26th December 2023
- 3rd, 8th, and 9th January 2024
- 2nd April 2024

As it has been over 4 years since initial translocation and the MFL's are well established, the plants receive supplementary watering only if they display signs of stress (in accordance with Section 5.1 of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9). Dates on which supplementary watering occurred include:

- 28th September 2023 (Quarry Hills)
- 1st March 2024 (Plenty Gorge Parklands)
- 13th March 2024 (Quarry Hills and Plenty Gorge Parklands)

2.7 Photo monitoring

During the reporting period, monitoring photos at both sites were taken in July 2023 and January 2024. These photos are provided in **Plates 1 to 10**, and locations of the photo monitoring points are provided in **Appendix A**.

Plate 1 Quarry Hills Park Photo Monitoring Point 1 – July 2023

Plate 2 Quarry Hills Park Photo Monitoring Point 1 - January 2024

Plate 3 Quarry Hills Park Photo Monitoring Point 2 – July 2023

Plate 4 Quarry Hills Park Photo Monitoring Point 2 – January 2024

Plate 5 Quarry Hills Park Photo Monitoring Point 3 – July 2023

Plate 6 Quarry Hills Park Photo Monitoring Point 3 – January 2024

Plate 7 Quarry Hills Park Photo Monitoring Point 4 – July 2023

Plate 8 Quarry Hills Park Photo Monitoring Point 4 - January 2024

Plate 9 Quarry Hills Park Photo Monitoring Point 5 – July 2023

Plate 10 Quarry Hills Park Photo Monitoring Point 5 - January 2024

Plate 11 Plenty Gorge Parklands Photo Monitoring Point 1 – July 2023

Plate 12 Plenty Gorge Parklands Photo Monitoring Point 1 – January 2024

Plate 13 Plenty Gorge Parklands Photo Monitoring Point 2 – July 2023

Plate 14 Plenty Gorge Parklands Photo Monitoring Point 2 – January 2024

Plate 15 Plenty Gorge Parklands Photo Monitoring Point 3 – July 2023

Plate 16 Plenty Gorge Parklands Photo Monitoring Point 3 – January 2024

Plate 17 Plenty Gorge Parklands Photo Monitoring Point 4 – July 2023

Plate 18 Plenty Gorge Parklands Photo Monitoring Point 4 – January 2024

Plate 19 Plenty Gorge Parklands Photo Monitoring Point 5 – July 2023

Plate 20 Plenty Gorge Parklands Photo Monitoring Point 5 – January 2024

3.0 5-year program overview

3.1 Summary of program to date

As of the 5-year monitoring report, the translocation plan can be deemed a success, with 98.8% survivorship. This survivorship far exceeds the translocation plan criteria of 85% survivorship. The translocated plants, and the nursery stock, have been monitored quarterly to biannually in the last five years, with no significant losses of translocated individuals. **Table 5** highlights the high survivorship and stability of transplanted plants. Between monitoring events, plants previously noted as 'Dead', have since been found 'Alive'. This is likely due to plants remaining dormant and not producing leaves above-ground, or plant leaves not being found due to high biomass within the translocation plots. Plants within both translocation plots are generally relatively healthy and have been observed producing fruit.

Table 5 Survivorship over the last five years

Monitoring Period	Survivorship		
	Quarry Hills Parkland	Plenty Gorge Parkland	Total
April 2020	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
May 2020	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
June 2020	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
July 2020	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
November 2020	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
January 2021	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
April 2021	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
July 2021	98.4% (*n* = 246)	99.6% (*n* = 249)	**99.0%**
January 2022	98.0% (*n* = 245)	99.6% (*n* = 249)	**98.8%**
January 2023	98.0% (*n* = 245)	99.6% (*n* = 249)	**98.8%**
July 2023	98.0% (*n* = 245)	99.6% (*n* = 249)	**98.8%**
January 2024	98.0% (*n* = 245)	99.6% (*n* = 249)	**98.8%**

3.2 Plant Conditions

In general, translocated MFL are of good health in Quarry Hills Park and Plenty Gorge Park. Only plants chosen for quadrat monitoring have been specifically monitored for flowers and fruits. However, most have reached reproductive maturity, observed producing flowers and fruit during the January monitoring events (**Plate 3**-**Plate 4**). They are also regenerating though the formation of ramets, forming 'mats' that emulate natural growth and regeneration (**Plate 5**).

Plate 3 Matted Flax-lily Fruit.

Plate 4 Matted Flax-lily Flower.

Plate 5 Mat of Matted Flax-lily regenerating ramets

Only three plants were deemed 'Dead' during the last monitoring event:

- 007-001 - Quarry Hills Parkland
- 018-001 – Quarry Hills Parkland
- 064-004 – Plenty Gorge Parkland

Plant 018-001 was previously found 'Alive' during the July 2023 monitoring event. Therefore, it may still be alive, but dormant. For example, plant 066-002 was deemed dead during the July 2023 monitoring event, but small leaves were found during the January 2024 monitoring event.

The above dead plants, and those that have been consistently small or water stressed are highlighted in **Table 6** below.

Table 6 Plants showing signs of stress

Plant ID	Jan 2024 Monitoring Notes	Actions
Quarry Hills Parkland		
007-001	Plant missing or dead. Plant not found in July 2023.	May be dormant, monitor for growth in July 2024.
018-001	Plant missing or dead. Plant found in July 2023.	May be dormant, monitor for growth in July 2024.
032-002	Slightly Yellowed and dried	Water.

Plant ID	Jan 2024 Monitoring Notes	Actions
039-001	2 small individuals. Has been noted in previous years as being small and stressed	Water.
039-002	3 small individuals. Has been noted in previous years as being small and stressed	Water.
042-002	Small individual. Not previously noted as being small or stressed.	Monitor for improvement in July 2024.
044-001	Small individual. Not previously noted as being small or stressed.	Monitor for improvement in July 2024.
066-002	Some small individuals. Was not found in July 2023	Monitor for improvement in July 2024.
069-001	Small, water-stressed individual	Water.
091-002	2 very small individuals.	Monitor for improvement in July 2024.
101-001	Small, dry individual. Has been noted in previous years as being water stressed	Water.
103-001	Small individual	Monitor for improvement in July 2024.
Plenty Gorge Parklands		
008-004	Very small individuals.	Monitor for improvement in July 2024.
041-003	Very small individuals.	Monitor for improvement in July 2024.

