



Annual monitoring of Matted Flax-lily: Aurora, Epping (year 9: 2017–18)

FINAL REPORT

Prepared for Lendlease Communities (Australia) Limited

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1 Background

Biosis Pty Ltd was commissioned by Lendlease Communities (Australia) Limited to undertake the year 9 (2017–18) annual monitoring of the Matted Flax-lily *Dianella amoena* population within reserves 2–3, 5–7, 9 and 11–13 at the Aurora residential development, Epping, Victoria (Figure 1).

1.1 Approval under the EPBC Act

Aurora is a residential development area in Epping North, Victoria (Figure 1). It is approximately 20 kilometres north of the Melbourne CBD, and 1.5 kilometres north of existing urban development in the township of Epping. It is bounded by Craigieburn Road East to the north, O'Herns Road to the south and the Craigieburn Bypass to the west. The east boundary follows existing property titles. Development Victoria (formerly known as VicUrban and then Places Victoria) were the major land holder of Aurora. In 2014 Lendlease Communities (Australia) Limited (Lendlease) acquired the balance of development land at Aurora although three of the Conservation Reserves remain as Development Victoria land (Reserve 10, 11 & 14).

The action was referred to the Australian Government Department of the Environment and Energy (DoEE) on 3 July 2007 seeking approval under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (EPBC 2007/3524). On 3 August 2007, DoEE declared that the proposed action is deemed a 'controlled action' and that it will be assessed by preliminary documentation. The project was approved with conditions on the 16 March 2008. Variations to the approval were given on the 15 April 2011, 3 October 2016 and the 29 November 2017.

Conditions relating to Matted Flax-lily include 1, 2c and 2e, as outlined below.

1. The person taking the action must undertake all works in accordance with the Aurora Conservation Management Plan – January 2008 (Biosis Research 2008).
2. To protect the threatened species listed EPBC Act, in particular the Matted Flax-lily and Golden Sun Moth *Synemon plana*, the person taking the action must monitor and manage the reserves identified in Figures 1a and 1b in accordance with the Aurora Conservation Management Plan – January 2008. In particular the following actions must be taken:
 - c. Monitoring of the Matted Flax-lily is to be undertaken between 1 October and 1 March every 12 months commencing 2008 and continuing for a period of 10 years after establishment of reserves.
 - e. If monitoring indicates a decrease of the Matted Flax-lily, the cause of the decline must be investigated. Corrective actions must be developed and implemented. In this event the Department must be provided, within two months of the monitoring results being known, with a report stating the corrective action(s) implemented.

1.2 Annual monitoring

Biosis has monitored the Matted Flax-lily population at Aurora annually since 2008. Annual reports submitted to the relevant Departments are listed in Table 1.

Table 1 Annual monitoring reports

Year	Report
Year 0: 2008–2009	Letters to DEWHA, 5 May and 26 June 2009
Year 1: 2009–2010	Report to DEWHA, 19 July 2010
Year 2: 2010–2011	Report to DSEWPaC, 4 May 2011
Year 3: 2011–2012	Report to DSEWPaC, 8 June 2012
Year 4: 2012–2013	Report to DSEWPaC, 4 April 2013
Year 5: 2013–2014	Report to DoE, 11 April 2014
Year 6: 2014–2015	Report to DoE, 1 March 2015
Year 7: 2015–2016	Report to DoE, 25 August 2016
Year 8: 2016–2017	Report to DoE, 25 August 2017
Year 9: 2017–2018	Current report – to be submitted to DoEE upon finalisation

