Appendix K
Koala occupancy report

UniSC Australia | Detection Dogs for Conservation | Scientific Koala Surveys

Koala occupancy surveys in the *Caloundra Transport Corridor Upgrade* area

Prepared for Sunshine Coast Council

by Scientific Koala Surveys / Detection Dogs for Conservation

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Document version control

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V1	25/02/2025	Romane Cristescu	Kye McDonald
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Table of Contents

1 Introduction

1.1 Background

The koala (*Phascolarctos cinereus*) is a highly specialised, folivorous, arboreal marsupial, recognised internationally as one of Australia's most iconic species (Martin and Handasyde 1990). Bringing more than three billion dollars to the Australian economy each year (Conrad 2014, Markwell 2021), the koala is a culturally significant species that serves as an ecological umbrella for a wide range of wildlife inhabiting forest ecosystems (Ward, Rhodes et al. 2020). Koalas are facing multiple threats, including habitat loss, degradation and fragmentation, disease, climate change (including worsening bushfires), vehicle strikes and canine attacks (Melzer, Carrick et al. 2000, McAlpine, Rhodes et al. 2006, Gonzalez-Astudillo, Allavena et al. 2017, Beyer, de Villiers et al. 2018, Shabani, Shafapourtehrany et al. 2023). In recent decades, koala populations have experienced dramatic declines which legislation has so far failed to reverse (McAlpine, Lunney et al. 2015, Tisdell, Preece et al. 2017). Following the 2019-2020 Black Summer megafire, the species was listed as Endangered in Queensland, New South Wales and the Australian Capital Territory under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (Commonwealth of Australia 2022).

1.2 Scope of works

This project aimed to determine koala occupancy in areas of interest for the Caloundra Transport Corridor Upgrade, within the Sunshine Coast Council (SCC), as identified in:

- Caloundra City Council Report for Koala Habitat Survey and Mapping. Final Report May 2008. GHD
- Caloundra Transport Corridor Upgrade (Figure 7.5: Potential habitat mapping for the Koala). Aurecon
- Sunshine Coast Council Drone Survey, Thermal Drone Koala Survey | Technical Report May 2023. 2023 Halo Nature Reserves Pty Ltd T/A Endeavour Vet Ecology

Two koala survey methods were selected to assess koala occupancy: bioacoustics and koala scat detection dog. Bioacoustics is a powerful way, during the koala breeding season, to detect the presence of male koalas through their periodic bellowing (Law, Gonsalves et al. 2020). Detection dog surveys are more accurate and efficient than human-led surveys to locate koala scats (Cristescu, Foley et al. 2015) and can be adapted to a range of koala survey types, including for occupancy surveys (Cristescu, Miller et al. 2019). For occupancy surveys, the added benefit of scats is that they can remain present and detectable within the survey area for months, therefore enabling surveys to encompass a longer sampling period (compared, for instance, to bioacoustics which sample only the deployment period).

2 Methods

2.1 Koala occupancy using bioacoustics

Data was recorded using Song Meter Micro (SMM, Wildlife Acoustics, Maynard, MA, USA) acoustic recorders at 14 sites within the area of interest (see **Appendix A** for coordinates, and **Appendix B** for site pictures). Acoustic recorders were programmed to record sounds from sunset until sunrise, the peak time for koala calls (Ellis, Bercovitch et al. 2011). Song Meter Micros have sampling rates of 32,000 Hz, resolution of 16 bits per sample and 24 dB gain and can typically detect koala bellows from a distance of up to 150 metres. These song meters were fitted with a 64-microSD card and Eneloop NiMH batteries, before being attached to a tree trunk at a height of 1.5 m above ground using lockable bands or rope. Typically, these recorders can operate for between 9 and 12 nights on a single deployment before batteries and microSD card require replacing if longer monitoring periods are sought.

Raw audio recordings were scanned with the open-source AviaNZ acoustic software (Marsland, Priyadarshani et al. 2019) using a koala recogniser (version: DPI_Male_Koala_V3_CNN15_10-02-23, Department of Primary Industries , Towsey, Planitz et al. 2012) developed using a deep learning procedure (Himawan, Towsey et al. 2018). Recordings matched by the recogniser with koala bellows were then validated manually by

visualisation of spectrograms of the audio in AviaNZ (**Figure 1:**), in conjunction with playback of recordings, to delete any false positives.

