Koala
Monitoring Program

Yarrabilba UDA

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1. Background

The Yarrabilba Priority Development Area (PDA) is approximately 2,200ha, of which 2,015ha is controlled by Lend Lease Communities (Yarrabilba) Pty Ltd. It is expected that the Yarrabilba project will have a development life of approximately 30 to 35 years.

Within this report, the Lend Lease component of the Yarrabilba PDA is referred to as the site (see **Figure 2-1**).

The site has been subject to numerous levels of planning and assessment to date, which have involved consideration of the impacts of urban development and required mitigation including the establishment of conservation zones and fauna corridors on site (e.g. Yurrah 2004; Chenoweth 2006; GHD 2010; and Carrick 2010). That process has been informed by numerous ecological studies since 2002 and is reviewed in Austecology (2012a).

The resultant long-term master-planned development incorporates an extensive network of dedicated open space (in excess of 25% of the site), of which a significant component is dedicated to the conservation of habitat for Koala *Phascolarctos cinereus*.

A Koala Management Plan (KMP) has been developed and identifies management strategies in respect to the koala, to inform the future and progressive development of the site (Austecology 2012b). The KMP was submitted as part of the information supporting the referral of the proposed action under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act*.

The protection, rehabilitation and expansion of habitat for koalas on the site is subject to an approval (with conditions) made under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* – EPBC 2013/6791 Approval dated 13 November 2014.

Condition 6 of the EPBC 2013/6791 Approval required the protection and management of 195ha of land to offset the impact of clearing 55 hectares of *habitat critical to the survival of the koala.* The offset areas (see **Figure 2-1**) form part of a wider network of dedicated open space which is to be protected and rehabilitated in accordance with the Koala Management Plan (Austecology 2012b) and Fauna Corridor Infrastructure Master Plan (Natura 2012).

An Offset Management Plan (OMP) was prepared in response to Condition 7 of the EPBC 2013/6791 Approval. The majority of the OMP focuses on strategies for the protection and rehabilitation of koala habitat values (see Austecology 2015).

Condition 1b of the EPBC 2013/6791 Approval refers back to commitments provided in the approved Koala Management Plan in respect to the *Development of a Koala & Habitat Monitoring Program (KHMP).*

2. Scope of Works

This plan has been prepared to respond to Condition 1b the EPBC 2013/6791 Approval, i.e.

> *Development of a Koala & Habitat Monitoring Program (KHMP). A key component of developing the KHMP is the design and implementation of a 5-year koala habitat monitoring program to establish basic ecological benchmarks[1] and to monitor initial responses of site's Koalas to development/implementation of management strategies. At conclusion, a comprehensive review will be implemented to determine successes and/or implementation of adaptive management requirements.*.

This plan focuses on strategies to monitor use of the site by koalas, such as movement patterns and home range sizes. This plan does not address strategies to monitor the characteristics of koala habitat, such as condition, extent, rehabilitation, etc. Monitoring strategies related to habitat condition and extent are addressed in detail within the following:

- the approved *Offset Management Plan* (OMP) for koala habitat offsets under the Commonwealth's EPBC 2013/6791 Approval (see Austecology 2015); and
- the approved *Habitat Rehabilitation Management Plan* (HRMP) for the remainder of the open space and conservation network on the site which currently supports, or is planned to support, habitat for koalas (see Natura 2015).

