Coomera Connector Stage One (1): Public Environmental Report

Queensland Department of Transport and Main Roads

Appendix 14: Koala Management Plan

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1. Introduction

1.1 Coomera Connector Stage 1: proposed action

The Queensland Department of Transport and Main Roads (TMR) is developing a high standard arterial road to the east of the Pacific Motorway (M1) between Loganholme and Nerang, to address the increasing traffic demands on the Brisbane to Gold Coast transport corridor and to relieve pressure on the M1. The first section is the proposed action which is the construction and operation of a new 16 km high-speed arterial road between Shipper Drive, Coomera and Nerang-Broadbeach Road, Nerang, broadly called the Coomera Connector Stage 1. TMR is preparing a Public Environment Report (PER) in response to the Commonwealth Environment Minister determining the referred project as a 'controlled action' that requires approval under the EPBC Act, due to the likely significant on Matters of National Environmental Significance (MNES) including the Koala. The proposed action is shown in Figure 1.

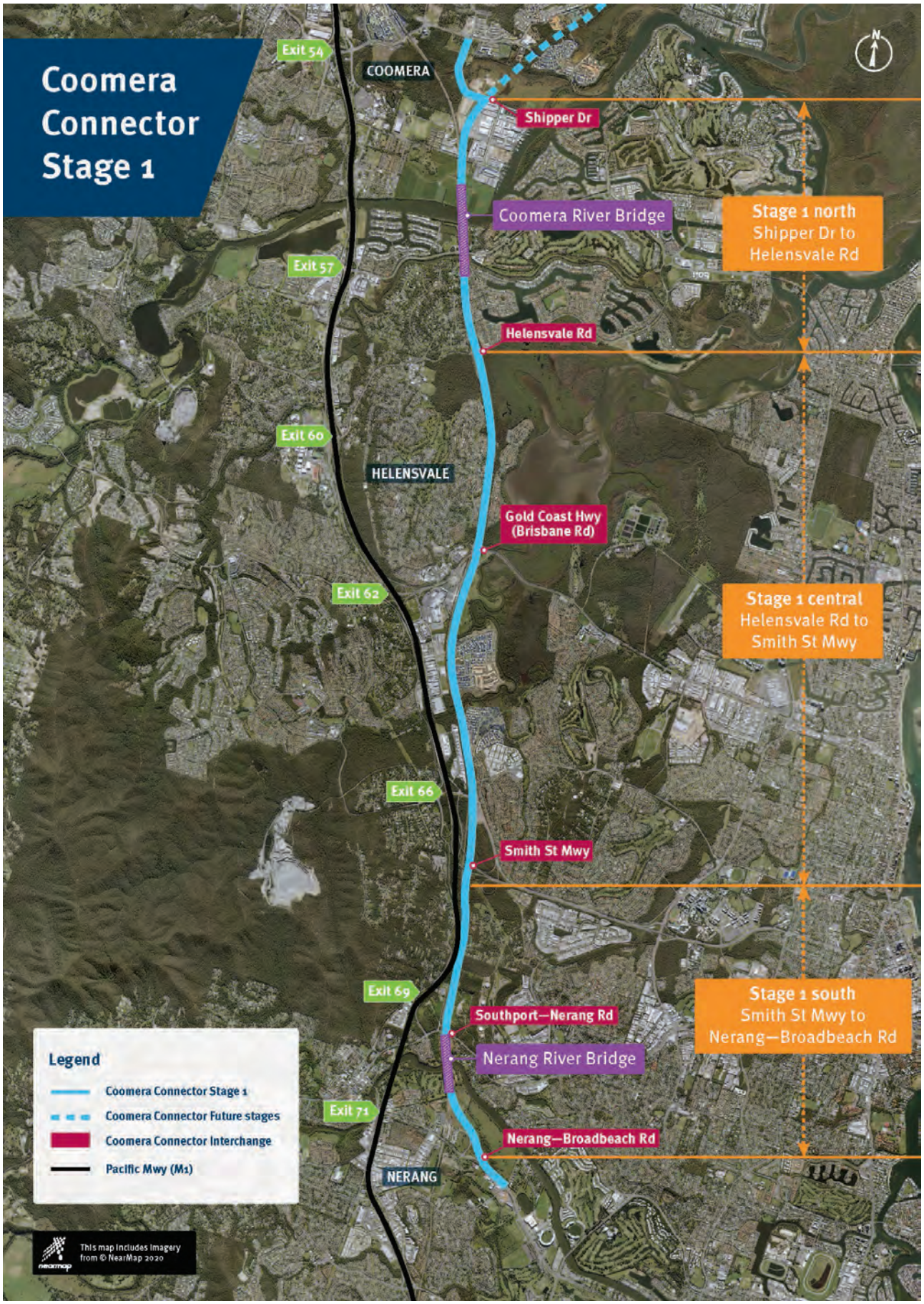


Figure 1 Proposed action corridor

1.2 Development of Koala Management Plan

The Koala is an important threatened species which has been found within and near the proposed action corridor. Details of the current Koala populations within and in proximity to the proposed action corridor are contained in chapter 5 of the PER. An analysis of the potential impacts to Koala are contained in chapter 6 of the PER, while chapter 7 of the PER contains information on the avoidance, mitigation and management measures TMR will undertake related to Koala and other matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

All three levels of government recognise the Koala populations in South East Queensland are under threat from the cumulative impacts of:

- habitat loss and fragmentation,
- vehicle strike,
- pests and domestic animals, as well as
- the overall health and welfare of the Koala populations.

Given the above, TMR has developed this specific Koala Management Plan to guide the implementation of a range of mitigation measures and management controls for the Koala during the pre-construction, construction, and operation phases of the proposed action. The key inputs into preparing this Koala Management Plan include:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales, and Australian Capital Territory (Commonwealth of Australia, 2014)
- Conservation Advice for *Phascolarctos cinereus* (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory (DAWE, 2022)
- National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE, 2022)
- proposed action PER (TMR, 2022)
- South East Queensland Koala Management Conservation Strategy 2020-2025

  The Strategy outlines Queensland Government's vision to *"halt the decline of Koala populations in South East Queensland and secure their long-term survival.*"

  The Strategy has been informed by an expert panel and has set targets for:

  - stabilising Koala populations in South East Queensland
  - achieving a net gain in the total core habitat area
  - commencing restoration of 10,000 hectares of Koala habitat
  - threat reduction programs to support least a 25% reduction in disease, injury, and mortality rates in these locations
- Coomera Connector Koala Conservation Strategy (EVE, 2021)

  The Strategy (Appendix A) will guide TMR in the implementation of a suite of measures to ensure the Koala is protected during construction and operation of the Coomera Connector.

  TMR will be informed by:

  - a comprehensive survey of remnant Koala habitat within and in proximity to the proposed action corridor
  - advice on the acquisition and replanting of habitat offsets in areas that are strategically valuable for local and regional Koala populations
  - a Koala Tagging and Monitoring Program to provide detailed datasets on population dynamics
  - a Koala Translocation Program to relocate Koalas from high-risk habitat into secure habitat areas

- advice on ongoing monitoring to measure the effectiveness of engineered Koala protection features
- advice on compensatory measures to address potential impacts to Koala welfare and population viability (e.g., chlamydia), and the development of beneficial research collaborations

- Koala-sensitive Design Guideline (DES, 2019)
- TMR policies and guidelines including:
  – Fauna Sensitive Road Design Manual Volume 1 – Past and Existing Practices (TMR, 2000)
  – Fauna Sensitive Road Design Manual Volume 2 – Preferred Practices (TMR, 2010)
- draft Code of Practice for the Welfare of Wild Animals Affected by Land Clearing and other Habitat Impacts and Fauna Spotter/ Catchers (Hangar and Nottidge, 2021)
- Gold Coast City Council Koala Conservation Plan (2017)

  The Plan outlines the Gold Coast City Council's aim for *"a long-term sustainable Koala population on the Gold Coast, including safe passage and habitat retention, through threat mitigation actions, research and community collaboration."*

  The Plan identifies and implements measures to minimise the threats to the Koala by:

  - improving safe passage of Koalas in urban areas
  - identifying and protecting Koala habitat
  - reducing Koala mortality from vehicle strike, dog attack and *Chlamydia*
  - increasing scientific knowledge of the Koala ecology and health by partnering with government, universities, community groups and other research organisations
  - maintaining a comprehensive, well-informed understanding of northern Gold Coast Koala populations and their threats

As described in the Coomera Connector Koala Conservation Strategy (EVE, 2022), four (4) primary on-ground program surveys have been undertaken.

Endeavour Veterinary Ecology Pty Ltd (EVE) carried out a comprehensive Koala survey within and in proximity to the proposed action to provide estimates of Koala distribution and health, potential offsite sites, potential translocation recipient sites as well as informing the Koala Management Plan. As described in Appendix 10 of Appendix A, there are 12 Koala Management Areas within and in proximity to the proposed action.

EVE conducted and reported on the comprehensive Koala survey for the proposed action in late 2020. Appendix 1A of the Appendix A contains information on Koalas observed during the survey. TMR has used the data from that survey to inform the design of the proposed action as well as offset and translocation recipient sites. As additional information is obtained, the Koala Management Plan will be update accordingly.

TMR will implement a Koala Tagging and Monitoring Program in three phases for the proposed action. The three stages include:

- Phase 1 which was the 2020 a comprehensive Koala survey within and in proximity to the proposed action to provide estimates of Koala distribution and health
- Phase 2 which involves the monitoring of the Koalas that are identified as at-risk during (or because of construction activities)
- Phase 3 that will involves the monitoring of the Koalas that remain after the construction of the proposed action.

TMR will translocate the at-risk Koala through a coordinated and approved approach under the Koala Translocation Program. The Koala Translocation Program is a component of the Koala Tagging and Monitoring Program and involves two phases

- Phase 1 which involves monitoring the resident Koala population in the translocation recipient site (minimum of six months prior to any translocation) to assess their health, movements and use of habitat
- Phase 2 which involves monitoring of translocated Koalas (minimum) of 12 months to assess their health and establishment of a stable home-ranging behaviour.

TMR commenced the Koala Translocation Program in August 2021 and that program of work is ongoing.

TMR will implement a long-term monitoring and management program to:

- monitor the Parkwood-Coombabah and East Coomera Koala populations to detect and identify the causes for any changes in the populations as a result of the proposed action
- manage any changes to the Koala populations using an adaptive management approach, in so far as the changes are caused or contributed by the construction and operation of the proposed action
- to hand-over the management to an appropriate government authority or agency at the completion of monitoring program.

TMR will use survey methods and reporting like the Comprehensive Koala Survey and the work undertaken by DES and the Gold Coast City Council (see section 2.1) for up to a period of 20 years.

1.3 Purpose of the Koala management plan

The purpose of the Koala Management Plan is to:

- describe and document the management structure and processes TMR and its contractors will use to manage the potential impacts on Koala during the preconstruction, construction, and operation phases for the proposed action
- outline and document how TMR will comply with the legislative framework including any approval conditions specifically related to Koala
- outline the monitoring program that will be implemented during the pre-construction, construction, and operation phases of the proposed action to assess the effectiveness of the mitigation measures and the need for any amendments to the mitigation measures and management controls
- document any feedback from key stakeholders, expert reviews, and update based on the latest research
- provide a basis for documenting updates and changes to the Koala Management Plan (which would normally happen before commencing each key phase of delivery (preconstruction, construction, and operation) of the proposed action

Impacts that cannot or are not proposed to be mitigated are considered residual impacts and are separate to this KMP. TMR will manage these residual impacts through the offsets strategy which involves undertaking works on the approved offset properties for regional Koala conservation and potential research. Some aspects of the offsets strategy may form part of the proposed Koala Translocation Program and have been included in the Koala Management Plan (See Section 3.5 for further details.

The Koala Management Plan will be a "living" document. TMR will update the Koala Management Plan at regular intervals based on:

- approval conditions imposed by the Federal Minister for Environment and Water
- results of the further monitoring from the Koala Tagging and Monitoring Program as outlined in the Coomera Connector Koala Conservation Strategy
- improvements in the scientific knowledge of Koala biology, conservation, and management
- input from relevant stakeholders about matters considered relevant to the Koala Management Plan

At a minimum. TMR will update the Koala Management Plan prior to the commencement of construction and operation of the proposed action.

2. Koala populations and potential impacts

2.1 Existing Koala populations

Section 5.7.4.1 within Chapter 5 of the PER discusses Koala populations in the northern Gold Coast. Previous important studies as well as those undertake as part of the proposed action are shown in Table 1. Further details are provided below.

Table 1 Summary of previous Koala studies

Source	Location	Study Area (ha)	Density	Population
East Coomera Koala Population Study 2017	Coomera-Pimpama	1,467	0.34 ± 0.05	499 ± 74
Parkwood-Coombabah Koala Population Study 2017	Parkwood-Coombabah	1,156	0.23 ± 0.04	266 ± 46
Planit 2018	Proposed action corridor	282.8		Up to 56
EVE 2020	Nerang- Broadbeach Road to Pimpama	615		99 to 204 40 within proposed action corridor

2.1.1 Online Search

An abundance of information exists regarding Koala populations and habitat in proximity of the proposed action and a detailed review of this information was completed for the preparation of the Koala Management Plan.

Koalas are known to utilise habitat within and around the proposed action. The Wildlife Online search identified 590 records of Koala sightings within 1km of the proposed action. Population assessments completed in 2017 identified an estimated Koala population in the Coomera-Pimpama (outside the proposed action corridor) and Parkwood-Coombabah areas (areas within the proposed action corridor) of 499 ± 74 and 266 ± 26 Koalas respectively. While recent urban development has significantly reduced Koala habitat in the SEQ region, Koalas have been recorded in these areas where habitat remains protected. It is likely that a sustainable Koala population can be maintained outside of the urban footprint. A desktop search identified that Koalas have been observed within the proposed action and in the region (Figure 2 and Figure 3).

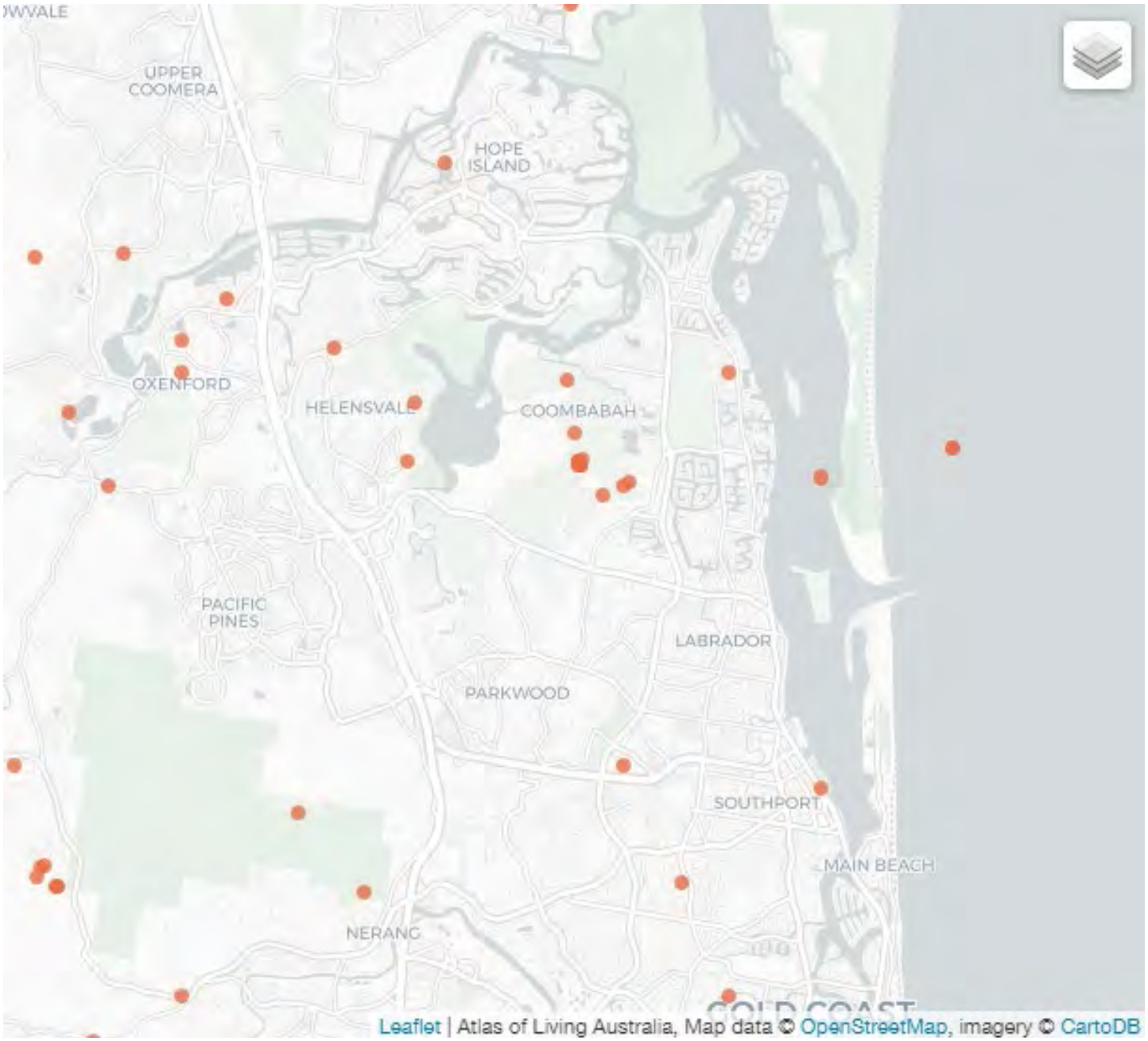


Figure 2 Koala records within proximity to the proposed action corridor (ALA, 2019)

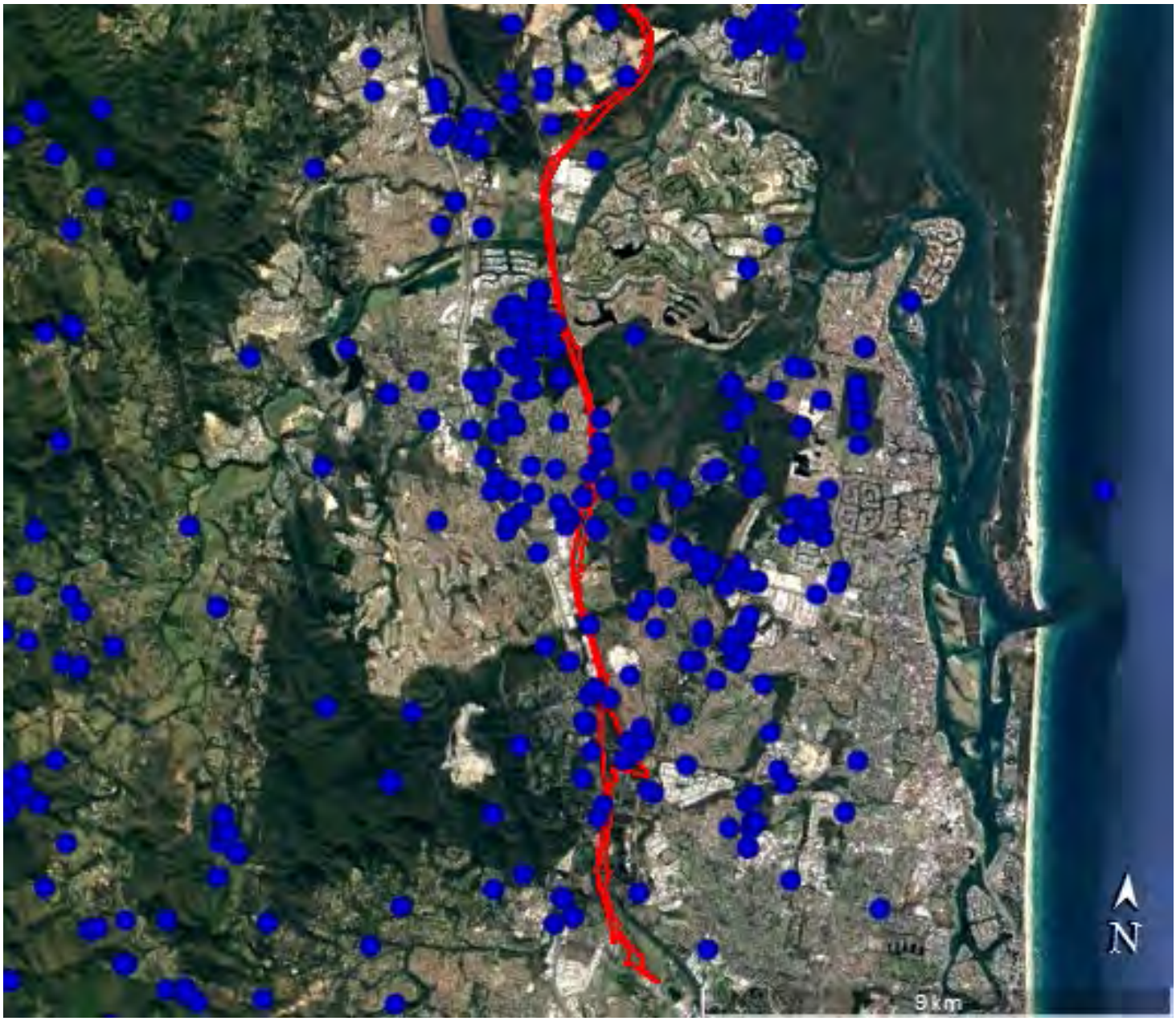


Figure 3 Koala records (WildNet, 2018)

2.1.2 Desktop review

Koala populations within the Gold Coast have been closely monitored over the last 20 years. A list of recent studies is provided in Table 2 with the critical studies discussed below.

Table 2 Previous Koala studies

Review of Selected Koala Habitat Densities				
Source	Study Location	Habitat Type	Comments	Koala/ha
White and Kunst 1990	Southeast Queensland Sheldon	Eucalypt Forest		0.4 (0.3-0.46)
Dique *et al*, 2003	Southeast Queensland Pine Rivers Shire	Tall shrubby open forest (Tertiary surfaces) and Tall open forest upon metamorphics	Stratified by two habitat descriptions 'urban' and 'bushland'	0-0.76

Dique *et al*, 2004	Southeast Queensland Koala Coast ~375sqkm of Redland, Logan and Brisbane City shires	Eucalypt Forests. Predominately RE 12.9-10.4 & 12.11.5	Study stratified by habitat descriptions: 'urban', 'remnant bushland', 'bushland' and 'other'. Remnant and bushland areas further stratified by proximity to the centre of the study area (high density=close to centre, low density=further away)	Range 0.02-1.26 Urban: 0.17 +/-0.013 High remnant: 0.70 +/-0.023 Low remnant: 0.20 +-/0.014 High bushland: 0.30+/-0.006 Low bushland: 0.11 +/-0.007 Other: 0
Sullivan et al 2004	Southwest Queensland	Eucalypt Forest/woodland within the mulgalands	Habitat stratified by floristics and land zone.	0.0007-2.513
Biolink 2007	Coombabah Koala Habitat Area	Mapped Gold Coast City Council vegetation (per Ryan *et al*, 2003) filtered to exclude communities not containing eucalypts	Spot assessment technique for Koala faecal pellets.	0.22 ± 0.04
Biolink 2007	Coomera- Pimpama Koala Habitat Area	Mapped Gold Coast City Council vegetation (per Ryan *et al*, 2003) filtered to exclude communities not containing eucalypts	Spot assessment technique for Koala faecal pellets.	0.23 ± 0.03
Gold Coast City Council 2013	Elanora-Currumbin Waters	Eucalypt Forest/Woodlands	Spot assessment technique for Koala faecal pellets and strip transects searches	1.12 ± 0.67 SAT 0.65 ± STRIP
Gold Coast City Council 2015	Burleigh Ridge	Eucalypt Forest/Woodlands	Spot assessment technique for Koala faecal pellets and strip transects searches	0.20 ± 0.16 SAT 0.33 ± 0.18 STRIP
Biolink 2017	East Coomera	Native vegetation containing eucalypts	Observations from radial searches (25m) during spot assessment technique and strip transects searches	0.34 ± 0.05 SAT 0.47 ± 0.06 STRIP
Biolink 2018	Parkwood - Coombabah	Native vegetation containing eucalypts	Observations from radial searches (25m) during spot assessment technique and strip transects searches	0.23 ± 0.04 SAT & STRIP Combined
Griffith University 2020	Helensvale	Native vegetation containing eucalypts	Observations from camera trapping, spotlighting surveys and scat sampling for Koala faecal and sightings	

Studies were conducted in 2007 and repeated in 2017 by Biolink on behalf of Gold Coast City Council including:

- Conserving Koalas in the Coomera-Pimpama Koala Habitat Area: a view to the future (2007) (CPKHA)
- Koala Habitat and Population Assessment for Gold Coast City LGA (2007)
- East Coomera Koala Population Study (2017) (ECKPS)
- Parkwood-Coombabah Koala Population Study (2017) (PCKPS)

These studies recognised and considered the existence of the Coomera Connector (previously known as Inter-Regional Transport Corridor (IRTC)) in the assessment of impacts on the Koala population.

A study was also conducted for TMR by the Environmental Research Institute at Griffith University. This study only covered a small portion of the proposed action in and around Coombabah Creek. This report from Griffith University was requested by TMR and was presented in two phases:

- Research Project: Koala Movement Under Transport Infrastructure, Phase 1
- Research Project: Koala Movement Under Transport Infrastructure, Phase 2

This study was carried out over 2019-2020, with results being presented at the end of 2020. The aim of the study was to monitor Koala populations and their use of flora close to the proposed action corridor. Results from the above studies are discussed below.

The 2007 studies included the CPKHA which covers an area of 3,640 ha and the Coombabah Koala Habitat Area (CKHA) which covers 1,400 ha. The proposed action traverses only a small portion of the land covered by the 2007 study, primarily the area south of Oaky Creek Road. These studies used the Spot Assessment Technique (SAT) (Philips & Callaghan 2011) to estimate activity levels and then strip transects to estimate Koala densities in occupied areas. The strip transect estimates were extrapolated from the CKHA. Results estimated that there were approximately 510 (+/-129) Koalas present in the CPKHA at the time of the study. Biolink undertook population viability analysis (PVA) modelling of CPKHA population in 2007 and updated the modelling in 2017.

The *East Coomera Koala Conservation Project* was the largest mitigation/salvage translocation of Koalas in Queensland and the largest Koala translocation monitored intensively by telemetry post translocation studies (Appendix 14 of the Appendix A Coomera Connector Koala Conservation Strategy) show that Koala translocation is a method that can be successful, when carefully managed, and that it is an important last-resort method for protecting Koalas under significant alienation pressures.

The Gold Coast City Council has identified the East Coomera area as a high priority for Koala conservation and indicated an intent to increase the protected area estate in that area substantially to ensure the long-term viability of the Koala population. This area is strategically valuable for Koala habitat offsets and sits within the East Coomera Koala Priority Area (KPA). EVE has commenced investigation of the Pimpama River Conservation Area in August 2021 as a potential translocation recipient site.

The ECKPS study revisited the 2007 CPKHA area and surveyed the remaining Koala habitat (1,467 ha), using both SAT and strip transects. A density estimate of 0.34 ± 0.05 was derived from the SAT-based radial searches and extrapolated over the remaining habitat resulted in an estimated Koala population of 499 ± 74 Koalas within the East Coomera study area. The ECKPS suggested that it is possible to establish a sustainable Koala population within the rural landscape of Coomera, external to the urban footprint. The location of Koala identified in the 2017 ECKPS study are shown in Figure 4.

As highlighted by the activity contours in Figure 4, the proposed action will not have any significant potential impacts on the habitat for East Coomera Koala population.

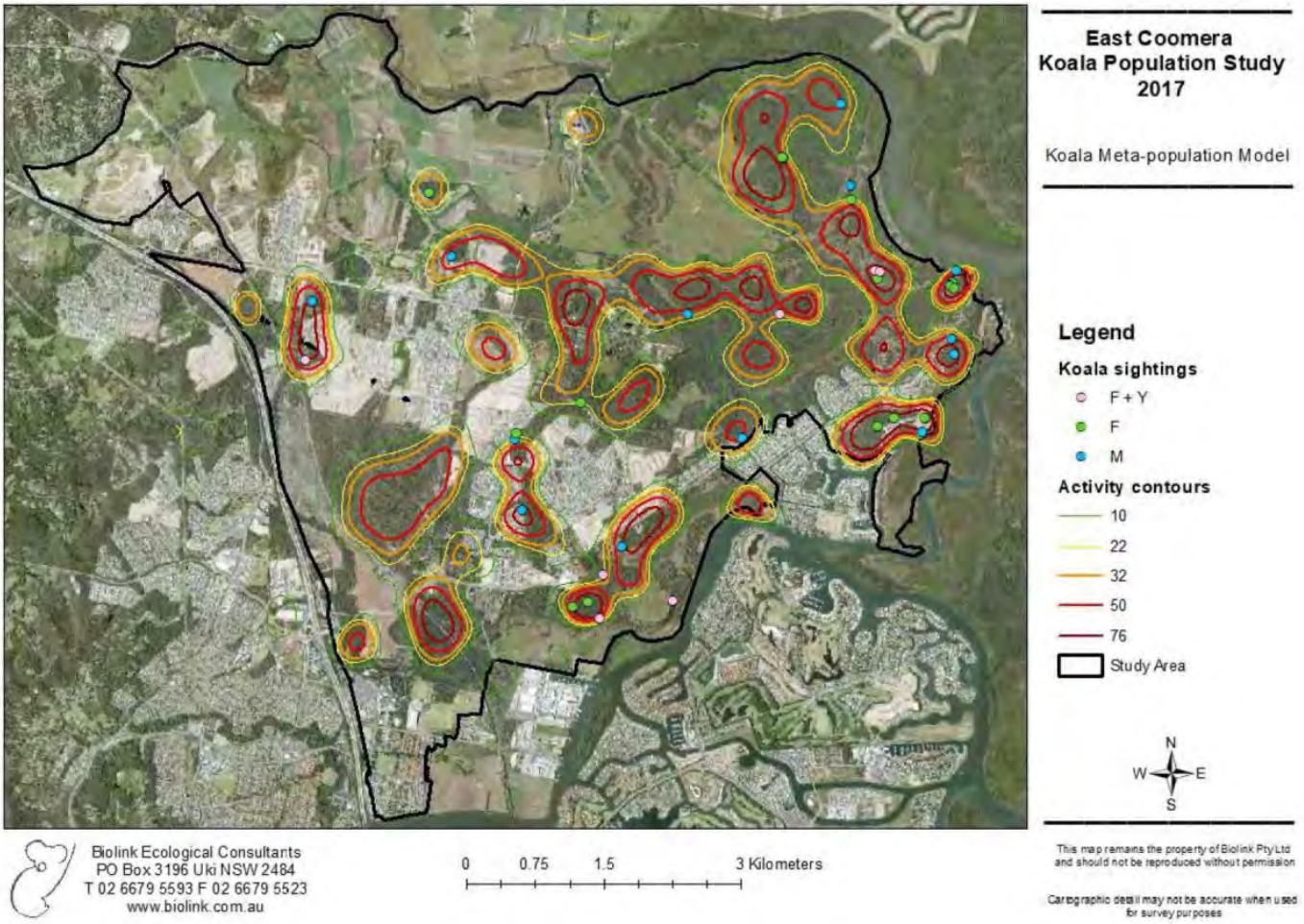


Figure 4 East Coomera study area (Biolink Ecological Consultants, 2017)

The PCKPS examined the current distribution, size, conservation status and viability of the Koala population within the reserves and urban areas of Parkwood-Coombabah. An estimated Koala population of 266 ± 46 was derived based on a density of 0.23 ±0.04 Koalas ha^{-1}. The study confirmed that Koalas are still resident in the majority of locations within the study area, where habitat has remained protected. The location of Koala identified in the 2017 PCKPS study are shown in Figure 5. A summary of the results from the ECKPS and PCKPS is shown in Table 3.

The Biolink PVA modelling highlighted the importance of the Coombabah Lakelands Conservation Area sub-population for future persistence of the urban sub-populations and the overall meta-population across the northern Gold Coast. This sub-population is significant as it provides a source of recruiting into adjoining urban areas of Helensvale, Runaway Bay, Arundel, and Parkwood. This survey noted that if it was possible to reduce risks to Koalas and subsequent mortality rates within key urban areas that support Koalas, that these areas may ultimately contribute to dispersing offspring into the adjoining Coombabah Lakelands Conservation Area.

The study provided several recommendations, of note was that five Koala management precincts were proposed. This study identified that some Koalas are likely to be disrupted and placed in imminent danger because of the Inter-Regional Coomera Connector. The study recommended that Koalas in the Ashmore/Molendinar precinct that are in imminent danger from the Coomera Connector or other approved developments be considered for relocation.

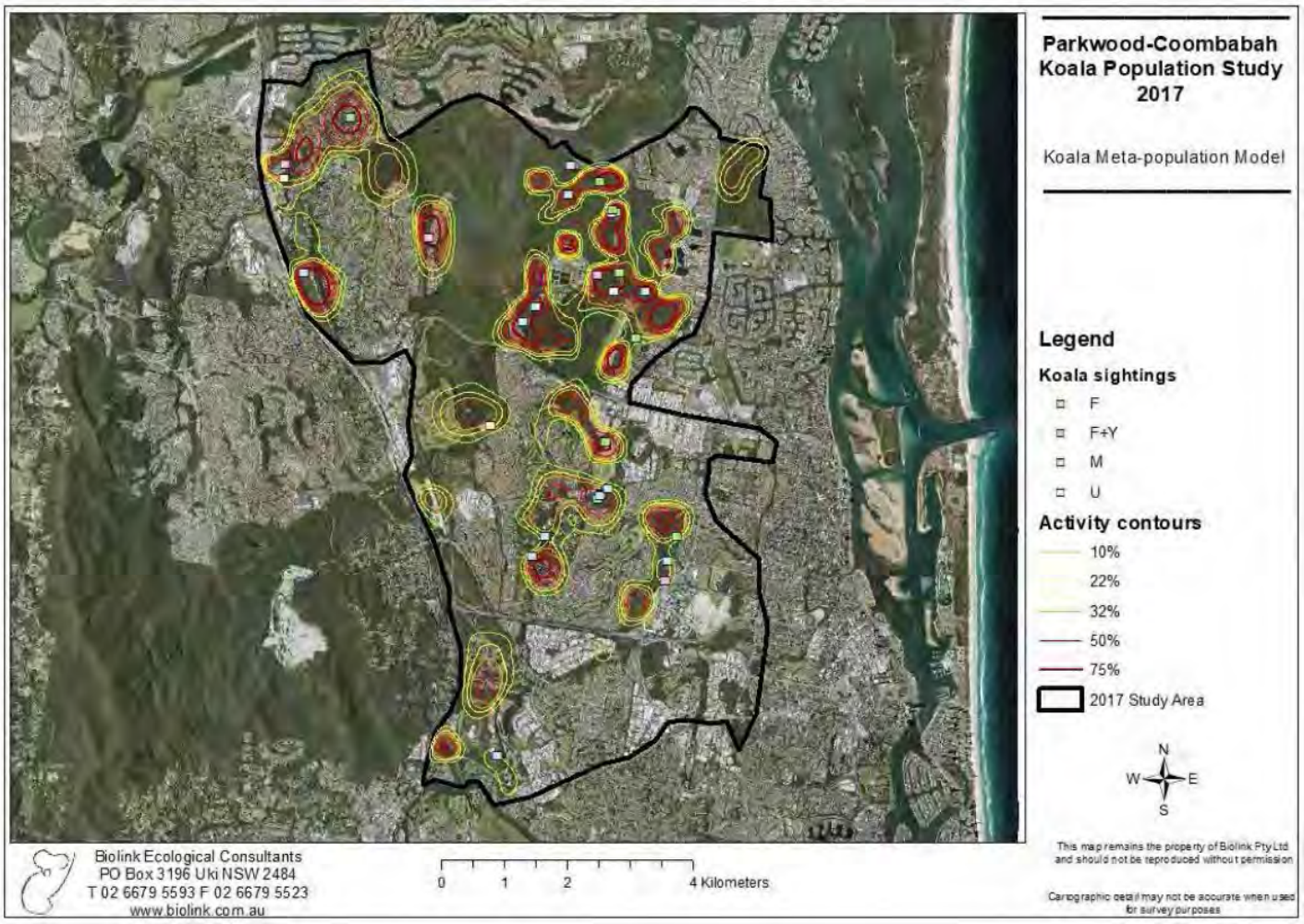


Figure 5 Parkwood-Coombabah Study Area (Biolink Ecological Consultants, 2017)

Table 3 Summary of ECKPS and PCKPS

Source	Location	Study Area (ha)	Density ha^{-1}	Population
ECKPS 2017	Coomera-Pimpama	1,467	0.34 ± 0.05	499 ± 74
PCKPS 2017	Parkwood-Coombabah	1,156	0.23 ± 0.04	266 ± 46

Figure 6 shows the location of the broader Koala populations from the ECKPS and PCKPS in comparison to the location of the proposed action.

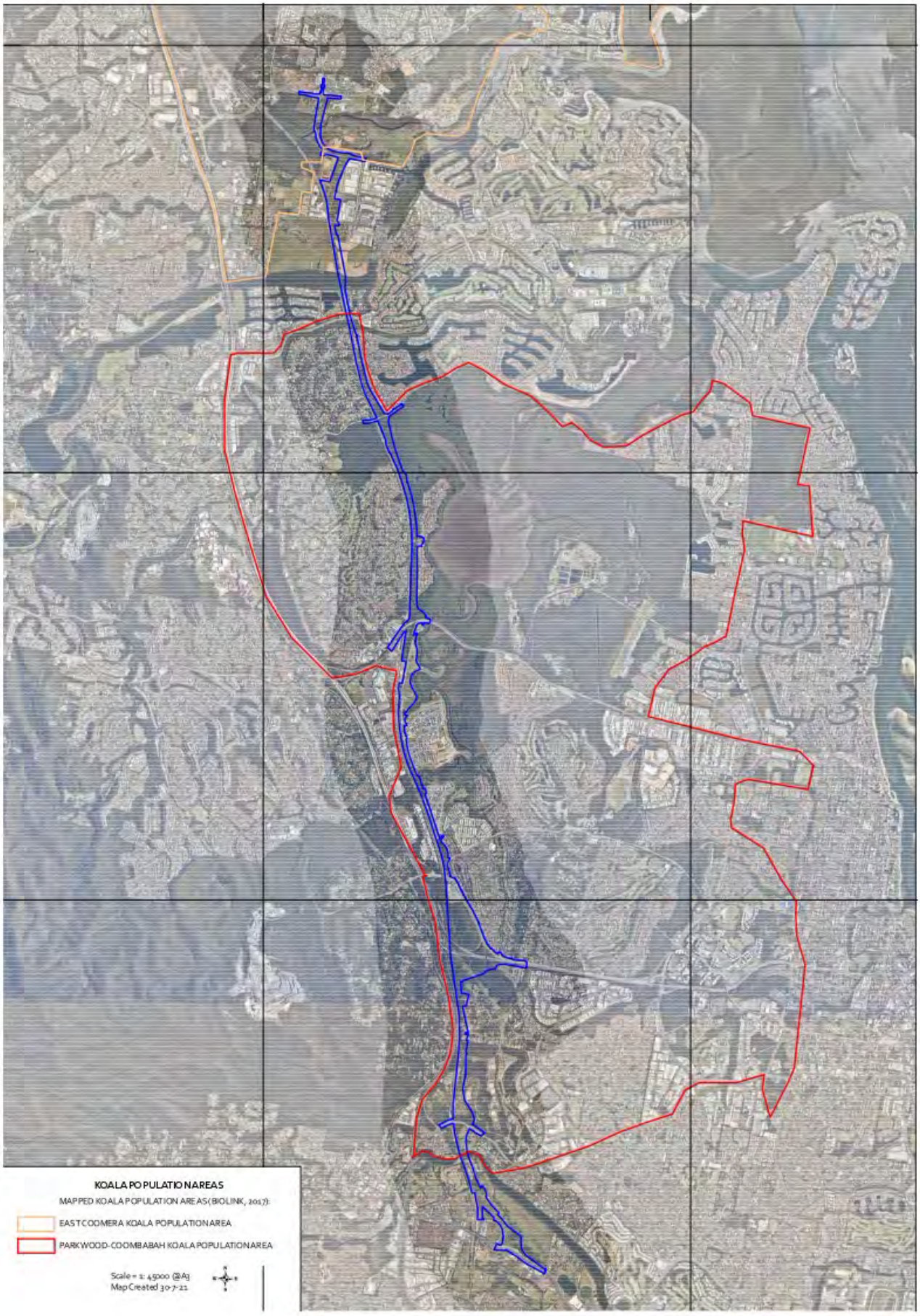


Figure 6 Koala population areas in comparison to the proposed action corridor

The Coomera-Helensvale Heavy Rail Duplication study (September 2014) did not record any Koalas within the railway corridor. The study determined that the corridor did not provide significant Koala habitat. However, the study indicated that transient use by individuals successfully negotiating a variety of dispersal barriers and crossing east/west between eucalypt forest/woodland patches was highly likely. Figure 7 shows the location of Koala sighting during the surveys.

Figure 7 Gold Coast Heavy Rail Line Koala sightings and trace map

Koala SAT were undertaken along the length of the Gold Coast Light Rail Stage 2 alignment with activity levels ranging from low to high. Assessments were conducted within the proposed Parkwood Park 'n' Ride facility, adjacent to the Smith Street Motorway, which indicated high use of the area by Koalas. Lower activity levels were observed in the south-east of the investigation area, while medium to high activity levels were commonly recorded in the west and north of the current proposed action footprint. Figure 8 shows the location of Koala observations during the study.

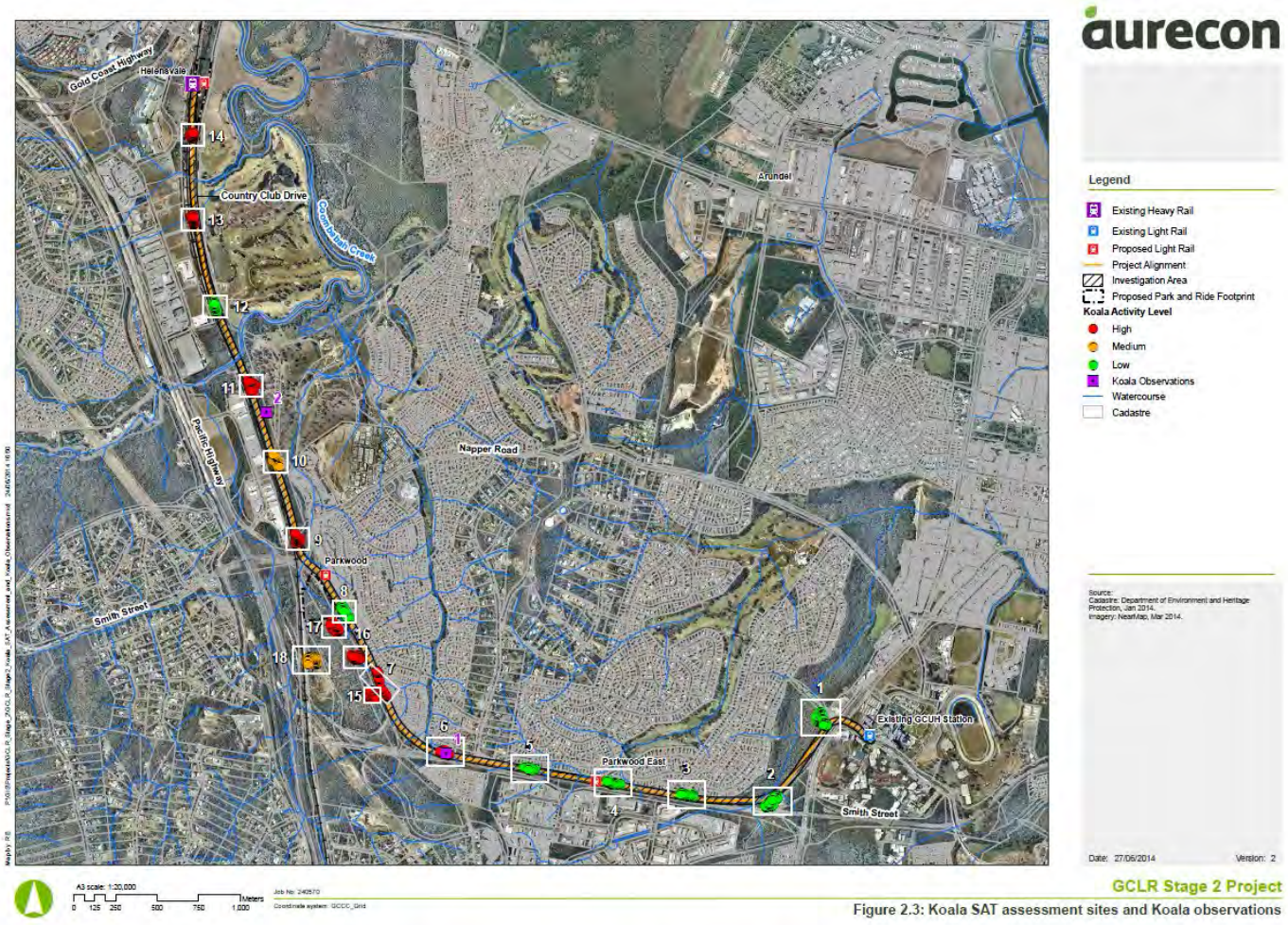


Figure 8 Gold Coast Light Rail SAT sites and Koala observations (Aurecon, 2014)

The Griffith University study aims was to monitor the current levels of Koala movements under the M1 and Gold Coast Heavy Rail Line near Coombabah Creek; assess Koala movement patterns in proximity to the existing transport infrastructure; and to provide recommendations regarding the location and design of fauna movements infrastructure for the proposed action. Phase One commenced in October 2019 and finished in April 2020, Phase Two commenced in August 2020 and concluded in October 2020. Three survey methods were used (camera trapping, scat surveys and spotlighting) to collect data at three different sites.

To ensure the data collected from both phases was comparable, similar survey efforts were undertaken during both phases of the study. The combination of methods employed in both phases confirmed that Koalas along with a wide variety of other fauna species were present within the three sites. There was a significant increase in the number of Koalas detected during Phase Two. The data collected identified that Koalas and macropods live within close proximity of the three sites surveyed, and regularly make use of the passageways beneath the Gold Coast Heavy Rail Line and Gold Coast Light Rail Line (daily movements).

Recent studies (Biolink, 2007 and 2017; Gold Coast City Council, 2013 and 2015) indicate that *Eucalyptus tereticornis, E. microcorys* and *E. propinqua/E. biturbinata* are the most preferred Koala food trees throughout the Gold Coast LGA. Previous research undertaken by Phillips & Callaghan (1996) in the Tweed Shire indicates that Swamp Mahogany (*E. robusta*) and Blue Gum (*E. tereticornis*) (including hybrids of the two) on alluvial deposits and Quaternary and Neranleigh-

Fernvale Group geomorphologies were considered to be primary habitats. Areas with sub-dominance of these species on Neranleigh-Fernvale alliances supporting Blue Gum (*E. tereticornis*), Tallowwood (*E. microcorys*) and/or Grey Gum (*E. propinqua*) comprise secondary habitat or primary habitat depending on the density of the latter two species. Updated studies by Biolink (2011) indicate *E. robusta, E. tereticornis, E. microcorys* and *E. propinqua* to be the most preferred tree species for Koalas within the Tweed Coast study area. Additional local shire studies (Phillips & Callaghan, 1998) noted Tallowwood to be a primary browse species and two types of Grey Gum (*E. propinqua, E. biturbinata)* to be secondary browse species in Currumbin.

2.1.3 Field surveys

Field surveys were undertaken to ground-truth the desktop data for Koalas. The on-ground surveys were conducted in accordance with the Koala Referral Guidelines, incorporating numerous direct and indirect detection methods (e.g., Line transects, nocturnal spotlighting, call playback, sensor activated cameras & SAT surveys).

An intensive surveying period of 12 months was conducted from July 2018 to July 2019, encompassing all seasons, weather and climate events. Additional surveys are continuing to develop a significant baseline that is relevant. On-ground surveys for Koalas were undertaken during peak (August to January) and off-peak (February to July) periods in accordance with the Koala Referral Guidelines.

Koalas and their habitat are widespread in areas of suitable habitat within and in proximity to the proposed action. The proposed action corridor contains Koala habitat and movement corridors that provide connectivity between habitat to the east and west of the existing transport infrastructure and contribute to the overall population size. Significant areas of Koala habitat and Koala food tree species are concentrated within the Coomera-Pimpama and Parkwood-Coombabah locations. Mapped area of remnant and regrowth regional ecosystems (DNRME, 2021) which are considered reflective of potential Koala habitat within the proposed action corridor (excluding estuarine wetlands, hardstand, cleared, water surfaces, cropping land etc as confirmed by survey) totals 58.158ha.

The SAT is an index-based approach that results in activity levels that identify potential habitat. The SAT method is an indirect assessment of Koala activity and involves the search of the base of a tree of any species known to have been utilised by a Koala, or to be considered of some importance for a Koala. In order of priority selection of the centre tree for a SAT site is to be based on one or more of the following criteria (Phillips & Callaghan 2011);

- a tree in which a Koala has been observed and/or
- a tree of any species at which one (1) or more Koala scat has been observed and/or
- any other tree known or considered to be potentially important for Koalas or for other assessment purposes.

The SAT approach locates one tree of the above criteria and then samples 29 of the closet trees. Sampling a minimum of 30 trees establishes a meaningful confidence interval for the activity level and creates a SAT site. The activity level identifies potential habitat and distribution of target species. The ‘east coast med-high population density’ activity threshold was adopted for the proposed action (Table 4). This method was used in all previous surveys by Biolink within PCKPS and CPKPS (2006/07 and 2010/07).

Table 4 Koala activity categorisation

Activity Category	Low Use	Medium (normal) use	High Use
East coast (low)	-	≥ 3.33% but ≤ 12.59%	> 12.59%
East coast (med-high)	< 22.52%	≥ 22.52% but ≤ 32.84%	> 32.84%
Western Plains (med-high)	< 35.84%	≥ 35.842% but ≤ 46.72%	> 46.72%

SAT surveys were undertaken throughout the proposed action to gather presence and absence data for the Koala. Forty-five SAT sites were surveyed within and adjacent to the proposed action to February 2020 using the traditional SAT method (Table 5).

Table 5 Spot Assessment Technique survey results

Site	Activity Level %	Activity Level	Site	Activity Level %	Activity Level
SAT 1	30	Medium	SAT 24	10	Low
SAT 2	10	Low	SAT 25	30	Medium
SAT 3	3.33	Low	SAT 26	30	Medium
SAT 4	26.66	Medium	SAT 27	26.66	Low
SAT 5	63.33	High	SAT 28	36.66	High
SAT 6	30	Medium	SAT 29	36.66	High
SAT 7	60	High	SAT 30	20	Low
SAT 8	40	High	SAT 31	36.66	High
SAT 9	36.66	High	SAT 32	33.33	High
SAT 10	46.66	High	SAT 33	30	Medium
SAT 11	53.33	High	SAT 34	33.33	High
SAT 12	46.66	High	SAT 35	50	High
SAT 13	36.66	High	SAT 36	43.33	High
SAT 14	26.66	Medium	SAT 37	56.66	High
SAT 15	40	High	SAT 38	20	Low
SAT 16	20	Low	SAT 39	30	Medium
SAT 17	13.33	Low	SAT 40	26.66	Medium
SAT 18	10	Low	SAT 41	20	Low
SAT 19	10	Low	SAT 42	23.33	Medium
SAT 20	13.33	Low	SAT 43	13.33	Low
SAT 21	6.66	Low	SAT 44	6.66	Low
SAT 22	20	Low	SAT 45	13.33	Low
SAT 23	13.33	Low			

Of the 45 SAT sites surveyed, all surveyed sites returned an activity level, with 18 being ‘low’, 10 being ‘medium’ and 17 having ‘high’ activity. No SAT site recorded a ‘nil’ rating, which was expected given the known Koala population and activity within the proposed action footprint and the quality of habitat encountered. These results are considered to be consistent with the most recent surveys conducted by Biolink (2017).

Scats were found under a variety of preferred Koala food/shelter trees and other native species within the gazetted proposed action. The most popular species include blue gum *E. tereticornis*, brush box *L. confertus* and pink bloodwood *C. intermedia*. The location of the SAT surveys is shown in Figure 9.

Targeted Koala field surveys by four qualified and experienced scientists were conducted around Helensvale to Parkwood area within the proposed action between March to April 2019 using the line transect method ecologists/environmental planners. These surveys were undertaken in bushland areas bounded by linear infrastructure and urban development. Transects were undertaken from north of Helensvale Road to south of Smith Street Motorway Interchange. These areas are some of the last remaining bushland remnants in the area and therefore are potentially significant for Koalas.

While the surveys were not undertaken during peak dispersal period; the survey allowed TMR to estimate abundance and density of the resident Koala population that utilise the proposed action. The density results produced from these surveys were consistent with those calculated within the PCKPS (Biolink 2017). The surveys resulted in the observation of 17 Koalas:

- one female with one dependent young
- five females

- ten males

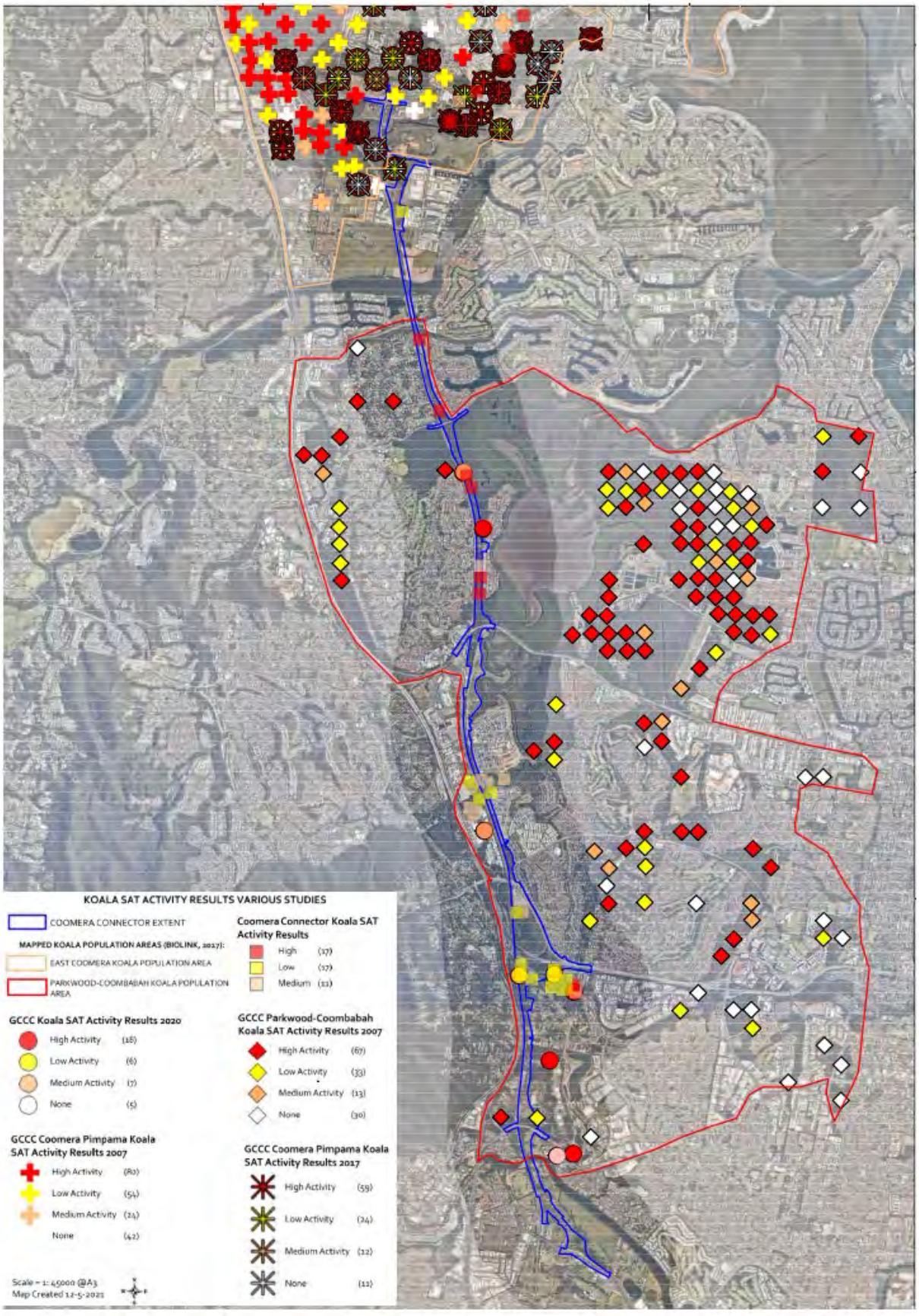


Figure 9 SAT survey sites

The average density estimate was calculated for the study area; 0.2398. Results were then compared with density estimates within the *Parkwood-Coombabah Koala Population Study* (Biolink 2017), which were found to be similar. Table 6 provides information and data from the current survey in the northern and southern transects while Table 7 provides comparative information from the current work and the PCKPS (2017).

Table 6 Targeted Koala surveys – Helensvale to Parkwood

Location	Area surveyed (ha)	Koalas recorded	Density Estimates (Koala/ha)
Northern transects: north of Helensvale Road to south of Gold Coast Highway	27.15*	10	0.16
Southern transects: area surrounding Smith Street interchange	43.73	7 (including dependent young)	0.37
Total	70.88	17	0.24

*Assumes that inundated swamp oak forest near Coombabah Wastewater Treatment Plant provides habitat

Table 7 Density estimate comparison

Location	Area surveyed (ha)	Koalas recorded	Density Estimates (Koala/ha)
Proposed action targeted Koala surveys	70.88	0.24	277 (SE)
Parkwood - Coombabah Koala Population Study (2017)	1156	0.23 ± 0.04	266 ± 46 (SE)

Opportunistic observations of Koalas were also undertaken along other sections of the proposed action. Combined, opportunistic observations and targeted transect surveys have resulted in more than 40 individual Koala observations within the proposed action's corridor. Photos of Koalas observed are shown in Figure 10. The location of Koala records across the proposed action corridor from all studies are shown in Figure 11, Figure 12 and Figure 13.

Figure 10 *Phascolarctos cinereus*

Endeavour Veterinary Ecology (EVE) carried out a comprehensive survey of Koalas between August 2020 and September 2020 using a team of highly experienced Koala surveyors. The team used representative strip transects or all-of-area patch searches of vegetation methods to provide estimates of Koala distribution and abundance. The survey also assessed the health and reproductive status of populations.

The Koala management areas are based on definable blocks based on natural or artificial boundaries such as waterways and linear infrastructure. Blocks that span the proposed action corridor include adjacent habitat that is known, or likely, to support Koalas that might be impacted by the proposed action, within reasonable limits. The Koala management areas

are consistent with the EPBC Act and its policies and policy statements and include Koala habitat that is likely to be directly and/or indirectly impacted by the construction and operation of the proposed action.

EVE surveyed approximately 700ha of potential Koala habitat from the Nerang-Broadbeach Road to Pimpama over 25 days. Of the 77 Koalas detected during the survey, 46 Koalas were detected inside or in close proximity to the proposed action corridor. There were 34 males, 41 females and two Koala where the sex was not determined. Forty Koalas were observed in the proposed action corridor. The remaining 31 Koalas were detected well away from the proposed action corridor. Based on detection probabilities and the amount of available habitat in each Koala management area (full survey included 17 Koala management areas, of these twelve were within the general proposed action area), it is estimated there were approximately between 99 and 204 Koalas present in Koala habitat around the proposed action corridor. The minimum and maximum average density range across all sites was 0.13 (observed Koalas) - 0.22 (estimated based on detection probability estimate) Koalas/ha, with an abundance of 99 (not accounting for <1 detection probability) to 204 Koalas estimated (based on detection probability) to reside within a Koala management area. The highest density of Koalas in a Koala management area was in KMA10(b) (section to the north of Helensvale Rd) which had a density of 0.89 Koalas/ha. This number is consistent with other studies referenced above. Table 39 summarises the outcomes of the Koala survey of the key Koala management areas. Figure 14 shows the location of where the surveys were undertaken.

Table 8 Outcomes of EVE Koala survey within the proposed action corridor

Koala Management Area			Koala Assessment
Reference	Location	Habitat Description (without mitigation)	No. of Koalas sighted in Koala management areas
KMA1	Nerang Broadbeach Road to Nerang River	Some loss of Koala vegetation but limited ecological value in local context	0
KMA2	Nerang River to Southport-Nerang Road	Loss of some large habitat trees that may be providing some value to the Koala	0
KMA3	Southport-Nerang Road to Keen Road	Gold Coast Heavy Rail Line has already created a barrier isolating habitat to west. The proposed action will worsen the barrier effect	0
KMA 4			7
KMA5	Smith Street Interchange	Relatively large area with existing fragmentation likely to be severely affected	2
KMA6			3
KMA7	Napper Road to Coombabah Creek	Patches and part of regional and Queensland fauna corridor	6
KMA8	Coombabah Creek to Gold Coast Highway	Small patches of Koala vegetation and part of regional and Queensland fauna corridor	0
KMA9	Gold Coast Highway to Helensvale Road	Significant area of Koala vegetation and part of regional and Queensland fauna corridor	5
KMA10			17
KMA11	Helensvale Road to Hope Island Road	Patches of Koala vegetation with southern part and part of regional fauna corridor	5
KMA12 (part)	Beattie Road to Shipper Drive	Coomera marine precinct with patches of Koala vegetation	1
Total			46

2.1.4 Habitat assessment

Remnant and regrowth bushland habitat within the Parkwood-Coombabah area along the proposed action corridor exhibit characteristics of critical Koala habitat in accordance with the Koala Habitat Assessment Tool. These areas are considered to score +8 against the Koala Habitat Assessment Tool (Table 9).

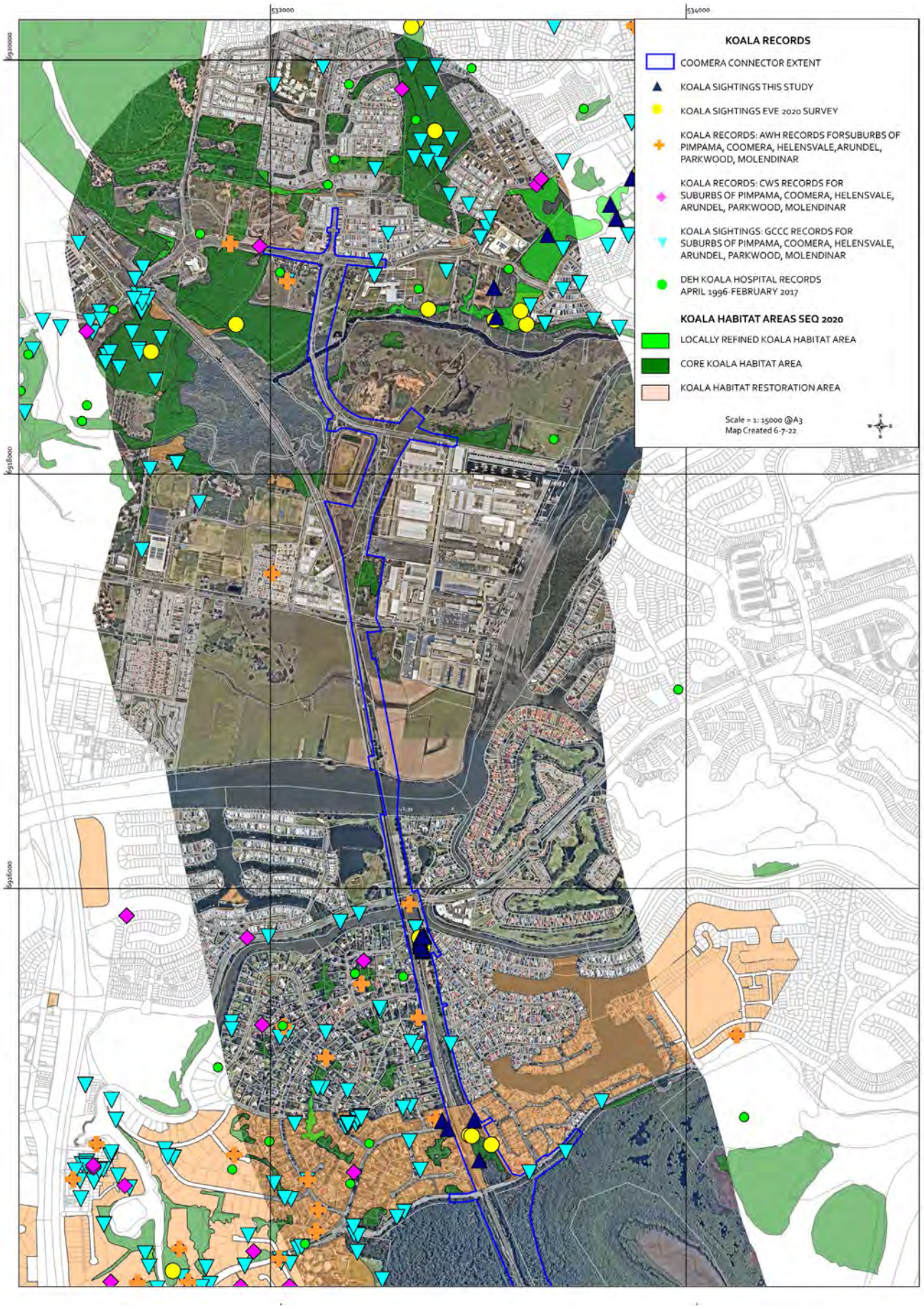


Figure 11 Koala records in the northern section of the proposed action corridor

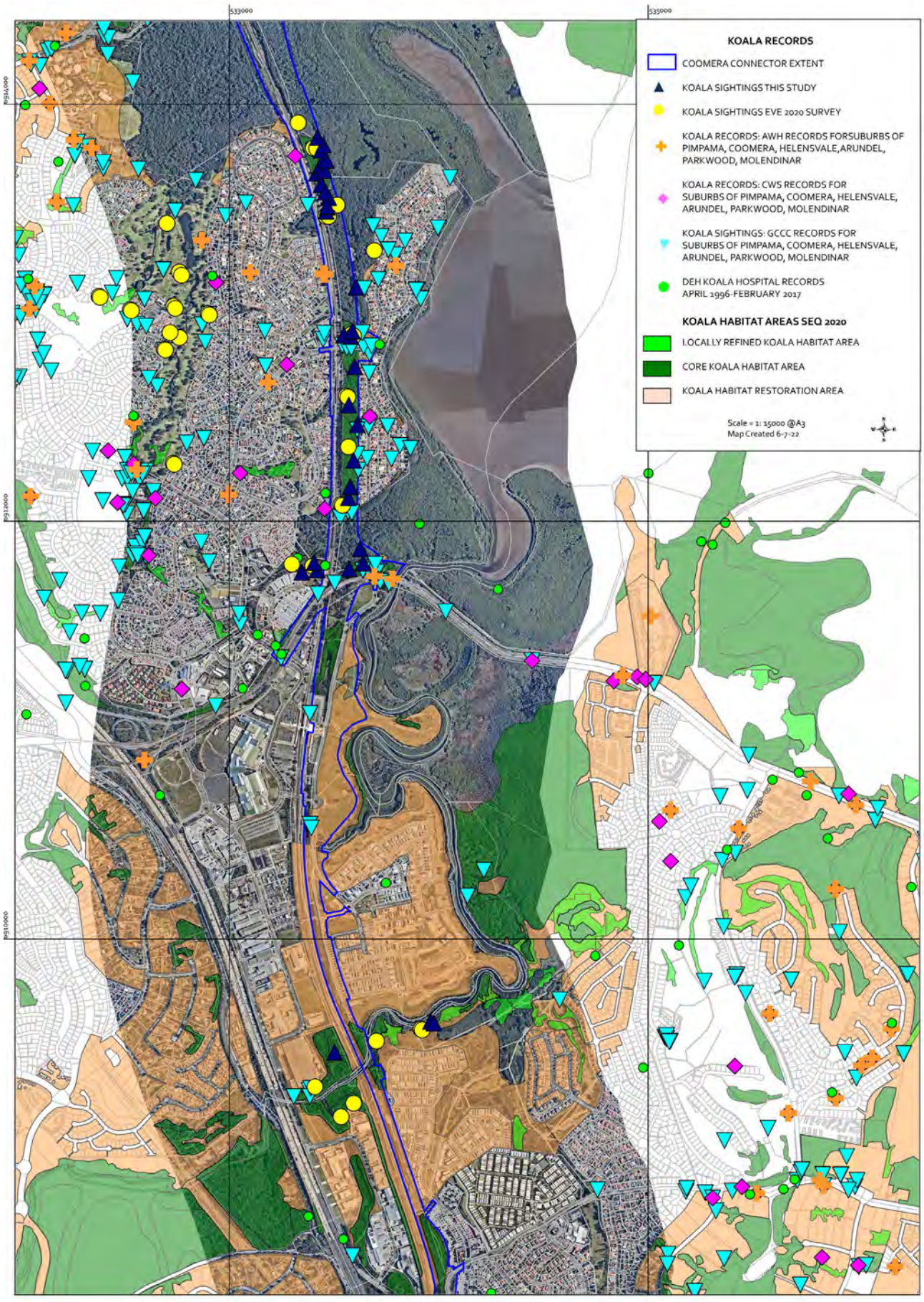


Figure 12 Koala records in the central section of the proposed action corridor

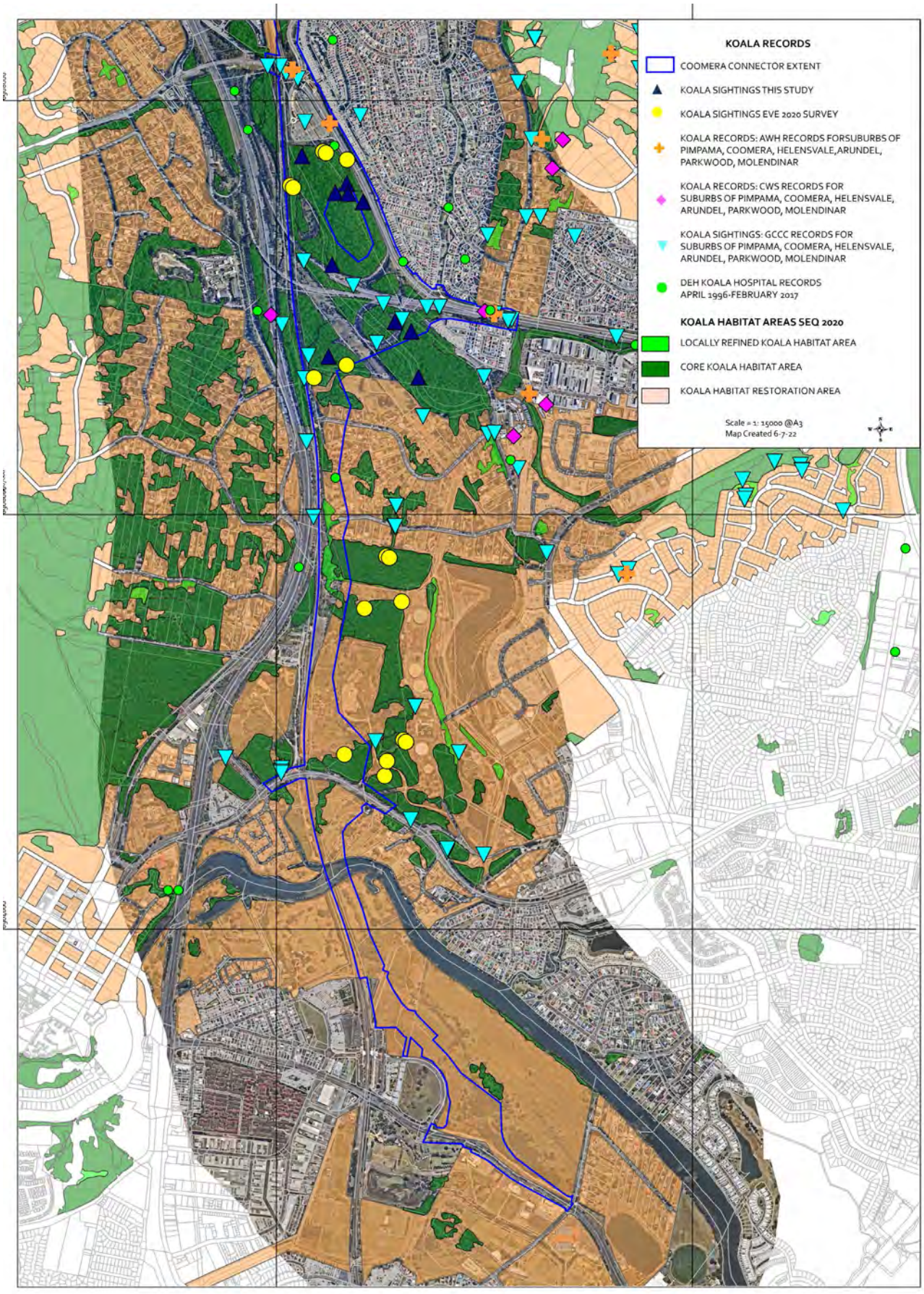


Figure 13 Koala records in the southern section of the proposed action corridor

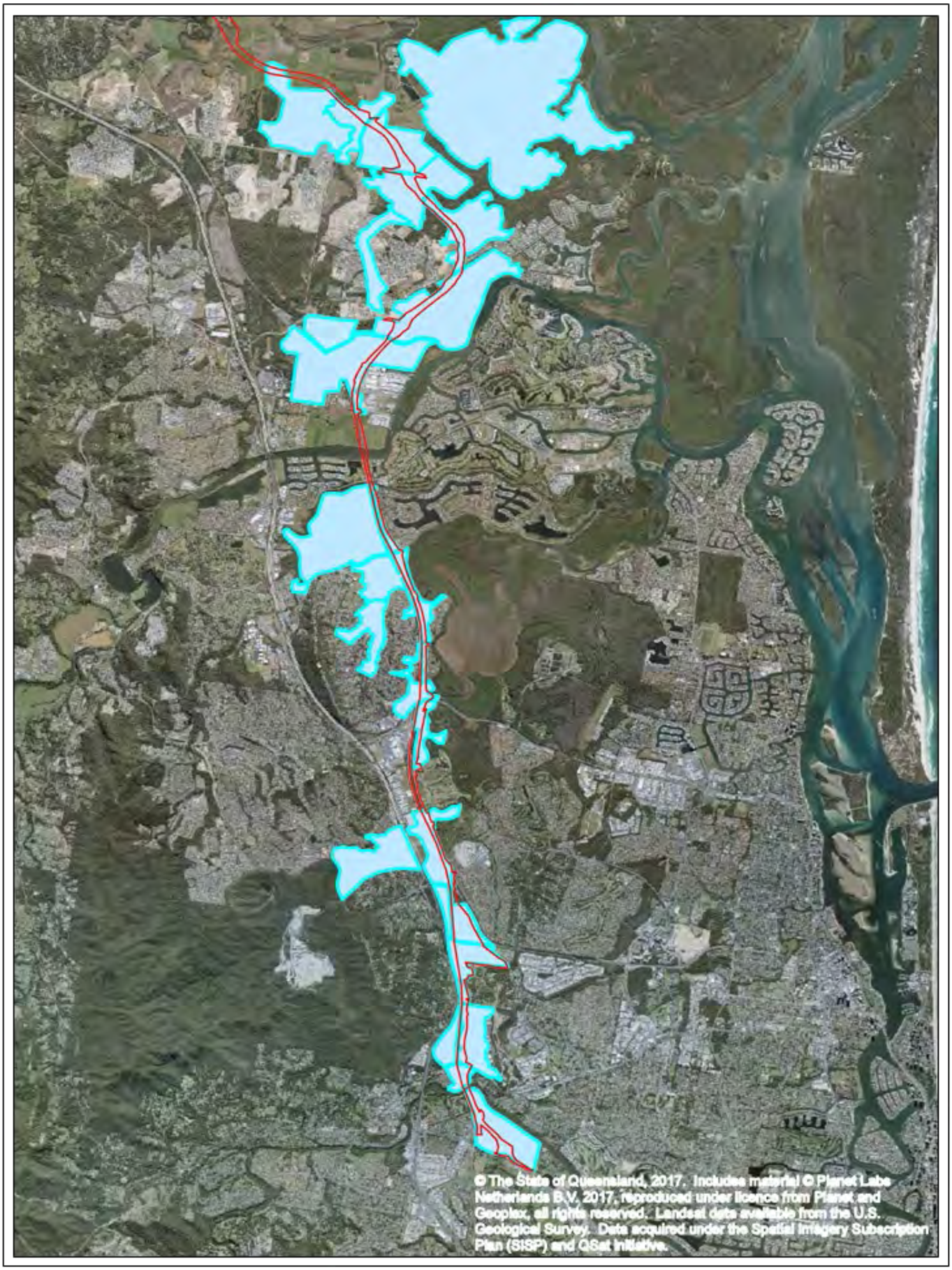


Figure 14 EVE comprehensive Koala survey locations

Table 9 Koala habitat assessment tool

Attribute	Criteria		Score	Comments
Koala Occurrence	+2 (high)	Evidence of one or more Koalas within the last two (2) years.	+2	Koalas have been recorded through both fauna surveying within this assessment and previous assessments by independent consultants and local and state agencies. Other sources such as Wildnet and Gold Coast City Council have also recorded Koalas within the proposed action Additionally, the proposed action also traverses a range of mapped Koala habitat and values including; high, medium and low bushland value and high, medium and low rehabilitation value A significant Koala population is known to occur within Coombabah, Helensvale and Parkwood which have been and continue to be monitored through a number of projects undertaken by the Gold Coast City Council The targeted Koala transect surveys within the gazetted alignment from Helensvale Road to Smith Street Motorway recorded numerous Koalas
	+1 (medium)	Evidence of one or more Koalas within two (2) km of the edge of the impact area within the last five (5) years.		
	0 (low)	None of the above.		
Vegetation Composition	+2 (high)	Has forest or woodland with two (2) or more known Koala food tree species, OR One (1) food tree species that alone accounts for >50% of the vegetation in the relevant strata.	+2	Multiple REs that occur within the proposed action corridor are considered suitable vegetation composition for Koalas with two or more known Koala food tree species 12.3.20 - Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains 12.11.23 - *Eucalyptus pilularis* open forest on coastal metamorphics and interbedded volcanics 12.11.27 - *Eucalyptus racemosa* subsp. *racemosa* and/or *E. seeana* and *Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics 12.3.11 - *Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains usually near coast 12.11.5 - *Corymbia citriodora* subsp. variegata woodland to open forest +/- *Eucalyptus siderophloia/E. crebra, E. carnea, E. acmenoides, E. propinqua* on metamorphics +/- interbedded volcanics 12.11.24 - *Eucalyptus carnea, E. tindaliae, Corymbia intermedia* +/- *E. siderophloia* or *E. crebra* woodland on metamorphics +/- interbedded volcanics
	+1 (medium)	Has forest or woodland with only one (1) species of known Koala food tree present.		
	0 (low)	None of the above.		
Habitat Connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	+2	The proposed action traverses a range of land use types including residential, commercial, industrial and agricultural areas which have fragmented the landscape and decreased habitat connectivity within the proposed action area. It is noted that the M1 and Gold Coast Heavy Rail Line run parallel to the proposed action. Portions of the proposed action are considered part of a contiguous landscape greater than 500ha. In some areas the land gazetted for the proposed action is considered the primary proposed action for fauna movements (e.g., Parkwood-Coombabah area).
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha		
	0 (low)	None of the above.		