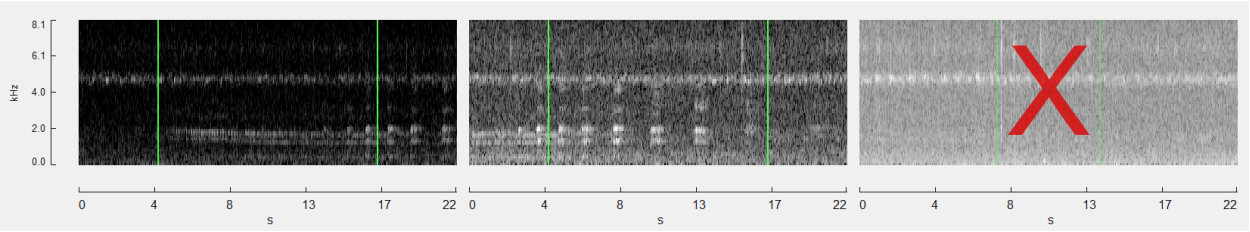

Figure 1: Examples of spectrograms from AviaNZ; left two images showing a male koala bellow, image on the right showing a false positive (manually marked with a cross by a human verifier).

2.2 Koala occupancy using detection dogs

The detection dog used for these surveys, Austin (**Figure 1:**), is a border-collie cross, trained and tested by the DDC to detect koala scats of any age. Austin is highly experienced in detecting koala scats and has conducted more than 300 surveys.

Upon arrival at each survey site, ecological characteristics that might have influenced the detectability and decay of scats were recorded as rapid scat decay type e.g. wet areas or recent fire (Cristescu, Goethals et al. 2012). The detection dog was fitted with a GPS collar that recorded time and location data, and was directed to search for koala scats. The team also visually searched for any signs of koalas.

Figure 2: Austin, koala scat detection dog.

Handlers are required to visually confirm scat identification and age – for this reason, it is critical that an ecologist or experienced koala researcher is involved. In fact, scat identification presents challenges even to experienced ecologists (Harrington, Harrington et al. 2010). Typical koala scats (**Figure 3**) have the following characteristics (Triggs 1996):

- symmetrical and bullet-shaped (not jelly-bean shaped),
- generally, about 1.5 cm long by 0.5 cm wide (adult koala scat size),
- evenly-sized, fine particles, and
- absence of insect parts (koalas do not eat insects).

Figure 3. Typical characteristics of koala scats.

3 Results

3.1 Koala occupancy using bioacoustics

Acoustic data was recorded over the period 6 February 2025 to 18 February 2025. All 14 deployed acoustic recorders successfully recorded at least 11 full nights of data each. Screening of these recordings resulted in no koala bellow detections at any of the 14 sites during the deployment period (**Figure 4, Appendix A**).

Figure 4: Acoustic recorder deployment locations (red points), all without any koala bellow detections during the monitoring period.

3.2 Koala occupancy using detection dogs

Detection dog surveys occurred on the 7th, 10th, 11th and 18th February 2025, totalling 30.4 km of searched transects, and resulted in no koala scats being detected by the detection dog (**Figure 4**). Some areas could not be covered due to human habitations or being flooded (where scats decay rapidly and cannot efficiently be searched).

