Appendix E

Evolve Environmental *Melaleuca irbyana* Assessment Audit Reports

saunders
havill
group

Everleigh - Mirvac

Melaleuca irbyana Assessment Audit – Everleigh Greenbank

03/12/2020

Job Number: 15ENV

Evolve Environmental Solution Pty. Ltd.

Document Control

Document: *Melaleuca irbyana* Assessment Audit – Everleigh Greenbank

Document Issue

Issue	Date	Prepared By	Checked By
Issue A	03/12/2020	Zoe Lutz	Adam Hutchinson

Prepared by

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Introduction

Evolve Environmental Solutions (Evolve) were engaged by **Mirvac** to undertake the installation and establishment of 625 *Melaleuca irbyana* at 146 Teviot Greenbank. This works is in accordance with the Impact Management Plan that was prepared by **Saunders Havill Group** (SHG) on the 11/06/2018 as per the requirements of the Natural Environment Site Strategy (NESS). The scope entails for weed management in the offset area, installation of offset planting, watering, ongoing weed management and monitoring. Establishment period runs over 24 months utilizing an adaptive management approach to achieve a holistic and resilient offset planting

Works Completion

Below is a summarised account of works that have taken place to date relating to the planting of the 625 *Melaleuca irbyana* at 146 Teviot Greenbank.

DATE	TASK
26.03.2019	Proposed offset site inspected and photo monitoring points established.
26.03.2019	Initial Weed Treatment commenced
27.03.2019	Completion of initial weed treatment
27.03.2019	Ground preparation for required planting of 625 *Melaleuca irbyana*
28.03.2019	All *Melaleuca irbyana* (625) installed with tree guards (Corflute tree guards with 1 x hardwood stake) and weed suppression mats (400mm x 400mm palm fibre, pinned with 200mm U pins). Provides both protection from fauna and weed incursion
09.04.2019	Watering of *Melaleuca irbyana*
12.04.2019	Watering of *Melaleuca irbyana*
31.05.2019	Watering of *Melaleuca irbyana*
19.06.2019	Watering of *Melaleuca irbyana*
16.08.2019	Watering of *Melaleuca irbyana* + Maintenance weeding
17.10.2019	Watering of *Melaleuca irbyana* + Maintenance weeding
01.11.2019	Watering of *Melaleuca irbyana* + installation of 80 plant due to failure
07.11.2019	Watering of *Melaleuca irbyana* (newly planted plants only)

21.11.2019	Watering of *Melaleuca irbyana* (newly planted plants only)
12.12.2019	Watering of *Melaleuca irbyana*
12.03.2020	Installation of replacement plants, planting to occur with auger and water spike
18.05.2020	Installation of replacement plants, planting to occur with auger and water spike + watering of *Melaleuca irbyana* + Site audit
12.06.2020	Site audit and water spiking of all 571 living plants
29.06.2020	Watering of all plants using water spike
29.07.2020	Site audit including monitoring photos
03.08.2020	Watering of all plants using water spike
02.11.2020	Installation of replacement plants, utilizing auger and water spike watering, all installed plants fitted with tree guards (Corflute tree guards with 1 x hardwood stake), existing *Melaleuca irbyana* deep watered with using water spike. Audit of existing plants conducted.
20.11.2020	Watering of all plants using water spike
03.12.2020	Site audit conducted, including monitoring photos. Watering of all specimens.

Table 1: Works Completion Table (*Note: Photo Monitoring taken once per quarter)

Offset Monitoring Point Locations

Offset monitoring points were established in March 2018. Since the establishment of these points, 9 monitoring events have taken place. Please refer to monitoring point locations below.

Monitoring Point	Site Photos	
1 27°44'8" S 153°0'31" E	**North** 	**East**
	South 	**West**

2	North	East
27°44'31" S 153°0'19" E		
	South	West

| 3 27°44'22" S 153°0'24" E | North | East |
| | South | West |

4	**North**	**East**
27°44'31" S **153°0'23" E**		
	South	**West**

Table 2: Monitoring point descriptions

There is little in terms of planting descriptions to occur at this stage due to slow growth rate and planting failures. At current, few specimens have protruded from the tree guards. As growth continues itemized descriptions of the monitoring points will occur.

Figure 1; Established *M. irbyana* protruding from tree-guard

Plan 1: Photo Monitoring Point

Environmental Site Audit

On Thursday 3rd December 2020 an ecologist from Evolve Environmental conducted a condition audit on the state of the 625 *Melaleuca irbyana* at 146 Teviot Greenbank. The audit was conducted to assess the following:

- Health and vigor of the planted specimens;
- Provide any dieback count;
- Assessment of the offset area in general for any weed incursion; and
- Conduct the routine photo monitoring.

Following the audit, a key goal is to provide rectification works requirements and recommendations of the offset to ensure compliance.

Site Audit Results

The site audit assessed the *Melaleuca irbyana* planting requirements as stipulated in the Impact Management Plan written by **SHG**. The following counts were noted during the site audit on 03.12.2020

- Of the 625 *Melaleuca irbyana* planted the audit found 191 of these plants to be dead;
- The remaining 434 *Melaleuca irbyana* were considered to be healthy.

A loss of 101 plants is recorded as occurring in the period between plant number audits on 02.10.2020 and 03.12.2020.

No weed incursion was found in the *Melaleuca irbyana* planting area. There were visible signs of fauna (probably wallabies and kangaroos) grazing on the tops of the planted specimens.

The audit revealed plants health and vigour being negatively impacted by the on-set of a seasonally warmer climate, the majority of plant losses were confined to replacement rather than established. Plants that are in sub optimal condition appear to be so due to climatic effects rather than fauna disturbance, signs of heat stress were noted, particularly on the top leaves of plants where they protruded from tree guards.

Climatic Variations (Past 6 Months)

Month	Rainfall (mm)	Historical Average (mm)
November 2020	28.8	97.6
October 2020	71.8	78.4
September 2020	11.4	34.6
August 2020	22.4	36.2
July 2020	49.4	25.8
June 2020	34.4	66.3
Average	**36.367**	**56.48**
Total	**218.2mm**	**338.90mm**

Table 3: Rainfall data Everleigh June 2020 to November 2020

Month	Rainfall (days)	Historical Average (days)
November 2020	3 days	7.7 days
October 2020	9 days	6.6 days
September 2020	3 days	4.2 days
August 2020	4 days	4.0 days
July 2020	10 days	3.6 days
June 2020	11 days	5.7 days
Average	**6.7 days**	**5.3 days**
Total	**40 days**	**31.8 days**

Table 4: Rain days data Everleigh June 2020 to November 2020
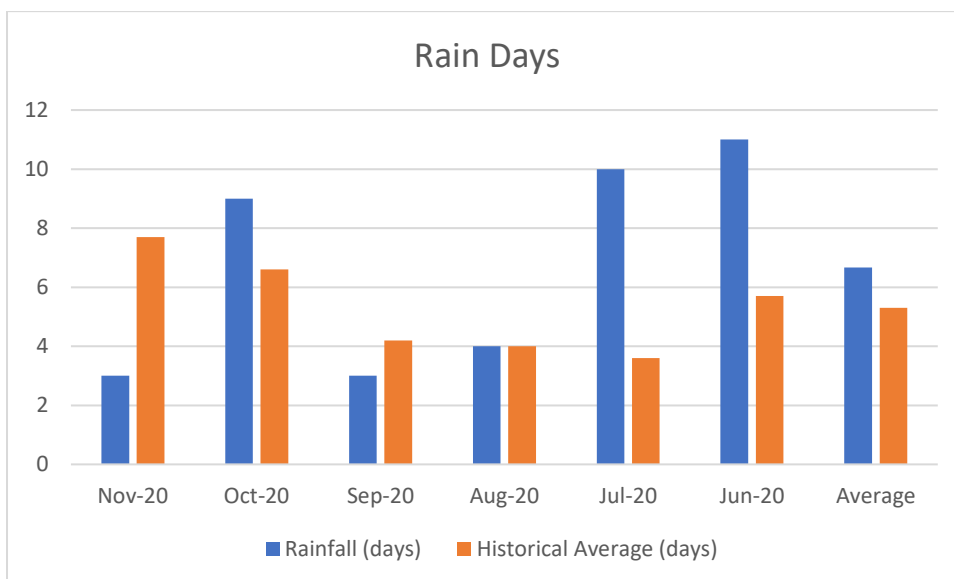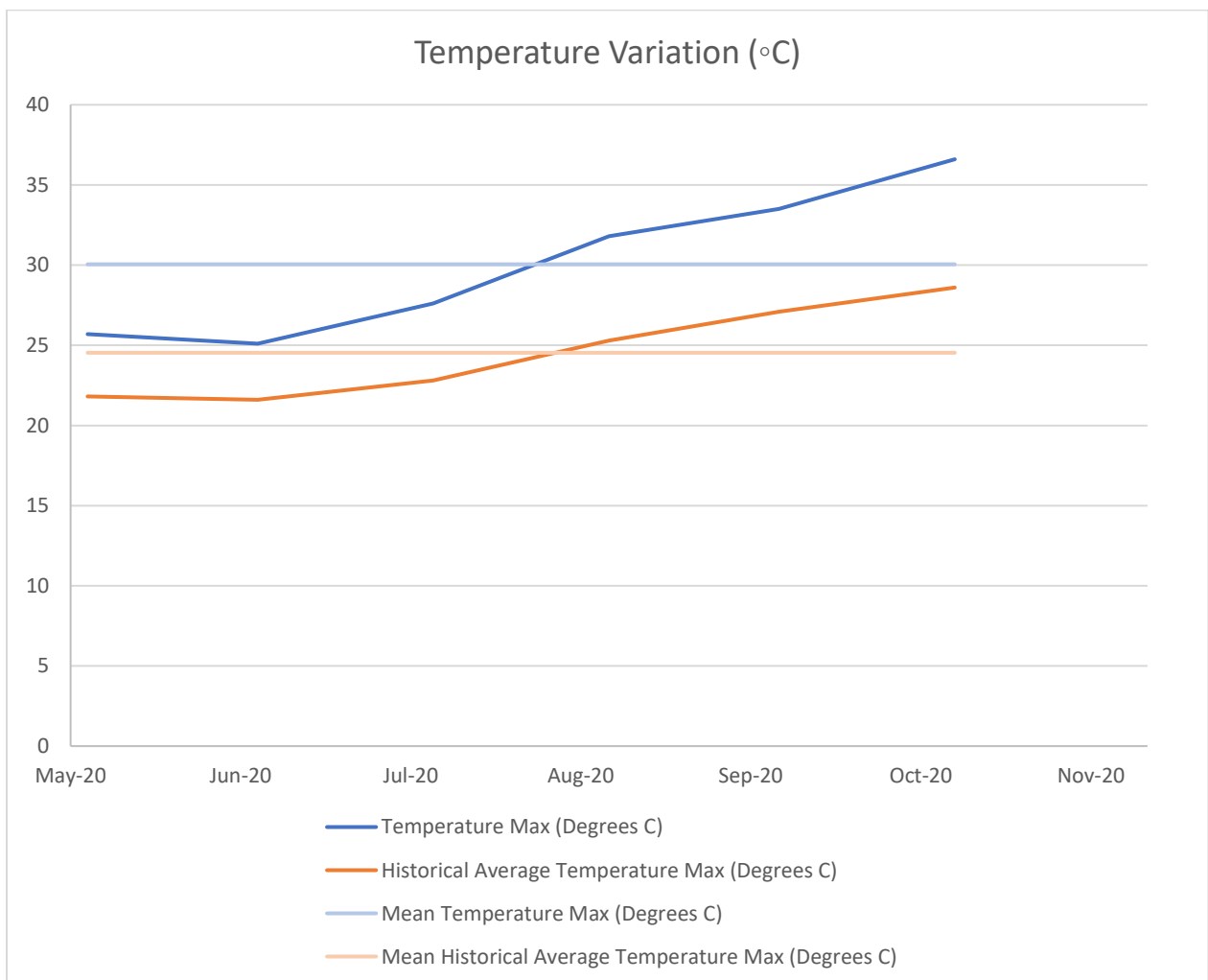

Graph 1: Rain days data Everleigh June 2020 to November 2020

While the number of rainfall days has been higher than the historical average over this period both the average monthly and total rainfall has been lower than the corresponding historical data.

Month	Temperature Max (Degrees °C)	Historical Average Temperature Max (Degrees °C)
November 2020	36.6 °C	28.6°C
October 2020	33.5°C	27.1°C
September 2020	31.8°C	25.3°C
August 2020	27.6°C	22.8°C
July 2020	25.1°C	21.6°C
June 2020	25.7°C	21.8°C
Average	30.05°C	24.53°C

Table 5 Temperature data Everleigh June 2020 to November 2020

Graph 2: **Temperature Data Everleigh June 2020 to November 2020**

Variations in climatic factors have heavily affected optimal growing conditions. Temperatures continue to be higher than the historical average posing ongoing challenges in terms of the planted specimens continued survival. Continuance of the implemented alterations to planting methodology and maintenance are essential to ensuring the survival and vigor of planted specimens as per the stipulations of **SHG's** Impact Management Plan.

Recommendations

Due to the site audit findings the following measures have been implemented to ensure planting success:

- Replacement plants are to be planted with an auger and water spike. Approximately 5L of water + fertilizer is to be delivered with the water spike during the planting process to ensure the plant is given ample nutrients and water to ensure early establishment;
- Conduct a full site audit of the planted area on a bi monthly basis to ensure reporting to the client and if appropriate alternative actions can occur to promote plant vitality and compliance;
- As / if additional plants die, implement the auger + water spike planting methodology on all new plantings; and
- Monitor rainfall gauges near the Everleigh site and increase watering when appropriate.

Plant condition has fluctuated in the last two months, the key driver of plant health is climatic variation, maintenance schedules will be adjusted to compensate for changes in rainfall and temperature. Following the actioned maintenance should see months of no replacement planting being required. It is at this stage that once the plants are considered self-sustaining that off maintenance will be achieved.

The following items are recommendations to be considered:

- Plant success will pose secondary challenges from native fauna in terms of a food source. Several kangaroo and wallaby scats have been located in the planting area, which alludes to selective grazing. This is a common problem and often accounts for slower growth rates. It is recommended that either:

- o The planting area be cordoned off to remove the risk of selective grazing during the establishment phase; or
- o Wire cages be installed over the tree guards to reduce grazing risk.

Conclusion

Evolve Environmental Solutions (Evolve) were engaged by **Mirvac** to undertake the installation and establishment of 625 *Melaleuca irbyana* at 146 Teviot Greenbank. This works is in accordance with the Impact Management Plan that was prepared by **Saunders Havill Group** (SHG) on the 11/06/2018 as per the requirements of the Natural Environment Site Strategy (NESS). The scope entails for weed management in the offset area, installation of offset planting, watering, ongoing weed management and monitoring. Establishment period runs over 24 months utilizing an adaptive management approach to achieve a holistic and resilient offset planting.

Site audit findings have highlighted the need for an alternative watering and planting procedure (mentioned above) to ensure the success of all new plantings. Additionally, grazing from native fauna has been highlighted as a potential risk and methods have be suggested (not yet implemented) to combat these risks. Studies of rainfall and temperature data has highlighted the changes in climatic conditions on the Everleigh site and the requirements to increase watering and soil conditioning techniques.

The next full site audit will be undertaken in February 2021.

Everleigh - Mirvac

Melaleuca irbyana Assessment Audit – Everleigh Greenbank

06/07/2021

Job Number: 15ENV

Evolve Environmental Solution Pty. Ltd.

Contents

Introduction

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Works Completion

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28.03.2019	All *Melaleuca irbyana* (625) installed with tree guards (Corflute tree guards with 1 x hardwood stake) and weed suppression mats (400mm x 400mm palm fibre, pinned with 200mm U pins). Provides both protection from fauna and weed incursion
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31.05.2019	Watering of *Melaleuca irbyana*
19.06.2019	Watering of *Melaleuca irbyana*
16.08.2019	Watering of *Melaleuca irbyana* plus Maintenance weeding
17.10.2019	Watering of *Melaleuca irbyana* plus Maintenance weeding
01.11.2019	Watering of *Melaleuca irbyana* plus installation of 80 plants due to failure
07.11.2019	Watering of *Melaleuca irbyana* plus (newly planted plants only)

21.11.2019	Watering of *Melaleuca irbyana* (newly installed plants only)
12.12.2019	Watering of *Melaleuca irbyana*
12.03.2020	Installation of replacement plants, planting to occur with auger and water spike
18.05.2020	Installation of replacement plants, planting to occur with auger and water spike, watering of existing *Melaleuca irbyana* and Site audit
12.06.2020	Site audit and water spiking of all 571 living plants
29.06.2020	Watering of all plants using water spike
29.07.2020	Site audit including monitoring photos
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20.11.2020	Watering of all plants using water spike
03.12.2020	Site audit conducted, including monitoring photos. Watering of all specimens.
25-01-2021	Site audit conducted. Stakes and guards checked, 4 caterpillars noted on plantings and removed.
27-01-2021	Watering of *Melaleuca irbyana*
09-02-2021	Watering of *Melaleuca irbyana*
02-03-2021	Watering of *Melaleuca irbyana.* Stakes and gaurds checked.
13-04-2021	Installation of replacement plants, planting to occur with auger and water spike. All existing plants watered using water spike. Manual weeding *Lantana camara* regrowth within planting area.
30-03-2021	Site audit conducted, including photo monitoring.
21-06-2021	Site audit conducted, including photo monitoring.

*Table 1; Works Completion Table (*Note: Photo Monitoring taken once per quarter)*

Offset Monitoring Point Locations

Offset monitoring points were established in March 2018. Since the establishment of these points, 11 monitoring events have taken place. Please refer to monitoring point locations below.

Monitoring Point	Site Photos	
1 **27°44'8" S** **153°0'31"** **E**	**North** **South** 	**East** **West**

2	North	East
27°44'31" S 153°0'19" E		
	South	West

| 3

27°44'22"
S

153°0'24"
E | North | East |
| | South | West |

4	North	East
27°44'31" S 153°0'23" E		
	South	West

Table 2: Monitoring point locations and photos

While the growth rate of M. irbyanas is slow an increased number of specimens are visible protruding above their tree-guards as plants continue to put on new growth, an indication of the plantings having established stable root systems to support growth. The fine nature of M. irbyana growth makes it is difficult to see at a distance against a background of natural vegetation, close-ups examples of two specimens have been provided in Figure 1, below.