Plants 039-001 and 039-002 in Quarry Hills Parkland are located towards the south of the site in Quadrat 4. This area is notably drier and on harder soil than the rest of the site. Water does not appear to drain down the slope through this section and the plants are therefore potentially missing key water and nutrients, leading to their poor health. It is recommended that these two plants are supplementary watered during dry periods. Other plants within this area should continue to be monitored for signs of water stress.

3.3 Performance Management and Contingency Planning

Table 7 outlines the success of the plan relation to the performance measures listed in the Translocation Plan (AECOM-GHD JV 2020a – Revision 9).

Table 7 Performance Management and Contingency Planning

Year for Completion of Activity	Standard to be Achieved	Contingency	Achieved?
Pre-planting	• 100% salvage of pre-clearance plants (121 plants) • Where achievable 6 clones to be created to replace salvaged plants. 726 plants to be established in total.	• If the six clones cannot initially be established, additional clones to be produced • Two clones maintained in nursery conditions	• **Possibly – this is believed to have occurred due to the outcomes but is not clearly stated in past reports**
End of first year	• >85% survivorship of 4 clones (minimum 412 plants)	• Do nothing and continue to monitor	• **Yes**
	• <85% survivorship of 4 clones (<412 plants)	• Replant up to 85% (412plants)	• **N/A**

Year for Completion of Activity	Standard to be Achieved	Contingency	Achieved?
		survivorship of 4 clones	
End of second year	• >85% survivorship of 4 clones (minimum 412 plants)	• Do nothing and continue to monitor	• **Yes**
	• <85% survivorship of 4 clones (<412 plants)	• Replant up to 85% (412plants) survivorship of 4 clones	• **N/A**
End of third year	• >85% survivorship of 4 clones (minimum 412plants)	• Do nothing and continue to monitor	• **Yes**
	• <85% survivorship of 4 clones (<412plants)	• Replant up to 85% (412plants) survivorship of 4 clones	• **N/A**
End of fourth year	• >85% survivorship of 4 clones (minimum 412plants)	• Do nothing and continue to monitor	• **Yes**
	• <85% survivorship of 4 clones (<412plants)	• Replant up to 85% (412plants) survivorship of 4 clones	• **N/A**
End of fifth year	• Achieved a performance target of at least 85% of clones surviving? • If this is the case the translocation plan is declared a success.	• No contingency required • Translocation can be declared a success	• **Yes**
	• If the performance target has not been met at the end of a 5-year period continue with replanting strategy.	• Review the existing strategy and explore options to improve success rates • Replant with 'insurance clones' as required to achieve performance target and monitor until performance target achieved	• **N/A**
End of year 6 to 10	• Achieve a performance target of at least 4 clones surviving for a minimum of five years (85% of plants translocated) • If this is the case the translocation plan is declared a success.	• No further contingency required	• **TBD – Have not reached this time yet**

Year for Completion of Activity	Standard to be Achieved	Contingency	Achieved?
	• If the performance target has not been met at the end of a 5 year period (85% of plants translocated) continue with replanting strategy.	• Review the existing strategy and explore options to improve success rates. • Replant all to be represented by 4 clones	• **TBD – Have not reached this time yet**

3.4 Analysis of success

The below **Table 8** analyses the success of the program against the performance benchmarks outlined in Section 7.1 of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9).

Table 8 Analysis of success against performance benchmarks

Performance Benchmark	Success?
Propagation and Nursery Management	
• The required number of transplants was available for the proposed translocation.	• Successful
• Correct labelling and documentation was maintained throughout the propagation and nursery management period.	• Successful
• Techniques for successful propagation of Matted Flax-lily developed through past translocation projects in Victoria were tested and/or advanced.	• Successful – See **Section 3.5 – Lessons Learned.**
• A genetically representative collection was maintained.	• Successful
Habitat and Threat Management	
• Good-quality habitat was restored or maintained within the recipient site.	• Successful – See **Section 2.3 – Site Conditions Potential Threats and Management**
• Management and maintenance activities were carried out at suitable intervals and to the required standard.	• Successful – See **Section 2.3 – Site Conditions Potential Threats and Management**
• Threatening processes, including weed invasion, were eliminated or effectively controlled.	• Successful – See **Section 2.3 – Site Conditions Potential Threats and Management**
Short- to Mid-term Translocation Criteria (1 to 5 years)	
• At least 85% of transplanted clones survive, including representatives from the range of genetic individuals salvaged.	• Successful – See **Section 2.5 – Assessment against performance benchmarks**. The translocation plan has achieved a 98.8% success rate.
• The translocated populations display similar growth, development and vigour as naturally occurring populations.	• Successful – See **Section 3.2 Plant Conditions.**
• Transplants survive to a reproductive stage (producing flowers and fruit).	• Successful – See **Section 3.2 Plant Conditions**.
• If plants don't survive to reproductive stage, then the plants will be replaced.	• Successful – The translocation plan has achieved a 98.8% success rate

Performance Benchmark	Success?
Propagation and Nursery Management	
• Regeneration occurs in the translocated individuals (since the recruitment of Matted Flax-lily through seed is thought to be rare, the production of ramets at a rate similar to naturally occurring populations is considered sufficient to meet this criterion).	• Successful – See **Section 3.2**
Long-term Criteria (after 5 years)	
• The number of individuals within the population is stable, or has increased by natural (including vegetative) recruitment.	• TBD – this time-milestone has not yet been reached
• Adequate levels of genetic diversity are maintained.	• TBD – this time-milestone has not yet been reached

3.5 Lessons Learned and Recommendations

A meeting was held with Richard Francis from ABZECO on 22nd May 2024 to discuss key lessons learned in the success of this project and recommendations for future translocations. This meeting was crucial for identifying key factors that contributed to the success of the translocation plan. Key lessons are highlighted below in **Table 9**.