Key Existing Threats	+2 (high)	Little or no evidence of Koala mortality from vehicle strike or dog attack at present in areas that score one (1) or two (2) for Koala occurrence OR Areas which score zero (0) for Koala occurrence and have no dog or vehicle threat present.	0	Key existing threats are known to occur throughout the entire proposed action alignment. These include vehicle strike, disease, attacks by domestic and feral animals and the fragmentation and removal of habitat. Detailed information on key threats and risks to Koalas has been recorded for specific areas within the proposed action. Such areas include the urbanised suburbs of Coomera-Pimpama and Coombabah-Parkwood. Existing threats to Koalas in the East Coomera area are well known, as extensive monitoring and research was completed during 2012 and 2013 prior to implementing the Council's translocation strategy. Vehicle strikes, dog attacks and disease are three existing threats to the East Coomera Koala population. The following data has been provided from Council's Reports and Plans (East Coomera Koala Conservation Plan 2014-2018) surrounding this strategy and reports on threats at a time when East Coomera was substantially less developed. Vehicle Strike: Between 2012 and 2013, Wildcare Australia recorded six (6) Koala fatalities from vehicle strike within East Coomera. In the same period, CGC recorded a further two (2) Koala fatalities taking the total deaths from vehicle strike to 8 for the period. The majority of these strikes occurred along Foxwell Road to the south of the proposed action site. Additionally, 13 Koala vehicle strikes were recorded along the M1where it traverses the Coomera area. Substantial development expansion and vehicle usage on existing and new roads has occurred since this period. Additionally, it is noted that the proposed action area includes two new large scale "trunk" road proposed actions partially funded by the Gold Coast City Council and Queensland Government. Dog Attack: There are approximately 60,000 registered dogs within the Gold Coast area, with the majority of these residing in urban settings and occur throughout the entire East Coomera area. In 2012, 15 Koalas were rescued or recovered from the East Coomera Area by Wildcare Australia. Many of these were due to threats of or actual suspected attacks by dogs. Substantial evidence of both frequent and regular Koala mortality from vehicle strike and dog attack is known within the immediate proximity of the proposed action site. These threats, along with the removal of habitat, are in essence why the Gold Coast City Council commenced this strategy of physically capturing and relocating the Koalas from the East Coomera area. Disease: Chlamydia is a common bacterial infection in Koalas which causes symptoms such as cystitis, conjunctivitis leading to blindness, respiratory infections, reduced fertility rates and if left untreated can lead to death. Unfortunately, most wild Koala populations are infected, and it inhibits conservation activities. Chlamydia is a serious threat to Koalas within the Gold Coast with a mortality rate of 78 per cent of those admitted to the Currumbin Wildlife Hospital. Wildcare Australia Koala rescues for 2011 and 2012 found that 26 per cent of examined Koalas from East Coomera tested positive for Chlamydia. Due to the existence of key threats, the attribute has scored 0.
	+1 (medium)	Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score one (1) or two (2) for Koala occurrence, OR Areas which score zero (0) for Koala occurrence and are likely to have some degree dog or vehicle threat present.		
	0 (low)	Evidence of frequent or regular Koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score zero (0) for Koala occurrence and have a significant dog or vehicle threat present.		
Recovery Value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table (of the Koala referral guidelines)	+2	The relevant interim recovery objectives for coastal areas are to: Protect and conserve large, connected areas of Koala habitat, particularly large, connected areas that support Koalas that are: • of sufficient size to be genetically robust / operate as a viable sub-population or • free of disease or have a very low incidence of disease or

	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the referral guidelines		• breeding (e.g., presence of back young or juveniles) Maintain proposed actions and connective habitat that allow movement of Koalas between large areas of habitat. The proposed action traverses one mapped Koala population and habitat areas within the Gold Coast; this being the Parkwood-Coombabah population. As discussed above these population are not considered to be free of disease or subject to a very low incidence of disease. The Coomera-Pimpama population is considered to be of sufficient size and genetically robust to establish a sustainable population within the rural landscape. Koalas were identified within land gazetted for the proposed action through Parkwood-Coombabah, some of which were females carrying young, indicating a breeding population within this area. As such, land within the proposed action corridor is considered important for providing connectivity between habitats, predominantly within Coomera-Pimpama and Parkwood-Coombabah. The proposed action will have no impact on the East Coomera Koala Population, and it is considered that the rural Koala population within this location is able to establish a sustainable population. TMR acknowledge the importance of facilitating Koala movement from within the urban area (west of the proposed action) to the rural landscape and as such have incorporated wildlife movement solutions into the road design to enhance connectivity, allowing urban Koalas to access the rural landscape. The land gazetted for the proposed action corridor from Parkwood to Coombabah is considered to be the primary access for Koala movement from north to south. The concept design has been amended to abut the Gold Coast Heavy Rail Line and preserve a vegetated proposed action along the eastern side of the proposed action from Helensvale Road to Coombabah Creek. This will also provide a visual buffer to residences and north-south movement opportunities for other fauna. This is subject to Queensland Rail (QR) approval.
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the referral guidelines		
Total Score			+8	Consistent with section 6 of the Koala Referral Guidelines, a score of ≥5 is considered to be habitat critical to the survival of the Koala. The proposed action is considered to impact on habitat critical to the survival of the Koala within the Parkwood-Coombabah Koala population. The proposed action is considered to have a minimal impact on the East Coomera Koala population as it is well outside the proposed action corridor.

2.2 Potential impacts

The potential impacts and general management measures for Koalas from the proposed action are shown in Table 10.

Table 10 Potential impacts and management measures for Koala

Impact	Issue	Management measure	Likelihood of success
Habitat loss and fragmentation	reducing the area of occupancy of an important population	engineering solutions and translocation	medium
	adversely affecting habitat critical to the survival of a species	engineering solutions and translocation	medium
	losing ≥20 hectares of high-quality habitat critical to the survival (habitat score of ≥ 8)	engineering solutions, translocation and offset sites	medium

Vehicle strikes	increasing Koala fatalities in habitat critical to the survival of the Koala due to vehicle-strikes	engineering solutions and translocation	medium
Light and noise	disturbing habitat disturbance during operation because of increased light and noise	compliance with integrated noise barriers and fauna fencing	high
Hydrology	changing hydrology which could degrade habitat critical to the survival of the Koala	engineering solutions and translocation	medium
Dog attacks	increasing Koala fatalities in habitat critical to the survival of the Koala due to dog attacks	engineering solutions and translocation	medium
Disease	increase in the prevalence of Chlamydiosis	vaccine trial and veterinary assessments	high
Climate change	increases in extreme weather events including droughts, floods and bush fires	offset site	medium

3. Avoidance, mitigation and management strategies for Koala

3.1 Overview

The main avoidance and mitigation measures in the Koala Management Plan include

- engineering solutions
- offsets measures (see chapter 9 of the PER re Greenridge and Tabooba)
- protect Koalas from harm during vegetation clearing and construction works through the use of fauna spotters
- continuation of the comprehensive Koala survey within the proposed action corridor and external in important Koala populations including in the East Coomera Koala Population and Parkwood-Coombabah Koala Population
- Koala tagging and monitoring program: this component includes an assessment of suitable translocation recipient sites within both the East Coomera Koala Population and Parkwood-Coombabah Koala Population; monitoring of the Koalas that are identified as being at-risk during and/or because of construction activities; and the monitoring of the Koalas that are remain during the operational phase of the proposed action
- active Koala management including but not limited to monitoring and observing the presence of the Koala within and in proximity to the proposed action corridor; assisted with the dispersal of Koalas to nearby surrounding habitat outside the proposed action corridor; and translocation of Koalas in imminent danger in the first instance to the East Coomera Koala Population. The translocation of any Koala will be undertaken through a coordinated and approved approach under the Koala Translocation Program
- long term monitoring of the trends in Koala populations within and in proximity to the proposed action corridor

- Compensatory Conservation Management Program to target existing or potential threats to local Koala population viability
- audit of the expected minimum area of Koala habitat expected to be lost and/or significantly impacted by the construction and operation of the proposed action.

The outcomes of the above will be included in reporting provided as part of the approval conditions of the proposed action as well as to both the Queensland Department of Environment and Science and Gold Coast City Council. Consultation will be undertaken with government stakeholders and other stakeholders as identified in Chapter 11 of the PER to provide a coordinated approach for the net benefit of Koala in the northern Gold Coast region.

3.2 Management approach

Those management arrangements are shown in Figure 15.

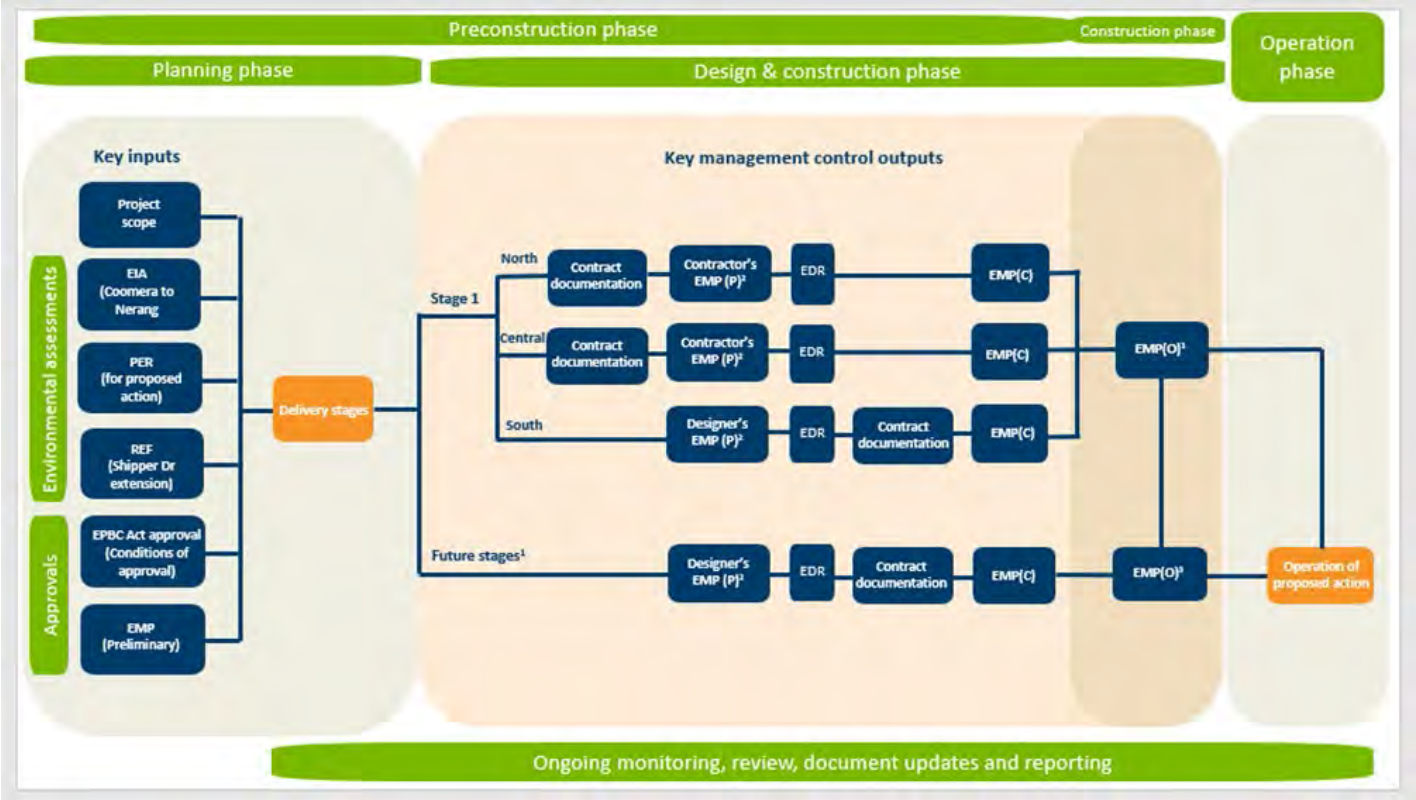


Figure 15 Environmental management process for the proposed action

The key environmental management control documents will include:

- The PER together with any subsequent approval conditions issued by the DAWE.
- The Environmental Management Plans (Planning) and site-specific environmental management measures for the design (pre-construction), construction, and operational phase of the proposed action which describe the proposed mitigation measures from the PER together with DAWE approval conditions.

The Environmental Management Plan (Planning) has been prepared in accordance with the TMR Environmental Processes Manual (August 2013). The current Environmental Management Plan (Planning) was prepared for the original referred footprint of the proposed action and will be updated during the pre-construction period by the three contractors for north, central and south sections of the proposed action.

Consistent with the above, the appointed contractors will update the Environmental Management Plan (Planning) for each design and/or construction package to provide:

- Details of the contractor's management responsibilities and timing for meeting Australian, Queensland and local statutory obligations and TMR's contract requirements.
- Revisions to the scope of the proposed action since the preliminary Environmental Management Plan (Planning) including the latest environmental information and approval conditions.
- The processes for communicating with the regulatory/administrative authorities/departments and the community including relevant stakeholders.

TMR will engage contract administrators to manage all three contracts for north, central and southern sections of the proposed action. The role will include but not be limited to managing the contract including any variations on behalf of TMR, the review of contract documents/proposed action plans and contract submissions, surveillance of the proposed action corridor, preparation of regular reports including environmental information, assisting with public enquires and keeping TMR informed. Both TMR and the contract administrator will review the updated Environmental Management Plan (Planning) and approve/accept its use before the commencement of construction of each package.

The Contract Documentation will as a minimum:

- specify the environmental contract requirements between TMR and the contractors for the various packages of the proposed action.
- include key environmental requirements from the PER, DAWE - DCCEEW approval conditions and any updates to the preliminary Environmental Management Plan (Planning).
- define the requirements for the contractor's environmental monitoring plan and program, review including auditing and reporting.

The contract documentation may vary with the type of design and/or construction contract. TMR will finalise and approve the contract documentation as part of the contract award process for each main contract package, which would normally include the following:

- an Environmental Design Report that will:
  - describe how the recommendations from the contractor’s/ designers Environmental Management Plan (Planning) have been captured in the design and contract documentation.
  - record any key decisions made during the design process.
- the Environmental Management Plan (Construction) that will:
  - define the environmental roles and responsibilities for the construction teams.
  - include details of Australian and Queensland Government and Gold Coast City Council approval conditions.
  - detail the management and mitigation measures to meet the requirements of Environmental Management Plan (Planning), Environmental Design Report and contract documentation for the construction phase.
  - address the environmental requirements and processes that will be followed during construction including key subplans for managing soil and land contamination, surface water quality, groundwater and threatened flora and fauna species.
  - identify areas of high environmental risks and the management of those risks.
  - outline a schedule of monitoring, auditing, reviewing, and reporting of the construction phase.
  - include site specific sub-plans as part of the general Environmental Management Plan (Construction).
- an Environmental Management Plan (Operation) that will:
  - define the environmental roles and responsibilities for the operations teams at TMR.
  - include details of Australian, Queensland and Gold Coast City Council approval conditions.
  - describe the maintenance requirements and practices to be followed to minimise both natural and human environmental impacts.

- outline a schedule of monitoring, reviewing, and reporting of the operational phase.

The Environmental Management Plan (Construction) will be a "living" document that will be updated and amended as required based on new/additional knowledge as construction activity progress.

The Contract Documentation will require the contractor for each section (north, central and south) to employ an experienced environmental representative to prepare and manage the environmental requirements of the Environmental Management Plan (Construction) through the construction phase based on approval conditions. The contractor's environmental representative will be required to manage the environmental requirements of the design including preparing and submitting the documentation to obtain Queensland and Gold Coast City Council's environmental approvals, licences, permits and authorities required under the Environmental Management Plan (Planning) separate from any approval conditions imposed by DAWE for the proposed action.

There will be single Environmental Management Plan (Operation) for the proposed action which will initially be prepared by one contractor and progressively updated by the subsequent contractors. TMR will:

- review and approve the Environmental Management Plan (Operation) before the commencement of the operational phase of each package.
- implement the approved Environmental Management Plan (Operation) for the life of the proposed action.

Both TMR and the contract administrator will review all the above Environmental Management Plans and sub-plans listed above and approve them before the commencement of construction and operation of the proposed action. Where the documents and/or plans do not fulfil the requirements of approval conditions, TMR and the contract administrator will request the contractor to update the documents and/or plans prior to approval.

A key input into the management measures is the outcomes of further monitoring of the size, movement, and health of the Koala populations. As described in Section 4.4 I, the Coomera Connector Koala Conservation Strategy (EVE, 2022), four (4) primary on-ground program surveys will be undertaken.

3.3 Pre-construction (design) management measures

TMR gathered baseline data on the presence Koala movement corridors within and in proximity to the proposed action. It is critical as an avoidance and mitigation measure that connectivity be retained in specific areas of the proposed action corridor.

To achieve this connectivity, TMR will incorporate permanent fauna connectivity structures in the design of the proposed action to allow Koala movement. These permanent fauna connectivity structures maintain or improve the current fauna connectivity across the proposed action and existing light and heavy rail corridors. TMR are currently proposing to construct wildlife movement solutions based on the known requirements for Koala, the current alignment of the proposed action corridor and condition of fauna corridors and topographical constraints. These will be fully assessed as part of detailed design. Most connectivity solutions are associated with bridge structures and be designed and constructed consistent with TMRs Fauna Sensitive Road Design Manual.

In the case where the proposed wildlife movement solutions are bridges, the minimum size be three (3) metres wide by three (3) metres high fauna passage which is consistent with previous research in the region. The wildlife movement solutions will;

- provide dry passage clear of batters/rock abutments/ scour protection to ensure long term viability
- provide suitable substrate conducive to the movement of the target species under bridges and around entrances
- provide connectivity and shelter
- consider limiting piers in waterways where reasonable and feasible
- maximise light penetration: for multiple carriageway bridges, provide a gap between carriageways where feasible to assist in allowing light penetration under the structures

- restore and/or maintain riparian vegetation along waterway corridors
- maintain natural stream flow
- locate bridge abutments away from waterways to increase opportunity for terrestrial passage where reasonable and feasible
- fauna furniture will be installed to allow refuge from predators for arboreal species where reasonable and feasible

Provision has also been made for the retention of a minimum ten (10) metre wide strip of vegetation on the eastern side of the new corridor from approximate Chainage 34600 (south of Helensvale Road) to the Gold Coast Highway as a north-south wildlife corridor. Table 11 provides information on the current proposed location and design of the wildlife movement solutions for the proposed action. Refinements will be made to wildlife movement solutions during detailed design.

TMR will also design and construct permanent Koala exclusion fencing and returns to minimise the potential impacts on Koala particularly during the operational phase of the proposed action. Urban areas and high traffic/speed zones pose several potential impacts which may have adverse impacts to fauna and access to these areas should be limited where possible. To avoid and minimise the impacts of vehicle strike and disruption of dispersal/movement, Koala exclusion and directional fencing is to be installed. This will discourage attempted crossings east-west across the proposed action, and guide fauna to designated safe fauna crossing locations and wildlife movement solutions. Significant areas for the installation of exclusion and directional fencing include the area from Helensvale Road to Coombabah Creek and the Smith Street Motorway Interchange, as these areas are significant for the local Koala population. Fauna exclusion fencing will be installed around the entirety of the Smith Street interchange which will bisect and fragment existing vegetation, to discourage individuals from entering a high traffic/speed zone with lanes heading in numerous directions. Fauna exclusion fencing will be designed and constructed in accordance with TMRs Standard Drawings Roads. Additional general considerations for fauna exclusion fencing include:

- construct fences to guide fauna towards the fauna crossing entrances
- construct bridges prior to the erection of permanent fencing
- modify for example, noise walls to prevent fauna from climbing the barrier
- adapt wire-mesh size, height and treatments to prohibit species from accessing the proposed action
- Use of alternative returns at the on and off ramps to discourage fauna from entering the proposed action

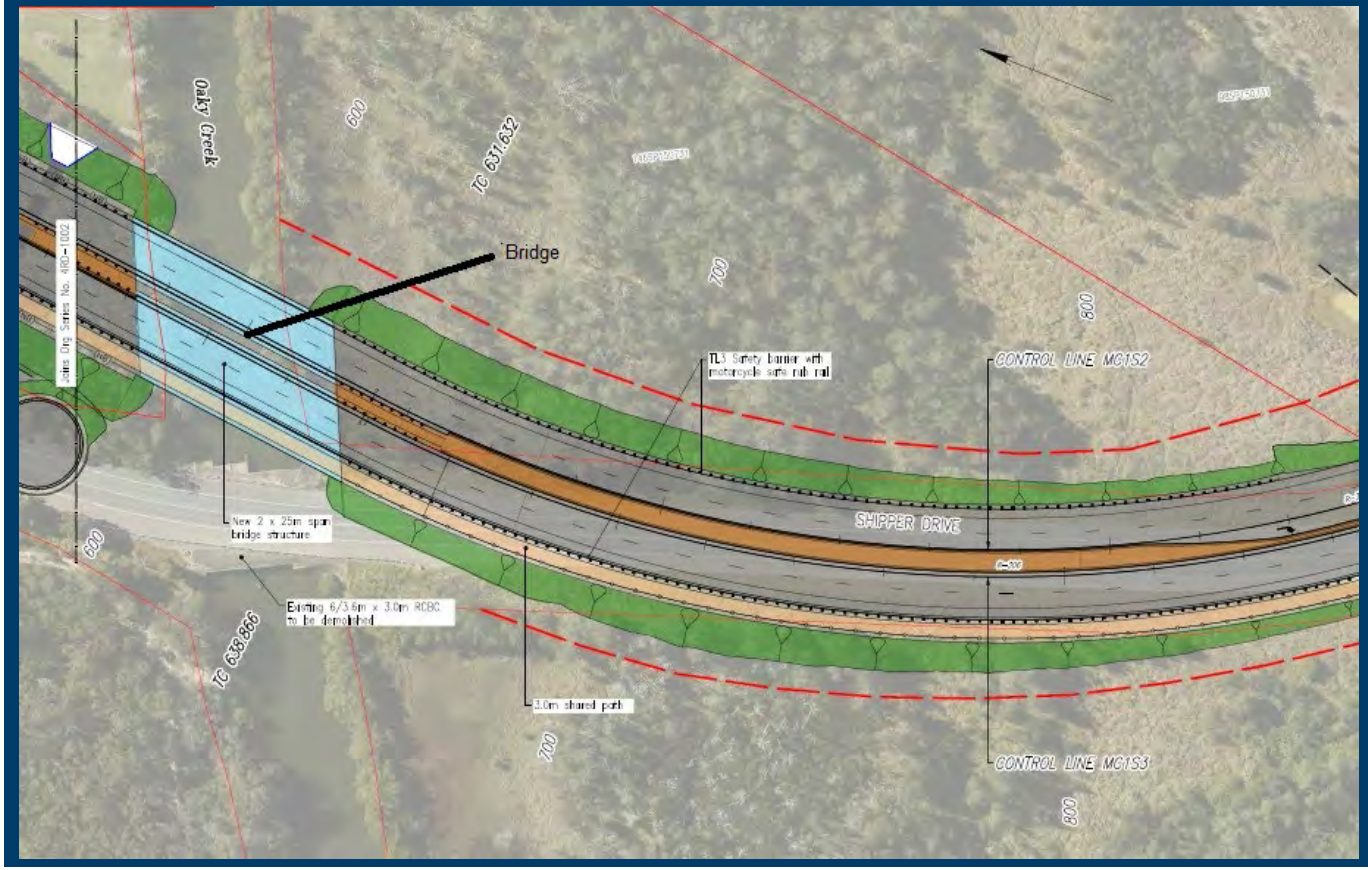
Noise and lighting will need to be mitigated. TMR commit to designing and installing noise barriers and lighting to limit noise levels to acceptable levels and maintain a high level of safety to both road user and residences. TMR will explore the following measures to minimise the impacts on fauna:

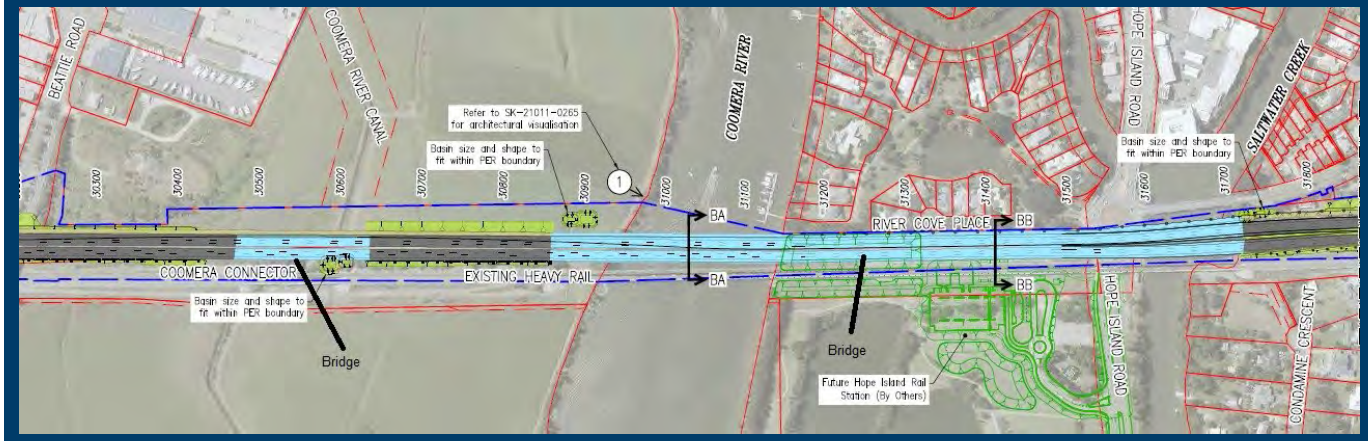
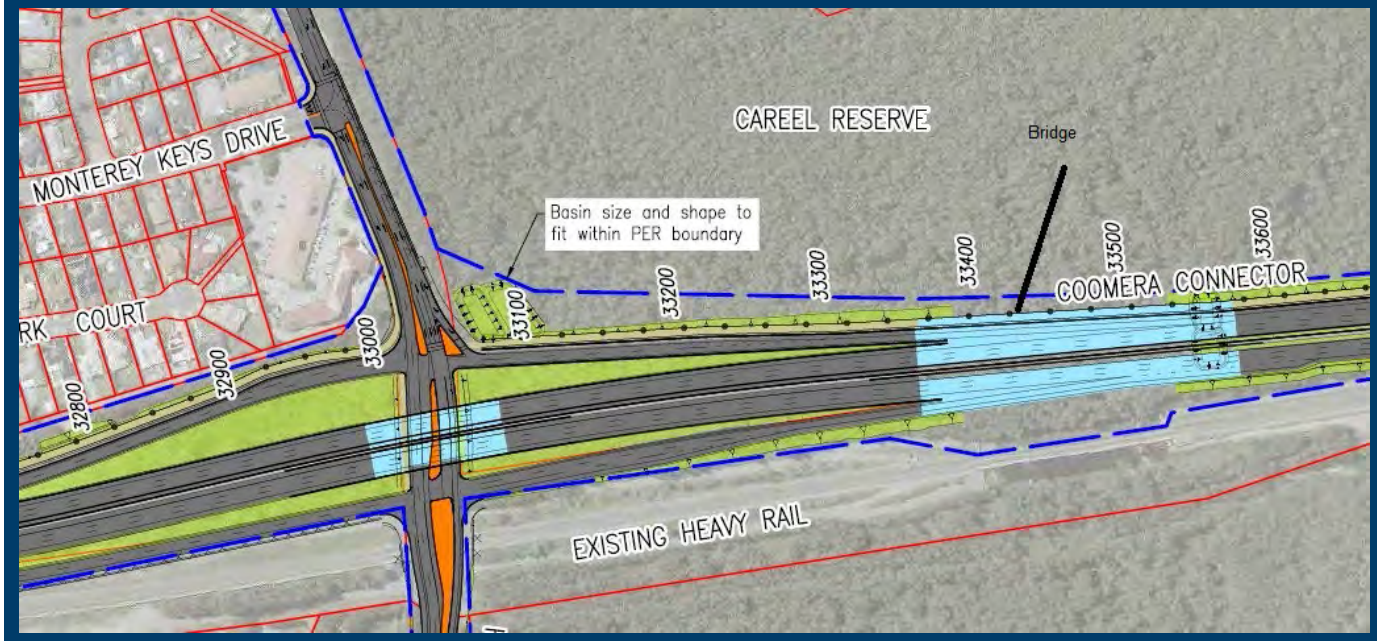
- utilise and if required modify the noise wall design to provide supplementary benefits to fauna
- minimise light spillage by providing directional lighting on street lighting at the more sensitive fauna locations including but not limited to installing lighting on the eastern side of the shared path facing west to reduce light spill to sensitive areas particularly in proximity to the Moreton Bay Ramsar Wetland where Koalas may inhabit
- undertake suitable landscaping including planting within and on the edge of the proposed action, in accordance with *Vegetation Management Sub-Plans* of the Environmental Management Plan (Construction) and *Urban Landscape Plan for the Proposed Action*

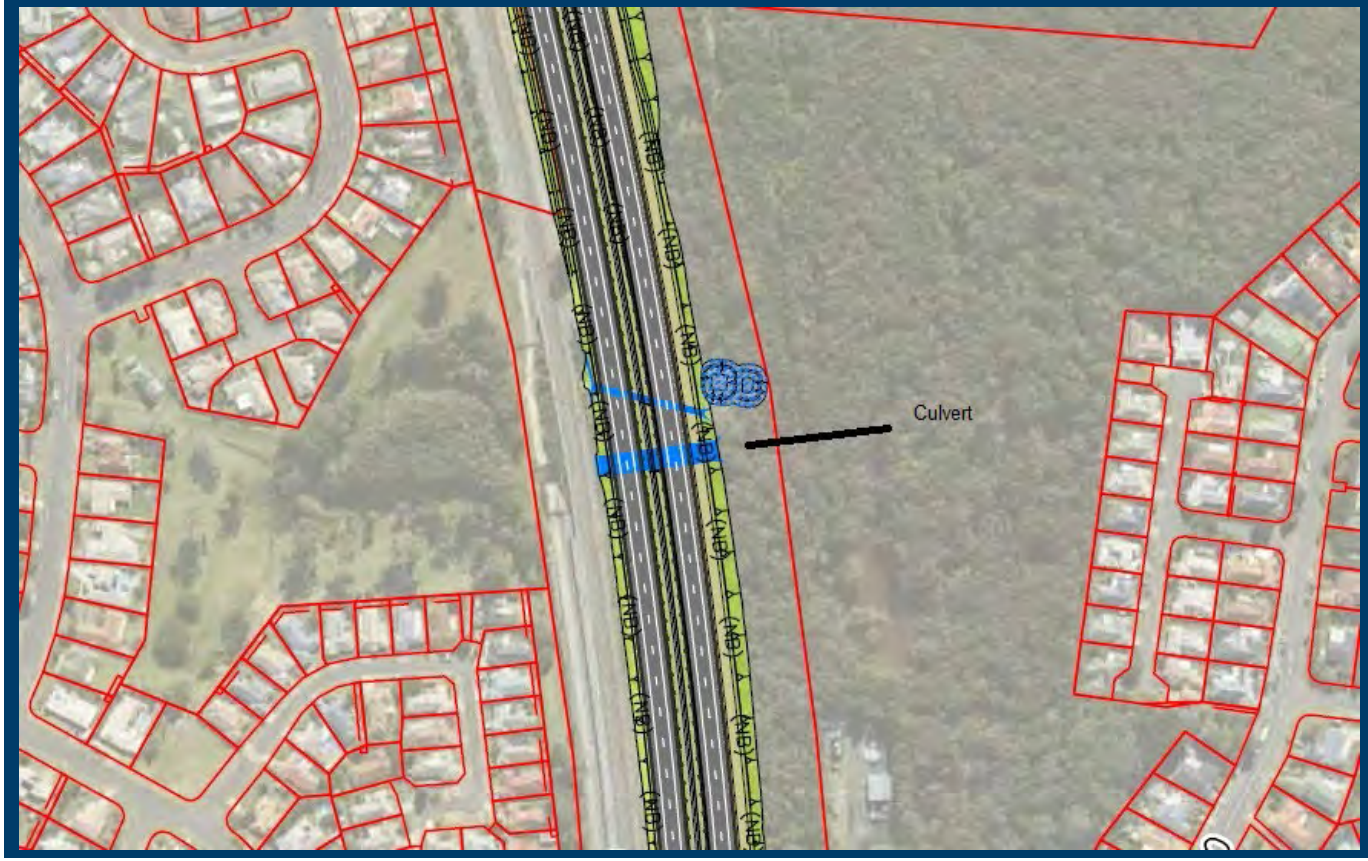
TMR will implement general preconstruction management measures outlined in Table 12 to mitigate the potential impacts on Koalas from the proposed action. Table 12 also outlines frequency for monitoring, corrective action, and triggers.

Table 13 provides details of the pre-construction management tasks specifically related to Koalas, to support the general construction management measures in Table 12.

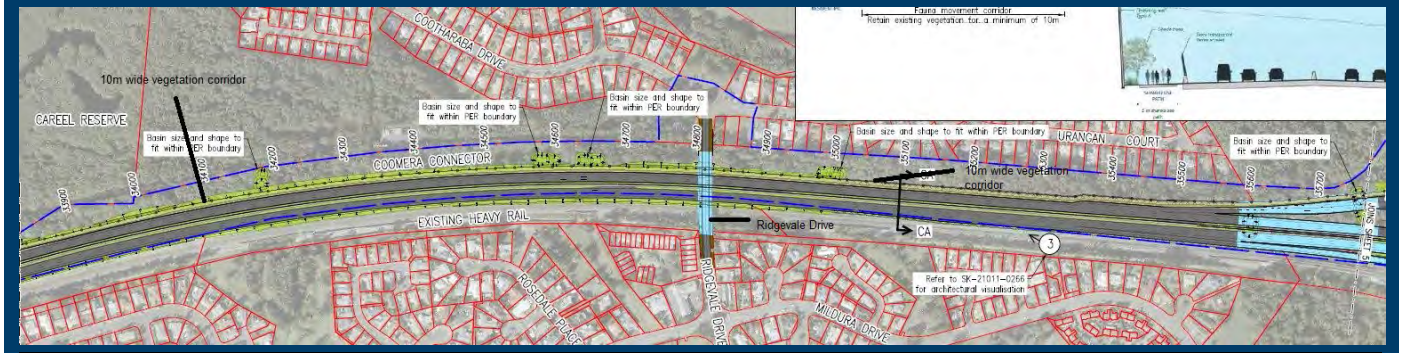
Table 11 Wildlife movement solution priority areas for the Koala

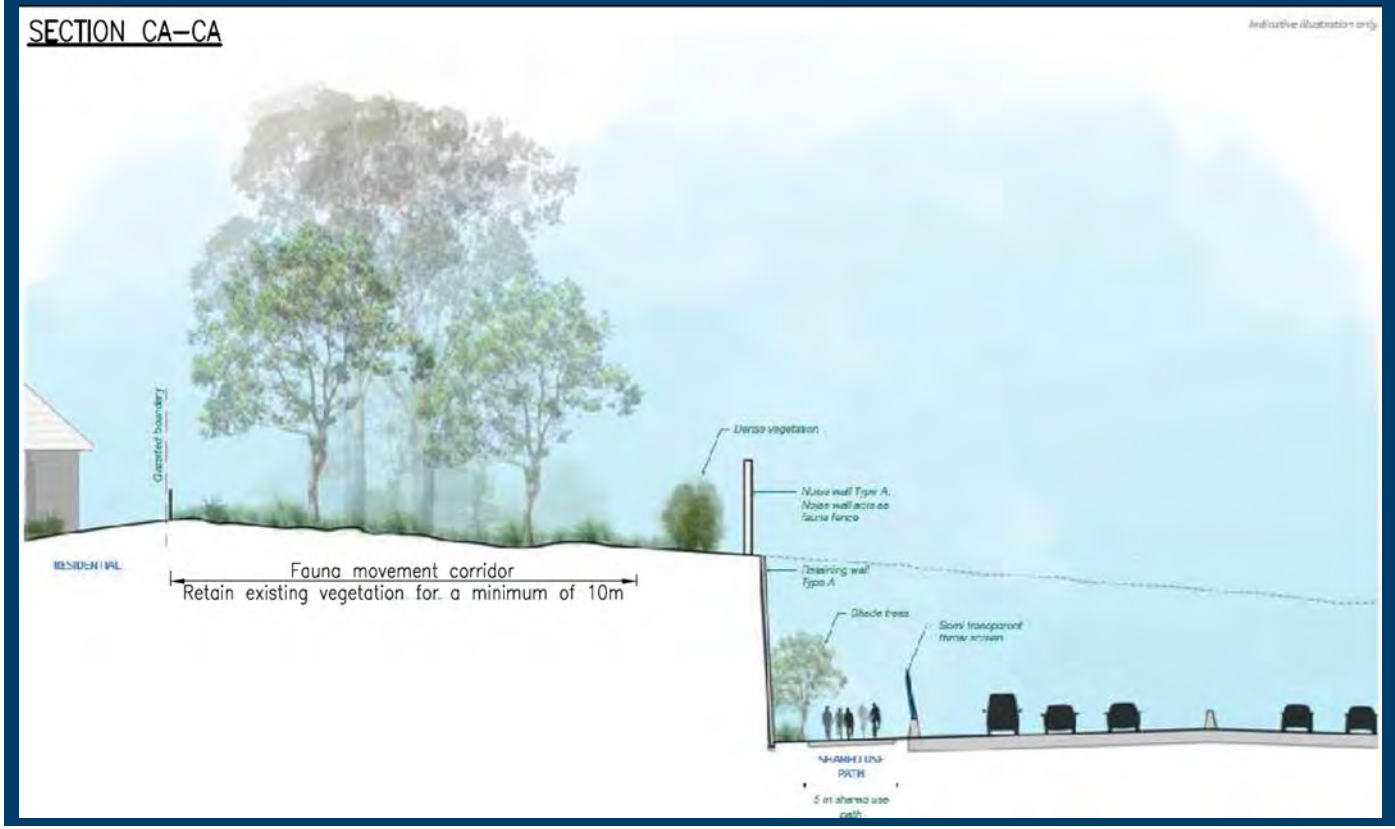
Location	Corridor Value	Comments/Recommended Wildlife Movement Solution
Shipper Drive Extension (Oakey Creek) 	BPA State & Regional Biodiversity Corridor	Provide minimum of 3 m wide by 3m vertical clearance of dry passage for fauna movement on northern and southern banks of Oakey Creek Remove existing culverts and revegetate creek banks

Coomera River Overflow, Coomera River and Saltwater Creek 	BPA State Biodiversity Corridor	• Provide minimum of 3 m wide by 3m vertical clearance of dry passage on northern bank of Coomera River, under the new Coomera River to Saltwater Creek bridge to facilitate fauna movement • Provide additional fauna movement under the new Coomera River overflow bridging.
Coombabah Lakelands Overflow Channel 	BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor	• Bridge sufficient in height and span to provide for fauna movement with minimum of 3m wide by 3m vertical clearance of dry land provided on northern and southern banks to facilitate fauna movement. • Strengthen east-west connection with planting / revegetation on approaches to proposed action and upgrade heavy rail underpasses with fauna furniture where reasonable and feasible

Chainage 34215  	BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor	• Utilise 2.1 m x 2.5 m culvert to provide supplementary east-west fauna movements • Strengthen east-west connection with planting/revegetation on approaches to proposed action

Coombabah Lake – Careel Reserve - Chainage 34600 (south of Helensvale Road) to the Gold Coast Highway

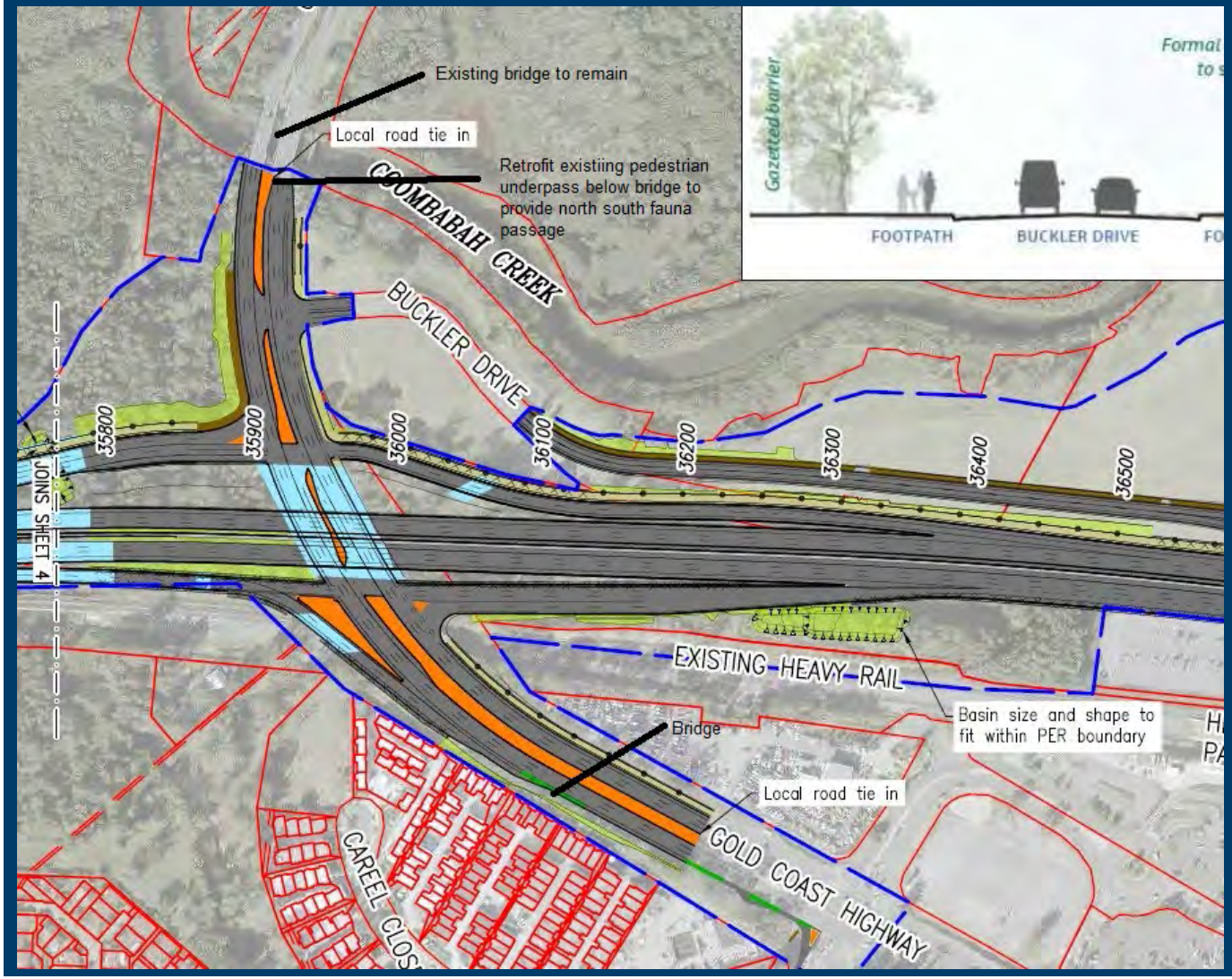




BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor

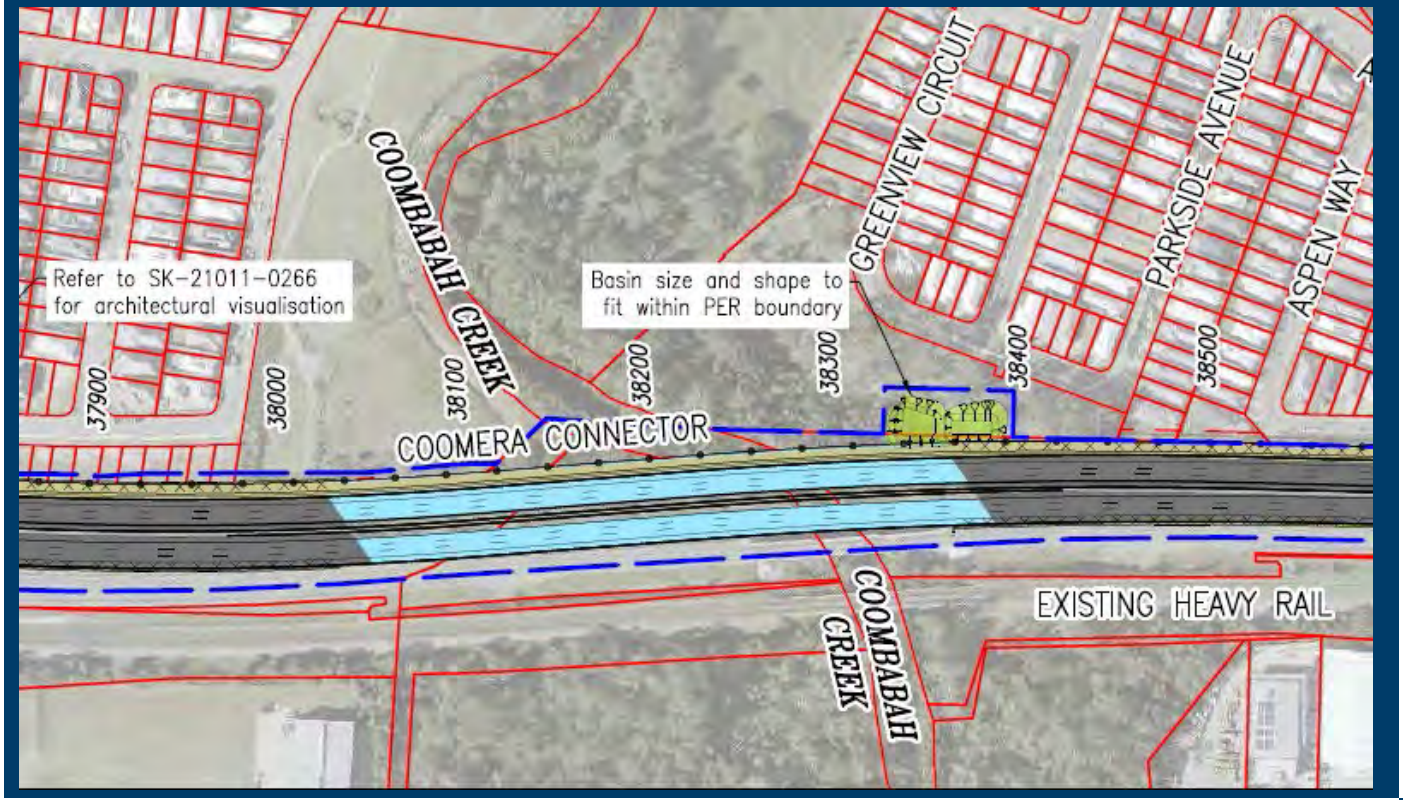
- Retain a minimum 10 m wide vegetation corridor on eastern side of proposed action for the north- south fauna movement
- At the Ridgevale Drive overpass, adjust design to abut the rail corridor and provide a narrow corridor of retained vegetation providing a visual barrier for residences and a minimum of 3 m wide by 3m vertical clearance to facilitate fauna movement.
- The bridge will extend over this vegetated corridor to provide north-south fauna movement opportunities

Coombabah Creek Pedestrian Underpass / Gold Coast Highway



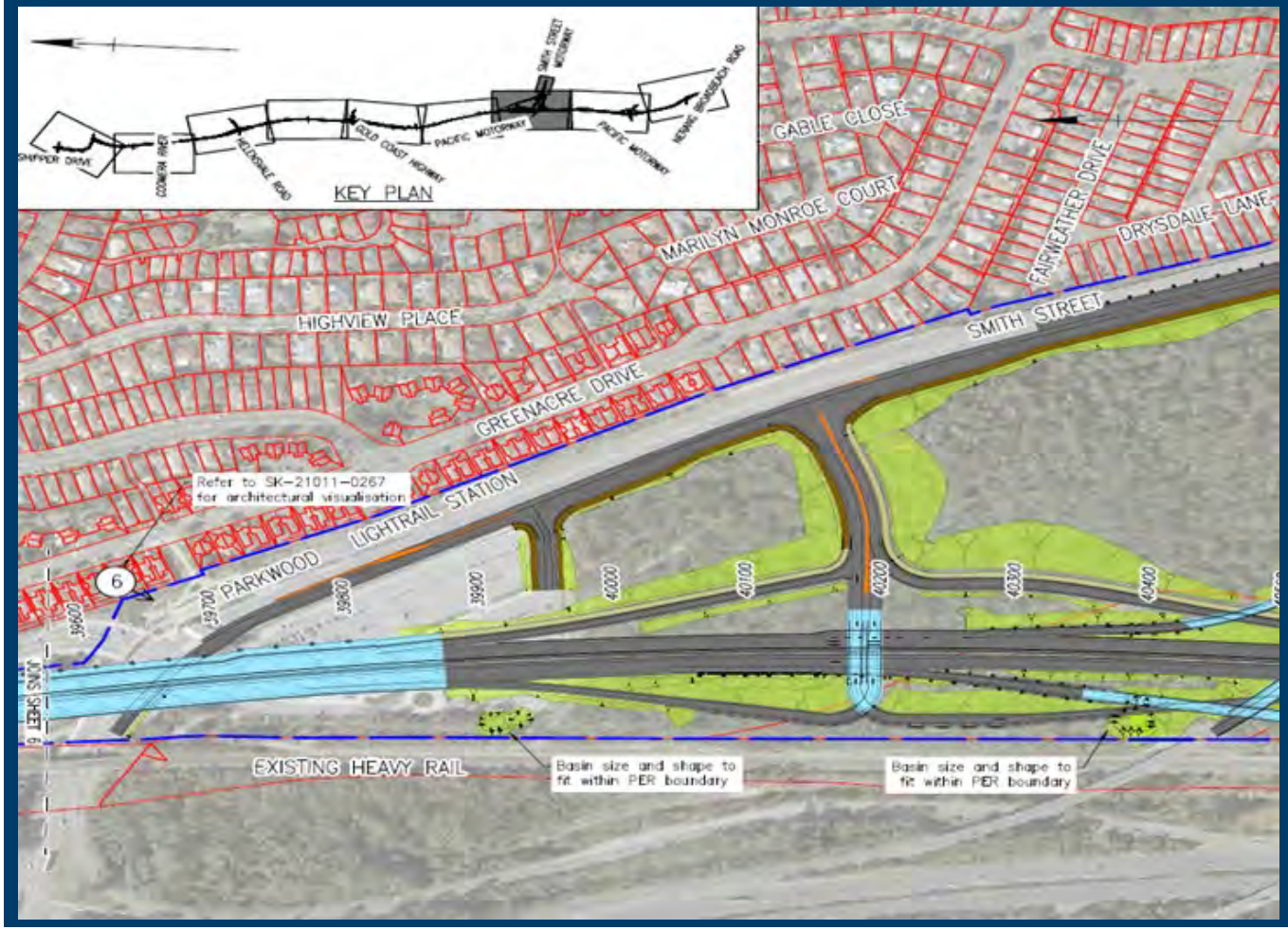
BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor	• Where reasonable and feasible, retrofit existing pedestrian underpass to a minimum of 3 m wide by 3 m vertical clearance of dry land on northern bank of Coombabah Creek under the Gold Coast Highway to facilitate fauna movement • Strengthen east-west connection with planting/revegetation on approaches to proposed action

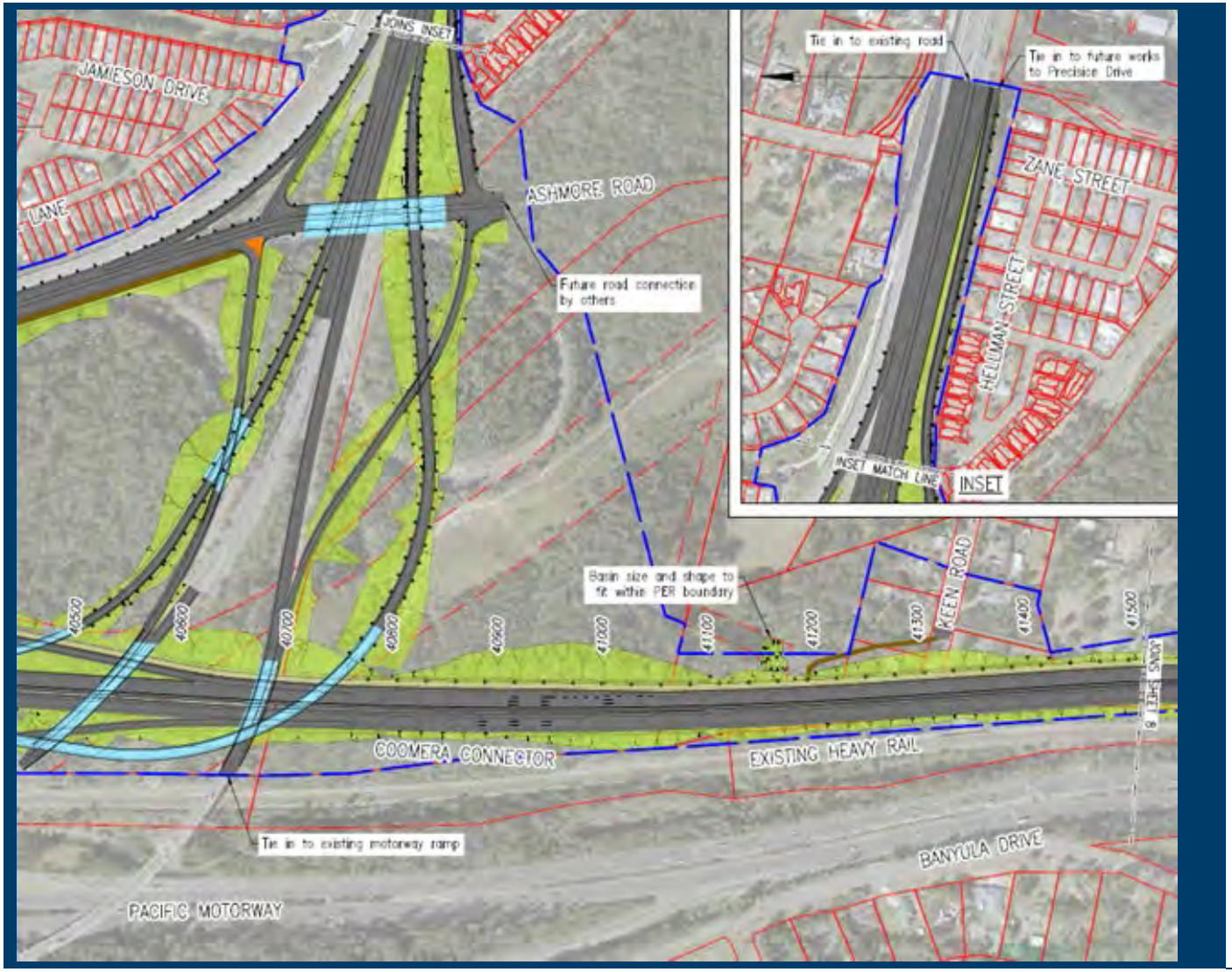
Coombabah Creek



BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor

- The bridge has been extended north to increase connectivity along Coombabah Creek as the creek doglegs in this area to facilitate fauna movement
- Provide minimum of 3 m wide by 3m vertical clearance of dry passage for fauna movement on northern and southern banks of Coombabah Creek
- Strengthen east-west connection with planting/revegetation on approaches to proposed action and upgrade heavy and light rail underpasses with fauna furniture where reasonable and feasible

Smith Street Motorway Interchange  	SEQ BPA State Terrestrial Corridor	Install fauna exclusion fencing around the entire interchange to discourage use by fauna (see Koala Management Plan outlining the process for translocating Koalas impacted by the proposed action)


JOINS INSET
JAMIESON DRIVE
LANE
ASHMORE ROAD
Future road connection by others
Tie in to existing road
Tie in to future works to Precision Drive
ZANE STREET
HELLMAN STREET
INSET MATCH LINE
INSET
Basin size and shape to fit within PER boundary
KEEN ROAD
JOINS SHEET 6
COOMERA CONNECTOR
EXISTING HEAVY RAIL
Tie in to existing motorway ramp
BANYULA DRIVE
PACIFIC MOTORWAY

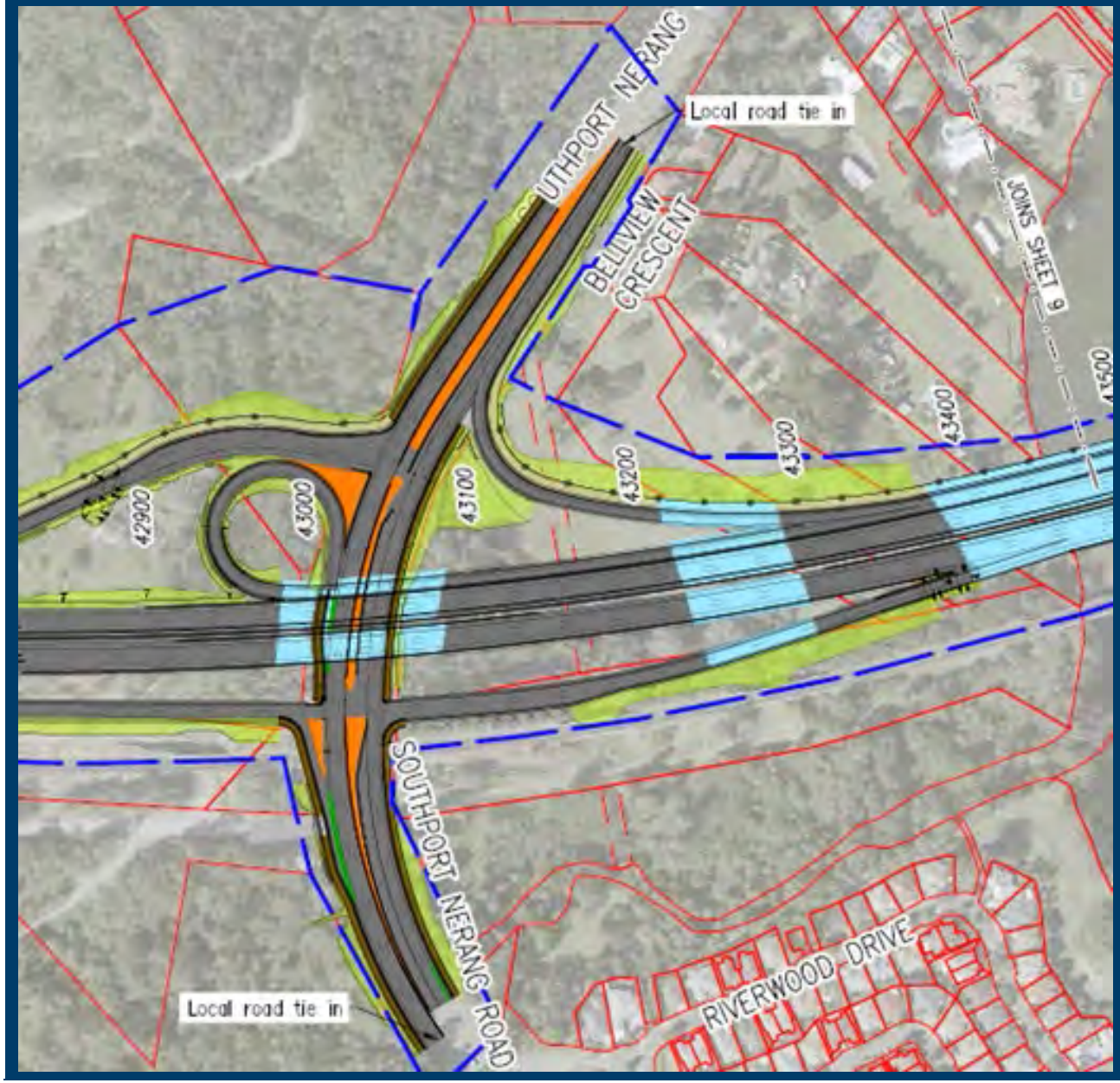
Nerang River  		BPA State Biodiversity Corridor and Gold Coast City Council's Hinterland to Coast Critical Corridor	• Provide east – west passage under Nerang overflow and northern bank of Nerang River bridging to facilitate fauna movement

Table 12 General environmental management measures and corrective actions for Koala – pre-construction

Management Response	ID No.	Proposed mitigation measure	Monitoring/ timing frequency	Triggers for corrective actions	Corrective actions	Responsibility
Update Koala Management Plan	PC-TS1	Progressively update the Koala Management Plan to reflect the latest requirements and relevant information	After proposed action approval to inform design and delivery, prior to construction and prior to operation as a minimum	Koala Management Plan will be updated to reflect the latest requirements and relevant information	Flag concerns and explore/ implement appropriate strategies and seek/ obtain approval before proceeding	TMR
Place infrastructure to avoid Koala habitats where possible	PC-TS2	Implement multi- disciplinary design review processes involving an ecologist to review placement of infrastructure in relation to habitat for threatened flora and fauna.	At each design iteration	Infrastructure intersects, overlaps or fragments habitat for threatened flora and fauna. Uncertainty regarding potential risks to threatened flora and fauna habitat	Flag conflicts and concerns with design lead and explore/ implement appropriate strategies or alternative design / engineering solutions	Environment Representative
	C-TS3	Identify habitat exclusion zones prior to clearing to guide the placement of infrastructure and ancillary facilities outside of threatened flora and fauna habitat areas, where possible	Prior to commencement of site works	Exclusion zones have not been: • clearly identified in site plans • flagged and identified on site.	Revise and reissue site plans and ensure flagging is installed correctly on the site before construction can commence	Proposed Action Ecologist
Provide design solutions to maintain the connectivity of adjacent Koala habitats	C-TS4	Proposed action design to incorporate suitable engineering solutions for fauna movement	Prior to construction at detailed design stage	Detailed design drawings indicate changes to the location or design specifications for fauna structures that have the potential to impact suitability to facilitate fauna movement	Provide additional fauna connectivity structures if design solution cannot feasibly achieve design principles for the identified fauna crossing locations as identified in Table 5	Design Manager / Environment Representative
Provide design solutions to minimise changes in hydrology within areas of Koala habitat	C-TS5	Proposed action design to incorporate engineering design to maintain the background hydrology and ensure adequate spill containment.	Confirm drainage design using hydrological modelling during detailed design. Use baseline monthly ground and surface water level monitoring to inform natural variation within the proposed action corridor	Water diverted to or from threatened flora or fauna habitat.	Review and if necessary, amend drainage design	Design Manager / Environment Representative
Noise and lighting	C-TS6	Proposed action design to incorporate suitable engineering solutions to minimise noise and lighting spill from proposed action	Prior to construction at detailed design stage	Detailed design has not properly considered effective engineering solutions	Review and if necessary, amend drainage design	Design Manager / Environment Representative

Table 13 Key pre-construction management tasks specific for Koala

Key management task	ID no	Description of task	Responsibility

Comprehensive Koala Survey		• Survey habitats within and in proximity to the proposed action corridor, potential translocation recipient sites, and potential offset sites to provide an estimate of:
		  · the number of Koalas likely to be directly and indirectly impacted by vegetation clearing
		  · the number of Koalas that might need to be translocated
		  · the Koala density in potential Koala translocation recipient sites to provide an estimate of additional carrying capacity
		• Assess the health of the Koala populations within and in proximity to the proposed action corridor, and potential translocation recipient sites to inform disease management measures for the Koala tagging and monitoring program and Koala translocation plan.
			EVE- completed

Commencement of Koala tagging and monitoring program		Commence the Koala tagging and monitoring program in the planning and preliminary design phases, to inform: • the design and engineered mitigation of the proposed action • the Koala translocation program • to determine the key impacts to local Koala population viability that will require management	EVE - completed
Implement Koala translocation program		Prior to commencement of vegetation clearing in areas designated as habitat from which Koalas will be translocated: • capture and undertake a health check of all Koala • subject to determining that Koalas as suitable for immediate release, tag the Koala with a telemetry device, immediately release in the designated translocation recipient site(s), and monitor for a minimum period of 12 months • If necessary, undertake veterinary management for treatment of disease and injury and perform any necropsy (post-mortem) examinations) • identify and revegetate suitable areas with Koala trees preferably adjacent to, or including habitat offset areas that are potentially suitable for the receiving of " at risk" Koalas • undertake activities such as wild dog monitoring to establish with reasonably certainty, the risk profiles that could potentially affect Koalas in habitat patches at translocation sites • engage and inform Koala rescue groups on the protocols for Koala monitoring and translocation for the proposed action. • implement a local community awareness program to ensure prompt notification of the TMR Responsible Officer of "at-risk" Koalas found in or near the delineated Koala management areas for the proposed action	EVE – in progress

Additional Measures to target existing or potential threats to local Koala population viability		• Using the data derived from the KTMP, along with other sources of information, TMR will develop undertake the following additional measures · work will Gold Coast City Council on a wild dog monitoring and control in relevant Koala management areas - triggers for control will be the contribution of wild dogs to Koala mortality of 10% or more · treat Chlamydial disease in all captured Koalas to be included in the relevant Koala management areas · vaccinate Koalas in the relevant Koala management areas based on the seriousness of the threat that chlamydial disease poses to population viability and subject to appropriate development and testing of the vaccine · install fencing as required along feeder roads to the proposed action if evidence indicates that they currently, or will during the operational phase of the proposed action create a significant risk of vehicular collision/trauma for Koalas · Provide climate-change impact mitigation measures, such as supplementary planting of heat-refuge tree and shrub species, artificial heat refugia and water sources, and bushfire mitigation in habitat offset and translocation sites. · Work with Gold Coast City Council to update the Population Viability Analyses for the ECKP and PCKP populations to support the adaptive management approach and ensure that conservation management and protective measures implemented are relevant and likely to support population viability at least in the medium-term	
Audit of the expected minimum area of Koala habitat expected to be lost or significantly impacted by the construction and operation of the proposed action		• Define the likely minimum and maximum extent of clearing of Koala habitat throughout the proposed action corridor, including those areas resumed for the purpose of tie-ins to local and other arterial roads. • Define and measure areas of existing Koala habitat, that are, at the completion of the proposed action, likely to be deemed of no ecological value for Koalas because of their small size, ecological isolation or other factors that have resulted partly or entirely from the proposed action. • Produce a map showing the extent of the Koala habitat impact (contained in chapter 5 of the PER)	

3.4 Construction Management Measures

The construction phase presents the most intense short-term risk for Koalas due to:

- risk of injury of death associated directly with vegetation clearing
- risk of injury, death and starvation/dehydration due to displacement from habitat during vegetation clearing and construction works

The key management goals are

- no Koalas will be killed or suffer serious injury as a direct consequence of vegetation clearing
- no Koala will be displaced from its habitat and thereby exposed to unacceptable risk because of vegetation clearing, but rather translocated (when appropriate) to suitable habitat with an acceptable risk profile.