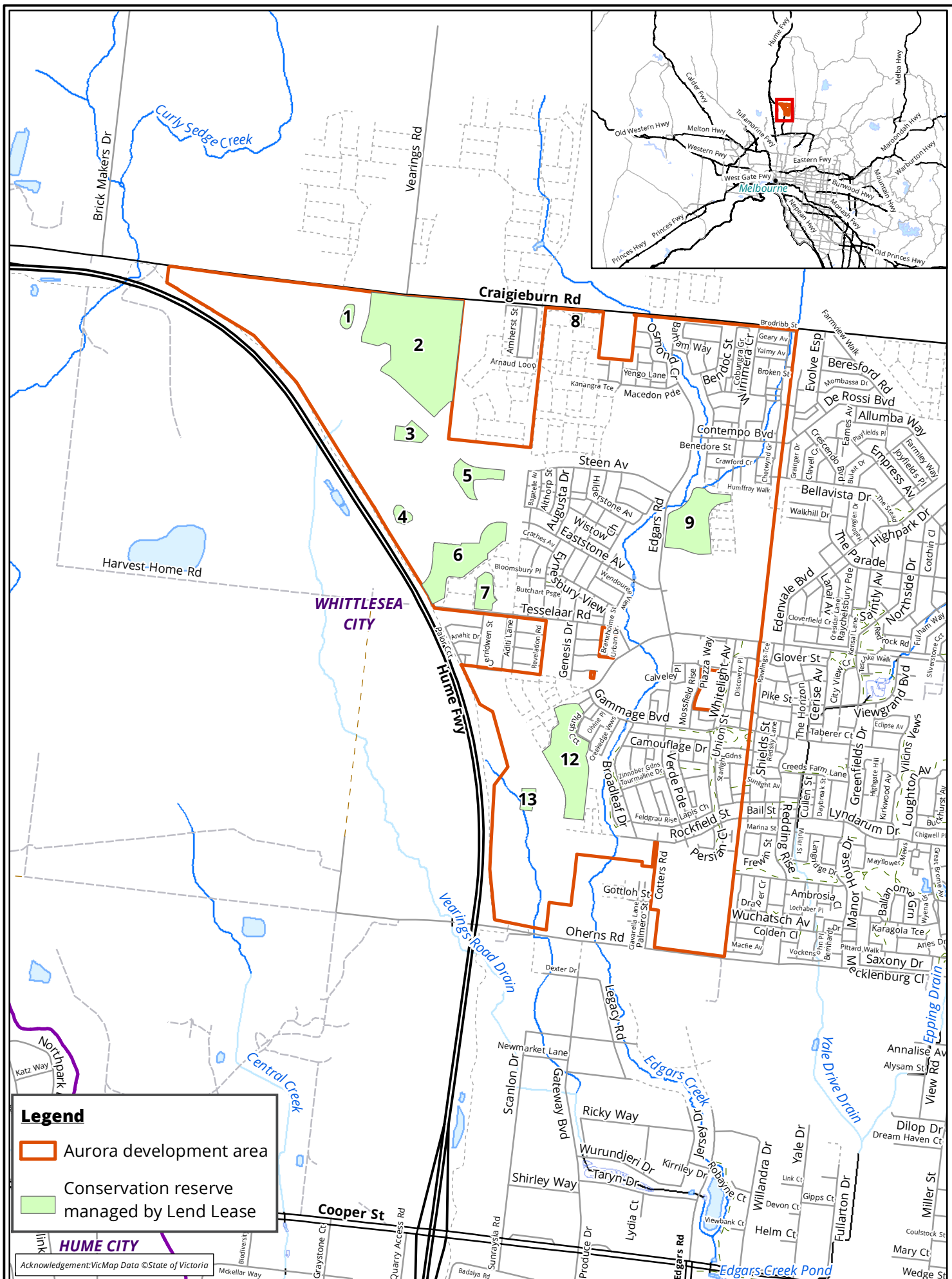


Figure 1 Location of the Aurora development, Epping North, Victoria

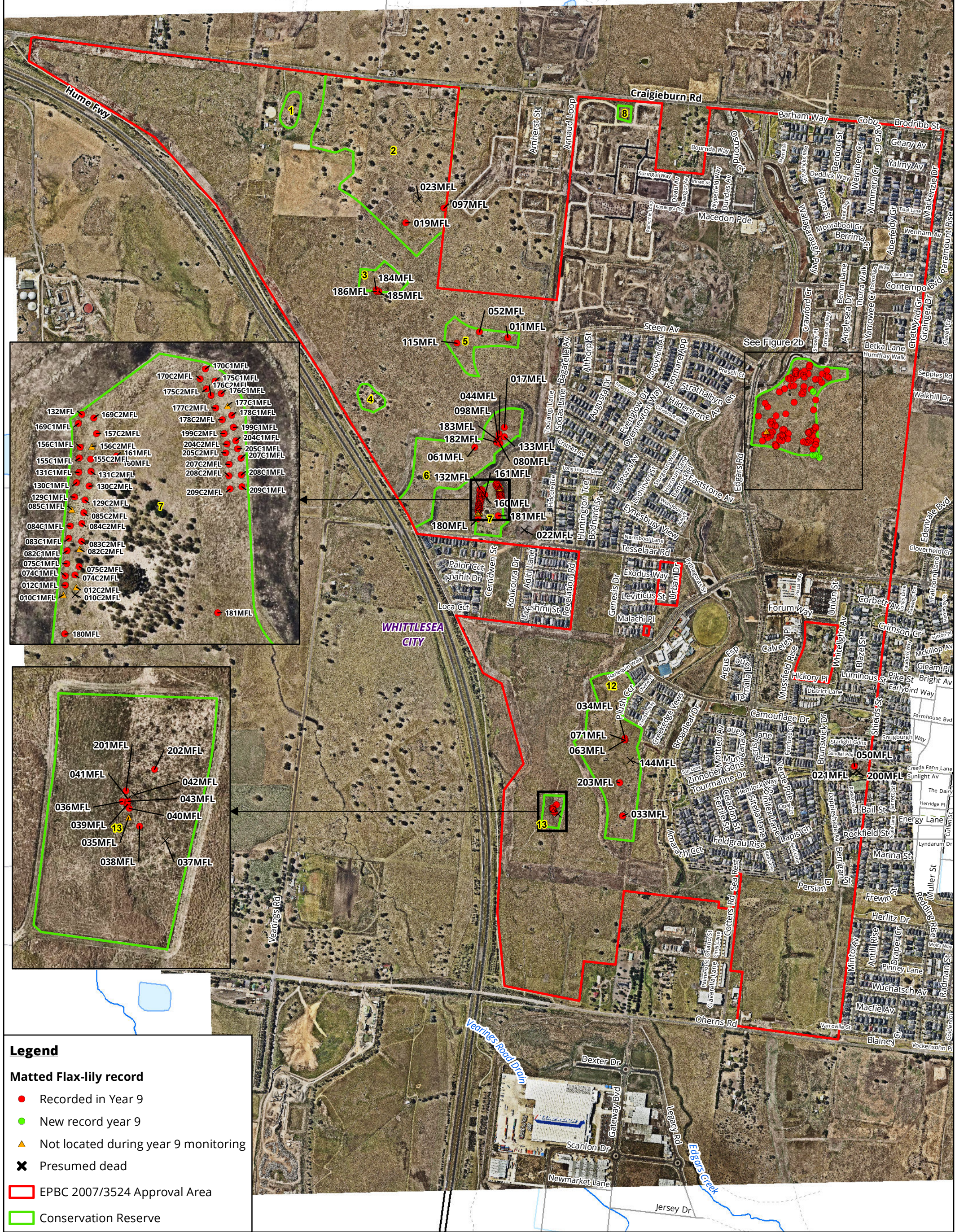


Figure 2a The distribution of Matted Flax-lily (MFL) within conservation reserves managed by Lendlease



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Acknowledgements: Vicmap ©State of Victoria, NearMap Imagery Oct 2016