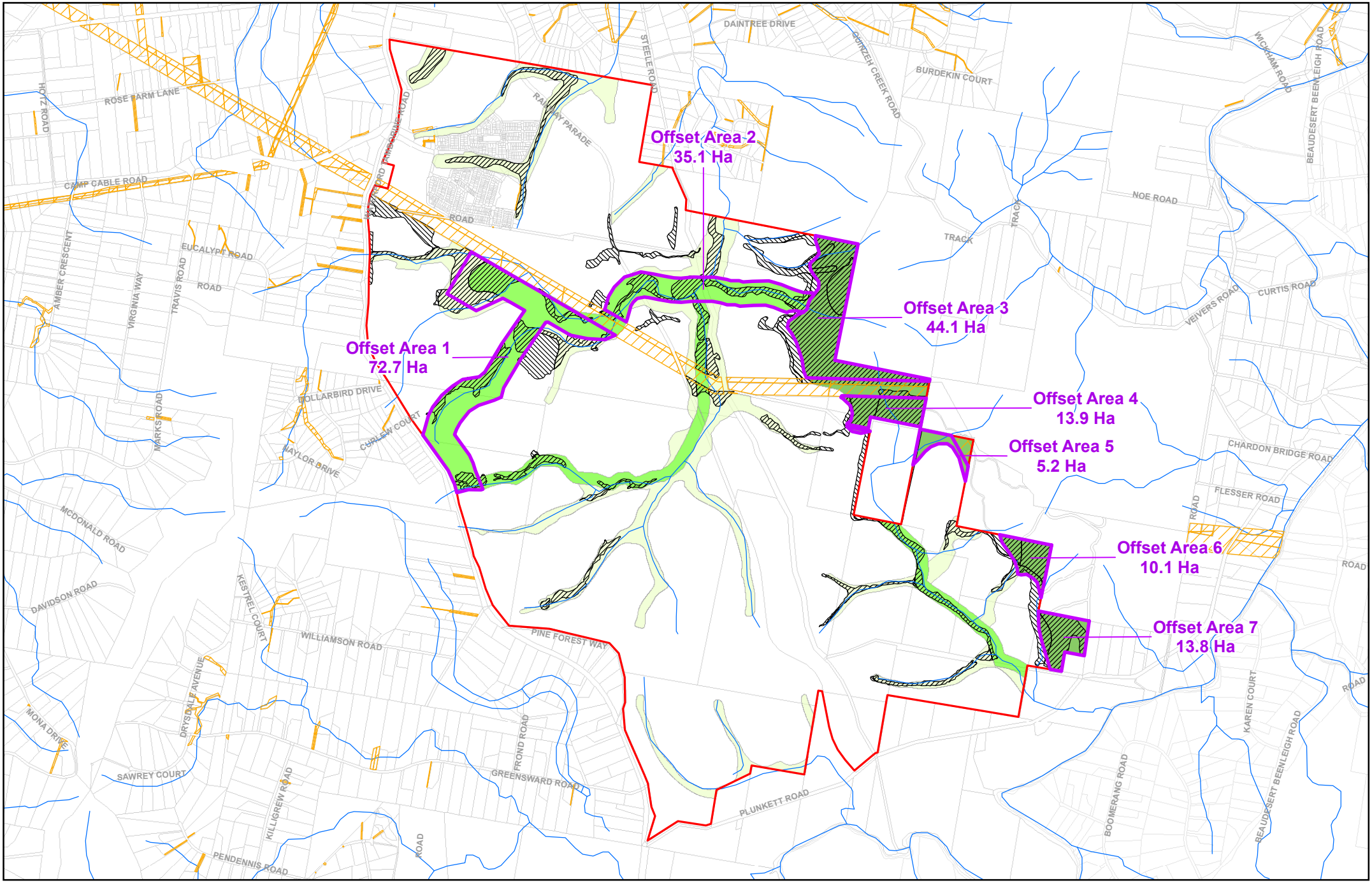
Likewise, plan does not address strategies to monitor threats to Koala usage of the site, such as dogs, and infrastructure constraints to movement. These are to be addressed through the OMP and HRMP.

The OMP and HRMP and the work arising from those plans should be considered along with this koala monitoring plan as the set of key deliverables in responding to Condition 1b the EPBC 2013/6791 Approval.

This plan outlines a monitoring program that addresses the most pressing gaps in our knowledge about the local koala population on the site. This document outlines a basic monitoring program but one which will provide a scientific basis to inform potential management actions, identify future research priorities, and guide conservation measures aimed at ensuring the long-term persistence of koalas at the site.

It is intended that this document will be reviewed and revised where required on the basis of a greater understanding of koala issues as they emerge. This is in-keeping with an adaptive management approach.

[1] *Parameters to include determination of Koala density, home range sizes, seasonal dietary patterns, and movement patterns.*



austecology

Source:	Watercourses: Department of Environment and Resource Management, VMA Queensland Regrowth Other Watercourses Version 2.1 Cadastral Boundaries / Department of Natural Resources and Mines 2014 Corridors and Assessable Koala Habitat vegetation layers supplied by: Austecology 2014 Offset requirement: Lend Lease 2014
Disclaimer:	No warranty is given in relation to the data (including accuracy, reliability, completeness, currency or suitability) and no liability is accepted (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.
File:	File: Yarrabilba-OffsetMP-Fig2-1-Offset-Area-Descriptions-150204 Date: 4/02/2015

0 490 980 1,470 1,960
Meters
A4 Scale 1:40,000
Coordinate System: GDA 1994 MGA Zone 56 Projection: Transverse Mercator

- Yarrabilba Priority Development Area
- Watercourse
- Yarrabilba Offset Requirement under EPBC Act - 195ha
- Easements
- Greenspace Corridor
- Fauna Corridor
- Environment Protection

Assessable Koala Habitat
- To be protected and managed
- To be cleared

Figure 1-1:

Areas subject to Koala Monitoring

3. Aims and Objectives

Whilst the presence of koalas on the site has been confirmed, there are many aspects of the health, movement and general ecology of koalas at the site which are yet to be examined. A greater understanding of these will be highly informative for the long-term management of koalas at the site throughout the various phases of development.