TMR will implement general construction management measures as outlined in Table 14 to mitigate the potential impacts on Koala because of the construction of the proposed action. Table 14 also outlines frequency of monitoring, the relevant triggers for corrective action and the correction action required if triggers are activated.

Table 15 provides details of the construction management tasks specifically related to Koalas, to support the general pre-construction management measures in Table 14.

Table 14 Environmental management measures and corrective actions for Koala – construction

Management Response	ID No.	Proposed mitigation measure	Monitoring/ timing frequency	Triggers for corrective actions	Corrective actions	Responsibility
Implement Koala Management Plan	C-TS7	Implement the Koala Management Plan (updated prior to construction	Throughout construction	Management actions not implemented	Flag concerns and explore/ implement appropriate strategies and seek/ obtain approval before proceeding	TMR
No damage to Koala habitat within marked exclusion zones	C-TS8	• Keep exclusion zones clearly marked and visible on site. • Undertake mandatory site inductions for all new site workers.	Throughout construction	• Exclusion zones do not correspond with approved drawings. Fencing moved or damaged. • Damage to vegetation or habitat for fauna within exclusion zones.	• Stop works until exclusion fencing has been reinstated in accordance with approved plans. • Contact proposed action ecologist to assess impacts. • Report breaches to TMR • Undertake suitable replanting works or provide biodiversity offset as necessary	Construction Manager / Environmental Representative
No vehicle collision incidents with Koala within the construction area	C-TS9	• Temporary fauna exclusion fencing installed as described in Environmental Design Review • Construction speed limits applied for all construction vehicles and machinery. • Induct all new site workers on the procedures to avoid and report with threatened fauna species	Throughout construction	• Fauna injury or mortality due to collision with construction vehicles. • Fauna within the construction footprint. • Non reporting of incidents	• Implementation of fauna rehabilitation protocols. • Review placement of fauna fencing/ crossings, haulage routes, as needed.	Construction Manager / Environmental Representative

No Koala injury or mortality due to vegetation clearing activities	C-TS10	Implement approved site clearing procedures including: • Qualified Fauna Spotter Catcher (FSC) endorsed by the Queensland Department of Environment and Science to be onsite for all clearing activities • Pre-clearing survey undertaken in accordance with approved procedures. • Proposed action ecologist to supervise site clearing • All activities to be undertaken consistent with Hanger (draft) *Code of Practice for the Welfare of Wild Animal Affected by Land-clearing and other Habitat Impacts and Wildlife Spotter/Catchers*	At all times during vegetation clearing works	Fauna injury or mortality	Immediately stop work and fauna rehabilitation procedures implemented	Construction Manager / Environmental Representative
Minimise impacts to hydrology and water quality during construction	C-TS11	• Implement the Erosion and Sediment Control Plans for the package of works • Monitor ground and surface water monitoring during construction • Contain any spills	Regular monitoring groundwater levels, surface water quality and control devices in accordance with relevant Environmental Sub-Plans	• Sediments/ pollutants introduced to local waterways and wetlands exceeding defined performance criteria in Environmental Sub-Plans • Groundwater levels outside of expected range	• Incident reported to TMR and regulatory agencies • Control devices/measures inspected for suitability and corrected/ reinstated where necessary • Spill containment provided on-site, and procedures implemented where appropriate • Capture learnings, update Sub-Plans and retrain site workers	Construction Manager / Environment Manager

Minimise noise, light and dust during construction	C-TS12	• Implement Environmental Management Plan (Construction) and Erosion and Sediment Control Plans measures for erosion and sediment control, dust suppression and noise • Temporary site lighting will be installed and operated in accordance with AS4282:1997 *Control of the Obtrusive Effect of Outdoor Lighting (Standards Australia* 1997)	Monitoring as per Environmental Management Plan (Construction)	Excessive amounts of dust, light and/ or noise	Implement control measures as outlined in EMP(C)	Construction Manager / Environment Manger
Reinstate habitat for Koala	C-TS13	Progressively restore and revegetate habitat in accordance Design Vegetation Management Sub-Plans of the Environmental Management Plan (Construction) and Urban Landscape Plan for the proposed action	Monthly inspection of revegetation works	Low survival rates of restored habitat areas and/or high incidence of weed species in revegetation areas	Assess habitat suitability and commission corrective improvement work as necessary	Construction Manager / Environment Manger
Avoid introducing or spreading disease-causing agents that could impact on the environment and biodiversity	C-TS14	Implement weed management processes and procedures in accordance with weed management requirements in the Contract Documents and documented in the Environmental Management Plan (Construction)	• Consider potential for pathogens on site or in the area should be given at an early stage (e.g., initial site inspection prior to commencement of works) • Undertake periodic monitoring for pathogens by a suitably qualified person, every month and in particular revegetation works and interface with retained/adjacent vegetation	• Management activities not being undertaken • New introduction of a disease-causing agent on and/or in proximity to the proposed action and during maintenance works (e.g., laboratory analysis to confirm suspected plant pathogens observed during monitoring)	• Review management actions and processes for weed management • Increase monitoring period	Construction Manager / Environment Manger

Table 15 Key construction management tasks specifically for Koala

Key management task	ID no	Description of task	Responsibility
Protect Koalas from harm during vegetation clearing and construction works		Develop comprehensive Koala protection procedures for Koalas during construction works, including: • establishing the appropriate culture within the construction team and shared responsibility obligations related to Koalas · erect temporary and permanent fauna fencing · developing and implementing management protocols s for Koala incidents, including injury, death, presence in the construction corridor, sightings etc · preparing key contacts for Koala incident management • develop and implement procedures for each workday to ensure the appropriate protection of "at risk" Koalas from vegetation clearing and/or other construction-related activities, such as: · flagging of the Koala tree with appropriate buffer zone · flagging of vegetation to remain as a link to habitat existing outside of the proposed action corridor until the Koala has moved of its own volition · capture of the Koala and assisted dispersal if permitted under approval conditions · capture of the Koala for a scheduled health examination · any other action as may be required from time to time to achieve the objective to avoid harm to Koala • specify conditions in the Contract Documents regarding vegetation clearing machinery and techniques that bind the construction contractor to specific actions • engage and inform Koala rescue groups and the community for the proposed action and procedures for reporting to TMR of "at-risk" Koalas found in or near the delineated Koala management areas for the proposed action	-
Fencing		• Monitor and adaptively manage emergent risks to Koalas during and towards the end of the construction phase, for example, repair/remediate sections of fencing through which a Koalas have entered the proposed action corridor, install rapid egress one-way Koala valves devices to enable Koalas to rapidly exit the proposed action corridor • Fencing may need retrofitting with skirting, Corflute® or other materials to make the fencing impermeable to Koalas	

3.5 Operation Management Measures

The following challenges all impacting on the sustainability of Koala populations:

- degradation of exclusion fencing
- degradation of Koala revegetation areas resulting in net Koala habitat loss
- wild dogs targeting Koalas at designated fauna crossings
- Koalas not using designated crossing structures

The key management goals are

- no Koala deaths or injuries associated with proposed action after a five-year period following commencement of the operational phase
- evidence of completed crossings by Koalas at targeted fauna crossing structures
- less than 30% mortality of planted Koala feed trees in Koala habitat revegetation areas for a period of five years post-construction
- reducing Koala mortality

TMR will implement the operation management measures outlined in Table 16 to mitigate the potential impacts on Koala because of the operation of the proposed action. Table 16 also outlines frequency of monitoring, the relevant triggers for corrective action and the correction action required if triggers are activated.

Table 17 provides details of the operational management tasks specifically related to Koalas, to support the general operation management measures in Table 16.

Table 16 Key operational management measures for Koala

Management Response	ID No.	Proposed mitigation measure	Monitoring/ timing frequency	Triggers for corrective actions	Corrective actions	Responsibility
Implement Koala Management Plan	C-TS15	Implement the Koala Management Plan updated prior to operation	Throughout Operation in accordance with Koala Management Plan	Management actions not implemented	Flag concerns and explore/ implement appropriate strategies and seek/ obtain approval before proceeding	TMR
Maintain habitat revegetation effort	C-TS16	Maintain and monitor and revegetated areas until revegetated habitat structure and floristics is on a trajectory to re-establish to target vegetation community, in accordance with *Vegetation Management Sub-Plan* of Environmental Management Plan (Construction)	• Quarterly monitoring for the first twelve months and then every 6 months for years two and three • Monitor in spring/summer to evaluate the success of revegetation against performance objectives	• Monitoring and maintenance activities not being undertaken • Performance measures not achieved	• Review maintenance schedule for revegetated areas within one month of trigger being identified and plant more feed and habitat trees as required • Undertake additional weed control • Increase monitoring period as advised by landscape designer	TMR
Maintain Koala exclusion fencing and connectivity structures for the life of the proposed action, to enable target fauna usage and minimise roadkill	C-TS17	• Maintain fauna connectivity structures as part of routine highway maintenance to remove debris and replace damaged and /worn furniture	• Undertake regular inspections as part of TMR routine highway maintenance program • Inspect annually targeting Koala underpass structures prior to start of breeding season (July)	A single reported roadkill of a threatened species	• A maintenance check is to be performed within five days of any reported roadkill incident • Any fence or structure found to be damaged during a maintenance check is to be repaired • Review the need for additional fauna fencing	TMR
Minimise impacts from pest animals on threatened fauna and their usage of crossing structures	C-TS18	• Consult with regional pest control agencies • Implement pest control program focused on crossing structures were deemed appropriate	Monitoring for presence of pest animals at crossing structures as part of fauna connectivity monitoring program	High usage of crossing structures (>25% increase) by exotic predators reported after the first monitoring period and each subsequent monitoring period	• Meet with regional pest control stakeholders as soon as practical and contribute to pest control program where reasonable and feasible • Implement pest control program around crossing structures to reduce pest animal predation	TMR

Sediment and pollutant levels are within acceptable parameter limits during construction and post-construction within a month of the completion of construction.	C-TS19	Procedures for the maintenance and monitoring of sediments and pollutants during construction are to be incorporated in Environmental Management Plan (Operation)	Environment Manager / Construction Manager

Table 17 Environmental management measures and corrective tasks specifically for Koala – operation

Key management task	ID no	Description of task	Responsibility
Evidence of Koalas using completed barrier crossing/barrier mitigation structures and engineered solutions		• Install additional Koala proof fencing along sections of the proposed action where it presents a risk to Koalas. • Apply an adaptive management response under the Triggered Action Response Plan where a structure is not fit for purpose.	
Maintenance of fauna exclusion fencing and fauna crossings		• TMR will maintain fauna crossing structures and exclusion fencing as part of the standard maintenance requirements as required in perpetuity. Maintenance of fauna fencing will be conducted in response to observations and reports of any Koala injuries or road kills in proximity to exclusion fencing and structures. Maintenance work will include repairs of any breaches in the exclusion fence, the slashing of overgrown vegetation that breaches the fence, and the removal of large debris or vegetation from culverts	
Predator control		• Monitor predatory animal activity as part of the crossing structure monitoring program • Where monitoring indicates that predators are a threat to Koala movement through the crossing structures, TMR will work with the relevant agencies and landholders to reduce this predation risk	

4. Koala protection and translocation

TMR will undertake active management of Koalas within the proposed action corridor. TMR will be guided by the Coomera Connector Koala Conservation Strategy in implementing a five-tiered intervention approach for Koalas living in habitat within or near the clearing footprint. These are

- Monitor and observe – this approach involves no interaction or intervention, as tagged Koalas would be monitored to ensure they do not encroach within the work site or corridor
- Unassisted dispersal – this approach involves the sequential clearing of habitat to safely disperse Koalas from the corridor by encouraging the natural movement of Koalas towards and into suitable surrounding habitat
- Assisted dispersal – this approach involves the capture and removal of Koalas from the clearing footprint at the time or in advance of clearing, where the safe movement of a Koala to surrounding habitat cannot be guaranteed without intervention. Typically, Koalas will remain within habitat that forms part of their existing home range
- Relocation – this approach involves capture and movement of Koalas from their usual ranging habitat to another suitable habitat within 5 km of the originating habitat
- Translocation – this approach involves the capture and movement of at-risk Koalas from their point of origin to another area of habitat greater than 5 km away where there are no other means of Koala protection or survival in, or within the vicinity of, the originating habitat

The number of Koalas requiring translocation has been informed by survey and reconciled with the available carrying capacity of any suitable remaining Koala habitat adjacent to the proposed action corridor. The management of Koalas to be translocated and those living in potential recipient habitat will be conducted as the Koala Translocation Program as outlined in the Coomera Connector Koala Conservation Strategy. While having a significant impact on Koalas within the proposed action corridor, TMR expects the number to be not significant in the context of the overall populations across the broader northern Gold Coast.

4.1 Koala translocation under Commonwealth and Queensland legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) currently considers wildlife translocation to be generally unsuccessful and, if proposed, is to be considered part of the impact itself, rather than a mitigation and/or offset measure. Translocation is generally considered to have either low or negative value in conservation terms (that is, it can cause more harm than good). However, there is evidence that translocation is a viable option where Koala habitat is to be removed.

Under the *South East Queensland Koala Conservation Strategy 2020–2025* (Action Area 3: threat management), the Queensland Government was to develop a new Koala translocation policy based on International Union for Conservation of Nature best-practice guidelines and investigate where translocation could support reintroduction of Koalas to empty habitat. Policy is still being developed to provide a mechanism for approving salvage translocations that are a consequence of a Koala management initiative, as opposed to bona-fide scientific research, such as developing a translocation program for population genetic augmentation or recovery

In 2017, Endeavour Veterinary Ecology undertook a review of translocations in Queensland and provide advice and recommendations on a review of Queensland Government policy. Appendix 14 of the Coomera Connector Koala Conservation Strategy Appendix A provides a comprehensive review of literature, policies and procedures for the translocation of the Koala in Queensland and concludes it is an effective strategy and management tool to manage at-risk Koalas. Section 11.2 of the Coomera Connector Koala Conservation Strategy outlines the success of two major Koala translocations:

- The East Coomera Koala Conservation Project conducted by Gold Coast City Council involved the translocation of 180 Koalas from East Coomera to two recipient sites in the Gold Coast hinterland
- The Moreton Bay Rail Koala Management Program involved the translocation of 28 Koalas to two recipient sites, one of which was a habitat offset site for the project that had been subject to extensive revegetation

4.2 Recipient site Koala population investigation

Subject to the necessary approvals and in collaboration with DES and Gold Coast City Council, TMR has identified the Pimpama River Conservation Area as the potential suitable recipient site for Koalas in imminent danger and requiring translocation. As noted in chapter 9 of the PER, TMR own land adjacent to the Pimpama River Conservation Area and Pimpama Conservation Reserve (Greenridge).

In accordance with the Koala Translocation Plan, TMR will commence with the capture, undertake a veterinary assessment and monitoring a representative subset of the resident Koalas currently inhabiting the proposed recipient sites. Adaptive management will be implemented to address threats to Koala health and viability at the recipient sites. Any new additional recipient site will undergo the same assessment.

TMR recognises the importance of understanding the risk/threat profile at the translocation recipient site is known, and that manageable threats are reduced to an acceptable level, this being that threats are reduced to a level such that the Koala population is stable or increasing.

4.3 Translocation process

In compliance with the Koala Translocation Plan, all Koalas selected for translocation will be caught/trapped, subjected to a thorough veterinary assessment, tagged with telemetry tags (if not already tagged) and if deemed to be suitable for translocation/release, transported to the translocation recipient site and released.

Where possible, groups of Koalas will be released together, in proximity, but not in the same tree unless they are mother-dependent joey pairs. Adult males will not be released within 50 m from other males.

Translocated Koalas will be intensively monitored by conventional field VHF-telemetry daily or bio-telemetry system daily, at as per animal ethics requirements, and thereafter TMR will revert to the standard field and remote monitoring protocols defined in the Koala Management Resource Manual. Six-monthly recapture and veterinary examination will be undertaken.

Koalas that are showing signs of injury and/or illness will undergo veterinary assessment and treated as required. Koalas that disperse beyond the translocation Koala management area boundary will be monitored as per standard protocols, and intervention will only occur if Koalas move into an area that is deemed to present unacceptable risks to the Koala's health and/or survival. In such a case, the Koala will be recaptured, and subjected to the procedure above, before being released at the original translocation site.

The monitoring of translocated Koalas and the resident cohort at each site will continue for a minimum period of 12 months after the translocation of the last Koala into the site or otherwise agreed through consultation and approval conditions with TMR, DAWE and Queensland Department of Environment and Science.

At the completion of the monitoring period, all Koalas, both residents and translocated Koalas will be captured, subject to a comprehensive veterinary examination, and released, if deemed appropriate after removal of telemetry tags. In accordance with usual Koala release protocols, the Koalas will be released at their most recent point of capture.

4.4 Adaptive management approach

TMR will implement an adaptive management framework informed by monitoring and the collection of other data to provide the most effective approach to Koala management. TMR will use the framework as outlined in Coomera Connector Koala Conservation Strategy that involves the following processes:

- key objectives, metrics and intervention trigger points are defined
- metrics measured at baseline and trends monitored over time using robust survey methods
- analysis of data collected regularly compared with intervention triggers
- intervention/management applied when data indicate trigger points are close to and/or being exceeded
- management response effectiveness measured and monitored over time
- process reviewed and improved after analysis of response to management
- repeat process with improved objectives, metrics, trigger points and management responses

The management response may vary significantly from the commencement of the plan to its end, as targeted management achieves the desired outcomes, or in the alternative, emerging threats are identified that require appropriate management responses. Evaluation of the findings will feed into the adaptive management response and trigger altered management approaches when key objectives are not met, or Triggered Action Response Plan triggers are exceeded.

The Triggered Action Response Plan applies when situations arise that require adaptive management, and/or would otherwise result in an unacceptable risk to Koala welfare or life, and/or there is a significant impact on the Koala population or a part of it. These are emergent threats that fall outside of the usual expectations and management controls and require an adjustment to the management response. The threats could include major incidents that threaten Koalas, such as bushfire, drought, major or repeated breaches of agreed protective protocols that threaten Koalas, and when the performance criteria or metrics for a particular action are not met.

Table 1 outlines a list of key significant adverse or potentially adverse situations which will require adaptive management action by TMR. Table 18 will be further developed as additional information becomes available.

Table 18 Target action response plan

Trigger	Normal level	Aim	Mitigation / response
Death of one or more Koalas caused by construction activities, including vegetation clearing	No death of Koalas caused directly or indirectly by vegetation clearing and other construction activities	Avoid death of, or harm to Koalas through actions of the Stage 1 Project during construction	Construction management plan to address danger to Koalas during vegetation clearing and during all construction activities
Imminent risk of death or injury to Koalas in Koala Management Area that are monitored under the Koala Management Plan caused by bushfire or other natural disaster	Not applicable	Delivery of comprehensive compensatory measures	Where catastrophic risk to Koalas is likely, and Koalas can be safely captured prior to the event under extraordinary circumstances. Koalas will be housed using available resources of the Koala Management Plan and Coomera Connector Koala Conservation Strategy service provider in conjunction with Wildcare, Currumbin Wildlife Sanctuary, Dreamworld, Australia Zoo, RSPCA if necessary

Significant Koala death due to high level of dog predation: >10% of Koala deaths are due to domestic and wild dog predation	Not applicable	Delivery of comprehensive compensatory measures	Elevation in dog monitoring and control in consultation with Gold Coast City Council
Very high level of female infertility detected in a sub-population (>75% female deemed to be sterile)	Not applicable	Delivery of comprehensive compensatory measures	Additional management measures to ensure local viability of that population, including lower threshold for translocation (either in, to bolster, or out to salvage) will be considered to support populations
Very high level of chlamydial disease prevalence at proposed translocation recipient site	Translocated Koalas moved into safe habitat that allows for a lower level of threatening processes/risks compared with their originating habitat site	Avoid death of, or harm to Koalas through actions of the Project during construction and following construction	Chlamydial disease management, including both treatment and vaccination (when available) of resident Koala population at the proposed recipient site prior to the translocation of Koalas into the site

5. Monitoring program

5.1 Koala population monitoring

TMR will undertake Koala monitoring through the implementation of a number of plans included in the Coomera Connector Koala Conservation Strategy. The plans and their outcomes are listed in Table 19.

Table 19 Monitoring program under individual plans

Monitoring plan	Monitoring activities and outcome
Koala tagging and monitoring plan	Protection of Koalas during vegetation clearing
	Detection of dead Koalas and determination of cause of death
	Appropriate responses to Koalas in danger
	Determine Koala habitat usage and ranging behaviour
	Identification of Koalas that require assisted relocation and/or translocation prior to and/or during the construction phase
	Monitoring and management of any disease outbreaks in Koala populations
	Monitoring and management of other threats to Koala welfare and conservation
	Inform mitigation measures during pre-construction, construction and operational phases using both adaptive and pre-emptive management frameworks
	Support mutually beneficial research programs and projects through access to data and information and in other ways facilitated by the Koala tagging and monitoring plan
	Datasets collected from the Koala tagging and monitoring plan on population health, reproductive output, mortality rates and mortality causes will inform ongoing management at translocation sites

Koala translocation plan	Data and/or biological samples derived from the Koala tagging and monitoring plan will be shared and/or given with approved collaborating research groups
	Search and capture of all Koalas in relevant Koala management areas
	All Koalas subjected to standardised and comprehensive veterinary examination under sedation
	Koalas deemed to warrant treatment or euthanasia on humane grounds - performed as per veterinary procedures
	Koalas deemed to be suitable for release will be released back to their point of capture, when appropriate and monitored for the agreed duration of the Koala tagging and monitoring plan
	Monitoring of Koalas will occur at such frequencies as allow for the detection of any death within three days
	Koalas will be monitored using near-real-time, remotely interrogable bio-telemetry systems
	Necropsy (post mortem) examination will be performed on all Koalas that die and/or are euthanased during the period of Koala tagging and monitoring plan. The necropsy examination will be of sufficient extent to reasonably determine the cause of death
	Koala ranging behaviour and habitat utilisation will be observed and recorded with sufficient frequency to inform road design, mitigation, and translocation measures
Linkages between Koala tagging and monitoring plan and Koala translocation plan	TMR will collect, store, collate and analyse data on the key population parameters including compiling individual health and field records
	TMR will prepare reports that include key metrics and events such as Koala inclusions, health summary, deaths, necropsy findings
	TMR will prepare reports and/or data analysis on both plans for presentation to stakeholders
Koala tagging and monitoring plans (construction phase and operational phase)	TMR will define the geographic extent of the relevant Koala Management Areas and or others that will be included in the monitoring for construction phase. These will be all Koalas that are left in-situ and are at some risk from vegetation clearing and other construction activities
	TMR will maintain continuity between the different phases of construction to minimise risk of “losing” Koalas and to reduces costs associated with repeated search and capture
	TMR will define the methods and/or technology to be used for the monitoring of the effectiveness of barrier mitigation and crossing structures

Figure 16 shows the process that is currently and will be used for the Koala tagging and monitoring plan and Koala translocation plan.

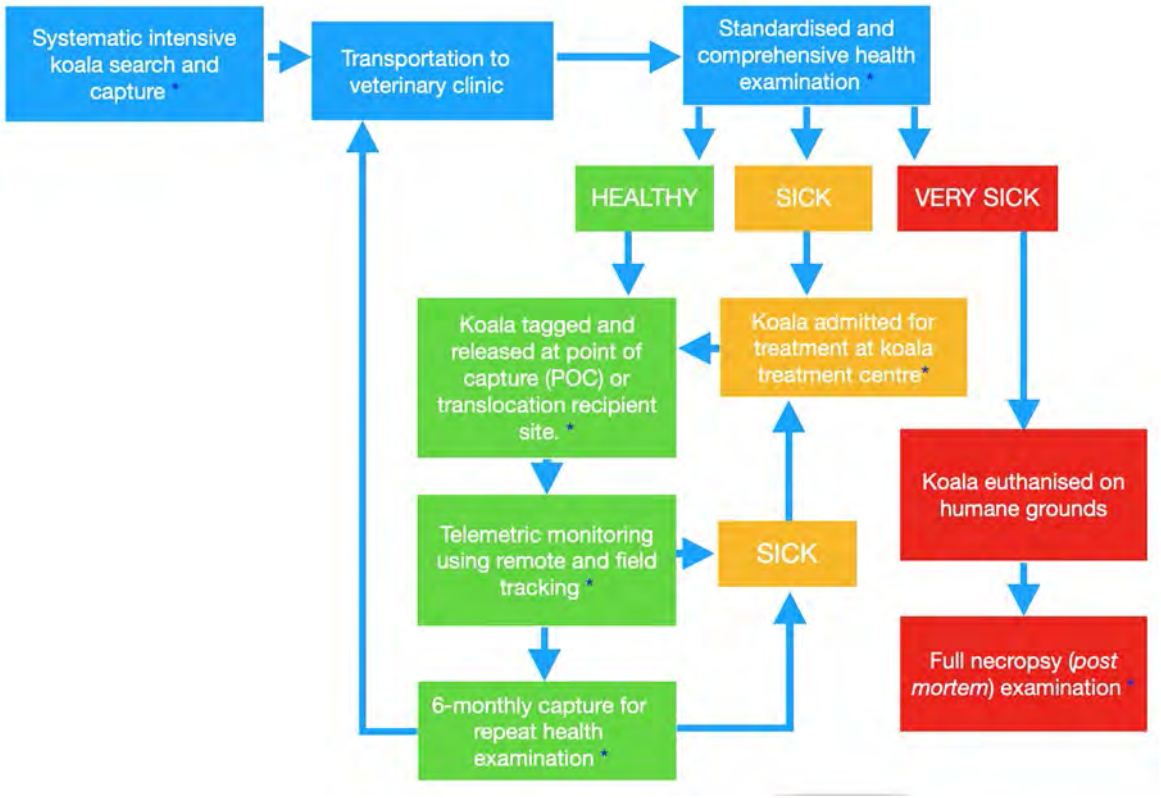


Figure 16 Koala tagging and monitoring plan and Koala translocation plan

The monitoring program (particularly the near-real-time telemetry system) will allow for rapid intervention when monitored Koalas in high-risk areas, and thus minimise the potential inadvertent death or injury during vegetation clearing.

5.2 Evaluation, project review and reporting

5.2.1 Plan evaluation measures and reporting

TMR will periodically evaluate the effectiveness of plans' directed actions in achieving their objectives. These include:

- annual review reports of the Koala management plan's outcomes against key objectives and metrics
- annual review reports of the Koala management plan's implementation prepared by an independent expert reviewer

TMR will be responsible for the regular evaluation of the Koala management plan's effectiveness and the procurement, when necessary, of additional resources to address emergent threats. TMR will also produce monthly reports detailing the Koala tagging and monitoring plan activities for the month, including details of Koalas included and Koala deaths, injuries and illness

TMR will work with Gold Coast City Council to update the existing population viability analysis for both the East Coomera and Coombabah -Parkwood Koala populations.

5.2.2 Adaptive management response

The evaluative findings will feed into the adaptive management response and trigger altered management approaches when key objectives are not being met, or Triggered Action Response Plan triggers are exceeded.

Further, the adaptive management approach which forms an important conceptual component of the plan, requires that the adaptive response to identified and emergent threats be timely, appropriate and proportionate measures that can be

practically implemented. For example, where there is the detection of significant wild dog predation by the Koala tagging and monitoring plan and diagnostic post-mortem examination of tagged Koalas would prompt the implementation of a wild dog monitoring and control program in the relevant Koala management areas. The adaptive management response to threats is an implicit and integral part of the Koala management plan informed via the Koala tagging and monitoring plan and Koala translocation plan.

5.2.3 Data storage

TMR will collect and retain detailed data on all matters related to all plans, including but not limited to health, details of captures and releases, any treatment, telemetry tags, adverse events, home-ranging behaviour and reasons for death and cause-of death diagnoses.

Data will be recorded digitally. A summary status sheet will be prepared monthly with the following information:

- Koalas currently alive in each program
- total Koalas processed, e.g., Koalas alive, dead, removed from the programs
- current Koala status (tagged, monitored, removed, dead, otherwise lost, in-care, etc)
- sex ratios (alive, total Koalas)
- reproductive datasets (dependent young, in-pouch, on back, near independent, etc)
- approximate age of joeys
- total and breakdown of vet. exams conducted (full vet exam, tag check, necropsy, etc)
- deaths each month and cause of death diagnosis, Koala identity, sex
- all Koalas in program at end-of-month (names and status)

5.2.4 Adverse incident reporting

Adverse incidents involving Koalas that are subject to an animal ethics committee approval(s) must be reported promptly to the relevant animal ethics committee. This is a responsibility of the animal ethics committee approval holder. The TMR Responsible Officer will require the contractor responsible for the delivery of the KTMPs and KTP to provide incident reports to TMR at the time of reporting to the animal ethics committee.

5.2.5 Trigger Action Response Plan

The Triggered Action Response Plan applies where circumstances arise that require adaptive management, and/or would otherwise result in an unacceptable risk to Koala welfare or life, and/or a significant impact on the Koala population. These events are emergent threats that fall outside of the usual expectations and management controls and require an adjustment to the management response. These events may include major incidents that threaten Koalas (such as bushfire), major or repeated breaches of agreed protective protocols that threaten Koalas, and when the performance criteria or metrics for a particular action are not met.

Appendix A Coomera Connector Koala Conservation Strategy

Coomera Connector w

Koala Conservation Strategy

V2.2 August 2022

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Document control

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Summary

This *Koala Conservation Strategy* (KCS) guides the implementation of a suite of measures to ensure that Koalas are appropriately protected during construction and operation of the Coomera Connector infrastructure project to be undertaken by TMR. The approach ensures compliance with relevant state and federal legislation as well as meeting community expectations regarding the welfare and conservation of Koalas.

The *Vision Statement* for the Project's management of Koalas (and the natural environment generally) incorporates the aspirations of low-impact and compassionate development, application of best-practice standards, and the ultimate delivery of an environmentally exemplary transport infrastructure project.

Key bodies of work defined in the *KCS* include:

1. A ***comprehensive survey*** of remnant Koala habitat in and beside the gazetted Coomera Connector alignment to estimate Koala numbers and inform design and management. *The comprehensive Koala survey* (CKS) for Stage 1 was conducted and reported in late 2020 (see Appendix 1A).

2. The acquisition and replanting of ***habitat offsets*** in areas that are strategically valuable for local and regional Koala conservation. Offset blocks were acquired at Tabooba in the first half of 2022.

3. The delivery of a ***Koala tagging and monitoring program*** **(*KTMP*)** to provide detailed datasets on population dynamics and facilitate the protection of individual Koalas during high-risk periods, such as vegetation clearing. The KTMP-1 commenced in August 2021 and was ongoing at the time of writing of this, KCS V2.2.

4. The proposed ***relocation of Koalas*** from high-risk habitat remnants into secure habitat areas, to ensure their safety and ongoing contribution to the persistence of the regional Koala population. The *Koala Translocation Program* (KTP) commenced concurrently with the KTMP-1 in August 2021 with investigation of the Pimpama River Conservation Area (PRCA) as a potential translocation recipient site.

5. Monitoring the effectiveness of various ***engineered Koala protection features***, such as bridges, Koala fencing, and fauna crossing structures.

6. A comprehensive package of ***compensatory measures*** addressing key threats to Koala welfare and population viability (such as chlamydial disease), and the development of beneficial research collaborations. Treatment of Koalas entering the KTMP and KTP programs for chlamydial disease commenced in August 2021. Research collaboration negotiations commenced with potential Koala research groups concurrently and were ongoing at the time of writing of this, KCS V2.0.

Important aspects of the *KCS* development and implementation are:

1. Ensuring the *KCS* informs the design of the Project to minimise impacts on Koala conservation and welfare;

2. Meaningfully engaging with Koala conservation groups and community stakeholders during development, revision and implementation of the *KCS* to ensure that it meets expectations regarding scope, delivery and outcomes;

3. Developing SMART objectives, implementing suitable methods, critically evaluating outcomes, and implementing adaptive management with respect to risk assessment and control, to achieve the ultimate goal: net local Koala conservation benefits;

4. Ensuring a 'greater good' arises from the implementation of the *KCS,* through mutually beneficial research collaborations and community conservation programs. That is, ensuring the best value-for-money outcomes are achieved in the implementation of the *KCS.*

The KCS will be updated regularly, generally at the completion of major bodies of work that provide data or information facilitating improvement, development and refinement of relevant components of the Plan.

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Glossary

Acronym	Expanded Term	Meaning
AEC	Animal Ethics Committee	A body created in accordance with the *Animal Care and Protection Act 2001 (Qld)* to assess and provide oversight of scientific and education projects involving the use of animals.
ACAPA	Animal Care and Protection Act 2001 (Qld)	The Queensland Act that prohibits cruelty to animals and requires the approval of an Animal Ethics Committee for some aspects of KCS-directed work.
AZWH	Australia Zoo Wildlife Hospital	One of the several charitable entities involved in the rescue and rehabilitation of Koalas in the CC project area.
CC	Coomera Connector	The Coomera Connector project.
CCG	Coomera Conservation Group	One of the community conservation stakeholder groups with an interest in Koala conservation in the CC project area.
CKS	Comprehensive Koala survey	The first major KCS-directed body of work to determine Koala distribution and abundance in the KCS-defined KMAs and TKMAs.
Cpec	*Chlamydia pecorum*	The primary chlamydial species (a bacterium) causing disease in Koalas, including urogenital and eye disease.
CWH	Currumbin Wildlife Hospital	One of the several charitable entities involved in the rescue and rehabilitation of Koalas in the CC project area.
EPBC	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)	The overarching Commonwealth legislation under which Koalas and Koala habitat are protected as a matter of national environmental significance (MNES).
KCS	Koala Conservation Strategy	This Plan and its various versions and revisions.
KCS-IT	KCS Implementation Team	The persons responsible for the implementation and management of activities defined in this KCS for the purposes of Koala protection and conservation. The KCS Implementation Team will include at least one representative of TMR with authority to direct actions under the KCS.
KHI	Koala habitat impact	A measure of the area and extent of Koala habitat that will be lost to vegetation clearing and/or rendered of no ecological use for Koalas after construction of the CC project.
KMA	Koala Management Area	A delineated area within which CC Koala management activities directed by this KMA will occur. See also TKMA.
KMP	Koala Management Plan	TMR document providing high-level description of the Koala management intent and activities for the Coomera Connector project.
KTMP	Koala tagging and monitoring program	An implemented component of the KCS that seeks to provide data and facilitate the protection of individual Koalas during key risk periods. Three KTMPs are proposed to cover pre-, during and post-construction (operational) periods. These are KTMP-1, KTMP-2 and KTMP-3.
KTP	Koala translocation program	A program to translocate Koalas from high-risk habitat fragments into secure habitat patches. The program includes a monitoring component similar in scope and methods to the KTMPs.
MOA	Memorandum of agreement	Agreement instrument between DES and TMR relating to Koala management on transport infrastructure projects in Queensland.
RSPCA (Qld)	Royal Society for the Prevention of Cruelty to Animals (Qld)	One of the several charitable entities involved in the rescue and rehabilitation of Koalas in the CC project area.
SMART	Specific, measurable, achievable, relevant and time-bound	Criteria that ensure that in defining the objectives, consideration is given to each of the five attributes to ensure they are useful and meet project/program goals in an efficient and effective way.
SPP	Scientific purposes permit	An authority issued by DES permitting the conduct of various scientific and management activities involving protected species.

TKMA	Translocation Koala Management Area	A delineated Koala management area in which assessment of suitability and translocation management actions directed by this KCS will occur.
TMR	Transport and Main Roads	The (Queensland) Department of Transport and Main Roads; the CC TMR.

1 Introduction and background

1.1 The Project

The Coomera Connector Project (from here on in, the Project or the CC Project) involves the design and construction of an approximately 45 km, 6-lane, high-speed, arterial road running essentially parallel to, and east of, the existing M1 motorway, between Nerang (Nerang-Broadbeach Rd) and Loganholme (Logan Motorway/M1). The Project is likely to be constructed in several stages: Stage 1 will run from the Nerang-Broadbeach Rd at Nerang northwards to Coomera; and *Future Stages*, from Coomera to Loganholme.

1.1.1 Background

The Coomera Connector (formerly known as the *Intra Regional Transport Corridor*) will be a key link in an expanded road transport network between Loganholme and the Gold Coast where residential and business communities are growing rapidly.

Since the 1990s, the corridor has been identified in various public planning documents, such as published street directories, regional transport plans, planning studies and Gold Coast City Council planning schemes. A joint 2015 study between the Department of Transport and Main Roads and the Gold Coast City Council confirmed the corridor as a future strategic transport link that will relieve traffic congestion on the M1 and surrounding local roads.

The Coomera Connector was gazetted in 3 sections:

1. The Nerang to Coomera section was formally confirmed in the Queensland Government Gazette on 18 March 2016.
2. The Coomera to Staplyton section was formally confirmed in the Queensland Government Gazette on 12 May 2017.

3. The Staplyton to Loganholme section was formally confirmed in the Queensland Government Gazette on 15 March 2019.

The gazetted alignment of the CC Project passes through important remnants of Koala habitat, which recent surveys have determined currently support a significant number of Koalas. Over the past few decades, Koalas have suffered considerable declines in SEQ and more broadly. To comply with the intent and provisions of the federal *Environment Protection and Biodiversity Conservation Act 1999* and meet community expectations, the Project must duly consider risks to Koalas and take measures to avoid and minimise those risks.

1.2 Koalas

The Koala was recently up-listed to *endangered* in Queensland, New South Wales and the Australian Capital Territory under the federal *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and is listed by Queensland State legislation as *vulnerable* (to extinction).

Koalas have suffered significant declines in population numbers across much of their range due to several threatening processes, such as land-clearing, leading to loss and fragmentation of habitat; disease; bushfires; anthropogenic threats and misadventure; and, more recently, climate-related drought and heatwaves. Population declines of up to 80% have occurred in the past 10-15 years in some areas (DEE (Aust. Govt.)).

In late 2019 and early 2020, catastrophic fires destroyed large areas of Koala habitat in NSW and Victoria, and less extensive bushfires affected Koala habitat in Queensland. Some estimates of Koala loss in NSW were up to 30% of the state population with an average 70% loss of Koalas across fire-affected areas (Phillips, 2020).

Climate-change associated drought and heatwave conditions are likely to cause the extinction of Koalas across large areas of the species' geographic range, with contraction of suitable climate envelope for Koala survival in an eastwards and southwards direction (Adams-Hosking *et al*. 2011a). Evidence of the severity of this impact was recently reported regarding the potential functional extinction of the Pilliga Koala population in NSW - previously thought to be secure (Lunney *et al* 2017; Roach, M and Callaghan, J. *pers. comm*. February 2020). Similarly, the Liverpool plains population has suffered a catastrophic decline (Crowther M. *pers. comm* March 2020; Lemon J. *pers. comm* Nov. 2019).

South-east Queensland represents a region where the persistence of Koalas in the face of climate change is arguably feasible. This is because active management is logistically easier, the climate is less severe, and populations generally occur in higher densities and on fertile soils. Hence, effective conservation management of Koala populations in SEQ is of critical importance to the survival of the species.

1.3 Koalas, other wildlife and community expectations

There is a general community expectation that animals should not be treated cruelly. This is reflected in Queensland by the *Animal Care and Protection Act 2001.* In addition, several legislative and regulatory instruments (detailed in the following section) reflect a community expectation that wildlife and their habitats are protected as much as possible, and that unavoidable impacts are minimised, mitigated and then offset, in that hierarchy of priority.

Land-clearing represents the most intense cause of large-scale death of wildlife. In 2003, WWF produced a report estimating that around 100 million native vertebrates were killed annually in Queensland alone by land-clearing during 1997-1999. A more recent report by WWF and the Qld RSPCA estimated that 34 million native mammals, birds and reptiles are killed annually in Queensland during vegetation clearing (WWF and RSPCA (Qld) 2017). Aside from the severe impacts on protected species from a conservation perspective, the report focused on the immense suffering to individual animals caused by injuries and lingering deaths, caused directly and indirectly by vegetation clearing.

Most wildlife injury and mortality associated with land-clearing is inapparent to the general public and therefore public perception of the magnitude of the loss is generally considerably less than the reality. Nevertheless, there remains a widespread community expectation that proponents of development projects will take all reasonable precautions to avoid harm to wildlife, both in terms of individual animal welfare as well as species conservation.

1.4 About this Koala Conservation Strategy

The intent of this Coomera Connector *Koala Conservation Strategy* is to guide the implementation of a comprehensive suite of measures that seek to avoid harm to individual Koalas, minimise and mitigate impacts on population viability, and provide compensatory benefits towards Koala conservation both locally and regionally.

The Plan gives due regard to compliance with the legislative and regulatory framework, but also ensures that community expectations are met regarding animal welfare and the imperative to effectively conserve Koala populations. In addition, it takes account of the recent catastrophic events associated with climate change, that have contributed to an unprecedented loss of Koalas across a significant proportion of their geographic range. This is a situation that should encourage proponents of development and infrastructure projects to apply the highest standards (best practice) in their endeavours to protect Koalas from harm.

This *KCS* applies the lessons derived from the very successful Koala management program implemented for the Moreton Bay Rail (MBR) project (TMR, 2017). That program achieved its aims, satisfied regulatory compliance and met community expectations regarding Koala welfare and conservation. Through numerous research collaborations, it also achieved an enormous benefit to scientific and research endeavours. Follow-up Koala surveys at two previous MBR sites in December 2019, showed a persistence in the benefits for the Koala populations under management, some 3 years after the Koala management program ended: Koala populations at a project site and also one of the offset/translocation recipient sites showed significant increases (de Villiers, in prep). It provides a good model for the Coomera Connector project in terms of outcomes as well as value-for-money, as the duration of benefit continued long after the cessation of costs.

1.4.1 Writing style and content

This Plan is intended to be easily read and understood by the average person, while providing a comprehensive and prescriptive plan. Words, acronyms and terms are often italicised to indicate a specific component of the Plan or a term that has a specific meaning under a piece of legislation, regulation or policy. For example, '*significant residual impact*' has a specific meaning within the Queensland *Environmental Offsets Policy.*

The Plan assumes that the reader has a basic understanding of Koalas and the local context. It does not seek to provide the reader with a detailed and comprehensive discussion of the biology, conservation, ecology, medicine and threats to Koalas. Rather, these things are described briefly and in the context of the Project. Also, the Plan does not intend to provide any justification for the Coomera Connector project itself: it seeks only to prescribe the actions that will be taken to protect Koalas and achieve a targeted net benefit to Koala conservation should the Project proceed.

1.4.2 Hierarchy of decision-referencing

This Plan seeks to ensure that all decisions and actions are guided by a hierarchy of understanding or reference, such that any inconsistencies in understanding or implementation can be referred up the hierarchy for resolution. Specifically, the overarching intent of the Plan and its implementation is guided by the *Vision Statement*; the vision statement then guides the main *goals* or *aims*; these then allow one or more objectives to be defined, leading to measurable outcomes and achievement of aims. The attributes of the objectives are guided by the SMART approach, detailed in the following section.

1.4.3 SMART objectives

SMART goals and objectives are those that are: *Specific*, *Measurable*, *Achievable*, *Relevant* and *Time-bound*. These attributes provide a rigorous reference framework for each objective and ensure the best likelihood of success in achieving the desired outcomes.

1.4.4 The What, Why, How, Where, Who, When,

Each objective, the actions necessary to achieve it, and the following attributes are summarised in Appendix 1:

- What: what will be done?
- Why: the justification for the objective or action?
- How: how the objective or action will be performed?
- Where: a definition or clear delineation of the geographic extent of the objective or measure.
- Who: who/what entity or person will perform the objective or action?
- When: the timeframes for commencement, completion and other time-related/staged actions.

1.4.5 Versions of the *KCS*

This *Koala Conservation Strategy* is a dynamic document, and will be kept up to date with respect to changes in:

- The status of Koalas, locally and regionally;
- Advances in technology that might improve efficiency or program outcomes;
- Changes in community sentiment about things that are relevant to the Plan;
- Improvements in scientific knowledge of Koala biology, conservation, medicine, and management;
- Acquisition of datasets on Koalas locally, particularly through the *KCS*-directed activities such as the *comprehensive Koala survey* and *Koala tagging and monitoring programs.*

The *KCS* is the roadmap that guides the implementation of a suite of measures designed to protect and conserve Koalas in the context of the construction and operation of the CC Project. Version 1 of the *KCS* was written prior to the commencement of any significant investigation of the Koala population in the area of the CC gazetted alignment. The table below shows the indicative timing of major reviews and updates of the *KCS* in association with planned major KCS-directed bodies of work.

Milestone/phase	Version	Revision	Schedule
Early planning	*KCS* V1	N/A	Early 2020
Completion of early Koala survey	*KCS* V2	Rev. 1	Mid-late 2020
Completion of *KTMP* 1 (prior to construction commencement	*KCS* V3	Rev. 2	Late 2022- early 2022
Completion of construction	*KCS* V4	Rev. 3	Late 2025

1.5 Regulatory framework

Several State and Commonwealth legislative *Acts*, *Regulations, Plans* and *Guidelines* are relevant to the environmental assessment of the Project, the protection and management of Koalas and/or give guidance on the intent of regulatory tools for Koala conservation. While compliance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) takes priority, several State instruments and guidelines apply. These include:

1. The *Nature Conservation Act 1992* (Qld) and its subordinate regulations and plans, including:
2. The (Draft) South East Queensland Koala Conservation Strategy 2019-2024
3. The Nature Conservation and Other Legislation (Koala Protection) Amendment Regulation 2020
4. The Nature Conservation (Koala) Conservation Plan 2017

5. Guideline: State Development Assessment Provisions: State Code 25: Development in South East Queensland Koala habitat areas;
6. State Government Supported Community Infrastructure – SEQ Koala Conservation Policy (and memorandum of agreement (MOA) between DES and TMR);
7. Queensland Environmental Protection Act 1994;
8. Queensland Environmental Offsets Policy (Version 1.8);
9. Queensland Animal Care and Protection Act 2001.

1.5.1 Commonwealth legislation

1.5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The objectives of the *EPBC Act* include, amongst other things, to:

- provide for the protection of the environment, especially matters of national environmental significance
- conserve Australian biodiversity
- provide a streamlined national environmental assessment and approvals process
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources

The *EPBC Act* is the primary regulatory instrument with which the CC project will need to comply regarding Koalas, given their listing as threatened species under the Act and hence a *matter of national environmental significance* (MNES). The Act requires a proponent to refer the matter for assessment under the Act and the matter may not proceed without approval from the Australian Government Minister for the Environment and Energy. The CC project had submitted an *EPBC* referral and, at the time of writing of this, KCS Version 1, a response from the regulator was pending.

The Act has several policies/policy statements of relevance to the CC project, in particular:

- The EPBC Act 1999 Environmental Offsets Policy (Oct 2012)
- Policy statement: Advanced environmental offsets under the EPBC Act 1999 (Sept 2017)
- Policy statement: Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC Act

The *Environmental Offsets Policy* deals with the use of offsets to compensate for the *residual impacts* of a proposed action on a MNES. Such offsets can be *direct offsets* or *other compensatory measures*, and, if both are proposed, they should align with the conservation priorities for the protected matter. *Direct offsets* must provide a measurable and durable conservation gain for the affected species and must contribute at least 90% of the offsets package. This *KCS* recommends the delivery of both direct habitat offsets and a range of *non-habitat compensatory measures*, including the support of conservation-related research. The policy stresses concepts such as the requirement for offsets to be relevant, timely, durable, proportionate and scientifically robust in their delivery of benefits for the impacted matter.

Appendix A to the policy defines criteria for the assessment of research and educational programs proposed to deliver non-direct or *other compensatory measures* as part of the proposed offsets package.

The *Advanced environmental offsets* policy statement deals with the use of already acquired or established offsets, which provide more immediate value or earlier delivery of ecological value than offsets that are provided after the impact. Advanced offsets are implemented prior to the impact and it is important that baseline data and improvements made to achieve the objectives of the offset are clearly and robustly documented. Advanced offsets may include habitat and non-habitat offsets and either *direct offsets* or *other compensatory measures*, as long as the baseline state is clearly and robustly scientifically determined, and a clear benefit for the protected matter can be demonstrated to have occurred, or at least commenced.

The CC project has the opportunity for delivery of *advanced offsets* through the early commencement of habitat restoration (habitat offsets – *direct offsets*) and *other compensatory measures*, through support of ARC-Linkage grants relevant to Koala conservation, for example (see Section 10.4).

The *EPBC Act* policy statement on the *Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC Act* has relevance to the translocation of Koalas proposed in this *KCS.* Under this policy, the translocation of Koalas proposed in the *KCS* in the context of the CC project would be a *salvage translocation* and therefore that process alone is not sufficient to compensate for the impacts of the action. The policy statement makes clear that *salvage translocation* of listed species is generally considered to have poor success and is likely to be considered as part of the *impact* rather than a *mitigation or offset* for it. It requires a proponent to clearly identify the aims and objectives of the proposed translocation and the post-translocation monitoring that will occur. Hence, the proposed translocation of Koalas under this *KCS* should form part of the submission to under the *EPBC Act*. The policy does not suggest alternatives to *salvage translocation* when death of individuals of the listed species is likely to occur during the *action* if translocation *is not* implemented.

1.5.2 State legislation

At the time of writing of version 1 of this *KCS,* the Queensland State regulatory provisions for the conservation of Koalas in South East Queensland had recently changed. Prohibition on clearing of Koala habitat in *Koala Priority Areas* (KPAs) came into effect in February 2020 and clearing of mapped Koala habitat outside of KPAs became State-assessable. State infrastructure projects were still subject to a policy committing to minimisation of impacts on Koalas (see: *State Government Supported Infrastructure Koala Conservation Policy July 2017* below).

The CC project (Stage 1) area of interest buffer area in the *EPBC Act* referral overlaps the East Coomera KPA.

1.5.2.1 Environmental Offsets

The Queensland Environmental Offsets Act 2014

- *Environmental Offsets Act 2014* coordinates the delivery of environmental offsets across jurisdictions and provides a single point-of-truth for offsets in Queensland.
- *Environmental Offsets Regulation 2014* provides details of the prescribed activities regulated under existing legislation and prescribed environmental matters to which the Act applies.

The *Queensland Environmental Offsets Policy (Version 1.8)* came into effect in February 2020 and prescribes the delivery of offsets under Section 12 of the *Environmental Offsets Act 2014* (Qld). However, if an action that affects a *matter of national environmental significance* (MNES) is deemed a *controlled action* under the federal *EPBC Act 1999*, then Koala offsets required under the *EPBC Act* approval are likely to also suffice to address State offsets requirements.

1.5.2.2 The South East Queensland Koala Conservation Strategy 2020-2025

On 7 February 2020 the Queensland Government amended the planning framework to address one of the key threats to Koala populations in South East Queensland – loss of habitat.

The framework now applies consistently across the South East Queensland region and establishes where clearing is prohibited, where it is assessable by the State, where Koala conservation outcomes will be considered by local governments and what exemptions may apply.

Inside a *Koala Priority Area* (KPA) clearing of Koala habitat will be prohibited. Development, that does not involve clearing, will be assessed by local governments for Koala conservation outcomes, such as safe Koala movement.

Outside of a *Koala Priority Area*, a proposed development involving the clearing of Koala habitat areas will be assessed by the Queensland Government.

The new strategy still defers to the *Nature Conservation (Koala conservation) Conservation Plan 2017* regarding matters such as sequential clearing, need for Koala spotters and translocation.

In general, State government funded infrastructure projects are exempted development with respect to the *SEQ Koala Conservation Strategy 2020-2025.* However, they may be subject to an MOU in accordance with the *State Government Supported Community Infrastructure – SEQ Koala Conservation Policy,* as outlined in the following section. The current in-force MOA between DES and TMR is also outlined below.

1.5.2.3 State Government Supported Community Infrastructure - SEQ Koala Conservation Policy

The planning, design and construction of Queensland Government supported infrastructure in the South East Queensland Koala Protection Area (SEQKPA) is to be carried out in a way that reduces adverse impacts on Koalas and Koala habitat and conforms with the Queensland Government's commitment to leadership on Koala habitat protection in South East Queensland. All government supported infrastructure providers must:

1. Commit to planning, developing, and delivering infrastructure that ensures the extent and condition of Koala habitat in south east Queensland is protected and enhanced to maintain a viable population of Koalas in the wild
2. Ensure infrastructure is planned and developed in accordance with the requirements detailed in the Infrastructure Assessment Criteria to the extent practicable under legislative arrangements or in accordance with an endorsed MOU;
3. Ensure compliance with the Infrastructure Assessment Criteria of this policy or in accordance with an endorsed MOU through a self-assessable framework established by this policy;
4. Ensure that any foreseeable costs associated with complying with requirements of the Infrastructure Assessment criteria or in accordance with an endorsed MOU, including the provision of environmental offsets, are included in project costing where required;
5. Deliver appropriate environmental offsets to provide a conservation outcome for significant residual impacts to Koala habitat arising from the delivery of infrastructure projects, according to relevant requirements of the Environmental Offsets Policy and Environmental Offset Act 2014;
6. Agree that the department administering the Nature Conservation Act 1992 (the Department of Environment and Science (DES)) will exercise a review and assessment role to assist with compliance of this policy.

A memorandum of agreement (MOA), dated June 2010, was still active at the time of writing between DES (then DERM) and TMR in respect of transport infrastructure within the SEQ Koala protection area (SEQKPA). The MOA binds TMR to, whenever practical, avoid aligning transport infrastructure such that it intersects with Koala habitat, or, when that cannot be avoided, aligning the infrastructure so that it intersects areas of the lowest value for Koalas rather than higher value areas. In constructing the project, TMR must, whenever practical, comply with the *Koala Conservation State Planning Regulatory Provisions* (now superseded, in part, by the *Nature Conservation (Koala) Conservation Plan 2017* and Schedules within the *Planning Regulation 2017*) and the intent of the Draft *South East Queensland Koala Conservation Strategy 2019-2024*. Some exemptions apply, but the CC project does not meet the criteria for exemption.

1.5.2.4 The Environmental Protection Act 1994

The Queensland *Environmental Protection Act 1994* has, as its primary object, the requirement for development within the state to comply with *ecologically sustainable development* principles. These principles include the application of *best practice environmental management* in environmental protection during an *environmentally relevant activity*, and the *general environmental duty* of a person or entity to take all practicable and reasonable measures to prevent or minimise harm. The Act also defines things such as *material environmental harm* and *serious environmental harm*, and the duties of a person or entity to notify of environmental harm caused or threatened during an activity.

1.5.2.5 The Animal Care and Protection Act 2001

The Queensland *Animal Care and Protection Act 2001* (*ACAPA*) provides for the protection of animals from acts of cruelty. Serious animal cruelty is a crime under the Queensland Criminal Code. A person who knowingly performs an act that causes or is reasonably likely to cause the suffering of serious injury or prolonged suffering to, and/or unlawfully kills an animal, is committing a crime.

The clearing of vegetation in which animals are resident (whether native animals or introduced animals) must be considered to be an act that, in some circumstances, could breach the *ACAPA*, and in serious cases result in the commission of a crime under the Queensland Criminal Code.

1.5.2.6 Permit requirements for Koala work

The survey, capture, veterinary assessment and radio-telemetric monitoring of Koalas in Queensland requires approval from two Departments: the Department of Agriculture and Fisheries (DAF) for approval by an *animal ethics committee* (AEC) and from the Department of Environment and Science (DES) for a *scientific purposes permit* (SPP). When translocation of Koalas is likely to be involved, that may require an additional approval from DES specifically authorising the translocation of Koalas.

1.5.3 Interaction of this *KCS* with federal and state regulatory instruments

With respect to legislation and the regulatory framework, this *KCS* places compliance with *EPBC Act* requirements as the foremost regulatory obligation. At the time of writing of Version 1 of the *KCS,* the Queensland Government regulations regarding Koalas were in a state of flux. However, the *KCS* seeks to deliver outcomes that are consistent with the intent of State Koala regulatory protective instruments, and the existing MOA between DES and TMR regarding Koala management.

Regarding the *EPBC Act*, the *KCS* seeks to deliver a comprehensive suite of measures to avoid, minimise and mitigate harm to Koalas, rather than a more simplistic approach of road-trauma mitigation and habitat offsets which, alone, may not deliver optimum outcomes. The intent of the *EPBC Act* is to ensure that measurable and scientifically valid actions occur that will have meaningful benefits to protection and conservation of listed species, such as the Koala. Hence, a holistic package of measures is preferred, implicitly. The related policies clearly state the importance of robust baseline data, and careful and scientific measurement of key metrics associated with offset/compensatory measures.

Regarding the translocation of Koalas: at the time of writing, the Queensland Government still generally prohibited the translocation of Koalas in response to development pressures (*salvage translocation*). This policy position was under review at the time of writing, but Koala translocation was permissible in some circumstances under a scientific purpose permit (SPP) issued by DES. Given that translocation of some Koalas will be necessary if the CC project progresses, a specific approval covering Koala translocation will be required from DES.

In respect of the *EPBC Act*: translocation of listed species is generally considered to have either low or negative value in conservation terms (that is, it can cause more harm than good). However, sufficient research on the *salvage translocation* of Koalas has occurred to show that it is a successful and valid management tool. Presentation of these findings may be required during assessment of the CC project under the Act, and certainly the translocation of Koalas will need to be notified as a likely mitigation action in the assessment process.

2 Koala habitat and threats to population viability

2.1 Koala habitat in and adjacent to the Coomera Connector

The current Coomera Connector footprint is 775 ha, of which approximately 437 ha was mapped as Koala habitat under the previous (2009) State Government Koala mapping methodology. Approximately 6200 ha of mapped Koala habitat occurs within 1km of the CC footprint.

Future Stages of the CC project pass through an area in East Coomera mapped as *Koala Priority Area* (KPA) under the new State Koala mapping, a designation that prohibits the clearing of Koala habitat except when exemptions apply. Clearing of Koala habitat in a KPA for a State transport infrastructure project is exempt development under the *Planning Act 2017* (Schedule 24). However, the provisions of the MOA between TMR and DES applied at the time of writing of version 1 of this *KCS* (See Section 1.5.2.3, above).

It is important to note that Koalas occur in many areas not mapped as *Koala habitat* by current State government mapping. The current Queensland Government *Koala habitat areas* mapping excludes some areas in which Koalas live. However, the new Queensland *Environmental Offsets Policy (v. 1.8)* states that 'An area that is not mapped as habitat, but which contains or is likely to contain Koalas (see Schedule 2, section 6(4) of the *Environment Offsets Regulation 2014)* is a *prescribed environmental matter*' (section 2A.1). Therefore, an offset may still be required for impacts on Koala habitat outside of the mapped *Koala habitat areas.*

The *EPBC Act* provisions do not rely on mapping to define the location and extent of a potential impact, and therefore the State government mapping should not be relied upon to determine the quantum of area required to provide an adequate offset under the provisions of the *EPBC Act.* Most of the vegetation remaining in and around the CC alignment is either mapped Koala habitat, or might periodically be used by Koalas, and therefore is, by definition, Koala habitat.

A list of the regional ecosystem (RE) designations and descriptions of vegetation occurring in and near the CC alignment is contained in Appendix 2. An estimate of the areas of direct and indirect impacts on vegetation which is, or might be, used by Koalas is contained in Section 2.2.3.1 below. For the purposes of the *KCS,* loss of habitat for Koalas as a result of vegetation clearing for the CC project is designated as *direct Koala habitat loss (DKHL)* and the loss of ecological value for Koalas as a result of isolation of remnant fragments is designated as *indirect Koala habitat loss (IKHL).*

Some of the remnant vegetation through which the alignment passes in *Stage 1* is classified as biodiversity status *endangered* or *of concern* regional ecosystem under the *Vegetation Management Act 1999* and its subordinate *Vegetation Management Regulation.* Approximately 167 ha within the CC footprint is mapped as *remnant vegetation* (Planit, 2020). It is important to note that whilst Koalas have very specific tree species preferences, they will make use of virtually any vegetation at times, including native regrowth and non-native trees/plantations.

A summary of the vegetation associated with the CC project (Stages 1 and *Future Stages*) is contained in the table below:

Category	Description	Area (ha)	Comment
Total area of CC footprint	Area encompassed by current CC gazetted boundary	774	Area within CC project boundary (not clearing extent)
Mapped RE in footprint	Area of vegetation mapped as remnant RE within project boundary	167	Excludes non-mapped and regrowth areas.
Mapped Koala habitat (old mapping) in CC footprint	Area of Koala habitat as per previous State Koala mapping	437	Includes high, medium and low value areas of habitat, rehab. and 'other' areas.

2.2 Threats to Koalas

The key threats to Koala conservation and population viability are well known. The ongoing loss and fragmentation of habitat has been, to date, the most significant cause of Koala declines, followed by chlamydial disease. However, the impact of climate change-related drought and heatwave conditions is likely to have caused catastrophic declines in populations west of the Great Dividing Range (GDR) over the past decade, as evidenced by major declines in populations subject to monitoring, such as the Pilliga scrub (Lunney *et al*. 2017; M. Roache, *pers. comm.* 2020) and Liverpool Plains (M. Crowther *pers. comm.* 2020). The devastating, extensive and sudden loss of Koalas in bushfires associated with severe drought and heatwave conditions likewise affected Koala populations along the GDR in the latter part of 2019 and early 2020. These climate-associated impacts are likely to become considerably more severe over the coming decades, and have probably now exceeded, by an order of magnitude, the loss of Koalas from other causes over the same period.

The following section intends only to briefly outline the current threats to Koala welfare and conservation, rather than offering a detailed discussion. It is important to note that the spectrum of threatening processes affects Koala populations variably, and, importantly, the critical threats vary in their impact both spatially and temporally. That is, while habitat loss, fragmentation, domestic dog attack, wild dog predation, vehicle trauma, disease and climate change affect nearly all Koala populations, the significance of each threat can be quite different from one population to the next and over time as well.

2.2.1 General threats - national and regional

2.2.1.1 Habitat loss and fragmentation

Extensive loss and fragmentation of Koala habitat since European colonisation of Australia has most severely affected land that is of high value for agriculture. These are areas of high soil fertility and generally higher rainfall areas. These features also correspond with the highest value habitat for Koalas. Hence, agricultural development has caused the most extensive loss and fragmentation of high-value Koala habitat.

Areas in which the highest densities of Koalas are supported are in coastal areas on highly fertile alluvial and volcanic-derived soils (such as the Redlands area in South East Queensland). These often correspond with

areas of high value for urban and agricultural development, and consequently these coastal areas have also suffered severe (and ongoing) net loss of habitat and increasing fragmentation.

Fragmentation of habitat increases edge effects, increases susceptibility to extirpation (localised extinction) and increases the susceptibility of Koalas to misadventure and predation while dispersing or moving between fragments. Hence, both habitat loss and fragmentation of remaining habitat can significantly affect population viability.

2.2.1.2 Climate change-related effects

Changes in the suitable 'climate envelope' for Koalas and consequently their distribution under the impacts of climate change have been modelled (Adams Hosking *et al* 2011). This modelling demonstrated a contraction in the geographic range within which Koala population can persist in a southwards and eastwards direction. Over the past decade or so, this effect has been dramatically demonstrated in the catastrophic declines in Koala populations in the Pilliga and Liverpool Plains areas of NSW. This impact is likely to have also affected Koala populations in central and western Queensland, but data are not yet available, however, anecdotal information suggests that the impact has been severe.

2.2.1.3 Chlamydiosis

Chlamydiosis refers to a spectrum of related disease conditions caused by infection with the specialised intra-cellular bacterium *Chlamydia pecorum* (*Cpec*). While other *Chlamydia* species also infect Koalas, *Cpec* is the species of most clinical significance. Infection of the urogenital tract can lead to severe, chronic urinary tract inflammation, reproductive sterility and death (Polkinghorne *et al*, 2013). Infection of the conjunctivae (lining of the eyes) can lead to painful and chronic conjunctivitis and blindness. Less commonly, the infection can cause respiratory tract infections, including rhinitis and pneumonia. Chlamydiosis is a significant threat to Koala population viability in northern Koala populations (Qld, NSW and ACT), a factor that contributed to their listing as *vulnerable* (now *endangered*) under the *EPBC Act*.

Infection rates with *Cpec* can be as high as 90% in some populations, and disease prevalence rates can be as high as 70% (Polkinghorne *et al,* 2013). This can lead to a large proportion of female Koalas being unable to breed (permanently) which can consequently reduce population viability. Hence, chlamydial disease can and does contribute to localised extinction. The epidemiology and risk factors contributing to severe impacts in some Koala populations are a research priority under investigation by several university-based research groups. Impacts of chlamydial disease appear to be worse in northern Koala populations (those occurring in NSW, ACT and Qld), and less severe in the southern populations (Vic and SA). The reason for this geographic difference is not known but may be related to the differential impact of the Koala retrovirus (KoRV) between northern and southern populations.

While chlamydial disease can be treated successfully if detected early, cases are often chronic (long-term) in wild Koalas presented to care facilities, and treatment success is lower. Nevertheless, a cure for infection can be achieved with antibiotic treatment, although this does not prevent future infections, and past infection does not seem to confer immunity. Significant progress has been made in the development of a vaccine to protect Koalas against chlamydial disease, but at the time of writing the vaccine was not being produced in quantities sufficient to be extensively used in chlamydial management at a population scale.

2.2.1.4 Wild dog predation

Wild dog predation of Koalas can, from time to time pose a risk to population viability in small, isolated populations. Significant wild dog predation of Koalas has been documented in major Koala monitoring programs in SEQ. In those programs effective suppression of wild dogs through trapping resulted in a significant reduction or elimination of predation. It is not expected that wild dogs will be a significant issue for Koala populations around the CC alignment due to local government monitoring and control, particularly in conservation areas such as Coombabah Lakelands and Pimpama River Conservation Area.

It is important to note that the presence of wild dogs in the environment does not necessarily mean that they are significantly impacting Koala population viability. Control programs must carefully consider the impacts of wild dog removal on ecosystem health and function. There is some evidence that wild dog presence reduces

the presence and impact of foxes and feral cats as well as providing the ecological service of an apex predator (see euanritchie.org). Hence, heavy wild dog suppression can have significant adverse impacts on ecosystems, despite the apparent short-term benefits for Koalas. Genetic analysis of wild dog samples from SEQ have typically indicated that wild dogs are dingoes or dingo hybrids, (rather than 'domestic dogs gone wild', as is the common misconception).

2.2.1.5 Anthropogenic misadventure and other threats

Aside from habitat destruction and fragmentation, other anthropogenic threats are highest around areas of human presence and activity (urban areas and roads). These threats include motor vehicle collisions/trauma, domestic dog attack, entanglement in fencing and other structures, drowning in swimming pools, entrapment in pits, dams, sediment ponds, drowning in sewage ponds, and so on. Because of the occurrence of these events around human habitation and activity, Koalas affected are often rescued and/or their mortality is reported, and hence these causes of death and injury are predominant in Koala hospital statistics. Such statistics do not represent the proportionate impacts on Koala populations more broadly and are likely to overestimate anthropogenic causes of injury and death across populations. Nevertheless, anthropogenic impacts can be locally significant and should be effectively mitigated whenever possible.

2.2.2 Local threats

2.2.2.1 Habitat loss and fragmentation

There has been significant loss and fragmentation of Koala habitat in the Gold Coast region. The fertile alluvial coastal plains which supported the highest densities of Koalas are now mostly developed, and subject to further loss due to infill development and development commitments in the East Coomera region. Despite this, important Koala populations persist in the larger habitat remnants along the coastal strip, smaller groups in urban and suburban parks and habitat corridors, and at lower densities within forested areas in the hinterland.

The protection of the coastal Koala populations is a priority for the Gold Coast City Council and which is enacting a city-wide Koala conservation strategy (see: https://www.goldcoast.qld.gov.au/Koala-conservation-plan-citywide-42304.html). A 2017 report by Biolink Ecological Consultants commissioned by the Gold Coast City Council, determined that a population of around 500 Koalas persists in the East Coomera area, despite intensive development. A separate Biolink report in 2017 focused on the Parkwood to Coombabah area (from Ashmore in the south to Helensvale in the north) and estimated that a population of approximately 266 Koalas persisted. Based on PVA, both the East Coomera and Parkwood-Coombabah Koala populations were considered viable in the long-term, if appropriate conservation measures were implemented.

2.2.2.2 Chlamydial and other disease

Chlamydial disease is a well-acknowledged and documented threat to Koalas in the Gold Coast region and affects Koalas in both urban and bushland contexts. Of documented Koala diseases, chlamydial disease is the most prevalent, and arguably causes the greatest impact regarding animal welfare and population viability. Infection with *Cpec* leads to disease in around 66% of cases (Robbins *et al*, 2019), and often leads to sterility in females with urogenital infections, as well as causing death in a proportion of cases. The severity of disease may be exacerbated by extreme environmental conditions such as heatwave and drought.

A modelling study examining various threats to Koalas in SEQ (Rhodes *et al,* 2011) concluded that control of chlamydial disease was the single factor that would most contribute to reversing the population decline. Nevertheless, this study, along with a more recent report by Beyer and co-workers (2018) recommended the management of multiple threats to achieve the best conservation outcomes. This conclusion supports the application of a comprehensive suite of compensatory measures to offset residual impacts of the proposed CC project, rather than only focusing on the delivery of habitat offsets.

Although diseases other than chlamydial disease are less common, they may become more apparent as chlamydial disease is controlled in managed populations. These include conditions putatively caused by strains of the Koala retrovirus (KoRV), such as leukaemia, a variety of other cancers, and immune-deficiency states, opportunistic infections, particularly during periods of prolonged inclement weather, and trypanosome-associated disease (Hanger and Loader, 2014). The impact of these on population viability is far less than that associated with chlamydial disease but can vary from population to population. The adaptive management approach recommended in this *KCS* facilitates the detection and response to threats that might arise as a result of non-chlamydial diseases.

2.2.2.3 Vehicle trauma

Motor vehicles are the most common cause of admission of Koalas to wildlife hospitals for trauma. The success rate for rehabilitation of trauma cases is low (<50%), affected by a range of factors, including the speed of response and resourcing of the rehabilitation facility. Trauma cases arising from any cause tend to occur more frequently in the 'breeding season' (July to February), although the season is less well defined in Queensland, compared with Victoria. This time of the year corresponds also with a period in which the dispersal of sub-adult Koalas (15-36 months) is more pronounced, and this demographic represents the most common casualty of trauma and misadventure.

Vehicle-related trauma on roads with a speed limit of >60km/hour is more likely to result in death of Koalas, and the period between dusk and dawn encompasses when most incidents occur. Road-trauma 'black spots' are defined as sections of road where Koala trauma is common, and these typically occur in areas where roads transect Koala habitat with medium to high population density and Koala movement corridors. These are areas where most benefit can be achieved by installation of Koala fencing and suitable crossing structures (Dique *et al* 2003).