Table 9 Lessons Learned

Factor for Success	Explanation	Lesson / Recommendation
Rhizome cleaning for weed control	• Past translocations have collected the MFL plant and soil surrounding the rhizomes. • When soil remains, weed seeds and propagules may also remain with the MFL rhizomes. • ABZECO removed as much soil from the MFL rhizomes as possible, washing in water. • This removed the weedy seed bank and meant that, during propagation, weed emergence in the pots was very low. • Low weed emergence made hand-weeding much easier, and reduced the need for herbicide application.	• Ensuring that MFL rhizomes are thoroughly cleaned of soil can significantly reduce weed issues.
Soil mixture	• Past translocations have grown the removed MFL in potting mix that generally consists of pine bark. This is in no way similar to the typical soil that MFL grows in. • ABZECO transplanted the removed MFL rhizomes into a soil mix consisting of sandy loam mixed with clay. This soil mixture is much more similar to the soil that MFL grows in in-situ. • The new soil mixture allows for a wet-dry cycle that better emulates nature when infrequently inundated by hand-watering. This is in contrast to potting mix which is designed to retain as much water as possible.	• Growing removed MFL in a soil mixture similar to that experienced in-situ, as opposed to potting mix, contributed to translocation success.
Pot selection	• Wide, 150mm squat pots were used to grow removed MFL. Wide pots allow for lateral rhizome growth and proliferation.	• Wide pots encourage lateral rhizome growth.
Site selection and weed control	• Past failed translocation plans have seen MFL planted into areas that have no naturally occurring MFL, into the depressions of Gilgai wetlands, and into sites with very high weed cover. • For this translocation plan, ABZECO worked with Whittlesea City Council to select sites that have natural occurring MFL within/nearby. • The MFL were planted in mid-slope areas that receive run-off and nutrients from above the slope, but avoid extended wet times typical of	• Ensuring that MFL were planted in areas that have naturally occurring populations, are planted mid-slope, receive sunlight, and lack weeds contributed to translocation success.

Factor for Success	Explanation	Lesson / Recommendation
	bottom slopes. These sites also lacked a dense overstory, meaning the MFL received sunlight. • Weeds were removed prior to planting, and continuously managed throughout the 5-year program.	
Translocation time	• Past failed translocation plans saw MFL planted during the millennium drought. • ABZECO planted MFL for this translocation plan on/around the Autumn Break. This generally occurs between March and May, typically around April.	• MFL should be planted on/around the Autumn Break.

The lessons from this project should be carried into future MFL translocation programs to ensure ongoing success and survival of the species

4.0 Conclusion

The survival rates of translocated MFLs at 98.8% (or 494 of 500) meet the performance standard of 85% (or 412 of 500), as defined in Section 7.2 of the Translocation Plan (AECOM-GHD JV 2020a – Revision 9). Given that the aim of achieving 85% survival of clones, contingency planning need not be initiated.

As the fifth year survivorship rate is well above the performance benchmark of 85%, the translocation should be declared a success. Regardless, the Department of Transport has committed to continuing monitoring the translocated populations for an additional two years.

5.0 Next steps

- At request of the Department of Transport, this monitoring program will continue for at least an additional 2 years.
- As the translocation plan enters its final 5 years, arrangements should be made for the remaining nursery stock. Conversations should start to occur between DoT, City of Whittlesea and City of Hume to discuss potential for additional plantings of the nursery stock throughout these shires. Early consultation will allow for investigation into potential programs and grants which would allow this stock to be utilised.

6.0 References

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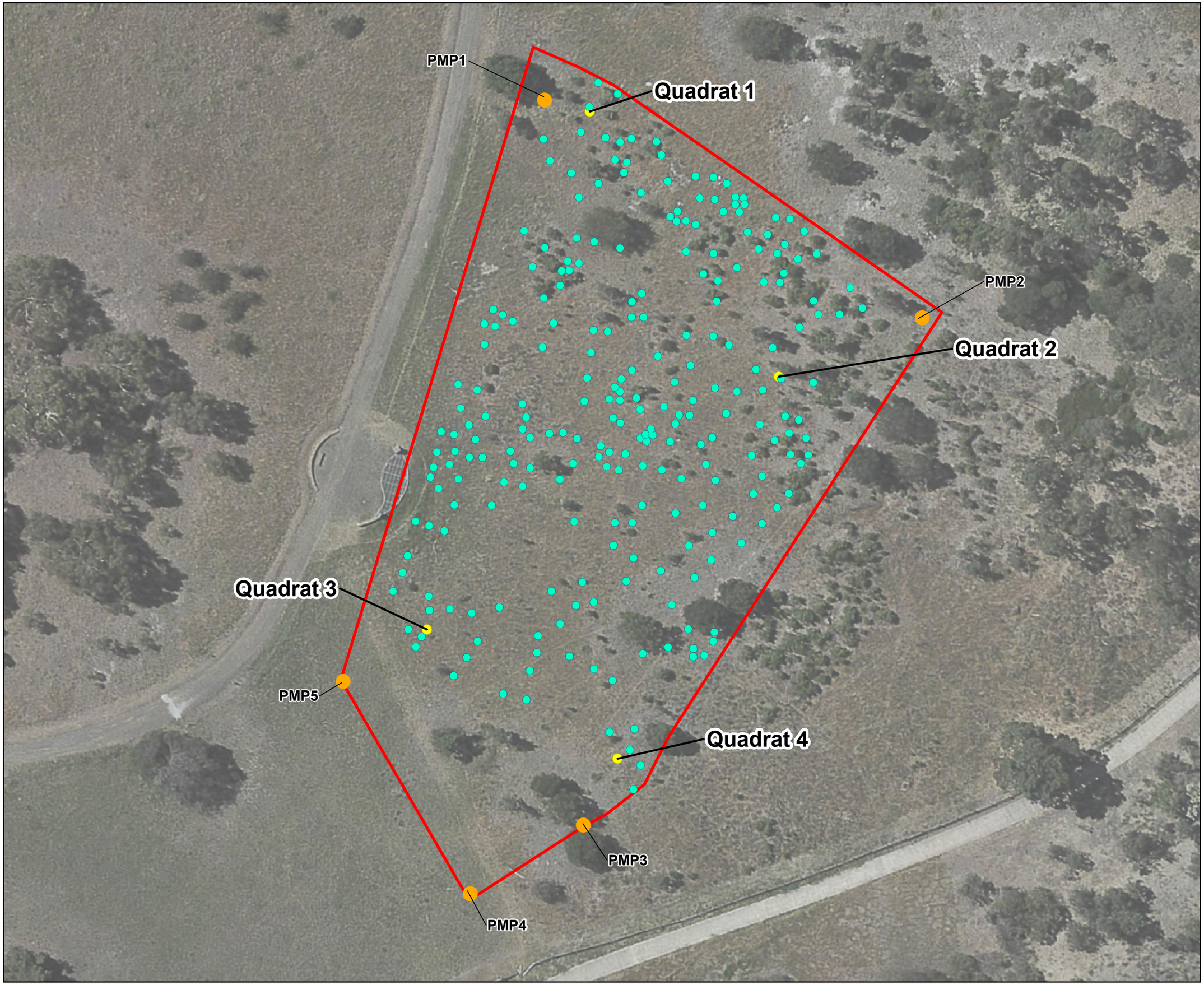
EP. 2010. Translocation and Management Plan for Matted Flax-lily Dianella amoena, South Morang Rail Extension, South Morang, Victoria. Prepared for Department of Transportation, February 2010.