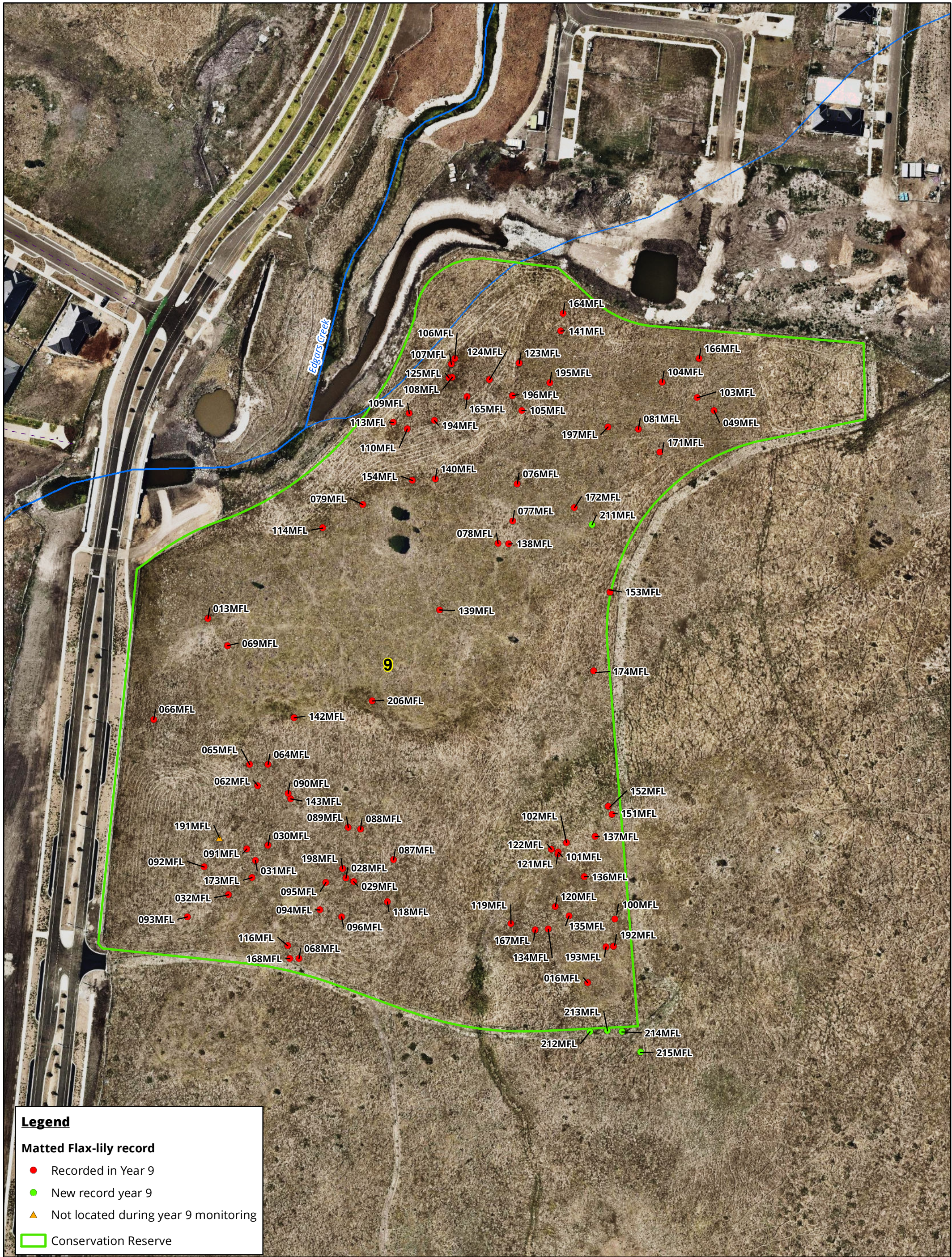
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Date: 26 July 2018,
Checked by: TD, Drawn by: SKM, Last edited by: smitchell
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Metres

Scale 1:12,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55





Legend

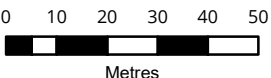
Matted Flax-lily record

- Recorded in Year 9
- New record year 9
- ▲ Not located during year 9 monitoring
- Conservation Reserve

Figure 2b The distribution of Matted Flax-lily (MFL) within conservation reserves managed by Lendlease

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Matter: 26288,
Date: 26 July 2018,
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Metres
Scale 1:1,500 @ A3
Coordinate System: GDA 1994 MGA Zone 55



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1.3 Timing of surveys

A total of 30 Matted Flax-lily were included in the EPBC Act referral and these plants were recorded over a number of years prior to March 2008. Since then, Biosis has completed nine years of annual Matted Flax-lily population monitoring. Surveys undertaken are set out in Table 2.

Table 2 Annual monitoring surveys

Year	Surveys
Pre 2008	Original records – plants included in the EPBC approval in March 2008, from surveys between 2001–2008 (i.e. the 30 original records)
2008–09 Year 0	Monitoring in December 2008 and June 2009
2009–10 Year 1	Monitoring in November 2009 and January 2010 (when plants were staked) and May–June 2010
2010–12 Year 2	Monitoring in December 2010 and January 2011 (when new plants were located with a DGPS and staked)
2011–12 Year 3	Monitoring in January–February 2012
2012–13 Year 4	Monitoring in December 2012 and January 2013
2013–14 Year 5	Monitoring in December 2013
2014–15 Year 6	Monitoring in December 2014 and January–February 2015
2015–16 Year 7	Monitoring in December 2015
2016–17 Year 8	Monitoring in December 2016 and January 2017
2017–18 Year 9	Monitoring in January 2018

In years 1 and 2 monitoring was undertaken in late spring–summer (as per the EPBC approval conditions), when the plants were due to flower and therefore generally easier to locate. However, due to poor conditions (drought and grazing) during 2008–2010 it was found that most of the plants had not flowered and were generally difficult to locate during the late spring–summer period. As a result, for both years 1 and 2, Biosis undertook follow-up surveys in autumn–winter, following substantial rains and subsequent growth of the plants. In both years, the plants were easier to locate at this time.

Surveys in years 3–9 have been undertaken in late spring–summer only. Plants were observed to be flowering and fruiting in each of these years and were mostly easily located. In addition, all of the plants have now been individually marked in the field with star pickets and labels, making them easier to locate.