Motor vehicle trauma can be a cause of significant loss of Koalas living in urban and suburban habitat remnants, and as such, can be a major contributing factor to localised extinction.

Smith Street (Molendinar-Gaven), Brisbane Road-Gold Coast Highway (Coombabah-Arundel), Helensvale Road (Helensvale) and Foxwell Road (East Coomera) are all roads that have been recognised as Koala 'black-spot' roads for vehicular strike. The Coomera Connector alignment crosses these roads and transects important remnant Koala habitat adjacent to those roads.

2.2.2.4 Domestic dog attack

Domestic dog attack of Koalas is common in semi-rural/acreage areas, and in higher-density suburban areas associated with high Koala density (such as East Coomera, Redlands). Domestic dog attack case survival rates are very low and are probably over-estimated by hospital data, because a proportion of Koalas escape the attack only to die later from their injuries. Dog-attack injuries in Koalas often result in massive internal damage, including fractures, laceration of internal organs, and massive damage to large muscle masses. Often the external signs belie the catastrophic damage under the skin.

The impact of domestic dog attacks on Koala population viability is greatest when sub-urban and urban developments impact upon high-quality Koala habitats, and without effective controls on dog management and ownership, the impacts can be severe. These impacts are significant in residential areas of Molendinar, Gaven, Coombabah, Helensvale, Oxenford and East Coomera where the gazetted CC alignment passes.

2.2.2.5 Climate-change related impacts

The effects of climate change for Koalas are most severe and most predictable at the limits of the viable Koala climate envelope - that is, in the northern and western extent of the species' geographic range. However, as evidenced by the extensive bushfires of 2019-2020, climate-change-related impacts are likely to have devastating effects through increased frequency and intensity of bushfire across the geographic range of Koalas. Hence, although coastal Koala populations are somewhat insulated from the severe heating and drying trends occurring at the limits of their geographic range in the north and west, they are not insulated from the effects of severe bushfire, the consequences of which can be devastating in the dense vegetation in coastal and hinterland areas.

New data from several Koala monitoring programs that suggest that the effects of chlamydial infection may be more rapid and severe, and mortality rates higher, during periods of heatwave and drought (A. Robbins, *pers. comm*. March 2020).

Local (Gold Coast) effects of extended drought and heatwave conditions were observed in the general deterioration in condition of Koala habitat trees, including foliage loss, and death of some trees. These effects lead to a reduction in the nutritive quality of the browse for Koalas, caused by a reduction in leaf moisture and nitrogen content, and possibly higher levels of toxic and 'anti-nutrient' components (Mella *et al* 2019). In addition, the reduction in foliar density in Koala food and shelter trees reduces shade availability and creates a heightened risk of heat stress and heat-related mortality.

Although the population-level effects of changes in foliar chemistry have not been investigated in detail, the gross effects of tree dieback and general loss of foliage have been well demonstrated by the catastrophic declines in western Koala populations in recent years (M. Crowther pers. comm. February 2020; M. Roache, pers. comm. February 2020).

Hence, it seems likely that the ongoing deterioration in climate stability will materially affect Koala population resilience in the Gold Coast region through increased frequency and intensity of bushfires, reduced survival during drought and heatwave conditions and increased susceptibility to the consequences of *Chlamydia* infection. Monitoring conducted during the KTMP-1 program and another Koala management program in SEQ (EVE) showed significant Koala mortality resulting from sepsis (blood infections) during prolonged rainfall events. Such events will undoubtedly occur with increased frequency and severity as climate change progresses.

2.2.3 Threats caused or exacerbated by the CC project

2.2.3.1 Habitat loss and fragmentation

The CC project is likely to cause a direct loss of Koala habitat, plus the further losses due to fragmentation into small habitat patches that have little or no meaningful conservation value for Koalas. At the time of writing, the direct loss and indirect loss (via fragmentation effects) along various sections of the proposed road had been calculated and submitted during the *EPBC* referral and assessment process.

2.2.3.2 Creation of barriers to safe Koala movement

The proposed Coomera Connector is a major, high-speed, multi-lane arterial road project. As such, it has the potential to create a barrier to the safe movement of Koalas in the local area. The two primary impacts will be:

- Koala mortality by vehicle collision where the road transects important Koala habitat; and
- preventing the normal movement and dispersal of Koalas through and between remnant habitat patches.

Hypothetically, both risks would be essentially entirely avoided by having the road tunnel under all areas of Koala habitat, or be elevated well above them on viaducts, or a combination of both. Cost constraints are unlikely to permit this approach, but it provides an ideal scenario. The CC project will need to incorporate effective barrier and road risk mitigation to avoid significant additional impacts on the local Koala population, which is already subject to fragmentation and alienation pressure.

The reliance on Koala exclusion fencing alone as a method to avoid vehicle collisions, without effective barrier mitigation (safe crossing structures) is an approach likely to fail. This is because Koalas, under a strong behavioural drive to disperse, will find any weakness or fault in a fence to breach it. Once within the active road corridor Koalas are very susceptible to vehicle collision, particularly if there is a central concrete safety barrier between opposing traffic flows. This risk can be somewhat mitigated by careful attention to fencing specifications, ensuring that central safety barriers are permeable to Koalas, provision of frequent egress devices, and ensuring that barrier crossing structures are well-sited and designed to maximise use by Koalas. Also, maintenance of fencing is of critical importance to ongoing effectiveness.

2.2.3.3 Vehicular collision

The risk to Koalas from vehicle strike would be very high unless a suite of appropriate mitigation measures is implemented/constructed. The gazetted alignment passes through important remnants of Koala habitat which support relatively high densities of Koalas. Koala casualties from road trauma are recorded regularly on Smith St, Brisbane Road, Helensvale Road and Foxwell Road regularly. The habitat patches adjacent to these roads are transected by the CC alignment and would be likely to support Koalas at risk of vehicle collision during the operational phase.

2.2.3.4 Increased predation risk

The level of predation of Koalas in the areas transected by the CC alignment is unknown. A higher risk of predation of Koalas may result if the displacement of Koalas (during vegetation clearing, for example) is not appropriately managed, and if predation risk is high at the translocation recipient site(s). This risk can be mitigated by monitoring of wild dog presence and management if Koala monitoring datasets indicate that predation will be a significant threat.

2.2.3.5 Increased risk of chlamydial disease impacts

The factors contributing to the development and severity of chlamydial disease in Koalas are the subjects of active research but are still poorly understood. There has been a widespread dogma that the stress induced in Koalas caused by ongoing habitat loss is the primary driver of high disease prevalence, but this is not supported by scientifically valid evidence. Nevertheless, factors such as chronic stress, poor nutrition, and weather extremes can contribute to high levels of Koala morbidity from a range of infections (A. Robbins and J. Loader, *pers. comm.* June 2020). Hence, some management of disease is warranted, as a direct, non-habitat offset measure. This could be delivered as a component of the Koala monitoring and management program.

2.2.3.6 Increased susceptibility to climate-change-related impacts

While not directly contributing to climate change impacts significantly, several arguments could be made regarding incremental impacts which are worsened or facilitated by the construction and operational use of the CC project. Factors that may exacerbate the impact are:

- Additional habitat loss and fragmentation leading to reduced resilience of the regional/local Koala population and diminished ability to respond to and rebound from severe climate-related impacts, including drought and heatwave, bushfire, and prolonged rain/flooding (leading to increased disease-related mortality);
- Significant CO2 emissions associated with construction and materials;
- Increased traffic generally, increased individual vehicle use due to reduced congestion, and therefore higher CO2 emissions generated by operational use of the CC;
- Increased risk of bushfire in habitat adjacent to CC during extreme weather events (drought and heatwave) resulting from discarded cigarette butts.

2.3 Previous local Koala work

The Gold Coast City Council has conducted and commissioned a considerable body of work in terms of Koala survey and management within the Gold Coast LGA. Surveys and a Koala translocation program were conducted between 2007 and 2014 for the *East Coomera Koala Conservation Project* (Gold Coast City Council). This program involved the translocation of 180 Koalas from East Coomera. Monitoring of those Koalas, resident Koalas left *in situ* at East Coomera and resident Koalas at the translocation recipient sites was conducted for several years. Follow-up surveys by Biolink Ecological Consultants were reported in 2017 and indicated that the total population in East Coomera had not changed significantly but was occupying less habitat (because of loss associated with urban development) at higher density (Koalas/ha).

The Gold Coast City Council commissioned Biolink (2017) to conduct Koala surveys in the Parkwood – Coombabah habitat corridor, which is parallel to, and east of, the proposed CC alignment. The study area included habitat remnants east of the M1, and between Coombabah/Runaway Bay in the north to Molendinar/Ashmore in the south. The study reported a population of 266 Koalas (+/- 46) occupying the estimated 1,156 ha of Koala habitat in the study area, resulting in an estimated density of 0.23 Koala/ha. This study site overlaps the alignment of the CC project between Helensvale Rd (in the north) and Southport Nerang Rd (in the south).

3 Overview of Koala management for the CC project

3.1 Key components of the *KCS* program

This *KCS* directs the implementation of a comprehensive suite of measures to protect Koalas and achieve Koala conservation outcomes in the context of the construction and operational use of the Coomera Connector project. Hence, the *KCS* directs the implementation of a number of distinct bodies of work, some of which occur ***on-site*** (within or adjacent to the defined Project Boundary for the CC project) and others which occur ***off-site*** (such as at the habitat offset sites and any Koala translocation recipient sites).

Important bodies of work that will occur on-site are:

- *Comprehensive Koala survey* in the Project Boundary and adjacent KMAs (Koala management areas for the CC Project);
- *Koala tagging and monitoring programs* (*KTMP*s), including direct management of Koalas during construction activities;
- A *Koala translocation program* (KTP);
- Installation and monitoring of mitigation devices (fences, barrier-crossing structures, etc)

Bodies of work that will occur at off-site areas are:

- Survey of potential offset and translocation recipient sites;
- Monitoring of Koalas translocated from high-risk on-site areas via the *KTP* (*Koala translocation program*) (See section 11);
- Acquisition and management of Koala *habitat offsets* (See section 9);
- Wild dog monitoring and control (if required/indicated by *KTMP* data);
- Delivery of *non-habitat offsets*, such as chlamydial disease management (of *KTMP* and *KTP* Koalas) and scientific research.

Long-term (out to 20 years post-commissioning) Koala monitoring and threat management will be conducted both on-site (at habitat patches intersected by or adjacent to the CC road) and at off-site offset and translocation recipient sites.

Habitat offsets will be delivered in the usual way, by acquisition of land of strategic value for regional Koala conservation, restoration of high-quality habitat and enhancing functional ecological connectivity. Non-habitat offsets will be delivered primarily through the *KTMP*s and *KTP*, through measures such as population-level chlamydial disease treatment and control, as well as through *other compensatory measures* further defined in section *10 Non-habitat offsets*.

The implementation of the *KCS* will be managed by the *KCS* Implementation Team using suitably qualified Koala experts contracted to conduct various bodies of work. The *KCS* Implementation Team will be created within the TMR CC Environmental Management Unit. The graphic overleaf shows the relationships of the various key components of the *KCS.*

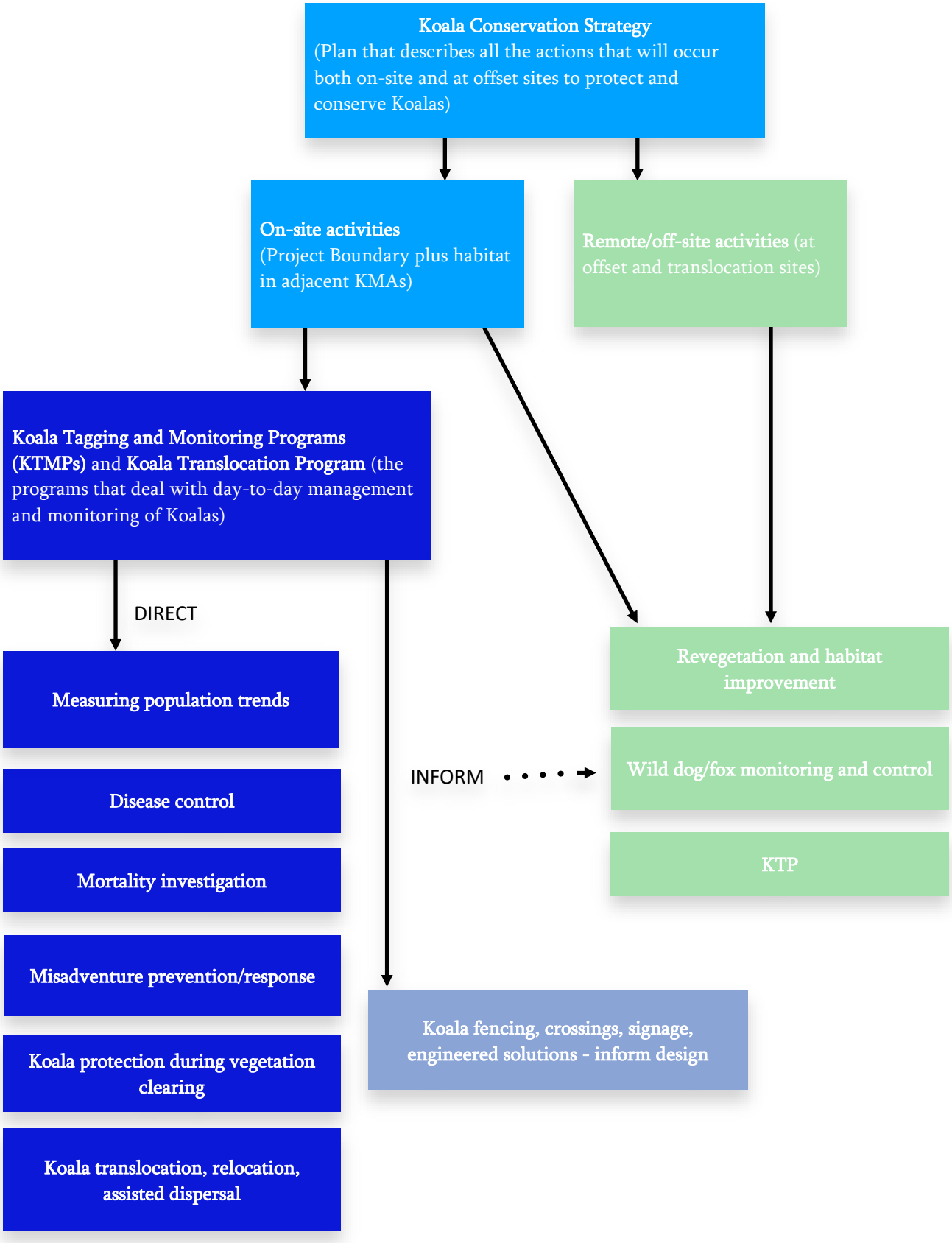


Figure 3.1: Graphic showing relationship of *KCS* components (excluding the long-term Koala monitoring and threat management program).

3.2 *KCS* concepts

Ultimately, the KCS must achieve its aims cost-effectively, deliver outcomes that are measurable, meaningful and durable, and be built on an approach that facilitates adaptive management. Several of the important concepts and strategies that justify and guide the approach to Koala protection and management in this Plan are outlined below.

3.2.1 TMR to retain control of *KCS* implementation

There are several important reasons why TMR (the TMR) should retain control of *KCS* implementation, rather than it forming part of the construction contract. These are:

- Major components of work directed by this *KCS* will occur outside of the window of time that the construction contract is applicable;
- It avoids any potential or perceived conflict of interests and commercial imperatives that might negatively impact the high-standard delivery of important *KCS* components;
- It gives community stakeholders greater confidence in the appropriate implementation of the program, and greater transparency;
- It makes it more economical to change scope, scheduling, methods and so on, which otherwise can become costly and time-consuming when tied to the approval and costing variations to the construction contract.

3.2.2 Protection of Koala welfare

There is a general community expectation that Koalas (and other wildlife) will be treated humanely and reasonably when development occurs. Injury or death of Koalas caused by an activity when reasonable measures could have been taken to avoid it is an unacceptable outcome. Such incidents can result in a significant public outcry and adverse media attention, particularly when reasonable and appropriate measures had not been taken to avoid them.

Hence, this *KCS* places a high priority on the protection of individual Koalas from harm. While concern for individuals is not prioritised in the *EPBC Act*, it is certainly a community expectation, and appropriate protection of individual Koalas ensures compliance with Queensland's *Animal Care and Protection Act 2001* and the intent of State Koala regulatory instruments.

The key mechanism for the monitoring and protection of individual Koalas in at-risk habitat within the CC Koala management areas (KMAs) is telemetric tagging and monitoring (via the *KTMPs*) during all risk periods. This represents an acceptable and reasonable level of protection when coupled with appropriate monitoring schedules and intervention procedures if Koalas become sick, injured or otherwise put at high risk due to their present circumstances.

3.2.3 Scientific approach to investigation and management of Koalas

The *EPBC Act* places a high level of importance on the acquisition of robust baseline datasets and ongoing monitoring datasets to determine the effectiveness of mitigation, direct offsets and other compensatory measures. The federal regulator is now placing an emphasis on achieving key outcomes, rather than just the management process. This requires an adaptive management approach, evaluation of the effectiveness of management actions over longer terms (up to 20 years), and remediation when key outcomes are not achieved.

The proposed Koala management in this *KCS* has scientific rigour as a key aspect of the methodological approach. Aside from meeting *EPBC Act* expectations, the acquisition of robust datasets on things such as disease prevalence, mortality rates and causes, reproductive rates and so on, allows determination of

baseline conditions and monitoring of trends in response to management interventions. As the CC Project impacts start to manifest, these data are critical to the adaptive management response, which aims to detect and address issues and adverse trends as they occur.

In addition, the scientific approach, when coupled with a sensible and comprehensive management plan, is the most critical risk management measure with regard to public relations. It allows unfair, untrue or unreasonable criticism to be firmly rejected by reference to the collected datasets. The value of this position cannot be overstated. The counterfactual situation is associated with a high risk of adverse PR, and, importantly, a high risk of not achieving the intent and objects of protective legislation, such as the *EPBC Act.* Given the recent severe and extensive impacts of recent drought and bushfire on the national Koala population, a best practice approach based on scientifically rigorous methods is warranted.

3.2.4 Adaptive management

Adaptive management informed by data and supported by a robust management framework provides the most effective approach to Koala management in the context of infrastructure development. The alternative is to apply resources and mitigation based on assumptions rather than data, risking poor outcomes and/or wasted resources. This KCS proposes Koala tagging and monitoring (the KTMPs) as a central method for collecting data as well as applying certain adaptive management interventions, such as disease treatment and assisted dispersal. The KTMPs deliver longitudinal datasets on factors such as mortality rates and causes, disease impacts, reproductive rates and behavioural/ranging responses by Koalas to vegetation clearing and assisted dispersal.

Collection of robust datasets on causes of mortality facilitates a targeted, cost-effective and meaningful response, that can change over time in response to changes in threat/risk profiles. The management response might vary significantly from the start of a program to its end, as targeted management achieves the desired outcomes, but emergent threats are identified and then require management. This approach was very successful on the Moreton Bay Rail project in managing Koala welfare and population viability, and reversed the extinction trajectory of the population in the rail corridor and adjacent habitat. It is therefore a sensible and appropriate approach for the CC project.

Adaptive management includes the following processes:

- Key objectives, metrics and intervention trigger points defined;
- Metrics measured at baseline and trends monitored over time using robust methods;
- Analysis of data collected and regularly compared with intervention triggers;
- Intervention/management applied when data indicate trigger points are exceeded;
- Management effectiveness measured and monitored over time;
- Process reviewed and improved after analysis of response to management;
- Repeat process with improved objectives, metrics, trigger points and management responses.

3.2.4.1 PVA and modelling

Population viability analysis (PVA) is a mathematical modelling tool used to determine the prospects for population persistence under a variety of circumstances, via a range of parameters that can be modified. PVA is a potentially valuable tool for conservation planning but is only as good as the data used to support assumptions and modify parameters in the model. For example, if assumptions are based on weak, old or potentially irrelevant datasets, the model may have very limited value. Conversely, PVA models based on robust, recent and rigorously collected datasets are likely to be highly accurate, and therefore valuable in predicting and modelling management scenarios. Such models can be refined and improved as more data become available, thereby increasing their predictive accuracy and value.

PVA was used to establish the benefit of the Koala management program for the Moreton Bay Rail project, based on the robust, longitudinal datasets collected during the four-year management program (Beyer *et al* 2018). Recent data acquired from Koala surveys in 2019 validate the accuracy and value of those PVA

models (de Villiers *et al* in prep.). PVA is a central method in evaluating the effectiveness of KCS implementation during the CC project.

3.2.5 Contributing to the greater good

Legislative and community expectations compel the proponent to do a certain amount of Koala management work. Broadly, this includes protecting Koalas from harm (injury and death) caused directly or indirectly through the Project, and ensuring that there is no net deterioration, and preferably a net *benefit*, to the conservation of the species, in this case, Koalas.

The actions taken to achieve those key objectives can have enormous benefit in the support of scientific research endeavours. Hence, ethically and fiscally, there is a strong argument that those potential benefits should be realised as much as possible. This represents responsible use of public funds and a more holistic and value-for-money prospect than not doing so, in which potentially large amounts of public money are expended with little or no collateral benefit. Hence, developing early research collaborations that provide mutual benefits or benefits that assist Koalas more broadly is an important component of this *KCS.* These collaborations are consistent with the *EPBC Act* offsets policy when they have a clear objective benefit for Koalas and can form part of the *direct* and *indirect offsets* package proposed during the assessment phase.

The ARC-Linkage Grants (Australian Research Council) scheme provides an opportunity for Project funds committed in support of a grant application to be leveraged with ARC funds, sometimes to 2-3 times the value. Support of ARC-Linkage grants has been successful in past TMR projects, including the MBR project, and has contributed to the production of dozens of peer-reviewed scientific papers and development of valuable Koala conservation tools, such as the Koala *Chlamydia* vaccine.

3.2.6 Community stakeholder engagement

Early engagement of key community stakeholders is an important strategy to ensure community acceptance of the Koala protection and management approach. Aside from being a sensible and proper thing to do, it also is an important risk management strategy. It allows concerns of community stakeholders to be aired and responded to and can allow opportunities for input into the development of the *KCS.* Ongoing engagement allows information gained from *KCS* activities to be shared with interested stakeholders, and emergent issues aired and resolved promptly.

Recommendations for community stakeholder engagement are contained in section 16.

4 *KCS* Intent, vision, aims and objectives

The intent of this *KCS* is to direct the activities and measures that will be implemented to ensure that Koalas are appropriately protected during the construction and operational phases of the Project, and that conservation impacts are *avoided*, *mitigated* and *offset* in that order of priority, as required by relevant legislation. In addition, the *KCS* recognises that community expectations generally exceed the minimum requirements of the legislative and regulatory instruments, and that a best-practice approach to Koala protection and management is warranted for this project.

The Coomera Connector project alignment passes through areas of Koala habitat that are critical for the regional survival of the species, and subject to significant public and community stakeholder interest/concern. Therefore, a minimalist, baseline-legislative-compliance approach is unlikely to be supported by the community or be consistent with the intent of federal and state legislation.

Rather, this Plan and the *vision statement* that fundamentally underpins it, reflect best-practice standards and an approach that seeks to meet community expectations.

4.1 Vision statement

A vision statement is a powerful aspirational statement against which key decisions must be considered. It is a foundational document that guides planning, decision-making, attitudes, and the culture within the broader project team. Referencing the vision statement helps to define the broad directions and approaches to be taken in both strategic and finer-level planning. It may also help to resolve differences and equivocation by providing a clear high-level statement of intent and can be inspirational and morale-building for project contributors and staff.

An example of an environmental *vision statement* for the CC project is:

> *Conservation outcome-based solutions for Koalas during all phases of activities for the Coomera Connector.*

The *vision statement* serves as the foundational statement of intent upon which the aims can be based.

4.2 *KCS* Aims

For the purposes of this *KCS,* the *aims* are the higher-level goals sought to be achieved by the CC project with respect to the protection of Koalas from harm and delivery of a net conservation benefit for Koalas at the local/regional level.

The broad aims of this *KCS* are:

1. To avoid the death of, and harm to, Koalas caused, either directly or indirectly, by the construction and operation of the Coomera Connector;
2. To avoid, to the maximum extent possible, the loss and further fragmentation of Koala habitat through engineering solutions, minimisation of the clearing footprint and realignment to avoid sensitive areas;
3. To deliver a comprehensive suite of compensatory measures that provide clear benefits to Koalas both locally and generally, resulting in improved local population viability as measured by the *KTMPs* in conjunction with population viability analyses (PVAs);
4. To deliver habitat offsets that provide a clear benefit for local and regional Koala conservation through appropriate size, high-quality revegetation and strategic placement;
5. To implement a scientifically robust Koala monitoring and management program that facilitates protection of individual Koalas, informs the adaptive management process and engineered mitigation, and facilitates evaluation of the success of the management program actions;
6. To make data derived from the Koala monitoring and management program available to scientific research groups and otherwise support research that advances the goals of TMR in the delivery of environmentally sustainable transport infrastructure, and provides benefits for Koalas more broadly;
7. To engage the local Koala conservation community in the development and implementation of the *KCS* through regular community stakeholder meetings and information sessions.

These aims drive the more detailed and specific objectives described in the following sections. These, in turn, guide the choice of methods and approach best suited to the efficient, cost-effective and successful achievement of those objectives.

4.3 How the aims will be achieved – key bodies of work

The key bodies of work that will be conducted to either deliver or facilitate the achievement of the aims are:

1. Delivery of habitat offsets;
2. Comprehensive Koala survey of habitat in the potential impact area of the CC project and offset and translocation recipient sites;
3. Implementation of the Koala tagging and monitoring programs (KTMP 1, 2 and 3) and the Koala translocation program (KTP);
4. Delivery of other compensatory measures, such as chlamydial disease control and support for conservation-related research;
5. Delivery/construction of key mitigation - Koala exclusion fencing and safe barrier-crossing structures;
6. A comprehensive Final Technical Report Koala management technical report, including PVAs, at the completion of the KTMP-3 phase;
7. The implementation of a long-term Koala monitoring and threat management program commencing at the completion of KTMP-3 and continuing for a 20-year duration.

Item 3 (above) is the implementation of the *Koala tagging and monitoring programs* (*KTMPs*) and the *Koala translocation program* (*KTP*). These have multiple functions - they provide data and information to inform other key aspects of *KCS* implementation, and they provide the proximate method for protecting Koalas during vegetation clearing and construction. They should not be seen as ‘sub-plans’ within this *KCS* - rather, they are components of *KCS* implementation that aim to directly deliver outcomes, as well as informing key

decision-making processes with respect to Koala protection and conservation. The graphic on page 31 shows the relationship of various components of the *KCS.*

The following sections expand on the aims and objectives of the *KCS.*

4.4 Objectives and key actions

Each of the objectives described below is derived from, and tied to, the high-level aims listed in the previous section. The objectives should be seen as the list of specific goals, the achievement of which ultimately results in the success of the project. In this case, the successful achievement of all the objectives in a clear and measurable way defines the success of the *KCS.*

Each of the objectives listed below seeks to conform to the SMART system of goal-setting. That is, each of the objectives is *Specific*, *Measurable*, *Achievable*, *Relevant* and *Time-bound*. Appendix 1 summarises the objectives and how they will be achieved, and Appendix 4 provides a summary list of key actions that must be undertaken to ensure that each of the objectives is scheduled and achieved successfully.

Many of the objectives that relate to the day-to-day, on-the-ground management of individual Koalas (as opposed to *habitat offsets* and so on) will be mediated thought the *Koala tagging and monitoring programs* (*KTMP*s) and the *Koala translocation program* (*KTP*) defined in detail in sections following.

Aim 1: Avoid harm to, or death of, Koalas caused directly or indirectly by the CC project.

Background and justification:

The most proximate risks to Koalas that may be caused by the CC Project are injury or death caused during vegetation clearing and construction works, and serious injuries or death caused by vehicle collisions during the operational phase (after the road is officially opened for use). Injury to, and death of, Koalas in such a way (i.e. by trauma) leads to issues of animal welfare and poor conservation outcomes, and must be avoided as much as possible to conform with the intent of relevant legislation as well as meeting community expectations.

In addition to those direct harms, displacement of Koalas by vegetation clearing may also, ultimately, result in traumatic death or death by starvation and misadventure as displaced Koalas seek suitable habitat. Further, Koalas isolated in fragments of habitat that, due to the location and physical barrier of the road, cannot then access other habitat, may die ultimately when their habitat remnants are insufficient to provide for their needs. They may also be exposed to risk of vehicle collision and other misadventure as they attempt to access or find alternative habitat. Deaths and injury to Koalas may also occur on other roads whose traffic volumes increase as a result of opening of the CC. These are examples of harm caused indirectly by the construction of the project.

Both direct and indirect harm can be avoided to a considerable extent by careful planning and application of appropriate measures and mitigation.

Objective 1: No Koalas will be killed or suffer serious injury as a direct consequence of vegetation clearing.

Actions:

1. All Koalas considered to be ‘at-risk’ will be tagged with telemetry devices to ensure that they are easily locatable, and that appropriate responses can occur if there is a risk of harm. This will be via the *Koala tagging and monitoring programs* (KTMPs).
2. Koala habitat that supports Koalas that are considered to be ‘at risk’ will be delineated by *Koala management areas (KMAs)* which will define the intensive search areas recruitment of Koalas into the *KTMP*s.
3. Vegetation clearing machinery and techniques are to be defined and included in the specifications documents that bind the construction contractor and sub-contractors to compliance contractually.

4. Fauna spotter/catchers are to be engaged by the TMR, or otherwise be independent of the construction contractor and/or vegetation clearing contractor.
5. Fauna spotter/catchers must be able to demonstrate that they meet or exceed specifications and will be compliant with criteria for expertise, requirements and operating procedures for wildlife spotter/catchers as detailed in Appendix 4.
6. The vegetation clearing footprint will be minimised to the greatest extent possible in areas where occupied Koala habitat will remain. The detailed design and final footprint for clearing may be informed by data derived from the *KTMP*s.
7. A 'zero-tolerance' approach will be implemented for breaches of approved procedures, specifications and conditions that are applied to minimise the risk of harm to Koalas. Breaches by the construction contractor will be associated with a substantial financial penalty in the event that a Koala is killed or injured as a result of a breach. In the event that a death or injury to a Koala resulted from the failure of an individual to follow approved procedures and/or a failure to comply with a properly given direction (by a wildlife spotter/catcher, for example), that individual will be prohibited from working on the Project.

Objective 2: No Koala will be displaced from its habitat and thereby exposed to unacceptable risk as a consequence of vegetation clearing, but rather assisted to move to suitable habitat with an acceptable risk profile.

Actions:

1. Identify and delineate the bounds of remnant Koala habitat patches that are likely to support Koalas that would be exposed to increased risk as a consequence of vegetation clearing, construction activities and final operational use of the CC road (the CC project *Koala management areas - KMAs*).
2. Identify suitable areas for early replanting (*habitat offsets*) and areas (preferably adjacent to, or including habitat offset areas) that are potentially suitable for the receiving of Koalas translocated from high-risk areas along the CC alignment.
3. Thoroughly survey the habitat delineated in Actions 1 and 2 (above) for the presence and number of Koalas (the *comprehensive Koala survey*). With respect to Action 1 areas, the number of Koalas likely to be living in each delineated area will be estimated, and an estimate of the number, if any, in each area that would require assistance to move to suitable habitat. With respect to Action 2 areas, the survey must estimate the Koala density (in Koalas/ha) and total abundance in the patch, and then make an informed judgement on the capacity of each area to receive Koalas.
4. Implement a *Koala tagging and monitoring program* and do other things necessary (such as wild dog monitoring) to establish with reasonably certainty, the risk profiles affecting Koalas in habitat patches delineated in Actions 1 and 2 (above).
5. Do such management actions as are necessary to minimise the impacts or factors negatively affecting Koala population viability in areas delineated in Actions 1 and 2 above. These must be implemented well prior to the translocation of Koalas from the alignment/KMAs to translocation recipient sites/offset sites.
6. Implement a *Koala translocation program* (with monitoring as per the *in-situ KTMP*) to move Koalas from high-risk and ultimately non-viable habitat remnants in or associated with the CC alignment to suitable recipient sites when natural dispersal is not a viable option.
7. Ensure that Koala rescue groups are aware of and engaged with the protocols for Koala monitoring and translocation for the CC Project; that is, they are aware of the delineation of habitat patches that are considered to be unsuitable for long-term persistence of Koalas and notify the *KCS* Implementation Team of Koalas that are at-risk, but not currently included in the *KTMP*.
8. Implement a local community awareness program to ensure prompt notification of the *KCS* Implementation Team of at-risk Koalas found in or near the delineated KMAs for the CC project.
9. Perform a Koala survey and risk analysis in collaboration with Gold Coast City Council Koala unit to determine the need for mitigation along Foxwell Road and Oakey Creek road when *Stage 1* (which ties-in to those local roads) becomes operational.

Objective 3: No Koalas will be killed or injured as a result of vehicle collisions on the Coomera Connector road (operational phase).

Actions:

1. Koala-proof (exclusion) fencing will be installed along all sections of the CC road identified by the *KCS* Implementation Team as presenting a risk to Koalas. Fencing will meet the specifications defined in the TMR Fauna Sensitive Road Design manual (volume 2) and Standard Drawing No. 1603 (TMR), and will be inspected and rectified as necessary, prior to practical completion of construction and contractual termination with the construction contractor. This fencing will be installed prior to commencement of operational use of the CC road.
2. Rapid Koala egress (one-way) valves or other rapid egress devices will be installed along sections of CC fencing defined by the *KCS* Implementation Team, at a density or frequency referable to the local Koala density/likelihood of Koalas gaining access to the CC road corridor (through local road tie-ins, for example). That is, where the CC passes through significant Koala habitat areas, a Koala egress device will be provided for every 50 m of fencing.
3. Where a central safety barrier is required for road-user safety, it will be permeable to Koalas by provision of ground-level windows or 'voids' to permit rapid transit of terrestrial wildlife across the barrier. The KCS Implementation Team will make arrangements for the design and testing of such devices with regard to their effectiveness for Koalas ensure engineering approval of their safety for motorists.
4. Where local and other State-controlled roads intersect with, or tie-in to the CC road, Koala-proof fencing will be installed as advised by the *KCS* Implementation Team to minimise risk of Koalas accessing the CC road corridor from remnant habitat patches proximate to those tie-ins. This fencing will be installed prior to commencement of operational use of the CC road.
5. Engineered connectivity structures (bridges and culverts) will be installed to maintain functional ecological connectivity at identified fauna movement corridors that transect the CC alignment.
6. The KCS implementation team will engage suitably qualified experts to provide advice on innovative solutions to minimising risk of Koala harm during operational use of the CC, such as lighting and Koala deterrent devices where fencing is not practical (at entry and exit ramps, for example); Koala grids or deterrents at areas where fencing cannot be installed, and so on.
7. Where engineered/constructed mitigation measures are insufficient to minimise risk to certain individuals, they will be translocated to suitable safe habitat and monitored as a recruit to the *KTP* (Koala translocation program).
8. Prior to the commissioning of the CC road (commencement of operational use), and for a period of 12-months following commissioning, the *KCS* Implementation Team will monitor the use of engineered barrier crossing structures by Koalas and respond to at-risk Koala notifications in collaboration with Wildcare and other local Koala rescue organisations. Details on the methods to be used to monitor connectivity/barrier crossing structures is provided below in the *KTMP-3* and *KTP* sections below.

Objective 4: Where the CC project transects important patches of Koala habitat, the Project will install effective and safe crossing devices, exclusion fencing and other engineered mitigation solutions to prevent Koala deaths on the road during operational use.

The following methods show the preferred order of preference for road-trauma mitigation. Tunnelling is not suitable for the CC project because of engineering and cost constraints, but the remainder will be considered to minimise risk to Koalas where the CC transects Koala habitat and movement corridors.

1. Tunnelling under habitat (not feasible or practical for the CC project);
2. Viaducts - road elevated above forest canopy;
3. Bridges over important habitat;
4. Land-bridge wildlife crossing (vegetated land-bridges);
5. Fauna culverts (avoiding wet areas/areas subject to inundation);
6. Rope bridges (for wildlife - effectiveness for Koala not demonstrated).

Actions:

1. *KCS* Implementation Team to use data derived from the initial *comprehensive Koala survey* and *KTMP-1* to refine the existing design and location of barrier mitigation structures. This input is to be provided to the CC Design Team at the earliest time that the *KTMP-1* delivers sufficient data to robustly inform the location and specifications of required barrier crossing devices/barrier mitigation measures.
2. Design team to implement recommendations of the *KCS* Implementation Team and relevant stakeholders (Gold Coast City Council) regarding the location and functional specifications of barrier mitigation/crossing structures.
3. As much as possible barrier mitigation measures should be installed/constructed as soon as possible, if not before, the effect of the barrier comes into being, whether that be through vegetation clearing, installation of temporary or permanent fencing, construction of bunds and cuts, and so on.
4. The effectiveness of barrier mitigation measures will be monitored and measured by various methods implemented during the *KTMP-3*. These will include use of movement-activated cameras ('trail cameras' or 'camera traps') (see Appendix 5) and using the Koala telemetry (movement) data derived from the *KTMP-3* monitoring of Koalas (*in-situ*).
5. Adaptive management response to a failure of Koalas to use barrier crossing structures under the *TARP* (*triggered action response plan)* (Appendix 6) is to be initiated when a structure is deemed not to be functioning as specified. This is to be notified by the *KCS* Implementation Team to the TMR at the earliest time that a definitive determination is made and provided with a suitable remedial response.

Aim 2: Avoid and minimise loss and further fragmentation of habitat remnants

Background and justification:

The ecological and Koala-specific impacts of habitat fragmentation and loss are well documented. The CC Project alignment passes through patches of remnant Koala habitat that are already severely fragmented in a regional/local context. Fragmentation increases extinction likelihood in remnant patches, exposes Koalas to anthropogenic misadventure, and prevents natural movement and gene-flow through the landscape.

Several engineering solutions can result in the complete or partial abatement of adverse effects associated with the barrier effect and the risk of road trauma to wildlife. These are, in order of effectiveness: road tunnels, flyovers or viaducts, dedicated vegetated fauna bridges, road bridges, culverts and dedicated fauna rope bridges. The barrier effect or fragmenting effect of a road and the risks to wildlife from vehicular trauma are avoided completely if relevant sections of the road pass through tunnels. Hence, tunnels provide the best ecological solution to avoid the barrier effect and road mortality. However, tunnelling is very expensive, and for cost and engineering reasons is not considered suitable for the CC project.

The location and alignment of the CC project has been subject to detailed analysis and is now heavily constrained by development. Hence, the gazetted CC alignment will not change, and avoidance of further significant Koala habitat loss and fragmentation will rely upon engineering solutions, and provision of habitat offsets, rather than road realignment.

Objective 5: Complete an audit of the expected minimum area of Koala habitat expected to be lost or significantly impacted by the construction of the road. This will be conducted in the planning phase and therefore will occur in mid-late 2020.

Actions:

1. The TMR (TMR) will, with the assistance of the *KCS* Implementation Team, define the likely minimum and maximum extent of clearing of Koala habitat throughout the gazetted project alignment, including those areas resumed for the purpose of tie-ins to local and other arterial roads.
2. The *KCS* Implementation Team will further define and measure areas of existing Koala habitat, that are, at the completion of the CC project, likely to be deemed of no ecological value for Koalas because

of their small size, ecological isolation or other factors that have resulted partly or entirely from the Project.

3. Actions 1 and 2 are to occur as soon as possible in the *planning phase* to ensure that acquisition and early replanting of offset sites occurs promptly. The sum of the areas defined in actions 1 and 2 will be the a*rea of Koala habitat impact* (KHI) which will form one factor in the calculation of area to be delivered by *habitat offsets*.
4. The *KCS* Implementation Team will produce a map showing the extent of the KHI. The map will be produced as geo-referenced *kml* file (Google Earth) and a shape file suitable for ArcGIS and related mapping programs.

Objective 6: Where the CC gazetted alignment transects important remnant patches of Koala habitat, suitable barrier crossing/barrier mitigation structures and engineered solutions will be implemented that achieve functional ecological connectivity for Koalas.

Actions:

1. The *KCS* Implementation Team will identify all patches of remnant Koala habitat that will require a solution to avoid the ecological separation or fragmentation of important Koala habitat. Important Koala habitat patches are defined as those that will retain viable populations or sub-populations of Koalas throughout the construction and operational phases of the Project.
2. Review the location and design of connectivity structures with reference to CKS and KTMP-1 data as those become available.
3. KCS Implementation Team will design the layout and detailed specifications for fauna exclusion fencing to maximise the effectiveness of connectivity/barrier crossing structures. Where appropriate, a departure from the current *Fauna Sensitive Road Design Manual* specifications may be recommended to improve effectiveness and/or reduce costs.
4. Monitor and evaluate the effectiveness of mitigation structures through installation of cameras and other monitoring devices at crossing structures, and through monitoring of Koala movements using telemetry devices as an objective of *KTMP*-2 and *KTMP*-3.

Aim 3: Delivery of compensatory measures for residual impacts to Koalas

Background and justification:

The Coomera Connector gazetted alignment passes through and adjacent to important Koala habitat patches. Realignment of the road is not possible due to surrounding development and gazettal of the current alignment.

Therefore, despite the various mitigation measures that might be implemented, a *residual impact* on Koalas will remain. This residual impact will result in four significant effects:

1. The loss, fragmentation and degradation of habitat;
2. The barrier effect of the road (causing ecological isolation of fragments and sub-populations);
3. The increased risk of Koala injury and mortality associated with vehicular collisions related to use of the CC and associated transport infrastructure; and
4. The displacement of Koalas from habitat that is cleared or caused to be functionally ecological isolated by the construction of the road.

In addition to these well-acknowledged residual impacts, there are other potential effects whose impact may be of lesser magnitude, less well known or less well measured, and which are largely out of the control of the TMR (TMR). These include things such as climate-change-related extremes of weather and rainfall (both drought and flooding), which may have longer-term impacts on Koala populations and which have not been sufficiently investigated at a finer scale. These, and the indirect effects on disease epidemiology, genetic flow (and genetic population health) and long-term population resilience are poorly understood.

Consequently, the reliance on *habitat offsets* alone (as the sole compensatory measure), is now not considered sufficient either to offset residual impacts or provide net conservation benefit (Beyer et al, 2018). The delivery of *habitat offsets* is dealt with in more detail in section 9.

Objective 7: Determine the status and current threats to Koala welfare and population viability affecting the Koala populations associated with the Coomera Connector alignment and proposed offset/translocation sites.

Actions:

1. **Implement *KTMP-1***: Capture, health-check and monitor for a minimum 12-month period, a representative sample of the Koala populations inhabiting habitat patches within and adjacent to the CC gazetted alignment.
2. **Implement *KTP***: Capture, health-check and monitor, for a minimum 12-month period, a representative sample of the Koala population(s) inhabiting habitat patches at and/or adjacent to proposed translocation recipient sites and habitat offset sites.
3. Following completion of the 12-month monitoring period for *KTMP-1* and KTP, the *KCS* Implementation Team will perform an **analysis of data and report** on the status, habitat utilisation, health, reproductive status and population viability of the subject Koala populations. This report is to include recommendations regarding the adaptive management of threats, and the mitigation of temporary and permanent risks to Koala welfare and conservation induced by the construction and operation of the Coomera Connector project.

Objective 8: Use information derived from KTMP-1 to develop and implement another compensatory measures program to target existing or potential threats to local Koala population viability.

Actions:

Note: The actions recommended below are generic rather than targeted with regard to the adaptive management framework. This is because, at the time of writing (*KCS* V1.4), the *KTMP-1* had not been implemented, and therefore no substantial datasets existed to inform targeted management of threats. The actions below will be revised in response to data derived from the *KTMP-1* such that threat management is targeted and proportionate.

1. Using the data derived from the *KTMP-1*, along with other sources of information (derived from Gold Coast City Council Koala work, for example), the *KCS* Implementation Team and TMR will develop ano*ther compensatory measures* program for Koalas. This will be complementary to the *habitat offsets* delivery program and work on its development will commence in the *planning phase* of the Project (late 2020), with refinement and review as new data become available. The following actions are examples of components of the proposed *CCMP*.
2. **Wild dog** monitoring and control will occur in all *KTMP* KMAs and in translation and offset site KMAs. Triggers for control will be the contribution of wild dogs to Koala mortality of 10% or more.
3. **Chlamydial disease** will be treated in all animals affected by it that are included in any of the *KTMPs* or *KTP*.
4. **Vaccination** of Koalas in *KTMP*s, *KTP* and KMAs will be considered based on the seriousness of the threat that chlamydial disease poses to population viability and subject to appropriate development and testing of the vaccine.
5. **Fencing** will be installed as required along feeder roads to the CC if evidence indicates that they currently, or will during the operational phase of the CC, create a significant risk of vehicular collision/trauma for Koalas.
6. **Climate-change** impact mitigation measures, such as provision of supplementary planting of heat-refuge tree and shrub species, provision of surface water, provision of artificial heat refugia and water sources, and bushfire mitigation will be considered in habitat offset and translocation sites.
7. The *KCS* Implementation Team will engage a suitably qualified expert to conduct **population viability analyses** to support the adaptive management approach and ensure that conservation management and protective measures implemented are relevant and likely to support population viability at least in the medium-term.

Additional *compensatory benefits* derived from the support of conservation-related research are outlined in the actions associated with Aim 6 (below).

Aim 4: Delivery of high-value habitat offsets

Background and justification:

The delivery of high-value and relevant *habitat offsets* is an important component of conservation management when residual impacts of a projects are likely. One reason that habitat offsets are valuable is that most wildlife habitats and ecosystems in Australia are so damaged and fragmented, that there is great scope to make improvements. It is important, however, that crucial factors are achieved to the greatest extent possible so that habitat offsets provide the most value, and the most locally, or at least regionally relevant benefits for the target species. These include:

1. No net loss of available habitat (and as much as possible deliver a net gain);
2. Like for like (in terms of regional ecosystem/ecological communities) as much as possible;
3. Increasing the extent and/or connectivity of existing high-value habitat;
4. Creating new high-value Koala habitat and/or contributing to the improvement/conversion of existing lower-value habitat to high-value Koala habitat;
5. Delivering offsets that will have a meaningful and measurable benefit for the target species;
6. Monitoring and measuring the benefit delivered using appropriate metrics, timeframes and methodology, and developing and implementing an adaptive management approach based on triggered action-response planning (TARP);
7. Ensuring the protection of the benefit of the offset for the species - that is, its durability - through measures including, but not limited to: protected (in perpetuity) land tenure or covenant, weed and pest animal control, monitoring and adaptive management of threats to its high-value status and or the target species using it.

It is important therefore that habitat offsets do not simply apply a protective mechanism over existing high-value habitat - because there will still be a net loss of habitat resulting from the Project. Although there may be a gain in the habitat included in the protected area 'estate', there is still a net loss of habitat for the species.

Objective 9: Identify and secure habitat offset sites that are strategically placed, provide opportunity for revegetation (creation of 'new' Koala habitat) and will be suitable for at least partial support of Koalas translocated from areas of the CC alignment.

Actions:

1. Perform desktop analysis and consultation with relevant stakeholders and experts to identify suitable candidate sites that meet the criteria for selection.
2. Acquire and/or otherwise secure offset sites of sufficient size, connectivity and suitability as per criteria for Koala habitat offsets (Appendix 7).
3. Develop and implement a *Koala Habitat Restoration Plan* that details the timing, extent, location, species suite, irrigation, weed control and management duration to achieve 'low management required' status.

Objective 10: Commence revegetation of previously cleared or degraded areas of offset sites as early as possible (mid-late 2020, early 2021).

1. TMR to engage a suitably qualified habitat restoration entity to implement the *Koala Habitat Restoration Plan (KHRP)* for suitable areas in secured offset sites. The contract and/or plan must specify the commencement and practical completion dates, as well as the duration and nature of management required for the revegetation areas to achieve 'useful maturity' without significant incursion of weeds.

2. Commence revegetation with a suite of species and as per the methods detailed in the *Koala Habitat Restoration Plan* to achieve high-value, diverse Koala habitat. This must occur at the earliest possible time to ensure that at the commencement of Koala translocations, the revegetation sites provide at least some capacity to support translocated Koalas (i.e. they should be of 2-3 years age).
3. *KCS* Implementation Team or TMR to conduct an audit of Koala habitat restoration areas at least once during preparation and early planting phase, and at 6-monthly intervals thereafter, in accordance with evaluation criteria established in the (*KHRP*), including, but not limited to: establishment of measurement plots, DBH, tree height, canopy diameter, foliage projective cover (FPC), weed infestation (nature and extent) foliage quality (e.g. insect damage, leaf drop), and evidence of use by Koalas.

Aim 5: Implement Koala tagging and monitoring programs (KTMPs)

Background and justification:

The *Koala tagging and monitoring programs* provide the means to achieve the following objectives:

1. Protection of Koalas during vegetation clearing;
2. Detection of death of program Koalas and determination of cause of death;
3. Appropriate response to Koalas in danger;
4. Determination of habitat usage and ranging behaviour;
5. Identification of Koalas (individuals and sub-populations) that will require translocation prior to or during the construction phase;
6. Monitoring and management of disease;
7. Monitoring and management of other threats to Koala welfare and conservation;
8. Informing of mitigation measures during design, construction and operational phases using both adaptive management and pre-emptive management frameworks;
9. Supporting mutually beneficial research programs and projects through access to data and information and in other ways facilitated by the *KTMP*s.

The *Koala Translocation Program* (*KTP*) is a version of a *KTMP* that specifically monitors and manages Koalas subjected to translocation as well as those Koalas that are already resident in translocation recipient sites.

Hence, these programs are one of the most important risk management actions from both the Koala perspective and the Project (reputational) perspective. The death of Koalas from natural causes and other causes unrelated to the CC project is inevitable during the several-years-long construction schedule. It is important that the CC project is not responsible, or blamed, for Koala deaths. Previous projects (such as the MBR Koala management program) showed that Koala annual mortality rates can be very high when subject to periods of high threat, such as heavy wild dog predation, but can be reduced to 10-15% per annum with appropriate adaptive management and threat control measures. The undiagnosed death of 'Project' Koalas presents a significant risk of reputational harm to the TMR and contractors. This risk can be controlled by implementation of a suitable *KTMP*.

Objective 11: Define the geographic scope, duration and other specifications of the KTMP-1.

Actions:

1. The TMR will engage a suitably qualified consultant to conduct a *comprehensive Koala survey* of distribution and abundance in all Koala habitat within the CC gazetted alignment and also in habitat adjacent to the CC alignment, which, in the opinion of the expert consultant, is likely to support Koalas that might be at risk during and/or as a result of, the construction and operation of the CC project.
2. In consultation with the TMR (TMR) the *KCS* Implementation Team will propose the Koala management areas (KMAs - areas of habitat within which all Koalas will be captured and included in *KTMP-1*). These *KMAs* will be clearly delineated on a map.

3. Subsequent to Action 1 (above) and with reference to the *comprehensive Koala survey* data, the *KCS* Implementation Team will provide an estimate of Koalas likely to be included in the *KTMP-1* and the cost of conducting the *KTMP-1*.

Objective 12: Capture all Koalas in KMAs, perform veterinary examinations, telemetry-tagging and monitoring.

Actions:

Note: the following actions will be performed by a suitably qualified expert contractor engaged to perform part or all of the *KCS* implementation. All *KTMP* and *KTP* actions require a scientific-purposes permit (SPP) from DES and animal ethics committee (AEC) approvals.

1. Intensive **search and capture** of all Koalas in KSAs.
2. All Koalas subjected to standardised and comprehensive **veterinary examination** under sedation.
3. Koalas deemed to warrant **treatment** or euthanasia on humane grounds - performed as per veterinary procedures.
4. Koalas deemed to be suitable for **release** will be released back to their point of capture (when appropriate) and monitored for the agreed duration of the *KTMP-1*.
5. **Monitoring of Koalas** will occur at such frequencies as allow for the rapid (within a maximum of 3 days) detection of death. Whenever appropriate, Koalas will be monitored using near-real-time, remotely interrogable bio-telemetry systems.
6. The *KCS* Implementation Team will respond to **mortality** events or '**low-activity**' as soon as is practicably possible.
7. **Necropsy (*post mortem*) examination** will be performed on all Koalas that die or are euthanased during the period of *KTMP-1* monitoring. The necropsy examination will be of sufficient detail to reasonably determine the cause of death.
8. Koala **ranging behaviour and habitat utilisation** will be observed and recorded with sufficient frequency to inform road design, mitigation and translocation measures.
9. Datasets collected from the *KTMP-1* on population health, reproductive output, mortality rates and mortality causes will **inform ongoing management** and the *other compensatory measures* program.
10. Data and/or biological samples derived from the *KTMP-1* will be shared with approved **collaborating research groups**.

Objective 13: Initiate the Koala translocation program (KTP)

Actions:

1. *KCS* Implementation Team will design the Koala translocation program (*KTP*) based on datasets from the initial *comprehensive Koala survey* and the *KTMP-1*. These will identify the individuals for which, and/or habitat areas from which, translocation will be conducted. This will be finalised at least 12 months prior to the scheduled or expected commencement of vegetation clearing operations for *Stage 1* of the CC construction project.
2. The *KCS* Implementation Team will identify the translocation recipient sites, and perform Koala capture, veterinary assessment and tagging of resident Koalas at least 6 months prior to the commencement of any translocations of Koalas into that/those sites. The number of resident Koalas captured and tagged will be 20, or the entire population living in the proposed recipient habitat patch, whichever is the smaller.
3. When necessary, the *KCS* Implementation Team with the TMR will ensure that significant threats to Koala welfare and population viability affecting the proposed translocation recipient sites are sufficiently managed prior to the commencement of translocations, and that, when necessary, threat management programs continue for as long as is necessary to ensure Koala population persistence is assured (in the medium to long-term (5 years)).
4. Prior to commencement of vegetation clearing in areas designated as habitat from which Koalas will be translocated, the *KCS* Implementation Team will capture, health check, and telemetrically tag all

Koalas in the designated habitat. Subject to deeming of Koalas as suitable for immediate release (by veterinary examination), they will be translocated to the designated translocation recipient site(s) and released.

5. Koalas subject to translocation will be monitored for a minimum period of 12 months following the translocation event, as will the resident Koalas in the recipient sites.
6. When necessary, veterinary management, including the treatment of disease and injury and the conduct of necropsy (*post mortem*) examinations will be performed by a suitably qualified expert or entity defined by the KCS Implementation Team.
7. The *KCS* Implementation Team will apply such interventions and management as are required to ensure the success of the *KTP* and will develop a *triggered action/response plan* (TARP) for response to events that threaten the success of the *KTP*.

Objective 14: Determine key Koala population parameters and dynamics in the KTMP-1 and KTP, including: Koala population number in each patch, health (prevalence and incidence of disease), Koala reproductive rate, mortality rate, important causes of mortality, habitat utilisation and ranging behaviour (home range determination).

Actions:

1. The *KCS* Implementation Team will perform the monitoring and management of Koalas included in the *KTMP-1* and *KTP*.
2. The *KCS* Implementation Team will collect, store, collate and analyse data on the key population parameters listed above, as well as compiling individual health and field records for *KTMP-1* and *KTP* Koalas. These records will be stored in a cloud-based dedicated Koala database accessible by the *KCS* Implementation Team.
3. The *KCS* Implementation Team will prepare monthly reports that include key metrics and events (Koala inclusions, health summary, deaths, necropsy findings and so on) relating to the Koalas in the *KTMP-1* and *KTP* and deliver these to the TMR on or before the third Monday in each month.
4. The *KCS* Implementation Team will prepare reports and/or data analysis on the *KTMP-1* and *KTP* for presentation to community stakeholders as and when requested by the TMR.

Objective 15: Determine the geographic extent, scope other specifications of the KTMP-2 (construction phase) and KTMP-3 (post-construction and operational phase) of the Koala monitoring and management programs.

Note: the aim of *KTMP*-2 is to monitor and manage risk to Koalas during the construction phase of the CC Project; the aim of *KTMP*-3 is to monitor and manage risk to Koalas during the post-construction and operational phases of the project, and to verify the effectiveness of various mitigation measures implemented or installed to maintain ecological connectivity and avoid Koala mortality by road trauma.

Actions:

1. For *KTMP-2*, the *KCS* Implementation Team will define the geographic extent of the KMAs and the Koalas from *KTMP-1* or others that will be included in the monitoring for *KTMP-2*. These will be all Koalas that are left *in-situ*, (that is, not translocated) and are considered to be at some risk from vegetation clearing and other construction activities.
2. If scheduling aligns, the *KCS* Implementation Team should endeavour to maintain continuity between *KTMP-1* and *KTMP-2* to minimise risk of 'losing' Koalas and to reduce costs associated with repeated search and capture.
3. The *KCS* Implementation Team will define the methods and/or technology to be used for the monitoring of the effectiveness of barrier mitigation and crossing structures. (See Appendix 6 for suitable methods.)

Objective 16: Protect Koalas from harm during vegetation clearing and construction works.

Actions:

1. The *KCS* Implementation Team will develop a comprehensive *Koala protection procedures (KPP)* document for protection of Koalas during construction works for the Principal/Construction Contractor (PCC). The KPP will include things such as:
    - Establishing the appropriate culture within the construction team, and the *shared responsibility* obligations;
    - How the *KTMP*-2 provides a mechanism for Koala protection, and its interface with construction operations;
    - How the *KCS* Implementation Team will interact with the construction contractor and sub-contractors during each phase of construction;
    - Establishment of temporary and permanent fauna fencing and its scheduling with respect to phases of construction;
    - Procedures for management of Koala incidents, including Koala injury, death, presence in the construction corridor, sightings, and so on;
    - Maintaining and disseminating key contacts for Koala incident management.
2. After the engagement of the principal construction contractor (PCC) for the CC, the *KCS* Implementation Team will meet with the PCC and clearly outline the management measures and processes to be implemented to ensure an appropriate level of Koala protection during the phases of construction, particularly vegetation clearing.
3. On each day of vegetation clearing the *KCS* Implementation Team will determine the Koalas that are inside the proposed clearing footprint for the day and a 200 m buffer zone and notify the nominated PCC person of the number and locations of Koalas.
4. The *KCS* Implementation Team will specify the actions that must occur on each day to ensure the appropriate protection of Koalas deemed to be at risk from vegetation clearing and/or other construction-related activities. Such actions will include things such as:
    - The flagging of the Koala tree and an exclusion or ‘no disturbance’ zone;
    - The flagging of trees or vegetation to remain as a link to habitat existing outside of the clearing footprint until the Koala has moved of its own volition;
    - The capture of the Koala and assisted dispersal (relocation) if such action is permitted under approval conditions;
    - The capture of the Koala for a scheduled health examination.
    - Any other action as may be required from time to time to achieve the objective to avoid harm to a Koala, as directed by the *KCS* Implementation Team.

Aim 6: To make data derived from the Koala monitoring and management program available

Background and justification:

The implementation of Koala management programs during infrastructure development projects provides opportunities that might otherwise not exist for the support of valuable scientific research. For instance, the telemetric monitoring of large numbers of Koalas provides excellent longitudinal datasets on mortality, risks to viability and disease prevalence and dynamics. These datasets can be immensely valuable to scientific endeavours that seek to improve Koala conservation. Hence, the support of such research, through data-sharing arrangements, support of biological sampling, and through mutually beneficial collaborations, is a good value-for-money proposition in the context of public expenditure on transport infrastructure projects.

In addition, university-based research groups can leverage such support to acquire funding through, for example, the Australian Research Council (ARC) grants program. This then provides mutual benefit by value-adding to work conducted for the infrastructure project. The Moreton Bay Rail project was an exemplar of that model and was highly productive in terms of research output (publication of peer-reviewed scientific papers) as well as robustly achieving the primary project objectives.

Objective 17: Proactively seek engagement with the Koala research community to maximise benefit derived from KCS-driven actions.

Actions:

1. *KCS* Implementation Team to define scope of suitable research collaborations prior to active engagement with potential collaborating research entities.
2. *KCS* Implementation Team to engage with key Koala research groups at major Queensland universities to investigation options for mutually beneficial research.
3. *KCS* Implementation Team to engage with the Koala Health Hub (KHH) based at the University of Sydney to notify groups of opportunities that might exist for mutually beneficial research.
4. CC Project Management team to determine budget allocation for support of research projects aligned with or associated with *KCS* activities. Budget might be for direct support of relevant projects, or for support of ARC-Linkage grants with moneys payable only on successful award of an ARC-Linkage grant.

Objective 18: Maintain a register of supported research projects

Actions:

1. *KCS* Implementation Team to establish and maintain a register of supported research projects and outcomes.

Aim 7: Engage the local Koala conservation community

Background and justification:

There is justifiable community concern for the plight of Koalas, particularly given the impact of the 2014-2020 drought and the 2019-2020 bushfires on Koala populations. The *EPBC Act* was under statutory review at the time of writing of V1 of this *KCS,* and community stakeholder and conservation groups generally consider that the Act and its regulatory framework require strengthening. Hence, community expectations generally require a greater effort than achieving (or aiming for) the minimum/baseline legislative and regulatory requirements in respect of Koala (and other vulnerable/endangered species) protection.

Community concern for Koala impacts caused by the Coomera Connector is likely to be significant due in part to the worse status of Koalas now, as compared with several years ago. It is therefore prudent, both from a moral and risk management standpoint, to engage with the Koala conservation community in the development and implementation of the *KCS.* That approach was extremely successful on the Moreton Bay Rail project and provides a suitable model for the CC project.

Objective 19: Establish a Koala stakeholder consultative committee

Actions:

1. CC management team to establish a Koala stakeholder consultative committee (KSCC) to which representatives from the Koala conservation/care community, Gold Coast City Council, and DES would be invited to contribute. One or more representatives from TMR and the *KCS* Implementation Team would be members of the KSCC.
2. KSCC facilitated to meet regularly, with an update prepared by TMR and/or the *KCS* Implementation Team, and minutes and actions recorded by TMR.

Objective 20: Establish and facilitate regular meetings for a Koala community stakeholder group

Actions:

1. CC environmental team to establish and coordinate a Koala and environmental community stakeholder group to meet on a regular basis to communicate progress and receive feedback on the development and implementation of the *KCS.*
2. CC environmental team to keep minutes of stakeholder meetings, encourage the airing of concerns and feedback, and follow up on information requests and concerns aired.

4.5 Detail of on-ground *KCS* deliverables

Six primary on-ground programs of work are proposed that deliver data and/or facilitate the achievement of the direct Koala management aims (rather than habitat offsets and road impact mitigation):

1. The comprehensive Koala survey;
2. The Koala tagging and monitoring program – phase 1 (KTMP-1);
3. The Koala translocation program (KTP);
4. The Koala tagging and monitoring program – phase 2 (KTMP-2);
5. The Koala tagging and monitoring program – phase 3 (KTMP-3);
6. The long-term Koala monitoring and threat management program.

Each program has different but overlapping aims and objectives, and the *KTMP*s and *KTP* have similar methods. Methods for these key bodies of work are expanded upon in section *7 KCS Methodology*, with Appendix 8 (in previous versions of this KCS) containing more detailed technical specifications and methods. KCS methods will be subject to periodic review as new or innovative methods and approaches are developed.

The long-term Koala monitoring and threat management program will be developed during the design and construction phases of the CC project by the KCS Implementation Team, with reference to data from the CKS and KTMP-1 and KTMP-2. This program will commence on completion of KTMP-3 (around 2026) and will continue for 20 years.

4.5.1 Comprehensive Koala survey

Overview and justification:

The *comprehensive Koala survey* involves the systematic survey of habitat patches, or representative plots in those habitat patches, occurring within the CC project footprint as well as habitat joined to or adjacent to habitat within the project footprint. These habitat patches are designated, for the purposes of this *KCS* as *Koala management areas* (KMAs). The survey will also include habitat associated with offset sites and that are potentially suitable for receiving translocated Koalas.

The purpose of the surveys is to determine the number and distribution of Koalas within the KMAs and offset/translocation recipient sites, and thereby better inform the *KCS* and allow a more accurate costing of *KCS* activities. It will probably also be required as condition of an EPBC approval.

Aims:

The aims of the *comprehensive Koala survey* are:

1. To provide an estimate of Koala distribution and abundance in each of the CC KMAs;
2. To provide an estimate of Koala density and number in potential offset sites and potential translocation recipient sites, as well as an estimate of the available carrying capacity in potential translocation recipient sites (TKMAs);
3. To provide an initial assessment of Koala health and demographics in surveyed areas;
4. To inform changes to, and review of, the *KCS;*
5. To inform cost estimates for bodies of work recommended by the *KCS.*

Once the results of the *comprehensive Koala survey* have been compiled, the scope and indicative costing for the *KTMP*-1 will be prepared by the *KCS* Implementation Team.

Actions:

1. The CC environmental management team will engage expert consultants to perform a *comprehensive Koala survey* in the Project alignment, adjacent KMA habitat areas and potential offset/translocation sites.
2. The CC environmental management team will determine the members, scope and roles of the *KCS* Implementation Team.

The *KCS* Implementation Team will compile the results of the *comprehensive Koala survey* and update the *KCS* to reflect the new information.

4.5.2 Koala tagging and monitoring programs (*KTMP*)

Overview and justification:

The *Koala tagging and monitoring programs* (*KTMPs*) and the *Koala translocation program* (*KTP*) are the most significant bodies of work directed by the *KCS.* They are the central methodology by which data are obtained that inform the nature and response of other *KCS* actions (through an adaptive management framework) and contribute to detailed design of the CC Project. They also provide the proximate risk management and response method for individual Koalas at risk from the Project.

The *KTMPs* will be implemented in three main programs: *KTMP-1, KTMP-2 and KTMP-3*, each of which has differing aims and scope. In addition to the *KTMP*s, the *KTP* will be the program which delivers the translocation and monitoring of a subset of Koalas deemed to be at unacceptable risk if they are left *in situ*, along with a subset of the resident Koalas at the translocation recipient site(s).

Aims:

The *KTMPs* facilitate the targeted, economical and effective application of risk mitigation and compensatory measures required for successful implementation of the *KCS.* Attempting to implement appropriate protective and conservation-related actions without the benefit of *KTMPs* is unlikely to result in outcomes that are successful or measurable. In other words, the *KTMPs* are central to the success of the *KCS.*

The *KTMP*s provide the most important and robust risk management tool with respect to Project risk associated with poor Koala welfare and conservation outcomes. This is because they provide the means to intervene when Koalas are at significant risk, sick or injured, and provide data to support the *KCS* actions and adaptive management. In doing so, they provide an important protection against critical project risks associated with Koala management.

KTMP-1

KTMP 1 will be implemented to acquire data on the Koala population, ranging behaviour, habitat usage, disease status, reproductive status, causes of mortality and population dynamics prior to commencement of any major construction works for the project. Hence, the KTMP-1 data provide an indication of *baseline conditions prior to any CC impact.* The *KTMP* 1 will investigate Koala habitat within and adjacent to the gazetted alignment and also at potential translocation recipient/offset sites and will commence in late 2020/ early 2021. *KTMP*-1 may commence at the same time as the *comprehensive Koala survey* proposed in Section 4.5.1 (above) or later, depending upon Project scheduling and other factors. If not commencing with the CKS, the KTMP-1 should commence a minimum of 12-months prior to the scheduled or expected commencement of vegetation clearing.

KTMP-1 aims

1. To determine the abundance, distribution, ranging and habitat usage, disease status, reproductive status, causes of mortality and population viability prospects for Koalas in at-risk areas associated with the CC project.
2. To determine the above parameters for Koala populations in prospective recipient sites for Koala translocation, including the proposed habitat offset sites.

3. To provide data to inform detailed design, engineered mitigation, and the need for Koala translocation.
4. To refine cost estimates for implementation of *KCS* actions during vegetation clearing, construction and operational use of the CC project.
5. To provide the location of each Koala in at-risk areas at any moment in time, to ensure that Project-specific risks are effectively managed. (Less relevant for *KTMP* 1 vs *KTMP* 2).
6. To facilitate the implementation of early compensatory measures, such as disease control, wild dog monitoring and control, and revegetation at offset sites.

KTMP-2

KTMP-2 will be implemented shortly prior to the commencement of vegetation clearing and will be the proximate method by which Koalas will be protected from risks arising during vegetation clearing and construction. *KTMP-2* should be scheduled to follow on from KTMP-1 to avoid de-collaring Koalas and having to repeat search and capture. *KTMP-2* should commence at the scheduled or expected commencement of vegetation clearing if Koalas are already tagged and under monitoring for KTMP-1. However, if there is not continuity between KTMP-1 and the commencement of KTMP-2 (because of major delay to the construction commencement date) then at least 3 months should be allowed for intensive search and capture for KTMP-2 prior to the expected commencement of vegetation clearing.

KTMP-2 aims

1. To monitor Koalas that are deemed to be 'at-risk' during (or because of) construction activities. This will include Koalas living in habitat that is in the vegetation clearing footprint and adjacent areas with the designated CC KMAs;
2. To ensure the safety of *KTMP* Koalas during vegetation clearing and other construction activities;
3. To improve the efficiency of construction works by avoiding delays associated with Koala presence in operational works areas, through translocation, relocation or assisted dispersal;
4. To identify additional Koalas that will be referred to the *KTP* (for translocation);
5. To provide data to inform and refine *KTMP* actions, particularly those related to adaptive management of threats and non-habitat compensatory measures (such as chlamydial disease control).

KTMP-3

KTMP-3 will commence on practical completion of the CC (*Stage 1*) and will monitor Koalas during the operational phase of the project, including things such as Koala interactions with the Koala exclusion fencing and Koala use of connectivity/barrier crossing structures.

KTMP-3 aims

1. To monitor Koala populations left in-situ in KMAs to determine changes in dynamics (mortality and reproduction, ranging behaviour), disease and population viability after the CC impact is established;
2. To monitor Koala interactions with the CC road, particularly access to the road corridor, interactions with the exclusion fencing and use of barrier crossing devices (culverts and bridges);
3. To provide datasets to incorporate into population viability analysis (PVA).

KTP

The *Koala translocation program (KTP)* will be implemented at a time between the commencement of *KTMP–1* and the commencement of vegetation clearing, such that Koalas are removed from areas of habitat that will be completely removed or have no prospect of supporting a viable Koala population. Hence, KTP will overlap with KTMP-1 and will run concurrently with KTMP-2 and possibly overlap with KTMP-3.

KTP aims

1. To evaluate potential translocation recipient sites for Koalas considered sufficiently at risk from CC-related construction or operational-phase impacts to warrant translocation to suitable and secure alternative habitat;
2. To identify Koalas that are deemed to be suitable candidates for translocation;
3. To monitor the resident Koala population(s) in the translocation recipient site(s) for a minimum of 6 months prior to the commencement of any translocation, for the purposes of determining health, ranging behaviour and recipient site risk profiles;
4. To inform risk mitigation measures to reduce risk to translocated Koalas in the recipient site(s) (particularly disease and wild dog predation);
5. To monitor Koalas subjected to translocation for a minimum period of 12 months following translocation to determine health and reproductive success and the establishment of stable home ranging behaviour (as age-applicable);

Section 7 *KCS Methodology* provides and outline of the methodological approach to the *KTMP*s and *KTP*; and section *11 Management of Koala displacement* provides more detail on the justification and implementation of the Koala translocation program (*KTP*).

Actions:

1. The *KCS* Implementation Team will compile and update on a regular basis, a scope, schedule and indicative costing for each of the *KTMP*s and *KTP* as data become available.
2. The *KCS* Implementation Team will prepare a scope and tender documents as required for each of the *KTMP*s and *KTP*.

The CC Management Team will make the necessary arrangements for budget allocation and approval for *KCS* actions to ensure that those actions occur/are implemented in timeframes optimal for meeting key Project objectives.

4.5.3 Long-term Koala monitoring and threat management program

Overview and justification:

There is an increasing expectation that Koala management programs associated with major developments deliver durable benefits and longer-term threat management outcomes. This requires a commitment to long-term monitoring, an adaptive management approach, and a robust framework for remediation of outcomes that are not desirable or fail to meet key objectives.