Appendix A

Figures



Legend

- MFL
- Monitoring Quadrat
- Photo Monitoring Points
- Recipient Site

Quarry Hills Park
Recipient Site

Figure 1

LEVEL CROSSING REMOVAL PROJECT

AECOM GHD JOINT VENTURE

0 3.75 7.5 15
Metres

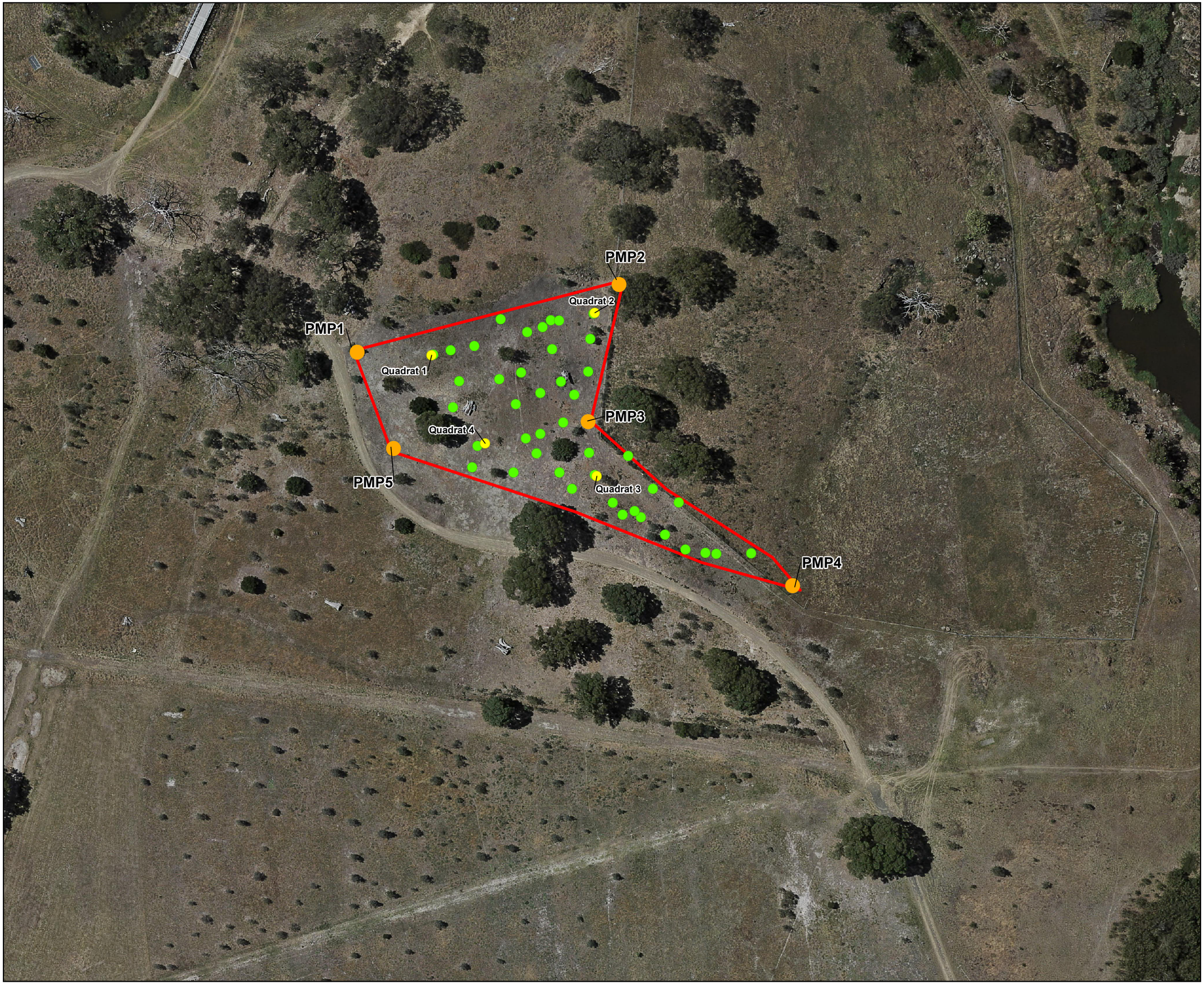
N

Paper Size A3

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:prachi.kulkarni1

X:\Project Data\PRGM\GIS\MXD\Mernda\ECOLOGY\20191219_Mernda_Ecology\F2_Quarry_Hills_Park_Rev1.mxd | prachi.kulkarni1 | Rev A | Date: 15 Apr 2020



Legend

- Monitoring Quadrat
- Matted Flax-lily Cluster
- Photo Monitoring Points
- Recipient Site

Plenty Gorge Parklands Recipient Site

Figure 2

LEVEL CROSSING REMOVAL PROJECT

AECOM GHD JOINT VENTURE

0 5 10 20
Metres

N

Paper Size A3

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:prachi.kulkarni1

X:\Project Data\PRGM\GIS\MXD\Mernda\ECOLOGY\20191219_Mernda_Ecology\F3_Plenty_Gorge_Parklands.mxd | prachi.kulkarni1 | Rev A | Date: 17 Feb 2020