Figure 1; Established *M. irbyanas* protruding from their tree-guard

Notably the growth rate of the newest specimens (Installed on 13th April, prior to the previous monitoring event) is excellent with most already beginning to protrude from their guards.

Plan 1: Photo Monitoring Point

Environmental Site Audit

On Monday 21st June 2021 an ecologist from Evolve Environmental conducted a condition audit on the state of the 625 *Melaleuca irbyana* at 146 Teviot Greenbank. The audit was conducted to assess the following:

- Health and vigor of the planted specimens;
- Provide any dieback count;
- Assessment of the offset area in general for any weed incursion; and
- Conduct the routine photo monitoring.

Following the audit, a key goal is to provide rectification works requirements and recommendations of the offset to ensure compliance.

Site Audit Results

The site audit assessed the *Melaleuca irbyana* planting requirements as stipulated in the Impact Management Plan written by **SHG**. The following counts were noted during the site audit on 21.06.2021

- Of the 625 *Melaleuca irbyana* planted the audit found 7 of these plants to be dead;
- Of the remaining 618 *Melaleuca irbyana* 585 were considered to be in excellent health, this is above the stipulated survival threshold of 560.

Lantana camara regrowth was removed from the *Melaleuca irbyana* planting area on the 13th March, no catergorised weeds were found during the subsequent site audit although some small *Passiflora suberosa* were hand weeded from the plantings closest to the creek to prevent establishment. There are visible signs of continued macropod presence on-site in the form of footprints and scat, however no evidence of grazing on the planted specimens was apparent at the time of the photo monitoring audit on 21st June with multiple healthy plants protruding from tree guards.

Fungal fruiting bodies were noted within one of the tree guards during the June audit, the M. irbyana within the guard was healthy and it is not anticipated that fungal presence will negatively impact the plantings.

The audit revealed plants health and vigor to have been positively impacted by favorably wetter climatic conditions and an increased watering scheme. The most recent of the replacement plantings were placed closer to the creek line than previously and have enjoyed a high survival rate with continued good growth and vigor indicating rapid establishment. This is due to correct planting placement, where site conditions match that of the plant thresholds.


Figure 2; Plantings located closer to the adjacent creek. Note multiple vigorous specimens protruding from the tops of their tree guards.

Climatic Variations (Past 6 Months)

| Month	Rainfall (mm)	Historical Average (mm)
May 2021	121.8	41.05
April 2021	88.8	50.95
March 2021	248.8	128.3
February 2021	150.0	152.2
January 2021	64.6	134.9
December 2020	190.4	124.7
Average	**144.1**	**105.35**
Total	**864.4**	**632.1**

Table 3: Rainfall data Everleigh December 2020 to May 2021
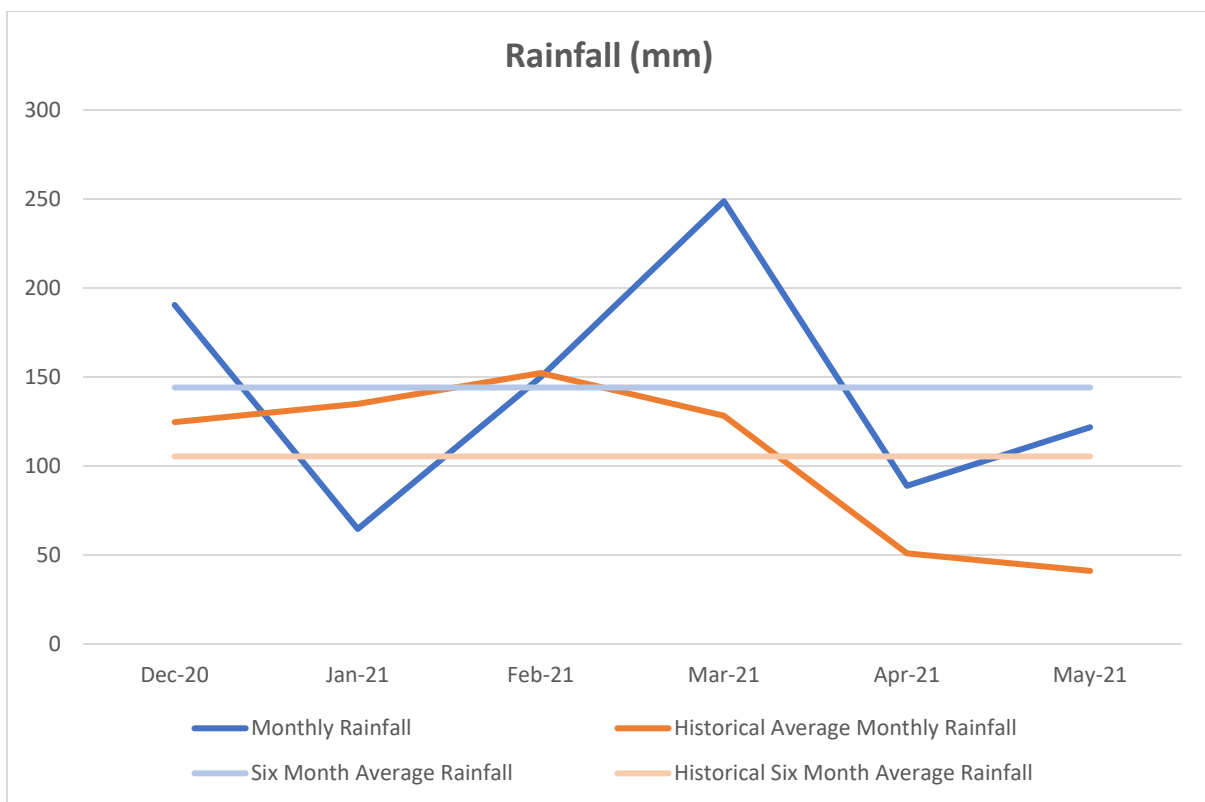
Graph 1; Monthly rainfall December 2020 to May 2021

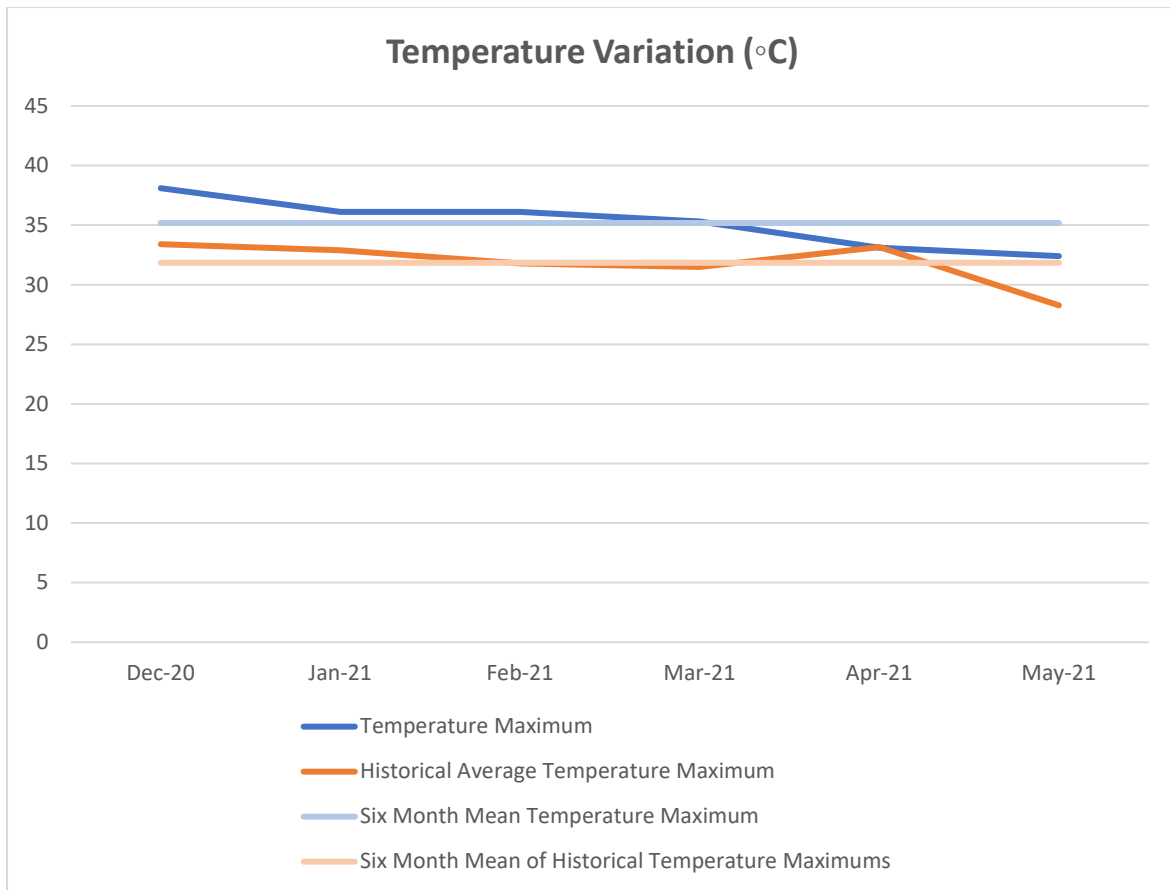| Month	Rainfall (days)	Historical Average (days)
May 2021	8	6.75
April 2021	10	9.25
March 2021	22	12.9
February 2021	14	12.3
January 2021	21	11.2
December 2020	14	10.9
Average	14.8	10.55
Total	89	63.3

Table 4: Rain days data Everleigh December 2020 to May 2021
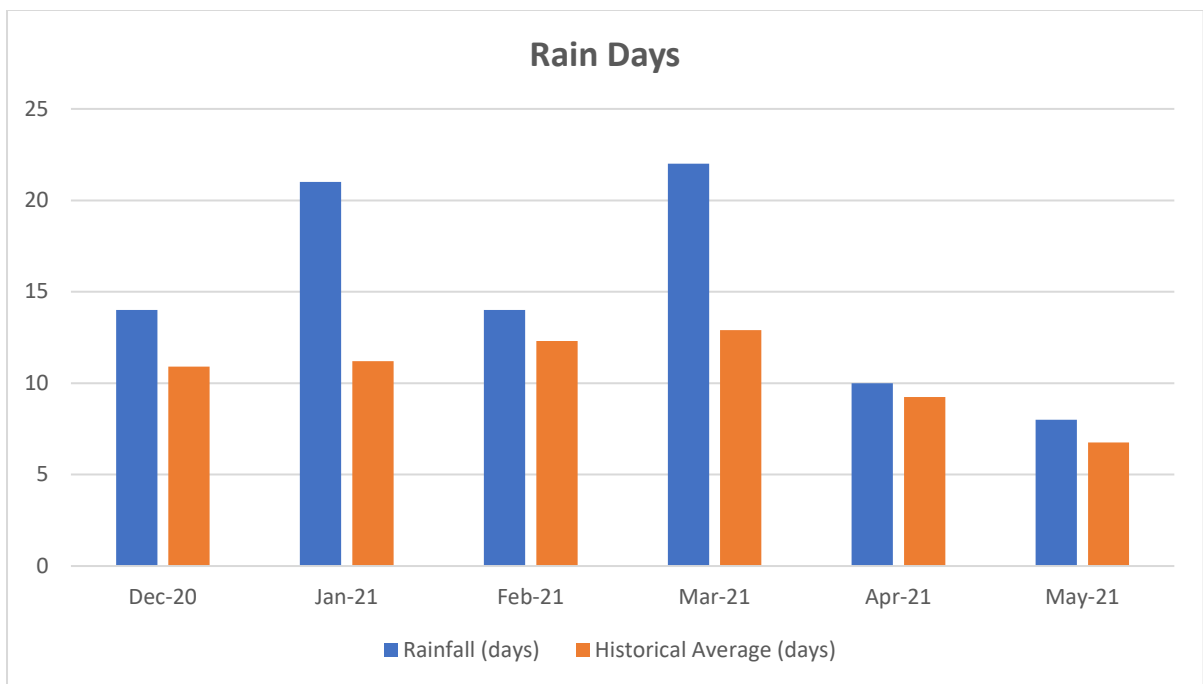
Graph 2: Rain days data Everleigh December 2020 to May 2021

Month	Temperature Max (Degrees °C)	Historical Average Temperature Max (Degrees °C)
May 2021	32.4	28.27
April 2021	33.1	33.15
March 2021	35.3	31.5
February 2021	36.1	31.8
January 2021	36.1	32.9
December 2020	38.1	33.4
Average	35.18	31.84

Table 5 Temperature data Everleigh December 2020 to May 2021

Temperature Variation (◦C)

Legend:
- Temperature Maximum
- Historical Average Temperature Maximum
- Six Month Mean Temperature Maximum
- Six Month Mean of Historical Temperature Maximums

Graph 3: **Temperature Data Everleigh December 2020 to May 2021**

Variations in climatic factors have heavily affected optimal growing conditions. Temperatures continue to be higher than the historical averages, however total rainfall and rain days have taken a favorable turn since January 2021 with both being slightly above the long-term average for the second time in a row this reporting period. This is due in-part to a wet March. Continuance of the implemented alterations to planting methodology and maintenance have also positively impacted the survival and vigor of planted specimens as per the stipulations of **SHG's** Impact Management Plan.

Recommendations

No watering has occurred within the planting site since 13th April, continued growth of installed specimens over the past two reporting periods in the absence of external interference is indicative of the planting's successful establishment and long-term viability.

The last two site audits have recorded survival of established specimens above the threshold value of 560 stipulated by the Impact Management Plan prepared by **Saunders Havill Group.**

As the planting has attained a level of establishment where continued maintenance is not necessary to the planting's survival and key performance indicators with respect to the number of established specimens and exclusion of weed species from the planting site have been met it is recommended that the *Melaleuca irbyana* planting site be moved to off-maintenance.

Conclusion

Evolve Environmental Solutions (Evolve) were engaged by **Mirvac** to undertake the installation and establishment of 625 *Melaleuca irbyana* at 146 Teviot Greenbank. This works is in accordance with the Impact Management Plan that was prepared by **Saunders Havill Group** (SHG) on the 11/06/2018 as per the requirements of the Natural Environment Site Strategy (NESS). The scope entailed weed management in the offset area, installation of offset planting, watering, ongoing weed management and monitoring.

Following early site audits adjustments were made to watering and planting procedures to compensate for poor climatic conditions recorded over the initial establishment period and improve plant establishment and survival. Subsequent site audits have demonstrated positive outcomes as a consequence of these adjusted procedures. The last two site audits have recorded survival of established specimens above the threshold value of 560 stipulated by the Impact Management Plan and demonstrated self-sustainability of the planting site in the absence of a continued watering regime. The planting site is now ready to be moved off-maintenance.

Everleigh - Mirvac

Melaleuca irbyana Assessment Audit – Everleigh Greenbank

02/04/2021

Job Number: 15ENV

Evolve Environmental Solution Pty. Ltd.

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19.06.2019	Watering of *Melaleuca irbyana*
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17.10.2019	Watering of *Melaleuca irbyana* plus Maintenance weeding
01.11.2019	Watering of *Melaleuca irbyana* plus installation of 80 plants due to failure
07.11.2019	Watering of *Melaleuca irbyana* plus (newly planted plants only)

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20.11.2020	Watering of all plants using water spike
03.12.2020	Site audit conducted, including monitoring photos. Watering of all specimens.
25-01-2021	Site audit conducted. Stakes and guards checked, 4 caterpillars noted on plantings and removed.
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09-02-2021	Watering of *Melaleuca irbyana*
02-03-2021	Watering of *Melaleuca irbyana.* Stakes and gaurds checked.
13-04-2021	Installation of replacement plants, planting to occur with auger and water spike. All existing plants watered using water spike. Manual weeding *Lantana camara* regrowth within planting area.
30-03-2021	Site audit conducted, including photo monitoring.

Table 1: Works Completion Table (*Note: Photo Monitoring taken once per quarter)

Offset Monitoring Point Locations

Offset monitoring points were established in March 2018. Since the establishment of these points, 10 monitoring events have taken place. Please refer to monitoring point locations below.

Monitoring Point	Site Photos	
1 27°44'8" S 153°0'31" E	**North** 	**East**
	South 	**West**

| 2 27°44'31" S 153°0'19" E | **North** | **East** |
| | **South** | **West** |

3 27°44'22" S 153°0'24" E	**North** 	**East**
	South 	**West**

| 4 27°44'31" S 153°0'23" E | North | East |
| | South | West |

Table 2: Monitoring point locations and photos

There is little in terms of planting descriptions to occur at this stage due to slow growth rate and planting failures. At current, specimens are visible beginning to protrude above their tree guards in the areas surrounding photo monitoring points 2 and 4. Additional, close-up photos of protruding specimens are provided in *Figure 1*.

Figure 1; Established *M. irbyanas* protruding from their tree-guard

Plan 1: Photo Monitoring Point

Environmental Site Audit

On Tuesday 30th March 2021 an ecologist from Evolve Environmental conducted a condition audit on the state of the 625 *Melaleuca irbyana* at 146 Teviot Greenbank. The audit was conducted to assess the following:

- Health and vigor of the planted specimens;
- Provide any dieback count;
- Assessment of the offset area in general for any weed incursion; and
- Conduct the routine photo monitoring.

Following the audit, a key goal is to provide rectification works requirements and recommendations of the offset to ensure compliance.

Site Audit Results

The site audit assessed the *Melaleuca irbyana* planting requirements as stipulated in the Impact Management Plan written by **SHG**. The following counts were noted during the site audit on 30.03.2021

- Of the 625 *Melaleuca irbyana* planted the audit found 14 of these plants to be dead;
- Of the remaining 611 *Melaleuca irbyana* 579 were considered to be in excellent health, this is above the stipulated survival threshold of 560.

Lantana camara regrowth was removed from the *Melaleuca irbyana* planting area on the 13th March, no catergorised weeds were found during the subsequent site audit. There are visible signs of continued macropod presence on-site in the form of footprints, as pictured in **Figure 2**, however no evidence of grazing on the planted specimens was apparent at the time of the photo monitoring audit on 30th March with multiple healthy plants protruding from tree guards. Four caterpillars were found grazing on *M. irbyana* specimens during the previous site audit conducted on 25th January 2021, the caterpillars were manually removed and no further insect activity was noted during subsequent site visits.