Aims:

The aims of the long-term Koala monitoring and threat management program are:

1. To regularly monitor trends in the Koala populations managed during the development of the CC project;
2. To detect declines in the population, or sub-populations and investigate the causes of those declines;
3. To adaptively manage declines in, or threats to, the Koala population in so far as the declines are caused, or contributed to, by the construction and operation of the CC project;
4. To evaluate the effectiveness of the remedial actions at addressing the decline(s) and deliver on-going adaptive threat management as appropriate;
5. To make arrangements for the hand-over and legacy management of the Koala populations to an appropriate government authority or agency at the completion of the program.

Methods:

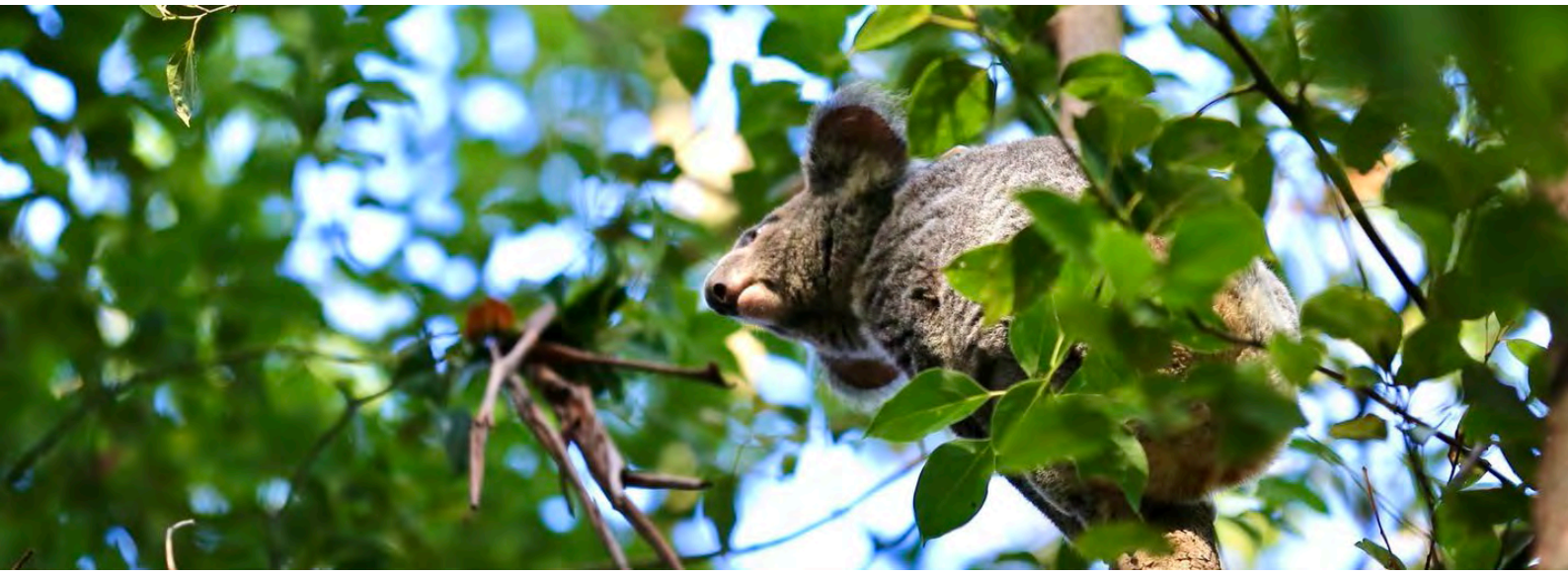
The survey methods and reporting will be similar to those described above for the comprehensive survey.

Additional datasets relevant to Koala incidents and casualties associated with the CC road and associated State and local roads will be sought from Gold Coast City Council, Wildcare, CWH, RSPCA Qld, CCG and AZWH.

A detailed approach to the long-term Koala monitoring and threat management program will be developed by the KCS Implementation Team after data from the CKS and KTMP-1 are available.

Actions:

1. The KCS Implementation Team will develop a plan for the long-term Koala monitoring and threat management program as soon as possible (prior to the development of KCS V2 during the design phase), based on the aims detailed above;
2. The KCS Implementation Team will liaise with the Gold Coast City Council, DES and other relevant stakeholders to provide input into the long-term Koala monitoring and threat management program, particularly with regard to end-of-program legacy arrangements;
3. The KCS Implementation Team will arrange for the inclusion of the detailed methods for the program in the next version of the KCS (V2).



5 Project scheduling

The CC Project is likely to be delivered in several stages: *Stage 1* will be the Nerang-Broadbeach Rd to Coomera section, and *Future Stages* the remainder, terminating at Loganholme. Associated with each stage will be the following phases: *planning*; *design*; *construction*; and *operation*. There will possibly be overlap of some phases between the two Stages. At the time of writing (KCS V 1), the CC Project was in the *planning* phase.

Appropriate scheduling of the main activities directed by this KCS with reference to the construction schedule is essential to ensuring that optimal outcomes are achieved. The key reference date with regard to KCS scheduling is the date of *commencement of vegetation clearing*. Working back from that date, the first Koala tagging, and monitoring program (KTMP-1) should commence a minimum of 12 months prior. This allows for the collection of robust datasets on baseline conditions for Koalas, including a full breeding/dispersal season, prior to any impact from the CC project. The *comprehensive Koala survey* (CKS) should be completed prior to commencement of KTMP-1, hence a minimum of 18 months prior to the scheduled commencement of vegetation clearing. Acquisition and evaluation of offset sites along with early replanting should occur in parallel with the commencement of the other KCS-directed activities if an *advanced offset* is proposed to meet *EPBC Act* requirements. During this phase, the KCS implementation team should consider engaging with research groups to explore opportunities for beneficial research collaborations.

Input into design, such as the location and specifications of fauna connectivity structures and exclusion fencing, must necessarily occur during the planning and business case phases, and may not have the benefit of data derived from later bodies of work such as the CKS and KTMP-1. However, minor refinements to those mitigation measures will be possible during the later design phase with reference to CKS and early KTMP-1 datasets.

KTMP-2, the program that seeks to manage risk during the construction phase, must be scheduled to commence just prior to the scheduled commencement of vegetation clearing. There is no break between the completion of KTMP-1 and commencement of KTMP-2. Similarly, the Koala translocation program (KTP) will commence in the month immediately prior to the scheduled commencement of vegetation clearing.

KTMP-3, the program that monitors Koala interaction with and use of fencing, underpasses and local habitat during the operational use phase, commences on practical completion of the construction phase and continues for 12 months. Periodic or ongoing monitoring of habitat offset sites may be required by *EPBC Act*

approval conditions. Subsequent revisions of the KCS will include details on actions required beyond the completion of the KTMP-3 and KTP programs.

The following schematic shows an indicative timeline for the CC Project (*Stage 1*) delivery alongside key Koala management actions. *Future Stages* delivery actions will be similar but offset from the indicated timeframe.

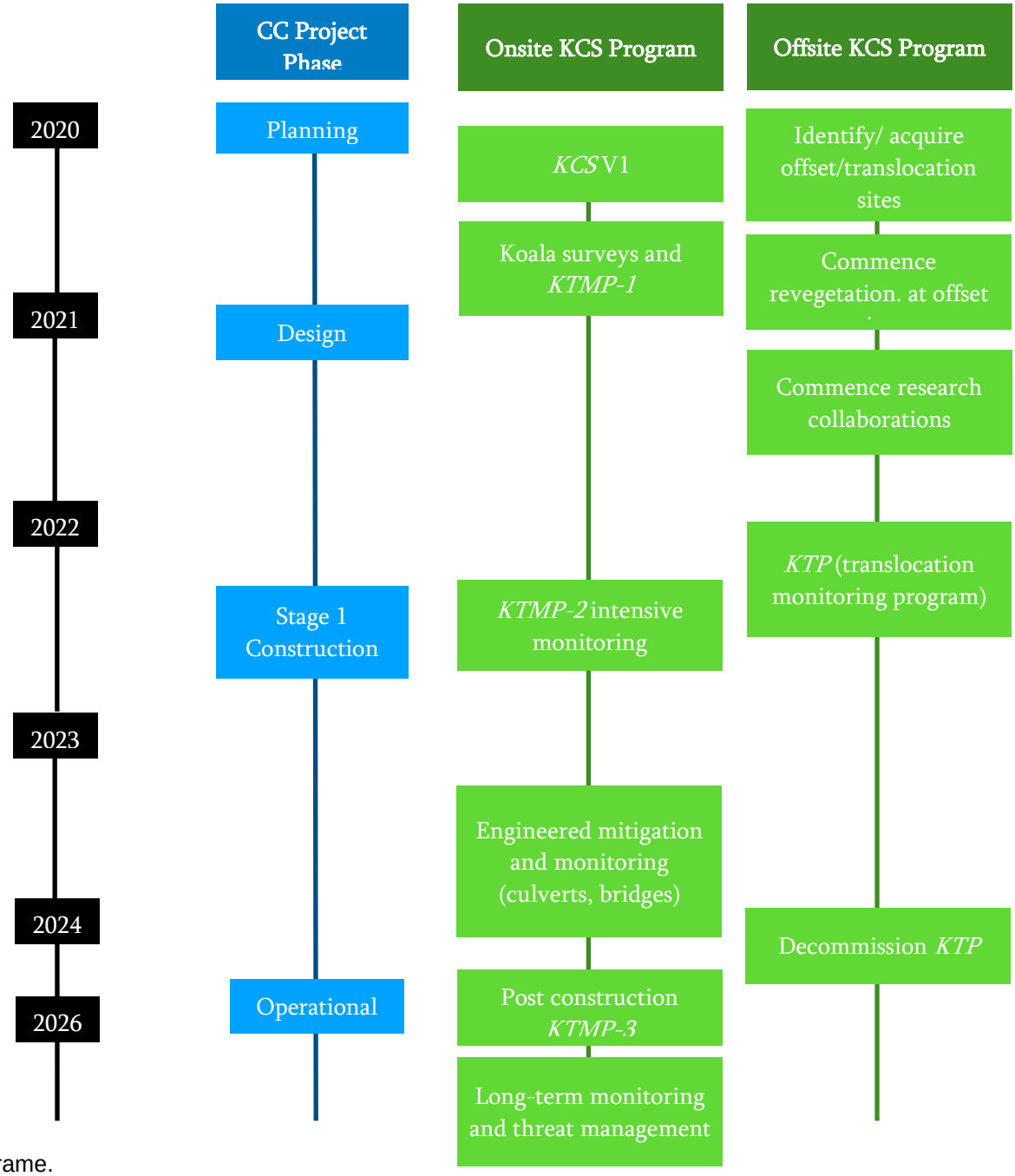


Figure 5.1: Schematic showing relative scheduling of main KCS-directed works

6 *KCS* management and implementation

KCS development, revisions and implementation will remain within the purview of the TMR (TMR). KCS-directed activities span *planning*, *design, construction* and *post-construction phases*, and also after practical completion of construction. Hence, inclusion of KCS-implementation in the construction contract(s) is not practical.

The interaction between the TMR and the contractors delivering components of KCS implementation will be managed by the KCS implementation team, which will sit within the TMR's CC Environmental Management team.

The KCS implementation team will have responsibility for oversight and delivery of the Koala management program and activities directed by the KCS, such as:

1. Interaction and liaison with key stakeholders, such as Gold Coast City Council and DES;
2. Interaction with community stakeholders and conservation groups (in collaboration with the CC communications team);
3. Identification and evaluation of habitat offset and translocation recipient sites;
4. Ensuring regulatory compliance of KCS-relevant activities and acquisition of necessary regulatory approvals;
5. Assessment and procurement of suitable service providers for KCS implementation;
6. Managing interaction of KCS activities and contractors with the construction contractor(s);
7. Producing the induction and training curriculum relating to the KCS intent and obligations for the construction contractor(s) and subcontractors;
8. Overseeing compliance of the construction contractor(s) and subcontractors with relevant KCS obligations;
9. Oversight of major KCS-directed activities including the CKS, KTMPs and KTP.

The graphic below shows the management and implementation structure for major *KCS* components.

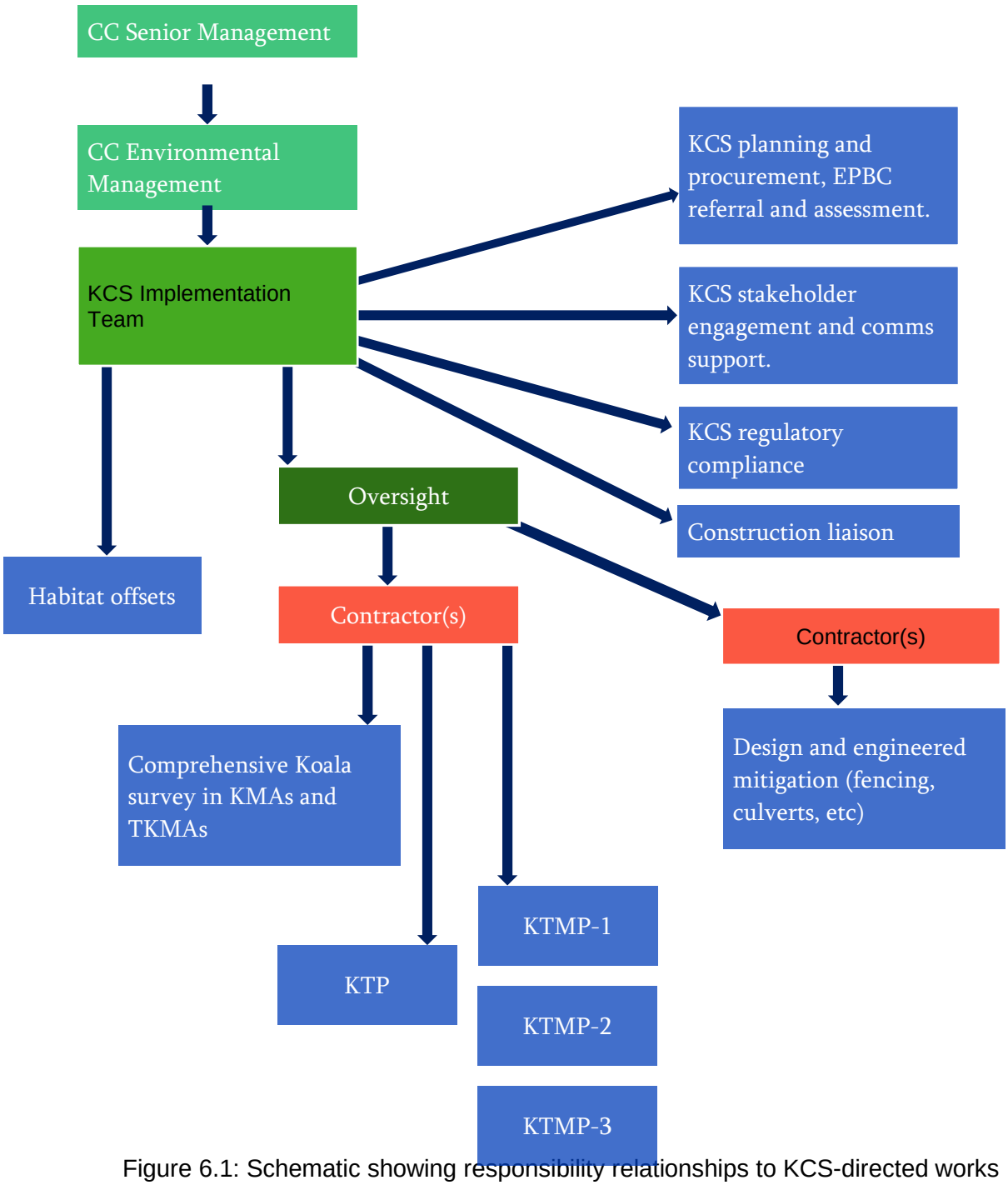


Figure 6.1: Schematic showing responsibility relationships to KCS-directed works

6.1 Responsibilities

6.1.1 Coomera Connector Project Environmental Manager

The CC Project Environmental Manager is responsible for the high-level management and oversight of the *KCS* Implementation Team.

6.1.2 *KCS* Implementation Team

The *KCS* Implementation Team (*KCS*-IT) will have responsibility for the planning and implementation of the *KCS,* including the preparation of tender documents for engagement of suitable consultants for various bodies of *KCS* work as required. The *KCS*-IT will also ensure that all Project contractors are aware of the requirements of the *KCS* as they relate to protection of Koalas on-site and particularly during construction works and hence develop the site induction training package as it relates to Koalas and the *KCS.*

The *KCS*-IT will liaise with key stakeholders relevant to the two *KCS,* including the Gold Coast City Council, DES and community stakeholder groups, such as Wildcare and the Coomera Conservation Group.

The *KCS*-IT will liaise with and provide advice and material to the CC Communications Team to assist in preparation of proactive communications regarding *KCS* development and implementation activities.

The *KCS*-IT will be responsible for ensuring that all conditions of *EPBC Act* and other approvals are complied with and that regulatory reporting occurs on time (including that which is the direct responsibility of the Koala management consultants), including adverse event reporting. The *KCS*-IT will also be responsible for the preparation of monthly reports on *KCS* activities, commencing with the engagement of consultants for the *comprehensive Koala survey.*

6.1.3 Koala management consultants

Expert consultants will be engaged to perform key *KCS* activities including the *comprehensive Koala survey*, the *KTMPs* and *KTP*. The consultant(s) will be responsible for acquiring the necessary regulatory approvals for operational work under the *KCS,* detailed development of methods, implementation as per scope and specifications documents developed by the *KCS* Implementation Team and reporting as required under the applicable contracts.

6.2 Staging of *KCS* implementation

6.2.1 Planning phase

Several important bodies of work are required to facilitate the refinement of this *KCS* and ensure that key actions are undertaken at the appropriate times to ensure the best outcomes. For example, the early identification and acquisition of habitat offset sites allows the early commencement of planting, and consequently the early delivery (possibly as *advanced offsets*) of new habitat of some value to Koalas that might require translocation during or prior to vegetation clearing works.

Early investigations of the Koala population will provide data to refine the *KCS,* inform costings, contribute to stakeholder discussions, contribute to the *EPBC* referral and assessment process, and allow for early planning of significant bodies of operational work. The following actions will occur during the *planning* phase of the CC Project (2020 - mid-2021).

6.2.1.1 Comprehensive Koala survey

1. A detailed Koala survey will be conducted to estimate the number of Koalas likely to be impacted during construction works for *Stage 1*. The survey sites are shown as draft *Koala management areas* (*KMAs*) in Appendix 8 and include patches falling within the Project footprint as well as those adjacent to the footprint. These surveys will occur in mid-late 2020, and will provide:
    - An estimate of number of Koalas likely to be directly impacted by vegetation clearing;
    - An estimate of number of Koalas likely to be indirectly impacted by vegetation clearing (i.e. living in patches of habitat that are contiguous or connected with habitat in the vegetation clearing footprint <1 km from the centreline);
    - An estimate of number of Koalas that might need to be translocated;
    - Koala density in potential Koala recipient sites for translocation (see section 11), and an estimate of additional carrying capacity, based on a target of not exceeding a density of 1 Koala/ha.
2. An initial assessment of the health of the Koala populations associated with the Project area as well as at potential translocation recipient sites. This will inform disease management measures implemented during the *KTMP*s and *KTP*.

6.2.1.2 Offset and translocation sites identification and early works

In parallel with the items listed in 6.2.1.1 (above) the following will occur with respect to habitat offset and translocation site acquisition:

1. Suitable sites for translocation of Koalas and habitat offset sites, and determination of the area of revegetation required to offset habitat loss and provide 'new' habitat to support translocated Koalas (see section 9 below), identified and acquired.
2. The process for selection will be based on several factors, but successful sites will have the attributes of actual or potential connectivity with existing, strategically important Koala habitat, currently support or have the potential to support a viable population of Koalas, and be suitable for revegetation/restoration of high-quality, diverse, Koala habitat.
3. Commencement of high-value habitat restoration in selected offset sites. High-quality Koala habitat is defined as that having both structural and floristic diversity, offering a range of food and shelter trees, including those suitable for heatwave refugia, as well as 'clumps' planted for that purpose. These might include food trees planted closely with mid-storey and shrub species, such as *Alphitonia excelsa, Glochidion spp.* and so on.
4. Prior to final selection and acquisition (when relevant) of habitat offset sites or those to be used for translocated Koalas, a survey will be performed to determine:

- The number, distribution and density of Koalas (resident) using the site;
- An estimate of the carrying capacity of the habitat patch, and therefore, by inference, its capacity to receive translocated Koalas.

6.2.1.3 Commencement of the *KTMP-1*

The first Koala tagging and monitoring program (*KTMP*-1) should be commenced either late in the *planning phase*, or early in the *design phase* of the CC project. The *KTMP*-1 provides data to inform design and engineered mitigation, inform the Koala translocation program, and determine key impacts to local Koala population viability that require management.

For the sake of economy of cost and resources, the KTMP 1 will be continuous with the Koala translocation program (KTP) (design and early construction phase) and KTMP 2 (construction phase).

It is important to note that the primary purpose of the *KTMP* 1 is to inform design and various aspects of Koala management and mitigation, whereas the primary purpose of *KTMP* 2 is to mitigate and manage risk to Koala associated with vegetation clearing and other construction works. (Figure 5.1 (above) shows the relationship of each program to the Project timeframes.)

6.2.1.4 Review and update of the *KCS* - development of *KCS* Version 2

Review and refinement of this *KCS* will occur with reference to data collected during the actions in 6.2.1.1 and 6.2.1.2 (above).

6.2.2 Detailed design and pre-construction phase

The following key actions will be implemented during the design/pre-construction phase:

1. Commence (or continue) the *KTMP*-1. This program will:
2. Provide data to inform, refine and minimise the vegetation clearing footprint;
3. Review and refine (if necessary) the locations and design specifications for bridges and culverts to facilitate permeability of the CC for Koalas with reference to KTMP-1 data;
4. Review locations, extent and design specifications for Koala fencing and egress devices;
5. Determine the need for translocation of Koalas and identify those for which translocation is necessary.
6. Monitor the dynamics of resident Koalas in and around the translocation recipient sites;
7. Commence or continue revegetation and management of offset/translocation sites;
8. Develop detailed specifications relating to Koala protection during vegetation clearing and construction works for inclusion in the construction contract;
9. Commence *KTP* - early translocation and monitoring of Koalas from habitat remnants that will be completely cleared during vegetation removal.

6.2.3 Construction phase

The construction phase of the project presents the most intense short-term risk for Koalas due to:

1. Risk of injury of death associated directly with vegetation clearing.
2. Risk of injury, death and starvation/dehydration due to displacement from habitat during vegetation clearing and construction works.
3. Therefore, key actions implemented during the construction phase are:

4. Implementation and enforcement of ***vegetation clearing controls and mitigation*** to protect Koalas. This will include monitoring of some *KTMP 2* Koalas *in-situ* for Koalas deemed not to warrant translocation.
5. Commencement of the ***KTMP-2***, the primary purpose of which is to protect Koalas at direct and indirect risk from vegetation clearing and construction activities.
6. Commence installation of ***temporary and permanent fencing*** where required to protect Koalas from the construction site, haul roads/routes and other construction-related risk areas.
7. Monitor and adaptively ***manage emergent risks to Koalas*** during and towards the end of the construction phase (e.g. repair/remediate sections of fencing through which a Koala(s) has entered the road corridor, install rapid egress (one-way Koala valves) devices to enable Koalas to rapidly exit the road corridor).

In addition, the construction phase of the project is the time when the barrier effect of the Project commences. Without appropriate mitigation, the barrier effect ecologically isolates Koalas in patches of habitat that have no prospect of supporting a viable population, nor, in some cases even supporting individual Koalas. Hence, during the construction phase the following mitigation and monitoring measures will be implemented:

1. Installation/establishment of ***barrier crossing devices*** or engineered solutions that permit effective ecological connection between important remnant habitat patches that have been transected by the road project.
2. ***Monitoring of the effectiveness*** of such devices by Koalas (and other wildlife) through a program of camera monitoring and use of other innovative technologies to monitor Koala movement through or across barrier crossing structures.
3. Monitoring and adaptive management of Koalas that have been translocated to offset or translocation sites using appropriate telemetric and other methods. This is the commencement or continuation of the ***KTP* (*Koala translocation program*)**.

6.2.3.1 Implementation of vegetation clearing risk controls

The specifications for vegetation clearing methods, machinery and wildlife risk controls would form part of the contract between TMR (the TMR) and the construction contractor(s). These must be clear, comprehensive and specific, and allow no discretionary changes, by either the construction contractor or sub-contracting entities, that might result in an increased risk to wildlife.

Management of risk to Koalas (and other wildlife) is achieved through three primary factors:

1. The clear statement and enforcement of a culture of shared responsibility for wildlife/Koala protection within the broad project team - TMR, Contract Administrator, Construction Contractor(s), *KCS* Implementation Team, and sub-contractors. This should be set as a key performance indicator (KPI) and must be associated with a clear understanding among all parties of a 'zero-tolerance' enforcement policy.
2. The implementation and enforcement of comprehensive, clear and specific *standard operating procedures* for vegetation clearing with respect to wildlife protection and salvage.
3. The engagement of a sufficient number of experienced wildlife spotter/catchers to manage wildlife protection and salvage at the clearing front and conduct of pre-clearing wildlife load reduction and other duties as specified in the (draft) Qld *Code of Practice* (See Hanger and Nottidge, 2019). The best outcomes are achieved when TMR retains control of all wildlife management activities (including engagement of wildlife spotter/catchers), to avoid conflicts of interest.

In addition, with respect to Koalas only, the key risk management method is the telemetric tagging of all Koalas in the at-risk areas, under the *KTMP 2*. This means that on any day of vegetation clearing, every Koala within a proposed daily clearing footprint and buffer zone will be locatable, so that their trees and an exclusion zone and habitat link can be flagged.

A procedure for management of the logistics and interaction between the *KCS* Implementation Team and the construction contractor(s) will be developed by the KCS Implementation Team prior to the award of the construction contract(s).

6.2.3.2 Koala tagging and monitoring program - phase 2 (*KTMP-2*)

The *Koala Tagging and Monitoring Program - Phase 2* (*KTMP-2*) is the most important mechanism for protecting Koalas from harm during vegetation clearing and construction of the CC project. It achieves this important objective by ensuring that all Koalas in the defined 'at-risk' habitat patches are captured and radio-tagged prior to the commencement of high-risk activities.

With respect to Koalas that are determined to be living in habitat patches that will not be retained or for which effective ecological connectivity cannot be maintained at completion of the Project, they will be translocated to safe and suitable habitat prior to the commencement of high-risk activities in their area. In most cases this will be conducted in the lead-up to the commencement of vegetation clearing, or possibly earlier. The program of works dealing specifically with the translocation and monitoring of Koalas is the *KTP*.

For the remainder of the Koalas, that is, Koalas living in habitat patches that will be largely retained, the *KTMP-2* provides the proximate mechanism for locating and identifying them during vegetation clearing and monitoring their movements during construction activities. The *KTMP-2* also provides the means for monitoring the use of barrier crossing structures (culverts, bridges) by Koalas where the road transects habitat patches. As the road Project transitions from construction to operational use, the *KTMP-2* will transition to *KTMP-3* (*Koala tagging and monitoring program-phase 3* - post-construction monitoring).

6.2.4 Post-construction and operational phase

The operational phase of the Project is when failures in the effectiveness of Koala exclusion fencing will become apparent as road mortality and injury, and when longer-term trends in Koala population health and viability are monitored.

Key points/activities relevant during the post-construction and operational phase of the Project are:

1. Commissioning of the CC road will mark the commencement of *KTMP-3*;
2. Ongoing monitoring of Koalas under *KTP*;
3. Monitoring of Koala use of offset sites;
4. Monitoring of Koala use of barrier crossing structures;
5. Monitoring of the effectiveness of the Koala exclusion fencing;
6. Conduct of population viability analysis based on *KTMP* and *KTP* data;
7. Production of the final technical report for the *KCS;*
8. Winding up of the KSCC and the Koala community stakeholder group;
9. Commencing the long-term Koala monitoring and threat management phase (out to 20 years post-commissioning).

6.3 Indicative Gantt Chart

Key milestone/KCS element	Now	Aug-Sept 2020	Oct-Nov 2020	Dec-Jan 2021	Feb-Mar 2021	Mar-June 2021	Mid 2021	Late 2021	Early 2022	Mid 2022	Late 2022	2023	2024	2025	2026	2027	2028	2046
CKS																		
Translocation/offset site options list																		
Finalise translocation site(s)																		
Revegetate offset/translocation sites																		
KTMP-1																		
Finalise fauna fencing and other mitigation																		
KTP																		
KTMP-2																		
Vegetation clearing																		
Construction																		
Install barrier crossing monitoring devices																		
KTMP-3																		
CC operational																		
5-year post-impact population assessment																		
Commencement of long-term monitoring and threat management																		

6.4 *KCS* methodology

This section gives an overview of the approach to some of the components of work directed by the *KCS.* Further detail on the methodological approach, permits and scheduling is included was included in Appendix 8 in previous versions of this KCS and will be included only as required in subsequent versions of this KCS. Methodological approaches to some components of work will be provided by entities contracted to perform that work, based on the scope and specifications developed by the *KCS* Implementation Team in accordance with the methods set out below.

This section describes the methodological approach for:

1. The comprehensive Koala survey;
2. The *KTMP*s (KTMP-1, KTMP-2 and KTMP-3);
3. The Koala translocation program (KTP);
4. The installation of engineered/constructed mitigation;
5. The long-term monitoring of the local Koala population and management of threats.

Methods and machinery to minimise risk of harm to Koalas during vegetation clearing are described in section *8 Minimising vegetation clearing risk to Koalas*. The approach for the delivery of *habitat offsets* is covered in section *9 Habitat offsets* and for non-habitat *direct* and *indirect offsets* in section *10 Non-habitat offsets*. The justification and approach to the translocation of Koalas is covered in more detail in section *11 Management of Koala displacement*, because this is a component of Koala management that is generally poorly understood and often controversial.

6.5 Comprehensive Koala survey

The *comprehensive Koala survey* is the first major operational deliverable in respect of this *KCS.* It provides the means to estimate the number of Koalas likely to require management directed by the *KCS* as the CC project progresses. It will also facilitate the development of indicative costings for various operational components of the *KCS.*

The *comprehensive Koala survey* includes habitat in and adjacent to, or near, the CC gazetted alignment as well as potential Koala translocation recipient sites, and habitat in or near potential offset sites.

6.5.1 Delineation of initial *Koala management areas* (KMAs)

The draft *Koala management areas* (KMAs) for *Stage 1* of the CC project are contained in Appendix 8. The KMAs boundaries are based on manageable blocks defined by natural or artificial boundaries such as road

and waterways. Those that span the alignment include adjacent habitat that is known, or likely, to support Koalas that might be impacted by the CC project, within reasonable limits. The *KCS* acknowledges that Koalas can move long distances, such that even a Koala currently living many kilometres from the alignment might be at risk if that Koala moves closer to it. However, the KMAs attempt to strike a reasonable balance between including all habitat, say, within 5 km of the centreline (which would be prohibitively expensive and unreasonable) versus only including habitat that falls within the Project footprint (which would be entirely inadequate).

As much as possible, the KMAs are delineated in a way that is consistent with the intent and specifications of the *EPBC Act* and its various policies and policy statements (outlined in section 1.6.1). Consequently, it includes habitat (and Koalas) that are likely to be directly and indirectly impacted by the construction and operation of the CC project.

The table below summarises the KMAs and translocation KMAs (TKMAs) for the proposed CC *Stage 1*. The KMAs in the table progress from south to north and are, in total, around 1144 ha.

CC-KMA1	Boulton Rd	86.9	CC Alignment
CC-KMA2	Nerang River	17.3	CC Alignment
CC-KMA3	Old Coach Rd	25.0	CC Alignment
CC-KMA4	Old Quarry	56.2	CC Alignment
CC-KMA5	Smith St	75.9	CC Alignment
CC-KMA6	M1 Gaven	16.9	CC Alignment
CC-KMA7	Napper Rd	158	CC Alignment
CC-KMA8	Coombabah Lake	110	CC Alignment
CC-KMA9	Helensvale Rd	133	CC Alignment
CC-KMA10	Beattie Rd	95.6	CC Alignment
CC-KMA11	Foxwell Rd	273	CC Alignment
CC-KMA12	Amity Rd	96	CC Alignment
CC-TKMA1	TBA	TBA	Offset/translocation site
CC-TKMA2	TBA	TBA	Offset/translocation site
CC-TKMA3	TBA	TBA	Offset/translocation site

6.5.2 Koala survey method

6.5.2.1 Survey design and analysis

Several survey methods can be used to determine Koala distribution and abundance. Whatever method is used it must be repeatable, robust and scientifically valid. Critical components of the methods are:

1. It must survey a *representative sample* of the habitat; that is, the survey plots or transects must be sufficiently representative of the habitat occurring in the surveyed patch as a whole;
2. Sample or survey plot or transect sizes must collectively be sufficient to robustly estimate the population number in that surveyed patch;
3. The survey must estimate *detection probability* or otherwise account for a detection probability that is less than 1 (less than 100%). Detection probability in some SEQ Koala habitat has been measured at as low as 0.17 in dense, swampy habitat, and up to around 0.75 in open forest (TMR, 2017).

Surveys may be completely randomised or stratified to account for variation throughout the patch; but whatever method is used, the surveyed sample must be representative of the habitat patch as a whole. Stratification may be helpful if a randomised design is likely to miss habitat that might, because of certain characteristics, support a much higher, or lower density of Koalas leading to an inaccurate estimate of density across the patch.

The formulae to be used in calculating Koala abundance and density in each KMA or TKMA is as follows:

$\boldsymbol{d_{[m]} = k/a}$ where $d_{[m]}$ is the measured (observed) density of Koalas in *Koalas/ha*
k is the number of Koalas found in the survey plot(s) or transect(s)
and *a* is the total area in hectares surveyed

To account for a detection probability of <1, the estimated density $\boldsymbol{d_{[e]}}$ is calculated as follows:

$\boldsymbol{d_{[e]} = d_{[m]}/p}$ where *p* is the estimated detection probability for that survey.

p will be determined for each habitat patch by averaging the estimates of *p* given by each survey participant at the end of each respective transect or patch search. This will be a figure between 0 and 1, based on the following guides: open-semi-closed forest (sparse mid-storey) – 0.75; semi-open to closed forest with medium density mid-storey – 0.5; closed forest with dense mid-storey – 0.15.

The estimated abundance (number) of Koalas (total Koalas estimated to be living in that patch) is calculated thus:

$N_{[e]} = d_{[e]} \times A$ where $N_{[e]}$ is the estimated total number of Koalas

and A is the total area of Koala habitat in the surveyed patch or KMA/TKMA.

Hence, the final report for the *comprehensive Koala survey* should provide estimates of Koala density in Koalas/ha, Koala number inhabiting that patch, and total area of Koala habitat in that patch, for each of the KMA/TKMAs. The population estimates for KMAs will be used to determine the number of Koalas potentially impacted by the CC project, and for the TKMAs, figures will be used to estimate the additional carrying capacity with respect to potential Koala translocations.

6.5.2.2 Field methods

Irrespective of the survey method used, the Koala survey team will record, as a minimum, the following data during or immediately after the completion of the survey plot or transect:

1. Start time and date.
2. Number of surveyors.
3. Weather conditions (ambient T°, cloud, wind, rain).
4. Start GPS coordinates (centre-point and radius for spot survey).
5. Start and finish GPS coordinates (two points, or point plus transect width, for transect surveys).
6. End time.
7. Estimated detection probability ($0<p_{[e]}<1$).

If a Koala(s) is found the following records will be recorded at the time of detection:

1. Time and date of Koala detection.
2. GPS location of Koala.
3. Apparent health status of Koala.
4. Sex of Koala (M, F, or not determined).
5. Whether a joey is present (no joey observed, pouch young, back young, near independent (off mother).
6. Tree species and diameter at breast height (DBH).
7. Tree height and Koala height in tree (m).

Irrespective of the survey method used, each surveyor will carry a GPS device set to record tracks and record each GPS track while conducting a search. GPS tracks will be used to validate and measure the area of survey sites/transects.
Comprehensive Koala survey report

The Koala survey consultant will produce a report at the completion of the field survey period (within one month of completion of the final field site survey). The report will include data on Koala density and estimated number within each KMA and TKMA, detailed description of field and analytical methods, and detailed and summary data on the demographics and apparent health/disease prevalence in detected Koalas.

6.6 Koala tagging and monitoring program

The methods outlined here are the general approach to various aspects of the *Koala tagging and monitoring programs* (*KTMPs*) and also the *Koala translocation program* (*KTP*). Additional methods that are specific for the *KTP* are outlined in section *7 Koala translocation*, below. Detailed methods relating to some aspects of the *KTMPs* and *KTP* are contained in the appendices, as indicated in the text.

All procedures involving the survey, capture, veterinary management, tagging and monitoring may only occur with AEC approval and a scientific purposes permit from DES authorising specifically all the components of the management program.

6.6.1 General methods overview

The following are the key operational components of a Koala tagging and monitoring program:

1. ***Search and capture*** of all Koalas within the Koala search area or KMA.
2. Standardised and comprehensive ***veterinary assessment*** of each Koala.
3. Application of identification and ***telemetry devices*** for Koalas deemed healthy and suitable for release and monitoring.
4. Admission or referral of ***sick or injured*** Koalas for treatment to an appropriate Koala treatment facility.
5. ***Euthanasia*** of critically ill Koala/s on humane grounds.
6. ***Monitoring*** of tagged Koalas after release back into suitable habitat.
7. ***Six-monthly recapture*** of Koalas for scheduled health assessment.
8. Rapid detection of Koala mortality and ***necropsy (post mortem) examination***.
9. ***Intervention***, as appropriate, when Koalas are found to be in high-risk situations or on detection of injury or illness.

This approach delivers on several of the key objectives of the *KCS*:

1. Data inform aspects of *KCS*-directed activities and the adaptive management process.
2. Protection of Koalas from harm caused by direct and indirect CC impacts.
3. Delivery of *non-habitat direct offsets* and indirect offsets as *other compensatory measures* (such as chlamydial disease control and support of relevant research projects (re *EBPC Act*).
4. Delivery of Koala welfare benefits through treatment of disease and injury and intervention when Koalas are in high-risk situations.
5. Monitoring of Koala responses to mitigation measures (such as fencing and underpasses).
6. Facilitates engagement with Koala community and other stakeholders.

6.6.2 Koala search and capture

The objective of the Koala search and capture effort is to capture essentially *all* Koalas inhabiting or using the *Koala search area* or KMA. This is so that all Koalas in areas that are at risk from CC activities are appropriately protected.

This is achieved in two distinct phases:

1. The initial *intensive search and capture* effort. This is a period of generally several weeks in which search and capture teams focus on capturing as many Koalas in the KMA as possible. It will usually result in around a 70% capture rate.
2. *Opportunistic captures*. These are captures that occur *after* the initial intensive search and capture effort and are triggered when field workers observe untagged Koalas in the KMAs. Over a period of around 6 months of usual fieldwork, opportunistic captures take the capture rate of Koalas in any given KMA up over the 90% mark.

Note, that in the TKMAs (potential Koala translocation sites), it may not be necessary to capture *all* Koalas because the objective does not include protection of resident Koalas from direct CC project risk. Rather, the primary objective is to determine the ranging behaviour, potential additional carrying capacity, and risk profile at the potential translocation recipient site.

6.6.2.1 Delineation of Koala search areas

The Koala search areas will generally be those defined as KMAs associated with the CC alignment, drafts of which are contained in Appendix 8. These may be subject to some revision/modification after completion of the *comprehensive Koala survey*.

Currently, for *Stage 1* of the CC project, 12 KMAs have been defined. At the time of writing of Version 1 of this *KCS,* two draft TKMAs (potential translocation recipient sites) had been delineated. Current draft KMAs for the *Stage 1* CC delineate a total area of around 1144 ha.

6.6.2.2 Intensive search and capture and opportunistic capture

Search and capture of Koalas in each KMA are performed by the systematic, transect-based search of habitat patches, with a capture attempt performed at the time of detection of each Koala. Approximately, one day of intensive search and capture effort per 10 ha of KMA, for a search and capture team of 6, should be allowed for. A capture attempt is only performed after an appropriate risk assessment and determination by the Koala capture team leader that the capture attempt will proceed.

Briefly, Koala captures are accomplished by three principal methods:

1. Tree climb and flagging conventional capture
2. Flagging conventional capture without tree climb
3. Trap capture

A Koala may also be included in a *KTMP* when rehabilitated by a rescue organisation which proposes to release that Koala back into habitat occurring within a CC KMA.

After the initial search and capture effort at each KMA or TKMA, opportunistic capture of Koalas may occur as Koalas are detected during routine fieldwork.

6.6.3 Veterinary assessment and management

The purpose of the veterinary assessment is to ensure that the individual animal welfare of each Koala is prioritised and to acquire baseline and trend data regarding key population metrics, such as reproductive rate, disease prevalence and incidence, and causes of death.

6.6.3.1 Veterinary examination

Following capture, each Koala will be transported to a veterinary facility for comprehensive veterinary examination. This permits a baseline determination of the health of each Koala, allows detection of disease or injury that might warrant treatment, or in extreme cases, euthanasia, and facilitates the attachment of identification and telemetry devices in suitable Koalas.

The veterinary examination process is conducted under deep sedation and in accordance with a standardised and comprehensive Koala veterinary assessment protocol. The protocol is designed to detect all conditions that are likely to be found in Koalas and includes ultrasonographic and cytological techniques for which specific expertise is required.

Biological samples are collected during the examination for diagnostic purposes. However, approved collaborating research projects may benefit from the collection of specific samples, or aliquots of those collected for diagnostic purposes.

The application of identification and telemetry tags varies based on Koala size and age. Koalas will receive their first veterinary assessment and tagging at between 9 and 12 months of age.

Scheduled recapture and health assessment of all *KTMP* Koalas will occur at 6-monthly intervals or at shorter intervals if required to monitor treatment outcomes or at the discretion of the consulting veterinarian.

6.6.3.2 Application of identification and telemetry devices

The purpose of tagging Koalas is two-fold:

1. To facilitate identification of Koalas using a unique ID tag(s).
2. To facilitate telemetric monitoring of *KTMP* Koalas.

Each Koala deemed to be suitable for inclusion in a *KTMP* or the *KTP* will be tagged with a combination of the following ID and telemetry devices.

1. A microchip with a unique ID (a permanent implant ID requiring a special scanner).
2. A plastic ear-tag to permit identification without a special scanning device (e.g., by public).
3. A primary telemetric tracking device – generally a collar.
4. A secondary/redundancy telemetry device – generally a VHF anklet or ear-tag beacon.

Small/juvenile Koalas may be tagged with a microchip and single telemetry device until large enough to be ear-tagged and bear a larger bio-telemetry device.

Tags must be checked regularly and adjusted for fit, particularly in growing animals. Severe injuries and death can occur if tags are not fitted appropriately and checked regularly.

Telemetry devices that permit remote monitoring (via the internet, for example) of large numbers of Koalas may be required for the cost-effective monitoring of Koalas during the CC *KTMP*s and *KTP*. These should include an alert function for the detection of abnormally low activity and death, and, if possible, geo-fencing alert functionality.

6.6.3.3 Treatment of sick and injured Koalas

Koalas found to be suffering from injury or illness as detected during initial and scheduled veterinary examinations, or during field monitoring, will be immediately referred for treatment at an appropriate Koala care facility.

Engagement of local Koala care organisations is recommended regarding foster-care and in-patient treatment of *KTMP* and *KTP* Koalas requiring in-patient care. However, the CC project will allow for the treatment and care of *KTMP* and *KTP* Koalas either by provision of appropriate facilities and resources or the provision of funds to a third-party organisation capable of providing veterinary and in-patient care to Koalas.

6.6.3.4 Euthanasia of very sick Koalas and necropsy examination

Koalas that are deemed to be suffering or otherwise have a poor quality of life that cannot be remedied by treatment or referral for captive care will be humanely euthanased by a veterinarian. The decision for

euthanasia will be solely at the discretion of the consulting veterinarian, who will be an expert in Koala veterinary management.

The determination of cause of death is a critical input into the adaptive management process in respect of the *KCS* and is an important component of the risk management framework. It is of critical importance that cause-of-death diagnosis is made as much as is practicable for all *KTMP* and *KTP* Koalas to ensure that significant causes of premature death are addressed promptly and that impacts on population viability are managed as much as possible. Importantly, the CC project must be able to prove that it is not contributing to Koala deaths. It can only do this if deaths are detected promptly, and diagnostic necropsy examination performed.

Every *KTMP* Koala that dies or is euthanased will be subjected to a thorough necropsy examination (*post mortem*) to determine the proximate cause of death and/or factors contributing to death.

6.6.3.5 Data records

All veterinary data, including tag details, treatments and necropsy findings will be recorded in a database with entries of data made directly and at, or shortly after the time of data collection (that is, on the day of data collection). As much as possible, double entry of data will be avoided to maximise efficiency and accuracy.

As much as possible, contractors providing Koala management services will facilitate the real-time or near-real-time access to veterinary, monitoring and fieldwork datasets to the *KCS* Implementation Team.

6.6.4 Monitoring of Koalas

Koalas included in the *KTMP*s and *KTP* will be monitored for the duration of those programs by two primary methods:

1. Direct observation during field monitoring in accordance with approved tracking schedules.
2. Remote monitoring (via desktop) using a near-real-time bio-telemetry system.

The aims of monitoring include to:

1. Acquire datasets that are required to meet the objectives of the *KTMPs* and *KTP*, such as ranging behaviour and habitat utilisation, mortality rate, reproductive rate and so on.
2. Facilitate prompt intervention if Koalas are found to be at risk from CC related activities or other causes.
3. Manage animal welfare during the *KTMPs* and *KTP*, particularly during vegetation clearing.
4. Detect mortality and respond appropriately.
5. Provide data to inform and improve *KCS* actions and outcomes, such as engineered mitigation.
6. Demonstrate compliance with *EPBC Act* conditions such as monitoring trends and metrics.
7. Demonstrate conformance with community expectations regarding Koala protection.
8. Provide data on Koala use of and/or interaction with engineered mitigation.
9. Provide data on Koala use of offsets habitat and success of translocation.

6.6.4.1 Field monitoring of tagged Koalas

Field monitoring of Koalas is accomplished by VHF radiotelemetry. Each VHF beacon attached to a Koala emits a ‘ping’ every 1-2 seconds of a unique frequency, which is detected by field teams using a VHF receiver and directional antenna. This is a commonly used ecological tool for monitoring of wildlife.

When the target Koala is located, several data are recorded, including characteristics of the Koala (such as health, presence of joey, tree species, height in the tree, appearance and functionality of tags, and so on), GPS position, and weather conditions. These should be recorded directly into an electronic database at the time of data collection to minimise data entry time and error rate.

The frequency of field-tracking of each Koala depends upon the type and functionality of the telemetry tags fitted to it. One of the most critical objectives of the *KTMP* is to rapidly detect the death of Koalas, so that the body can be retrieved for diagnostic necropsy examination (*post mortem*). This requires the monitoring method to be able to detect mortality no longer than three to four days after death. Longer intervals between the time of death and conduct of the necropsy examination led to a lower chance of achieving a cause-of-death diagnosis.

Hence, for Koalas bearing a bio-telemetry device that uploads its data at least once daily, the *KTMP* monitoring team can observe the daily data, including the activity data, and detect the death or serious illness of Koalas. Consequently, they can respond promptly to a 'zero' or 'low' activity reading, generally within 24 hours of death. Field tracking frequency is generally once every 2-4 weeks.

However, for juvenile and subadult animals (generally < 3 kg bodyweight), their only telemetry tag will be a VHF beacon. Also, in older animals that have dropped their bio-telemetry device, or it is otherwise non-functional, a field tracking frequency of twice per week is necessary to achieve the objective. The table below summarises the standard field tracking frequency required to achieve the objectives of the *KTMP* with regard to Koala welfare and mortality detection.

Category of telemetry device	Field tracking frequency
VHF beacon only	Every 3-4 days (twice per week)
Functional bio-telemetry tag	Every 2-4 weeks
Dropped or non-functional bio-telemetry tag	Every 3-4 days (twice per week)

6.6.4.2 Remote monitoring of Koalas

Large numbers of Koalas (>20) are most efficiently and cost-effectively monitored using innovative telemetry systems that upload data to the 'cloud' generally using the mobile data networks (such as 3G). This allows the critical objectives to be achieved at significantly lower cost than if conventional VHF telemetry and field tracking is used.

The remote telemetry system must provide at least daily data uploads, with datasets to include *GPS location* and *activity*, as a minimum. 'Activity' data can be in the form of a simple number, indicating the activity level over a measured period of time (e.g., 12 hours), or as an accelerometer output or trace. The monitoring team will monitor the bio-telemetry data on a daily basis to detect 'zero' and 'low' activity scores on any of the Koalas and monitor Koala locations to facilitate rapid intervention if Koalas stray into high-risk areas.

GPS locations and other data will be stored and collated in an appropriate database, with analysis of those data to inform *KCS*-directed activities such as engineered mitigation location and specifications, and Koala protection during vegetation clearing and other construction activities.

6.6.5 Summary of *KTMP* and *KTP* objectives, scope, and workflow

The table below summarises the objectives and scope of the three separate *KTMP*s and the *KTP* and shows the relationship to CC project phase.

KTMP	Key objective	Scope	CC project phase
KTMP-1	Determine baseline status of target Koala populations to inform *KCS* review, costings and future directed actions, including translocation	All KMAs and potential offset/translocation recipient sites.	Planning and design phases
KTP	Pre-impact translocation of Koalas away from non-viable habitat prior to commencement of CC construction	All translocated Koalas from CC alignment KMAs plus ongoing monitoring of Koala residents in recipient sites	Design and pre-construction phase, persisting through to construction/operational phase.[1]
KTMP-2	Protect and proactively manage Koalas during vegetation clearing and construction phase	All Koalas remaining in CC alignment KMAs (i.e. those not needing translocation)	Construction phase
KTMP-3	Monitor effectiveness of mitigation plus ongoing adaptive management to achieve *EPBC* approval conditions	All Koalas living close to the CC road and at risk, or likely to interact with mitigation.	Post-construction/operational phase

[1] KTP Koala monitoring will continue for a minimum of 12 months after last Koala translocation.

The graphic below shows the workflow with respect to the *KTMP*s and *KTP*.

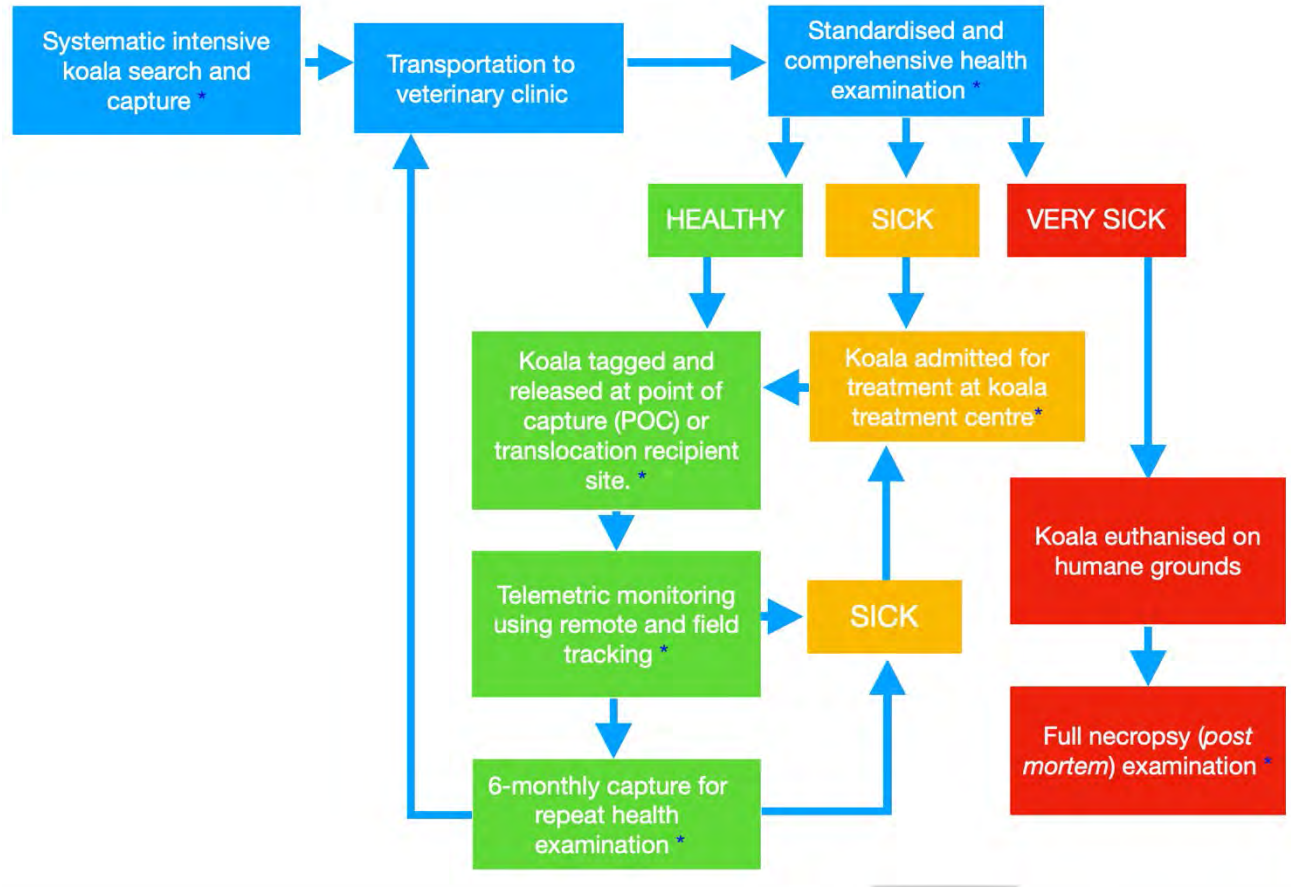


Figure 7.1: *KTMP* and *KTP* workflow

* Data are collected during field events (detection of Koalas, capture, release, field monitoring events), from veterinary assessments and necropsy examinations, and via the bio-telemetry system. Each text box with a blue asterisk in the schematic above, is a part of the operational process during which data are collected. Aside from providing data, the monitoring program (particularly the near-real-time telemetry system) facilitates intervention when monitored Koalas approach high-risk areas and minimises risk of inadvertent death or injury during vegetation removal.

Note: Koalas found dead during monitoring will be subjected to a necropsy examination to determine the cause of death. This process is not indicated in the flow-diagram above, for simplicity.

6.7 Design and engineered mitigation

Several impacts on Koalas can be mitigated by design and engineered solutions:

1. Minimising the gross loss of habitat;
2. Avoiding or minimising loss of habitat connectivity;
3. Avoiding or minimising the death of or injury to Koalas caused by vehicle trauma.

6.7.1 Minimising loss of habitat

The location of the CC project is constrained significantly in the southern half (*Stage 1*) of the alignment by urban development. Hence, there are very limited opportunities to shift the alignment to avoid areas of Koala

habitat. A detailed analysis of the option of expanding/upgrading the capacity of the M1 to achieve similar transport outcomes has been conducted and has been determined to be a less desirable option.

Consequently, the most practical primary design/engineering solution for minimising Koala habitat loss associated with the Project will be the inclusion of bridges over significant habitat areas/corridors and maximising the span of these bridges.

6.7.1.1 Delineating important Koala habitat

Prior to commencement of the *comprehensive Koala survey* the *KCS* Implementation Team will review and define the initial KMA boundaries for the purposes of defining the scope of the survey. After completion of the *comprehensive Koala survey* the KMAs will be reviewed and finalised and will then form the KMAs and TKMAs defining the geographic scope of the *KTMP-1* and *KTP*.

6.7.1.2 Informing detailed design

During the business case and early detailed design phase, the *KCS* Implementation Team will consider results (if available at the time) of the *comprehensive Koala survey* and early *KTMP-1* data to make recommendations regarding:

1. Minimising the clearing footprint for the Project in areas where functional Koala habitat will be retained adjacent to the Project through careful delineation/flagging of 'no-go' zones for machinery;
2. Making recommendations to increase the height and/or span of road bridges in relevant areas where the alignment transects or is adjacent to important habitat patches;
3. Wherever possible, reducing the size and extent of batters and cuts, by grade/elevation adjustment;
4. Wherever possible, realigning the vegetation clearing footprint to avoid or minimise the loss of significant vegetation and/or high-Koala-use trees (as determined by scratches, scats during the survey, or by reference to KTMP-1 GPS data).

6.7.2 Avoiding and minimising loss of habitat connectivity

A preliminary design showing the location and specifications of bridges and culverts was reviewed by the Gold Coast City Council and some recommendations made to improve the effectiveness of the structures in terms of maintaining ecological connectivity across the CC.

Significant benefits to ecological permeability of the CC road will be achieved through measures such as:

1. Increasing the number, height and span of bridges over habitat areas;
2. Increasing the number of other barrier crossing devices, including fauna-specific culverts as well as hydrology/drainage culverts, which, if generally dry, will be used by wildlife;
3. Encouraging wildlife use of barrier crossing/permeability points through provision of dry ledges, adequate lighting, sufficient size and 'furniture' (mainly for possums), and lead-in landscaping and plantings.

On completion of the *comprehensive Koala survey* and analysis of early data from the *KTMP-1*, the location and specifications of barrier crossing structures will be reviewed and recommendations updated by the *KCS* Implementation Team. This will occur in the *design phase* (late 2020 - 2021).

6.7.3 Avoiding death of Koalas by vehicle trauma

There are three important principles that must be applied to minimise the risk to wildlife caused by transport infrastructure:

1. Keep them out of the corridor using appropriate fencing;

2. Provide lots of permeability to minimise their challenging of the fence; and
3. When they get into the corridor (inevitable), get them out quickly by:
4. Permeable central safety barrier; and
5. Lots of rapid egress devices (one-way ‘valves’).

Common causes of failure are:

1. Not installing appropriate fencing;
2. Fencing not installed strictly as per specifications;
3. Impermeable central safety barrier;
4. Infrequent or ineffective egress devices;
5. Insufficient safe crossing opportunities (i.e. low permeability due to low number of culverts etc.).

It is important to note that, even with the best fencing and good permeability, wildlife will still enter the transport corridor periodically. Hence, all three principles (above) must be diligently applied if the best outcomes for wildlife and road-users are to be achieved.

6.7.3.1 Koala/fauna exclusion fencing

The primary constructed mitigation measure to avoid Koala incidents on the CC during its operational use phase will be installation of Koala exclusion fencing along stretches considered to be posing anything other than a ‘low’ risk to Koalas. Fencing specifications will be as per the Fauna Sensitive Road Design Manual (TMR) but with improved Koala egress/escape devices.

In addition to fencing installed along relevant sections of the CC road, it will also be installed along feeder roads where additional traffic attributable to the CC poses a significant additional threat to Koalas (for example Foxwell Rd).

Fencing specifications: a fence with a non-climbable strip of sheet metal (the ‘slip panel’) is preferable to the ‘floppy-top’ design sometimes used; the concrete plinth at the base of the fence is essential for it to maintain its design purpose. Not using a concrete plinth results in washouts and animal push-under that Koalas can use to enter the road corridor. An alternative to the concrete plinth or bund is to use a mesh ‘skirt’ or return on the safe side to prevent animals from pushing under. Careful design and construction of gateways, drainage channels and other potential breach-points are essential. These must be carefully inspected prior to sign-off.

The current TMR specifications for Koala exclusion fencing show the location of the slip panel at the top of the fence. Consideration should be given to lowering the height of the slip panel to 1500 mm above ground level (at the top of the slip panelling). This may encourage Koalas that climb the fence from inside the road corridor to climb down the ‘safe side’ and exit the road corridor, whereas the current design discourages this because the slip panel is flush with the top of the fence. This also will reduce the wind-loading on the fence and may allow cost savings associated with a modified design.

Koala exclusion fencing must include devices to permit rapid egress of Koalas that inadvertently enter the fenced road corridor. These should be one-way ‘Koala valves’ or similar. Escape poles are less efficient at facilitating Koala egress from infrastructure corridors (see MBR Koala Management Program (TMR 2017)). Egress devices should be placed every 100 m in low-moderate risk areas and every 50 m in high-risk areas. Appendix 9 gives design specifications for a one-way Koala egress device, tested during the MBR Koala Management Program.

Fencing location and specifications will be reviewed after collection of data for the comprehensive Koala survey and KTMP-1 (design phase late 2020-2021). As soon as possible following the reporting of the findings of the CKS, the KCS Implementation Team will arrange for detailed plans of the locations of fauna fencing and specifications to be developed for inclusion in construction contract documents.

6.7.3.2 Permeable central safety barrier

Koalas that access the road corridor are at lower risk of vehicle collision if there is no central safety barrier or if the central safety barrier is easily traversed by Koalas or otherwise permeable to their movement. Solid central safety barriers are a death trap for terrestrial wildlife and should be avoided as much as possible. If a solid central concrete safety barrier is essential for road-user safety, it will be made permeable to Koalas by inclusion of voids or windows at or just above ground level at 1 m distances to permit rapid transit by Koalas.

6.7.3.3 Lighting

Recommendations for enhanced street lighting will be developed by the *KCS* Implementation Team after the *comprehensive Koala survey* has been completed. The lighting design will be updated if necessary, as new data derived from the *KTMP*-1 are acquired.

Lighting can significantly reduce accidental wildlife strike on roads, and particular attention to lighting enhancement occur entry and exit ramps, intersections and other places where continuous Koala exclusion fencing is not possible.

6.7.3.4 Traffic calming devices and road design

The *KCS* Implementation Team will make recommendations on traffic calming devices and design features to minimise risk of vehicle strike to Koalas particularly on entry and exit ramps, where continuous Koala exclusion fencing is not possible. Data derived from the *comprehensive Koala survey*, *KTMP-1* and local knowledge will be used to inform the location and specifications of such devices.

Safety barrier devices that discourage Koala incursion onto entry and exit ramps but facilitate rapid egress will be installed whenever possible. Concrete safety barriers that prevent rapid escape of Koalas from the road corridor will not be used, unless designed with exit voids or windows at ground-level. These may be fitted with one-way valves of thick, UV-stable clear plastic flaps. The installation of ‘ladder-type’ devices are not effective as a means of facilitating the rapid traversing of the barriers by Koalas.

6.7.3.5 Novel technologies

Several innovative technologies are being used in Australia and elsewhere to reduce the risk of wildlife-vehicle collisions. These include auditory and visual alert systems to discourage animals from entering the transport corridor and driver awareness and behaviour modification systems (such as ‘smart-signage’) that detects the presence or proximity of tagged wildlife.

During the planning phase, the *KCS* Implementation Team will seek the advice of suitably qualified experts on the potential use of innovative technologies to reduce Koala-vehicle collisions on the CC.

6.7.4 Learnings from the MBR Koala management program

Key learnings from the Moreton Bay Rail project’s Koala Management Program – AKHO (alternative Koala habitat offsets) program (TMR 2017) were:

6.7.4.1 Culverts

1. That higher permeability in terms of a *greater number* of potential crossing structures was preferable to fewer, but more expensive, or ‘fancy’ fauna crossing structures; Koalas used dry drainage culverts as much as the used dedicated fauna culverts; Hence ‘more’ is better than ‘bigger’ or ‘fancy/expensive’, with respect to Koalas.
2. That fauna ‘*furniture’ is not used by Koalas* and is therefore unnecessary for Koalas, but was used by possums;

3. That *culvert height was not particularly important* and that culverts as low as 900 mm were used by both Koalas and eastern grey kangaroos. However, in generally larger culverts (such as 2m x 2m) are preferable to smaller culverts.

Hence, the CC project should carefully consider sections where a higher level of barrier permeability (i.e. a larger number of simple drainage/box culverts) might be preferable to fewer, but more expensive and larger culverts. It is important to point out that the width of the rail corridor and therefore functional length of the culverts was probably less than the wider width of proposed CC project. This has impacts on lighting and the *aperture: length* ratio of should be no less than on the MBR project.

In addition, there is a trade-off between the height of the proposed culvert and the potential additional loss of habitat associated with higher batters caused by the road being more elevated above normal ground level. In other words, lower culverts (that are still effective) might require less clearing of Koala habitat, because the extent/width of batters is less. (This assumes that most batters will not ultimately be reverted to functional Koala habitat by planting.)

6.7.4.2 Fencing and egress devices

Despite detailed specifications for the Koala exclusion fencing along the MBR corridor, there were notable breaches detected during the *KTMP*. These produced to very important learnings:

1. That Koalas will find the smallest breach or imperfection to enter the exclusion area, but may then not be able to get out easily;
2. That Koalas will not readily or reliably use escape poles, and alternative egress devices that work better should be used.

Koalas were able to access the corridor through parts of the exclusion fencing that were not conforming with important specifications. In one case (Koala *MacGyver*) the gap between the lower edge of the chainmesh fencing and the concrete bund was sufficient for the Koala to push under (it should be <50 mm), and in another case (Koala *Saba*), non-conforming grating installed at a hydrology depression, allowed the Koala easy access to the rail corridor.

Hence, detailed fencing specifications, including those relating to things such as returns, treatment of batters and cuts, treatment around culverts, maximum allowable gaps, treatment of hydrology installations, gates and so on, are essential, as is careful and thorough inspection for conformance prior to sign-off.

With regard to Koala egress devices: these must facilitate *rapid* exit (egress) of a Koala that finds its way into a transport corridor. While Koalas are physically capable of climbing the escape poles commonly installed in transport corridors, they do not naturally see them as an escape point. This was clearly demonstrated in the case of the MBR *KTMP* Koala *MacGyver* who repeatedly walked past escape poles in the MBR corridor, but did not use them (see TMR, 2017). An alternative, ground-level egress device was designed and successfully used experimentally. Use of a similar device should be considered for the CC project.

Data derived from the *comprehensive Koala survey* and *KTMPs* will be used to inform detailed design features, such as the location, number and specifications of culverts for Koala passage, and locations, extent and additional specifications for Koala exclusion fencing.

6.7.5 Summary of engineered/built mitigation

The *KCS* Implementation Team will review and update recommendations regarding the locations and specifications of engineered mitigation as data become available through the *comprehensive Koala survey* and *KTMP-1*. Engineered mitigation will include numerous barrier crossing devices installed at areas of significance for habitat connectivity such that ecological permeability for Koalas is maximised.

Fauna exclusion fencing will be installed along all stretches of road considered to create anything other than a ‘low’ risk for Koalas. Fencing design and specifications will be in accordance with the TMR Fauna Sensitive Road design manual, with improvements to specifications as recommended by the *KCS* Implementation Team

with reference to MBR learnings and new information derived from recent publications. As with other aspects of this *KCS,* engineered or built mitigation will reflect current best practice and current states of knowledge.

6.8 Long-term Koala monitoring and management of threats

Recent development of the draft *SEQ Koala Conservation Strategy 2019-2024* and the findings of the Koala expert panel highlight the importance of long-term monitoring and threat management as crucial to the conservation of Koalas (DES, 2020). The CC project will have an enduring impact on habitat connectivity and will create an ongoing risk to Koalas through vehicle trauma. In general terms, the greater the connectivity and diversity of habitat available for populations of Koalas, the greater their resilience to the effects of climate change. Despite the implementation of best-practice road trauma mitigation methods, the CC road will still have a residual risk for Koalas moving through the landscape, particularly where fencing is not or cannot be installed (such as at entry and exit ramps).

Hence, this KCS directs the following long-term Koala monitoring and management actions in a program that will commence at the completion of the *KTMP-3* program of works.

1. Collection and collation of Koala road incident data on the CC road and linked State-controlled roads within a 1 km distance from the CC centre-line.
2. Collection and collation of data originating with other Koala stakeholders on Koala sightings and transport infrastructure incidents within 5 km of the CC project, including DES, Gold Coast City Council, Wildcare Australia, Currumbin Wildlife Hospital and Australia Zoo Wildlife Hospital records, whenever available.
3. Development of an incident investigation and response program for Koala incidents involving the CC and adjacent or linked transport infrastructure. This should seek to identify deficiencies in the mitigation devices where those may have contributed to incidents and define suitable responses and response times, for example that rectification of a fence breach or hole will be completed within 1 month of detection.
4. Every three years, commencing on the three-year anniversary of the commissioning of the CC road, the conduct of a Koala survey in all Koala habitat patches intersected by, or adjacent to, the CC corridor and offset/translocation recipient sites, using survey methods defined in *7.1 Comprehensive Koala survey* (above). The results are to be collated and reported with reference to the *CC KCS Final Technical Report* and PVAs, and a determination made as to whether the Koala population(s) is/are stable, increasing or declining.
5. If Koala populations in the locality of the CC or the offset/translocation sites are found to be declining a KTMP will be implemented within 6 months of the finding with the aim of determining the cause of the decline and rectifying the decline as much as is possible. If the cause of the decline is entirely out of the control of the TMR, and/or could not reasonably be attributed to the construction or operation of the CC project either directly or indirectly, the TMR will not be obliged to remedy the decline but may refer the issue to the DES.

7 Minimising vegetation clearing risk to Koalas

7.1 General principles

Vegetation clearing poses the most proximate risk of mass wildlife mortality and adverse animal welfare outcomes during infrastructure development projects in which large areas of vegetation (wildlife habitat) are removed. Two legislative Acts in Queensland have relevance with respect to the potential impact of vegetation clearing on animals. The *Animal Care and Protection Act 2001* prohibits the cruel treatment of animals and the unlawful killing of animals, and the *Nature Conservation Act 1992* prohibits the killing (or 'taking') of protected fauna. Breaches of both Acts can be avoided by the application of best-practice methods.

Application of best practice clearing methods and mitigation measures implemented before and during clearing, can reduce the risk of causing wildlife death and harm considerably. These include things such as:

1. The implementation of fauna load reduction methods through trapping and early relocation in the period immediately preceding vegetation clearing works;
2. The telemetric tagging of Koalas, which may not be moved during vegetation clearing operations except under the provisions of a scientific purposes permit or other DES-issued Koala translocation approval;
3. The use of machinery and clearing techniques that facilitate (rather than hinder) wildlife detection and removal by wildlife spotter catchers;
4. The establishment and maintenance of a culture of shared responsibility for wildlife protection among the Project team, including the construction contractor and subcontractors, and the enforcement of a 'zero-tolerance' policy for non-compliance with wildlife protection procedures.

Appendix 10 provides guidance on the approach to minimising risk to Koalas (and other wildlife) during vegetation clearing operations. The Queensland *Draft Code of Practice for the welfare of wild animals affected by land-clearing and other habitat impacts; and wildlife spotter catchers* provides guidance on best-practice management of wildlife during vegetation clearing and development.

Aside from the telemetric tagging of all Koalas in the risk area, three things are of critical importance to minimising risk to Koalas and other fauna during vegetation clearing operations. These are:

1. The establishment of a culture within the whole Project team (proponent, construction contractor(s), and sub-contractors) that embraces and gives due regard to the *vision statement*, the intent of the *KCS* and the procedures and measures that support it.

2. The use of appropriate machinery and techniques to ensure that vegetation clearing maximises the detection and rescue of fauna.
3. The engagement of competent wildlife spotter/catchers at a minimum number of one per machine engaged in vegetation removal and/or processing (including tub-grinders and the like) plus at least one per clearing front to manage wildlife housing, veterinary care, euthanasia and release of fauna removed during vegetation clearing.

7.2 Establishing the culture of shared responsibility

The clear articulation of the *vision statement*, aims and intent with regard to Koala protection, form the foundation of the culture that must be established within the Project team to ensure that risk to Koalas is minimised. The imperative to protect Koalas from harm during construction operations, particularly vegetation clearing must be seen as a *shared responsibility* of all team members and contractors - not just those tasked with wildlife protection. More broadly than that a culture must exist within the planning and design teams/phases, that recognises the importance and priority of implementing every measure possible to reduce the harm to Koalas and the impact on their population viability and habitat.