Appendix B

Raw field data sheets

Quarry Hills Park: Population Total Count					
Date:					
Plant ID	Live/Dead	Notes	Plant ID	Live/Dead	Notes
001-001	L	V large individual	029-002	L	
001-002	L	Small indi - lots of themeda *	030-001	L	~~Stake~~ tag. AM.
002-001	L	weeds encroaching	030-002	L	
002-002	L		031-001	L	
003-001	L		031-002	L	
003-002	L		032-001	L	
004-001	L	*	032-002	L	bit dry / yellowed
004-002	L		033-001	L	
005-001	L		033-002	L	
005-002	L		034-001	L	
006-001	L		034-002	L	
006-002	L		035-001	L	
*007-001	MISSING - NO PLANT OR STAKE		035-002	L	
007-002	L		036-001	L	
008-001	L		036-002	L	
008-002	L		037-001	L	
009-001	L	Twisty fruit (!)	037-002	L	
009-002	L		038-001	L	
010-002	L		038-002	L	no tag
010-003	L		039-001	L	2 small individuals
011-001	L		039-002	L	3 small indiv
011-002	L		040-001	L	
012-001	L	Tag in middle of plant	040-002	L	
012-002	L		041-001	L	
013-001	L		041-002	L	
013-002	L		042-001	L	
014-001	L		042-002	L	small indiv. no tag, not re-tagged
014-002	L		*043-001	L	
015-001	L	could not find tag not re-tagged	043-002	L	
*015-002	L		044-001	L	small indiv, weed biomass +++
016-001	L	New tag	044-002	L	
016-002	L		045-001	L	
017-001	L		045-002	L	re-staked.
017-002	L		046-001	L	
018-001		could not find plant or stake.	046-002	L	
018-002	L		047-001	L	
019-001	L		047-002	L	
019-002	L		048-001	L	
020-001	L		048-002	L	
020-002	L		*049-001	L	
021-001	L		049-002	L	
021-002	L		050-001	L	
022-001	L		050-002	L	
022-002	L	New tag - could not find old	051-001	L	
023-001	L		051-002	L	high weed biomass
023-002	L		052-001	L	
024-001	L		052-002	L	
024-002	L		053-001	L	
025-001	L		053-002	L	
025-002	L		054-001	L	re-tagged.
026-001	L		054-002	L	
026-002	L		055-001	L	
027-001	L	New tag	055-002	L	New tag
027-002	L	under tree (dead tree.	056-001	L	
028-001	L		056-002	L	
028-002	L		057-001	L	

retagged needs weeding. → 059-001

Plant ID	Live/Dead	Notes	Plant ID	Live/Dead	Notes
057-002	L		087-002	L	
058-001	L		088-001	L	
058-002	L	needles	088-002	L	New tag
059-001	L	could not find tag	089-001	L	Retagged - New tag
059-002	L	no tag needs weeding	089-002	L	
060-001	L		090-001	L	
060-002	L		090-002	L	
061-001	L		091-001	L	
061-002	L		091-002	L	very small - 2 inds. AM
062-001	L		092-001	L	
062-002	L		092-002	L	~~Very small - 2 inds.~~ State Aplaced
063-001	L		093-001	L	
063-002	L		093-002	L	
064-001	L		094-001	L	
064-002	L	re-tagged.	094-002	L	
065-001	L	New tag	095-001	L	
065-002	L		095-002	L	
066-001	L		096-001	L	
066-002	L	some small individuals (she's back)	096-002	L	
067-001	L		097-001	L	
067-002	L		097-002	L	
068-001	L		098-001	L	
068-002	L	New tag	098-002	L	
069-001	L	Small & water stressed	099-001	L	
069-002	L		*099-002	L	NT
070-001	L		100-001	L	no tag needs weeding
070-002	L		100-002	L	
071-001	L		101-001	L	Small dry
071-002	L	weeding needed.	101-002	L	
072-002	L		102-001	L	
073-001	L		102-002	L	
073-003	L		103-001	L	
074-001	L		103-002	L	* small, no tag, no paint, not retagged
074-002	L		104-001	L	
075-001	L		104-002	L	
075-002	L		105-001	L	
076-002	L		105-002	L	
076-003	L		106-001	L	retagged
077-001	L		106-002	L	
077-002	L	New tag	107-001	L	
078-001	L	needles.	107-002	L	
078-002	L		108-001	L	
079-001	L		108-002	L	High biomass - Could not find tag th
079-002	L		109-001	L	
080-001	L		109-002	L	
080-002	L		110-001	L	
081-001	L	New tag	110-002	L	
081-002	L	*	111-001	L	needles
082-001	L		111-002	L	One plant
082-002	L		112-001	L	
083-001	L		112-003	L	
083-002	L		113-001	L	
084-001	L	needles	113-002	L	needles
084-002	L		114-001	L	
085-001	L		114-002	L	*
085-002	L		115-001	L	
086-001	L	no tag.	115-002	L	

086-002	L		116-001	L	
087-001	L		116-002	L	retagged

Quarry Hills Park: Population Total Count

Date:

Plant ID	Live/Dead	Notes	Plant ID	Live/Dead	Notes
117-001	L				
117-002	L				
118-001	L	not on map			
119-001	L	Needles			
119-002	L	no tag large individual			
120-001	L				
120-002	L				
121-001	L	AM			
*122-001	L				
122-002	L				
123-001	L				
123-002	L				
124-001	L				
124-002	L				
125-001	L				
125-002	L				

114-002 - Aline

* cluster

- 004 001
- 001 002
- 103 002
- 114-002 ← tag
- 081-002

- no tags
- previously found so not retagged
- 5 individuals
- estimated which is which from map

030-001 already marked
if similar number missing
assume 'typo'