1.4 Additional plants

Many additional plants have been located within reserve 9 since year 1, such that the reserve has been found to support an above-average population of the species. By December 2011, a total of 82 plants had been recorded within this reserve. At this point it was decided there was no further value in continuing to record or monitor additional plants so Biosis have ceased to record, mark or monitor any additional plants encountered during surveys. It is known that the number of plants in reserve 9 exceeds the 82 plants recorded to date.

An additional 26 Matted Flax-lily plants were recorded outside reserves 6, 9 and 10 prior to 2014. These were salvaged in January 2014 in accordance with the translocation plan (Biosis 2013). Clones of these

plants were translocated into reserve 7 in winter 2015. Translocated Matted Flax-lily plants are now being monitored as part of the annual monitoring.

2 Methods

2.1 Marking of Matted Flax-lily

At commencement of the 10-year monitoring program, the locations of Matted Flax-lily were recorded using a hand-held GPS unit (± 7 m accuracy). This aided in relocation of plants, but still led to difficulties where plants were stressed and/or surrounding biomass was high.

Biosis have since recorded plants with a DGPS, which has greater accuracy than a standard GPS (± 4 m) enabling improved accuracy of mapped Matted Flax-lily locations.

All monitored Matted Flax-lily have also been marked with a star picket positioned adjacent to each plant with a numbered tag attached to each star picket. This has made relocation of plants much easier and also ensures contractors undertaking vegetation management works within conservation reserves are aware of the location of all Matted Flax-lily plants.

2.2 Monitoring data

During year 9 (2017–18) monitored plants were located using current mapping (Figure 2) and with the aid of star pickets next to each plant.

The following information was recorded for each plant:

- Plant health (good, moderate, poor)
- Number of inflorescences (<5 , ≥ 5 <10 , ≥ 10)
- Approximate number of leaf tufts (<5 , ≥ 5 <10 , ≥ 10)
- Approximate spread of the plant (width at the widest point in cm)
- Management–other notes (e.g. presence of fruit, if weeding is required, evidence of herbivory).

2.3 Year 9 monitoring dates

Monitoring in Year 9 was undertaken on 11, 12, 23, 25 and 25 January 2018.

3 Results

The total number of Matted Flax-lily recorded in each reserve is provided in Table 3 and plant health data is provided in Table 4 and 5. Figure 2 indicates the location of monitored Matted Flax-lily in year 9.

Data for the translocated Matted Flax-lily has been tabulated separately in this report to distinguish remnant population health from translocated population health (Table 5).

3.1 Annual numbers of Matted Flax-lily

Table 3 provides the located and monitored numbers of Matted Flax-lily by survey year. During the period 2008–2011 (years 0–3) the reserves were surveyed and numbers of Matted Flax-lily were recorded. Over this period the number of Matted Flax-lily recorded increased substantially. Very few additional remnant plants have been recorded in the reserves since, therefore monitoring has focused on the health and survivorship of the known population. We suspect that this increase in the number of plants detected is a result of increased survey effort over time, however, it is possible that some of the additional plants observed were new recruits within the population.

Over the monitoring period to date, numbers of Matted Flax-lily recorded have increased substantially from 25 plants in year one across the entire Aurora landholding, to 160 Matted Flax-lily plants in year 9. This includes plants that have been translocated to reserve 7 as well as those found outside reserves 6, 9 and 10. Despite small annual fluctuations in recording of individual Matted Flax-lily plants, the Aurora population is considered to be stable and thus it appears that current management of the population is appropriate.

3.2 Plant health

Comprehensive data collection on Matted Flax-lily health, including numbers of inflorescences and leaf tufts, commenced in year 3 (2011–12). A comparison of data collected in years 3 to 9 for remnant Matted Flax-lily is provided in Table 4. Translocated Matted Flax-lily health data is provided in Table 5. Health data collected during year 9 includes Matted Flax-lily from reserves managed by Lendlease Communities (Australia) Limited.

Among remnant populations, there was a sharp decline in plant health in year seven, where the proportion of plants recorded as having 'good' health dropped from 91% to 41%. However, the health of the population rapidly recovered the following season. The proportion of plants in 'good' health was marginally lower this season compared with the last. No plants were observed as showing 'poor' health in years 8 and 9.

There were fewer inflorescences present in year 9 compared with the previous year, with 42 per cent of plants having more than five inflorescences compared to 58 per cent in year 8.

Among living plants, only 11 percent of translocated plants were recorded with any inflorescences this season, while 76 percent of remnant plants had inflorescences. In contrast, 96 percent of translocated plant were recorded with inflorescences the previous season, compared with 47 percent of remnant plants.