Such a culture can be established by:

1. Developing a training and induction program that all Project team members and contractors are obliged to complete. This can be delivered along with other inductions, such as WHS inductions.
2. Ensuring that the senior Project personnel are invested in the *vision* and intent of the project to minimise harm to Koalas and understand the key processes that must be followed to ensure this outcome. It must not be considered an optional or subordinate component of project management.
3. Ensuring that the construction contractor(s) engaged to construct the Project understand the priority of Koala protection and the provisions of the *KCS,* and that compliance with the *KCS* forms a legally binding condition of the Construction Contractor's contract with the TMR.
4. Enforcing a 'zero tolerance' approach to breaches of Koala protection measures and procedures, particularly during vegetation clearing and construction works.
5. The proponent (TMR) appointing a senior environment manager to deliver the Koala training/induction package and oversee and ensure compliance with the *KCS* by all Project personnel and contractors.

7.3 Use of appropriate machinery and techniques during clearing

The use of appropriate machinery and techniques can have a considerable benefit in terms of wildlife protection and rescue (salvage) as well as safety for the engaged wildlife spotter/catchers. Conversely, the use of certain machinery and ignorance of, or refusal by, the vegetation clearing contractor and/or machinery operators to use recommended techniques can significantly increase the risk of serious injury and death to wildlife, lead to breaches of the Queensland *Animal Care and Protection Act 2001* and increase the risk of injury or death to wildlife spotter/catchers.

Hence, the recommended methods outlined below must be seen to be essential for achieving *KCS* objectives as well as contributing to human safety at the vegetation clearing front.

Key points are:

1. The use of machinery with the ability to perform a controlled fell of vegetation and that has some 'dexterity' is essential. In practice, this means the use of excavators mounted with grapples or pincers: in most cases this can be fixed grapples, such as five-finger or stone/rock grapples which provide significant benefits over buckets or ripping hooks in terms of achieving a controlled fell.
2. Primary clearing of vegetation with bulldozers, or excavators, drotts or other machines mounted with grinding or mulching heads is prohibited. These machines have exclusions zones that prevent wildlife spotter/catchers from effectively performing their duties safely.
3. For large habitat trees where dismantling using an EWP and arborist is unnecessary, a controlled fell can be achieved with a sufficiently large excavator with an articulating and rotating grapple.

4. For most large habitat trees, the use of a cherry picker (EWP) will be required to either inspect hollows and habitat features (with a wildlife spotter/catcher) or allow for dismantling of the tree by an arborist. Hollow limbs may need to be blocked and lowered using various controlled lowering techniques.
5. The use of grapples allows:
    - Much greater control of felling;
    - The 'peeling-away' of vegetation at the clearing front - allowing the wildlife spotter/catcher a much better view of the layers of canopy, thereby facilitating wildlife detection and early salvage;
    - More control of sorting and holding vegetation immediately after felling, to assist in detection and recovery of wildlife;
    - The ability to 'peel-away' vines (such as *Parsonsia*) and other material that can impede the wildlife spotter/catcher's view of the canopy and vegetation substructure.
6. Ensuring that at least one wildlife spotter/catcher is working with each machine involved in removing and processing vegetation (including tub-grinders, excavators with shears, bulldozers, etc). Wildlife, including Koalas, are known to seek refuge in vegetation piles after primary vegetation felling. Felled vegetation must not be assumed to be free of wildlife, and therefore must be treated as any other habitat that potentially contains wildlife requiring appropriate protection.
7. Machinery operators must acknowledge and diligently perform their shared role in the protection of wildlife. They will often spot Koalas and other wildlife before the wildlife spotter/catcher and have a crucial role in ensuring that wildlife can be safely rescued or removed from the vegetation clearing site by the wildlife spotter/catcher. A zero-tolerance/instant dismissal approach must be enforced to ensure safety during vegetation clearing and wildlife rescue/salvage works.
8. Vegetation at the clearing front must not be pushed into standing vegetation but must be 'pulled' or 'peeled-away' from the standing vegetation. This method is easy and efficient for a competent excavator operator and provides the greatest degree of safety for both the wildlife and the wildlife spotter/catcher.
9. Communications protocols must be followed between machinery operators and wildlife spotter/catchers to ensure safe and efficient vegetation clearing and wildlife salvage works. If positive communications in either direction (operator to FSC or FSC to operator) is ignored or impeded in anyway (such as due to flat battery, antenna issue etc.) work must stop immediately until positive communications are restored.

Machinery operators must immediately freeze the machine, when safe to do so, on an instruction from the wildlife spotter/catcher.

8 Habitat offsets

8.1 General principles

Offsetting of habitat loss caused by a project is the last measure in the *avoid, mitigate and offset hierarchy*, and is applied when a project has been unable to avoid some loss of habitat (part of the *residual impact* as per the *EPBC Act*) through re-alignment or re-siting of the impact area. Even though offsetting is the least desirable outcome of the three, it is an important and necessary component of conservation management and can (and should) deliver measurable net benefits for a species and/or ecological community in most circumstances.

With respect to Koala conservation in SEQ, the trend of severe population decline, habitat loss and fragmentation and the impacts of endemic *Chlamydia* infection, provide a fertile ground for the delivery of meaningful benefits through habitat offsetting and *other compensatory measures*. In other words, much can be done to assist the cause of Koala conservation in the region, and therefore deliver a *net benefit*, because the species is already under considerable duress. A comprehensive approach to offsets and threat reduction is acknowledged as an appropriate approach to offsetting residual impacts under the *EPBC Act.*

This section deals with the delivery of *habitat* offsets for Koalas. The next section deals with *non-habitat/other compensatory measures* that seek to help Koala conservation in ways other than the delivery of habitat offsets.

As much as possible, Koala translocation (see section 7 Koala translocation) *recipient sites* should be linked to *habitat offsets sites*, particularly if *advanced offsets* can be provided. This then demonstrates that 'new' habitat is being created in an area where displaced Koalas will be moved to. Although, that new habitat is unlikely to be of sufficient age to entirely support translocated Koalas at the time that the translocation is required, the MBR project showed use of replanted areas by Koalas within 3 years of planting.

Ideally, habitat offsets should:

1. Provide like-for-like replacement of lost habitat in terms of vegetation/ecological communities (like for like *regional ecosystems* as per Qld Herbarium mapping);
2. Be located close enough to the area of impact that the local Koala population is benefitted;
3. Be strategically sited such that the net benefit of the offset is greater than just the area delivered. That is, it delivers a benefit in terms of:
    - Expansion of an existing protected area; or
    - Connects two existing habitat patches not previously functionally connected, or
    - Provides a habitat patch to support a viable Koala population where previously that did not exist; or
    - Substantially improves the quality and habitat value of a degraded patch of potential Koala habitat and so on.

4. Provide 'new' habitat for Koalas by reestablishment of high-quality habitat in an area that had been previously cleared, or had low habitat values for Koalas;
5. At least replace, or if possible, improve on, the floristic and structural diversity of the habitat that has been lost.

Habitat offsets are of lesser value if:

1. They provide a habitat patch that is isolated from other Koala habitat, and which cannot meaningfully contribute to Koala conservation either by providing support for a viable population, or providing a strategic 'stepping-stone' patch that assists a population to move safely from one patch of habitat to another;
2. They simply involve the acquisition and protection of an existing habitat patch without any restoration or revegetation because there is still a *net loss of habitat*.

The best value is achieved by the strategic acquisition of offset areas that contain some high-value Koala habitat, but also provide significant areas where revegetation can achieve a meaningful net gain in Koala habitat. In the context of the CC project, in which translocation of some Koalas will be necessary to avoid their death, using revegetated offset sites that include or are adjacent to the translocation recipient sites is a highly desirable option. In this way, a clear link is established between the loss of habitat and displacement of Koalas that were using that habitat, and the provision of 'new' habitat into which those Koalas are moved or may use in time (as plantings mature).

8.2 Offsetting regulatory frameworks

As much as possible, the CC project should aim to meet both federal and state offsetting requirements for Koalas. Both federal and Queensland offsets policies generally allow for the provision of habitat replacement offsets as well as direct and indirect non-habitat actions (including research and education programs) that provide a *conservation outcome* (Section 2.3.1.2 of the Queensland *Environmental Offsets Policy* (v. 1.8)). However, the Queensland *Environmental Offsets Policy (v. 1.8)* specifically *prohibits* the delivery of a *Direct Benefit Management Plan* instead of habitat replacement offsets for Koalas.

The *EBPC Act*'s *Environmental Offsets Policy* (see section 1.6.1) provides detailed guidelines on the nature, extent, quality and monitoring of offsets, among other things. In particular, habitat-related offsets can include such things as the delivery of 'new habitat', improvement of the quality and value of 'existing habitat' and the provision of *advanced habitat offsets* - the most desirable and valuable option in the context of the CC *KCS.*

The policy requires that 90% of delivered offsets be *direct offsets*: these can be habitat-based or non-habitat offsets but must produce *a tangible and measurable on-ground conservation gain*. The remaining 10% may be *other compensatory measures* that may not necessarily deliver direct benefits (for Koalas) in the immediate area of the impact, but provide a general benefit, such as support of conservation-directed research. Proposed *other compensatory measures* for the CC project are described in more detail in the following section: *10 Non-habitat offsets (other compensatory measures)*.

8.3 State offsets policy (Queensland)

Although *EPBC Act*-approved offsets for the CC Koala impact would generally preclude an additional State-imposed habitat offset, the Queensland Koala offsets policy (under the *Environmental Offsets Act 2014*) is informative.

The Queensland *Environmental Offsets Policy* requires three new Koala habitat trees to be established for every non-juvenile Koala habitat tree removed in SEQ. For Koala habitat in SEQ an average tree density of 250 trees per hectare is assumed. A *significant residual impact* on Koala habitat in SEQ is any *prescribed activity* that will remove a non-juvenile Koala habitat tree (*NJKHA*).

The Policy lists the following definitions:

- Koala habitat tree means a tree of any of the following genera – *Angophora*, *Corymbia*, *Eucalyptus*, *Lophostemon* and *Melaleuca*.

- non-juvenile Koala habitat tree means a Koala habitat tree that is more than 4m high or has a trunk with a circumference of more than 31.5cm at 1.3m above the ground - equivalent to a *diameter at breast height* (DBH) of 10 cm.

The policy prohibits the provision of non-habitat (as delivered under a *Direct Benefit Management Plan*) offsets instead of *habitat offsets* for Koalas.

A summary of the offset requirements under the *EPBC Act* versus Qld State regulatory provisions is contained in the table below.

Jurisdiction	Habitat offsets	Non-habitat offsets	Explanation
EPBC Ac	Yes	Yes	Direct habitat plus non-habitat offsets must be greater than or equal to 90% of offsets, with remainder as non-direct *other compensatory measures.*
NCA Act	Yes	No[1]	Only three-for-one replacement of non-juvenile Koala habitat trees acceptable (or a cash payment at an applicable rate per NJKHT).

8.4 Relationship with local offsetting and Koala conservation plan

The Gold Coast City Council has a well-developed Koala conservation strategy and has conducted significant work regarding local Koala conservation, particularly with respect to semi-urban Koala populations including those in East Coomera, Coombabah-Parkwood, Burleigh Heads, and Elanora-Currumbin-Waters. Conservation areas in East Coomera/Pimpama and Clagiraba/Lower Beechmont and other locations within the City managed by Gold Coast City Council for Koala conservation provide potential opportunities for the CC project to offset Koala impacts. These opportunities include:

1. Acquisition of additional lots to increase the conservation estate;
2. Enhancement of the value/quality existing conservation properties.

Optimal conservation outcomes are likely to be achieved if the CC offsets (and *KCS* actions generally) are integrated or align with local Koala conservation initiatives managed by Gold Coast City Council. Consultation with the Gold Coast City Council will be essential in the determination of suitable areas for acquisition for use as offsets or translocation recipient sites.

The ***East Coomera/Pimpama*** area of is of interest for *habitat offsets* and as translocation recipient sites[2]. Much of the area of interest occurs in the recently mapped Coomera KPA, and also has *regional biodiversity value* and *regionally significant greenspace* (SEQ Regional Plan 2017) overlays. This area also includes large areas of previously-cleared farmland suitable for Koala habitat restoration. Other potential suitable areas will be determined in consultation with Gold Coast City Council.

8.5 Coomera Connector gazetted footprint

The current gazetted footprint of the CC Project between Nerang and Loganholme is 775 ha (Stages 1 and 2). Of that, Stage1 occupies approximately 98 ha of Koala habitat and approximately 339 ha in *Future Stages*, leading to a total of approximately 437 ha across all stages (Planit, 2020). Of this total, environmental consultants Planit, estimated that up to 117 ha of *habitat critical to the survival of the Koala* might be cleared across the whole project in a 'worst-case' scenario.

[1] Qld offsets policy allows non-habitat offsets in addition to, but not instead of, 3 for 1 habitat/tree replacement.

[2] Koala density, carrying capacity and threat/risk profiles will be established prior to use for Koala translocation.

It is important to note that, at the time of writing of this *KCS* (Version 1), the vegetation clearing footprint had not been finalised, and therefore the total area of Koala habitat likely to be lost is unknown. Further, the impact, with respect to loss of habitat available to support a viable Koala population, includes patches of habitat that might be excised from others, thereby creating an island or patch of habitat so small as to offer no long-term benefit to local Koala population viability. Hence, meaningful offsets must take account of the total loss of habitat available to support a viable Koala population rather than that lost only from vegetation clearing.

The *KCS* Implementation Team will, as a matter of priority during the *planning phase*, conduct the following regarding habitat loss:

1. Estimation of Koala habitat likely to be lost during vegetation clearing works;
2. Estimation of Koala habitat likely to be lost or rendered not functionally/ecologically useful for Koalas (due to isolation, unmitigable threats, and so on);
3. Total Koala habitat required to be offset under *EPBC Act* provisions.

8.5.1 Current Status of the CC Koala habitat offsets program

As at March 2020, the initial actions regarding identification and securing of Koala habitat offset sites had commenced. The *KCS* intends the Project to be able to deliver some *advanced offsets* subject to the early acquisition of suitable land for rehabilitation. Discussions with the Gold Coast City Council Koala conservation management personnel were in progress at the time of writing. As at August 2022, offset properties had been acquired for Koalas at Tabooba, and the Greenridge site had been acquired at Pimpama to offset impacts for Stage 1 to provide potential Koala offsets for *Future Stages*.

9 Non-habitat offsets (other compensatory measures)

The provision of *other compensatory measures* (such as conservation research and education) may form up to 10% of the Koala offsets allowable under the *EPBC Act.* These can include things that provide an indirect benefit to Koala conservation but are not necessarily addressing *directly* the impacts caused by the *action* (i.e. the project). Hence, these are *non-direct* offsets, under the EPBC Act provisions.

However, some non-habitat measures may *directly* offset impacts created by the Project, and hence can form part of the 90% (minimum) *direct offsets* measures. Hence, non-habitat offsets may be *direct* or *indirect* with regard to the project's residual impact. Section 10 provides a summary of the *KCS* actions with respect to *direct* and *indirect* offsets and *habitat* and *non-habitat offsets.* This section outlines *KCS*-directed activities that are not habitat-related offsets but seek to improve Koala population viability and provide broader conservation benefits to Koalas through other means.

9.1 Background and justification

Measures other than delivery of 'new' or improved habitat through habitat offsets can deliver meaningful Koala conservation benefits, resulting in significant improvements to Koala population viability. These can include the management of any process that is determined to be significantly negatively impacting Koala population viability. In the case of the MBR project, wild dog predation and chlamydial disease management reversed an extinction trajectory in the local Koala population resulting in a prolonged benefit with a duration well beyond the end of the management program (TMR, 2017; Beyer *et al* 2018; de Villiers *et al* in prep).

Under the provisions of the *EPBC Act* and its relevant policies, these non-habitat offsets may be *direct*: that is, they are directly offsetting impacts created or worsened by the CC project. These *direct offsets* (including habitat offsets) must comprise at least 90% of the offsets package proposed.

Hence, non-habitat offsets or compensatory measures can be as valuable, and sometimes more valuable, than habitat offsets, particularly when things other than habitat factors are contributing significantly to population decline. Such measures are best applied in an adaptive management framework in which the relative contribution of multiple factors is either known with certainty or can be measured, for example by a Koala tagging and monitoring program (Beyer *et al* 2018).

9.2 Aims

Aims of the non-habitat compensatory measures program:

1. To deliver meaningful benefits to Koala conservation locally and/or more broadly by targeting management of threats based on recent/current data;
2. To support *bona fide* scientific research that has a direct relevance to Project objectives through funding and/or in-kind contributions;
3. To use the adaptive management framework to identify key threats, manage those threats, evaluate the success of management, then review and adjust as necessary;
4. To estimate the overall and long-term benefit of the non-habitat compensatory measures program for the local Koala population using population viability analysis.

Examples of factors that could be controlled to improve Koala population viability are:

1. Chlamydial disease (through treatment and vaccination);
2. Disease other than chlamydiosis (through treatment and other control measures);
3. Predation risk (through wild dog monitoring and control, for example);
4. Anthropogenic risk:
    - Motor vehicle trauma (through fencing and barrier crossings);
    - Domestic dog trauma (through fencing and collaboration with Gold Coast City Council);
    - Entrapment and entanglement (pits, sediment ponds, fences etc);
5. Climate and weather extremes (through habitat and microclimate improvement).

9.3 Direct non-habitat offsets

Some of these control measures are not considered offsets; rather they are mitigation methods that seek to directly reduce impacts caused by the Project. However, actions such as population-level disease management (through treatment) and prevention (by vaccination) can provide a significant benefit to the at-risk Koala population and constitute management of a critical threat unrelated to the Project. Therefore, they can be considered as part of the *direct offsets* package via a non-habitat offset (See Section 10).

Non-habitat compensatory measures are most cost-effectively implemented when applied to critical threats informed by recent datasets. It is proposed that these data will be largely derived from the *KTMP*s. The *KTMP*s therefore serve to provide data to inform adaptive management responses as well as providing the means for evaluation of the success of such management actions, at least in the short-term.

9.4 Indirect non-habitat offsets

Non-habitat compensatory measures may also include funding contributions to research programs that have a clear purpose of improving Koala conservation outcomes. Such funding contributions may be through *full* funding of projects that have a direct relevance or benefit for a TMR-required outcome or may be via partial

contributions (cash and in-kind) to projects funded through other sources. For example, the Moreton Bay Rail project contributed $180K cash to a successful ARC-linkage grant that funded development and testing of the *Chlamydia* vaccine for Koalas. Such funding would normally be contingent upon successful award of the grant. ARC-Linkage grants facilitate the use of TMR funds to leverage significant additional funding for projects of relevance to TMR objectives.

A comprehensive suite of compensatory measures, including habitat offsets, provides the most effective means of achieving meaningful Koala conservation benefits, when targeted at threats identified by the *KTMP*s. With due forethought and early grant application, funding contributions through the ARC-Linkage grant scheme can deliver excellent project outcomes by leveraging non-Project funds.

As of August 2022, several research projects, notably the development of a Koala *Chlamydia* vaccine, had been funded or approved for funding as a component of the non-habitat offsets '*other compensatory measures'.*

10 Management of Koala displacement

10.1 Introduction and regulatory background

The approval of developments that result in the destruction or clearing of Koala habitat inevitably cause significant risk of harm to Koalas and lead to the displacement of Koalas that survive vegetation clearing works. From ethical and conservation perspectives, it is imperative that all reasonable measures are taken to avoid harm to Koalas caused either directly or indirectly (via displacement) by habitat clearing. The human-mediated movement of Koalas in response to development impacts (*salvage* or *mitigation translocation*) is controversial in the Koala conservation community because of a concern that it might facilitate approval of development applications that might otherwise not receive approval. Salvage translocation of Koalas is generally unsupported by Queensland regulatory instruments and policy which instead require sequential clearing and for Koalas 'to move of their own volition'. Hence, under current State policy, salvage translocation of Koalas is prohibited except under strict conditions generally in association with a scientific-purposes permit (SPP) or when conducted by authorised departmental (DES) officers acting in accordance with an operational guideline.

10.1.1 The science of Koala translocation

There have been numerous well-conducted and successful Koala translocations in Queensland that have been subject to rigorous monitoring and evaluation. A comprehensive review of Koala translocations, which included recommendations to the Queensland Government on changes to Koala translocation policy, was published in 2018 (de Villiers 2018). A similar review is being conducted for the NSW Dept. Planning, Industry and Environment (DPIE), with a report due in late 2020.

While the need for salvage translocation should be avoided as much as possible, it is nevertheless an important tool in mitigating what can amount to significant residual harm. The alternative (or counterfactual) scenario is that affected Koalas are left *in situ* to take their chances during vegetation clearing and the subsequent development impact, often in situations that provide no realistic prospects for survival and ongoing contribution to the local or regional population. This is a situation that is unacceptable in terms of general community expectations and is not consistent with the intent of federal or state threatened species conservation legislation.

The Queensland Government policy on salvage translocation of Koalas is currently under review, but remains a general prohibition, except under the provisions of a scientific purposes permit. This regulatory option has

allowed for several Koala sub-population translocations in response to development in the past decade, including for the Moreton Bay Rail project. At the time of writing this remained the most suitable regulatory approach to seek approval for KTP works.

The *EPBC Act* considers wildlife translocation to be generally unsuccessful and, if proposed, is to be considered part of the *impact* itself, rather than a mitigation or offset measure. However, scientific evaluation of several of Koala translocation programs conducted in Queensland over the past 3 decades indicates that Koala translocation can be highly successful if conducted appropriately. Neither federal nor state regulatory frameworks provide guidance on appropriate management of Koalas subject to displacement if they are not translocated.

10.2 Previous salvage mitigation Koala translocation programs

Two major Koala translocation (salvage translocation) programs have been conducted in the past decade, both of which were subject to intensive telemetric monitoring, health management and rigorous evaluation. The *East Coomera Koala Conservation Project* conducted by Gold Coast City Council (now Gold Coast City Council) involved the translocation of 180 Koalas from East Coomera to two recipient sites in the Gold Coast hinterland. The Moreton Bay Rail Koala Management Program involved the translocation of 28 Koalas to two recipient sites, one of which was a *habitat offset* site for the project that had been subject to extensive revegetation.

A summary of the key features and outcomes of those projects is presented in the table overleaf. More detailed review is provided by de Villiers (2018) and the primary reports can be sourced from the proponents (Gold Coast City Council and TMR, respectively).

Project	East Coomera KCP	MBR *KCS*
Koalas translocated	180	28
Koalas monitored in situ (approx.)	38	200
Mortality rate translocated Koalas <, = or > than residents and *in situ*	=	=
Initial outcome for all groups (translocated, in situ, resident)	Success[1]	Success
Follow-up assessment of medium-term outcomes	Success[2]	Success

In each project, because the primary objective was mitigation of impacts on Koalas rather than a purely scientific experiment, control groups of Koalas left *in situ* to measure the consequences of unmitigated exposure to vegetation clearing other impacts were not established. This would have been ethically challenging and scientifically questionable in any case.

In both projects, the health of each of the subgroups of Koalas was monitored and managed as much as possible, and subsequent surveys at most sites reveal stable or increasing Koala populations. At the MBR sites (one *in situ* and one translocation recipient site), re-surveyed in 2019, three years after practical completion of operational Koala work, the observed prevalence of chlamydial disease was 0% (40 of 40 Koalas observed appeared healthy). At commencement, the overall chlamydial disease prevalence was around 28%. Hence, in that project, both translocation and chlamydial disease management appear to have either had no adverse effects or delivered a durable benefit, at least in the medium-term.

10.3 Terminology

Given the controversy associated with the concept of Koala translocation, it is useful to provide some definitions that assist in interpretation and justification. Wildlife translocation is generally defined to mean the human-mediated movement of wildlife from their point of origin to another area. Translocations can be for the primary purpose of advancing conservation objectives (*conservation translocations*), or, as is proposed here, for the salvage of threatened or protected species that might otherwise perish (*salvage* or *mitigation translocations*).

Conservation translocations are further categorised (by the IUCN) as *introductions* (species introduced into habitat not within former or known range), *reintroductions* (species introduced into area of known range from

[1] Success defined as survival, reproduction and normal ranging established within project timeframe.

[2] Success defined as survey results indicating a stable or increased population based on original baseline.

which extirpation has occurred) and *reinforcements* (where conspecifics are present in the proposed recipient site).

1. Given that the primary purpose of the Koala translocations proposed here is to avoid the unnecessary death of a subset of the at-risk Koalas, we will define it as a *salvage translocation*. We also propose the following definitions to make clear the distances likely to be involved in Koala translocations or movements directed under this *KCS*:
2. *Assisted dispersal*: a Koala in a high-risk or imminent high-risk location is moved into safer habitat at the time of or immediately before the high-risk or imminent risk circumstance is detected;
3. *Relocation*: the movement of a Koala from its usual ranging habitat into other suitable habitat within 5 km of its originating habitat, when its usual ranging habitat is unlikely to provide viable supporting habitat into the future due to fragment size, isolation, or present or future risks.
4. *Local translocation*: the movement of a Koala from its usual ranging habitat into other suitable habitat that is further than 5 km from its point of origin, but within habitat supporting the local/regional metapopulation; and further that the Koala is not moved across a natural geographic barrier that might otherwise constrain or limit natural Koala dispersal. This would occur when habitat within 5 km does not meet criteria for providing viable supporting habitat into the future, due to fragment size, isolation, or present or future risks.

For the purposes of this *KCS,* we define 'suitable habitat' as Koala habitat that is of medium or high quality, within or connected to a large tract of Koala habitat that is considered to have sufficient carrying capacity to support the translocated Koala(s).

10.4 Threats associated with translocation

It is beyond the scope of the *KCS* to provide a comprehensive discussion of wildlife translocation. However, significant risks are associated with wildlife translocation generally, and are worthy of note here due to their relevance for *KCS*-directed Koala movement.

The table overleaf summarises the threats and how the *KCS* will address them:

Threat	***KCS* management**	***KCS*-directed deliverable**
Disease transmission	Veterinary management of all Koalas included in *KTMP*s and *KTP*. No translocation of Koalas with communicable diseases/infections.	KTMPs, KTP
Animal welfare	All Koalas in *KTMP*s and *KTP* subject to regular veterinary assessment (6-monthly and as required) and high-intensity telemetric monitoring through field and remote methods.	KTMPs, KTP
Conservation impacts (population level)	Risk profiles at donor and receive sites, population health status, dynamics, and habitat carrying capacity investigated and deemed appropriate prior to translocation. Evaluation via *KTP* and PVA as monitoring and health datasets acquired. Adaptive management response to adverse population impacts.	*KTMP*s, *KTP*, PVA
Genetic adverse impacts	No translocation of Koalas across natural geographic boundaries that might otherwise have prevented dispersal and genetic mixing. No long-distance translocation proposed in *KCS.*	KTP

Table 11.1 Risks of Koala translocation and threat management during KCS implementation

Threats associated with not translocating Koalas (the counterfactual scenario) that are subjected to severe development impacts include:

1. Direct mortality caused by trauma during vegetation clearing works;
2. Mortality due to vehicle trauma, predation/dog attack and other forms of misadventure when Koalas are displaced from their ranging habitat by vegetation clearing;

3. Starvation, dehydration and exposure caused by loss of feed and shelter resources;
4. Loss of individuals from the local/regional population;
5. Extirpation of sub-populations;
6. Increased susceptibility of surviving individuals and sub-populations to stochastic events, such as bushfire;
7. Severe animal welfare impacts associated with injury, misadventure, predation and disease following displacement from habitat;
8. Loss of genetic resource and genetic mixing as a result of sub-population isolation/extirpation.

All of these factors are addressed by the direct management and monitoring of at-risk Koalas during the *KCS*-directed *KTMP* and *KTP* programs. In addition, the consequences for the reputation of the TMR and associated contractors (including KCS implementation contractors) are potentially severe if appropriate management of Koalas during vegetation clearing and construction is not implemented.

10.5 Methods

The general methods relating to the *KTP* in terms of Koala capture, health assessment, tagging and monitoring are described in Section *7 KCS Methodology*. Field and veterinary methods for the *KTMPs* and *KTP* are identical.

10.5.1 Investigation of potential translocation recipient sites

In consultation with the Gold Coast City Council, the *KCS* Implementation Team will identify and investigate a minimum of two sites suitable for the receiving of translocated Koalas from the CC alignment and associated KMAs. Each site will be subjected to a comprehensive Koala survey (as described in Section 7.1) and an estimation of the Koala carrying capacity made by a suitably qualified expert. This estimate, expressed as a density (Koalas/ha), will be used with the estimated current Koala density to derive a figure that estimates the available capacity of the habitat patch to receive translocated Koalas.

The ideal characteristics of potential translocation recipient sites are:

1. They are of secure tenure in the long-term;
2. They consist largely of high-quality Koala habitat;
3. They currently support or historically supported Koalas;
4. They have sufficient carrying capacity to accept translocated Koalas;
5. The risk/threat profiles are, or will be, investigated and managed as necessary;
6. They are part of or will contribute to areas strategically important for the long-term persistence of Koalas in SEQ;
7. They are currently or will in the near future be monitored and managed specifically for Koala conservation.

The broad areas proposed for receiving of translocated Koalas from the CC alignment and KMAs are the Pimpama-East Coomera area (currently encompassed by Queensland Government-designated KPA) for Koalas that might require relocation from the CC alignment north of Coombabah Ck, and west of the M1 in the Gaven-Nerang region for Koalas originating along the alignment south of Coombabah Ck.

The delineation of the Koala survey and management area for the potential translocation recipient sites (TKMAs) will be an action of priority for the *KCS* Implementation Team, so that scope and procurement of the comprehensive Koala survey occurs during the early *planning phase*.

As a component of early planning for the KTP, the KCS Implementation Team will engage a suitably qualified expert to develop criteria for the assessment of habitat patches and individual Koalas as appropriate for translocation rather than local management. These criteria will give due regard for the results of the CKS, the

long-term prospects for retained habitat to contribute to local and regional Koala conservation, and the imperative to optimise long-term Koala conservation outcomes resulting from KCS-directed actions. The criteria will be developed in consultation with Gold Coast City Council and relevant community stakeholders.

10.5.2 Estimation of number of Koalas likely to require translocation

Following the comprehensive survey of the draft CC KMAs and TKMAs, the *KCS* Implementation Team will define the areas of KMAs that are unlikely to provide safe refuge and ecological value for Koalas during and after construction of the Project. In combination with survey data, this will allow an estimate of Koalas likely to require translocation, and an initial assessment of population health.

The maximum number of Koalas estimated to require translocation will be reconciled with the available carrying capacity in the proposed translocation recipient sites, and a decision made in consultation with suitably qualified Koala ecology experts on the following:

1. Definitive designation of translocation recipient sites;
2. The number of resident Koalas to be monitored and the duration of monitoring at each site required to establish risk/threat profiles and if necessary, manage those to acceptable levels;
3. Specify the receiving site for Koalas derived from each KMA from which Koalas are to be translocated.

10.5.3 Recipient site Koala population investigation

During the early investigation of potential translocation recipient sites and habitat offsets, the use of non-invasive methods, such as faecal pellet collection and analysis may be used. These can provide information on demography, *Chlamydia* positivity and relatedness. Observational surveys can reinforce this information and provide some data on the prevalence of overt disease, reproductive rates and demography. Subject to the necessary approvals, the operational phase of the *KTP* will commence with the capture, veterinary assessment and monitoring of a representative subset of the resident Koalas inhabiting the proposed recipient sites. The methods for capture, veterinary assessment, tagging and monitoring will be as described in section *7 KCS Methodology*. Adaptive management will be implemented to address threats to Koala population health and viability in the recipient sites as data, such as cause-of-death diagnoses, become available.

It is important that the risk/threat profile at the potential translocation recipient site(s) is reasonably well known, and that manageable threats are reduced to a level that is acceptable. That is, threats are reduced to a level such that the Koala population is stable or increasing. It is acknowledged that management of the population will be constrained by cost and what is reasonable, and that the extent and continuity of habitat in potential translocation sites might preclude entire population management. In that case, population management will be limited to the geographic area defined by the TKMA if translocation into that area is considered necessary.

10.5.4 Selection of individuals for translocation

The *KCS* Implementation Team will develop and refine criteria for selection of individual Koalas as data become available through the *comprehensive Koala survey* and the *KTMP-1*. The criteria will be based on those used in the Moreton Bay Rail project (TMR, 2017) and published in the *Review of Koala translocation in Queensland* (de Villiers, 2018). In brief, Koalas will be selected for translocation if:

1. Their continued occupation of a KMA or part of a KMA is likely to result in their death; or
2. That part of the KMA will be so isolated at the completion of the CC project that there is no prospect of meaningful contribution to the local or regional Koala population; and
3. The Koala is essentially healthy and both able to tolerate translocation and not carrying communicable pathogens; and
4. No other individual or local circumstances override the imperative for translocation.

Hence, both individual and habitat/circumstantial factors are considered in the assessment criteria.

10.5.5 Translocation process

All Koalas selected for translocation will be captured, subjected to the thorough veterinary assessment, tagged with telemetry tags (if not already tagged) if deemed to be suitable for translocation/release, and then transported to the translocation recipient site and released.

Whenever possible, groups of Koalas will be released together, in close proximity, but not in the same tree unless they are mother-dependent joey pairs. Adult males will not be released closer than 50 m from each other.

Translocated Koalas will be monitored by conventional field VHF-telemetry daily for the first 7 days, then once every second day for 3 tracking events, then every 3rd or 4th day for the duration of the project, or while fitted with a bio-telemetry collar thereafter will revert to the standard field and remote monitoring protocols.

Koalas that are showing signs of injury or illness will be recaptured for veterinary assessment and treated as required. Koalas that disperse beyond the TKMA boundary will be monitored as per standard protocols, and intervention will only occur if Koalas move into an area that is deemed to present unacceptable risks to the Koala's health and/or survival. In such a case, the Koala will be recaptured, and subjected to the procedure in the paragraphs above, before being released at the original TKMA.

10.5.6 Translocation monitoring duration

The monitoring of resident Koalas at recipient sites will commence at a minimum of 6-months prior to the scheduled or estimated commencement of translocation of Koalas. This will involve the capture, veterinary processing and monitoring of all, or a representative cohort, of Koalas that are already resident in the translocation recipient site. This provides sufficient time to determine usual ranging behaviour and assess and monitor risk/threat profiles. To remove doubt, the 6-month, pre-translocation monitoring period will commence on the capture of the *last* resident Koala in the cohort, such that all included resident Koalas are monitored for a minimum of 6 months prior to the commencement of translocations into the site. Hence, the total duration of the pre-translocation monitoring of resident Koalas might be 9 months, or more.

The monitoring of translocated Koalas and the resident cohort at each site will continue for a minimum period of 12 months *after* the translocation of the *last* Koala into the site. The table below summarises a likely scenario for duration of the *KTP*.

Koala category	Monitoring period	Month
First resident Koala captured	6 months	0
Last resident Koala captured	6 months	3
First translocated Koala release	12 months	9
Last translocated Koala release	12 months	12
Post translocation monitoring period	12 months	24
Commence recapture, final health check and tag removal	N/A	27
Complete recapture and terminate *KTP*	3 months	30

Hence, the minimum duration of the *KTP* might be up to for each TKMA (but note that the KTP will be conducted at different TKMAs concurrently, as much as possible). The duration of vegetation clearing and efficiency of implementation of the KTP will affect the total duration of the KTP.

10.5.7 Termination and decommissioning of the *KTP*

At completion of the obligatory monitoring period, all Koalas included in the *KTP* (residents and translocated Koalas) will be captured, subject to a comprehensive veterinary examination, and released (if deemed appropriate) after removal of telemetry tags. In accordance with usual Koala release protocols, the Koalas will be released at their most recent point of capture.

10.6 *KTP* data records and reporting

The *KTP* contractor will record data in accordance with the *KTMP* and *KTP* methods described in Section 7. Datasets will be made available to the *KCS* Implementation Team as and when required, preferably via direct on-line database access. If possible, a near-real-time telemetry system will be used allowing authorised personnel of the TMR and *KCS* Implementation Team to access telemetry data including GPS location and daily activity data from *KTP* Koalas, via a web-based portal.

The *KTP* contractor will provide monthly reports on the *KTP*s which will include at a minimum, the following:

1. Koala captures, releases, deaths and notable movements;
2. Koala health changes, illness, treatments and so on;
3. Reasons for non-scheduled recaptures;
4. Necropsy examination findings and cause-of-death diagnoses;
5. Unusual or excessive dispersal of translocated Koalas;
6. Other notable findings.

The *KTP* contractor will provide a detailed final technical report on completion.

11 Evaluation of *KCS* effectiveness

11.1 Formal *KCS* evaluation measures

Several approaches will be taken to evaluate the effectiveness of *KCS*-directed actions in achieving the objectives. These are:

1. Annual review of *KCS* outcomes against key objectives and metrics;
2. Bi-annual review of *KCS* implementation by independent expert reviewer;
3. Population viability analysis at baseline (*KTMP*-1) and at end of *KTMP*-2 and *KTMP*-3.

The *KCS* Implementation Team will be responsible for the regular evaluation of *KCS* effectiveness and the procurement, when necessary, of additional resources to address emergent threats or *KCS* failures.

11.1.1 Annual review

At the end of each 12-month period from practical commencement of KCS-directed activities, the KCS Implementation Team will conduct a review of the KCS implementation and relevant outcomes against the objectives and metrics detailed in Appendix 1 and Appendix 11. The KCS Implementation Team will produce a brief report detailing the findings of the review and necessary actions to remediate non-conformance with the KCS and/or failure to meet objective metrics and milestones.

11.1.2 Bi-annual review by independent reviewer

At end of each two-year period from practical commencement of KCS-directed activities, the KCS Implementation Team will engage a suitably qualified Koala expert to review the implementation and outcomes of the KCS against the relevant objectives and metrics detailed in Appendix 1 and Appendix 11. The independent reviewer will produce a brief report detailing their findings and recommending remedial action when necessary.

11.1.3 Population viability analysis

Population viability analysis (PVA) will be the tool used to scientifically evaluate the effectiveness of the KCS-directed activities at avoiding a net negative impact on Koala population viability, and, if possible, improving local population viability. The KCS Implementation Team will engage a suitably qualified expert to conduct PVAs based on the datasets derived from the KTMP-1 with modelling to estimate impacts/benefits associated with the following scenarios:

1. No development of the CC project;
2. Development of the CC project with mitigation and conservation measures proposed herein.

The PVA will be based on the Koala population living in areas defined by the KMAs/TKMAs only.

The first PVA will be scheduled for practical completion of KTMP-1 and hence, will provide a prediction for Koala population viability based on the current state of the population without significant intervention. The second PVA will be scheduled for late in the KTMP-3 works, so that the effect of the suite of mitigation and compensatory measures can be appropriately modelled.

11.1.4 Adaptive management response

The evaluative findings will feed into the adaptive management response and trigger altered management approaches when key objectives are not being met or TARP triggers (Appendix 6) are reached.

In addition, the adaptive management approach which forms an important conceptual component of the *KCS,* dictates the adaptive response to identified and emergent threats by timely, appropriate and proportionate measures. For example, the detection of significant wild dog predation by the *KTMP*s and diagnostic *post mortem* examination of tagged Koalas would prompt the implementation of a wild dog monitoring and control program in the KMAs and TKMAs. Hence, the adaptive management response to threats is an implicit and integral part of the *KCS* delivered via the *KTMP*s and *KTP*.

11.1.5 *KCS* contractor management and supervision

Contractors engaged by the CC project to implement *KCS*-directed activities, such as the *KTMP*s, *KTP*, offsets revegetation and construction/installation of engineered mitigation, will be required to conform to specifications, submit regular reports for review by the *KCS* Implementation Team, and make good any non-conformances.

Regular monthly reports for the *KTMP*s and *KTP* will be reviewed at monthly meetings between the *KCS* Implementation Team or manager and the contractor to ensure that key metrics are tracking acceptably and that early response to adverse trends is facilitated.

In addition, the AEC and SPP approvals relating to the *KTMP* and *KTP* programs require annual reports and adverse event reporting and management, providing an additional layer of program scrutiny and adaptive management.

11.2 Informal *KCS* review measures

In addition to the formal measures defined above, the *KCS* implementation and effectiveness will be subject to informal review and input from the *Koala Community Stakeholder Representative Group* via the two-monthly stakeholder workshops. These will provide an opportunity for community concerns around the effectiveness of the *KCS* to be aired and addressed (see Section *16 Communications and public relations*).

12 Summary of *KCS* impacts for *EPBC Act* assessment

The following tables summarise the impacts and response/deliverables in respect of *EPBC Act* assessment of the CC and the *KCS.* The provision of early or *advanced offsets* for the CC project will be beneficial in the assessment of the project under the Act.

Threats and impacts to Koalas, with *KCS* response other than offsets:

Threat/impact	Current level (regional)	Additional potential impact from CC	*KCS* Response/Mitigation	Residual impact from CC
Loss of habitat	Severe	Moderate	Limited and constrained	Moderate
Loss of ecological connectivity	Severe	High	Provision of multiple crossing structures	Moderate
Koala death due to vegetation clearing/construction works	Severe	High	*KTMP* protections, vegetation clearing protocols (Section 8 and Appendix 13)	Negligible/minor
Koala displacement (indirect risk of death)	Severe	High	*KTMP* protections, and Koala translocation (*KTP*) (Sections 7.2, 8 and 11, Appendix 13)	Negligible/minor
Vehicle trauma	Severe	High	Koala fencing and crossing structures	Moderate
Koala disease (*Chlamydia*)	Severe	Minor/unknown	*KTMP* monitoring and treatment.	Unknown
Climate-change (drought and bushfire impacts)	Severe	Moderate	Provision of crossing structures (barrier mitigation)	Moderate
Wild dog predation	Moderate/unknown	Moderate/ unknown	Adaptive management response (Section 12.4.4)	Moderate/ unknown
Reduced regional population viability	Severe	Incremental - moderate	KCS	Net benefit proposed.

The *EBPC Act*'s *Offsets assessment guide* (associated with the *Environmental Offsets Policy*) was used to inform the following table summarising the proposed offsets to be provided via the *KCS* relating to those threats listed above for which there is likely to be a residual impact.

Threat/impact	Residual impact from CC	*KCS* Response	Offset	Net outcome	Impact remaining
Loss of habitat	Moderate to severe	Habitat offset	Habitat restoration and improvement	Net increase in high-quality Koala habitat	Nil
Loss of ecological connectivity	Moderate to severe	Mitigation	N/A see table below.	Residual impact	Moderate
Vehicle trauma	Moderate	Mitigation	N/A see table below.	Residual impact	Minor
Koala disease (*Chlamydia*)	Unknown	Mitigation	N/A see table below.	Residual impact	Minor
Climate-change (drought and bushfire impacts)	Moderate	Habitat offset	Habitat restoration and improvement	No net change	Minor
Wild dog predation	Moderate/unknown	Mitigation	N/A see table below.	Unknown. Variable.	Moderate

12.1 Offsetting of residual impacts through indirect offsets

The table above indicates that several residual impacts remain if *KCS*-directed habitat offsets and mitigation measures are used to address mitigable threats, such as vehicle trauma. These are:

1. A net reduction in Koala habitat connectivity/creation of a significant barrier to movement of Koalas through the landscape;
2. An increase in the risk of vehicular trauma;
3. A possible increase in chlamydial disease impacts;
4. A reduction in local population resilience to climate-related impacts;
5. A possible increase in wild dog predation risk.

The table overleaf lists the direct and indirect *other compensatory measures* that the *KCS* proposes to compensate for the residual impacts not directly addressed by mitigation or offsets.

Threat addressed/benefit	*KCS* response	*KCS* component	EPBC offset type
Disease impacts	Veterinary management, chlamydial disease treatment	KTMPs, KTP	Direct, non-habitat
Chlamydial disease	Vaccination and support of vaccine research	*KTMP*s/*KTP*, financial contribution via ARC-Linkage grant	Indirect (*other compensatory measure*)
Population viability	Adaptive management response to measured and emergent threats to population viability	*KTMP*s, *KTP*, wild dog monitoring and control	Direct and indirect mitigation and offsets
Koala ecology and management	Intensive Koala population monitoring and management, in-kind support of bona fide collaborative research projects	*KTMP*s, *KTP*, PVA	Indirect offset (*other compensatory measure*)

12.2 Estimating the benefit of offset and mitigation measures

Other large Koala management programs involving intensive telemetric monitoring of large numbers of Koalas have provided enormous value in terms of refining and improving Koala conservation management approaches. Of particular note are the *East Coomera Koala Conservation Project* and the *Moreton Bay Rail Koala Management Program.* Both provided robust datasets on Koala responses to translocation at an

individual and population level, and both have contributed valuable datasets and biological samples to collaborating research projects, resulting in the publication of numerous scientific papers.

Both programs demonstrated either stability or growth in the Koala populations that were subject to management in surveys conducted some years after completion of those management programs. Both also delivered conservation benefits through comprehensive management that included disease control, dog control, and adaptive management as proposed in this *KCS.*

Use of the *EPBC Offsets assessment calculator* will assist in estimating the benefits associated with mitigation that seeks to reduce mortality, improve reproductive rates and provide high-quality habitat for Koalas. These outcomes, which the *KCS* seeks to deliver can be considered to be *direct offsets*, because they provide direct population viability benefits if implemented at a sufficient scale, to the impacted Koala populations.

13 *KCS* reporting and data storage

13.1 *KCS* monthly reports

The *KCS* Implementation Team will prepare monthly reports on *KCS* activities starting with the commencement of the *comprehensive Koala survey.* After commencement of the *KTMP*-1, the consultant engaged to perform the *KTMP*s and *KTP* will be required to submit to the *KCS* Implementation Team a monthly report detailing the *KTMP* activities for the month, including details of Koalas included and Koala deaths, injuries and illness.

13.2 Detailed or annual reports

The *KCS* Implementation Team will decide on the comprehensive reporting required in respect of key *KCS* activities (*KTMP*s and *KTP*) in due course. For example, whether detailed reports are required annually for those programs, or only at key milestones (such as completion).

13.3 Data storage

The *KCS* Implementation Team will require consultants engaged to perform the *KTMP*s or *KTP* to keep detailed datasets on all aspects relevant to the objectives, including (but not limited to) health, details of captures and releases, treatment, telemetry tags, adverse events, home-ranging behaviour and determination, deaths and cause-of death diagnoses.

As much as possible, these datasets should be recorded digitally and at the time of primary data collection to minimise data entry error and maximise efficiency. Key datasets must be provided to the *KCS* Implementation Team at monthly intervals, as well as a summary status sheet showing at least the following data:

1. Koalas currently alive in each program;
2. Total Koalas processed, i.e. Koalas alive, dead, removed from the programs;
3. Current Koala status (tagged, monitored, removed, dead, otherwise lost, in-care, etc);
4. Sex ratios (alive, total Koalas);
5. Reproductive datasets (dependent young, in-pouch, on back, near independent, etc);
6. Approximate age of joeys;
7. Total and breakdown of vet. exams conducted (full vet exam, tag check, necropsy, etc);
8. Deaths each month and cause of death diagnosis, Koala identity, sex;

9. All Koalas in program at end-of-month (names and status).

13.4 Adverse incident reporting

Adverse incidents involving Koalas that are subject to an AEC approval(s) must be reported promptly to the relevant animal ethics committee. This is a responsibility of the AEC approval holder. The *KCS* Implementation Team will require the contractor responsible for the delivery of the *KTMP*s and *KTP* to also provide incident reports to the *KCS* Implementation Team at the time of reporting to the AEC.

14 Risk analysis and management

There are several areas in which risk is inherent and for which specific risk analysis and management are warranted. These are:

1. Animal welfare;
2. Conservation/ecological;
3. Reputational risk to proponent and contractors;
4. Public relations;
5. Operational;
6. Financial;
7. Legislative/regulatory;
8. Workplace safety;
9. Public safety.

15.1 Control measures and evaluation

The following table summarises the control measures for each category of risk and the evaluative procedures that will occur for the duration of the Project.

Category	Examples of consequences	Key control measures	Evaluation/targets
Animal welfare	Koala death or serious injury	*KCS* implementation is by experienced and capable team, working at best practice standard.	Annual audit by *KCS* Implementation Team, plus usual AEC reporting requirements. (Incident reporting plus annual return)
Conservation/ ecological	Isolation of sub-population and localised extinction	*KCS* best practice and reviewed by independent expert	Annual audit/review of *KCS* implementation by TMR with respect to key metrics.
Reputation	Tarnished reputation due to manifestation of inadequately managed risk	Application of best practice methods by competent and expert Implementation Team.	Annual review by TMR of compliance with *KCS,* adverse events reporting.
Public relations	National or international adverse media attention	Carefully planned and proactive communications management with specific component for Koalas and wildlife management	At least 6 positive media releases per annum during *KCS* operational works, no adverse media attention.
Operational	Major interruption to works schedule	*KCS* carefully planned and compliance understood by all parties (TMR, construction contractor, contract administrator, etc)	Metrics and timeframes met as per Appendix 15. No significant delays to construction works due to *KCS* implementation.
Financial	Major budget gap leading to non-conformance	Adequate costing of *KCS* implementation prior to release of tender documents.	No budget deficit or change to *KCS* implementation due to budget shortfall, or unexpected cost. Independent audit of *KCS* financials by TMR deemed satisfactory.
Regulatory	Non-compliance and regulatory enforcement/penalty	All approvals and regulatory conditions understood and implemented by capable and expert *KCS* team. Annual audit of compliance with approvals.	Annual returns and regulatory reporting compliance. No non-compliance actions or penalties.
Workplace safety	Workplace death or injury e.g. during clearing operations	SWMS, JSEAs, certification, Construction Safety Management Plan, and compliance with state legislation.	No significant workplace injuries or incidents. Annual audits (internal) all satisfactory. No Worksafe Qld interventions or penalties.
Public safety	Death or injury - e.g. vehicle collision.	As for workplace safety, plus potential public safety risk actions approved by *KCS* implementation director with appropriate controls.	No significant public safety incidents. Annual review of risk management procedures for *KCS* implementation.

15.2 Trigger Action Response Plan

The *KCS-Trigger Action Response Plan* (TARP) outlined in Appendix 6 applies when significant adverse or potentially adverse situations ('triggers') arise or are detected that require adaptive management. These are triggers, such as the death of a Koala by preventable causes and/or events or circumstances that would, without intervention, result in an unacceptable risk to Koala welfare or life, and/or a significant impact on the Koala population or a part of it.

They are emergent threats that fall outside of the usual *KCS* expectations and management controls and require an adjustment to the management response. They may include major incidents that threaten Koalas (such as bushfire), major or repeated breaches of agreed protective protocols that threaten Koalas, and when the performance criteria or metrics for a particular action are not met.

15 Communications and public relations

Careful information and communications management is an important risk management approach for projects around which there is significant controversy or community concern. The risk associated with adverse public and stakeholder anxiety associated with how the CC project might impact Koalas can be mitigated by:

1. The development and implementation of a comprehensive and effective plan for managing risk to Koalas (what this KCS seeks to achieve); and
2. The open and transparent communication of the intent of the plan through active engagement with community and other stakeholders and a commitment to its full implementation.

15.1 Early engagement of key stakeholders

One of the exemplary approaches taken to deal with community anxiety about Koalas with respect to the Moreton Bay Rail (MBR) project was the early and ongoing engagement of key community stakeholders

(TMR, 2017). These stakeholders were given the opportunity to air their concerns, contribute ideas about what a Koala Conservation Strategy should include, and provide feedback on drafts of the Koala Conservation Strategy. Meetings of the community stakeholder group continued throughout the project at around 2-month intervals. During the pre-construction phase (under the *Koala Tagging and Monitoring Program 1*) the community stakeholder group was given presentations on the findings of the monitoring program, and monthly summary reports were published on the TMR website. Consequently, by the time of vegetation clearing and construction, the stakeholder group was well versed in the methods being applied and confident in the program's ability to protect Koalas.

Given the success of that approach on the MBR project, the Coomera Connector project will apply a similar approach by:

1. Early engagement with key stakeholders;
2. Establishment of a key stakeholder representative group (KSRG);
3. Establishment of a set of rules for the KSRG interaction with the TMR;
4. Provide an opportunity for the KSRG to contribute ideas on key aspects/features of the *KCS* and its implementation;
5. Given the KSRG an opportunity to comment on the draft *KCS;*
6. Establish a schedule for regular updates on *KCS* development and implementation for the KSRG.

15.2 Broadcast, print and social media engagement

Regular media posts/stories associated with *KCS* development and implementation will help to show transparency in respect of Koala protection and conservation. Aside from the general community benefits of such an approach, it will also mitigate the risk/consequences of adverse publicity that is likely to occur at some stage on a project such as the CC, because of the significant risk of harm to Koalas.

Early development and commencement of a communications strategy relating to Koalas and other environmental issues that might arise during the planning and construction phases of the project, is essential to managing risk and gauging community sentiment around those issues.

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Appendix 1A Coomera Connector Stage One (1) Comprehensive Koala Survey Report

Coomera Connector (Stage 1)

Comprehensive Koala Survey

Document control

Version	Date delivered	Authors	Authorised
D1	6 Nov 2020	Deidré de Villiers, Amy Robbins	JJH

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Executive summary

The *comprehensive koala survey* represents the first major body of work directed by the *Coomera Connector Koala Management Plan (CC-KMP) Version 1*. The *CC-KMP* is a dynamic document that is updated at the completion of each major body of work or as otherwise required to ensure that the Plan is current and relevant. As such, this *comprehensive koala survey* report will form a component of the CC-KMP Version 2.

Comprehensive koala surveys were conducted in August-September 2020 within and adjacent to the Coomera Connector (Stage 1) in koala management areas (KMAs) defined in the Coomera Connector *Koala Management Plan*. The aim was to determine the distribution and abundance of the local koala population and the numbers of koalas likely to be affected by habitat clearing and construction works for the road project. A secondary aim was to assess the prevalence of disease and reproductive status of populations in the search areas.

Representative strip transects or all-of-area patch searches of vegetation were conducted by a team of highly experienced koala surveyors in 17 KMAs along the Stage 1 project corridor. Almost 700 hectares was traversed over 25 days, resulting in the detection of 77 koalas. Detection probabilities and the amount of available habitat in each KMA was used to determine that there were between 99 and 204 koalas living in the koala habitat within the delineated Stage 1 KMAs (including buffer zone). The variation in those figures was due to the application of a detection probability, with the higher number accounting for a detection probability of <1.

In addition, a meandering strip transect search of habitat in and around the *Pimpama River Conservation Area* (TKMA1 - a potential offset/translocation recipient site) resulted in the findings of koala scats, scratches and remains of deceased animals, but no live koala detections. The survey area represented approximately 5% of the total koala habitat and excluded lots for which permission for survey access was not granted by the owners. Given the high apparent suitability of this area as both an offset site and translocation recipient site, and the recent progress of a compulsory acquisition process by CoGC, this is a high priority for investigation as part of the *Koala Translocation Program* (KTP) directed by the CC-KMP.

Threat mitigation, disease management, habitat enhancement and translocation will be among a suite of management actions required to ensure the health and viability of koala populations impacted by construction and operation of the Coomera Connector motorway. Approximately 60 koalas will be directly impacted by the disturbance footprint and will require careful monitoring and active management. Of these, approximate 40 may require capture and translocation to safe habitat of secure tenure at translocation recipient sites. The remainder will require varying degrees of *in situ* management, including assisted dispersal into adjacent suitable habitat. Approximately 18 koalas will require close monitoring during construction and operation but are unlikely to require translocation or assisted dispersal.

Several sites encountered during the comprehensive koala survey provide opportunities for habitat offsetting and as potential koala translocation recipient sites. These include KMAs 3 and 4 (currently owned by CoGC), the Helensvale Golf Course (currently owned by CoGC) and habitat and unforested land delineated by TKMA (EC) which is owned partly by CoGC and partly under private ownership. The *McCoys Creek Wetland*, *Coombabah Lakelands* and CoGC-managed reserves near the eastern extent of Colman Road in East Coomera, are sites that might be suitable as recipient sites for translocation of small numbers (<6) of individuals, subject to survey findings and populations trends and negotiation with CoGC.

Given the finding of approximately 40 koalas that will almost certainly require translocation, the next body of work required under the *KMP* will be determining the threat profiles and additional carrying capacity of likely translocation recipient sites. This will require close consultation and collaboration with relevant CoGC officers, the primary external stakeholder in the local management of koalas. The accelerated CC construction timeframes consequent to the recent Qld election result and pre-election commitments by the State Government, make this a high priority action for immediate implementation.

1. Introduction and background

The Logan City and City of Gold Coast areas of south east Queensland are undergoing rapid development due to an expanding population. Existing road transport infrastructure between Loganholme and the Gold Coast is becoming overwhelmed, leading to congestion issues on the main arterial road linking Brisbane and the Gold Coast, the M1 motorway. The Coomera Connector (CC) is an approximately 45 km arterial road designed to supplement existing road transport infrastructure between Loganholme and the Gold Coast and alleviate congestion on the M1 motorway. It is planned to run parallel to, but east of, the M1 motorway, and is likely to be constructed in two stages: Stage 1, Nerang to Coomera; and Stage 2, Coomera to Loganholme.

Koala populations in the Logan City and City of Gold Coast areas of south east Queensland, as well as more broadly, are undergoing declines due habitat loss and fragmentation, disease, anthropogenic and climate-related threats. Recent koala surveys in the gazetted alignment of the Coomera Connector project identified important remnant koala habitat, supporting a significant number of koalas. Consequently, the CC project has developed a *Koala Management Plan (KMP)* to direct a holistic suite of actions aiming to minimise or avoid risks to koalas, thereby complying with the provisions of the federal *Environment Protection and Biodiversity Conservation Act 1999* and addressing community expectations regarding the protection of koalas from harm.

1.1 The Coomera Connector *Koala Management Plan*

A *Koala Management Plan* (KMP) for the CC project was developed to guide the implementation of a comprehensive suite of measures that seek to avoid harm to individual koalas, minimise and mitigate impacts on population viability, and provide compensatory benefits that lead to demonstrable improvements in koala conservation both locally and regionally. The Plan gives due regard to compliance with the legislative and regulatory framework, but also ensures that community expectations are met regarding animal welfare and the imperative to effectively conserve koala populations. The *comprehensive koala survey* was the first major operational deliverable directed by the *KMP*.

1.2 Previous koala surveys

Koala surveys of the East Coomera and Parkwood-Coombabah areas were conducted and reported by Biolink (2017). The East Coomera survey resulted in an estimated koala density of 0.34 koalas per hectare (based on SAT-sited area search) and 0.47 koalas/ha (based on strip-transect searches). Observed disease prevalence was 22% with both cystitis and conjunctivitis cases recorded. The male : female ratio was 1:2. Joeys were observed with 30% of females. The Parkwood-Coombabah survey resulted in a koala density estimate of 0.23 koalas/ha based on combined SAT-sited/transect search data. Two of 30 (7%) koalas observed had overt signs of chlamydial disease and the male : female ratio was 4:5. Joeys were observed with 40% of females.

Planit conducted fauna surveys for the Coomera Connector project in 2019 and 2020 during which time 68 koala sightings in the project footprint and adjacent areas were recorded. Sixteen (16) sightings were made during transect searches specifically for koalas, with the remainder made during non-targeted ecological surveys and incidental observations. Accurate density data are not available, and some of the observations are likely to have been multiple observations of individuals at different times.

2. Aims and objectives of the *Comprehensive Koala Survey*

The primary objective of the *comprehensive koala survey* was to determine the number and distribution of koalas likely to be affected by the CC project, as well as inform design, costing and management actions directed by the CC-KMP (Objective 11 of the CC-KMP).

The specific aims of the comprehensive koala survey were to:

1. Estimate, with reasonable accuracy, the number of koalas inhabiting bushland remnants within each of the koala management areas (KMAs);

2. Provide an estimate of koala density and number in potential offset sites and potential translocation recipient sites, as well as an estimate of the available carrying capacity in potential translocation recipient sites (TKMAs);

3. Make a preliminary assessment on the health and demographic status of koalas in the KMAs, as much as is practical within the constraints of an observational survey;

4. Inform changes to, and review of, the *KMP*;

5. Inform cost estimates for bodies of work recommended by the *KMP*.

The report of the *comprehensive koala survey* (this document) will be appended to the *CC-KMP Version 2*, which will be updated to reflect relevant information derived from the survey. The CC-KMP should be seen as a dynamic document that is updated to include current and/or improved knowledge and methods over the multi-year life of the project, with KMP-directed activities similarly updated and improved to ensure that koala protection and conservation outcomes are optimised.

3. Methods

3.1 Site characteristics

Koala surveys were conducted in koala habitat within the City of Gold Coast local government area. The search sites were delineated by the koala management areas described below, and outlined in the appendices to the Coomera Connector Koala Management Plan (V1.4). Habitat types varied from predominantly cleared agricultural and urban landscapes to regrowth and remnant, eucalypt-dominated vegetation and *Melaleuca quinquenervia*/*Casuarina glauca*-dominated coastal forest and wetland. Regional ecosystem types occurring in the KMAs are summarised in Appendix 2 of the CC-KMP (V1.4).

3.2 Time of year

Comprehensive koala surveys were conducted over five consecutive weeks during August and September 2020. This time of year corresponds with generally mild weather conditions and lower chance of rainfall, which assist fieldwork and koala detection rates. It also occurs within the koala breeding season, during which time koalas are more active and generally more visible, and the presence of large, dependent young makes estimation of reproductive activity and population health more reliable.

3.3 Search polygons

Factors that were considered when creating search polygons of Koala Management Areas (or KMAs) for koala surveys were proximity of suitable koala habitat within and adjacent to the proposed footprint of stage 1 of the CC project, historical koala sighting and hospital admission records, habitat type and availability, and stakeholder objectives. As much as possible, the KMAs were delineated in a way that was consistent with the intent and specifications of the *EPBC Act* and its various policies and policy statements. Consequently, they included habitat (and koalas) that were likely to be directly and indirectly impacted by the construction and operation of the CC project.

Eighteen KMAs were delineated and surveyed for Stage 1 of the CC project by reference to aerial imagery using the Queensland Globe (Qld Government) and Google Earth® websites. These polygons included 17 KMAs spanning the Coomera Connector project footprint (Stage 1 plus a buffer zone overlapping Stage 2 in the north) and one potential translocation recipient site (TKMA-East Coomera). The KMAs are shown in Appendix 10 to the CC-KMP (V1.4) and also in Appendix 1 to this report. The total area covered by the searched KMAs (1-17) for Stage 1 (including northern buffer zone) of the CC project was approximately 1144 ha.

Although the proposed Stage 1 project terminates in the north at Oakey Creek Road (East Coomera), and therefore spans KMAs 1 to 13, a 'buffer zone' which included KMAs 14-17 were also surveyed, consistent with the project's *EPBC Act* referral.

3.4 Classifying koala habitat

Areas within each KMA were classified as vegetation that was likely to support koalas or areas that were not likely to support koalas. The presence and density of eucalypt species of a sufficient size was considered to be the minimum requirement for vegetation to be classified as likely to support koalas. Habitat within each KMA that was classified as not likely to support koalas, such as RE 12.1.1 (*Casuarina glauca* woodland), was not searched as part of the *comprehensive koala survey*. Habitat and non-habitat areas, and surveyed areas were delineated and measured using tools on the *QldGlobe* website and *ArcGIS* application.

3.5 Survey methods

Two survey methods were used to estimate koala distribution and abundance during the comprehensive koala survey (See also Appendix 2). Strip transects, covering the entire habitat patch, were used to search the majority of habitat within KMAs. Representational stratified transects, encompassing different habitat types within the KMA, were used to search large habitat patches where strip transects were not practical due to logistical and resourcing constraints.

Transect orientation within the habitat patch was determined by the size and shape of the KMA, landscape features and manmade structures (such as the presence of watercourses or roads), and the number of surveyors. Vegetation types within the habitat patch (RE classifications) were also considered for representational stratified transects. Each transect encompassed two KMA boundaries.

During transects, surveyors were organised in a linear fashion and progressed through the habitat patch on essentially parallel trajectories while maintaining a set distance between each surveyor. The distance between each surveyor varied between 5 m and 20 m and was determined by the vegetation characteristics. That is, in dense vegetation, surveyors were more closely spaced, whereas in more open vegetation with easy visibility surveyors were spaced more widely. This approach attempted to account for differences in the type and density of vegetation, to provide a more accurate estimate of detection probability while still maintaining survey efficiency.

Surveyors scanned the trunk and canopy of trees within and adjacent to the search transect with both the naked eye and binoculars to detect the presence of koalas. Concurrently, surveyors observed and noted signs of koala activity by inspecting the trunks of trees for koala scratch marks and the ground under trees for koala scats.

3.6 Data collected

Each surveyor carried a hand-held GPS device to record their GPS track for each search transect. At the beginning and end of each search transect, the following data were recorded:

1. Start time and date;
2. Number of surveyors;
3. Weather conditions (ambient temperature, % cloud cover, wind, rain);
4. Start and finish GPS coordinates (two points, or point plus transect width, for transect surveys);
5. End time;
6. Estimated detection probability ($0<p_{[e]}<1$).

When a koala(s) was detected, the following information was recorded at the time of detection:

1. Time and date of koala detection;
2. GPS location of koala;
3. Apparent health status of koala;
4. Sex of koala (M, F, or not determined);
5. Whether a joey is present (no joey observed, pouch young, back young, near independent (off mother));
6. Tree species and diameter at breast height (DBH);
7. Tree height and koala height in tree (m);
8. Weather conditions (ambient temperature, % cloud cover, wind, rain);
9. Distinguishing features of koala.

Data were recorded in a customised koala management database (Ko-Dat) based on the FileMaker® application platform.

3.7 Detection probability

At the conclusion of each search transect, each surveyor estimated a detection probability for the transect. This was made by consideration of a variety of factors, including, but not limited to the density of the vegetation, weather conditions, terrain and surveyor factors, such as fatigue. Weather conditions that might impact the detection probability are the presence of rain, quality of light and strength of wind. Surveyor factors that might impact the detection probability are the experience of the surveyor, the speed with which the transect was completed, and the level of fatigue. The detection probabilities estimated by each surveyor were then averaged to calculate a detection probability for the search transect. The detection probability ($p_{(d)}$)was a number between zero and 1 ($0< p_{(d)}<1$) where a detection probability close to one indicated a very high likelihood of all koalas present in the search area being detected, and a low detection probability, applied in very dense or difficult vegetation/habitat, corresponding to a very low likelihood of detecting all koalas present.

As a guide, the following detection probabilities measured during the Moreton Bay Rail project using known koala density/abundance (TMR 2017) were used: dense vegetation 0.17; mixture of dense and less dense open and closed forest 0.5; open forest 0.72. These figures relied upon a highly experienced koala survey team working in ideal conditions.

3.8 Estimating koala abundance and density

Measured koala abundance was calculated from the total number of koalas detected in each search transect within the KMA. If search transects within a KMA occurred on different days, the sex, age and distinguishing features of the koala, as well as koala home range sizes reported in similar habitat types, were used to determine whether detected koalas represented previously detected individuals. GPS tracks from each surveyor were analysed to calculate the total area surveyed within the KMA. These parameters were then used to calculate the *measured koala density*, and the estimated detection probability was applied to generate an *estimated koala density*. Finally, the total area of koala habitat in the KMA was used to determine the *estimated koala abundance* within the KMA.

The formulae used to calculate koala abundance and density in each KMA or TKMA are as follows:

$\boldsymbol{d_{[m]} = k/a}$ where $d_{[m]}$ is the measured density of koalas in *koalas/ha*
k is the number of koalas found in the survey plot(s) or transect(s)
and *a* is the total area in hectares surveyed

To account for a detection probability of <1, the estimated density $\boldsymbol{d_{[e]}}$ is calculated as follows:

$\boldsymbol{d_{[e]} = d_{[m]}/p}$ where *p* is the estimated detection probability for that survey.

The estimated abundance (number) of koalas (total koalas estimated to be living in that patch) is calculated thus:

$N_{[e]} = d_{[e]} \times A$ where $N_{[e]}$ is the estimated total number of koalas

and A is the total area of koala habitat in the surveyed patch or KMA/TKMA.

3.9 Sick koalas

During the comprehensive koala survey, koalas with overt signs of disease were detected. If koalas with overt signs of disease were deemed to be suitable for capture, based on safety and welfare concerns, a capture attempt was made by EVE's experienced koala capture team. If a koala with overt signs of disease was deemed to be unsuitable for capture or a capture attempt had to be aborted, the koala was located each day until the capture could successfully be completed. Captured koalas were transported to EVE's veterinary facilities at Toorbul for a thorough veterinary assessment under anaesthesia. If a koala was deemed to be suitable for treatment, based on welfare concerns (such as severity of disease and long-term prognosis), the koala was admitted for treatment. If a koala was deemed to be a poor candidate for treatment, based on welfare concerns, it was euthanased prior to recovery from anaesthesia.

3.10 Regulatory approvals

The Coomera Connector comprehensive koala survey was conducted under animal ethics permit CA 2019/04/1278, issued by the Animal Ethics Committee of the Queensland Department of Agriculture and Fisheries, and Scientific Purposes Permit issued by the Queensland Department of Environment and Science.

4. Results

4.1 Koala abundance and density

The surveys detected 77 individual (i.e. not repeat-counted) koalas residing within and adjacent to the proposed Coomera Connector road corridor. Surveys involved a team of up to five personnel over 25 days searching approximately 700 ha of land varying from intact bushland to highly fragmented and mostly cleared vegetation on rural properties. Koalas, or signs of koala activity, were detected at nearly all KMA survey sites including those in which live koalas were not detected. In only KMA-1 were signs of koala use not detected. Incidental signs of the presence of koalas included scratch marks on smooth-barked tree trunks, faecal pellets beneath tree canopies, detecting the unique scent of koala urine, or whole or partial remains/skulls of koalas. KMAs at the southern extent of the road corridor at Nerang had low abundances/no koalas detected (KMAs 1 and 2), while koalas were in high abundance at sites at the northern end of Stage 1 around Coomera. Table 1 (overleaf) summarises the survey data and calculations for each KMA. Aerial images overlaid with koala detection data are contained in Appendix 1.

Koala densities in habitat patches ranged from 0 koalas/hectare to over 1 koala /hectare; the latter typically in patches where small corridors of vegetation remained in a relatively fragmented landscape. The minimum and maximum average density range across all sites was 0.15 (observed koalas) - 0.26 (estimated based on detection probability estimate) koalas/ha, with an abundance of 99 (not accounting for <1 detection probability) to 204 koalas estimated (based on detection probability) to reside within the KMAs. The Coomera KMAs were estimated to contain the most koalas, with around 94 (almost half) of the koalas in KMAs 12-17. The highest density of koalas in a KMA was in KMA10(a) (section to the north of Ridgevale Drive) was 0.81 koalas/ha.

There was a noticeable difference in the prevalence of disease in koalas to the north and south of the Coomera River. All sick koalas (n=6) were found in KMAs in the Coomera region. Three females had a combination of diseases that led to the poor prognosis for treatment and the euthanasia of these animals, with a combination of cystitis and/or conjunctivitis and reproductive disease. Three males all had conjunctivitis and were successfully treated and returned to the wild. There was also a corresponding difference in the fecundity of female koalas north and south of the Coomera River. Surveys were conducted at a time of year when joeys were approximately 6-9 months old and were visible as large bulges in the pouch or out of the pouch with their mother. Fecundity of female koalas can be an indicator of the health and fitness of the population, in lieu of veterinary assessment to determine reproductive status (fertility/infertility). There was a noticeable difference in the reproductive rates of females - 71% (17 out of 24 females with young) had young in KMAs south of the river, and north of the river was 21% or 3 out of the 14 females spotted during surveys.

Eleven koalas were detected at the Helensvale Golf Course (0.68 koalas/ha), 8 females and 3 males. Of the female koalas, 88% (7/8) had joeys, indicating that this population has a high reproductive rate and is likely to be healthy.