Plenty Gorge Parklands: Population Total Count

Date: 12/1/24

Cluster ID	Plant ID	Live/Dead	Notes
1	001-003	L	could not find tag
1	001-004	L	could not find tag
1	002-003	L	
1	002-004	L	
1	003-004	L	
1	033-004	L	
2	004-003	L	extremely high biomass + weeds, difficult to find tags
2	004-004	L	
2	005-004	L	
2	006-003	L	
2	006-004	L	
2	026-003	L	
3	007-003	L	high weed biomass. cluster very choked could not find tag could not find tag could not find tag small individuals
3	007-004	L	
3	008-003	L	
3	008-004	L	
3	009-003	L	
3	009-004	L	
4	010-001	L	
4	010-004	L	
4	011-003	L	
4	011-004	L	
4	012-004	L	
4	043-004	L	
5	012-003	L	
5	013-004	L	
5	014-003	L	
5	063-003	L	
5	073-004	L	
5	080-003	L	
6	016-004	L	no tag found high weeds + biomass
6	017-003	L	
6	017-004	L	
6	018-003	L	
6	018-004	L	
6	048-003	L	no tag found
7	019-003	L	
7	020-003	L	no tag found ~~no tag~~
7	020-004	L	
7	021-003	L	
7	021-004	L	
7	041-004	L	
8	013-003	L	high weed covert biomass could not find tag
8	015-004	L	
8	022-003	L	
8	022-004	L	
8	023-003	L	
8	023-004	L	
9	015-003	L	
9	024-004	L	
9	027-003	L	
9	027-004	L	
9	044-004	L	
10	059-004	L	
10	112-004	L	
10	061-003	L	
10	096-004	L	
10	043-003	L	
10	014-004	L	
11	047-003	L	no stake blackberry tamandra encroachment
11	049-004	L	
11	052-003	L	
11	053-004	L	
11	103-003	L	
11	114-004	L	
12	016-003	L	
12	019-004	L	
12	040-004	L	
12	042-004	L	
12	045-003	L	could not find tag
12	045-004	L	
12	048-004	L	
13	025-003	L	
13	026-004	L	no tag
13	033-003	L	no tag
13	037-003	L	no tag
13	042-003	L	no tag
13	071-003	L	
14	003-003	L	
14	040-003	L	
14	041-003	L	very small individual could not find tag
14	044-003	L	
14	055-003	L	
14	055-004	L	
15	005-003	L	
15	024-003	L	
15	028-004	L	
15	029-003	L	
15	029-004	L	
16	025-004	L	lots of biomass
16	031-004	L	no tag
16	049-003	L	stake over grown
16	051-004	L	no tag
16	050-003	L	no tag
17	070-004	L	could not find tag
17	060-003	L	
17	064-003	L	
17	046-003	L	no tag
17	050-004	L	smothered by geranium
17	101-003	L	
18	046-004	L	lots of weedy shrubs
18	051-003	L	juncus, no tag
18	052-004	L	could not find tag
18	054-003	L	
18	058-003	L	
18	058-004	L	
19	081-003	L	no tag
19	081-004	L	no tag
19	083-004	L	no tag
19	087-004	L	bushy weeds
19	093-003	L	
19	102-003	L	
20	057-003	L	no tag
20	057-004	L	no tag
20	065-003	L	no tag
20	065-004	L	
20	066-003	L	
20	066-004	L	no tag
21	028-003	L	
21	031-003	L	
21	032-003	L	~~no tag~~
21	035-004	L	
21	037-004	L	no tag
21	038-003	L	no tag
22	053-003	L	
22	056-003	L	
22	062-003	L	
22	062-004	L	no tag
22	104-004	L	
23	059-003	L	clumped together, difficult to distinguish
23	060-004	L	
23	061-004	L	
23	063-004	L	no tag
23	064-004	L	no tag

high biomass + weeds

Cluster ID	Plant ID	Live/Dead	Notes
23	073-002	L	no tag
24	084-003	L	no tag
24	084-004	L	
24	086-004	L	no tag
24	101-004	L	smothered a by lomandra
24	102-004	L	
24	104-003	L	
25	076-001	L	
25	079-004	L	no tag
25	085-004	L	no tag
25	089-004	L	
26	088-003	L	no tag
26	088-004	L	no tag
26	099-004	L	no tag
26	100-003	L	no tag
26	110-003	L	no tag
26	111-003	L	
27	093-004	L	no tag
27	094-004	L	no tag
27	095-003	L	no tag
27	095-004	L	no tag
27	106-003	L	blackberry
27	106-004	L	large, dense cluster,
28	016-004	L	all very healthy
28	117-003	L	
28	117-004	L	
28	118-003	L	no tag
28	122-004	L	no tag
28	123-004	L	
29	121-004	L	
29	123-003	L	one staple found,
29	124-003	L	no tag
29	124-004	L	
29	125-003	L	
29	125-004	L	
30	108-004	L	No tag
30	119-004	L	No tag
30	120-003	L	No tag
30	120-004	L	no tag
30	121-003	L	No tag
30	122-003	L	No tag
31	107-003	L	No tag
31	107-004	L	No tag
31	111-004	L	No tag
31	112-002	L	No tag
31	113-003	L	very high grass mass
31	119-003	L	
32	072-004	L	
32	097-004	L	no tag
32	105-003	L	no tag
32	105-004	L	no tag
33	098-003	L	no tag
33	098-004	L	no tag
33	099-003	L	no tag
33	100-004	L	no tag
33	116-003	L	
33	118-004	L	no tag
34	089-003	L	
34	091-004	L	no tag
34	092-003	L	no tag
34	092-004	L	no tag
34	094-003	L	high biomass
34	096-003	L	no tag
35	086-003	L	no stake, no tag
35	087-003	L	very high, no tag
35	090-003	L	grass biomass, no tag
35	090-004	L	no tag
35	091-003	L	no tag
35	097-003	L	
36	082-003	L	no tag
36	082-004	L	
36	083-003	L	blackberry
36	085-003	L	no tag
36	115-003	L	no tag
36	115-004	L	no tag
37	108-003	L	
37	109-003	L	
37	109-004	L	
37	110-004	L	could not find tag
37	113-004	L	
37	114-003	L	
38	067-003	L	
38	069-003	L	
38	072-003	L	
38	077-004	L	blackberry
38	080-004	L	
38	103-004	L	no tag
39	067-004	L	no tag
39	068-003	L	no tag
39	068-004	L	plants flattened
39	074-003	L	
39	078-003	L	
40	034-003	L	
40	034-004	L	
40	035-003	L	
40	036-004	L	
40	038-004	L	
41	030-003	L	no tag
41	030-004	L	
41	036-003	L	
41	039-003	L	no tag
41	054-004	L	no tag
41	056-004	L	no tag
42	069-004	L	missing stake
42	070-003	L	no tag
42	074-004	L	no tag
42	075-003	L	
42	075-004	L	no tag
42	078-004	L	weed - choked
43	032-004	L	no tag
43	039-004	L	no tag
43	047-004	L	
43	071-004	L	
43	076-004	L	
43	079-003	L	