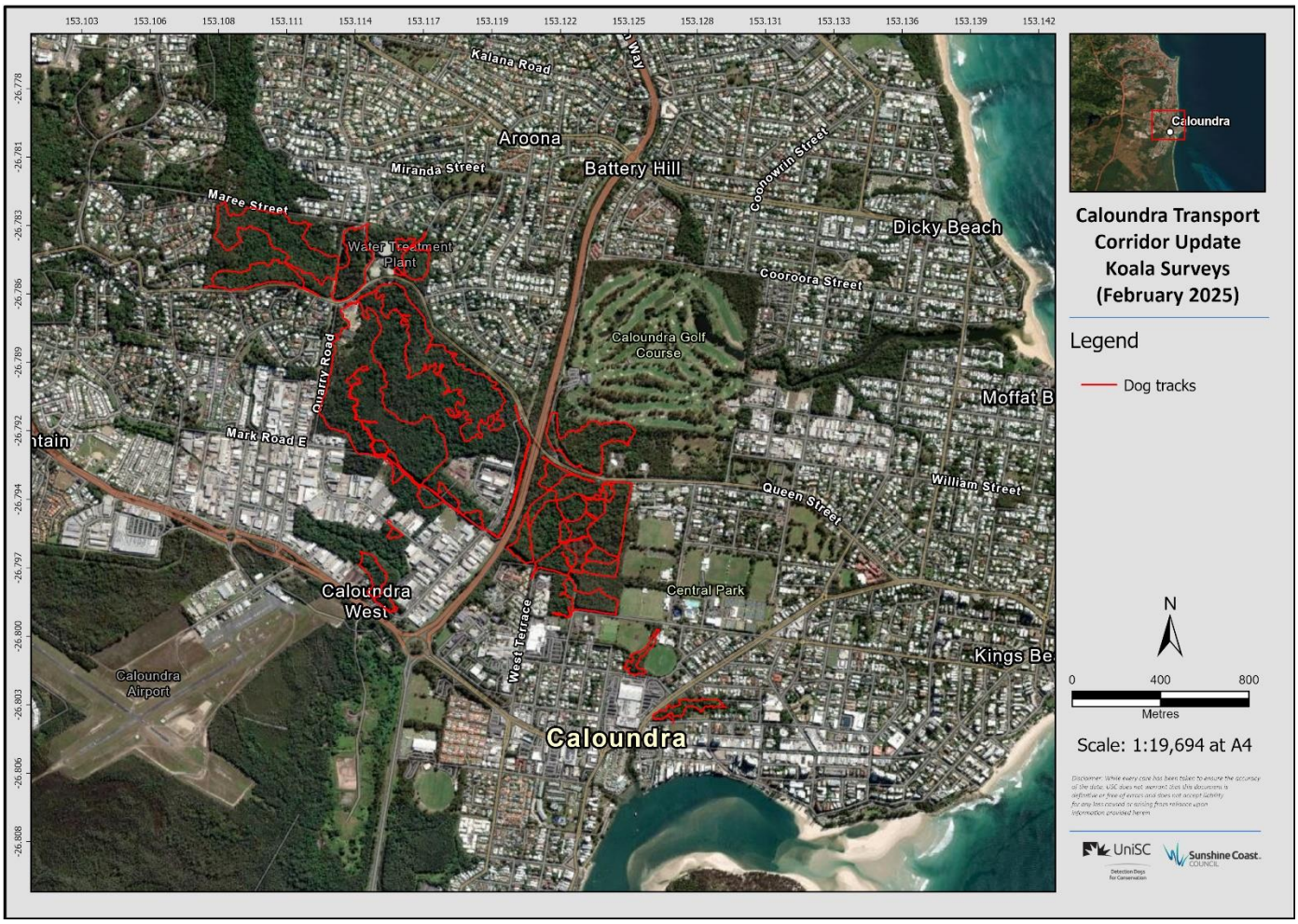

Figure 5: Detection dog survey search tracks, with no koala scats detected.

4 Discussion

Appropriate koala survey effort and coverage (**Figure 4-5**) has found no evidence of recent use by koalas within the study area. This is consistent with previous thermal imaging drone surveys which also found no koalas at the time of survey (EVE, 2023), but our results further increase confidence, both by expanding the search area and extending the period of sampling (bioacoustics 11 nights, and detection dog up to a few months).

Like any ecological survey, failure to detect koalas in an area is not necessarily conclusive, and may suggest, for a koala scat survey, either of the following:

- Koalas are not present in the area (i.e., true absence) at the time of the survey. Note that true current absence does not infer that the site has not been used in the past, or could not be used in the future (i.e., it could still be potential koala habitat).
- Koalas occur in the area; however, scats were not detected (i.e., false negative) because:
    - Scats were present at some stage but decayed and disappeared from the environment before the survey was conducted.
    - The dog did not detect the scat; and/or,
    - The dog indicated the presence of a scat, but it was too decayed to be confirmed.

Detection dog surveys can also be hampered by wet conditions, which degrade koala scats faster than normal. In addition, impenetrable and/or flooded bushland for detection dog teams, reduces accessibility and therefore the effectiveness of surveys. Due to the location, multiple sites had water inundation/swampy conditions. The relevant dog track maps in **Figure 4** reflect this, with certain areas within the designated sites not completely covered by the dog team.

However, in combination with the bioacoustics monitoring, complete koala survey coverage was achieved across the entire study area, with no evidence of koala occupation found. It is important to note that, although these survey methods have the power to confidently

ascertain presence, confirming absence is difficult. To infer true absence, multiple surveys are generally necessary (MacKenzie and Royle 2005).