KMA	Area (ha)	Total koala Habitat (ha)	Koala habitat surveyed (ha)	Prop. of habitat surveyed	Estimated detection prob.	Koalas sighted #	Estimated koalas in surveyed area (corrected for detection probability)			Tot. koala abundance in each KMA based on amount koala habitat in each KMA	
							Min	Max	Density	Min	Max
1	83.8	0.9	0.9	1.00	0.85	0	0	0	0.00	0	0
2	16	6.6	4.5	0.69	0.4	0	0	1*	0.22	0	1
3	24.2	12.6	10.5	0.83	0.58	0	0	2*	0.19	0	2
4	59	40.4	38.3	0.95	0.54	7	7	3	0.08	7	14
5	47.9	38.7	28.2	0.73	0.58	2	2	3	0.11	3	5
6a	31.6	31.6	31.5	1.00	0.592	3	3	5	0.16	3	5
6b	13.3	9.6	4.7	0.49	0.5	0	0	1*	0.43	0	3
7a	58	30.8	30.8	1.00	0.59	5	5	8	0.26	5	8
7b	93.8	84.9	43.8	0.52	0.583	1	1	2	0.05	2	3
8	28.6	7.2	5.5	0.76	0.7	0	0	1*	0.18	0	1
9	35.1	18.8	18.1	0.96	0.7	5	5	7	0.39	5	7
10a	81.8	12	11.9	0.99	0.7	6	6	9	0.76	6	10
10b	48.4	16.0	16.0	1.00	0.8	11	11	14	0.88	11	14
11a	9.42	5.6	5.6	1.00	0.8	4	4	5	0.89	4	5
11b	184	46.0	10.4	0.23	0.425	1	1	2	0.19	4	10
12	188	36.8	31.9	0.87	0.65	1	1	2	0.06	1	2
13	238	103.5	102.1	0.99	0.61	12	12	20	0.20	12	20
14	93	69.8	59.7	0.86	0.51	4	4	8	0.13	5	9
15a	107	63.0	24.3	0.39	0.525	2	2	4	0.16	5	10
15b	46	41.7	27.6	0.66	0.35	5	5	14	0.51	8	22
16	96.9	73.0	35.4	0.49	0.61	5	5	8	0.23	10	17
17a	50.3	42.3	19.6	0.46	0.575	3	3	5	0.26	6	11
17b	142	37.3	23.0	0.62	0.4	0	0	2*	0.09	0	3
TKMA (EC)	723	477.9	23.7	0.05	0.667	0	0	1*	0.04	0	20
Totals	**2499**	**1315**	**615**	**Av. 0.73**	**Av. 0.60**	**77**	**78**	**138**	**0.22**	**99**	**204**

Table 1: Summary of koala observations data and abundance estimates by KMA

Only independent animals were counted

*Note – where no koalas were found (negating further calculations of koala estimates based on the detection probability), a maximum number of koalas thought to occupy the site was derived from supporting evidence such as property owner advice and/or degree of indirect evidence of koalas in the area.

4.2 Koala movements

Three adult male koalas were captured within the road corridor after being observed with chlamydial disease (kerato-conjunctivitis) during surveys. These animals (koalas *Theo, Joshua* and *Jacob*) were successfully treated at the Endeavour Veterinary Ecology veterinary facilities at Toorbul, then released back to their respective habitat areas. Telemetry tags were fitted to permit post-release monitoring using the *K-Tracker* koala telemetry system. Examples of the outputs of the telemetry system accessed via the internet are shown below. The *K-Tracker* system provides a near-real-time remote monitoring solution that facilitates the monitoring and management of large numbers of koalas concurrently.

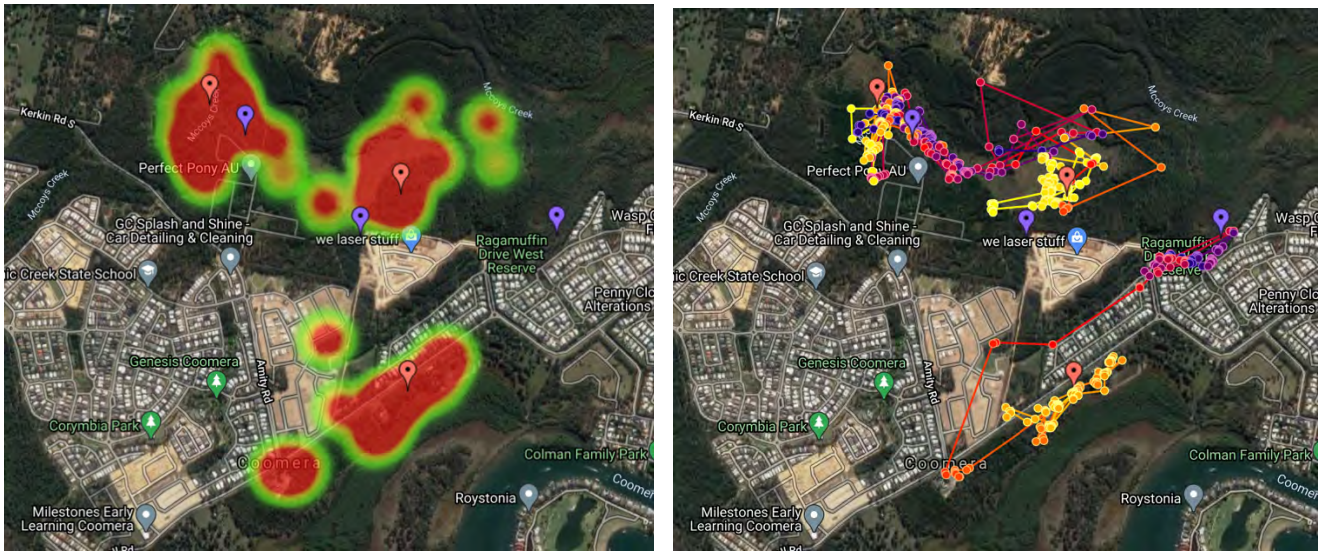


Figure 1: Indicative ranging of the koalas *Jacob, Joshua* and *Theo* in clockwise arrangement starting at the top left. Left image shows the 'heat-map' view of indicative home range, and the right image shows movement paths and GPS fixes.

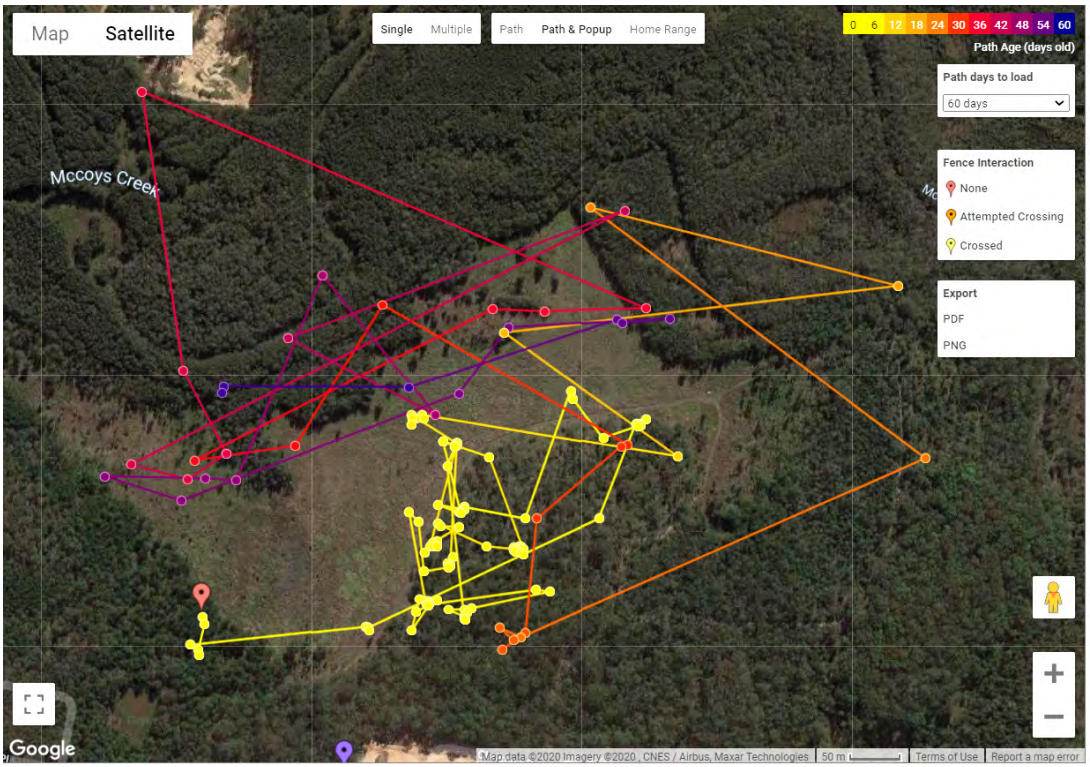


Figure 2. Koala Joshua's movements in and around a large patch of koala habitat rehabilitation.

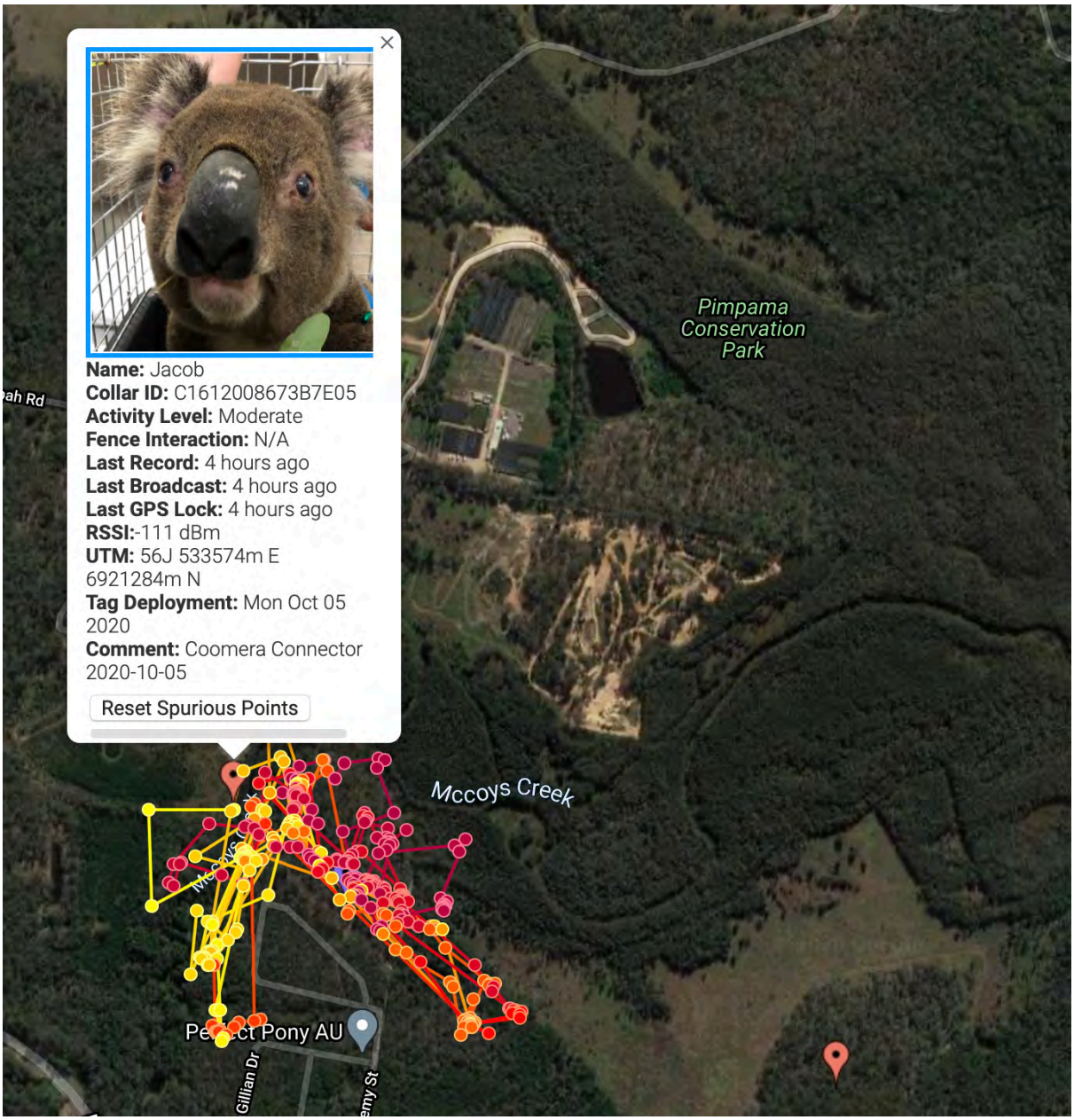


Figure 3: Movements of the koala *Jacob* over the 2 months spanning September-October 2020

5. Discussion

5.1 Key findings

The *comprehensive koala survey* provided an assessment of the distribution, health and fecundity of koalas residing in and around the Coomera Connector road corridor. These data are graphically displayed in Appendix 1.

The results of the survey are generally consistent with those conducted in the region in the last few years. Koala abundance and distribution and relative densities are consistent with the findings of Biolink (2017) and Planit (2020). The key findings are that 77 koalas were observed during the systematic survey throughout the 17 KMAs surveyed, resulting in an estimated number (corrected for a <1 detection probability) of 204 koalas. There were 34 males, 41 females and 2 koalas of indeterminate sex. Six koalas showed overt signs of chlamydial disease, and all were in polygons north of the Coomera River. There were 20 dependent young observed, leading to an observed fecundity of 49%. North of the Coomera River, only 2/15 (13%) females had dependent young, whereas 18/26 (69%) females observed south of the Coomera River had dependent young.

The *comprehensive koala survey* was the first major body of operational work directed by the Coomera Connector KMP. It is important to note that the survey results represent the findings at a moment in time; koala populations are dynamic and subject to a range of factors that can cause populations to increase or decrease, sometimes dramatically. Chlamydial disease, climate and weather extremes and anthropogenic threats can have additive effects that drive populations and subpopulations towards localised extinction. This conflagration of effects may be significantly impacting koalas in habitat remnants in East Coomera, but seems to be affecting other subpopulations, such as those on the Helensvale Golf Course and other areas of KMA10, and the sub-population in KMA4 to a lesser degree. An anecdote provided by a community stakeholder in the East Coomera area suggested a localised decline in the koala population in recent years.

5.2 Chlamydial disease

The prevalence and severity of chlamydial disease varies between geographically separated koala populations. The most common clinical manifestations of chlamydial disease in koalas are ocular disease (conjunctivitis/keratoconjunctivitis) and urogenital disease (cystitis (bladder inflammation) and/or reproductive tract disease). Conjunctivitis/keratoconjunctivitis and cystitis produce overt clinical signs, inflamed tissue around the eyes and ocular discharge, and a damp, urine stained rump, respectively, and can therefore, in a high proportion of cases, be detected during field surveys. Although reproductive disease can render koalas reproductively sterile, it may not produce overt clinical signs, leading to significant underestimation in observational surveys, such as this one. Consequently, reproductive disease is rarely detected during field surveys, and the absence of a joey may be the only indication that a female koala is affected. During the surveys, all six koalas with confirmed chlamydial disease occurred north of the Coomera River and the apparent low reproductive rate is consistent with a high prevalence of chlamydial disease.

Chlamydial disease can be a significant threat to fragmented, at-risk koala populations (such as those in this study). Consequently, chlamydial disease dynamics are an imperative consideration for population management and recovery programs in south east Queensland, and, in the context of the Coomera Connector project, provide an opportunity for meaningful non-habitat offsets or non-habitat *other compensatory measures*, as defined in the *EBPC Act* offsetting guidelines.

5.3 Habitat suitability and connectivity

Habitat quantity and quality in the KMAs varied considerably – some areas were largely cleared of vegetation apart from remnants associated with the project footprint. Other areas had abundant habitat adjacent to the corridor, providing alternative habitat for any koalas displaced by construction of the road. As such, the mitigation of impacts to koalas during vegetation clearing operations will need to carefully address site specific constraints to the safe movements and relocation of koalas.

In this survey koala density and abundance *did not* necessarily correlate with high-quality large patch sizes, and in contrast, higher densities were observed in highly modified and constrained areas, such as the remnant strips of koala habitat in the CC alignment as it passes through Helensvale. This apparent paradox is probably due to significant constraints to dispersal in those areas in combination with a very low prevalence of chlamydial disease.

Appendix 2 outlines the requirements for koala management by KMA, based on the quality, connectivity, size and present threats impacting remnant koala habitat in the area. In some KMA, such as KMAs 5, 6, 7 and 8, there are limited routes for safe dispersal of koalas and highly constrained local context with roads and urban development creating significant risks. In contrast, KMA10 (adjacent to the Coombabah Lakelands conservation reserve has apparent extensive connectivity with vegetated habitat, but much of it is unsuitable for koalas, and provides limited practical dispersal opportunities.

In short, koalas living within KMAs and subject to risk associated with the construction and operation of the CC project will be effectively managed in four ways:

1. Translocation to safe, secure habitat (applicable to koalas with little or no prospect of safety if left *in situ*);

2. Assisted dispersal to adjacent safe habitat (applicable to koalas for which localised displacement into remnant habitat does provide a reasonable prospect for persistence *in situ*);

3. Koalas monitored closely and moving of their own volition into suitable adjacent habitat in response to vegetation removal;

4. Koalas close to, but not directly impacted by construction or operation of the project, but subject to close monitoring during operational (construction) works and early operational phase.

There is an obvious need for the translocation of some koalas where either: 1. No adjacent habitat exists outside the road corridor; 2. Limited avenues for safe and successful dispersal to other adjacent habitat exists; or 3. Adjacent sites are at capacity and animals may be further displaced if relocated locally. This is plainly evident in a few of the Coomera KMAs where koala numbers have remained high, even with the past intensive management and translocation of koalas to sites west of the freeway during development of the Coomera Town Centre. These densities may be artificially higher due to development pressures and habitat loss in the region resulting in higher abundances of koalas in the remaining habitat, much of which lies within the road corridor.

5.4 Survey limitations

Koalas are a cryptic species that can be hard to detect in the canopies of trees. Previous studies in south east Queensland have determined that koalas are missed, even when highly experienced

observers are conducting searches. Habitat and vegetation factors significantly affect koala detection probability. Detection probability can be as low as 0.17 (17%) in dense vegetation communities. Because of the significant variability in detection probability throughout the survey area from patch to patch, we felt that the application of estimated detection probabilities for each patch or transect was important to improve accuracy, and was a superior method than methods that apply averaging and confidence interval estimation to account for detection probabilities of less than 1.

The average detection probability across all sites in the comprehensive koala survey was 0.6. This implies that an experienced koala survey team, concentrating entirely on finding koalas is likely to miss 40% of animals, on average. This figure, although as an average not useful in terms of estimating abundance, indicates the importance of applying telemetric methods to facilitate the monitoring and protection of koalas during vegetation clearing. This concept and approach is outlined in the sections of the CC-KMP that deal with managing risk to koalas during vegetation clearing operations.

6. Management recommendations

6.1 Koala habitat revegetation

There are several areas of cleared or degraded habitat within the KMAs that may be suitable for revegetation to enhance local quality, extent and connectivity. The following table shows indicative areas in relevant KMAs which might be suitable for revegetation and could contribute to offsetting obligations, subject to landholder/stakeholder approval and tenure suitability.

KMA	Area available (ha)	Comment
KMA-3	6.4	Very limited connectivity except with KMA-4 through culvert. Would need fencing along M1 to be suitable for support of the local koala population.
KMA-4	5.7	Important remnant koala population present. Area available for revegetation may be increased if CC footprint is less than project boundary. May provide valuable translocation recipient site for Smith St interchange koalas.
KMA-7	6.2	Important riparian habitat corridor along Coombabah Creek. Opportunity to add to revegetation works conducted by CoGC in that area. Available area may be more than indicated. Climate-change associated sea-level rise may make some areas unsuitable in the longer term.
KMA-7 to KMA-8	12.3	Opportunity to enhance north-south connectivity along Coombabah Creek adjacent to new development, but long-term issues with sea-level rise. Additional areas to the eastern extent of KMA-8 may also be available.
KMA-9	1.7	Enhancement of habitat in Careel Reserve may assist in providing additional habitat for koalas remaining in the area around the intersection of CC and Brisbane Rd/GC Hwy. Limited connectivity and high-risk context.
KMA-10	20 (approx.)	Helensvale Golf Course and open space to the north provides a large area of potential new/enhanced habitat currently supporting a health koala sub-population, and possibly suitable for translocation of koalas from other areas in KMA-10 (north and south of Ridgevale Drive).
TKMA(EC)	91	Large area of paddock in multiple lots along Green Meadows Rd and subject to compulsory acquisition process by CoGC provides the priority site for revegetation and translocation of koalas.

Revegetation works are recommended to improve the carrying capacity of a number of the KMAs and the TKMA. In particular, the survey identified that KMA3 and KMA4 could be suitable offset sites, provided appropriate koala fencing and crossings are installed. Extensive revegetation to the east of KMA16 and KMA17, extending into the TKMA, would also provide a significant area of koala habitat that could contribute to koala habitat offset delivery. The existing revegetation in KMA7 and KMA13 should be supplemented, particularly in the Arundel Wetlands and adjacent to Oakey Creek. Revegetation would also be beneficial in keys areas of the Helensvale Golf Course and in the Careel Reserve Park in KMA9 to support a healthy and likely increasing local koala population.

6.2 Translocation

The observed difference in the prevalence of chlamydial disease between the koala populations occurring north and south of the Coomera River suggests that the Coomera River might be acting as a geographical barrier, either protecting the koala population south of the Coomera River from the introduction of more severe chlamydial strains or resulting in the evolution of increased chlamydial disease resistance in these koalas. It will be important to carefully consider and manage risk associated with translocation of koalas across this natural geographic barrier, and *Chlamydia* genotyping might be warranted to avoid the spread of highly pathogenic strains, or exposure of translocated koalas to highly pathogenic strains endemic in the populations north of the Coomera River.

Findings from the *comprehensive koala survey* indicate that TKMA(EC) at East Coomera, which was delineated to encompass the Pimpama River Conservation Area and the Pimpama Conservation Park, could be a suitable recipient site for koalas that require translocation. The immediate capture, tagging and longitudinal monitoring (for at least 6 months) of resident koalas at this site is recommended to assess the health of this sub-population and allow for a more accurate estimation of the number of donor koalas that the site could support as well as present risk profiles (such as level of wild dog predation and chlamydial disease). Longitudinal monitoring of resident koalas and active predator surveillance will assist in defining the threat profile at the site, informing management interventions that might be necessary prior to the introduction of translocated koalas. This component of work, detailed in the CC-KMP as the *Koala Translocation Program* (KTP), will also provide baseline data by which the success of the translocation program can be assessed. The carrying capacity of this site has the potential to be significantly increased with revegetation works. This should be commenced as soon as possible, subject to the acquisition of the site by the CoGC and their approval of it as an offset and/or translocation recipient site for the CC project.

An appropriate recipient site for koalas displaced from around the Smith Street interchange area could be KMA-4, given its existing koala population and capacity for revegetation, subject to landholder (CoGC) approval. Although there is virtually no connectivity with large areas of habitat to the west of the M1, the area has the potential to be managed as a viable koala population, albeit one that is likely to require future management of dispersal and immigration.

Coombabah Lake Conservation Park, as well as the Nerang State Forest and Nerang National Park, as a translocation recipient site (for koalas from KMA8, the linear part of KMA9, KMA10 and KMA11) warrants further consideration and discussion with CoGC as options. Coombabah Lakelands Conservation Area may be suitable for translocations of a small number of koalas, but this would be subject to discussion and approval by CoGC. It is significantly constrained geographically, causing it to be essentially quite isolated. Like KMA-4 it supports an important and viable koala but one which will require ongoing active management of dispersal and immigration.

KMA	Max no. Koalas in KMA	Estimated koalas in CC footprint (Stage 1)	Koalas that may require assisted dispersal to adjacent habitat	Koalas requiring translocation to alternative habitat	Koalas requiring close monitoring adjacent to the clearing footprint
1	0	0			
2	1	1		1	
3	2	N/A			
4	14	2			6
5	5	5		5	
6a	5	6		6	
6b	3	3		3	
7a	8	2	2		5
7b	3	N/A			
8	1	1		1	
9	7	5		5	2
10a	10	10		10	
10b	14	N/A			
11a	5	5		5	
11b	10	N/A			
12	2	0			
13	20	4		4	5
Total	112	44	2	40	18

Table 2. Estimated numbers of koalas in the Stage 1 Coomera Connector footprint that will require active management during clearing operations.

6.3 Threat mitigation

Habitat disturbance can exacerbate threats to koalas, particularly when animals are displaced and travel across cleared areas or roads that can be barriers to the successful dispersal from one area of habitat to another. Wild dogs can have significant and prolonged impact on koalas, particularly those seeking new habitat if left to disperse away from the site of clearing on their own volition. Adaptive management of these and other emerging threats will be required as the project progresses through construction and into the operational use phase. Mitigation measures adopted to minimise direct and indirect harm to koalas during road construction. This may include the fencing of high speed/high volume roads in the area to reduce koala and vehicle collisions, retrofitting of existing fences, temporary signage to alert drivers to koala activity, wild dog control programs in areas with a known dog presence. As an aside, wild dog activity was seen in KMA-7a as evidenced by a freshly predated kangaroo carcass found in an area near Coombabah Ck.

Koala fencing is recommended along the border of KMA-3 and KMA-4 at Southport-Nerang Road and the Pacific Motorway. Koala crossings should be maintained between KMA-3 and KMA-4 if possible, as well as between KMA2 and KMA4, and by doing so, will lend further support to these sites as possible receive locations. Koala fencing and crossings are also necessary at koala hotspots along Foxwell Road, Amity Road and Kerkin Road in Coomera and Pimpama to ensure the safe permeability of the landscape to koalas in these areas. East-west permeability for koalas across the CC corridor is important in KMA7, KMA9, KMA10 and KMA12 – KMA17.

7. Conclusions

The comprehensive koala survey confirms that a significant number of koalas are likely to be directly and indirectly affected by the construction and operation of the Coomera Connector. The total number requiring management through the KTMPs and KTP proposed in the CC-KMP is likely to be around 200, although this figure does not take into account koalas at potential translocation recipient sites or offset sites at which some koala monitoring will be required. We anticipate that the additional koalas inhabiting sites such as the *Pimpama River Conservation Area* and unsearched habitat adjacent to KMA-4 (potential translocation recipient sites) might be between 50 and 100. This represents a suitable number for pre-translocation monitoring which will be sufficient to provide robust datasets on present risk profiles, mortality rates and causes.

Next steps for progression of KMP implementation are:

1. Consult with the CoGC as a key stakeholder in local koala conservation and management with a view to choosing 2-4 sites suitable for receiving translocated koalas;

2. Specifically, with regard to the *Pimpama River Conservation Area*, consult with CoGC koala officers, regarding their recent survey in the area, and intentions regarding future koala population management;

3. Determination of suitable sites for revegetation and habitat enhancement for fulfilment of koala habitat offsetting requirements and to support the enhancement of sites into which koalas will be translocated;

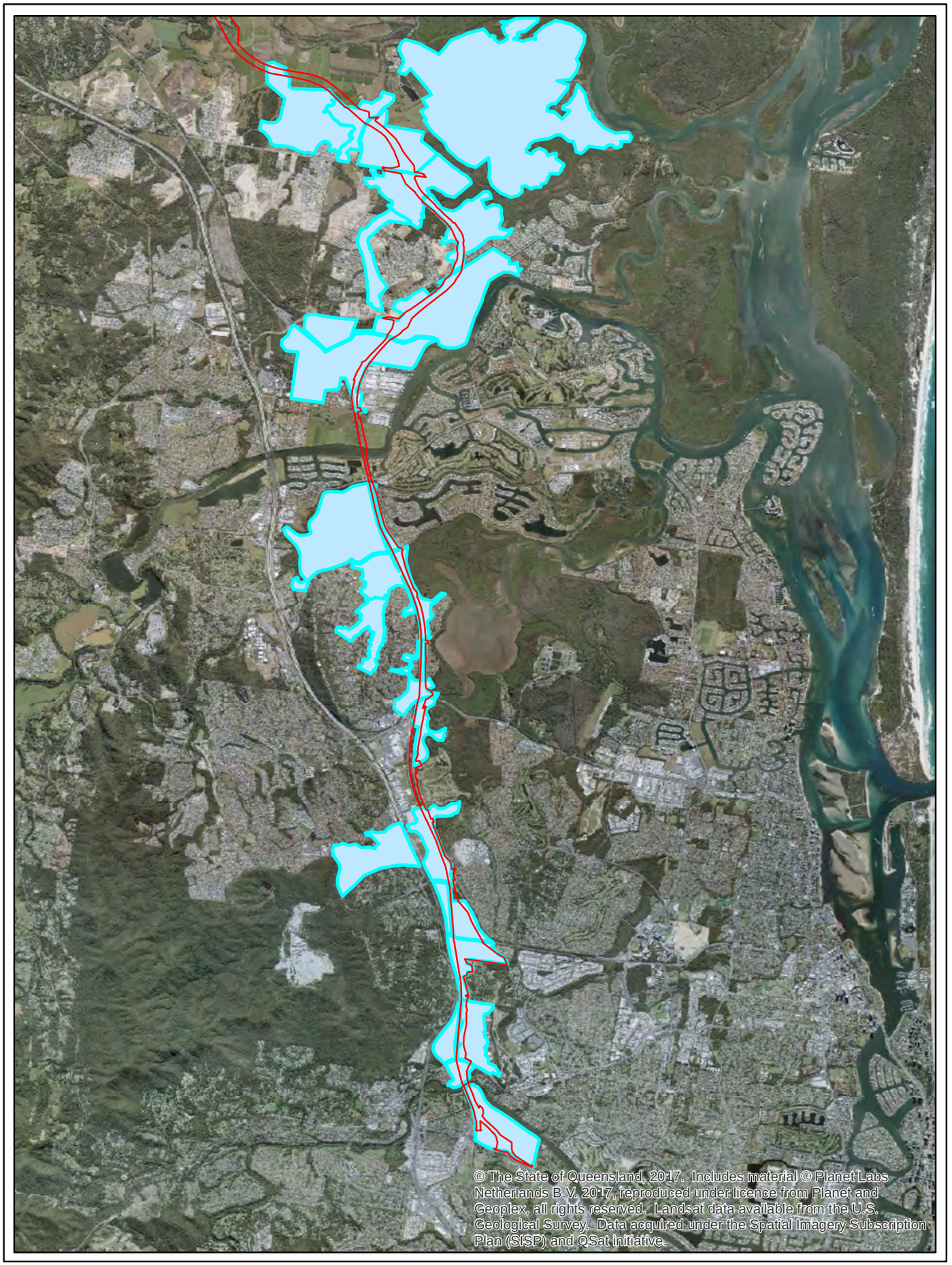
4. Defining the scope and budget forecasts to implement the KTMP and KTP and commence offset/translocation site acquisition and revegetation;

5. Commence KTP (*Koala Translocation Program*) early works – investigation of koala population resident in and risk profiles of proposed koala translocation recipient sites;

6. Development of a detailed fauna exclusion fencing plan in collaboration with CoGC to ensure that both the CC project and local-road tie-ins are mitigated in terms of risk of vehicle strike to koalas;

7. Commence early revegetation works at approved sites.

Appendix 1: Koala Management Areas and survey results



Coomera Connector - Comprehensive Koala Survey

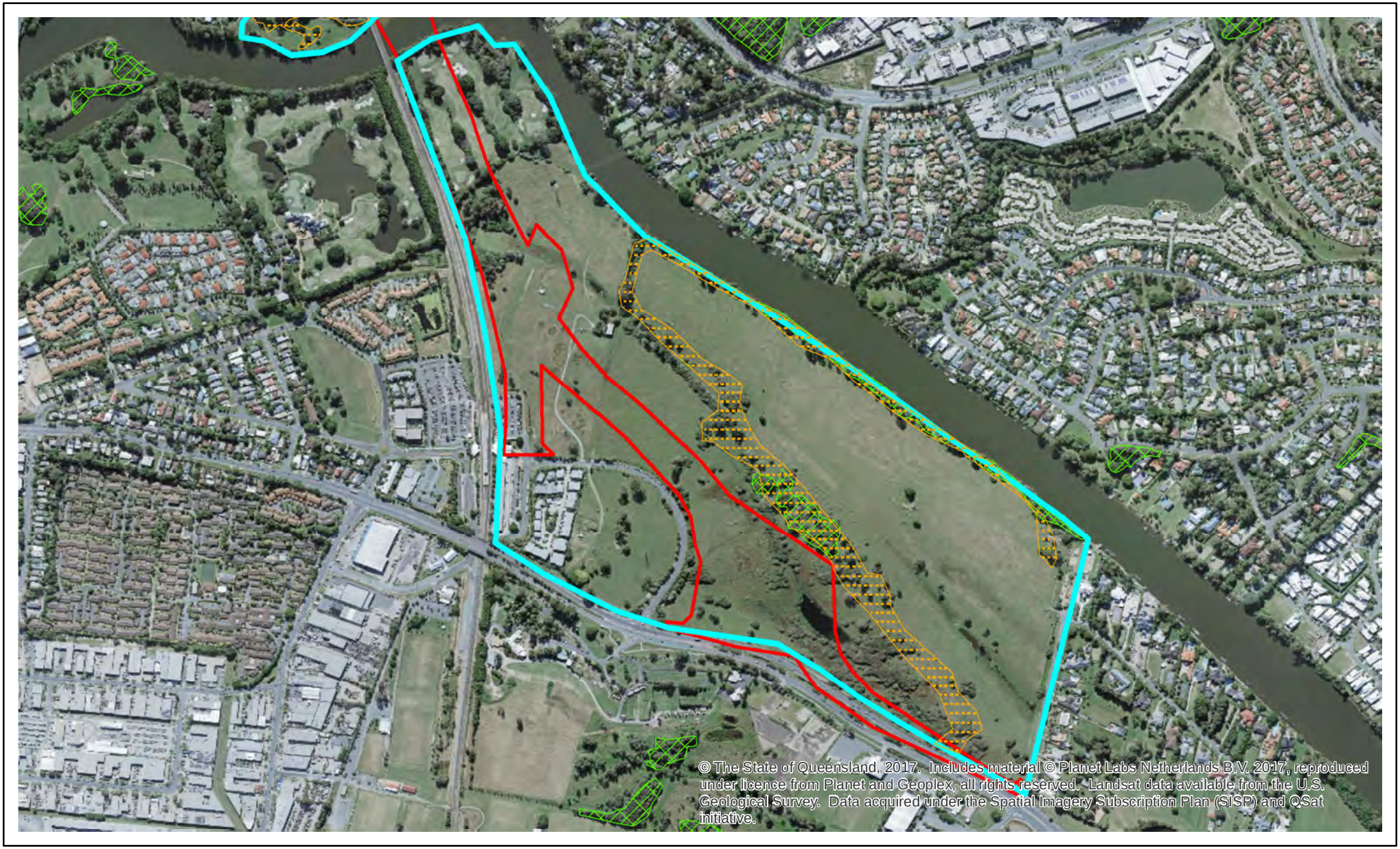
Koala Management Areas - Overview

Legend

- Coomera Connector
- KMA (Koala Management Area)

N

0 0.5 1 2 3 4 Kilometers



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 1

0 0.125 0.25 0.5 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 2

0 0.05 0.1 0.2 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 3 (left)
Koala Management Area 4 (right)

0 0.125 0.25 0.5 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 5

0 0.1 0.2 0.4 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 6a (right)
Koala Management Area 6b (left)

0 0.1 0.2 0.4 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 7a

0 0.125 0.25 0.5 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

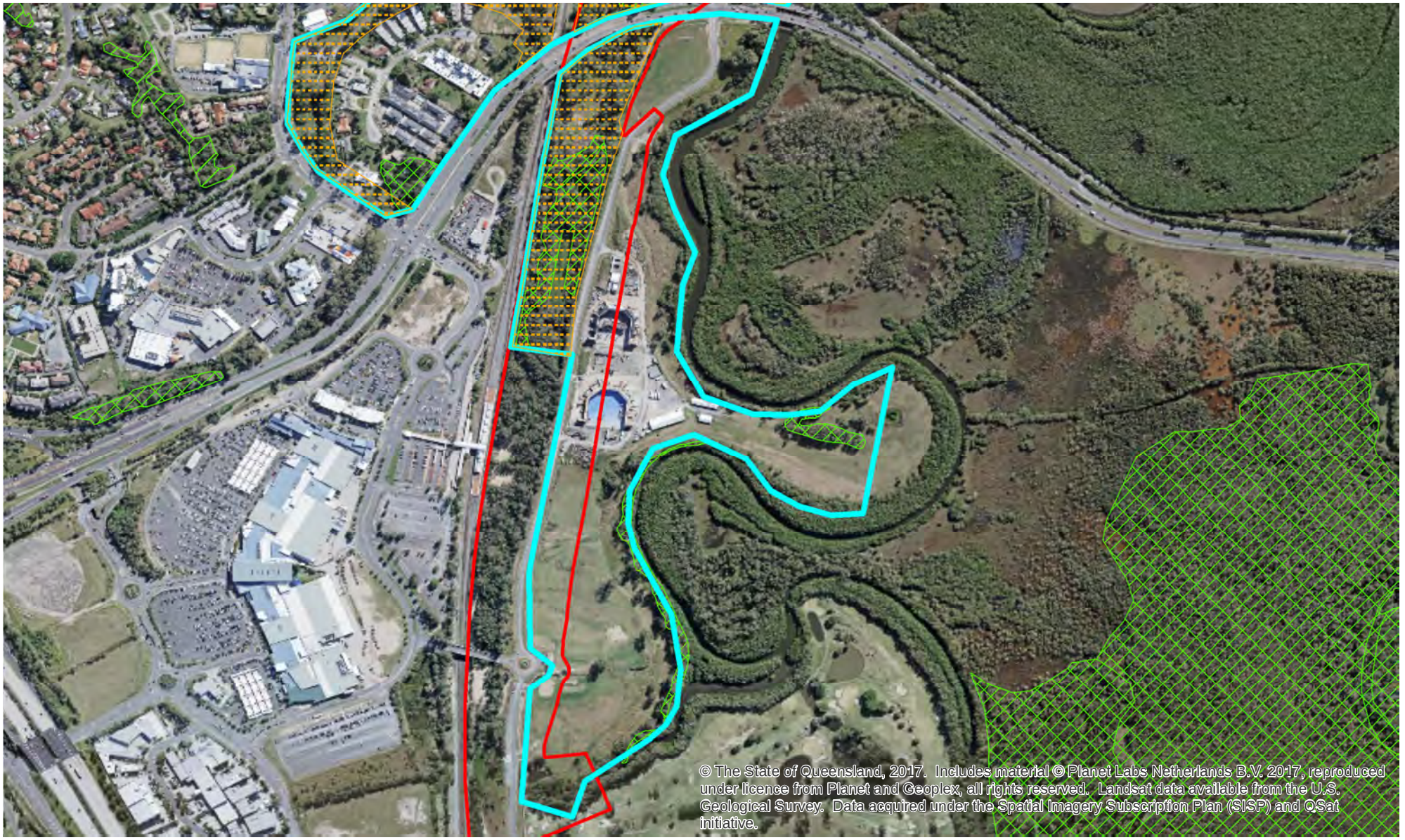
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 7b

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

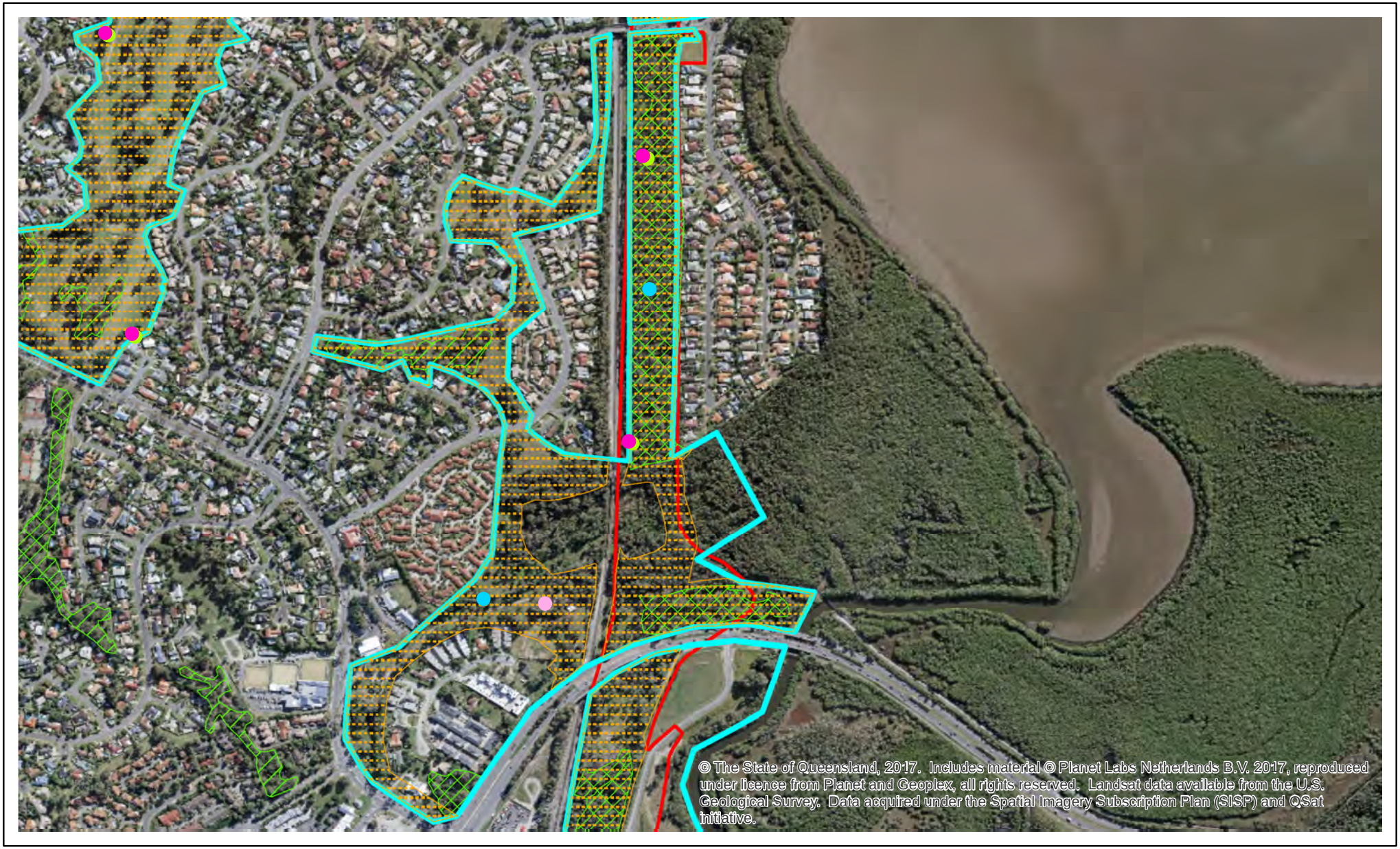
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 8

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

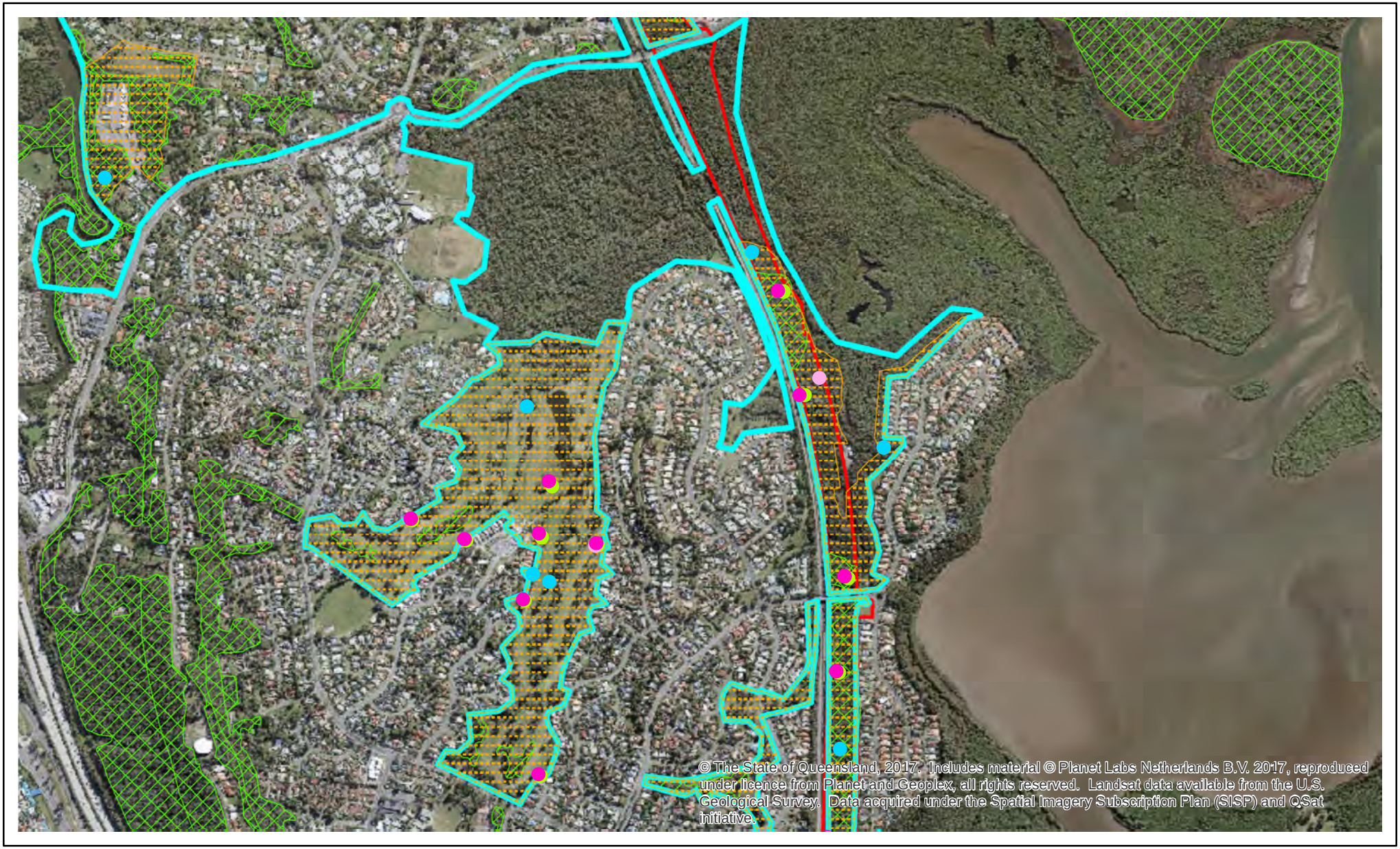
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 9

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 10a (right)
Koala Management Area 10b (left)

0 0.225 0.45 0.9 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

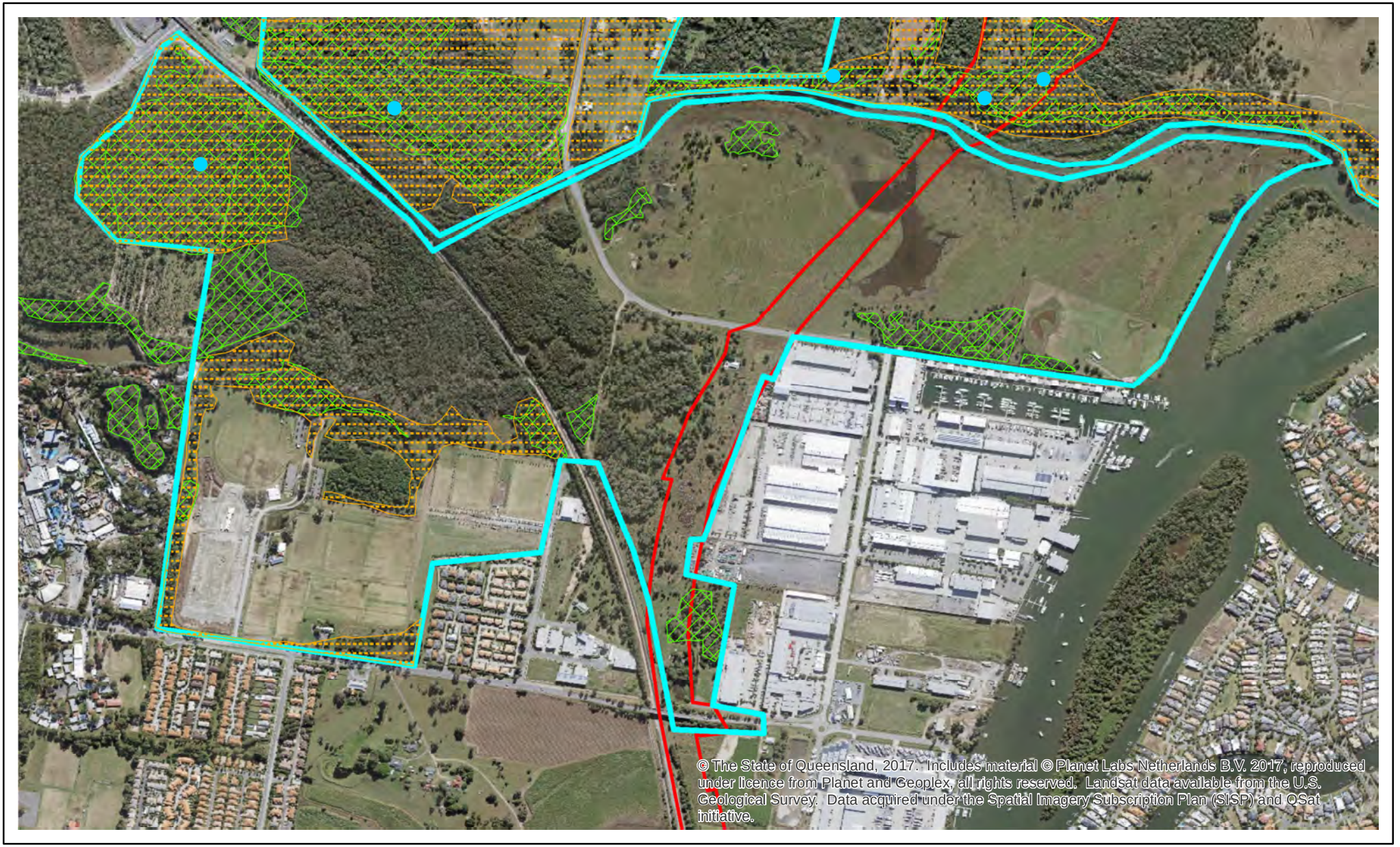
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 11a (right)
Koala Management Area 11b (left)

0 0.25 0.5 1 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 12

0 0.25 0.5 1 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

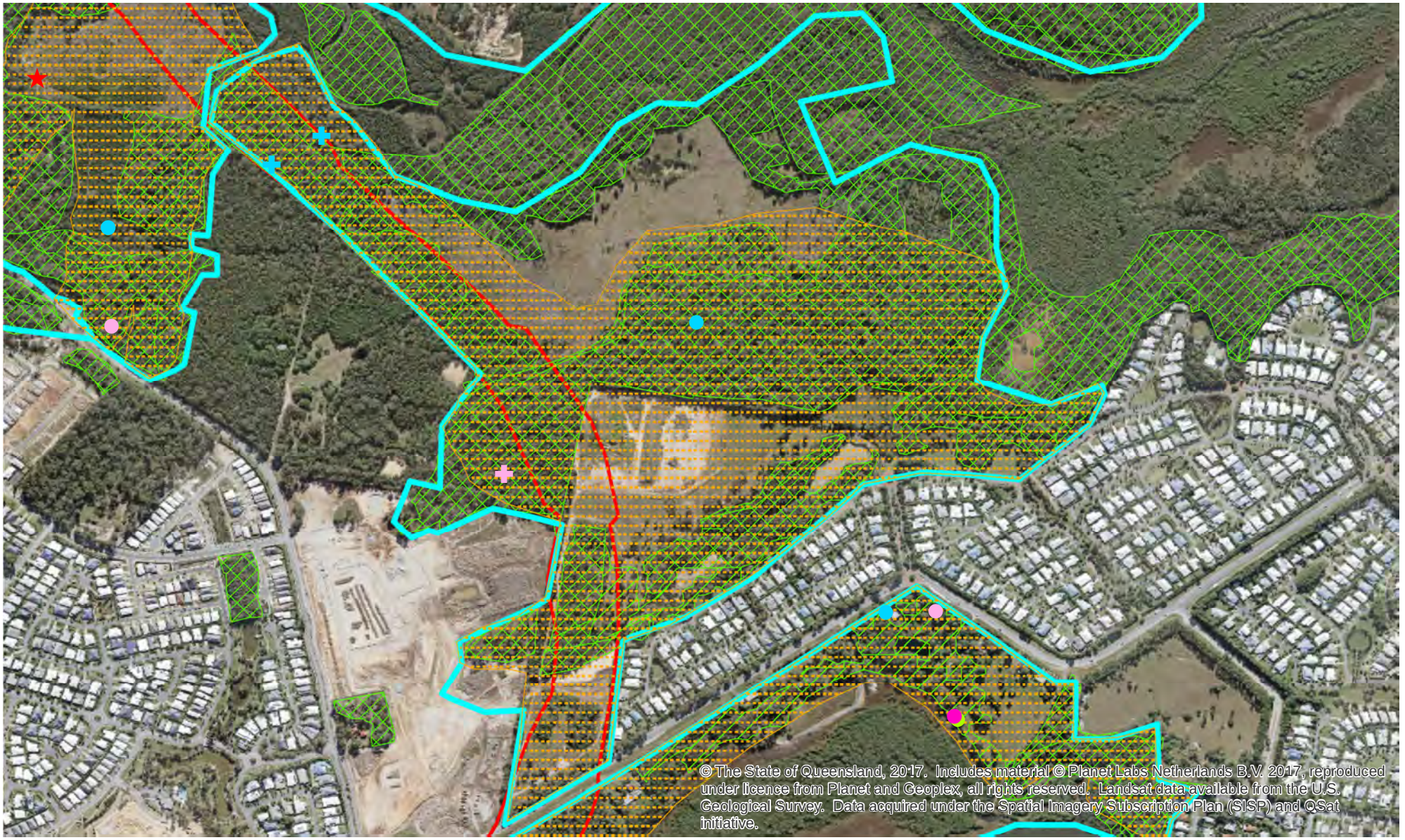
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 13

0 0.25 0.5 1 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

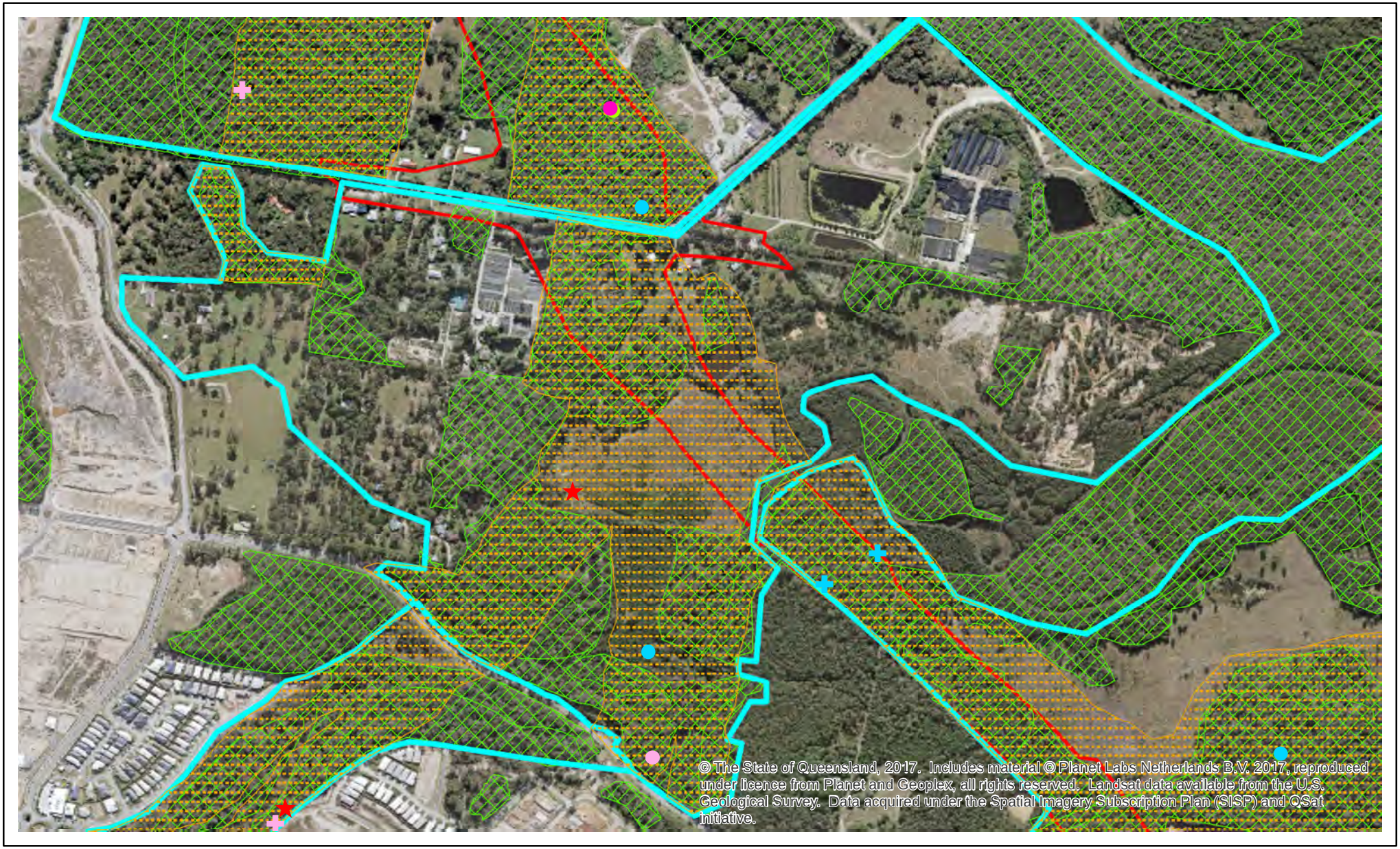
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 14

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

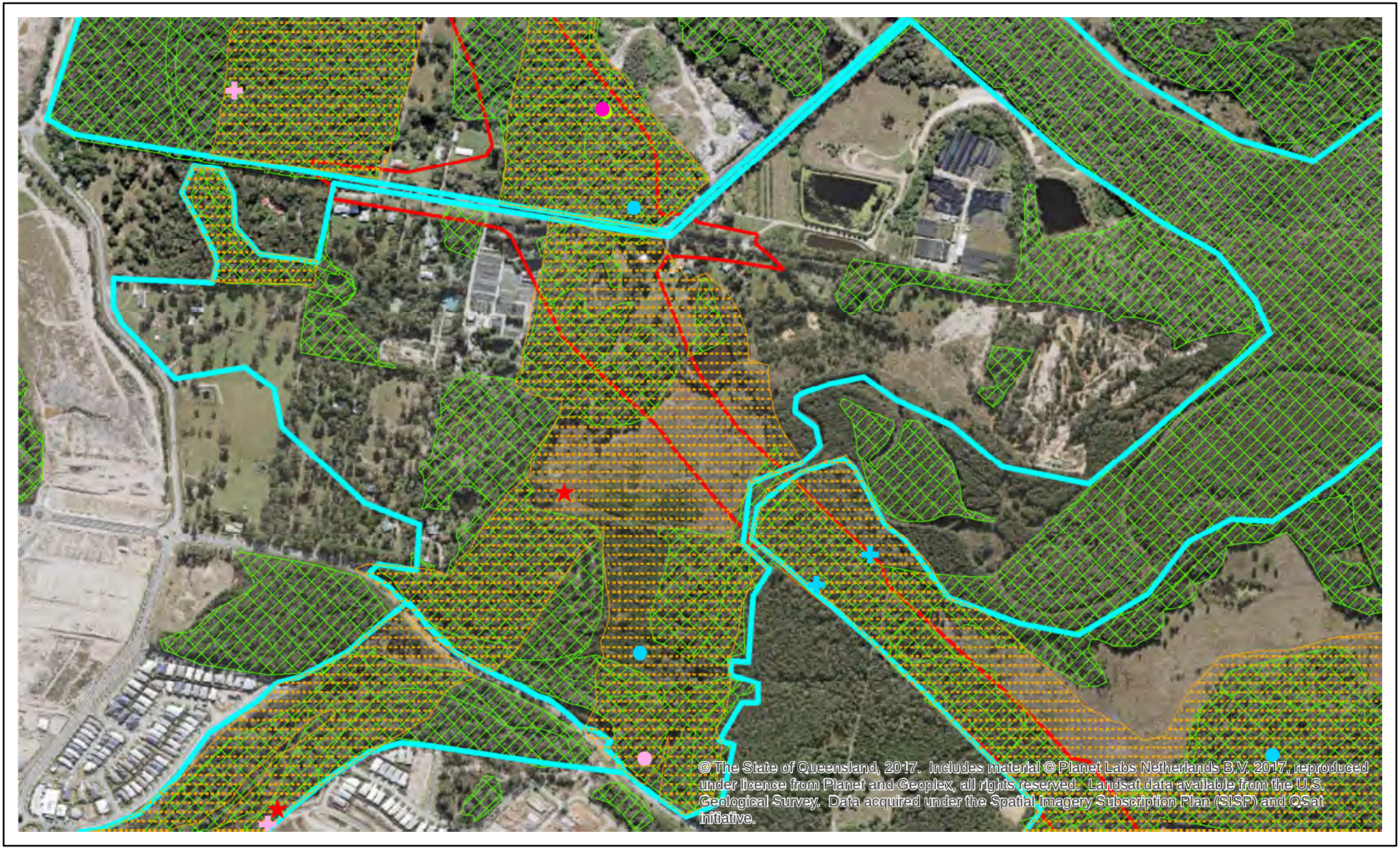
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 15

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 15a

0 0.125 0.25 0.5 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

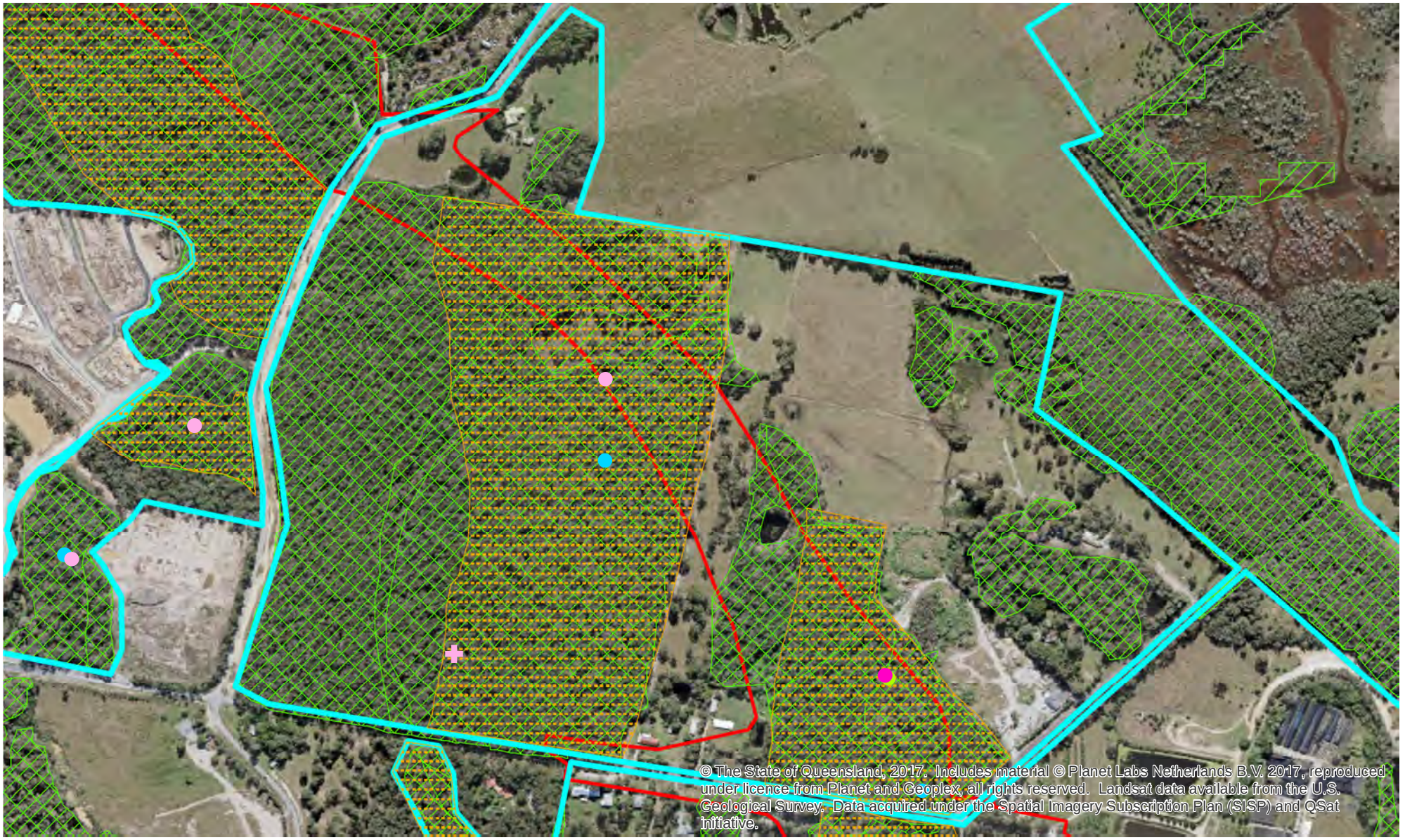
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 15b

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 16

0 0.125 0.25 0.5 Kilometers

N

Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

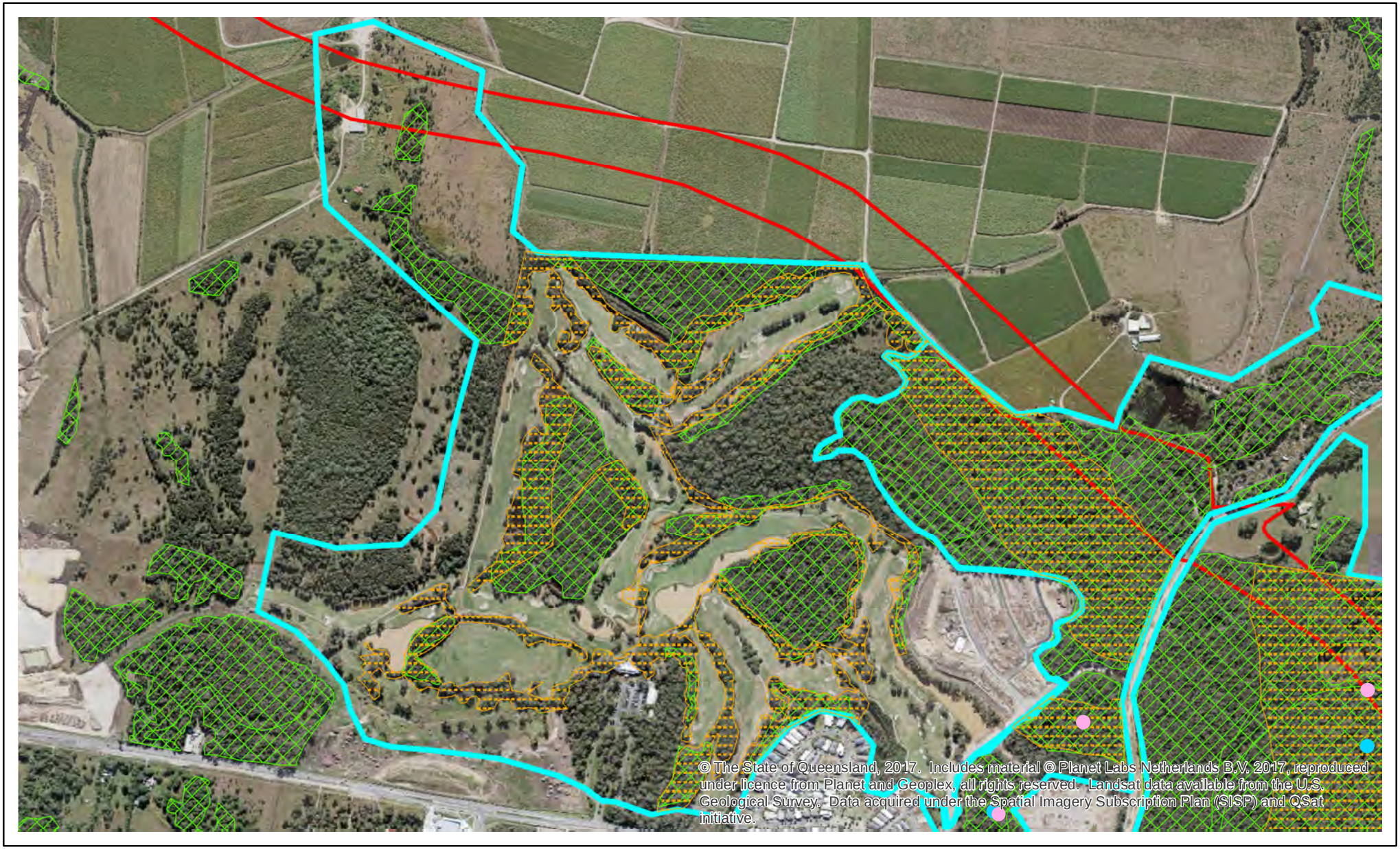
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 17a

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

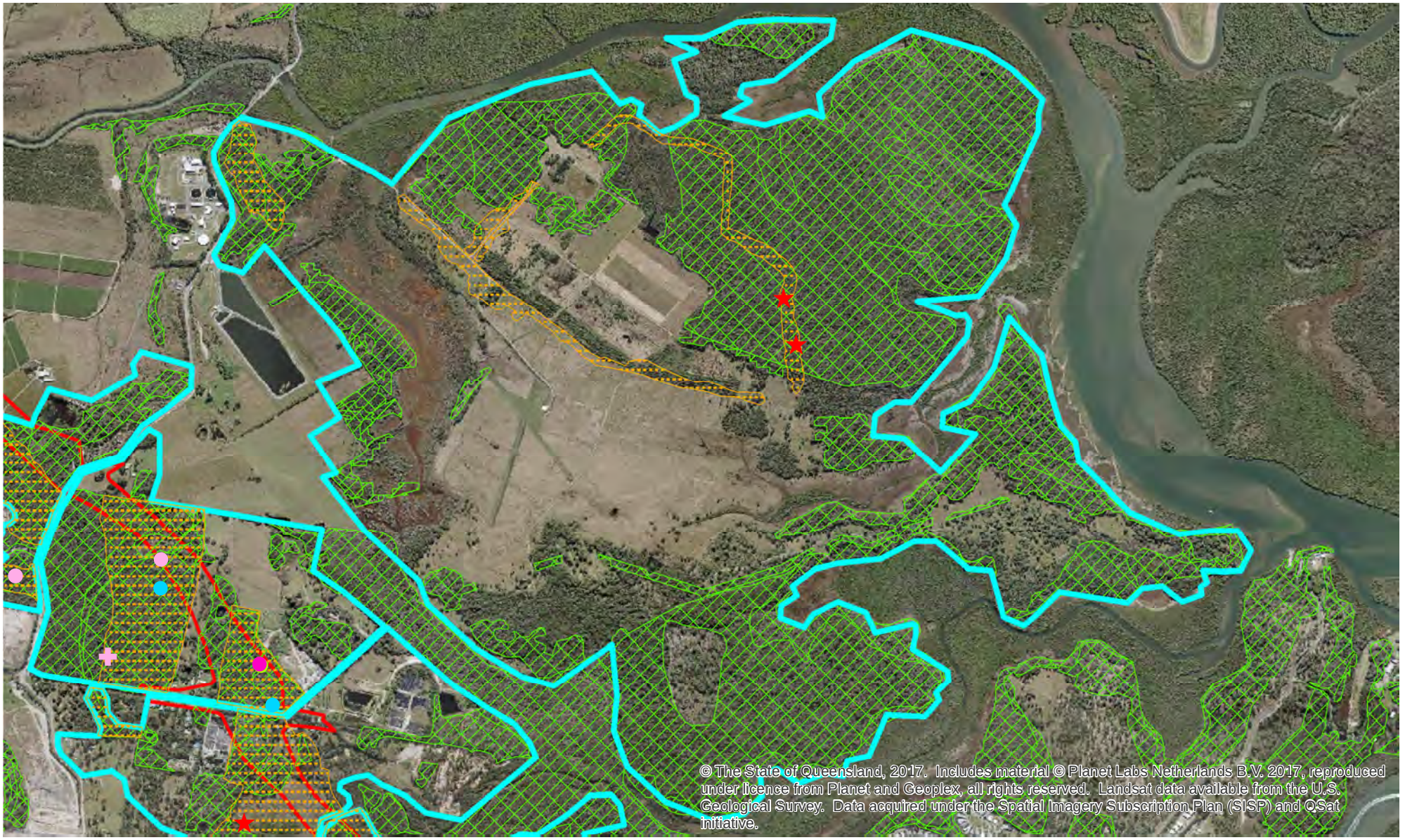
cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Koala Management Area 17b

0 0.125 0.25 0.5 Kilometers

N



Coomera Connector - Comprehensive Koala Survey

Legend

Koala sightings

cSex

- Female
- Female+D
- Female+Y
- Joey
- Koala remains
- Male
- Male+D
- Unknown
- Area surveyed
- KMA (Koala Management Area)
- Koala habitat area (Koala Plan)
- Locally refined koala habitat area (Koala Plan)
- Coomera Connector

Translocation Koala Management Area 1 (EC)

0 0.25 0.5 1 Kilometers

N

Appendix 2: Recommendations for koala translocation at each KMA.