Quarry Hills Park: Quadrat Monitoring

Date:		Surveyors:		1 = 0 - 5	2 = >5 - 10	3 = 10+

Quadrat 1

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
012-001	40	1110 10/m	400	3	N - Fin	450	1	3	N	N	N	Buds + fruit only
018-002	40	600	380	3	N - Fin	450	1	3	N	N	N	Finished flowering - some rot
022-002	30	650	300	3	N - Fin	400	1	3	N	N	N	

Quadrat 2

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
028-002	30	550	300	3	N	550 [illegible]	1	1	N	N	N	Finished flowering
096-002	25	1100	350	3	N	400	1	3	N	N	N	Finished flowering
105-001	25	1000	300	3	Y	370	1	3	N	N	N	Fruit + bud, 1 flower

41 flores observed

Quadrat 3

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
029-002	35	750	300	3	Y	400	1	3	N	N	Y-Grass	Buds, no flows, fruit
033-002	5	500	400	3	N	450	1-N	3	N	N	Y-Grass	
106-001	60	1250	550	3	Y	600	3	3	N	N	N	very healthy plant, - Flows + fruit + buds
095-002	30	500	550	3	N	~~400mm~~ 400	1	3	N	N	Y-Grass	lots of fruit

Quadrat 4

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
039-002	5-10	~~700~~	300	2	N	300	1-N	N	N	N	N	Only a few inds - small - stunted
039-001	5	240	150	1	N	150	1	N	N	N	N	1 small inds. observed
057-001	10	400	260	2	N	360	1	1	N	Y	Y	Some buds, no flows, some fruit

yellowing | Plantago + catsear

Plenty Gorge Parklands: Quadrat Monitoring

Date:		Surveyors:		1 = 0 - 5	2 = > - 10	3 = 10+

Quadrat 1 (Cluster 1)

					Inflorescence/infructescence				Evidence of...			
Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	Other Comments
002-003	20	630	280	3	N	750	1	3	N	N	Y	grass
001-004	30	700	330	3	N	700	1	3	N	N	Y	NO tag
002-004	15	500	330	3	N	1000	1	3	N	N	Y	
001-003	30	650	400	3	N	650	1	2	N	N	Y	No tag
003-004	25	900	400	3	N	730	1	3	N	N	Y	
033-004	50	1100	450	3	N	500	1	3	N	N	Y	

Quadrat 2 (Cluster 9)

					Inflorescence/infructescence				Evidence of...			
Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	Other Comments
027-004	20	450	500	3	Y	650	1	3	N	N	Y	
024-004	30	500	450	3	Y	600	2	3	N	N	Y	drain sedge
044-004	25	500	400	3	Y	600	2	3	N	N	Y	
015-003	15	800	450	3	N	500	1	3	N	N	Y	
027-003	35	650	550	3	Y	750	2	3	N	N	Y	no tag

Quadrat 3 (Cluster 37)

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
109-004	5	350	300	3	Y	450	1	3	N	N	Y	
113-004	10	650	250	3	Y	400	1	3	N	N	Y	
109-003	7	450	300	3	Y	600	1	3	N	N	Y	some weed encroachment
110-004	15	500	300	3	Y	400	1	2	N	N	Y	
108-003	5	900	400	3	Y	800	1	2	N	N	Y	
114-003	5	600	330	3	Y	550	1	2	N	N	Y	

Quadrat 4 (Cluster 21)

Plant ID	Cover-abundance	Plant basal diameter (mm)	Max Leaf Length (mm) - height	No. leaves/shoot (1 - 3)	Inflorescence/infructescence				Evidence of...			Other Comments
					Flowering? (Y/N)	Height (mm)	Flowering (1 - 3)	Fruiting (1-3)	Herbivory (Y/N)	Water Stress (Y/N)	Weed encroachment/competition (Y/N)	
038-003	15	350	300	3	Y	650	-	2	N	N	Y	no tag
031-003	7	450	450	3	Y	450	-	-	N	N	Y	
035-004	10	350	500	3	Y	600	-	3	N	N	Y	
032-003	20	600	400	3	Y	750	-	-	N	N	Y	
037-004	15	300	350	3	Y	600	1	-	N	N	Y	no tag
028-003	10	750	300	3	Y	650	1	2	N	N	Y	

Appendix C

Nursery Audit

Prepared for
Department of Transport
ABN: 69981208782

AECOM

Matted Flax-lily Nursery Audit - 2023

21-May-2023

aecom.com

Delivering a better world

Matted Flax-lily Nursery Audit - 2023

Client: Department of Transport

ABN: 69981208782

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Quality Information

Document Matted Flax-lily Nursery Audit - 2023

Ref 60647371

Date 21-May-2023

Prepared by Jasmine Bettiol

Reviewed by Dan Haysom

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	21-May-2023	Final	Dan Haysom Associate Director - Environment	

Table of Contents

1.0 Introduction

The AECOM-GHD Joint Venture (JV) were previously engaged by the Level Crossing Removal Project (LXRP) to undertake regular audits of a population of Matted Flax-lily *Dianella amoena* salvaged from the construction footprint of the Mernda Rail Extension Project (the Project) in April 2017. Since October 2020 the Project has formally transferred from LXRP to the Department of Transport (DoT). DoT are now the agency responsible for undertaking reporting and monitoring events as required by the EPBC 2016/27674 Matted Flax-lily Translocation Plan.

The plants subject to this audit are managed at ABZECO nursery as 'insurance stock' to ensure that plants translocated in July/August 2019 can be supplemented if necessary to achieve an overall survival rate of at least 85%. This 'insurance stock' is in the care of ABZECO consultants, who will manage and maintain the plants until the maintenance period is over (between two and 10 years) at which time any remaining plants will be provided to Parks Victoria and/or other local agencies for revegetation projects within the region. It should be noted that plants already translocated are subject to a separate audit and are not within the scope of this memo. The salvage, maintenance and final translocation of the Matted Flax-lily to their recipient sites are guided by the EPBC 2016/27674 Matted Flax-lily Translocation Plan (LXRA-MNDA-00-PA-RPT-004 Revision: 9) released on 9 March 2020.