Translocated plant health in year 9 is generally lower than that of the natural populations with 67 per cent of plants in 'good' health. Most translocated plants were small, with 87 per cent having less than five leaf tufts. Many did not have inflorescences at the time of monitoring and none of the translocated plants produced more than five inflorescences during year 9.

Table 3 Number of Matted Flax-lily observed yearly by reserve

Reserve-location	Baseline pre-2008	Year 0 2008-09	Year 1 2009-10	Year 2 2010-11	Year 3 2011-12	Year 4 2012-13	Year 5 2013-14	Year 6 2014-15	Year 7 2015-16	Year 8 2016-17	Year 9 2017-18
2	2	-	1	2	2	2	2	2	2	2	2
3	-	-	-	3	3	3	3	3	3	3	3
5	1	2	2	3	3	3	3	3	3	3	3
6	2	2	4	8	8	8	7	7	6	7	7
7 (existing plants)	-	-	-	5	5	5	5	4	4	4	5
9	5	5	7	18	80	82	81	81	81	82	82
12	2	2	5	6	6	6	6	5	6	5	5
13	9	5	5	5	5	5	7	7	6	7	7
Subtotal in reserves	21	16	24	50	112	114	114	112	111	113	114
Public open space, outside conservation reserves	2	1	1	1	1	1	2	1	0	1	0
Plants outside reserves 6, 9 & 10 (now planted in reserve 7)	2	1	1	9	9	9	26	26	-	-	-
7 (translocated plants)	-	-	-	-	-	-	-	-	44	49	45
Total Matted Flax-lily	25	18	26	60	122	124	142	139	155	163	160

Table 4 Analysis of Matted Flax-lily remnant population health

	Year 3: 2011-12	Year 4: 2012-13	Year 5: 2013-14	Year 6: 2014-15	Year 7: 2015-16	Year 8: 2016-17	Year 9: 2018
Health							
Poor	10%	9%	0%	1%	17%	0%	0%
Moderate	76%	20%	1%	8%	31%	6%	10%
Good	14%	71%	99%	91%	41%	86%	82%
Stake Not Found	-	-	-	-	11%	8%	-
Number of inflorescences							
<5	51%	66%	40%	83%	85%	34%	50%
≥5 <10	21%	14%	13%	8%	10%	17%	14%
≥10	28%	20%	47%	9%	5%	41%	28%
Number of leaf tufts							
<5	5%	13%	5%	11%	37%	6%	5%
≥5 <10	21%	13%	8%	17%	18%	8%	7%
≥10	74%	74%	87%	72%	44%	78%	80%

Table 5 Analysis of Matted Flax-lily translocated population health

	Year 8: 2016-17	Year 9 2018
Health		
Poor	4%	6%
Moderate	25%	23%
Good	67%	58%
Stake Not Found	4%	
Number of inflorescences		
<5	100%	100%
≥5 <10	0%	0%
≥10	0%	0%
Number of leaf tufts		
<5	88%	92%
≥5 <10	12%	8%
≥10	0%	0%

3.3 Missing and dead plants

A total of eighteen Matted Flax-lily's were dead or could not be located during the survey. Of these plants, eleven are presumed to be lost as they have not been seen for two consecutive years. This includes ten remnant plants (21, 22, 23, 183, 191, 144, 37, 41, 42, 200) and one translocated plant (P10C2). Two plants previously assumed to be lost (037, P84C2) were recorded as alive this survey. Six additional translocated plants (P10C1, P12C2, P82C2, P85C1, P156C2, P177C1) were recorded as dead this year and will be checked next year to determine if the plant has been lost.

The loss of these plants is believed to be attributed to environmental pressures such as drought and grazing stress, and/or natural population fluctuations. Alternatively, mapping errors prior to commencement of the 10-year monitoring program may account for the difficulties with relocating some of these plants. Overall, the loss of 10 plants from the large population now present at Aurora is minor and does not represent a concerning decline in the population. Details of each plant are provided in Table 6.