KMA	Management required	Number of koalas*	Justification for recommendation
1	No	N/A	No koalas detected.
2	Assisted dispersal /relocation	1	Koala relocated to KMA4 to ensure safe movement across Southport-Nerang Rd.
3	No	N/A	This site appears to have unoccupied habitat that could be further enhanced and threats mitigated through fencing of adjacent roads.
4	No	N/A	There is suitable habitat adjacent to the road corridor. However, habitat and connectivity in the broader region is currently confined to a < 1km strip of vegetation adjacent to the Pacific Motorway on the east, leaving the long-term viability of this population in question.
5	Assisted dispersal or translocation	4	Assisted dispersal to KMA4 or translocate to another site that is yet to be determined (e.g. West of the Pacific Motorway to Nerang State Forest). Final numbers will depend on the extent of clearing in the road footprint and can be reassessed when the extent of the clearing is known.
6	Assisted dispersal or translocation	9	Assisted dispersal to KMA4 or translocate to another site that is yet to be determined (e.g. West of the Pacific Motorway to Nerang State Forest). Final numbers will depend on the extent of clearing in the road footprint and can be reassessed when the extent of the clearing is known.
7	Assisted dispersal	2	There is suitable habitat between the rail corridor and the Pacific Motorway that will not be impacted by the loss of road corridor vegetation. Revegetation of land to the east of the road corridor and immediately south of Coombabah Creek will greatly enhance existing habitat in the area and the relocation of impacted koalas.
8	Translocate	1	Translocate koalas to another yet to be determined site. There is limited opportunity to relocate (through assisted dispersal across the Gold Coast highway) into habitat to the north in KMA9, as much of this habitat is also within the road corridor and those koalas may also require translocation.
9	Translocate	5	Translocate koalas to another yet to be determined site. There is limited opportunity for koalas to be displaced into Careel Reserve and much of the vegetation to the east of the road corridor is not koala habitat (R.E.12.1.1 - Casuarina glauca wetland buffering Coombabah Lake). Final numbers will depend on the extent of clearing in the road footprint and can be reassessed when the extent of the clearing is known.

10	Translocate	10	Translocate the majority of koalas in KMA10a to another yet to be determined site. There is limited opportunity for koalas to be displaced into the reserve to the immediate east of the road corridor in the south east corner of the KMA as there are currently koalas residing in this strip of habitat and much of the vegetation is melaleuca swamp with very limited value as koala habitat. Additionally, there is limited options to relocate koalas to KMA10b (Golf Course) as: there is a relatively high density of koalas at the site; there would need to be some undertaking by Council to revegetate areas, such as drainage lines, that would not impact on the operations of the golf course to increase the carrying capacity of the site; and fencing installed to secure the movements of translocated koalas away from threats in the residential areas buffering the golf course. As per KMA4, koalas that remain in the reserve will have limited prospects for safe dispersal and movement as much of the area is likely to be constrained by the road to the south and west and Coombabah Lake and residential development to the north and east. Final numbers will depend on the extent of clearing in the road footprint and can be reassessed when the extent of the clearing is known.
11	Translocate	5	Translocate all koalas in KMA11a to another yet to be determined site. There is very limited (small park) suitable habitat in the north of KMA11b for northern displaced koalas and no safe passage to the south for koalas at the southern end of the KMA to access suitable habitat.
12	Assisted dispersal or translocation	1	Assisted dispersal of any koalas found in the road corridor (although unlikely to be present) to habitat to the west of the rail line in the north western corner of the KMA or translocation to TKMA1 (EC), pending future development plans for the area and currently generally unsuitable and highly fragmentated habitat to the east of the rail line.
13	Assisted dispersal or translocation	4	Assisted dispersal of road corridor koalas within the KMA or translocation to TKMA1 (EC), pending future development plans for the area as much of the habitat to the south of Foxwell Rd is earmarked for residential development of falls within the road corridor.
14	No	N/A	There is suitable habitat adjacent to the road corridor.
15	No	N/A	There is suitable habitat adjacent to the road corridor.
16	No	N/A	There is suitable habitat adjacent to the road corridor.
17	No	N/A	There is suitable habitat adjacent to the road corridor.

*The number of koalas requiring management through assisted dispersal or translocation will depend on the amount of vegetation removed from the road footprint. These numbers are derived from the survey results and based on independent koalas estimated to reside within the road footprint and excludes numerous dependent joeys that are likely to be independent animals in the coming months (refer to Table 1 and Appendix 3 KMA survey results maps).

Appendix 1 Key KCS objectives

#	Objective	What	Why	How	Where	Who	When
1	No koalas killed or injured due to vegetation clearing	Effective protections applied for individual koalas via the KTMP-2, as well as vegetation clearing procedures, methods and monitoring and enforcement.	This is a key objective defined by the intent of legislation and community expectation.	KTMP-2 implemented immediately prior to commencement of vegetation clearing by suitably qualified provider. Strict clearing controls and methods monitored and enforced during clearing works.	All sites relevant to CC construction	TMR KCS Implementation Team to appoint consultant to implement KTMP-2 and detailed vegetation clearing specifications to be included in construction contract with appropriate penalties indicated for non-compliance	Key controls to commence immediately prior to vegetation clearing works and continue until completion of construction works.
2	No koala displaced and thereby placed at risk during vegetation clearing	Risk to koalas managed via KTMP-2 and by translocation to safe/secure habitat if on-site risk not reasonably manageable.	Both direct and indirect risk to koala welfare is an expectation of community and necessary to achieve the intent of relevant legislation	KTMP-2 implemented immediately prior to clearing works. At-risk koalas necessitating translocation identified and managed via the KTP.	All sites relevant to CC construction and offset/translocation sites	TMR KCS Implementation Team to appoint suitably qualified expert consultant to implement KTMP-2 and KTP	Preliminary survey to determine number and locations of koalas likely to require translocation in pre-construction phases. Management to occur for duration of construction phase.
3	No koalas killed by vehicle collision during operational phase of CC	Effective mitigation including fencing, barrier crossings, design features (lighting etc) plus monitoring via KTMP-3 to minimise risk of koala incursion into CC active corridor.	Minimisation of koala harm during operational use a key objective required under State and federal legislation as well as high priority in terms of community expectations.	Holistic package of mitigation methods defined and informed by KCS and KCS-directed activities implemented during construction, along with monitoring of short-term efficacy via KTMP-3, and adaptive management framework and TARP.	CC project site, including primary feeder roads within 500 m buffer of CC centreline.	TMR KCS Implementation Team to ensure that KCS recommendations and data from KCS-directed activities appropriately informs design specifications. KCS-IT to engage suitable contractor to implement KTMP-3 and associated mitigation evaluation program.	KTMP-3 to commence at practical completion of construction and for a minimum of 12 months of operational use. Mitigation methods recommended by KCS to be incorporated into detailed design during CC design phase.

4	Installation of appropriate barrier crossings	Important koala habitat remnants transected by CC to have effective ecological connectivity maintained by appropriate safe koala barrier crossing structures	Minimisation of habitat fragmentation impacts and habitat patch isolation a key component of ecological harm minimisation required by relevant State and federal legislation.	Effective barrier crossing measures included in detailed design and specified in construction contract. Crossing structures effectiveness to be monitored via KTMP-3. Structures to maintain connectivity between all significant koala habitat remnants and movement corridors.	CC corridor and associated works/feeder road upgrades.	TMR KCS Implementation Team to ensure key specifications and inclusions are recommended for inclusion in detailed design. TMR to ensure that detailed specifications for mitigation are included in construction contract, along with compliance, remediation and enforcement processes.	Detailed design phase for finalisation of sites and specifications for barrier crossings. Monitoring of effectiveness to commence on establishment of effective barrier and for a minimum of 12 months following commencement of operational use of CC.
5	Audit of koala habitat likely to be lost or rendered non-viable for koalas.	Comprehensive audit of all koala habitat likely to lost during vegetation clearing for construction as well as habitat fragments rendered non-viable for koalas due to isolation/patch size reduction.	Necessary to arrive at appropriate area requiring habitat offsetting under the *EPBC Act* and other relevant environmental offsets policy intent.	KCS Implementation Team to engage suitably qualified consultant to use GIS methods and field confirmation as necessary to accurately define the extent and area of impacted habitat.	CC corridor plus minimum buffer of 500 m from centreline, except when a habitat patch further from the buffer zone is clearly caused to be isolated by the CC project.	KCS Implementation Team to engage consultant to perform analysis and determination, possibly in parallel with the comprehensive koala survey.	Planning phase of CC project (hence, immediate implementation). Completion required prior to end of 2020 calendar year.
6	Maintain functional ecological connectivity of koala habitat	Minimise clearing footprint through design and engineering. Install suitable koala barrier crossing devices where connecting habitat loss is unavoidable.	Necessary to meet intent of *EPBC Act* and minimise risk of sub-population isolation and minimise risk of koala incursion into road corridor.	KCS Implementation Team to work with relevant stakeholders (including CoGC) and use data derived from comprehensive koala survey and KTMP-1 to define locations and specifications of design and devices to ensure functional ecological connectivity is maintained.	All sites in and near the CC alignment where there is currently connectivity of koala habitat and/or non-habitat areas that are nevertheless important as koala movement corridors between habitat remnants.	KCS Implementation Team and TMR CC design team.	Location, design and specifications to be finalised prior to release of tender package for construction.

7	Determine current status and threats to koala population in CC alignment and potential translocation recipient sites.	Current status of koala population: numbers, distribution, population trajectory, threats, reproductive status, health status to be determined prior to commencement of significant construction works.	Necessary to determine baseline parameters as part of the *EPBC Act* guidelines and to ensure that trends of decline are detected and adaptively managed if impacts from the CC are, or could be, contributing.	Via *comprehensive koala survey, KTMPs* and *KTP. KTMP*s and *KTP* provide the primary data acquisition mechanism and response vehicle to facilitate adaptive management response and trend monitoring.	CC alignment and adjacent habitat remnants plus offset/translocation recipient sites.	KCS Implementation Team to appoint suitably qualified experts to conduct key bodies of on-ground work.	Minimum of 12-months prior to commencement of significant construction works, and for duration of construction works, and for a minimum of 12 months following commencement of operational use.
8	Provide compensatory conservation measures for residual impacts	Holistic package of targeted compensatory measures delivered, based on measurement of threats, so that maximum benefit for koala population is delivered cost-effectively.	Required by *EPBC Act* and to meet community expectations.	Deliver direct and indirect offsets as required by *EPBC Act* to offset/compensate for residual impacts of CC project on koala and population viability.	Within KMAs, TKMAs and more broadly, as appropriate and consistent with *EPBC Act* requirements for offsets	KCS Implementation Team to determine compensatory measures package as part of *EPBC Act* assessment process, and TMR to implement as per this KCS.	All compensatory measures to be delivered during KCS-directed operational works, which are expected to be completed within 24 months of commencement of operational use phase of CC, except as otherwise directed by this KCS.
9	Provide habitat offsets	Provision of habitat offsets, including new habitat (revegetated) to enhance existing habitat that supports local koala populations in the long-term, and provides suitable recipient site for translocated koalas.	Required by *EPBC Act*	TMR to work with CoGC and, when applicable, KCS contractors to determine suitable sites for provision of habitat offsets.	East Coomera and possible Clagiraba-Lower Beechmont identified as potential areas for delivery of habitat offsets.	KCS Implementation Team.	Item is currently in progress. Advanced offsets desirable under *EPBC Act*, hence delivery prior to substantial commencement of impact is desirable (e.g., prior to early-mid 2022.

10	Commence habitat restoration at offset sites	Provision of new habitat (revegetated) to enhance existing habitat that supports local koala populations in the long-term, and provides suitable recipient site for translocated koalas.	Required by *EPBC Act*	TMR to work with CoGC and, when applicable, KCS contractors to determine suitable sites for provision of habitat offsets.	East Coomera and possible Clagiraba-Lower Beechmont identified as potential areas for delivery of habitat offsets.	KCS Implementation Team.	Item is currently in progress. Advanced offsets desirable under *EPBC Act*, hence delivery prior to substantial commencement of impact is desirable (e.g., prior to early-mid 2022.
11	Define KTMP-1 scope	KMAs to be determined and agreed by TMR; conduct comprehensive koala survey in KMAs and TKMAs to facilitate costings and preparation of specifications and tender documentation for KTMP-1	Necessary for cost-effective implementation of KCS	Draft KMAs and TKMAs to be finalised by KCS Implementation Team to facilitate engagement of suitable consultant to perform comprehensive koala surveys in areas relevant to CC/KCS . Comprehensive koala survey conducted and used to inform KTMP-1 scope.	KMAs and TKMAs as determined by KCS Implementation Team.	KCS Implementation Team and koala survey consultant.	Mid-late 2020. Finalised by end 2020.
12	Capture, process and monitor koalas for KTMP-1	Implementation of KTMP-1 program which provides baseline data as per objective 7 (above) and commences collection of data to inform other KCS-directed actions and detailed design of CC.	Required to establish baseline conditions of impacted koala population as per *EBPC Act* requirements. Allow adaptive and cost effective management of koala population during CC development.	KCS Implementation Team to engage a suitably qualified and experienced contractor to deliver KTMP-1 including acquiring and complying with relevant state approvals, and subject to *EPBC Act* approval/KCS approval.	KMAs and TKMAs as defined by objective 11 (above).	KCS Implementation Team, KTMP-1 contractor.	Commencement in early to mid 2021. Completion prior to commencement of construction operational works and/or transition to KTMP-2.

13	Conduct KTP	Identify and translocate koalas from CC development sites when their habitat is determined to have no long-term prospect of providing safety and population contribution for those koalas.	Required to avoid unacceptable death/loss of koalas. Consistent with community expectations and the intent of federal and state legislation relating to koala conservation.	KCS Implementation Team to engage suitably qualified contractor to deliver KTP in accordance with necessary state regulatory approvals and subject to *EPBC* approval of this KCS.	KMAs and TKMAs as defined by objective 11 (above).	KCS Implementation Team and KTP contractor.	Commencement to occur some time after commencement of KTMP-1 and prior to commencement of vegetation clearing works for main construction. Duration for a minimum of 12 months following last koala translocation event.
14	Determine and report on baseline parameters for koala populations subject to management under KTMP-1 and KTP	Baseline parameters and trends relating to population distribution, abundance, health, reproductive rates, mortality rates and causes, and ranging behaviour to be analysed and reported, and then inform further KCS-directed measures and CC design, when applicable.	Required to establish baseline parameters and trends in koala population impacted by CC project, as per *EPBC Act* requirements. Key component of project risk assessment and management.	KCS Implementation Team to engage and supervise contractors to conduct KTMP-1 and KTP and provide data, analysis and reports necessary to clearly establish baseline parameters and trends.	KMAs and TKMAs.	KCS Implementation Team and KTMP and KTP contractor(s).	Analysis and report to be completed if possible, prior to commencement of construction operational works (i.e. prior to commencement of CC impact on koalas).
15	Determine scope and specifications for KTMP-2 and KTMP-3	KTMP-2 (during construction) and KTMP-3 (operational use phase) are KCS-directed measures to protect koalas during respective phases and inform the adaptive management response.	Key measures for delivery of koala protection and to inform mitigation as required by the *EPBC Act* with respect to monitoring of impacts and appropriate response as required to minimise impacts/consequences.	KTMP-2 and KTMP-3 provide the proximate mechanism for monitoring of koalas in the risk-areas of the CC project, and appropriately intervening or otherwise responding to expected or emergent threats to koala welfare and population viability.	KMAs, modified KMAs if required due to different objectives for KTMP-3.	KCS Implementation Team and contractors engaged for delivery of KTMP-2 and KTMP-3.	KTMP-2 to commence immediately prior to commencement of CC construction works and end at practical completion. KTMP-3 to commence immediately prior to commencement of operational use phase and be completed within 12-24 months of commencement.

16	Protect koalas during vegetation clearing works	KTMP-2 and vegetation clearing specifications (methods, machinery and control measures). Koala translocation under KTP as required.	Key measure to meet community expectations regarding protection of koalas from harm. Required to comply with intent of federal and state legislation to minimise harm to koalas. Compliance with ACAPA.	KTMP-2 has as a primary purpose the protection of koalas from harm by vegetation clearing by providing the mechanism for telemetric monitoring of at-risk koalas and intervention as and when required.	KMAs.	KCS Implementation Team and KTMP-2 contractor. Clearing/construction contractors and operators have obligations imposed by the contract specifications as well as the *ACAPA*.	KTMP-2 commences immediately prior to the commencement of construction operational works (i.e. vegetation clearing).
17	Maximise research benefit from KCS-directed activities	Active engagement with research community to maximise the benefit for science and koala conservation, particularly where mutual benefits are likely to occur.	Necessary to maximise the 'greater good' benefit that arises from the expenditure of public money. Ethical obligation to maximise the benefit derived from KCS-directed expenditure.	KCS Implementation Team will engage with key koala research groups to explore potential research collaborations that provide mutual benefit and/or contribute significantly to scientific knowledge without significant cost to CC project.	N/A	KCS Implementation Team.	Duration of KCS implementation period. Research benefit likely to be a durable benefit that continues beyond practical completion of KCS-directed activities.
18	Maintain register of supported research projects	Records of collaborative research projects, supported research projects and relevant publications, reports and presentations to be maintained by the KCS Implementation Team.	Necessary to demonstrate appropriate use of public funds and for auditing and accountability/good governance.	KCS Implementation Team to keep current records of all engagements with the research community, including provision of samples, data and information derived from KCS-directed activities. Publications to be approved by KCS Implementation Team/TMR nominated officer prior to submission for publication.	N/A	KCS Implementation Team and approved collaborating research groups.	Duration of KCS implementation period.

19	Koala stakeholder consultative committee (KSCC)	KCS Implementation Team to establish a committee with key representatives from koala stakeholder groups, including CoGC, Wildcare and others as required to provide feedback and input into KCS development and implementation as required.	Necessary to demonstrate transparent, accountable and community-engaged delivery of koala protection and conservation management. Important component of project risk management approach.	KCS Implementation Team/TMR environmental and communications team to determine membership, scope and role of KSCC, along with meeting schedules and agendas, dispute/issue resolution mechanisms and agreement regarding confidentiality and communications management.	N/A	CC KCS Implementation Team/TMR environmental and communications teams.	Duration of KCS-directed actions.
20	Community stakeholder meetings/information sessions	Delivery of regular community stakeholder information sessions for sharing of information, transparency, airing of concerns, educational purposes, proposed to be every 2 months.	Important component of transparent delivery of CC particularly with respect to environmental outcomes and koala conservation outcomes. Important component of project risk management.	CC TMR environment team to determine membership/attendance and management of community stakeholder meetings/information sessions, prepare presentations and information requests and so on.	Meetings to be local to the CC area and at a venue sufficient to hold up to 30 participants.	CC Environment team (TMR)	Duration of KCS development/implementation.

Appendix 2 Regional Ecosystem types in CC alignment and KMAs/TKMAs (Stage 1)

KMA	Approximate location	RE types
CC-KMA1	Boulton Rd	12.3.20
CC-KMA2	Nerang River	12.3.20, 12.11.23
CC-KMA3	Old Coach Rd	12.11.23, 12.11.24/25
CC-KMA4	Old Quarry	12.11.23, 12.11.24/25
CC-KMA5	Smith St	12.11.23, 12.11.24/25
CC-KMA6	M1 Gaven	12.3.11, 12.11.23
CC-KMA7	Napper Rd	12.1.1/2/3, 12.3.11, 12.3.20, 12.11.23, 12.11.24
CC-KMA8	Coombabah Lake	12.1.1/2/3, 12.11.24
CC-KMA9	Helensvale Rd	12.1.1, 12.11.24, 12.11.25
CC-KMA10	Beattie Rd	12.1.1/2/3, 12.2.15, 12.3.11, 12.3.20
CC-KMA11	Foxwell Rd	12.1.1/2/3, 12.2.15, 12.3.11, 12.3.20, 12.11.5, 12.11.24
CC-KMA12	Amity Rd	12.3.11, 12.3.20, 12.11.24
CC-TKMA1	East Coomera (Green Meadows Road)	12.1.1/2/3, 12.2.5, 12.2.7, 12.2.15, 12.3.20
CC-TKMA2	Clagiraba-Lower Beechmont (Belliss Road)	12.3.11, 12.11.3, 12.11.5 12.11.24, 12,11,25

RE type		Status
12.1.1	Casuarina glauca woodland on margins of marine clay plains	Of concern
12.1.2	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains	Least concern
12.1.3	Mangrove shrubland to low closed forest on marine clay plains and estuaries	Least concern
12.2.5	Corymbia intermedia +/- Lophostemon confertus +/- Banksia spp. +/- Callitris columellaris open forest on beach ridges usually in southern half of bioregion	Least concern
12.2.7	M. quinquenervia or rarely M. dealbata open forest on sand plains. Also E. tereticornis, C. intermedia, E. bancroftii, E. latisinensis, E. robusta, L. suaveolens, Livistona decora.	Least concern
12.2.15	Gahnia sieberiana, Empodisma minus, Gleichenia spp. closed-sedgeland in coastal swamps	Least concern
12.3.11	Eucalyptus tereticornis +/- Eucalyptus siderophloia, Corymbia intermedia open-forest on alluvial plains usually near coast	Of concern
12.3.20	Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains	Endangered
12.11.5	Corymbia citriodora sub. variegata woodland to open forest +/- E. siderophloia/E. crebra, E. carnea, E. acmenoides, E. propinqua on metamorphics +/- interbedded volcanics	Least concern

12.11.23	Eucalyptus pilularis open-forest on coastal metamorphics and interbedded volcanics. Other canopy species include E. microcorys, Corymbia intermedia, Angophora woodsiana, E. tindaliae and E. carnea. C. gummifera and E. resinifera are prominent in the Nerang area.	Endangered
12.11.24	Eucalyptus carnea, E. tindaliae, Corymbia intermedia +/- E. siderophloia or E. crebra woodland on metamorphics +/- interbedded volcanics	Least concern
12.11.25	Corymbia henryi and/or Eucalyptus fibrosa subsp. fibrosa +/- E. crebra, E. carnea, E. tindaliae woodland on metamorphics +/- interbedded volcanics	Of concern

Appendix 3 Key actions to ensure effective KCS scheduling

Action	Completion Date	By whom
Define KMAs and potential TKMAs	End June 2020	TMR Environment Team
Determine offset sites and potential translocation sites (consultation with Gold Coast City Council)	End October 2020	TMR Environment Team
Develop budget for KCS early works (CKS, KTMP-1, KTP, Habitat Offsets)	End October 2020	TMR Environment Team
Engage consultant to conduct comprehensive Koala survey	End June 2020	TMR Environment Team
Establish KCS Implementation Team	End October 2020	TMR Environment Team
Commence habitat offsets/acquisition/early revegetation – advanced offsets	Mid-late 2020	TMR Environment Team/KCS Impl. Team
Establish Koala Stakeholder Consultative Committee	End October 2020	TMR Environment Team/KCS Impl. Team
Prepare tender/scope of KTMP-1 and KTP with reference to CKS	End October 2020	TMR Environment Team/KCS Impl. Team
Engage contractor to commence KTMP-1 and early KTP	Late 2020/early '21	TMR Environment Team/KCS Impl. Team
Develop budget for KTMP-2 and KTMP-3 (CC Stage 1)	Mid 2021	TMR Environment Team/KCS Impl. Team
Engage contractor for KTMP-2 and KTMP-3 (CC Stage 1)	Mid-late 2021	TMR Environment Team/KCS Impl. Team

KMA: Koala management area
TKMA: Translocation recipient site Koala management area
CKS: Comprehensive Koala survey
KTMP: Koala tagging and monitoring program
KTP: Koala translocation program

Appendix 4 Fauna spotter/catcher expertise and resource specifications

Key competency/requirement	Qualification/Resources	Description
Safe work procedures on construction sites	Construction white/blue card	All fauna management personnel
Use/work in elevated work platform	Working at heights certification	At least two of fauna management team
Safe use of chainsaw.	Chainsaw ticket	At least two of fauna management team
Safe capture and handling of venomous snakes	DES permit/other certification	All fauna management personnel
Communications with vegetation clearing operators	CB/UHF radio competency, CB/UHF radios	All fauna personnel. Back-up devices (minimum of one per team required on site)
Fauna management team leader	Minimum of five (5) years' experience working as a wildlife spotter/catcher on construction sites	At least one fauna management team leader per vegetation clearing front.
Capacity to capture and manage wide range of terrestrial fauna	Fauna contractor must have access to all equipment necessary to conduct fauna management appropriately, as well as standard operating procedures. Fauna contractor must be appropriately licensed to carry out all fauna management procedures under the *Nature Conservation Act 1992* and its relevant regulations and policies.	Equipment must include (but not be limited to) snake bags, hoop bags, snake hooks, cages, aquarium-type enclosures for frogs and small fauna, enclosures/transport boxes suitable for medium fauna, etc. All fauna management personnel must carry a two-way radio and binoculars during vegetation clearing supervision. Standard operating procedures must be comprehensive and provided prior to contractual engagement.
Ability to conduct wildlife euthanasia effectively and humanely	Demonstrated expertise in euthanasia of all taxa of terrestrial fauna. Standard operating procedures clear and understood by all fauna management personnel.	Standard operating procedures for wildlife euthanasia approved by TMR prior to award of contract.
Provision of veterinary care	Fauna spotter catcher team must have an experienced wildlife veterinarian to refer injured fauna to.	Fauna spotter catcher team must have a standard operating procedure detailing the management of injured fauna, to be approved by TMR prior to award of contract, and compliant with the ACAPA. The SOP must include a procedure for assessment and management of injured fauna, which must include the referral of injured fauna for veterinary treatment in a timely manner to comply with the provisions of ACAPA.
Provision of suitable temporary housing for fauna	Fauna must have appropriate and sufficient temporary housing/enclosure to restrain and meet the needs of salvaged fauna prior to release back into suitable habitat.	Fauna spotter catcher contractor must demonstrate that it has sufficient and appropriate housing to temporarily keep salvaged fauna and standard operating procedures that deal with housing of fauna in hot or cold weather, provision of water, shelter and food as required. SOPs must include management of eggs, neonates and adult-dependent young.
Appropriate trapping equipment and methods	Fauna contractor must demonstrate that it has appropriate traps and standard operating procedures to conduct pre-clear fauna load-reduction trapping.	Standard operating procedures for pre-clear fauna load-reduction trapping must include types, methods and frequency of checking of traps set for fauna load-reduction.

Provision of darting/remote tranquilisation	Access to appropriate darting equipment and sedatives (compliant with the *Health (Drugs and Poisons Regulation 1996* (Qld)) and the *Veterinary Surgeons Act* or a suitably qualified veterinarian able to provide darting services.	Remote tranquilisation of medium to large fauna may be required. Fauna contractor must be able to demonstrate lawful access to darting services and/or equipment and drugs and procedures for dealing with injured, entangled fauna requiring darting and/or veterinary sedation on-site.
Reporting of all fauna removals and incidents	Suitable recording method (digital on-line or real-time database) for recording of all fauna captures and outcomes. Adverse incidents in which there has been an injury or death to fauna must be recorded separately.	The fauna contractor must provide detailed datasets of all fauna encountered and managed in the course of fauna management works, including adverse incidents and outcomes.

ACAPA: *Animal Care and Protection Act 2001* (Qld). The ACAPA places a duty of care on a person 'in charge of an animal' to ensure that its biological needs are met, and that it receives prompt and appropriate veterinary care if it is injured or sick. The Act also prohibits a person who is not a veterinarian from killing an animal using a drug (such as a veterinary euthanasiate) unless the person works for an entity authorised under the Act (a prescribed entity).
The *Health (Drugs and Poisons) Regulation 1996* defines the requirements for the lawful possession and use of restricted (Schedule 4) drugs for animal control purposes. A person who is not a veterinarian may not use restricted drugs for animal treatment or sedation without an authority from the delegate under the regulation, or unless the drug has been prescribed by a veterinarian for that specific animal. The Guideline can be accessed here: https://www.health.qld.gov.au/__data/assets/pdf_file/0032/465098/animal-manag-welfare-guideline.pdf.
The *Veterinary Surgeons Act* prohibits the conduct of acts of veterinary science for fee or reward, such as animal anaesthesia and sedation, by a person who is not a registered veterinarian in Queensland.

Appendix 5 Methods for monitoring of Koala use of barrier crossing structures

Method	Description	Benefits	Limitations
Motion-activated trail cameras	Large variety of 'off-the-shelf' motion-activated trail cameras available. Cost generally determines robustness, reliability and image quality.	Inexpensive, easy to maintain and access/interpret data, cellular/remote data download versions available. Some have heavy-duty security boxes available. Useful for detecting most taxa (mammals, birds, large reptiles and amphibians, depending on conditions). Other trigger methods available for some devices (e.g. IR beam).	Not 100% reliable at detecting Koalas (and other fauna), particularly in hot weather. (They rely on movement of differential heat signature). Prone to theft and malicious damage/vandalism.
Other camera systems (e.g. Arlo®)	Cellular-connected motion-activated camera systems for home use.	Relatively inexpensive and can provide video footage of crossings. Near-real-time data upload may reduce theft (image not stored on-board).	Prone to theft and vandalism. Require data plan/SIM card.
WID/Data logger	Wireless ID (WID) device tag that emits a unique ID as a 'ping' every 5-20 seconds. This is logged by a data logger/receiver when the tag is in proximity.	Small ear-tag or other attachment method. Allows detection of uniquely identified target fauna. Generally short battery life <6 months, depending on 'ping' rate and battery size.	Expensive, bespoke solution requires capture and tagging of target individuals. May not confirm actual crossing. Data interpretation more labour intensive than camera data review.
GPS tags	GPS tags applied as collars	GPS locations, particularly in combination with geofencing modes triggering high fix rate may suggest or clearly indicate (depending on fix-rate) the barrier crossing used.	GPS collars are relatively expensive, require capture and tagging of target individuals. Fix rate may not be sufficient to determine definitively the crossing structure used.
BLE beacon/receiver/sniffer	Bluetooth Low Energy beacon/tag with data logger. BLE logger/sniffer mounted on entrance/exit to crossing device. Proximity of tag and signal strength logged when tag in proximity.	Low-cost tag with unique ID allowing logging of barrier crossing structure transit by a tagged animal. Long battery life compared with WID tags. Less expensive system than WID tags.	New application of this technology. Not deployed in Koala management program yet.

Appendix 6 Trigger Action Response Plan (TARP)

Trigger	Normal level	Aim	Action/response
Death of one or more Koalas caused by construction activities, including vegetation clearing	No death of Koalas caused directly or indirectly by vegetation clearing and other construction activities	Aim 1: Avoid death of, or harm to Koalas caused by CC project.	*KCS* Implementation Team to conduct comprehensive investigation into the circumstances surrounding the death and causes. If death was either partly or entirely by a failure to follow an agreed procedure, then disciplinary action or penalty applied to the offending contractor. Review compliance auditing for Koala protection procedures. Action/response to be completed within 1 week of the incident(s).
Imminent risk of death or injury to Koalas in KMAs (under *KCS* management) caused by bushfire or other natural disaster	N/A	Aim 3: Delivery of comprehensive compensatory measures	Where catastrophic risk to *KTMP* Koalas is likely, and Koalas can be safely captured prior to the event, then this will occur. Koalas will be housed using available resources of the *KCS* and Wildcare, Currumbin Sanctuary, Dreamworld, Australia Zoo, RSPCA if necessary.
Significant Koala death due to high level of wild dog predation: > 10% of Koala deaths are due to wild dog predation.	N/A	Aim 3: Delivery of comprehensive compensatory measures	If necropsy examinations demonstrate greater than 10% of Koala deaths are caused by wild dogs, this will trigger an elevation in wild dog monitoring and control. This may be a task taken on by Gold Coast City Council.
Very high level of female infertility detected in a sub-population (>75% female deemed to be sterile)	N/A	Aim 3: Delivery of comprehensive compensatory measures	If veterinary examinations indicate that >75% of females in a habitat patch are sterile, the *KCS* Implementation Team will consider additional management measures to ensure local viability of that population, including lower threshold for translocation (either in, to bolster, or out to salvage).
Very high level of chlamydial disease prevalence at proposed translocation recipient site	Translocated Koalas moved into safe habitat that allows for a lower level of threatening processes/risks compared with their originating habitat site.	Aim 1: Avoid death of, or harm to, Koalas caused by the CC project.	Chlamydial disease management, including both treatment and vaccination (when available) of resident Koala population at the proposed recipient site prior to the translocation of Koalas into the site. The chlamydial prevalence must be reduced to a level no greater than one half of the prevalence measured at the donor site.
Failure of Koalas to use barrier crossing devices, entry into road corridor/breach of fencing	No incursion of Koalas into fenced road corridor. Regular use by Koalas of barrier crossings as evidenced by camera/data logger data.	Aims 1 (Avoid Koala harm) and 2 (Avoid habitat fragmentation/ isolation)	Immediate inspection of Koala exclusion fencing in area of suspected breach (1 km either side of suspected incursion point/area). Remediation of defects within 2 weeks of detection. Remediation of design flaw within 6 months whenever possible.

Appendix 7 Qld Koala habitat offsets requirements

The following is an excerpt from the Queensland Environmental Offsets Policy (v1.8) **Section 2A.4 *Specific requirements for Koala habitat offsets in SEQ.***

(DES, 2020). (https://environment.des.qld.gov.au/__data/assets/pdf_file/0018/102834/offsets-policyv1-8.pdf)

An offset site must be capable of delivering a *conservation outcome* for the impacted *prescribed environmental matter*. For Koala habitat in SEQ, the only appropriate action to offset Koala habitat within SEQ is the rehabilitation, establishment and protection of Koala habitat and where the following requirements can be met:

- The offset site must contain, or be capable of containing, a self-sustaining population of Koalas; and
- The offset must result in the establishment of three new *non-juvenile Koala habitat trees* for every one *non- juvenile Koala habitat tree* removed. *Non-juvenile Koala habitat trees* can be established by either planting new *Koala habitat trees* that are managed until they become *non-juvenile Koala habitat trees,* or managing existing juvenile *Koala habitat trees* (i.e. regrowth) until they become *non-juvenile Koala habitat trees*; and
- The *non-juvenile Koala habitat trees* established as part of the offset must be reflective of the species that are endemic to the offset site and be planted at densities that will produce a mature density reflective of the regional ecosystems relevant to the offset site; and
- The offset site can be legally secured for the duration of the impact (including in perpetuity) using one of the mechanisms outlined in section 2.3.1.4 of this policy; and
- The offset site is located in the following order of preference:
- A restoration area identified on the Koala Habitat Restoration Areas Map[1] in the Koala Priority Area that is closest to the impact site; or where this is not possible
- A restoration area identified on the Koala Habitat Restoration Areas Map in the next closest Koala Priority Area to the impact site; or where this is not possible
- A restoration area identified on the Koala Habitat Restoration Areas Map that is as close as possible to a Koala Priority Area and the impact site; or where this is not possible
- As close as possible to the impact site where the proposed offset site:
- Contains an area suitable for Koala habitat restoration; and
- Will result in the creation or improvement of connectivity, corridors or linkages between patches of Koala habitat and/or Koala Priority Areas; and
- Can be managed to protect Koalas and Koala habitat from threats and threatening processes; and
- Can be legally secured for the duration of the impact for which the offset is required.
- In assessing the suitability of a proposed offset site, the administering agency will consider the above order of preference when assessing an offset delivery plan or an application to register an advanced offset for SEQ Koala habitat. It will also consider that not all restoration areas identified on the Koala Habitat Restoration Areas Map will be appropriate receiving sites for Koala habitat offsets due to factors such as zoning, current or future land use, surrounding land use or the presence of unmanageable threats

Appendix 8 KMAs and TKMAs maps

CC-KMA1

Nerang-Broadbeach Rd

533848.69E 6904339.05N (Zone 56)

535599.30E 6904333.98N (Zone 56)

533843.78E 6902597.72N (Zone 56)

535594.13E 6902592.65N (Zone 56)

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Datum: Geocentric Datum of Australia 1994
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For more information, visit https://qldglobe.information.qld.gov.au/help-info/Contact-us.html

Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA2

Nerang River

533670.58E 6904847.50N (Zone 56)

534477.60E 6904845.21N (Zone 56)

533668.32E 6904044.72N (Zone 56)

534475.30E 6904042.43N (Zone 56)

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Queensland Government

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CC-KMA3

Old Coach Rd

533055.67E 6906124.13N (Zone 56)

534806.54E 6906119.19N (Zone 56)

533050.88E 6904382.54N (Zone 56)

534801.49E 6904377.60N (Zone 56)

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CC-KMA4

Nerang Rd Quarry

533675.42E 6905973.73N (Zone 56)

535124.63E 6905969.58N (Zone 56)

533671.38E 6904532.19N (Zone 56)

535120.41E 6904528.04N (Zone 56)

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CC-KMA5

Smith St

532913.82E 6908331.24N (Zone 56)

535540.60E 6908323.76N (Zone 56)

532906.66E 6905718.48N (Zone 56)

535532.88E 6905711.00N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA6

M1 Gaven

533093.15E 6908245.42N (Zone 56)

535152.51E 6908239.58N (Zone 56)

533087.51E 6906197.01N (Zone 56)

535146.52E 6906191.16N (Zone 56)

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CC-KMA7

Napper Rd

532920.59E 6909765.60N (Zone 56)

534628.42E 6909760.81N (Zone 56)

532915.94E 6908066.83N (Zone 56)

534623.53E 6908062.04N (Zone 56)

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CC-KMA8

Buckler Dr

532911.15E 6911772.94N (Zone 56)

534312.50E 6911769.03N (Zone 56)

532907.34E 6910379.00N (Zone 56)

534308.53E 6910375.09N (Zone 56)

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CC-KMA9

Careel Reserve

532819.93E 6912889.40N (Zone 56)

534375.48E 6912885.06N (Zone 56)

532815.72E 6911342.09N (Zone 56)

534371.06E 6911337.75N (Zone 56)

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CC-KMA10

Coombabah Lake

532217.56E 6914682.49N (Zone 56)

534132.13E 6914677.22N (Zone 56)

532212.47E 6912778.10N (Zone 56)

534126.74E 6912772.82N (Zone 56)

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CC-KMA11

Rivertree Park

530959.97E 6915975.92N (Zone 56)

533276.57E 6915969.75N (Zone 56)

530954.05E 6913671.68N (Zone 56)

533270.21E 6913665.50N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA12

Coomera Marine

531855.29E 6919104.38N (Zone 56)

533868.81E 6919098.90N (Zone 56)

531850.01E 6917101.58N (Zone 56)

533863.19E 6917096.09N (Zone 56)

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Queensland Government

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CC-KMA13

Foxwell Rd

531065.43E 6921247.27N (Zone 56)

535386.02E 6921235.39N (Zone 56)

531054.37E 6916950.09N (Zone 56)

535373.43E 6916938.20N (Zone 56)

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Queensland Government

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CC-KMA14

Christina Dr

533448.65E 6921536.21N (Zone 56)

535122.62E 6921531.46N (Zone 56)

533444.04E 6919871.13N (Zone 56)

535117.78E 6919866.38N (Zone 56)

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Queensland Government

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CC-KMA15

Amity Rd

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534448.82E 6922479.17N (Zone 56)

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534443.35E 6920562.83N (Zone 56)

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Queensland Government

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CC-KMA16

Yawalpah Rd

532406.26E 6923174.51N (Zone 56)

533913.04E 6923170.37N (Zone 56)

532402.24E 6921675.72N (Zone 56)

533908.84E 6921671.59N (Zone 56)

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Queensland Government

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CC-KMA17

Gainsborough Greens

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533177.01E 6921841.10N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA18

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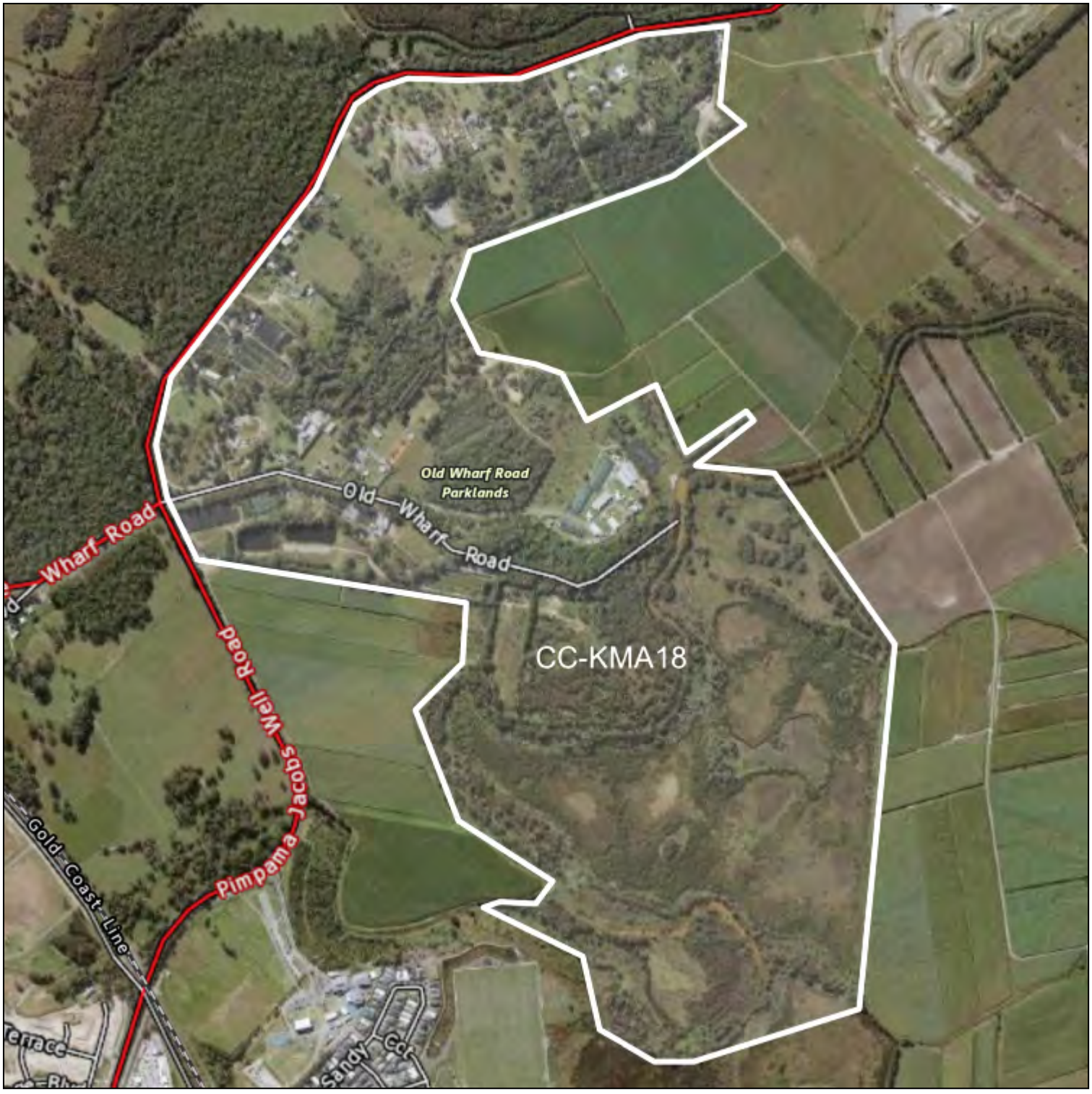

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA19

Eggersdorf Rd

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CC-KMA20

Minka Lane

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527928.88E 6929045.61N (Zone 56)

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527923.86E 6926864.77N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA21

Burnside Rd Quarry

524624.11E 6932208.12N (Zone 56)

527207.78E 6932202.60N (Zone 56)

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527202.01E 6929632.77N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA22

Woolshed Parklands

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526214.71E 6934003.63N (Zone 56)

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526211.76E 6932637.62N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA23

Yellowood Reserve

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525750.08E 6936176.41N (Zone 56)

522839.16E 6933292.34N (Zone 56)

525743.96E 6933286.53N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA24

Eagleby

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523422.35E 6938801.08N (Zone 56)

519382.61E 6934796.70N (Zone 56)

523414.62E 6934789.60N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-KMA25

Mount Cotton Rd

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521834.87E 6937892.99N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-TKMA1 (EC)

East Coomera

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537203.31E 6925020.75N (Zone 56)

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Queensland Government

Department of Natural Resources, Mines and Energy

CC-TKMA2 (LB)

Lower Beechmont

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524563.25E 6899711.18N (Zone 56)

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Queensland Government
Department of Natural Resources, Mines and Energy

CC-TKMA2 Overview

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523388.84E 6896919.48N (Zone 56)

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CC-TKMA2 Overview

Legend

Railway

Road

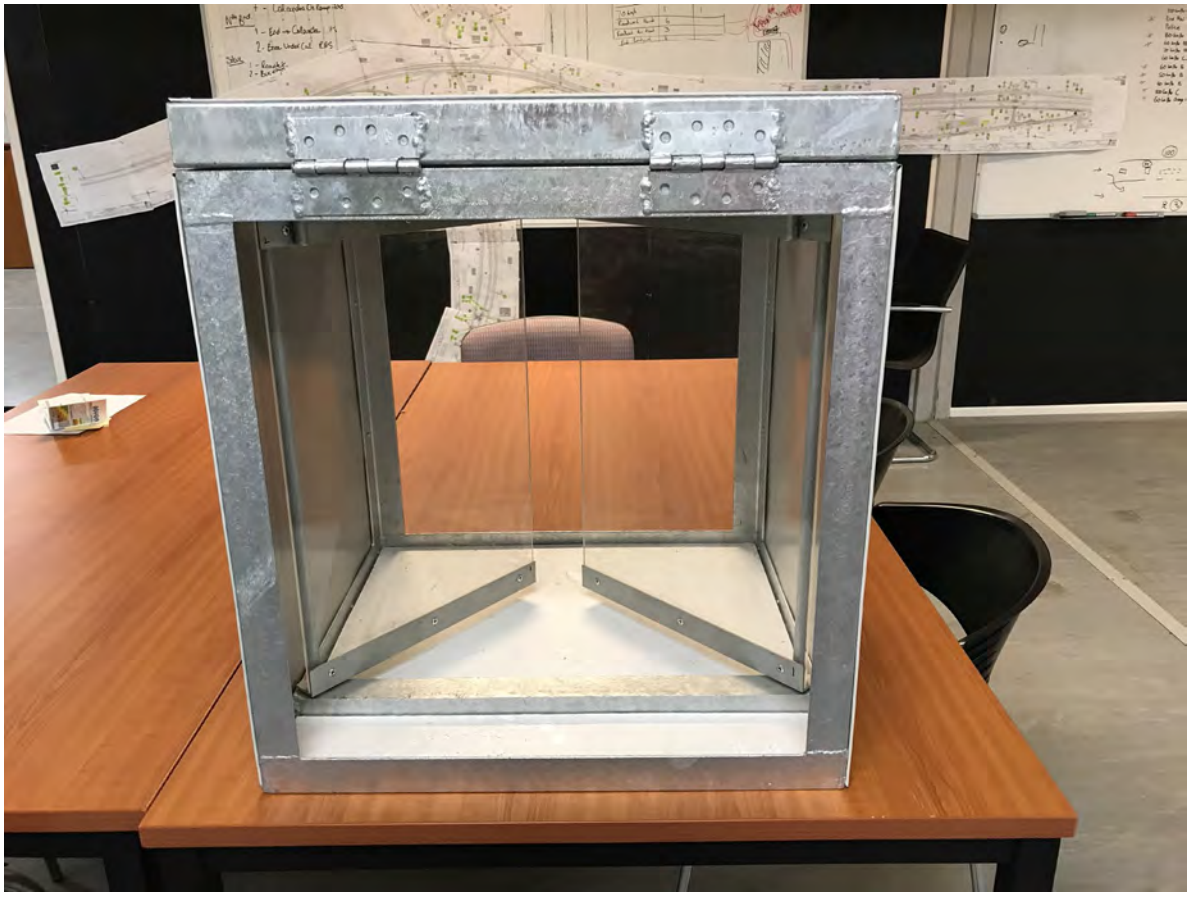
- Highway
- Main
- Local
- Private

Cities and Towns

Attribution

Earthstar Geographics

Appendix 9 Koala one-way egress valve



Guide to the installation of one-way Koala valves in Koala/wildlife fencing along roads

Concept:
Where roads traverse wildlife habitats motor vehicle collision with wildlife crossing roads can be significant. This creates issues of animal welfare, wildlife conservation and public safety. The fencing of roads with suitable wildlife-proof fencing can significantly reduce wildlife-vehicle collision potential by reducing wildlife presence on, and access to the road corridor. However, there exists a need, in some areas, to allow for the movement of wildlife from within the road corridor to the fenced 'safe' areas when wildlife gains access to the fenced road corridor (for example, as a result of poor fence maintenance or when only one side of a road is fenced).

This guide relates to the installation of one-way 'Koala valves' (herein referred to as 'valves') which permit the easy movement of Koalas and some other wildlife from the road corridor into fenced safe areas. The correct construction and proper installation of these valves is essential to ensure their efficacy. They must not be installed in such a way as to permit or facilitate the retrograde movement of wildlife – that is, the movement of wildlife from fenced areas back onto the road corridor. As with wildlife fencing, a regular maintenance program is important to maintain full functionality and efficacy of the devices.

Fence design:
Wildlife-proof fencing generally consists of chain-mesh fencing approximately 2m high with an upper cladding on the 'wildlife side' (i.e. not the road corridor side) of sheer metal sheeting of approximately 500-600mm width. Where the movement of small mammals, reptiles and amphibians is also to be impeded, wildlife fencing may include a lower component of fine mesh (such as sediment fencing) with a curved upper return – installed on the 'wildlife side'. The integrity and functionality of all fencing components should be maintained as well as possible at the installation site of the Koala valves, which otherwise might cause a break in the efficacy of the small animal fencing component. More detail on the construction of fauna fencing can be found in the various *fauna-sensitive road design* manuals available on-line.

Valve siting:
Valves should be sited at areas known to be Koala or wildlife crossing 'hot-spots', if such information is available, and at significant habitat corridor crossings. At high-risk areas, valves should be placed at high frequency in the fencing to improve the rapid egress of Koalas/wildlife from the road corridor. For example, in high-use or high-risk areas, valves should be no more than 50m between sets. (A 'set' is an arrangement of two valves and funnels, facing away from each other, that is, providing an ingress point for Koalas or other fauna coming from either direction along the fence line.)

Where possible, siting valves away from public view will reduce risk of vandalism. Valves should not be sited in areas subject to frequent or severe inundation and should be maintained with sufficient regularity to ensure efficacy.

Fence treatment at valve sites:
The rapid egress of wildlife from the road corridor to the 'safe' areas using valves can be enhanced by appropriate treatment of the fauna fencing at the sites of valve installation. Essentially, this involves creating funnels in the fencing to facilitate use of the valves by Koalas or other wildlife moving along the fence-line

inside the road corridor. (See plans.) Where the distance-from-road constraints allow, the funnel sections of fencing should protrude from the existing fence-line into the road corridor. Where these constraints are limiting, the valve/funnel assembly may be set back from the road corridor.

The ideal assembly of funnel and valve permits a Koala moving along a fence line (from either direction), to easily see through the valve to the 'safe' area of bushland. A clear line of site to the safe area will facilitate the rapid or immediate use of the valve by the animal. Conversely, placement of the valve perpendicular to the fence-line, without funnel-treatment of the fence, may allow a Koala to run past the assembly without noticing it. While this type of assembly may still work, and financial or other constraints may limit installation to this type, it is likely to be less effective than valves installed with the ideal fence treatment. Whenever possible, valve device/funnel assemblies should be installed in pairs, such that one valve faces each direction along the fence (see plans).

The gap between the fence component and the valve assembly must be sufficiently small as to not permit climbing of the fence posts by Koalas or possums. The internal sheer metal sheet cladding should be continuous across the whole fence-treatment-valve assembly. A Koala that gains access to the top (roof) of the valve device must not be able to then climb over the fauna fencing. Where the fauna fencing is sufficiently low to facilitate climbing over, the top of the valve assembly must be protected by sheer metal sheeting.

Installation:
Installation of valves and associated fauna fencing treatments should be by appropriately trained and competent personnel. Even minor defects or errors in installation may lead to minor or major failure of the device/assembly or lead to unacceptable risk to wildlife attempting to use the device. The correct installation of the springs in the valve device is extremely important to ensure only a minimal amount of effort from fauna attempting to use the device is required to open the valve flaps. A spring balance or gun trigger gauge should be used to ensure the valve flap tension at the free edge of each valve (measured perpendicular to the valve flap edge) remains within the specifications (110g – 130g).

Safety:
The valves are designed to facilitate the one-way movement of wildlife up to wallaby/small kangaroo size. Consequently, they will allow movement of people across fence lines if a person were inclined to get down on all-fours to use the device. A reduced scale valve could be used in areas where significant misuse by people could be expected, and certain smaller species are the target of the valve. Also, other devices (such as climb-over poles) may be more suitable in some circumstances.

Maintenance:
The valves use relatively light springs to provide closing tension to the two flaps of Perspex that form the primary valve device. The installation of strong springs is likely to impede the use of the device by wildlife and should not be used. The use of light springs means that any impedance to the return of the valve flaps to their resting position is likely to render the device non-functional or of reduced function in preventing retrograde movement of wildlife. Things that might impede movement of the valve flaps include growth of grass or weeds in, or near, the inside of the valve, mud wasp nests being constructed on internal surfaces, and deposition of grit or sand on the hinge components. Maintenance of valves, along with fence inspection, is recommended every 6 months to ensure optimal efficacy of the devices. The valve device is constructed with a top-opening, hinged roof to facilitate cleaning and maintenance. The floor of the valve is compressed fibre-cement sheeting, which will prevent growth of grass or weeds within the structure, however, overgrowth of weeds, grasses or other vegetation that protrudes into the internal spaces of the valve may impede movement of the valve flaps, and therefore may affect efficacy. Therefore, maintenance activities should include works required to prevent such impedance and ensure spring tension of the valve flaps is within specifications.

Maintenance summary:

1. Ensure that the pathways to and from the valve structure (including funnel and associated fencing) are free of debris, obstructions and excessive vegetation growth.
2. Ensure that the fauna fencing in proximity to the valve structure is intact and free from fallen trees, branches and regrowth that might facilitate retrograde movement of fauna onto the road corridor.
3. Open the top door of the valve device and clean internal parts. Ensure that the swinging valve flaps are not impeded by mud wasp nests, termite mounds and the like. Clean the valve flaps with a soft cloth and water if possible.

4. Remove any weeds, grass or vegetation that is protruding inside the valve device.
5. Ensure the valve closing spring tension (measured at the free edge of the valve flap) is in accordance with the specifications, and that the valve flaps return to their resting positions after the being activated. If not, replace and retest the springs. The maximum gap between valve flaps at their resting positions is 40mm.
6. Close the top door of the valve device and lock if necessary.

Appendix 10 Wildlife management and vegetation clearing

Wildlife generally:

1. Avoid clearing during winter – late summer is better. This is because many reptiles are not active during winter and are much more likely to be killed and injured during removal of refugia – both on the ground and in trees/hollows. Birds are nesting in late winter and spring, so these times should be avoided as much as possible.
2. Wildlife spotter/catchers *must* be able to identify and handle venomous snakes.
3. Pre-clear trapping is an important wildlife load reduction technique in some circumstances and can improve recovery/protection of some cryptic and small species. Trapping techniques can include drift-lines with funnel and pitfall traps, Elliott traps and cage traps.
4. Habitat trees/hollows and other refugia must be checked prior to destruction. Hollow limbs must be checked by the FS/C using EWPs (cherry-pickers) and borescopes if necessary, prior to destruction or felling, and if that is not possible, hollow-bearing limbs cut and lowered using rope in a manner that avoids risk of injury or death; e.g., it is not acceptable to *drop* a habitat tree and *then* check the hollows for wildlife. Felling a habitat tree that does (or is highly likely to) contain animals is a breach of the *Animal Care and Protection Act 2001* (animal cruelty) and the *Nature Conservation Act 1992*. Hollows and other refugia should be checked with cherry-picker techniques (standard arborist techniques).
5. Primary method of vegetation removal should be using excavators mounted with fixed or articulating tree grabs (pincers). Fixed grabs are cheap and perfectly fine for most vegetation and can clear as quickly as a dozer in the hands of a competent operator.
6. Specifically prohibit the clearing of vegetation with a DBH of >8cm with any machinery that cannot achieve a controlled fell. Examples of machinery that cannot reliably achieve a controlled fell are dozers, excavators mounted with buckets or ripping hooks. An excavator mounted with a fixed tree-grab (pincer) is acceptable, as are the larger excavators with articulating and rotating tree-grabs.
7. Tree-grabs facilitate the careful dismantling of rock piles, log piles and other potential wildlife refugia, whereas other machines do not. Therefore, use of excavators with tree-grabs as the primary vegetation clearing machine allows efficient and effective progress of the vegetation clearing front.
8. Exclude or prohibit the use of any machinery that has a safety exclusion distance that prevents a wildlife spotter/catcher from effectively performing his/her duties. Such machines include those with mulching heads that have a large safety exclusion zone, preventing the wildlife spotter/catcher from performing their duties appropriately.
9. Excavator drivers must 'pull' vegetation towards and to the left side of the machine – not push it into standing vegetation. Good operators can very easily do this. Pushing vegetation into standing vegetation makes it impossible for the supervising wildlife spotter/catcher to effectively check each 'layer' of vegetation before it gets cleared.
10. Windrows of cleared vegetation and other potential wildlife refugia must be assumed to be harbouring wildlife and must be treated as for standing vegetation. Often snakes, amphibians, mammals displaced by the primary clearing seek refuge in vegetation windrows, so these need attention prior to and during fragmentation and mulching as much as standing vegetation does.
11. At least one wildlife spotter/catcher supervising each machine involved in vegetation clearing, mulching, interference with potential wildlife refugia/habitat (including man-made structures). There must also be a 'runner' who can take wildlife away for treatment or temporary housing so that the wildlife spotter/catcher supervising the machine can continue (prevents lost time). So minimum number of wildlife spotter/catchers is one per machine + one.
12. Wildlife spotter/catchers must have agreement in place regarding provision of veterinary care for injured animals, and provision of foster care (with local wildlife carers) for orphaned and other needy wildlife.
13. Wildlife spotter/catchers must provide an acceptable euthanasia protocol for critically injured or unviable wildlife and demonstrate appropriate training and competence in approved euthanasia techniques.
14. Vegetation clearing contractor and/or principal contractor must acknowledge the joint/collective responsibility to protect wildlife – not just the responsibility of the wildlife spotter/catcher. Zero tolerance

for activities or behaviour that risks wildlife welfare. This sort of unacceptable behaviour can lead to human safety risks when wildlife spotter/catchers take risks to protect wildlife.

15. Establish a very clear culture of respect for wildlife and a shared responsibility for that in the whole project team, and all subcontractors – must be a key part of the induction process, with a very clearly articulated 'zero tolerance' policy for breaches. (This culture should be established from the Project Director all the way down.)

Koalas:

1. Consider that in 'average' vegetation in SEQ, the spotting rate of Koalas by experienced 'Koala people' is probably around or a bit under 50%. In dense vegetation, and using wildlife spotter/catchers, the detection rate is likely to be far less – perhaps less than 25%. (Reference for those figures is Chapter 6 in the Final Technical Report for the MBR Koala management program.)
2. Avoiding risk to Koalas in 'low-risk' habitat (e.g., sparse, open canopy, few trees) involves pre-survey by Koala experts, then supervision of clearing by Koala experts, armed with binoculars. Tree-clearing protocol clearly defined and involves careful inspection of every tree with binoculars; controlled fell using excavator mounted with tree grab.
3. Medium or high-risk or high-use habitat: Koala mortality can only be reduced to acceptable risk by prior Koala survey, capture and tagging with telemetry devices. Tagged Koalas to be tracked and positively identified/located on each morning of vegetation clearing, and throughout the day. Duplicate telemetry devices (anklet and collar) required to avoid 'losing' Koalas from tag drop-off.
4. Koala capture, tagging and monitoring program preferably should commence 12 months prior to commencement (to allow for one full breeding season to pass), but at the very least 6 weeks prior to vegetation clearing. Detection and capture rate in first pass survey likely to be less than 50%. 95% capture and tagging require multiple survey over weeks or months.
5. Management of sick Koalas requiring veterinary treatment and euthanasia to be defined and agreed well prior to commencement.
6. Current State legislation prevents capture and moving of Koalas in response to clearing. Regular (6-monthly) veterinary health checks and more regular 'tag sizing and re-fitting' checks provide a mechanism for removal of Koalas from clearing areas.

Tagging and monitoring of Koalas can improve the efficiency and speed of vegetation clearing in dense vegetation areas, and very substantially reduces the risk of expensive delays if an 'incident' occurs, not to mention the risk of adverse PR/media attention and/or political interference.

Appendix 11: Program metrics and evaluation

The following table outlines the key metrics and approach to evaluation of *KCS* implementation. The auditing entity or independent reviewer will be appointed by the TMR in due course.

Item	Target	Measurement method	Responsible entity/person
Koala metrics			
No Koala deaths attributable to CC construction	Zero deaths attributable to vegetation clearing and other construction works	All Koala deaths investigated and cause and contributing circumstances identified whenever possible. (All Koalas at risk from CC works to be radio-tagged and monitored during risk period). *KTMP*s.	*KCS* Implementation Team
No Koala deaths attributable to translocation	Zero deaths attributable directly or indirectly to the translocation of Koalas.	All Koala deaths investigated and cause and contributing circumstances identified whenever possible. (All Koalas at risk from CC works to be radio-tagged and monitored during risk period).	*KCS* Implementation Team
No Koala deaths attributable to vehicular trauma (operational use phase)	Zero Koala deaths attributable to vehicular collision on the CC during post-construction/operational use *KTMP* monitoring	All Koala deaths investigated and cause and contributing circumstances identified whenever possible. (All Koalas at risk from CC operational use to be radio-tagged and monitored for 12 months post commissioning).	*KCS* Implementation Team
Improved Koala population viability as measured by PVA, plus positive population growth.	PVA demonstrates an improved (+ve) slope change for population trajectory. Reproductive rate > mortality rate. Positive (growth) trajectory achieved by year 3 of *KTMP*s/*KTP*	PVA conducted by appropriate expert in conservation modelling and analysis. Vortex 10 (Lacy and Pollak, 2014). *KTMP* data. Mortality rate as measured during *KTMP*s and *KTP* reduced year on year.	*KCS* Implementation Team
Reduced level of chlamydial disease in managed populations	< 5% affected individuals in each sub-population at least 6 months prior to scheduled program completion	Measured by veterinary examinations during *KTP* and *KTMP*s. Disease prevalence measured using appropriate epidemiology formulae.	*KCS* Implementation Team
Adaptive management framework: Mortality rate attributable to any individual 'manageable factors' not more than	<20% of Koala deaths attributable to a single factor that can be reasonably managed by the CC project during *KCS* activities. E.g., if > 20% of deaths in any given 12-month period	All Koala deaths investigated and cause and contributing circumstances identified whenever possible. (All Koalas at risk from CC works to be radio-tagged and monitored during risk period).	*KCS* Implementation Team

20% of all deaths during *KTMP*s/*KTP*.	are attributable to wild dog predation, adaptive management response would be required.		
Program metrics			
Net gain in high-quality Koala habitat delivered by commencement of operational phase.	Net gain as measured in the absolute increase in high-quality habitat available for occupation by Koalas.	Total area of 'new' (i.e. replanted) Koala habitat with connection to existing and occupied Koala habitat > than loss of habitat due to direct and indirect loss (as per table in, Section 2.2.3.1)	*KCS* Implementation Team
All *KTMP*s and *KTP* commenced at scheduled commencement and continue for recommended duration	All on-ground programs commenced at recommended times (see itemised list below)	All Koala programs commenced at scheduled times/timeframes prior to key construction timeframes and continued for recommended durations. Program reports to be comprehensive.	TBA
Community stakeholder engagement program successful	No adverse media targeted to CC project by Koala/community stakeholder groups/individuals. No media or post score of -2, and net positive score of at least 6 achieved in each year, commencing with 2020.	All media reporting classified as positive (score of 1 - somewhat positive; or 2 - very positive), neutral (score of zero - neither positive nor negative story) or negative (score of -1 - somewhat negative; or 2 - very negative).	CC Media and Comms Team.
Engineered mitigation			
Engineered solutions reduce vegetation clearing in key habitat areas	At least three (3) engineered solutions reduce the extent of vegetation clearing/loss in important Koala habitat patches	At least three engineered solutions incorporated into detailed design for the purpose of reducing the extent of Koala habitat cleared or permanently lost due to the CC project	TBA
Barrier mitigation devices prevent isolation of Koala habitat remnants of > 1ha. (Maintenance of fine-scale habitat connectivity.	No isolation of a patch of Koala habitat greater than 1 ha in size with evidence of Koala use, or 5 ha in size where there is no evidence of Koala use.	Isolated fragment size measured using QldGlobe tools or field-based measurement (GPS). Isolated fragment defined as a fragment that cannot provide meaningful use to a Koala or Koala population.	TBA
Ecological connectivity of Koala habitat maintained at landscape context	All important Koala movement corridors transacted by the CC project sufficiently protected through engineered solutions that	All key Koala movement corridors identified in Appendix 11 (of previous versions of this *KCS*) are adequately protected by construction of bridges or viaducts or land/habitat bridges and	TBA

(Large-scale connectivity maintained.)	facilitate safe and unhindered Koala movement.	associated Koala-exclusion fencing. Koala use demonstrated by *KTMP* data.	
Engineered culverts for Koala movement of adequate size. To allow sufficient light penetration.	All culverts installed for Koala movement/barrier mitigation at least of 1: 30 (cross sectional area of culvert: length in m) or ratio of 0.036) plus a minimum culvert height of 1 m for every 25 m of length.	Metrics include the ratio of cross-sectional area (in m2) of culvert to length (in m) of no less than 0.036; plus no less than 1 m of culvert height per 25 m of culvert length, or proportion thereof. Koala use demonstrated by *KTMP* data.	
Koalas adequately protected from vehicle collision on CC and feeder roads.	No Koala deaths on CC or feeder roads within 300 m of CC centreline.	Measured by recording all Koala mortality on CC and on feeder roads within 300 m of centreline. Records to be maintained by road management entity and collated with Wildcare and Gold Coast City Council records during operational use phase.	TBA
Comms. Management			
Broadcast and print media stories relating to Koala incidents or management on the CC project	No adverse stories.	All media relating to CC monitored by CC media and communications team and recorded in external media register	CC Communications Manager
Social media (CC)	Minimum of one post every two weeks from commencement of *KTMP*-1 with positive news story	Register of positive Koala media posted on CC social media sites maintained by CC Comms. Team.	CC Communications Manager
Social media (non-CC)	No adverse posts. Adverse posts responded to within 72 hrs with factual information/appropriate response if valid criticism	Register of all known non-CC social media posts relating to Koala management or incidents on the CC project	CC Communications Manager
KSRG meetings	KSRG meeting/workshop conducted at least once every 2 months starting at or near delivery of *comprehensive Koala survey* report, and prior to commencement of *KTMP*-1	Register of KSRG members, meetings, agenda items, minutes and actions-arising kept by CC comms. team.	CC Communications Manager
Regulatory compliance			
EPBC conformance	Full compliance with all aspects and components of EPBC conditions regarding Koala management	*KCS* Implementation Team to keep a register of all key targets/metrics/conditions of EPBC approval related to Koalas	CC Environmental Manager

SPP and AEC (state regulations)	Full compliance with all aspects of SPP (DES) and AEC (DAF) approvals relating to Koala operational work	*KCS* contractors to keep a register of all relevant approvals and reporting/compliance history	CC Environmental Manager
State MOA/Regulatory conformance	Full compliance with relevant MOA or other instrument relating to TMR management of Koalas and Koala habitat	*KCS* Implementation Team to keep a register of key compliance conditions, actions and reporting (when required)	CC Environmental Manager
Compensatory measures (Koala conservation)			
Habitat offsets	Habitat offsets area clearly exceeds habitat loss by CC vegetation clearing PLUS secondary loss of ecologically functional habitat for Koalas	CC Environment Manager to keep and maintain a record of all habitat lost (in real time) which will be habitat cleared PLUS habitat isolated or otherwise deemed of little or no functional ecological value to Koalas. Register to also include acquisition and replanting status of all offset habitat acquired by CC project. To be updated at least monthly	CC Environmental Manager
Non-habitat offsets	Non-habitat offsets to deliver meaningful improvements to a minimum of two (2) factors determined to be of critical importance to Koala population viability, plus support of at least two (2) *bona fide* scientific research projects of relevance to Koala health and/or conservation.	CC Environmental Manager to keep a register of all non-habitat offset measures, including research projects supported with details of objectives, funds/in-kind support provided etc.	CC Environmental Manager

Appendix 12 Key actions for immediate and near-future implementation

Key Action	Commencement	Completion
Determine membership of and establish the *KCS* Implementation Team	Immediate	By end 2020
Engage with Gold Coast City Council – particularly Koala unit to discuss KCS and TKMAs/offset sites, form regular meeting schedule/attendees	Immediate	Ongoing
Review and refine KMAs	At or before completion of CKS	By end 2020
Refine offsets sites and potential translocation recipient sites (TKMAs)	At completion of CKS	By end 2020
Review and refine habitat loss estimates for EPBC offsets calculation	Immediate	Completed (?)
Complete draft EPBC offsets calculator spreadsheet	Immediate	
Write scope and procure comprehensive Koala survey	Immediate	
Commence acquisition of offset sites for *advanced offsets*	Immediate	ASAP
Write scope (including species lists) and procure revegetation works for offset sites	Immediate	By end 2020
Commence revegetation at offset sites	ASAP	End 2021
Engage with DES to discuss KCS	ASAP	End 2020
Develop fauna exclusion fencing design	October 2020	End 2020

Appendix 13 Summary of main on-ground *KCS* works

Item	Description	Timing and duration	Notes
Comprehensive Koala survey	Comprehensive survey of all Koala habitat in and near gazetted alignment plus potential Koala offset and translocation sites	As soon as possible. Prior to commencement of *KTMP*-1. Prior to commencement of detailed design.	The results of the comprehensive Koala survey will inform the actions and cost of subsequent on-ground Koala management works, as well as engineered/design features, such as barrier crossing/mitigation.
***KTMP*-1**	Koala tagging and monitoring program - phase 1. Determination of key Koala population parameters	As soon as possible. Commencement prior to detailed design. Duration of 12 months.	Necessary to inform detailed *KCS* Koala management actions, including threat management, detailed design, translocation management, costings.
***KTMP*-2**	Koala tagging and monitoring program - phase 2. Management of Koalas during construction.	Commencement 3 months prior to commencement of significant vegetation clearing works. Duration: throughout construction phase	Necessary to provide the critical Koala protection measures during vegetation clearing and other construction works. May also inform some aspects of design and construction. Adaptive management approach.
KTP	Koala translocation program. Relocation of Koalas from high-risk/non-viable habitat fragments to secure habitat patches	Commencement 3 months prior to commencement of vegetation clearing works. Duration: for 12 months following the translocation of the final Koala in the program.	Translocation program is likely to require a specific approval from DES (Qld). Translocation should commence with sufficient time to ensure that clearing works are not hindered by presence of Koalas that will ultimately be translocated.
***KTMP*-3**	Koala tagging and monitoring program - phase 3. Determination of end-of-project Koala population parameters, PVA and effectiveness of crossing structures.	Commencement at practical completion of construction and prior to operational commissioning. Duration for minimum 6 months after commencement of operational phase.	Necessary to evaluate the effectiveness of the *KCS* as a whole, and specifically of mitigation devices, such as barrier crossing structures, Koala exclusion fencing, and other compensatory measures.