Figure 2; Wallaby tracks present on access road.

The audit revealed plants health and vigor to have been positively impacted by favorably wetter climatic conditions and an increased watering scheme. Replacement plantings have been placed closer to the creek line than previously and have enjoyed a high survival rate with good growth and vigor indicating rapid establishment as visible in **Figure 3**, below.

Figure 3; Replacement plantings located closer to the adjacent creek. Note multiple specimens protruding from the tops of their tree guards.

Climatic Variations (Past 6 Months)

Month	Rainfall (mm)	Historical Average (mm)
March 2021	248.8	128.3
February 2021	150.0	152.2
January 2021	64.6	134.9
December 2020	190.4	124.7
November 2020	28.8	97.6
October 2020	71.8	78.4
Average	**125.7**	**119.4**
Total	**754.4**	**716.1**

Table 3: Rainfall data Everleigh October 2020 to March 2021
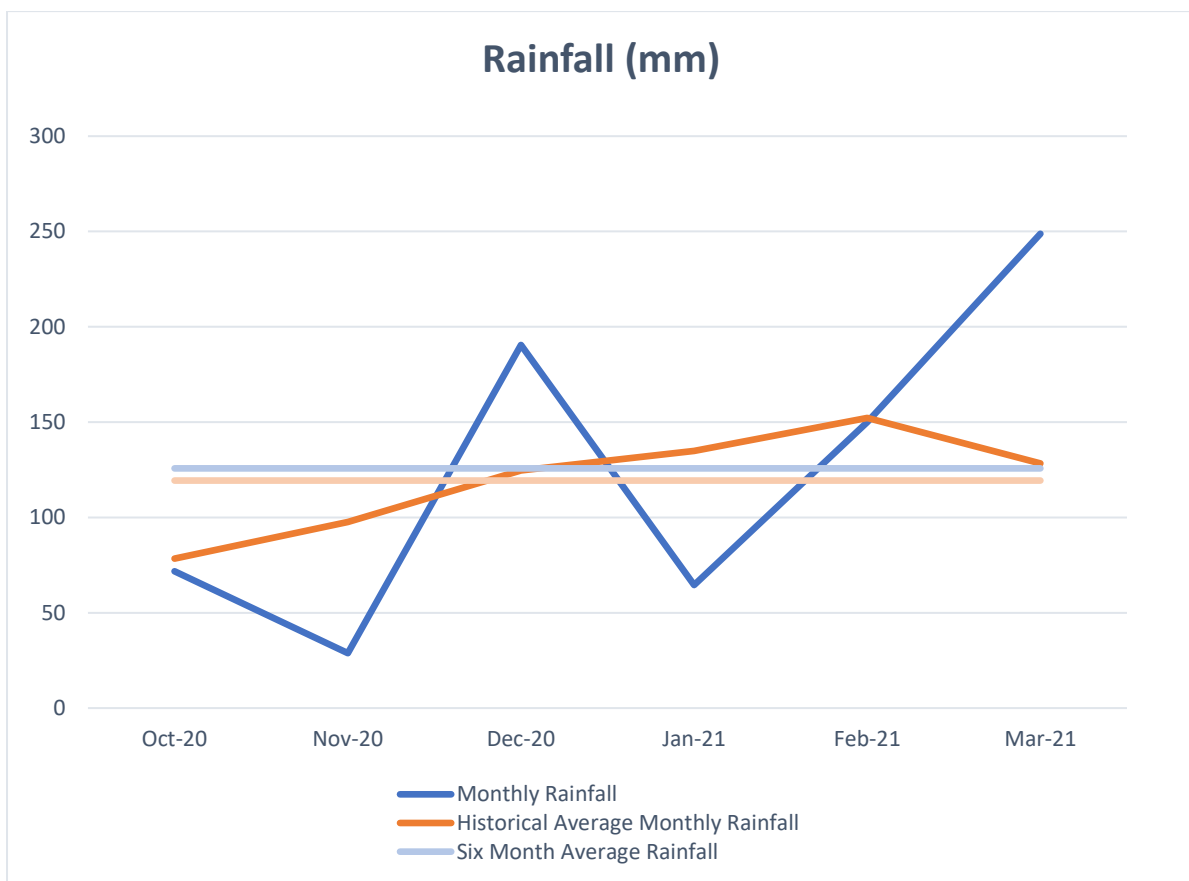
Graph 1; Monthly rainfall October 2020 to March 2021

| Month	Rainfall (days)	Historical Average (days)
March 2021	22	12.9
February 2021	14	12.3
January 2021	21	11.2
December 2020	14	10.9
November 2020	3	7.7
October 2020	9	6.6
Average	**13.8**	**10.3**
Total	**83**	**61.6**

Table 4: Rain days data Everleigh October 2020 to March 2021
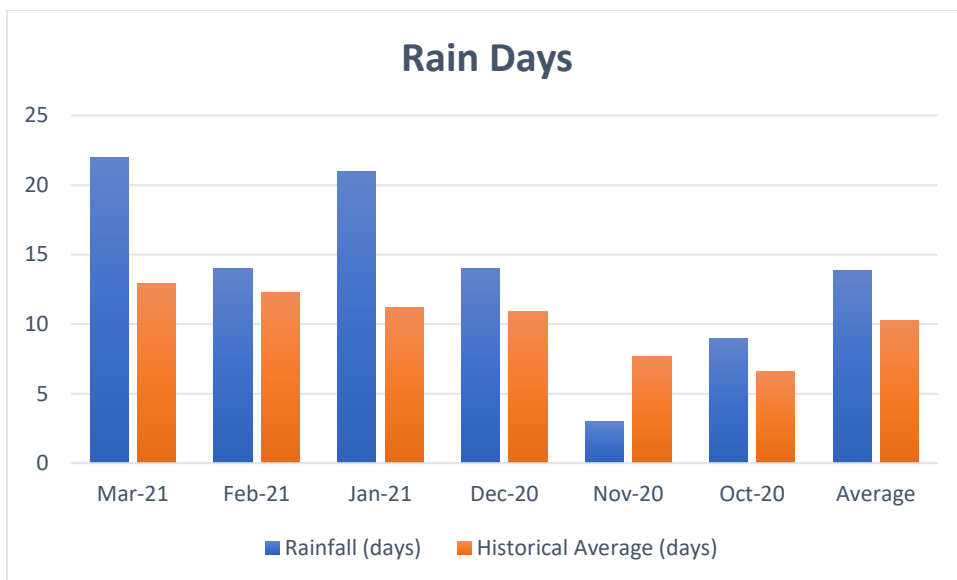
Graph 2: Rain days data Everleigh October 2020 to March 2021

Month	Temperature Max (Degrees °C)	Historical Average Temperature Max (Degrees °C)
March 2021	35.3	31.5
February 2021	36.1	31.8
January 2021	36.1	32.9
December 2020	38.1	33.4
November 2020	36.6	28.6
October 2020	33.5	27.1
Average	**35.95**	**30.88**

Table 5 Temperature data Everleigh October 2020 to March 2021

Temperature Variation (◦C)
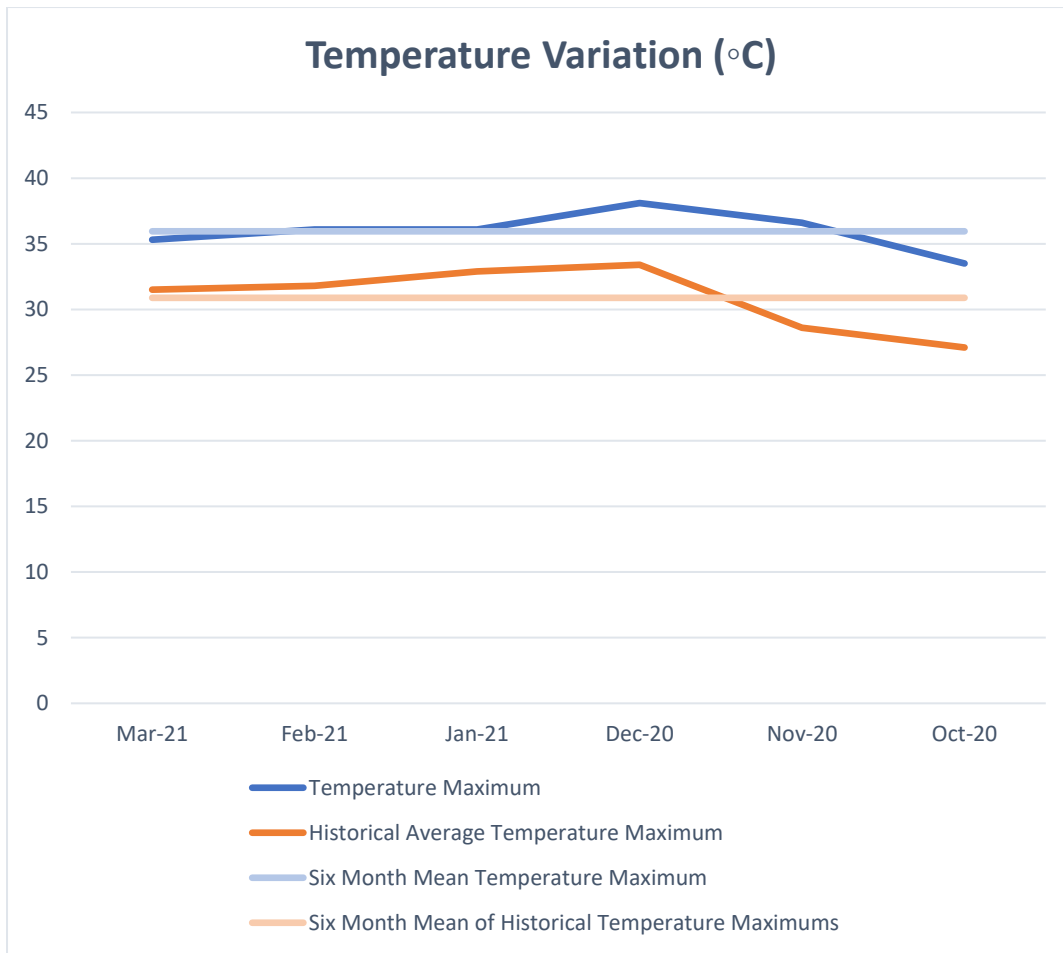
Graph 3: **Temperature Data Everleigh October 2020 to March 2021**

Variations in climatic factors have heavily affected optimal growing conditions. Temperatures continue to be higher than the historical averages, however total rainfall and rain days have taken a favorable turn since the time of last reporting with both being slightly above the long-term average. This is due in-part to a wet March with almost double the long-term average rainfall being received for this month. Continuance of the implemented alterations to planting methodology and maintenance have also positively impacted the survival and vigor of planted specimens as per the stipulations of **SHG's** Impact Management Plan.

Recommendations

Due to the site audit findings the following measures have previously been implemented to ensure planting success:

- Replacement plants are to be planted with an auger and water spike. Approximately 5L of water + fertilizer is to be delivered with the water spike during the planting process to ensure the plant is given ample nutrients and water to ensure early establishment;
- Conduct a full site audit of the planted area on a bi monthly basis to ensure reporting to the client and if appropriate alternative actions can occur to promote plant vitality and compliance;
- As / if additional plants die, implement the auger + water spike planting methodology on all new plantings; and
- Monitor rainfall gauges near the Everleigh site and increase watering when appropriate.

Additionally planting areas closer to the creek-line bordering the planting site have been prioritized for replacement plantings to maximize long term survival and water access.

No evidence of grazing is currently present on-site, however herbivory should continue to be monitored for as seasonal variation reduces the availability of fresh browse. The following methodologies may be utalised to prevent grazing:

- Plant success will pose secondary challenges from native fauna in terms of a food source. Several kangaroo and wallaby scats have been located in the planting area, which alludes to selective grazing. This is a common problem and often accounts for slower growth rates. It is recommended that either:
    - The planting area be cordoned off to remove the risk of selective grazing during the establishment phase; or
    - Wire cages be installed over the tree guards to reduce grazing risk.

Conclusion

Evolve Environmental Solutions (Evolve) were engaged by **Mirvac** to undertake the installation and establishment of 625 *Melaleuca irbyana* at 146 Teviot Greenbank. This works

is in accordance with the Impact Management Plan that was prepared by **Saunders Havill Group** (SHG) on the 11/06/2018 as per the requirements of the Natural Environment Site Strategy (NESS). The scope entails for weed management in the offset area, installation of offset planting, watering, ongoing weed management and monitoring. Establishment period runs over 24 months utilizing an adaptive management approach to achieve a holistic and resilient offset planting.

Site audit findings have highlighted the need for an alternative watering and planting procedure (mentioned above) to ensure the success of all new plantings. Additionally, grazing from native fauna has been highlighted as a potential risk and methods have be suggested (not yet implemented) to combat these risks. Studies of rainfall and temperature data has highlighted the changes in climatic conditions on the Everleigh site and the requirements to increase watering and soil conditioning techniques.

The next full site audit will be undertaken in July 2021.

Appendix F

Offset Area Management Report

Baseline – Year 1

Aroona Station Offset Area Management Report – Baseline Year 1

EPBC 2016/7817

V2 | January 2022

Document Control

Current document	
Title	Aroona Station Offset Area Management Report Baseline Year 1 EPBC 2016/7817
Date	January 2022
Prepared by	Georgina Braun

Document Issue			
Issue	*Date*	*Prepared by*	*Checked by*
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Reports and/or Plans by Others

Reports and/or plans by others may be included within this Offset Area Management Report to support the document.

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CHAPTER 1:   INTRODUCTION

The purpose of this document is to report on the management actions and outcomes required for the provision of koala (*Phascolarctos cinereus*) habitat offset, by Approval EPBC 2016/7817 issued pursuant to sections 130 and 133 of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC 1999). The focus of the plan is on the protection and enhancement of the koala habitat associated with the secured offset for the Mirvac Queensland Pty. Ltd. EPBC 2016/7817. This document will report in accordance with stipulations and requirements laid out in the Offset Area Management Plan.

The structure of the document reflects the requirements of the Department of Agriculture, Water and the Environment (DAWE), and details the key threatening processes which could impact on the existing koala population. The chapters that comprise the document report on the overall health of the koala population, vegetation composition, and actions to minimise threats to koalas. The management regime put in place by the Queensland Trust for Nature (QTFN) will enhance existing koala habitat through the exclusion of land practices detrimental to the site and will track improvements and progress in the annual offset report over the active management period.

This report is the first submitted to date since the approval date for the offset (EPBC 2016/7817) on the 11th October 2019 and commencement of the action. The past and future reporting requirements are listed below.

Milestone	Due Date	Status
Approval of EPBC 2016/7817	11th October 2019	Completed
Legal Security	4 December 2020	Completed
Year 1	4 December + 3 months	Submitted January 2022
Year 2		
Year 3		
Year 4		
Year 5		
Year 6		
Year 7		
Year 8		
Year 9		
Year 10		

1.1 SUMMARY OF COMPLIANCE

This document stands as a compliance report for the agreed upon management conditions (Table 1) outlined in the EPBC2016/7817 Offset Area Management Plan.

It is acknowledged that any non-compliance with the conditions must be reported by no later than 2 business days after becoming aware.

Table 1. Compliance summary and checklist for all conditions relevant to this reporting interval under the OMP.

Key Actions and Monitoring Requirements	Reporting Requirements	Compliance
Management Action 1 – selective chemical/mechanical management		
• Develop and implement a weed strategy, with a particular focus on weeds with particularly ability to impact on koala movement and structural vegetation composition (mainly *Lantana camara* and *Schinus terebinthifolius*), and under the Biosecurity Act 2014, to reduce weed cover to target thresholds. • ▪ Undertake weed management according principles outlined in section 7.1	*Lantana camara* and *Schinus terebinthifolius* cover is reduced across the offset area, and weeds are not impacting on the movement of koalas across the site and not negatively impacting on recruitment of koala and GHFF food and shelter trees. Year 5, 10, 15 and 20 assessment unit Non-native Plant Cover KPIs achieved	ongoing
Management Action 2- ecological burns		
• ▪ Develop and implement a Fire Management Strategy with particular focus on Regional Ecosystem burning intervals and property fire history. • ▪ Undertake ecological burns in accordance with principles outlined in this section.	Year 5, 10, 15 and 20 assessment unit MHQA KPIs achieved for: • Koala Site Condition • GHFF Site Condition • GHFF Species Stocking Rate	ongoing
Management Action 3 – wildfire hazard reduction		
• Hazard reduction action will take place to reduce fuel loads based on Overall Fuel Hazard Assessment. • Install firebreaks and fire trails (access tracks). • Prescribed burning will be undertaken in consultation with, and under the guidance of the Queensland Rural Fire Brigade and in compliance with the Fire and Emergency Services Act 1990. • Inspect firebreaks and access tracks, undertake any maintenance required to achieve compliance with Fire Management Plan.	No recorded high-intensity fires in the offset area. No recorded injury or death from fire. Implementation of Fire Management Plan reduces fuel levels. Vegetation composition not negatively affected by fire regime. Minimise the risk of koala and GHFF mortality within the offset area due to prescribed burning. Year 5, 10, 15 and 20 assessment unit MHQA KPIs achieved	Y
Management Action 4 – direct seeding where natural regeneration is lacking		
• Conduct direct seeding of native species in areas where natural regeneration not occurring. • Species mix to be representative of Preclear Regional Ecosystem	Year 5, 10, 15 and 20 assessment unit MHQA KPIs achieved for: • Koala Site Condition • GHFF Site Condition • GHFF Species Stocking Rate Livestock are excluded from offset area other than for the purposes of hazard reduction actions. Large offset areas are legally secured.	Y
Management Action 5: Legal protection from incompatible land uses		
• Legally secure the offset area by way of voluntary declaration under the Vegetation Management Act 1999 prior to commencement of Stage 2 of the action. • The voluntary declaration will be in place for the duration of the impact, or until such time as another enduring protection mechanism (such as a Nature Refuge under the Nature Conservation Act 1992) has been formally registered on title and evidence of this has been provided to the Department.	Large offset areas for koala and GHFF habitat protected for the duration of the impact.	Y 4/12/21
Management action 6: Monitoring and control of introduced predators		