This document outlines a three-year monitoring program that addresses the abovementioned gaps in our knowledge about the local koala population on the site. This document outlines a basic monitoring program which will provide a scientific basis to inform potential management actions, identify future research priorities, and guide conservation measures intended to support the long-term persistence of koalas on the site.

The aims of the Koala Monitoring Program include:

1. Examine koala home ranges and habitat use across the site, with a key focus on the Fauna Corridor and EPBCA Offset Areas.

2. Gain an understanding of the health of koalas at the site, especially the level of chlamydial infection which can be a major contributor to population decline if not managed appropriately.

3. Assess the diet of koalas at the site, to inform habitat restoration efforts and the identification of core habitat areas.

4. Conduct an assessment of the genetic diversity and health of koalas at the site using collected tissue samples.

5. Build on our understanding of the general ecology of koalas on the site, such as their reproductive output and population demographics.

4. Research Methodology

To support the aforementioned aims, the Koala Monitoring Program will comprise of three components, i.e.:

1. *Koala Capture / Monitoring Events* - Fieldwork which primarily focus on the capture of koalas for the purpose of health assessments and to tag and/or attach monitoring collars.

2. *Koala Monitoring Events* - Fieldwork to track koalas in order to assess condition and collect information on tree species preferences.

3. *Koala Population Survey Events* – Field events to provided a systematic survey of koala abundance and distribution on the site.

4.1. Koala Capture / Monitoring Events

Koala home range sizes are known to vary considerably and are potentially influenced by habitat quality, season, koala density and sex. The population dynamics of koalas may also be impacted by disease (e.g. chlamydial infection) which can cause irreversible infertility in females and lead to death in severe cases. This component of the program is designed to provide information to assess these issues on the site.

This component of the program will involve fieldwork to catch, examine and tag selected koalas for monitoring purposes. This work will target koalas in areas of greatest interest, such as the Fauna Corridor and EPBCA Offset Areas 1, 2 and 3.

When a koala is located in the field, an assessment will be made in regard to the appropriateness of the koala capture method. It there is sufficient evidence that the tree is suitable to support a safe capture, the "traditional flagging capture method" will be instigated[2]. Here, one or two personnel experienced in both tree climbing and koala capture will ascend the tree to encourage the koala to descend where experienced koala handlers wait at the base of the tree to manually restrain the koala.

Where the field assessment indicates that the koala cannot be safely captured using the "traditional flagging capture method", the "fence trap capture method" will be employed. Here, a temporary fence is erected around a tree to direct the Koala into a cage trap, once it descends (koalas generally move between trees across the ground, each night) koala trap will be set at the base of the tree. When the trap is triggered, a motion-sensor camera will send an SMS message alert to field personnel monitoring the trap, so that they can respond immediately to retrieve the koala.

Captured koalas will be given a health assessment before being measured, tagged and fitted with a GPS data-logging collar. In addition to the field health check, swab and blood samples will be collected for subsequent laboratory analysis.

Captured koalas will be uniquely ear-tagged tagged following previous protocols used earlier in 2017 (see **Figure 4-1**). This will provide an enduring means of identifying any captured koala in the field long after the life of the fitted data-logging collar, especially given that koalas live up to 10-12 years in the wild. In some cases, it may not be appropriate to attach a monitoring collar to a captured koala, thus ear-tagging may provide the only means of unique identification of a koala.

Captured koalas will be assessed in regards to their suitability to carry a GPS data-logging collar. Two types of monitoring collars will be considered for captured koalas, i.e. small, conventional VHF radio-collars, and the larger bio-telemetry collars. The latter are capable of transmitting position and activity data to the research team at their desks using the mobile

[2] Though acknowledging that any decision to implement capture will also be influenced by other considerations, including, the prevailing weather conditions, the presence of dependent young, and any other factor which may affect the safety to koalas and personnel.

phone network[3]. The smaller, conventional VHF collars will only be used on juvenile or small koalas that may not be capable of carrying the bulkier bio-telemetry collars (though may also be used on adult koalas as determined in the field). Any collar used on koalas will incorporate a device allowing the collar to easily break or slip off if a koala becomes entrapped or ensnared in vines, braches, etc., so that koalas do not become fatally entrapped by the collar.