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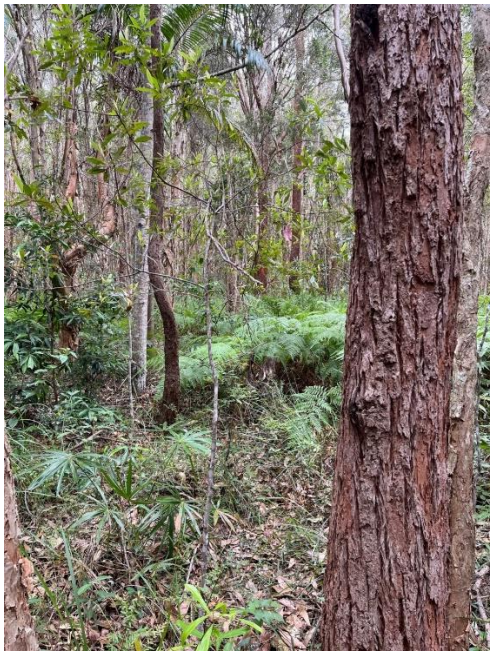
Appendices

Appendix A - Bioacoustic recorder deployment locations, with recording times and durations

Survey Code	Recorder Name	Latitude	Longitude	First recording	Last recording	Recording duration	Koala bellow detected
AR250206KM	DDC 009	-26.797979	153.103180	06/02/2025 18:38	18/02/2025 03:29	11 days	No
AR250206KM	DDC 010	-26.789486	153.114304	06/02/2025 18:38	18/02/2025 04:30	11 days	No
AR250206KM	DDC 011	-26.791712	153.120316	06/02/2025 18:38	18/02/2025 23:28	12 days	No
AR250206KM	DDC 012	-26.792389	153.116013	06/02/2025 18:38	18/02/2025 21:29	12 days	No
AR250206KM	DDC 013	-26.796251	153.115250	06/02/2025 18:38	18/02/2025 22:28	12 days	No
AR250206KM	DDC 014	-26.789246	153.116913	06/02/2025 18:38	17/02/2025 22:29	11 days	No
AR250206KM	DDC 022	-26.800808	153.113556	06/02/2025 18:38	18/02/2025 05:29	11 days	No
AR250206KM	DDC 023	-26.808767	153.116150	06/02/2025 18:38	18/02/2025 19:28	12 days	No
AR250206KM	DDC 024	-26.792270	153.122711	06/02/2025 18:38	18/02/2025 19:28	12 days	No
AR250206KM	DDC 025	-26.794899	153.123764	06/02/2025 18:38	18/02/2025 20:28	12 days	No
AR250206KM	DDC 026	-26.797607	153.124008	06/02/2025 18:38	18/02/2025 03:30	11 days	No
AR250206KM	DDC 027	-26.795822	153.121231	06/02/2025 18:38	18/02/2025 01:29	11 days	No
AR250206KM	DDC 028	-26.801083	153.125229	06/02/2025 18:28	17/02/2025 19:29	11 days	No
AR250206KM	DDC 029	-26.802683	153.127304	06/02/2025 18:28	18/02/2025 01:29	11 days	No

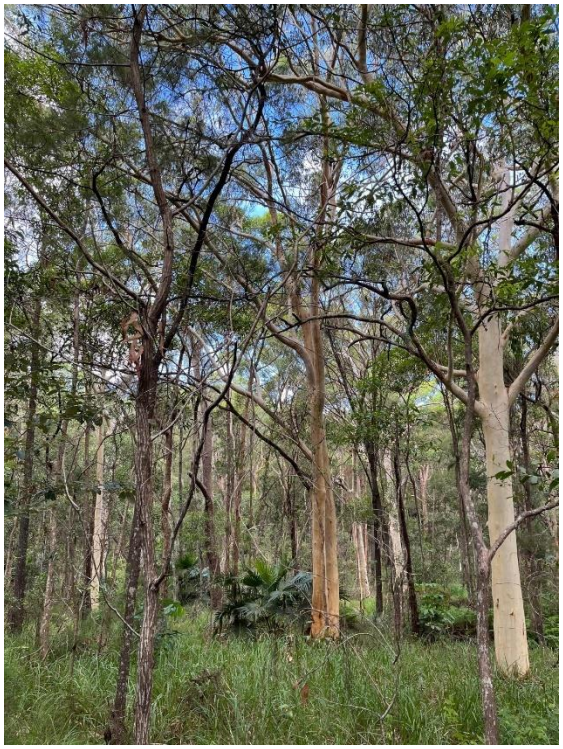
Appendix B - Pictures of survey sites

Town Reserve (1)