• Conduct a baseline survey to establish introduced predator abundance and location on the property. This can be undertaken through the use of remote motion-activated cameras and/or identification of scats. • Establish a Relative Abundance Index and confidence intervals around associated population trends. • Implement introduced predator control program. The control program and techniques (trapping, baiting, shooting) will be informed based on the results of the abundance surveys. Where practical, and to increase the effectiveness of a control program, the landholder will seek to coordinate control programs with comparable activities being undertaken by neighbouring landholders. • Set-up a community engagement program including but not limited to interpretive signs, fact sheets and community presentations with the aim to raise community awareness and encourage responsible pet ownership. • Directly input into the Little Liverpool Range Strategy for controlling introduced predators across the Range.	Relative abundance index does not increase from baseline for feral animal abundance Annual report to include all feral animal survey data. No recorded injury or death from introduced predator attacks within the offset area.	Y Ongoing

Management action 7: Revegetation

• Implement a revegetation program in cleared areas using best practice techniques with tree and shrub species representative of the pre-clearance Regional Ecosystem including koala and GHFF food and shelter trees (see Appendix G for proposed species list). Revegetation details outlined in section 7.7. • Exclude livestock from areas undergoing revegetation activities • Legally secure the offset area	80% survival of seedlings. Year 5, 10, 15 and 20 assessment unit MHQA KPIs achieved for: • Koala Site Condition • GHFF Site Condition • GHFF Species Stocking Rate Livestock are excluded from offset area other than for the purposes of hazard reduction actions (hazard reduction using livestock only to occur when OMU3 areas reach a height able to withstand the introduction of cattle). Large offset areas are legally secured	Y Ongoing

Management action 8: Koala Species Stocking Rate survey

• Undertake koala density/occurrence surveys using SAT methodology (Phillips and Callaghan 2011) within the offset area • Repeated surveys to be undertaken at 5-year intervals. • Koala SAT surveys to be undertaken by a suitably qualified ecologist with extensive experience with koala surveys.	Year 5, 10, 15 and 20 assessment unit MHQA KPIs achieved for Koala Species Stocking Rate	Y Ongoing

Management action 9: Cattle Grazing Management

• Cattle grazing to be used only as a wildfire hazard fuel reduction tool in accordance with Management Action 3 – Wildfire hazard reduction. • Ensure that all livestock are excluded from planting/revegetation area (e.g. by fencing) for a minimum of 5 years, or until a suitably qualified independent expert has determined that planted koala and grey-headed flying-fox feed trees are of sufficient size to withstand impact from cattle. • ▪ Provide the Department with a report from the suitably qualified independent expert verifying that planted koala and grey-headed flying-fox feed trees are of sufficient size to withstand impact from cattle. • Ensure that any grazing is managed so as to prevent the risk of injury or mortality of Koalas.	No material adverse impacts to target habitat quality improvement outcomes. Vegetation composition not negatively affected by cattle grazing Year 5, 10, 15 and 20 MHQA KPIs achieved for: • Koala Site Condition • o GHFF Site Condition	Y Ongoing

1.2   SETTING AND LOCALITY

By way of Deed, Mirvac Queensland Pty. Ltd. secured delivery of an Offset Area Management Plan and registration of a Voluntary Declaration (under the *Vegetation Management Act 1999* (QLD) (VMA) of a staged offset area imposed by EPBC Approval 2016/7817 as part of the offset for the Greenbank development.

The voluntary declaration was secured on the 4th December 2020 and reporting for EPBC 2016/7817 will include information from 2021 onwards.

1.2.1   Aroona Station Locality

The offset area pertaining to EPBC 2016/7817 is managed as part of a larger conservation property located on Alpers Road, Mount Mort, Queensland comprised of multiple lots; Part of lot 54 on CC1018, Part lots 44 and 45 on CC32, Part of Lot 6 on RP21558, Part of lot 13 on RP21558, Part of lot 31 on CH312311, Part lot 216/CH311631, Part of 218 on CH311734, Part lot 222/CH311798, Part lot 30/CH312310, and Part lot 64/CC552, totalling approximately 686.44 ha (Map 1). The whole site, henceforth referred to as 'Aroona Station', was gifted to QTFN in 2015 with the wish to see the property managed for both its production and conservation value, under a variety of income initiatives.

The tenure of the site is freehold, wholly owned by QTFN. It is included within the Ipswich City Council and Lockyer Valley Regional Council Local Government Areas. On a regional scale, the site is part of the Little Liverpool Range, providing connectivity to Main Range National Park and the Great Eastern Ranges.

The Range stretches for 90km from Laidley, through Mount Mort to Thornton and Mulgowie, and encompasses 20,400ha of land. It is an important wildlife corridor, providing habitat for a number of vulnerable species including the glossy black-cockatoo *(Calyptorhynchus lathami)*, powerful owl *(Ninox strenua)*, grey-headed flying-fox *(Pteropus poliocephalus)* spotted-tailed quoll (*Dasyurus maculatus maculatus)*, brush-tailed rock-wallaby *(Petrogale penicillata)* and koala (*Phascolarctos cinereus*).

Climate data for the area gives a mean maximum and minimum temperature of 26.9°C and 13.1°C respectively for 2021. The average annual rainfall is 1230mm (BoM 2021), with the wettest month in January and the driest month in August. The site contains six Regional Ecosystems (REs):

- 12.3.3 Endangered: *Eucalyptus tereticornis* woodland on Quaternary alluvium
- 12.3.7 Least Concern: *Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca spp*. fringing woodland
- 12.8.9 Least Concern: *Lophostemon confertus* open forest on Cainozoic igneous rocks
- 12.8.16 Least Concern: *Eucalyptus crebra +/- E. melliodora, E. tereticornis* woodland on Cainozoic igneous rocks
- 12.8.17 Least Concern: *Eucalyptus melanophloia +/- E. crebra, E. tereticornis, Corymbia tessellaris* woodland on Cainozoic igneous rocks
- 12.9-10.17a Least concern: *Lophostemon confertus* or *L. suaveolens* dominated open forest usually with emergent *Eucalyptus* and/or *Corymbia* species on sedimentary rocks
- 12.9-10.7 Of concern: *Eucalyptus crebra +/- E. tereticornis*, *Corymbia tessellaris*, *Angophora spp*, *E. melanophloia* woodland on sedimentary rocks

The highest point of the site is 670m above sea level on the northern block, close to the border of lot 45 on CC32, and is one of the two peaks of Mount Beau Brummel. The Geological Survey of Queensland 1:100,000 Ipswich Geological Map (DME 2008) lists the geology as:

- Qa SEQ: Quaternary; clay, silt, sand, gravel, flood plain alluvium
- Tit SEQ: Tertiary: trachyte (anorthoclase and riebeckite trachyte)
- Jbmk: Jurassic; lithofeldspathic labile and sublabile to quartzose sandstone, siltstone, shale, minor coal, ferruginos oolite marker
- Jbmg: Jurassic; lithic labile and feldspathic labile sandstone

1.3   EPBC 2016/7817 OFFSET AREA ATTRIBUTES

The EPBC 2016/7817 offset area contains multiple parcels within the Aroona Station property, on the northern and southern land parcels (Map 1). The vegetation composition and land use history vary across the property.

The offset area contains remnant vegetation typical of eucalypt Forest and dry sclerophyll (RE12.8.9). Surrounding vegetation is consistent with varying ages of mature eucalypt regrowth forest (RE12.8.16/RE12.9-10.7), previously cleared for cattle grazing purposes. The lowland offset areas are typical of alluvial blue gum and melaleuca flats (RE12.3.3/12.3.7). Vegetation remains along creek lines providing important dispersal pathways. However, the flats have been historically cleared for cattle grazing and will benefit from revegetation activities.

Map 1. Offset area in the context of Aroona Station and the Little Liverpool Range
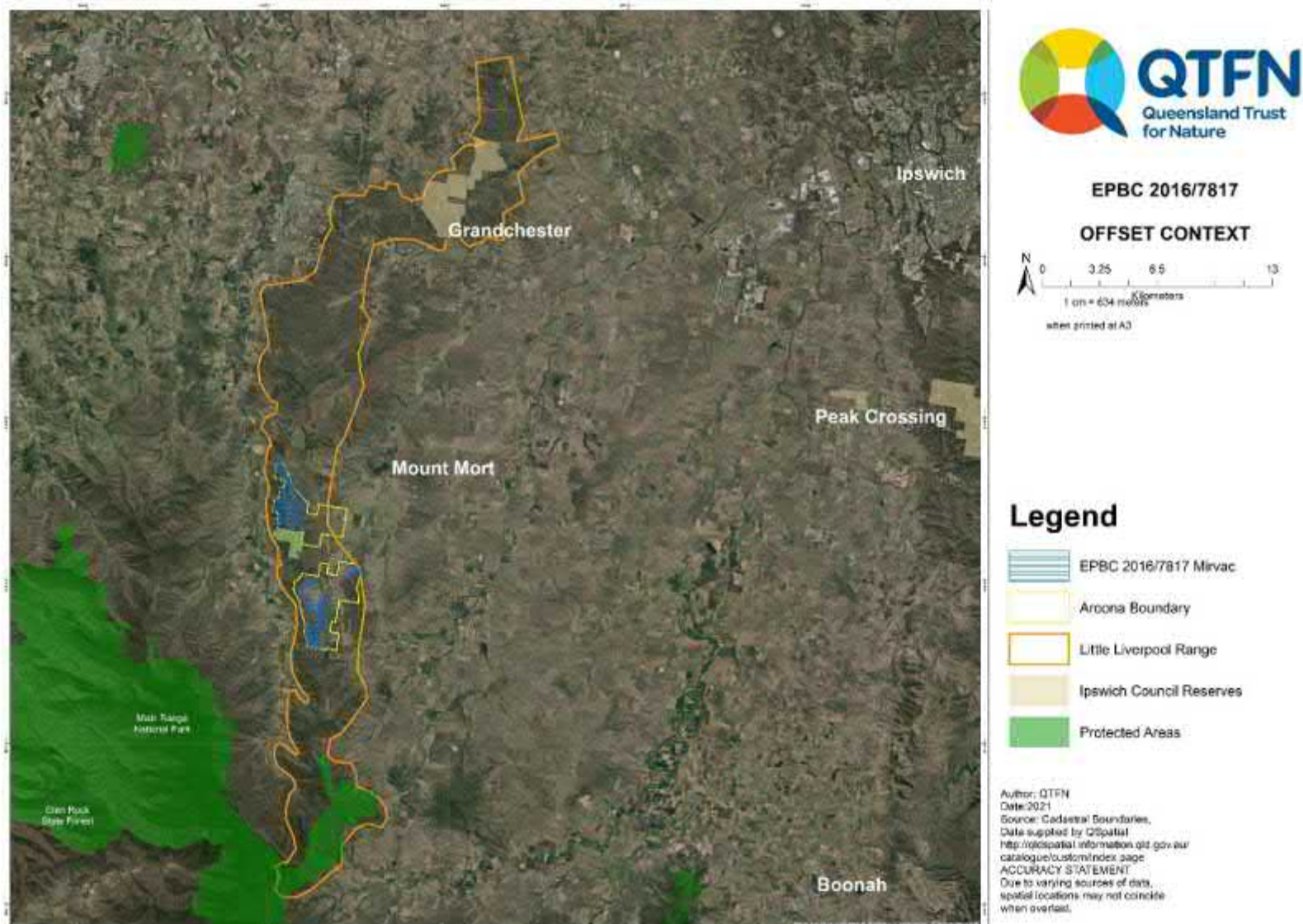
CHAPTER 2: BASELINE ASSESSMENT AND MANAGEMENT REPORT

This chapter summarises the baseline survey data and methodology in line with the Offset Area Management Plan and the final Approval Conditions set by the relevant parties. Management actions and reporting relevant to each condition will be discussed in each section.

2.1 HABITAT CREATION AND QUALITY IMPROVEMENT

Management Action 4 and 7

An ecological assessment was conducted at Aroona in 2016 by AusEcology. The surveys were carried out using the methodology outlined in Offset Management Plan, where BioCondition plots were established and data relating to the habitat quality of the land-based offset was collected, in line with the modified version of the Queensland State Governments *"Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy"* Version 1.2 April 2017 (the Guideline). These plots, herein referred to as 'Habitat Quality Transects', allowed for the assessment of the offset area and were designed to determine the condition of the vegetation and its suitability as an offset for the koala and the grey-headed flying-fox.

The site was broken up into eleven assessment units based on regional ecosystem (RE) and vegetation status (remnant, regrowth and cleared). Fourteen Habitat Quality Transects were established across these assessment units. The transects were distributed in such a way as to provide a representative sample of the RE, and gradient condition states of each AU present on the property.

For the purposes of managing the offset, the land was categorised into three management units, remnant (OMU- 1), regrowth (OMU-2) and cleared (OMU-3) Broadly, condition and management actions required are similar for all REs in remnant status, all REs in regrowth status and all cleared areas. As a result, it was decided to assess habitat quality and potential improvements based on OMUs. Operational management units are made up of assessment units relating to the regional ecosystems and vegetation classes within the offset area Table 2. OMU's are used to demonstrate management actions and impacts across vegetation groups.

Table 2. Offset Site Management and Assessment Units

OMU	VMA Status	Assessment Unit	Number of BC sites	Status	Regional Ecosystems	Benchmarks
OMU-1	Category B/ Remnant	AU-2 AU-3 AU-5	BC2, BC7 BC3 BC5, BC8	Remnant	12.8.9 12.8.16 12.8.17	12.8.9 12.8.16 12.8.17
OMU-2	Category C/ Regrowth	AU-1 AU-4 AU-6 AU-7 AU-8	BC1, BC14 BC4, BC11, BC13 BC6 BC9, BC12 BC10	Mature Regrowth	12.9-10.7 12.8.16 12.8.17 12.3.3 12.3.7	12.9-10.7 12.8.16 12.8.17 12.3.3 12.3.7
OMU-3	Category X/ Cleared	AU-9 AU-11 AU-12	Nil Nil Nil	Cleared	12.3.7 12.3.3 12.8.17	12.3.7 12.3.3 12.8.17

2.1.1   BASELINE SURVEY RESULTS

OMU1

OMU-1 contained remnant regional ecosystems 12.8.9, 12.8.16 and 12.8.17. Overall, the remnant OMU was in reasonable condition, ranging between 60-80% and classed as 'nearly fully functional ecosystems'. OMU-1 was dominated by the remnant mosaic RE 12.8.16/12.8.17, but there was a lack of diversity in the shrub, grass and forb layer and the widespread presence of invasive weed species. RE 12.8.16 and 12.8.17 are classified as being potentially high suitability for koala habitat (Rhodes et. al 2015). However, influential factors like annual rainfall totals, topography and species composition impact on overall carrying capacity.

Habitat assessments in the remnant OMU showed Tree Canopy Height, EDL recruitment, Canopy Cover and Tree species richness all received the maximum or near maximum score, indicating the vegetation has the potential to provide important koala habitat. The dominant eucalypts present were *Eucalyptus crebra, E. melliodora, E. tereticornis, E. melanophloia, Corymbia tessellaris* and *C. intermedia*. Large tree scores were below maximum. Trees that fall below large tree threshold are considered immature and therefore have capacity to be more susceptible to destruction in wildfires, particularly with a high-level *lantana camara* abundance.

OMU2

Mature regrowth assessment units ranged from average to degraded in condition class, therefore showing significant potential for rehabilitation. Canopy cover met the benchmark for all assessment units, with average percentages: 123.9% for AU-2, 96.3% for AU-3 and 115% for AU-4. Dominant species across these AUs included *Eucalyptus melanophloia, Eucalyptus crebra, Eucalyptus melliodora* and *Eucalyptus tereticornis.* Assessment Unit 06 contained notably a large number of large woody species, but notably less had achieved full growth compared to other regrowth areas. This is likely because these areas had been cleared or managed for agricultural purposes for longer than other regrowth vegetation.

Shrub cover for OMU-2 was notably poor. *Lantana camara* (lantana)*, Celtis sinensis* (chinese elm) *and Schinus terebinthifolius* (broad-leaved pepper) were prevalent along riparian areas, preventing access of koalas to food and shelter trees.

Improvements in the OMU-2 will be realised through reduced grazing pressure, weed management and ecological burning to increase recruitment of koala and grey headed flying fox food species. Lantana is identified as a significant threat to the ecosystem, koala habitat health and koala movement throughout the site. Securing the offset from incompatible land uses such as clearing will further protect existing vegetation and increase the value of the habitat over time.

OMU3

No habitat transects were carried out within the cleared (VMA Category X) areas as there was no complex vegetation present. These areas consisted of cleared pastures with isolated paddock trees. Of the native paddock trees present, these occur at an approximate density of four trees (of any size, some smaller than able to be utilised by koalas) per hectare, and in some areas this density is even less, meaning average distance travelled between trees is greater than 50m. Whilst the isolated paddock trees do provide koala habitat on their own, the distance between trees means there is significantly more time spent on the ground by koalas, which increases energy resource use by the koala and increases the risk of predation. Generally, trees within the Cat X areas are immature regrowth, providing limited habitat potential. The high sparsity, immaturity, and lack of complexity within the Cat X areas means the quality of koala habitat provided is negligible.

Lantana camara was present in all Category X areas, and *L. camara, Schinus terebinthifolius and Celtis sinensis* were present in large infestations in the riparian areas, significantly impacting the ability of koalas to utilise the habitat. All weed species are visible from aerial imagery.

A summary of all the scores for OMU-1, OMU-2 and OMU-3 are presented in Appendix 1. Refer to OMP for Assessment Unit baseline data.

2.1.2   Management Actions

OMU 1 AND OMU 2 – Habitat Quality Improvement

All actions outlined in this document contribute to the management of OMU1 and OMU2 to improve habitat quality.

Rehabilitation actions are conducted line with the Aroona Weed Management Strategy and the Aroona Fire Management Plan, detailed in sections 2.5, and 2.8, respectively.

Monitoring transects were established, located in Map 3.

OMU3 – Habitat Creation

Revegetation actions are underway to create habitat for the koala and grey-headed flying fox (Figure 1). Revegetation actions within the offset area have been completed in part with the remainder planned for the 2022 planting season (Autumn). Growing of tube stock and seed supply have commenced. Photo monitoring points are established and will be presented in the year 2 annual report once all works are completed.