The monitoring collars will provide highly detailed movement datasets by recording several locations per day. In addition, koalas will be routinely radio-tracked in the field until sighted, in order to monitor their well-being and record tree use preferences (see also *Koala Monitoring Events*). Collared koalas will need to be recaptured every 3-6 months to download logged data and check collar fit.

To achieve the above, it is proposed to conduct four catching field trips per year. Each *Koala Capture / Monitoring Event* will be of two to three days' duration, depending upon site access and activities at the time. Each event will involve at least four personnel. Part of the field team will aim to camp-out at the site to facilitate fieldwork such as night-time spotlighting and trap checking.

It is proposed that the monitoring will commence during September/October 2017 and run for a period of three years from the start date (i.e. until late 2020). One *Koala Capture / Monitoring Event* will be conducted during September/October 2017, with the aim of catching 2-3 koalas for monitoring purposes. Four *Koala Capture / Monitoring Events* will be conducted in each of 2018 and 2019 and then three trips will be conducted in 2020 to complete the research program (see **Table 7-1**).

The overall aim will be to track at least six different koalas throughout the program. All collars will be removed from monitored koalas prior to project completion.

It is envisaged that the *Koala Capture / Monitoring Events* will need to continue for the first three years of the monitoring program. The value of additional events beyond the first three-year period will be the subject of a detailed review in the relevant progression report.

4.2. Koala Monitoring Events

In addition to the koala capture events, field events will be implemented to track and establish the location of collared koalas in order to assess tree use preferences (though also koala health). During the nocturnal component of the activity, koalas will be located, host tree species identified, and faecal pellets collected.

Collected pellet samples will contribute to the store of material for laboratory analysis, ultimately to provide information on diet composition, potential tree species preferences and seasonal influences on tree species used[4].

[3] This functionality can assist in determining a problem with a Koala (lack of movement indicating a sick or injured animal) and enabling a rapid response if Koalas require attention in the field.

[4] Furthermore, the age profile and genetic structure of population can be assessed from pellet sampling.

These additional field events will be implemented on a monthly basis for the first 18 months of the monitoring program (see **Table 7-1**). This sampling effort should provide sufficient coverage for a variety of koalas and as a representative sample across seasonal conditions which might reflect changes in forage tree species selection.

The utility of continuing the monthly monitoring events beyond the first 18 months of the monitoring program will be the subject of a detailed review in the relevant progression report.

4.3. Koala Population Survey Events

In order to assess koala abundance and extent of occurrence in a broader site-wide context, a series of systematic transect searches will be implemented through the full extent of the Fauna Corridor, and the seven EPBCA Offset Areas (see **Figure 2-1**). Given the spatial context and potential contribution to koala habitat values on the site, the "Wal's Block" section of the Plunkett Conservation Park will be included in the surveys[5].

Koala surveys will be implemented using one of two methods, i.e. total counts (whole of area search) or line transects.

The total count method will be implemented throughout the Fauna Corridor, providing a systematic and complete search using teams of observers working in unison, to move through the area, methodically searching all trees within the area for koala presence. All koalas observed will be recorded, with additional information noted, e.g. GPS location and tree identification.

The line transect method will be implemented within the remaining survey areas - EPBCA Offset Areas 3 to 7, and in Wal's block (**see Figure 2-1**). This method will involve a two-person team following a pre-determined transect line (a GPS track alignment) and searching for koalas within trees up to 50m either side of the line transect. Each line transect will be spaced approximately 150m apart in order to minimize the potential for double counting from adjacent line transects.

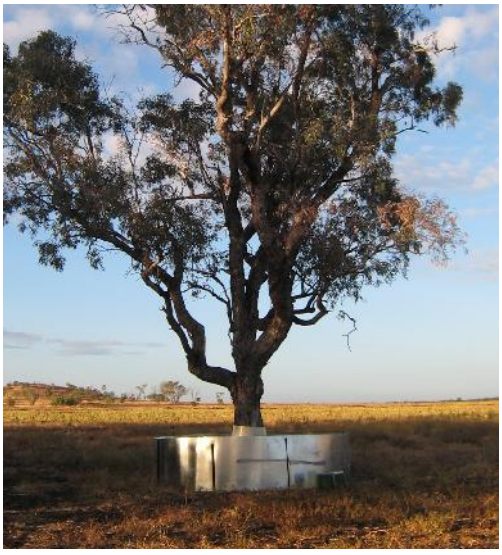
The surveys are to be implemented twice per year, commencing in February and six months later in August. The survey timing in August is considered to be important because at that time of the year koala joeys are still dependent, with their mothers as either back young or pouch young, and are large enough to be detected by observers from the ground using binoculars if necessary. The presence of observable young may assist in estimating the proportion of adult females breeding and to monitor trends in breeding rates over time.