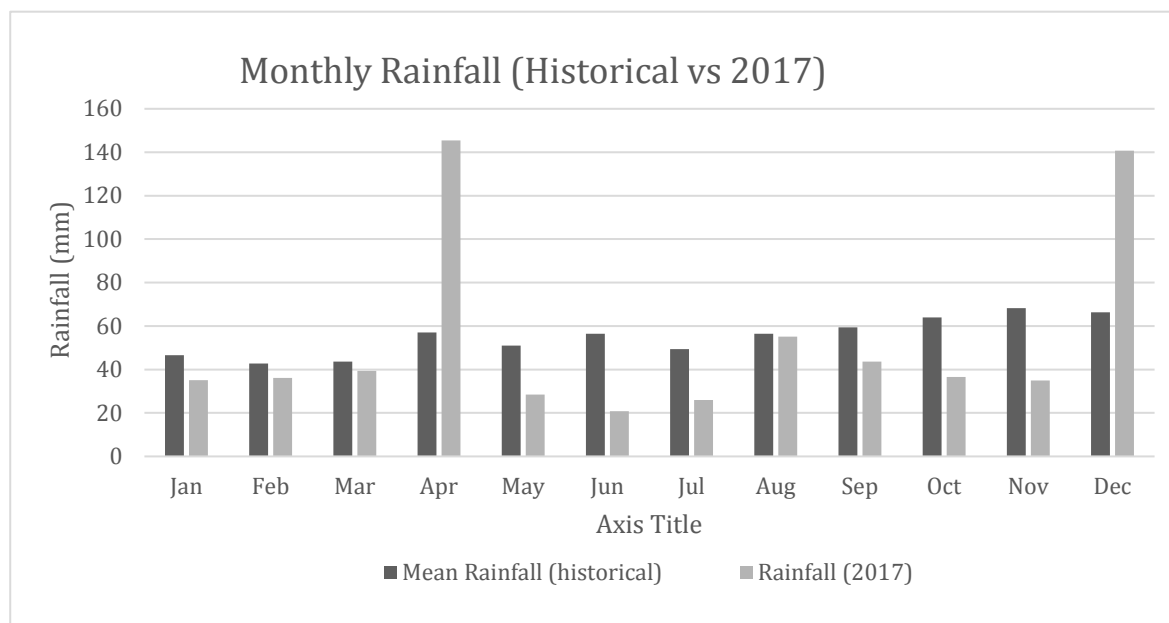
Table 6 Remnant and translocated Matted Flax-lily presumed lost

Matted Flax-lily ID	Location	Last recorded
021 MFL	Public open space (west of Shields Street)	Last recorded in year 4, in year 6 it was searched for but not found
022 MFL	Gas easement (north side of Harvest Home Road). Completely buried.	Last recorded in year 1
023 MFL	Reserve 2	Last recorded pre-2008 prior to commencement of monitoring
037 MFL	Reserve 13	Last recorded pre-2008 prior to commencement of monitoring
041 MFL	Reserve 13	Last recorded in year 1
042 MFL	Reserve 13	Last recorded pre-2008 prior to commencement of monitoring
144 MFL	Reserve 12	Last recorded in year 6
183 MFL	Reserve 6	Last recorded in year 5
191 MFL	Reserve 9	Last recorded in year 5
200 MFL	Public open space (west of Shields Street)	Last recorded in year 6
P10C2	Reserve 7	Not recorded since year 8