Direct seeding of upland OMU3 sections was conducted in 2021 (Figure 1). Despite delays due to weather conditions, the ecological burn was undertaken resulting in a patchy cool burn. This provided an excellent ash bed for the direct seeding of eucalyptus seeds. Acacia seeds were dispersed pre-fire to promote germination. Monitoring of germination and early-stage establishment will be undertaken.

The southern hemisphere has entered a La Niña weather phase. This has resulted in significant rainfall across the offset site, benefiting the offset area considerably. Climate models suggest this La Niña will persist until the late southern hemisphere summer or early autumn 2022. How this phase will impact revegetation operations will be monitored closely and contingency plans implemented where necessary.
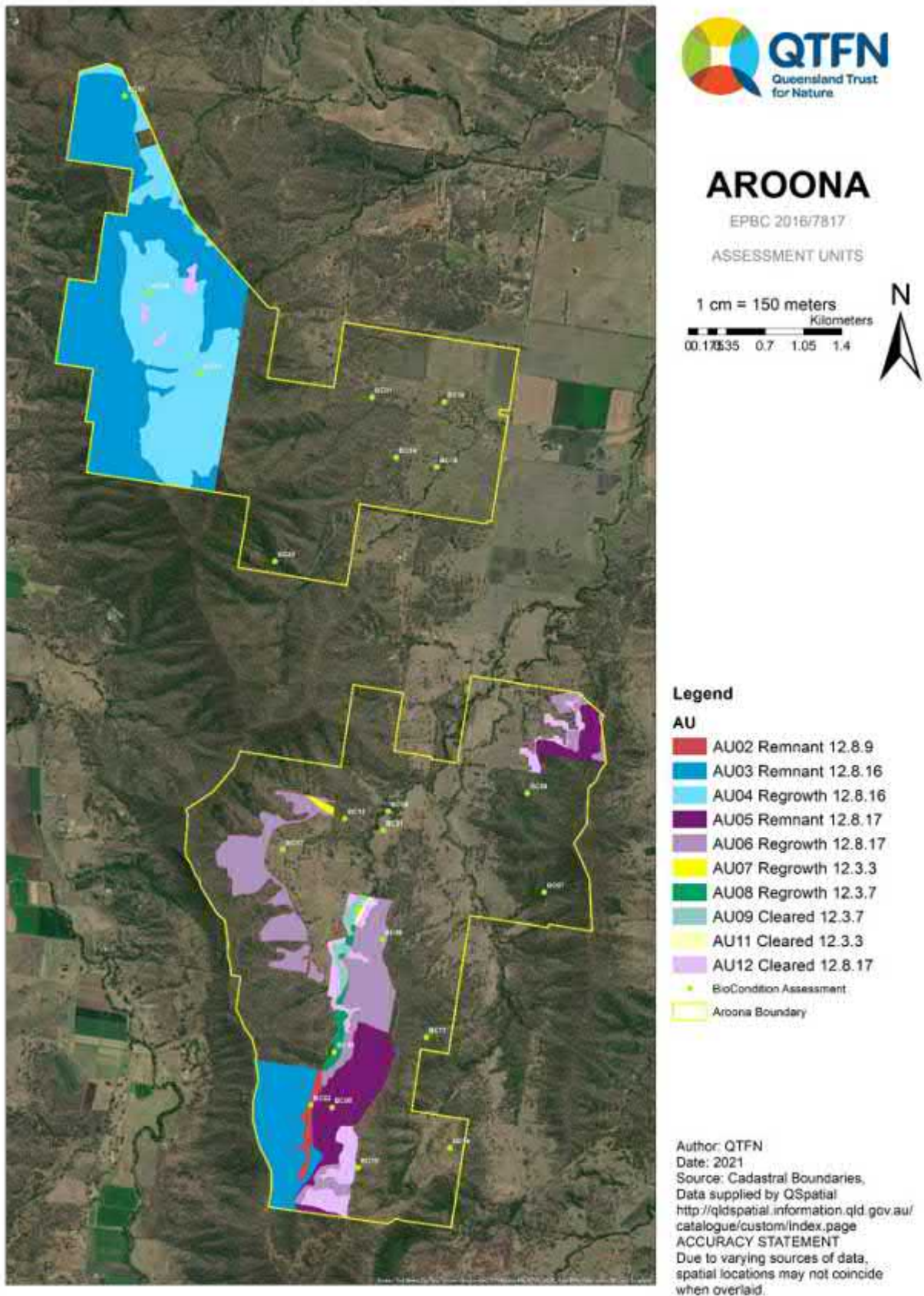

Figure 1 Revegetation activities within the offset area; tree planting of alluvial blue gum flats.

Map 2. Offset area management units

Map 3. Assessment units within offset area
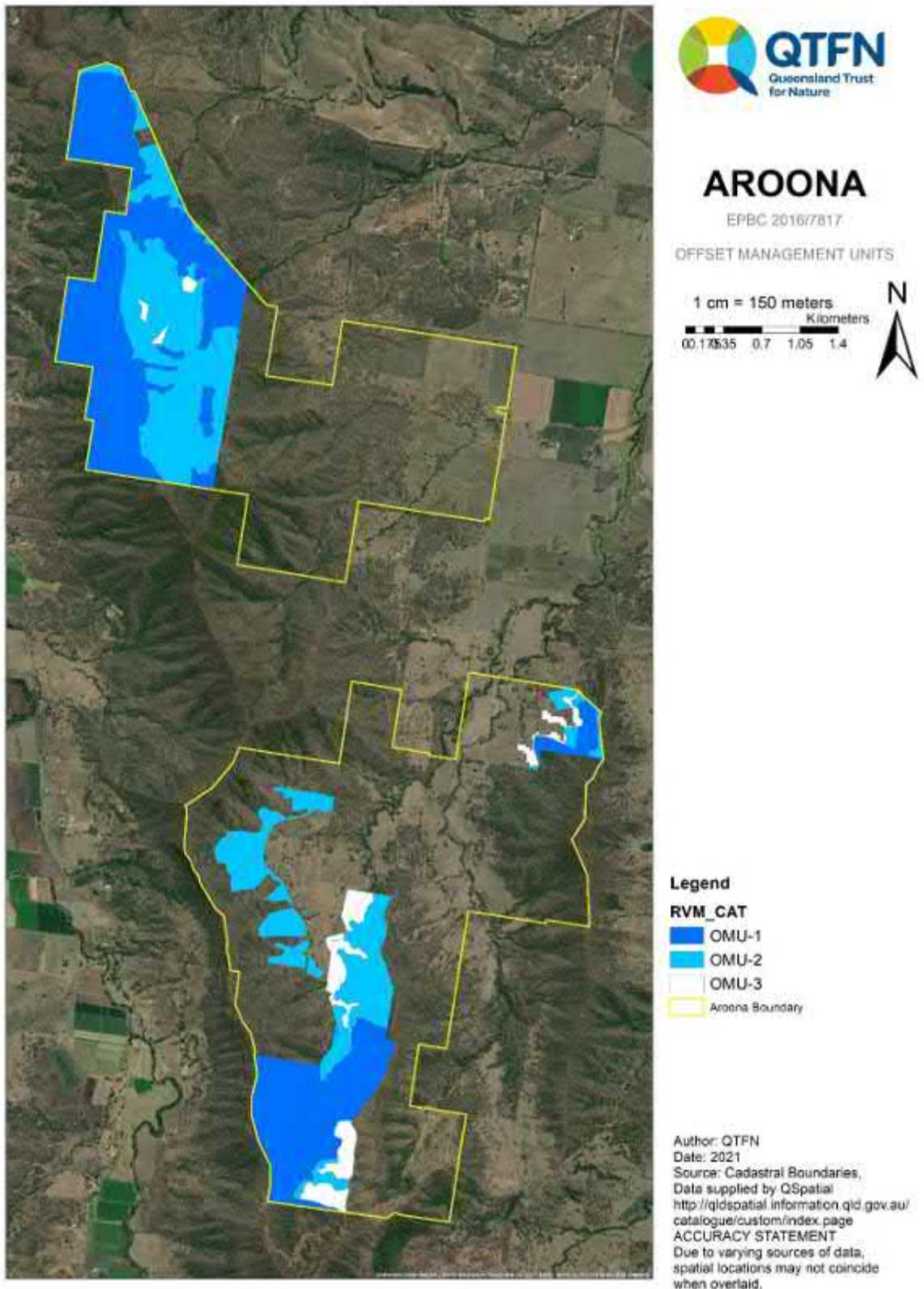
Map 3. Assessment units within offset area

2.2 GREY HEADED FLYING FOX FORAGE HABITAT

MANAGEMENT ACTION 4 and 7

Proximity of grey-headed flying fox (GHFF) colonies to the offset site were determined in a desktop analysis using the National Flying-fox Monitoring viewer (DoE) and cross checked using the state mapping for flying-fox roost sites (DES 2019). Flying-fox camps within 30 km of the site are listed in Table 3**.**

Table 3. Grey-headed Flying-fox Camps

Camp name	Level	Proximity to site
Boonah, Bicentennial Park	3	23.5km
Laidley, Laidley Plainlands road	2	24.5km
Gatton, Tenthill creek	2	26.3km

2.2.1 Baseline Survey Data

Trees identified as priority GHFF food tree species were identified within the remnant and regrowth AU (Table 4). These species are listed below and provide year round opportunities for feeding with at least one having the potential to flower at any point in time. Size of these species produced high canopy cover and large tree benchmark scores, indicating they provide substantial habitat for GHFF.

A summary of all the scores for OMU-1, OMU-2 and OMU-3 are presented in Appendix 2.

2.2.2 Management actions and species occurrence

The presence of GHFF was recorded in March 2021, observed feeding in a fig tree (Figure 2).

Flowering grey-headed flying fox forage trees were GPS located and recorded throughout the reporting year Map 4. This allowed for a spatial and seasonal representation of food availability in between milestone reporting years (5 yearly).

Corymbia intermedia and *Eucalyptus tereticornis* were the most dominant flowering forage tree. This provides year round coverage as they are a summer and winter forage species respectively.
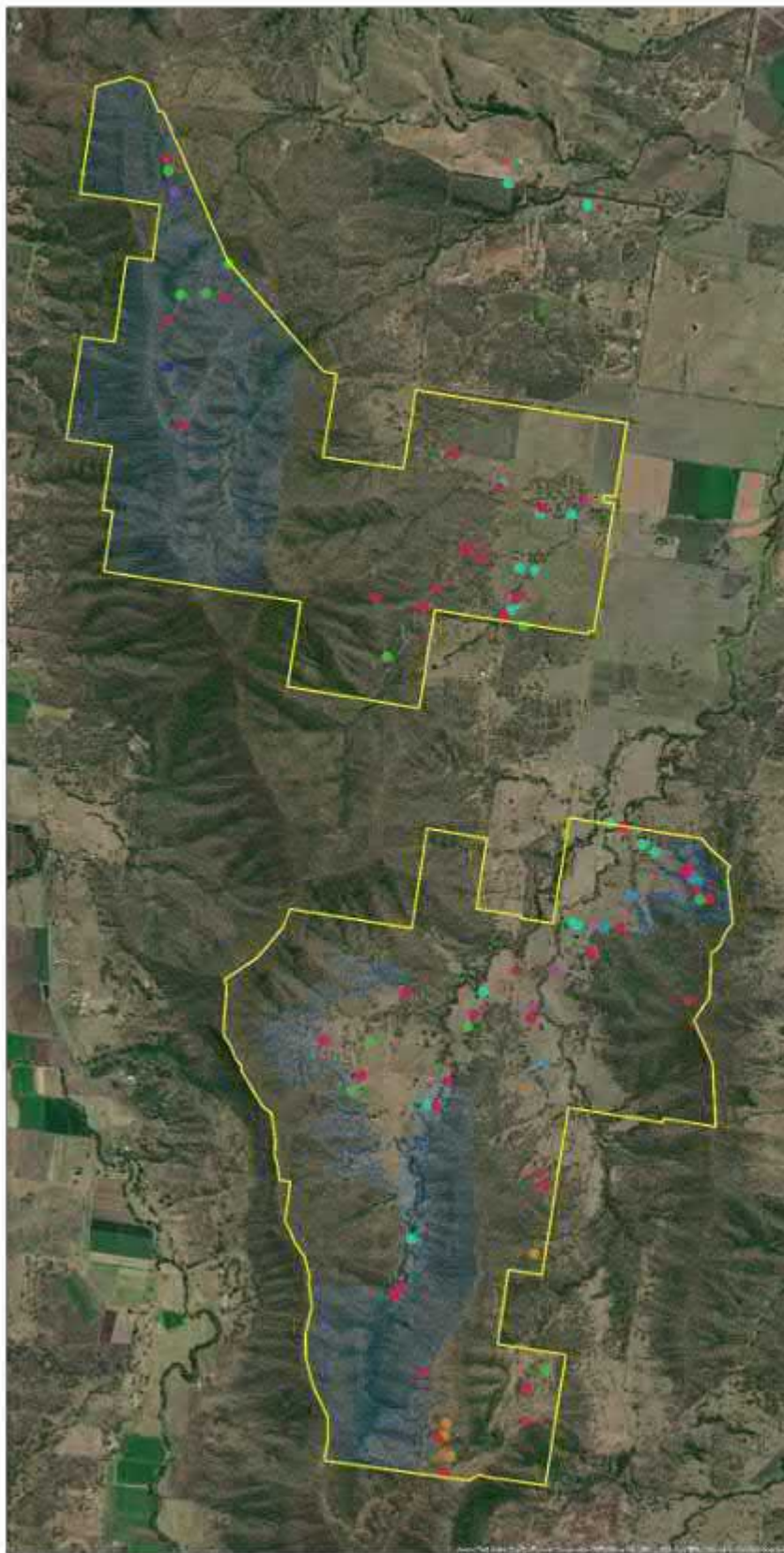
Figure 2. Grey-headed flying fox observed feeding in fig tree and example of *Corymbia tessellaris* flowering.

Table 4. GHFF Forage Species Calendar (blue shading = literature based flowering times, X = observed flowering in offset area)

Species	OMU 1	OMU 2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Angophora floribunda	Y	Y												
Lophostemon confertus	Y	Y												
Melia azedarach	Y	Y												
Corymbia intermedia	Y	-	X		X									
Corymbia tessellaris	Y	Y	X											
Eucalyptus crebra	Y	Y								X	X			
Eucalyptus melanophloia	Y	Y	X											
Eucalyptus melliodora	-	Y									X			
Eucalyptus tereticornis	Y	Y							X	X	X			
Ficus coronata	-	Y	X		X									
Ficus opposita	Y	Y												

Map 4. GHFF forage trees in flower across offset area

2.3   SPECIES STOCKING RATE

MANAGEMENT ACTION 8

The species stocking rate of the koala is an estimate of species carrying capacity of the site at the time of undertaking the survey. This metric is used to represent the sites capacity to support koala populations and the species occupancy.

Species stocking rate is calculated using the following parameters:

- Species presence on or adjacent to the site

- Species usage of the site

- Approximate density of the species on the site

- Role/importance of species population on site

Baseline data was collected from 2016 to 2019 across the offset site using multiple survey methodologies, summarised in Table 5. These surveys will be carried out across the offset area though the lifetime of the offset to report on the effectiveness of management actions and the increase in koala abundance and activity.

Table 5. Koala monitoring methods.

Methodology	Frequency	Characteristic monitored	Result
SAT surveys (Phillips and Callaghan 2011)	Annually	SAT monitoring, recording the presence of koala scats under food and habitat trees. Survey will record activity and abundance of koalas.	Demonstrated increase in koala density and abundance through an increase in scats recorded during SAT
Intensive population surveys using methodology modified from Ellis et al (2015) Method involves capturing, conducting health assessments by a wildlife vet includingage, body mass, reproductive health and signs of koala disease. In addition to capturing individuals, surveying will include nocturnal spotlighting, acoustic listening for male bellowing and camera trapping.	At years 5, 10, 15 and 20	Surveys are designed to detect koala breeding within the offsetarea. Data collected will show evidence of breeding through back/pouch young, used pouches and male bellowing records.	Demonstrated use of the offset site for breeding purposes.

SCAT SURVEY METHOD

Baseline Koala activity levels were determined through utilising the Spot Assessment Technique (SAT) (Phillips *et al.* 2011). The SAT method is an industry recognised technique for identifying presence/absence of koala at a site and is specified as an appropriate survey method in the *EPBC Act Referral Guidelines for the Vulnerable Koala*. Results fromthe SAT surveys are compared against current available published scientific literature to identify an estimated koala carrying capacity (stocking rate) to be determined.

The SAT involves identifying a non-juvenile tree of any species within the subject site that is either observed to have a koala or scats, or is known to be a food tree or otherwise important for koalas, and recording any evidence of koala usage of that tree including presence, identifiable scratches or scats. The nearest non-juvenile tree is then identified, and the same data recorded. The next closest non-juvenile tree to the first tree is then assessed and so on until 30 trees have been surveyed.

The number of trees showing evidence of koala activity is expressed as a percentage of the total number of trees sampled to indicate the frequency of koala usage. Assessment of each tree involves a systematic search for koala scats beneath the tree within a 1 metre (m) radius of the trunk. After approximately two minutes of searching for scats, the base of the trunk is observed for scratches and the crown for koalas (refer Phillips & Callaghan 2011).

The SAT methodology is considered to be an accurate technique for estimating low-density koala populations. Research by Rhodes *et al*. (2015) found koala density in South- East Queensland council areas (excluding areas inland of Ipswich) to be approximately 0.07 koalas/ha based on data collected from 2005 - 2015. Therefore, the SAT survey methodology is considered to provide an accurate determination on koala activity levels in South-East Queensland.

Koala stocking rate scores are calculated using the SAT activity categories taken from the Australian Koala Foundation Koala activity level classification table by Phillips & Callaghan 2011, Table 6.

Table 6. Koala Activity Level Classification (Phillips and Callaghan 2011)

Usage	East Coastal(low)	East Coastal (med-high)	Western (med-high)
Low	<9.5%	<22.5%	<35.8
Moderate	9.5-12.6%	22.5-32.8%	35.8-46.7
High	>12.6%	>32.8	>46.7

2.3.1 Baseline Survey Data

Koala data was collected in 2016 by OWAD Environmental using a koala detection dog. The data collected by OWAD examined occupancy of koalas, showing how much of the property searched contained scats. Of sites searched, 27% contained scats in the northern parcel, and 35% in the southern parcel. Scats were found in both remnant and mature regrowth vegetation.