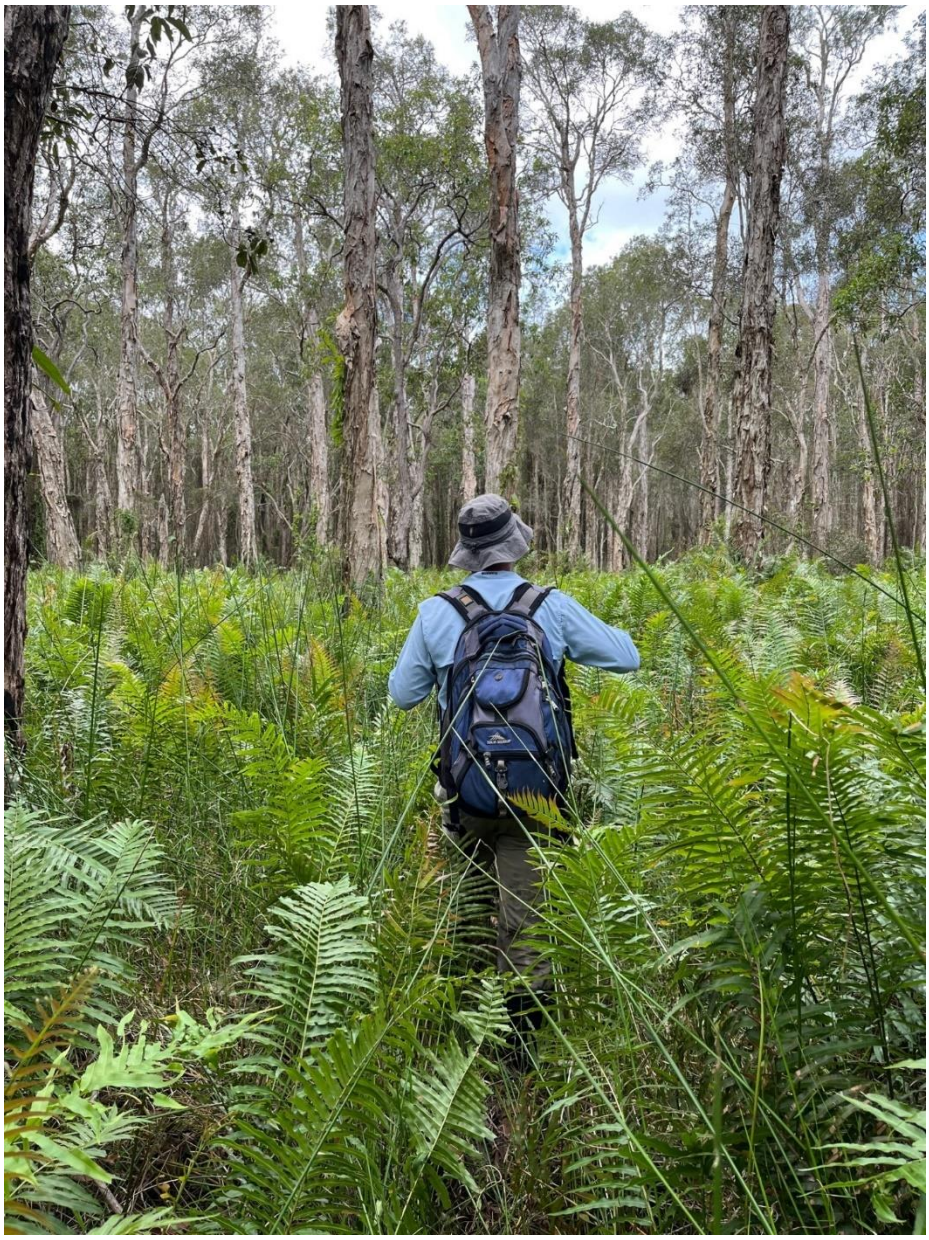
Town Reserve (2)

Town Reserve (3)



Town Reserve (4)

Russell Barker Memorial Park



Queen Street Bushland Park

Ben Bennett Bushland Park (1)

Ben Bennett Bushland Park (2)

Ben Bennett Bushland Park (3)

Gosling Park

Bicentennial Park

End of report