[5] The section of the Plunkett Conservation Park know as "Wal's Block" forms what could be viewed as an in holding within the central-eastern part of the site (see **Figure 2-1**).

Figure 4-1 Photographs of Field Monitoring and Techniques

Above Left: All captured koalas will be subject to health assessments and vital statistics recorded. **Above Right**: Durable, ear tags (colour and alpha-numeric codes) will be attached to all captured koalas to provide long-term identification of individual koalas.

Above Left & Right: Traditional flagging capture method requires an experienced tree climber to encourage the koala to descend down the tree by holding or waving a flag (attached to the end of an extendable pole) above the koala. Two experienced koala handlers wait at the base of the tree to assist with pole flags and ultimately to manually restrain the koala when it reaches the ground.



Above Left: Koala fitted with a GPS monitoring collar. **Above Right:** Koala trap set at the base of a tree.

4.4. Laboratory Analysis

Laboratory analyses will be undertaken to assess dietary preferences, and the genetic diversity and health of koalas on the site. Swabs taken during assessments of captured koalas will provide the key material for the assessment of the genetic diversity and health of koalas. Koala faecal pellets collected during the capture and monitoring events will provide the key material to identify leaf cuticle fragments of browse trees (against tree species reference slides) in order to investigate dietary preferences. Several research institutions in Australia are presently requesting koala scats for genetic analysis and such opportunities to collaborate with other research groups will be assessed for their potential to increase the research quantum at the Yarrabilba site.

Swabs taken during health assessments of captured koalas will be analyzed following each capture event and results will be provided within each subsequent event report. Analysis of faecal pellets collected during the monitoring events will be undertaken opportunistically and on a batch basis.

All analyses will be undertaken by staff of the University of Queensland's Koala Ecology Group.

4.5. Record Management System

All observations of Koalas derived from the monitoring program activities will be entered into the project records database. The minimum information entered for each record will include: observation date, GPS location, unique koala identifier, and health score. The database will be designed to be able to be interrogated to prepare reports for various purposes (e.g. compliance reporting; state of environment reports) and with data formatted to allow uptake into GIS mapping systems.

4.6. Animal Welfare

Any decision about the capture of a koala will be made by the capture team leader. As described previously, any decision to implement capture of a koala will be influenced by a variety of considerations, including: the suitability of the tree for climbing; the prevailing weather conditions; the presence of dependent young; and any other factor which may affect the safety to koalas and personnel.

Any koalas found to be suffering from injury or illness which would warrant veterinary treatment, will be transported in an enclosed, air-conditioned vehicle to the nearest suitable veterinary clinic. Such treatment would be applied in strict accordance with the University of Queensland Koala Ecology Group's animal ethics permits.

Any release of koalas back onto the site will comply with Section 15 of the *Code of Practice: Care of orphaned, sick or injured protected animals*, as approved under the *Nature Conservation Act 1992*.

5. Reporting and Review Processes

5.1. Event Reports

A summary report will be provided after each *Koala Capture / Monitoring Event*. The report will be scientific, professional and succinct. The report will outline all work completed and provide images and details of koalas monitored. Reports will also include GPS plots of the koala movements and home range areas as these data become available.

A final report will be provided at the end of the project, synthesizing all the research findings, including the results of laboratory analyses. Further, the final report will provide practical recommendations on management actions aimed at enhancing the long-term conservation of koalas at the site, as well avenues of potential further research that will help to achieve this aim.

5.2. Program Progression Reports

A report will be prepared at approximately six-monthly intervals, with key deliverables being:

1. A summary of the results of the monthly *Koala Monitoring Events* and the *Koala Population Survey Event* for the reporting period; and

2. A review of program progression through the reporting period and identification of any constraints / limitations to progress as envisaged in this plan, and recommendations to mitigate impacts to the progress of key deliverables during the next reporting period.