Additional SAT surveys were conducted in July 2019, showing percentage of trees within single sites where scats were found. Fourteen SATs were conducted at Aroona, across all assessment units in both the northern and southern parcels. Of the surveyed sites, only six contained any koala scat. Of those that did contain scat, the highest activity was recorded at a single site was 16% (i.e. of the 30 trees surveyed at each site, 16% contained scat). The highest activity was recorded in the remnant vegetation and alluvial systems (land zone 3, RE 12.3.3/12.3.7), with limited use across mature regrowth areas.

OMU1

SAT surveys conducted in July 2019 included three remnant areas. All three sites yielded koala occupancy data, with activity from between 3% and 16% at each site, classified as low use under the Est-Coast med-high category.

OMU 2

Results from the 2019 SAT survey showed koala occupancy at 3 out of the 7 sites. Activity at sites where koala scat were recorded ranged from between 3% and 13%.

OMU 3

SAT surveys were conducted on the isolated paddock trees to test koala usage of these areas. No scats were recorded in any of the Category X areas, likely due to the largely scattered nature of the trees and infestation of weeds around the base of food trees.

2.3.2 Management actions and species occurrence

Opportunistic scat surveys were conducted across the reporting period (Map 5).

Koala scat was observed through all of the offset management units, including individual large trees on cleared land. This further demonstrates the importance of these areas within the landscape and the high potential of OMU-3 cleared areas to restore connectivity.

Map 5. Koala occurrence
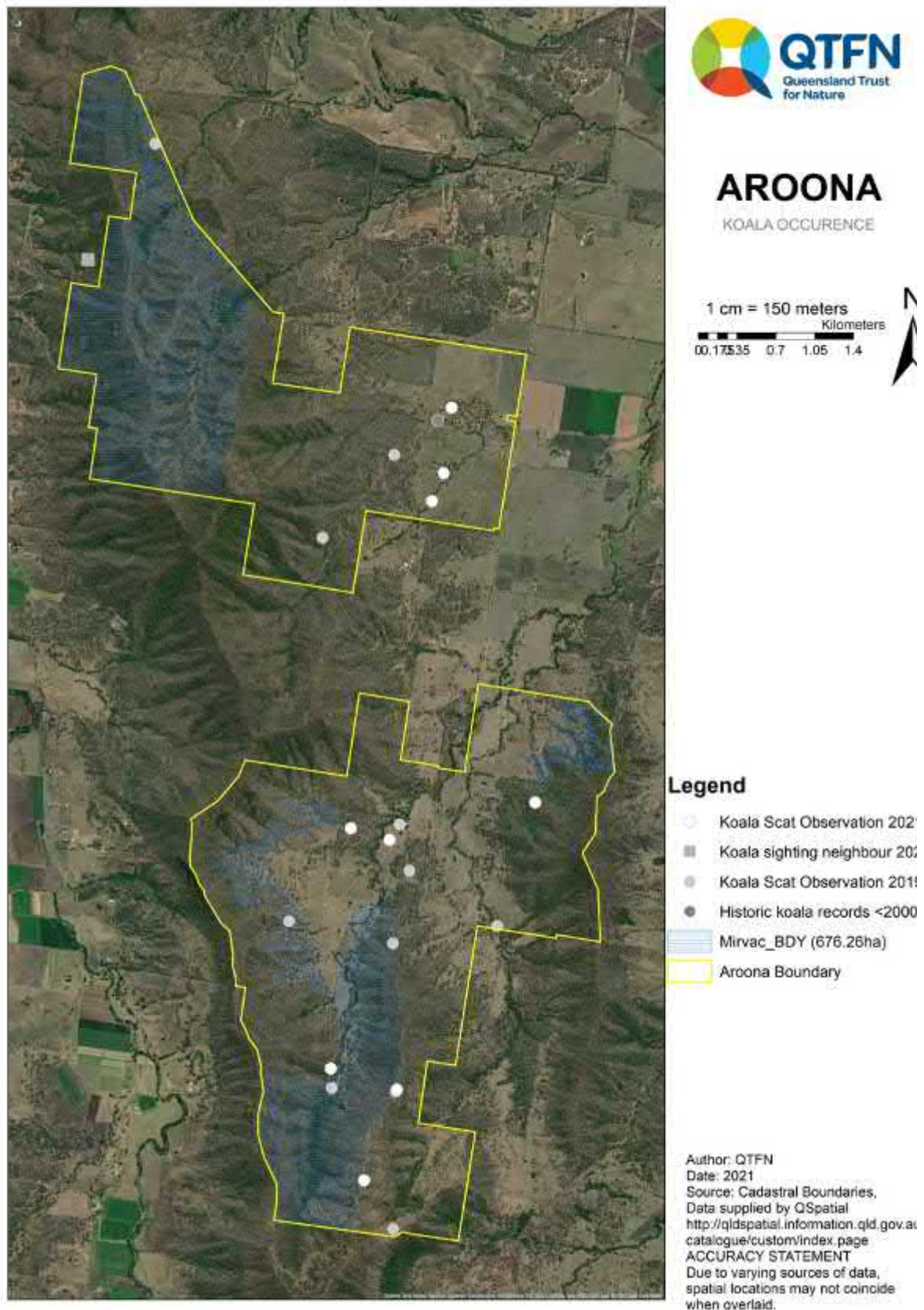
2.4 EXTENT OF WEED COVER

MANAGEMENT ACTION 1

At the commencement of site management, weed extent was be mapped across the property. This will form the basis for the targeted areas for treatment. Monitoring will occur on an annual basis and the extent and abundance of weed cover in OMU-01, OMU-02 and OMU-03 will be measured through the improvement in non-native plant cover, measured through quadrats in Habitat Quality Transects assessments. Milestone surveys in the form of Habitat Quality Transects assessment will measure the success of the weed treatment every 5 years.

Baseline weed assessments were conducted in 2021 and will be conducted annually for the duration of the offset management plan. Permanently marked transects were surveyed according to Nelder *et al* 2015 in a 50 x 10m transect (Map 6). Photo points were recorded at each transect to ensure that the progress of the site could be monitored (Appendix 3).

The target weed species identified as a threatening process to koalas are lantana (*Lantana camara),* broad-leaved pepper (*Schinus terebinthifolius),* Chinese celtis (*Celtis sinensis*) and cat's claw *(Macfadyena unguis-cati)*. Whilst other weeds were measured for overall ecological health, the focus of the weed management is the control and eradication of these woody weeds, as they have the capacity to prevent koala movement and access to food and shelter trees, particularly in riparian corridors.

Weed coverage is recorded and mapped spatially at a one hectare scale of the property (Map 7). Due to the isolate distribution of cat's claw and Chinese elm, these species are not mapped for coverage.

2.4.1 Baseline Survey Data

EXTENT

Lantana is the predominant threat within the offset area, occurring in all transects with coverage up to 100%. Broad-leaved pepper was recorded at over 50% of the transects, with those in riparian environments reaching coverage of 100%. Chinese elm was recorded at 30% of transects, but remained in low coverage below 20%. Cat's claw was not recorded within the offset area, despite occurring on the property. Weed occurrence is presented in Map 6.

COVERAGE

Lantana varies in density across the offset area, present in all offset management units. Broad-leaved pepper is constrained to creek lines and gullies. The coverage of lantana and broad-leaved pepper, the two weed species with the highest spatial coverage are presented in Map 7. Chinese elm and cat's claw were not mapped spatially due to their isolated nature (i.e coverage rarely extending beyond one hectare).
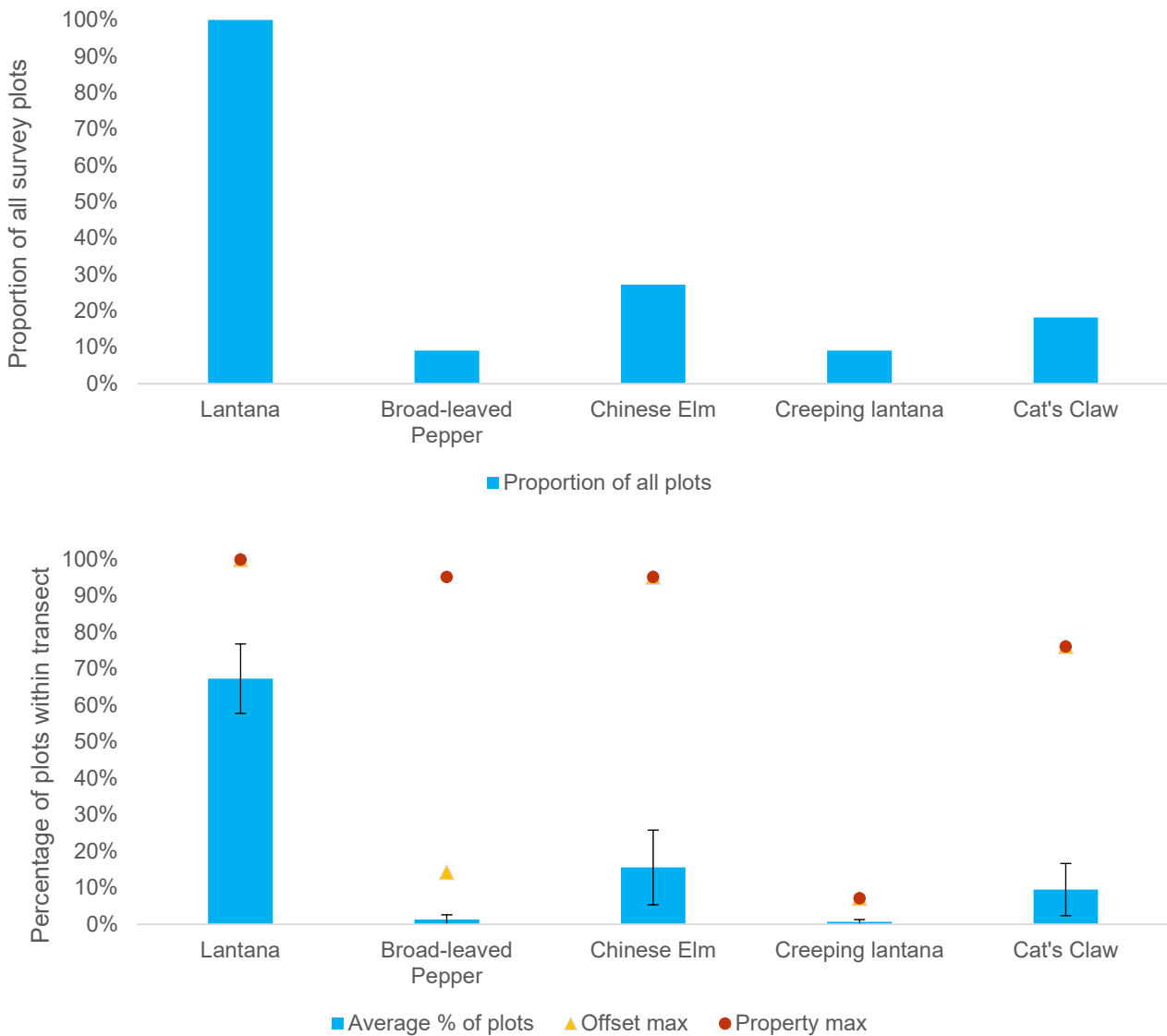
Figure 3. The percentage of the weed transects across EPBC 2016/7817 offset site with weed cover (top), and the average percent coverage of all transects across offset site with maximum coverage across whole of property (blue circle) and offset specific (orange

2.4.2   Management outcomes

The Weed Strategy 2020-2025 outlines the principles and approach to weed management at a property wide scale. Results from this survey have informed the approach for the next five years. A contractor has been engaged to complete weed control in high priority areas targeting lantana, broad leaved pepper and cats' claw in the endangered blue gum alluvial flats (RE12.3.3), and into the foothills.

Map 6. Baseline weed extent across the property, the larger the circle the higher the density within the transect sampled, x= absent.
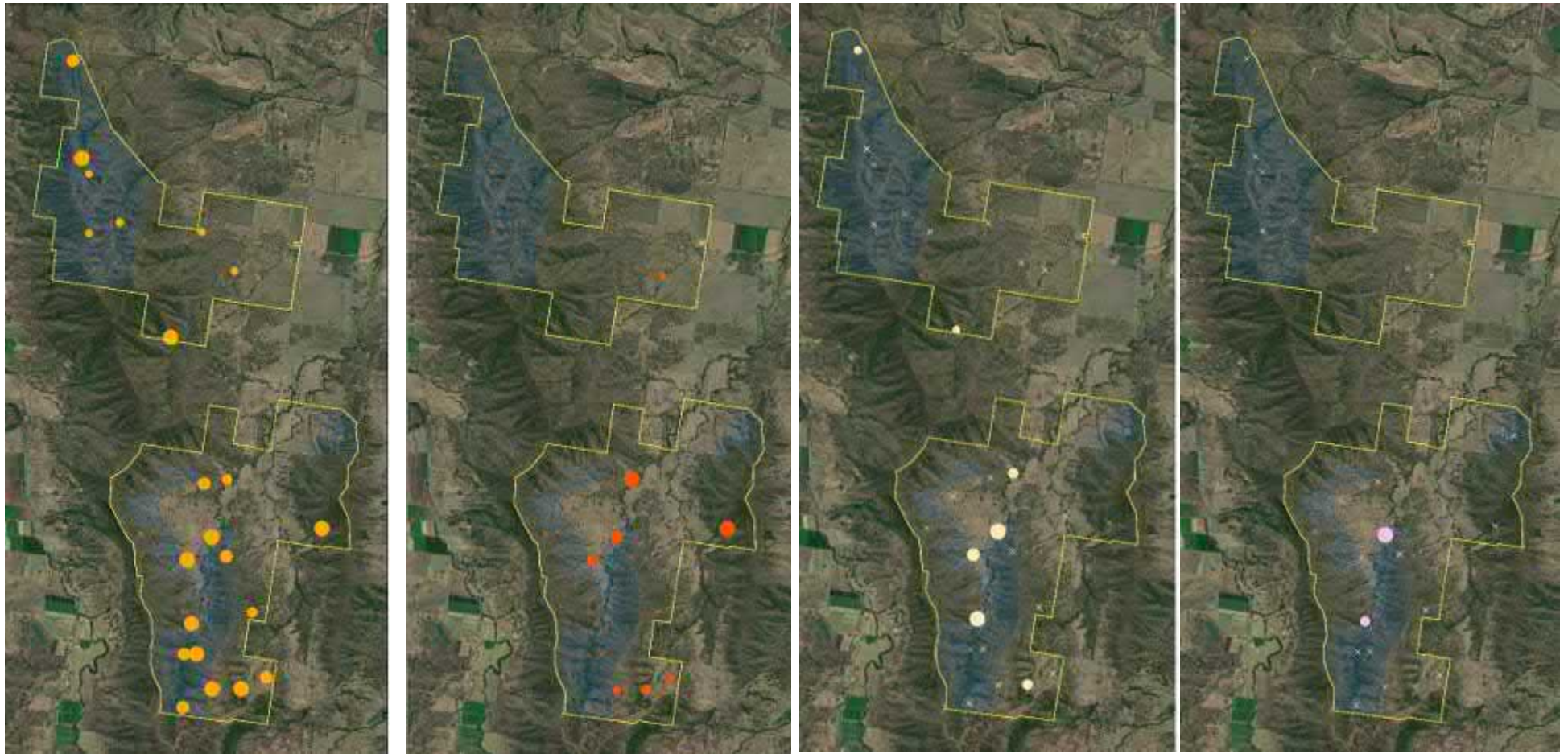
| Lantana | Broad-leaved pepper | Chinese Celtis | Cat's Claw |

Map 7. Baseline weed coverage across the property, darker shades indicate higher density of weeds.

Lantana

Broad-leaved pepper

**note: Chinese elm and cat's claw are in isolated patches not shown in these maps

2.5   NON-NATIVE PREDATORS AND HERBIVORES

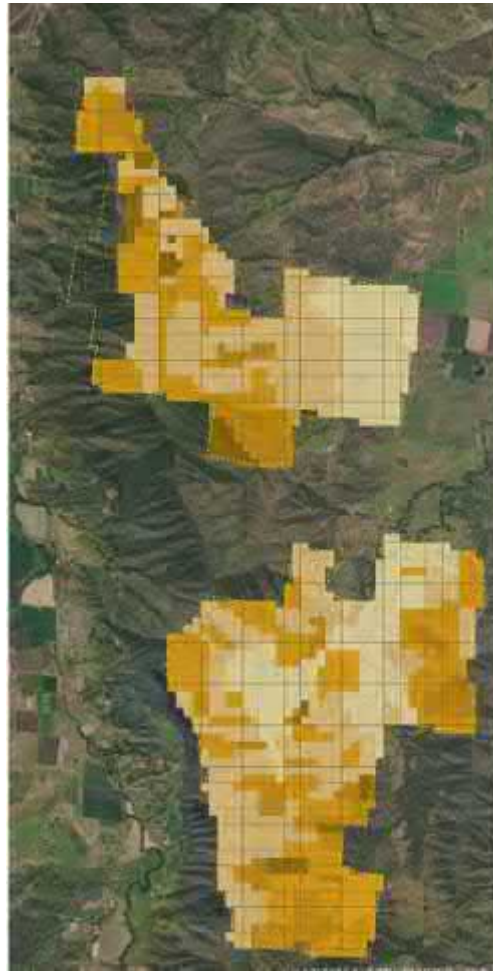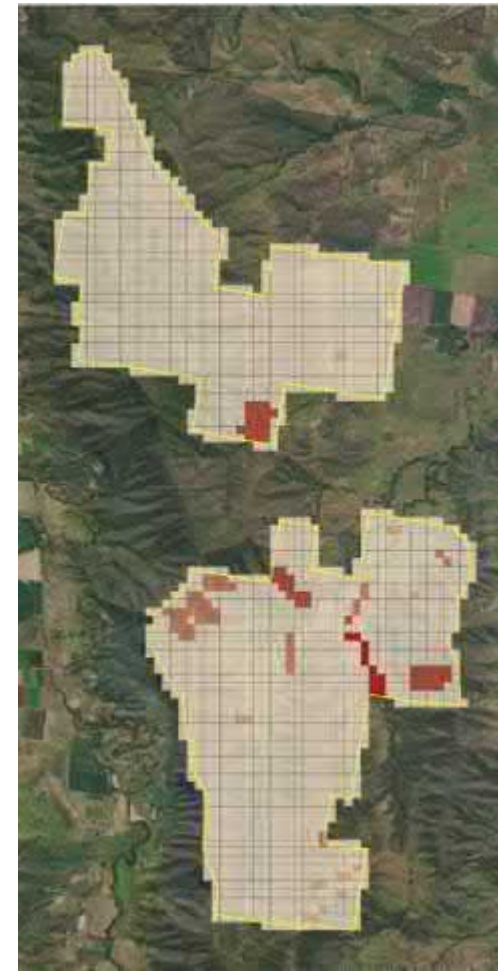**MANAGEMENT ACTION 6**

Wild dogs/dingoes, feral foxes and feral cats are restricted invasive animals under the *Biosecurity Act 2014* (QLD),and do not require specific control measures. It states, "The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive animals under their control". The adaptive predator control measures, rigorous monitoring and coordinated landscape approach that will be implemented at the offset site go far beyond the minimal requirement of reducing the risks associated with invasive animals.