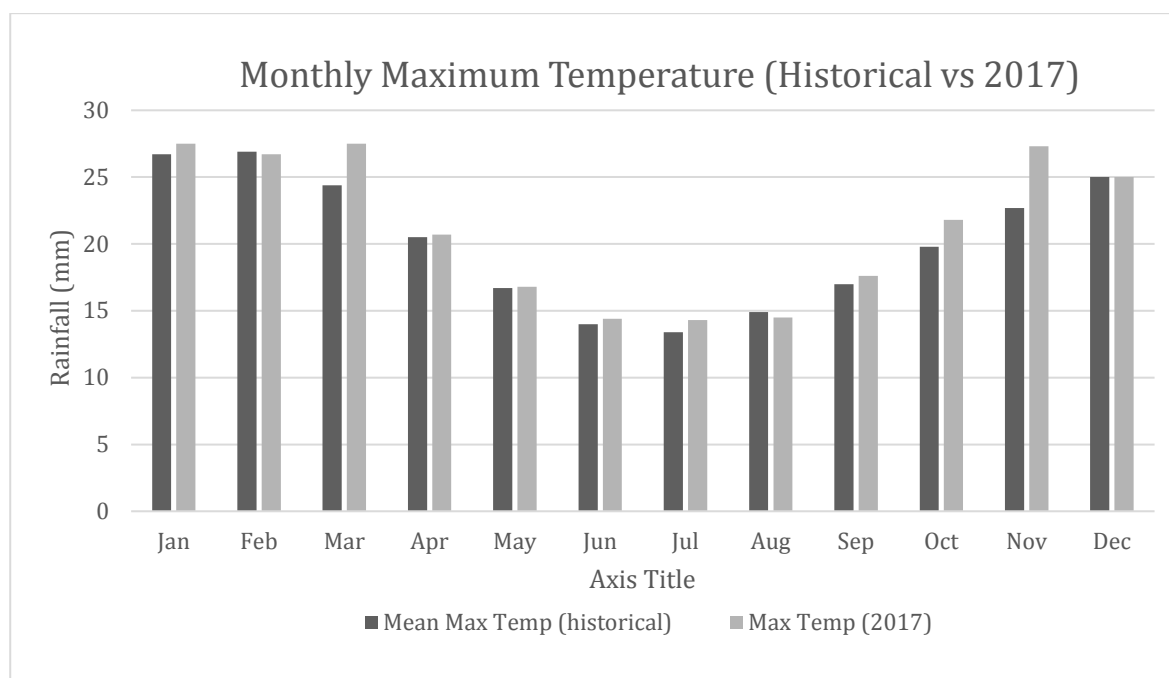
3.4 Seasonal conditions of 2017

Weather data from Bundoora (the closest weather station to Aurora) presented in Graph 1 shows that overall, the mean monthly rainfall in 2017 was lower than the historical mean monthly rainfall (Commonwealth of Australia Bureau of Meteorology 2018). April and December were exceptions, both having a monthly rainfall of more than double the historical mean. The monthly mean maximum temperature was generally higher throughout 2017 compared with the historical mean, most notably throughout spring (Graph 2). Spring and summer rainfall in particular are known to influence the reproductive output of Matted Flax-lily. Lower than average rainfall throughout spring in 2017 might, in part, explain the poor rate of flowering among

translocated plants, and the fewer inflorescences recorded on remnant plants this season compared with the last.



Graph 1 2017 monthly rainfall, Bundoorra, Victoria



Graph 2 2017 mean daily maximum temperature, Bundoorra, Victoria

4 Proposed actions in accordance with Condition 2(e)

At the end of year 9 the health of the natural populations of Matted Flax-lily is stable and generally good. Fluctuations in health are within the ranges of natural variability and do not represent a decline. Translocated plants are less healthy and should continue to be monitored closely. If significant further declines in health or survivorship are observed in this population further actions may need to be taken.

The additional four plants that were located on the boundary of the conservation reserve 9 fence should be salvaged and translocated into reserve 9 prior to construction in the area (if construction has not yet commenced). This can occur at any time of year but ideally would occur during winter when there is a higher level of soil moisture available.

5 Conclusion

Since monitoring began (2008–09) the number of Matted Flax-lily plants has increased. In year 1 data was collected on 25 Matted Flax-lily within the EPBC approvals area whereas in year 9 data was collected on 160 Matted Flax-lily plants within the reserves managed by Lendlease Communities. There are additional Matted Flax-lily in reserves managed by Development Victoria.

In year 9 overall population health was good for the remnant Matted Flax-lily. The overall health observed in year 9 was marginally lower than in year 8 and fewer inflorescences were recorded. Compared with the previous year, a very small proportion of living translocated plants had inflorescences.

Less favourable seasonal conditions during spring and summer of 2016, including lower-than-average rainfall, are likely to have contributed to the results observed. Overall health of the translocated Matted Flax-lily in reserve 7 was moderate, and lower than that of the natural populations. These plants are generally stunted and possibly recovering from the 2015 season.

Six translocated Matted Flax-lilies that were recorded as living in year 8 were recorded as dead in this monitoring season. Matted Flax-lily undergoes natural cycles of dieback and we anticipate that under more suitable climatic conditions, Matted Flax Lily populations may recover. Eleven remnant plants have been categorised as 'presumed lost' since monitoring began. All plants categorised as presumed dead will continue to be searched for during each subsequent monitoring event.

At this stage it is considered that translocated Matted Flax-lily plants not detected in year 8 or 9 are unlikely to have survived translocation. These plants should be replaced with clones in winter 2018 when conditions are suitable.

If the weather outlook for the second half of 2018 indicates a hot, dry summer outside normal climatic limits, year 10 monitoring will be conducted earlier in the season to monitor Matted Flax-lily at peak flowering time. This will maximise the probability of detecting Matted Flax-lily as they are easier to detect when flowering.

Changes in overall population health observed in year 9 are not favourable, however we consider the population of Matted Flax-lily at Aurora in its current state to be stable and it appears that current management which includes hand weeding of the population is appropriate. If the weather outlook for the second half of 2018 indicates a hot, dry summer a watering program should be initiated.

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