This nursery audit forms part of the Year 5 2023-2024 Matted Flax-lily Annual Summary Report.

1.1 Purpose

This memorandum provides a summary of the current status of the Matted Flax-lily 'insurance stock' as a result of the most recent audit. Specifically, the memorandum will detail:

- The current management and number of transplants available as 'insurance stock'
- Evidence of correct labelling and documentation maintained throughout the propagation and management period
- Evidence of the appropriate sized pot usage
- Evidence of the health, growth and survivorship of clones created from parent plants
- Evidence of weed and pest control
- Evidence of 'hardening' off if required for future translocations.

2.0 Results of April 2023 audit

On the 11 April 2023, two AECOM ecologists met with Jack Latti, the nursery manager of ABZECO consulting. The nursery is located at 105 Gumtree Road, Research.

The audit found that all criteria documented within the translocation plan were being met and the 'insurance stock' Matted Flax-lilies were observed to be in a healthy condition and well managed. Specifically;

- pots of live, healthy Matted Flax-lily representing the required number of clones were observed,
- individuals were clearly labelled and potted in appropriate pots and potting medium, and
- no diseased individuals were observed.

Results are described in greater detail in Table 1 and supported by Plate 1 to Plate 2.

Table 1 Results of 2023 audit

Item	Details
The required number of clones are available: 6 clones to be created per salvaged plant where possible 4 clones per salvaged plant available for translocation 2 clones per salvaged plant maintained in nursery conditions	Pots containing clones of the original salvaged plants were observed at the nursery. These represented a minimum of 2 (more in some instances) clones per salvaged plant which are maintained at the nursery as 'insurance stock'.
Labelling of clones with staked metal nursery tags in addition to labelling of pot with permanent marker in the format of 001 (patch number) – 001 (clone number)	The 'insurance stock' clones were clearly labelled with a metal tag and permanent marker on the outside of the pot. Labels represented the patch and clone number as required.
Clones to be in good health with minimal individuals showing signs of stress or having senesced, evidence of growth	Clones were observed to be in good health, and thatching (last year's growth which had dried off and been left in place during summer as a form of mulch and to assist with water retention) had recently been removed from the pots.
Evidence of disease	No evidence of disease was observed.
Pest control actively managed (e.g. thrips, rabbits, deer)	The pots had been moved to a slightly different location on the property for long term storage. The pots were surrounded by deer proof fencing. The nursery manger reported that there has not been any deer or rabbit pest issues. The presence of a dog which patrolled the nursery and surrounds is also likely to keep animal pests at bay.
Weed control actively managed (e.g. hand weeded during winter months or as needed)	No weeds were observed within the pots. The nursery manager confirmed that hand weeding occurred on a regular basis, especially during winter months. Plants were also trimmed to help new growth as there is no natural predation given the predator proof fencing surrounding the plants.
Propagation material appropriate (e.g. sandy loam etc.)	The nursery manager identified that the potting material originally used for the clones had been changed from typical potting mix used for native vegetation to a sandy-loam mix which had resulted in less drying out of pots and better water retention.
Pot size appropriate (e.g. minimum of 14 cm diameter pot)	Pot sizes were observed to be within the recommended range.
Watering and fertilizer regime appropriate (e.g. reflective of climatic conditions where appropriate, fertilisation in advance of translocation)	The nursery manager stated that the plants had received one dose of a 12 month controlled release fertiliser in the last year. Supplementary hand watering occurred during summer if the temperature was above 35 degrees and cracking soils were observed. There had been no need for supplementary watering in the months outside of summer. As the nursery is located outdoors, watering by hand is considered supplementary to rainfall.
Evidence of 'hardening off' of plants prior to translocation	Plants occur outdoors and are exposed to climatic conditions.

Item	Details
Additional observations (e.g. thatch kept/removed to assist with water retention etc.)	Thatch had recently been removed, give the end of the summer season

Plate 1 Newly established deer proof fencing around pots

Plate 2 Thatching recently removed within pots

3.0 Next Steps

The 'insurance stock' Matted Flax-lilies should continue to be monitored on an annual basis as per the schedule in Table 2. An auditor's checklist is provided below in Table 3 to provide consistency and assist with future audits. Results of the nursery audits should be included in the translocation program's annual report.

Table 2 Audit schedule

Year	Audit 1	Audit 2
Salvage	April 2017	
Year 1		
6 monthly audit	September 2017	April 2018
Year 2		
6 monthly audit	September 2018	April 2019
Year 3	April 2020	
Year 4	April 2021	
Year 5	April 2022	
Year 6	April 2023	
Year 7	April 2024	
Year 8	April 2025	
Year 9	April 2026	
Year 10	April 2027	

Table 3 Auditor's checklist

Item	Details
The required number of clones are available for translocation 6 clones to be created per salvaged plant where possible	
Labelling of clones with staked metal nursery tags in addition to labelling of pot with permanent marker in the format of 0001 (patch number) – 001 (clone number)	
Clones to be in good health with minimal individuals showing signs of stress or having senesced, evidence of growth	
Evidence of disease	
Pest control actively managed (e.g. thrips, rabbits, deer)	
Weed control actively managed (e.g. hand weeded during winter months or as needed)	
Propagation material appropriate (e.g. sandy loam etc.)	
Pot size appropriate (e.g. minimum of 14 cm diameter pot)	
Watering and fertilizer regime appropriate (e.g. reflective of climatic conditions where appropriate, fertilisation in advance of translocation)	
Evidence of 'hardening off' of plants prior to translocation	
Additional observations (e.g. thatch kept/removed to assist with water retention etc.)	

4.0 References

AECOM-GHD Joint Venture. 2018. Mernda Rail Extension Project – EPBC 2016/7674 Matted Flax-lily Translocation Plan (LXRA-MNDA-00-PA-RPT-0004) Revision 8.

AECOM-GHD Joint Venture. 2020b. Mernda Rail Extension Project: EPBC 2016/7674 Matted Flax-lily Translocation Plan. Report prepared for the Level Crossing Removal Authority, Revision 9, March 2020.