As part of the management program, baseline monitoring will be undertaken on the property and a relative abundance index (RAI) calculated for wild dogs and foxes. Where post control surveys indicate that there has been a recurrence of wild dogs and/or foxes on the site, control measures will be actioned using methods (e.g. controlled shooting and/or trapping) as determined by a pest control professional in consideration of these monitoring results.

Predator home ranges exceed the Aroona Station property area, and the EPBC 2016/7817 offset area within. Therefore, as predator abundance and activity can be influenced by multiple factors including, seasonality, food availability and neighbouring predator control works, it is important to provide context for the surrounding landscape of the offset area.

Predator management on Aroona Station has occurred since 2018. To date, dingoes (*Canis lupus*), foxes (*Vulpes vulpes*) and cats (*Felis catus*) have all been recorded on-site in camera trapping, from visual sightings or from the collection of scats. A property wide scale assessment was conducted to ensure that detection of predator activity is maximised, to reflect the large home ranges, and best inform management actions. Pursuant to the Offset Management Plan, this will best inform the property wide predator control program. Regardless, specific attention will be paid to individuals observed on camera trap stations directly within the offset area.

Table 7. Average foraging range for three target predators ascertained from the literature (Harden 1985; Meek 1999; Meek & Saunders 2000; Molsher et al. 2005; McNeill et al. 2016), and the camera trap stations that therefore assess the RAI of each species within

Species	Radius	Camera stations with territories that overlap EPBC 2016/7817
Dog (*Canis lupus*)	2 to 3km	a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q
Cat (*Felis catus*)	600 to 1km	a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q
Fox (*Vulpes vulpes*)	~900m	a/b/c/d/e/f/g/h/i/j/k/l/m/n/o/p/q

2.5.1   Baseline Survey Data

Feral predator abundance has been monitored on Aroona Station using two methods since 2018: camera trapping and scat searches.

Camera trap set up

The home-ranges of non-native predators; dogs, foxes and cats in both peri-urban and agricultural are presented in Table 7. Operating under this assumption, we placed a network of 16 camera trapping stations that ensured coverage of the entire property (Map 8). Cameras were deployed for a 40-day trapping interval in each season, and all photos were databased, categorised and analysed using Camelot (©WildLabs, 2018), with an independence threshold of 10min.

Camera trapping is performed biannually to account for seasonal variation in predator behaviour. To demonstrate a significant reduction in non-native predator numbers over time within the offset site, the response variable able to be used are discussed below.

Metric 1 –RELATIVE ABUNDANCE INDEX - a relative measure of abundance based on the frequency and duration of time each predator species is recorded on camera i.e. how many are there relative to survey time.

As ascertaining the exact number of individuals from camera trapping is impossible, relative indexes of abundance are a preferred way to ascertain whether the activity level of any given animal has increased or decreased (under the assumption that lower activity implies potentially lower numbers of animals, or at least lower threat of predation upon koala). To assess the activity of introduced predators for this baseline report the Relative Abundance Index (RAI) will be used– a metric calculated by Camelot and exported from the program for each 40-day trapping interval and with an independence threshold of 10minutes.

Statistical inferences for RAI contain no variance element, which limits analysis techniques for testing for a significant departure from baseline. This report will establish confidence limits for changes in predator abundance based on the baseline estimates from the 2019 summer and 2020 winter survey season. This is the season that predates offset commencement and management actions. Therefore, this report will consider any estimate of RAI equal to the upper baseline estimate (± 0.1) as no evidence of change, an estimate beyond this but within the confidence limits as conservative evidence of change (*C. lupus* between 0.4-22, *V. vulpes* 0.1 – 1.6, *F. catus* 0.04 -0.3 and *Sus scrofa* 0.1 – 8.9). Any estimate beyond the upper confidence limits ± the variance (standard deviation) of historic data is considered significant evidence of change. The historic data provides context into what natural fluctuations in predator activity have been seen on the property.

At baseline, RAI estimates for each species and their confidence intervals are summarised in Figure 4.

Metric 2 –OCCUPANCY – the proportion of camera trapping stations at which a predator was detected i.e. how many locations that had evidence of predators in the area.

This metric focused more on the spatial concentration of predators rather than their number, and whether the hypothetical home range of any captured animal overlaps with the EPBC2016/7817 offset area.

At baseline, occupancy estimates for each species are summarised in Figure 4 and Map 8.

Species observations

Climate and weather conditions influence the occupancy of feral animals. During dry weather periods, animals display a lower occupancy score as they (and their prey) are constrained to water sources. During wet weather periods, the occupancy score is likely to increase as the animals find prey across the landscape. This was evident in the winter of 2021 compared to the dry summer of 2019. Historic data provides an advantage to calculating variance with baseline estimates, as it encapsulates natural variation expected by the local population.

Wild dog and fox numbers have fluctuated over time, but always been present within the property. Wild dog numbers have decreased from the baseline threshold and remain at a stable occupancy level. Camera trap footage demonstrated isolate individuals and no large packs in the winter of 2021.

Fox numbers and occupancy has increased slightly in the winter of 2021, but remain below the threshold. A higher abundance in winter is typical for foxes, in comparison to wild dogs.

One cat was observed in the winter of 2019 and 2020, and two in 2021. Occupancy data shows that across the property, feral cats were observed in only riparian lowland habitats, wild dogs and foxes were observed across the whole property.

Pigs (*Sus scrofa*) have also been observed in the property. Pig abundance and occupancy fluctuates with weather conditions. The year was typical of above average rainfall, attracting pigs to lowland alluvial flats, and providing ample food source. Although the relative abundance of pigs exceeds the baseline threshold, occupancy was constrained to camera traps located near water points. There was minimal evidence of pigs in the revegetation area and no disturbance observed. Management action will be taken.
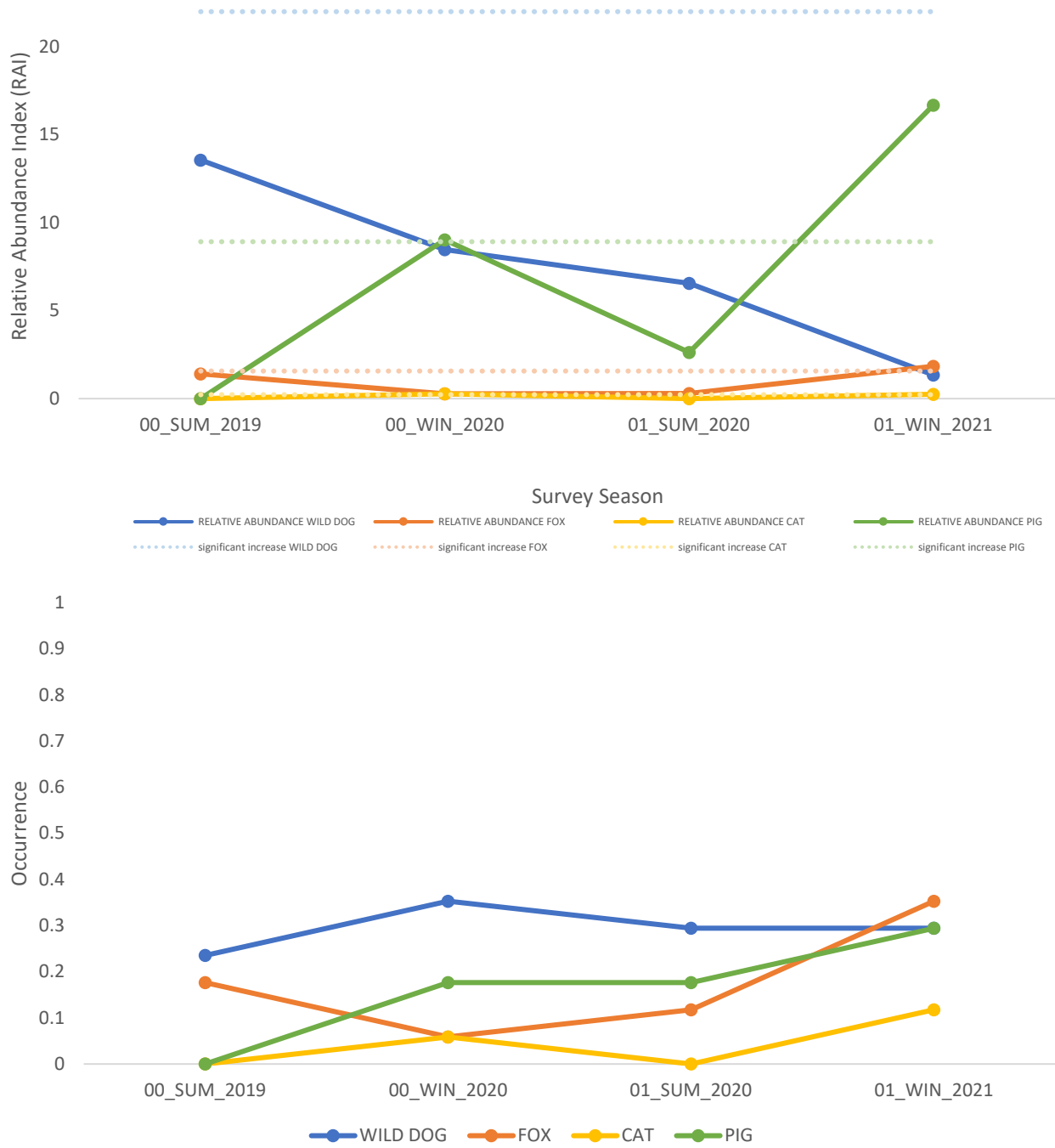
Figure 4. Relative Abundance Index (RAI) and Occupancy of predators across camera traps, and confidence limit threshold to show future deviations from the baseline.

2.5.2 Supplementary scat searches

Throughout the year, predator scat is collected opportunistically across the property. In addition to opportunistic scat collection, scat is collected during bi-monthly traverses of the Aroona Station property, roadsides and creeks.

Scats are GPS located and collected for laboratory dietary analysis. Scat identification and dietary analysis gives an indication of species and predation trends over time, but is not considered a metric in relation to accurately monitoring predator abundance.

Predator scat analysis

To date, predator scat analysis shows no presence of koala in any predators diet on Aroona Station. In the past four years, macropods and wallabies have been the main fauna group present in predator scat, followed by small native mammals, birds and reptiles. A number of non-native mammals were found in scat including goat and pigs since 2017.

QTFN have been actively collecting and analysing predator scat on Aroona Station since 2018 (Figure 5).

Predator scats continue to be found across the Aroona Station site and within the EPBC 2016/7817 offset area (Map 8). Although both foxes and dogs remain on the site, predatory scats collected during this reporting period suggest that neither predator is consuming koala, and the diets of most individuals is composed of macropods and vegetation (Table 8).
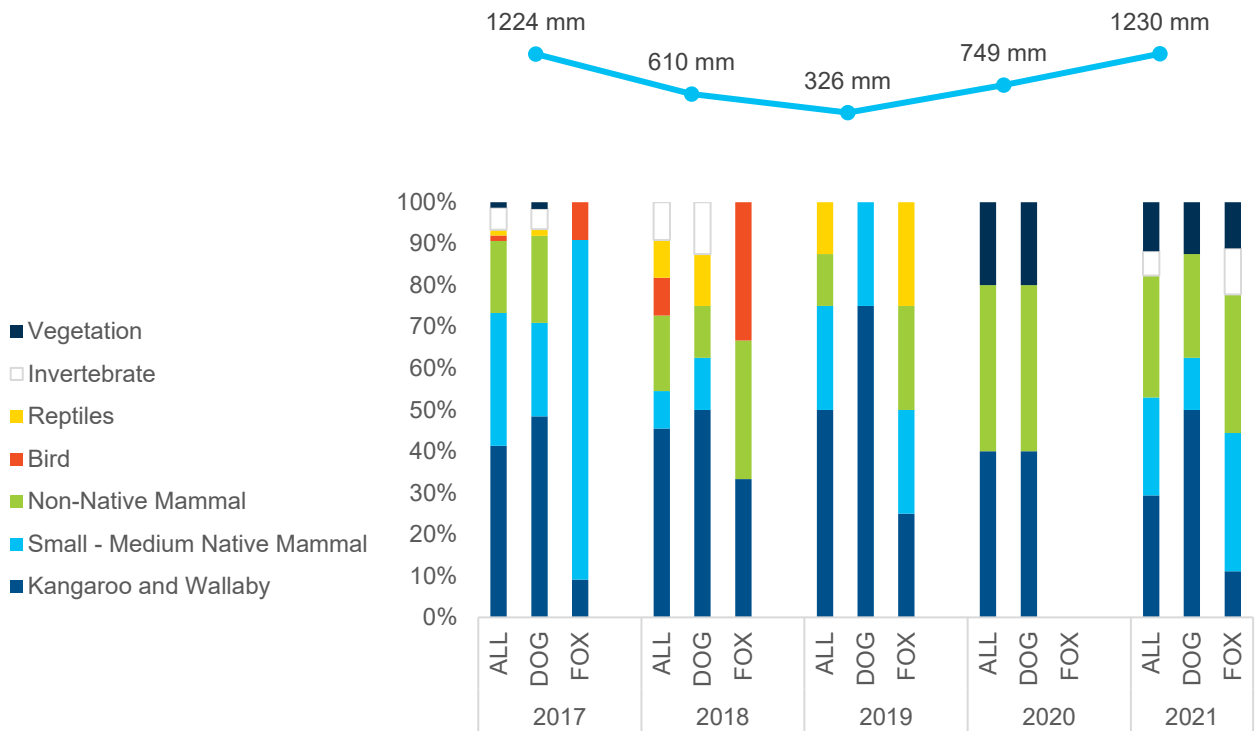

Figure 5 Long term predator diet analysis, percentage of prey type found in scat across years with annual average rainfall (points). i.e. in 2019, all reptile prey was only recorded in fox scat. No fox scats collected in 2020.

Table 8. The types of prey item identified from fox and dog scat collected within the site from June 2020 to April 2021, sorted by the frequency of individual predators whose scat contained each prey type (e.g. Eastern Grey Kangaroo were found in 11% of the 9 scats collected.

Species name	Common name	Frequency
Wallabia bicolor	Swamp wallaby	0.33
Macropus giganteus	Eastern Grey Kangaroo	0.11
Macropus robustus	Eastern Euro	0.11
Isoodon macrourus	Northern brown bandicoot	0.33
Pseudocheirus peregrinus	Common ringtail possum	0.11
	Deer	0.11
Mus musculus	House mouse	0.33
Rattus rattus	Rat	0.11
	Insect	0.11
	Vegetation	0.22

2.5.3   Management outcomes

As of Summer 2020, a contractor has been engaged. Biannual monitoring using camera traps will continue, and the feral animal contractor will target the creek line within the offset area that regularly captures predators and pigs. Management will include trapping seasons and ad hoc removal when required.

The inherent nature of controlling introduced predators over an unfenced site means some years will see an increase in numbers, regardless of measures put in place to control them.

The Little Liverpool Range Initiative held a pest management workshop for landholders in the Range. Landholders have the option to join the range wide monitoring program and led by leading research Prof. Peter Murray and pest fauna contractors.

## 2.6   KOALA MORTALITIES ATTRIBUTABLE TO NON-NATIVE PREDATORS

MANAGEMENT ACTION 6

No koala mortalities caused by non-native predators was recorded in the last monitoring season.

2.6.1   Management outcomes

An inventory is kept for any incidences relating to koala mortalities attributable to non-native predators.