The program progression report coinciding with the 12-month anniversary of the project will include an interim review of all components of the program to date, with an accompanying plan (revised or otherwise) to progress the program for the following 12-months.

It envisaged that this current plan (and subsequent modifications) will be subject to a complete and detailed review to coincide with the year-three anniversary of the project.

In regard to the above, it should be noted that this monitoring plan has been based on, as far as practical, the current state of knowledge of koalas on the site, species ecology and best practice monitoring / survey approaches. When new facts emerge from future research, they should be immediately integrated into the plan so it remains consistent with the current state of knowledge (and best practice). This should form part of adaptive management approach. Adaptive management being a way of managing natural resources where management actions are regularly reviewed and, if necessary, modified based on monitored changes in environmental condition and/or changes in base knowledge, which underpins the original management approach.

It is envisaged that the progress reports provide the main opportunity for presentation of timely advice and recommendations in regard to any program revisions / modifications as required.

5.3. General

All final reports will be issued in an unsecured PDF format. The final reporting will provide full referencing and a bibliography of relevant information sources. Where appropriate, tables and figures will present and summarise data. Photographs will support the report findings.

Mapping will be used and will be of such detail to enable identification and location of significant features, habitat types, fauna observations and monitoring sites etc. All field survey sites, transects, locations of species observations, etc., will be geo-referenced and detailed in mapping outputs presented in the final report, and in a format suitable for incorporation into the site's GIS (see also **Section 4-5**).

6. Study Team and Roles and Responsibilities

The Koala Monitoring Program will be a collaboration between Austecology and the University of Queensland's Koala Ecology Group.

Dr Bill Ellis will co-ordinate the field work and reporting from the Koala Ecology Group. The study team specializes in koala research of this nature and is highly experienced in the safe capture and monitoring of koalas.

Lindsay Agnew will co-ordinate Austecology's contribution to the field work program and reporting outputs. Lindsay Agnew will also provide overall project management and a single point of contact for Lend lease.

Professor Frank Carrick will provide peer review of the program and advice as required.

7. Program Progression and Key Timelines

Table 7-1 identifies the proposed timing, frequency, and duration of the key deliverables of the project. As noted previously, a program progression report coinciding with the 12-month anniversary of the project will include an interim review of all components of the program to date, with an accompanying plan (revised or otherwise) to progress the program for the following 12-months. A detailed proposal for works in the following 12-month period will accompany the program progression report.

It envisaged that this current plan (and subsequent modifications) will be subject to a complete and detailed review to coincide with the year three anniversary of the project.

Table 7-1 Koala Monitoring Program – September 2017 to February 2020

Year	2017	2017	2017	2017	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	Event	Event	Number of Field Events
Month	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Days	Nights	
Koala Capture / Monitoring Field Event	x	x															3	2	1
Koala Capture / Monitoring Field Event							x	x									3	2	1
Koala Capture / Monitoring Field Event									x	x							3	2	1
Koala Capture / Monitoring Field Event											x	x					3	2	1
Koala Capture / Monitoring Field Event													x	x			3	2	1
Koala Monitoring Events		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	1	15
Koala Population Survey Events						x	x					x	x						2
Report - Koala Capture / Monitoring Event			x						x		x		x		x				
Program Progression Report								x						x					
Year	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2020	2020	2020	2020	Event	Event	Number of Field Events
Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	Days	Nights	
Koala Capture / Monitoring Field Event			x	x													3	2	1
Koala Capture / Monitoring Field Event					x	x											3	2	1
Koala Capture / Monitoring Field Event							x	x									3	2	1
Koala Capture / Monitoring Field Event									x	x							3	2	1
Koala Capture / Monitoring Field Event															x	x	3	2	1
Koala Monitoring Events	x	x	x																3
Koala Population Survey Events		x	x					x	x					x	x				3
Report - Koala Capture / Monitoring Event					x		x		x		x								
Program Progression Report				x						x						x			
Year	2020	2020	2020	2020	2020	2020	2020	2020	2021	2021							Event	Event	Number of Field Events
Month	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB							Days	Nights	
Koala Capture / Monitoring Field Event	x	x															3	2	1
Koala Capture / Monitoring Field Event			x	x													3	2	1
Koala Capture / Monitoring Field Event					x	x											3	2	1
Koala Population Survey Events				x	x														1
Report - Koala Capture / Monitoring Event	x		x																
Final Reporting - Capture / Monitoring Events - Monitoring Events - Population Surveys							x	x	x										
Final Program Review Report									x	x									

8. References

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