Map 8. Non-native predators and herbivores monitoring and dispersal distances
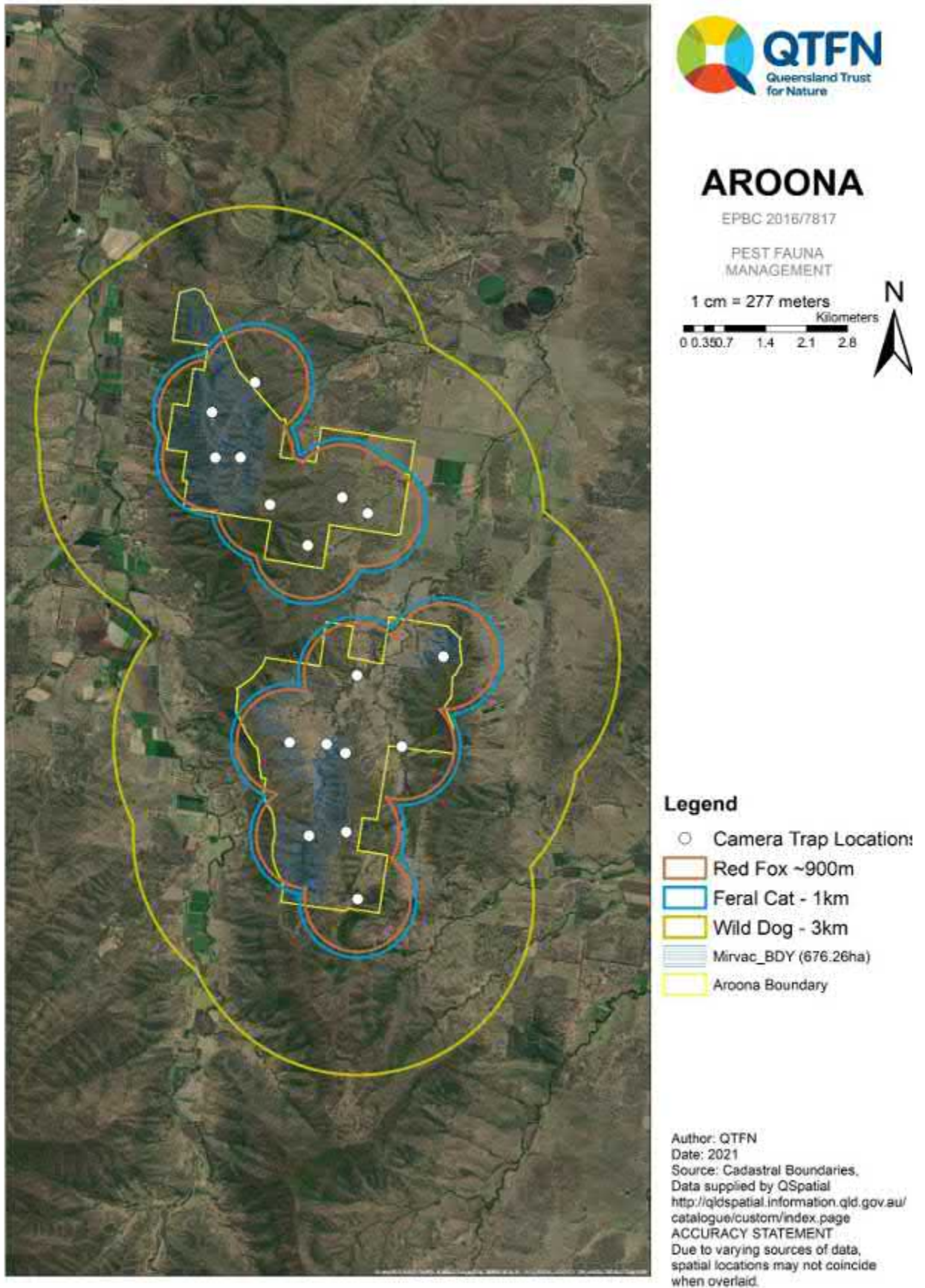
2.7   STOCK MANAGEMENT

MANAGEMENT ACTION 9

2.7.1   Cattle grazing monitoring

Cattle grazing for the purpose of fuel hazard management was conducted in line with the decision matrix provided in the Offset Management Plan.

Fuel hazard assessments demonstrated that the near surface (grasses) fuel layer contributed the greatest to the high, very high and extreme overall ratings. The biomass in this layer is a significant food source for cattle, before it cures and contributes further to fuel loads. When managed correctly, it can be reduced without impact on native recruitment.

Figure 6. Near surface fuel load comparison, left = offset area without cattle, right = not offset area with cattle.

- Frequency, duration and location of grazing, and stock density for each grazing period;

Where fuel hazard assessments scored high and very high, cattle were moved into offset areas until the fuel hazard was reduced. Only one grazing period was conducted between fuel hazard assessments. In early 2021, cattle were rotated across paddock as single mobs to reduce initial fuel loads and assist site preparation of fence construction. A summary is provided in Table 9.

- The timing and frequency of monitoring undertaken; and

Fuel hazard assessments were conducted bi-annually (January and August), Table 9. The year 2021 has experienced above average rainfall contributing to growth in the near surface layer, reflected in the second assessment. Higher fuel hazard ratings are attributed to the near surface fuel layer.

- Details of any injury or mortality of individual koalas;

No evidence of koala injury or mortality caused by cattle grazing was recorded.

- Details of corrective actions already undertaken and/or proposed to be undertaken in the event of injury or mortality of individual Koalas as a result of grazing, and/or if monitoring demonstrates the outcomes under 15-18 are not achievable.

In the event that it occurs in the future, cattle will be removed from the offset area and the cause of interaction will be investigated.

If target vegetation composition is negatively affected by cattle grazing, implement adaptive management actions which may include: additional cattle exclusion areas, additional re-vegetation / rehabilitation in areas negatively affected by cattle grazing, reduce intensity of grazing for fuel reduction purposes, and exclude cattle from the offset area.

2.7.2   Management outcomes

Fauna friendly stock exclusion fencing has been installed around Operational Management Unit 3 areas where existing fences did not sufficiently exclude cattle. A local contractor was engaged to complete the works, whom demonstrated professionalism and high quality services. Example of fencing can be observed in Figure 7.

An ecological burn was planned in the mountain paddock; however, due to weather conditions the burn was unable to be conducted. Cattle were introduced to reduce fuel loads as per the flowchart.

A trial of satellite imagery is being conducted to assess the potential to assist in pasture monitoring.

No wildlife incidents or mortality have been recorded with the newly installed fences.

Fuel hazard assessments will continue to be conducted.

Figure 7. Example of cattle exclusion fencing

Table 9. Cattle management summary

Paddock	January FHA						August FHA					
	FHA	Cattle Hazard Reduction Triggered	Cattle Moved In	Cattle Moved Out	Head of Cattle	Days grazing	FHA	Cattle Hazard Reduction Triggered	Cattle Moved In	Cattle Moved Out	Head of Cattle	Days grazing
Basils	H	Yes	15/03/2021	30/04/2021	111	46	H	Yes				0
	M	No	15/03/2021	30/04/2021	111	46	H	Yes				0
Desjardin	H	Yes				0	M	No				0
Gerhke	M	No	18/06/2021	12/08/2021	111	55	H	Yes	20/09/2021	4/12/2021	30	75
	H	Yes	18/06/2021	12/08/2021	111	55	VH	Yes	20/09/2021	4/12/2021	30	75
Meiers	M	No				0	H	Yes				0
Mountain	H	Yes				0	H	Yes	9/08/2021	10/10/2021	72	62
	VH	Yes				0	VH	Yes	9/08/2021	10/10/2021	72	62
	M	No				0	H	Yes	9/08/2021	10/10/2021	72	62
	M	No				0	M	No	9/08/2021	10/10/2021	72	62
	VH	Yes				0	VH	Yes	9/08/2021	10/10/2021	72	62
	H	Yes				0	H	Yes	9/08/2021	10/10/2021	72	62
	M	No				0	VH	Yes	9/08/2021	10/10/2021	72	62
Mt Grey	M	No				0	H	Yes				0
Sawmill	M	No				0	M	No				0
Spring	M	No				0	H	Yes	11/10/2021	15/11/2021	36	35
Wensley	H	Yes	30/04/2021	18/06/2021	111	49	H	Yes				0

2.8   FIRE MANAGEMENT

MANAGEMENT ACTION 2 and 3

The threats to koalas from fire was addressed in accordance with OMP by referring to the 'Aroona Station Fire Management Plan'.

The Aroona Station Fire Management Plan divides the property into Fire Management Zones: Land Management Zones, Exclusion Zones and Asset Protection Zones. Within the Land Management Zones, the landscape is broken up into subzones or Fire Management Areas(FMAs) according to practicable containment lines. The Fire Management plan details burning intervals recommended for these FMAs.

2.8.1   Management outcomes

Two ecological burns were conducted on Aroona Station, one inside the offset area (Map 9). The burn conducted within the offset area was undertaken with the direct seeding revegetation, outlined in section 2.1 above.

The burn conducted outside the offset area was a cultural burn conducted by Firesticks Alliance and was characteristic of a cool, mosaic burn (Figure 8).

Fuel hazard assessments demonstrate moderate to very high fuel loads, with approximately 50% exceeding a 'High' hazard score. Ratings were variable within and across offset management areas.

Fire break trails were inspected and maintained at regular intervals.

Figure 8 Ecological burn as part of direct seeding revegetation, noting patchiness and low intensity.

Map 9. Fire management within offset area.
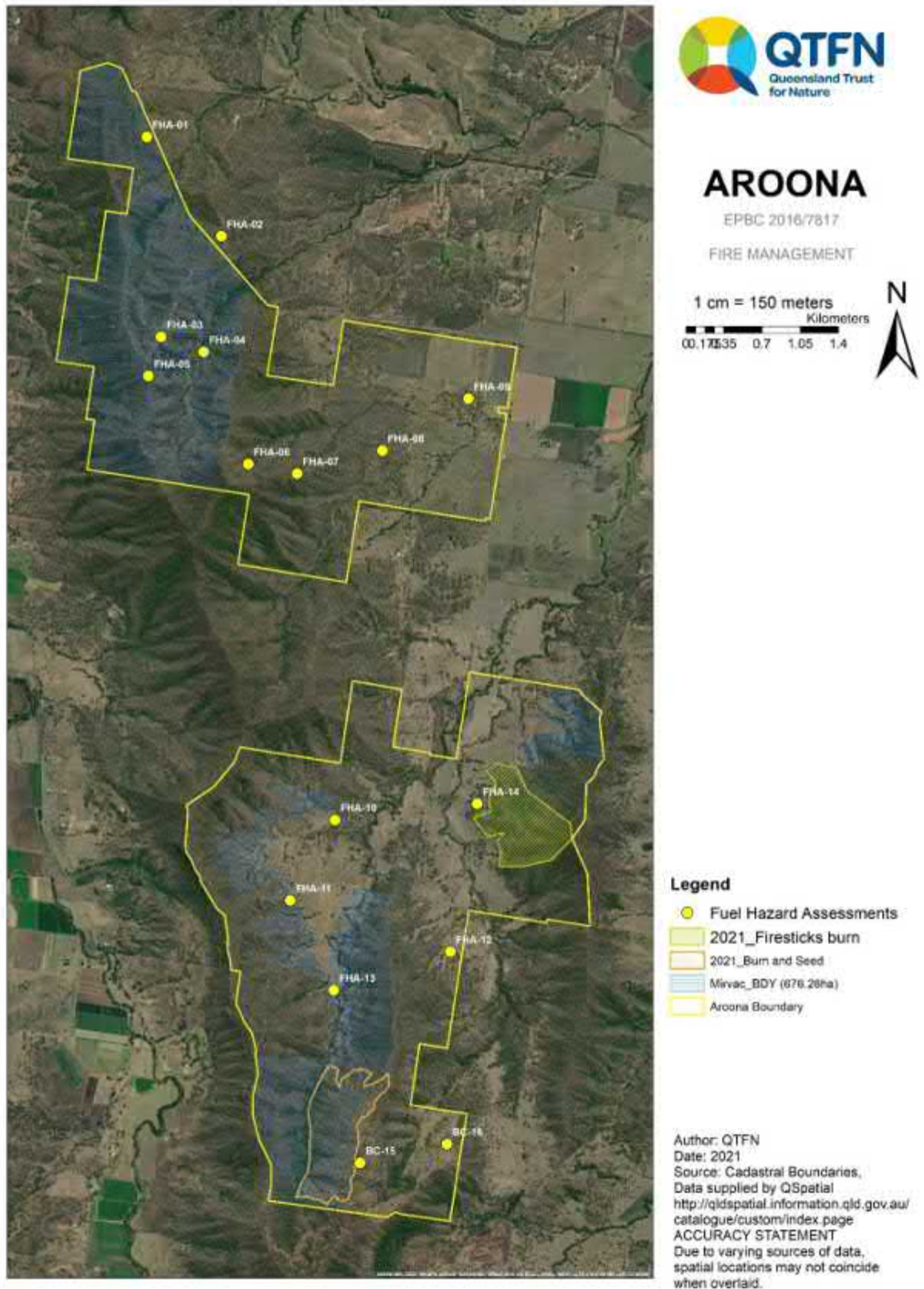
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APPENDIX

Appendix 1. Koala Habitat Quality – Operational Management Units

		OMU-1			OMU-2					OMU-3		
		AU-02	AU-03	AU-05	AU-01	AU-04	AU-06	AU-07	AU-08	AU-09	AU-11	AU-12
		12.8.9	12.8.16	12.8.17	12.9-10.7	12.8.16	12.8.17	12.3.3	12.3.7			
		Remnant	Remnant	Remnant	Regrowth	Regrowth	Regrowth	Regrowth	Regrowth	Cleared	Cleared	Cleared
		Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score
Site Condition (30 %)	Recruitment of woody perennial species	5	5	5	5	5	5	3	0	0	0	0
	Native plant species richness - trees	5	5	5	5	5	2.5	5	5	0	0	0
	Native plant species richness - shrubs	2.5	0	0	0	2.5	2.5	0	0	0	0	0
	Native plant species richness - grasses	5	5	2.5	5	5	2.5	2.5	2.5	0	0	0
	Native plant species richness - forbs	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0	0	0
	Tree canopy height	4	5	4	3	4	3	4	5	0	0	0
	Tree canopy cover	5	5	5	2.5	5	2.5	5	5	0	0	0
	Shrub canopy cover	5	3	3	2.5	5	2.5	5	5	0	0	0
	Native perennial grass cover	1	1	5	3	5	3	3	5	0	0	0
	Organic litter	5	5	5	5	5	5	5	3	0	0	0
	Large trees	5	15	15	5	5	0	10	5	0	0	0

	Coarse woody debris	2	5	5	2	2	2	2	0	0	0	0
	Weed cover	3	3	3	3	3	3	3	3	3	3	3
	Quality and availability of food and foraging habitat	5	10	10	5	5	5	5	5	1	1	1
	Quality and availability of shelter	5	10	10	5	5	5	5	5	1	1	1
	Site condition score	**60**	**79.5**	**80**	**54**	**62**	**46.5**	**58**	**46**	**5**	**5**	**5**
	Max score	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
	Site condition score (out of 3)	**1.80**	**2.39**	**2.40**	**1.62**	**1.86**	**1.40**	**1.74**	**1.38**	**0.15**	**0.15**	**0.15**
Site Context (30 %)	Size of the patch	10	10	10	10	10	10	10	10	10	10	10
	Connectedness	4	4	4	4	4	4	4	4	4	4	4
	Context	4	4	4	4	4	4	4	4	4	4	4
	Ecological corridors	6	6	6	6	6	6	6	6	6	6	6
	Role of site location to species overall population in the State	4	4	4	4	4	4	4	4	4	4	4
	Threats to the species	7	7	7	7	7	7	7	7	1	1	1
	Species mobility capacity	7	7	7	7	7	7	7	7	1	1	1
	Site context score	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**30**	**30**	**30**
	Max score	**56**	**56**	**56**	**56**	**56**	**56**	**56**	**56**	**56**	**56**	**56**

	Site context score (out of 3)	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**	**2.25**	**1.61**	**1.61**	**1.61**
Species stocking rate (40 %)	Presence detected on or adjacent to site	10	10	10	10	10	10	10	10	5	5	5
	Species usage of the site	15	15	15	15	15	15	15	15	0	0	0
	Approximate density	10	10	10	10	10	10	10	10	0	0	0
	Role/importance of species population on site	10	10	10	10	10	10	10	10	0	0	0
	Species stocking rate score	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**5**	**5**	**5**
	Species stocking rate score (out of 4)	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**0.29**	**0.29**	**0.29**
	Total (out of 10)	6.62	7.21	7.22	6.44	6.68	6.22	6.56	6.20	2.04	2.04	2.04
	OMU Average (rounded to nearest whole number)	7.198 (rounded to 7)			6.496 (rounded to 6)					2.043 (rounded to 2)		

Appendix 2. GHFF Habitat Quality – Operation Management Units

		OMU-1			OMU-2					OMU-3		
		AU-02	AU-03	AU-05	AU-01	AU-04	AU-06	AU-07	AU-08	AU-09	AU-11	AU-12
		12.8.9	12.8.16	12.8.17	12.9-10.7	12.8.16	12.8.17	12.3.3	12.3.7			
		Remnant	Remnant	Remnant	Regrowth	Regrowth	Regrowth	Regrowth	Regrowth	Cleared	Cleared	Cleared
		Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score	Average Score
Site Condition (40 %)	Vegetation Condition	20	20	20	10	10	10	10	10	5	5	5
	Species Richness	10	20	10	10	20	10	10	10	0	0	0
	Flower Score	8	8	8	8	8	8	8	8	0	0	0
	Timing of Biological Shortages	10	10	10	10	10	10	10	10	0	0	0
	Quality of Foraging Habitat	5	5	5	5	5	5	5	5	0	0	0
	Non-native Plant Cover	5	5	5	5	5	5	5	5	5	5	5
	Site condition score	**58**	**68**	**58**	**48**	**58**	**48**	**48**	**48**	**10**	**10**	**10**
	Max score	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
	Site condition score (out of 3)	**2.32**	**2.32**	**2.32**	**1.92**	**2.32**	**1.92**	**1.92**	**1.92**	**0.40**	**0.4**	**0.4**
Site Context (30%)	Size of the patch	10	10	10	10	10	10	10	10	10	10	10
	Connectedness	3	3	3	3	3	3	3	3	3	3	3
	Context	6	6	6	6	6	6	6	6	6	6	6

	Ecological corridors	10	10	10	10	10	10	10	10	10	1	1
	Role of site location to species overall population in the State	5	5	5	5	5	5	5	5	5	5	5
	Threats to the species	5	5	5	5	5	5	5	5	1	1	1
	Site context score	**39**	**39**	**39**	**39**	**39**	**39**	**39**	**39**	**35**	**35**	**35**
	Max score	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**
	Site context score (out of 3)	**1.95**	**1.95**	**1.95**	**1.95**	**1.95**	**1.95**	**1.95**	**1.95**	**1.75**	**1.75**	**1.75**
Species stocking rate (30%)	GHFF foraging large tree density	5	15	15	5	5	0	10	5	0	0	0
	Species stocking rate score	5	15	15	5	5	0	10	5	0	0	0
	Max score	**150**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
	Species stocking rate score (out of 3)	**1.0**	**3.0**	**3.0**	**1.0**	**1.0**	**0**	**2.0**	**1.0**	**0**	**0**	**0**
	Total (out of 10)	5.27	7.67	7.27	4.87	5.27	3.87	5.87	4.87	2.15	2.15	2.15
	OMU Average (rounded to nearest whole number)	7.55 (rounded to 8)			4.74 (rounded to 5)					2.15 (rounded to 2)		

Appendix 3. Weed Transect Monitoring Photos

Transect #4

Transect #6

Transect #7

Transect #8

Transect #BC03

Transect #BC04

Transect #BC05

Transect #BC06

Transect #13

Transect #BC20

Transect #BC22

Appendix 4. Images from wildlife monitoring cameras

Dogs – *Canis lupus*

| Summer | Winter |

Fox – *Vulpes vulpes*

| Summer | Winter |

Cat – *Felis catus*

None recorded

| Summer | Winter |

Pig – *Sus scrofa*

Summer

Winter