



ECOLOGICAL ASSESSMENT REPORT

LS305: GREENBANK TO FLAGSTONE CENTRAL CONVEYANCE PIPELINE

NOVEMBER 2018

Approval Register

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Controlled Document – Change Register

Revision	Section Changed	Change Description	Initial	Date
1.0	All	Preparation of Ecological Assessment Report (all sections)	RZ	20/11/2018



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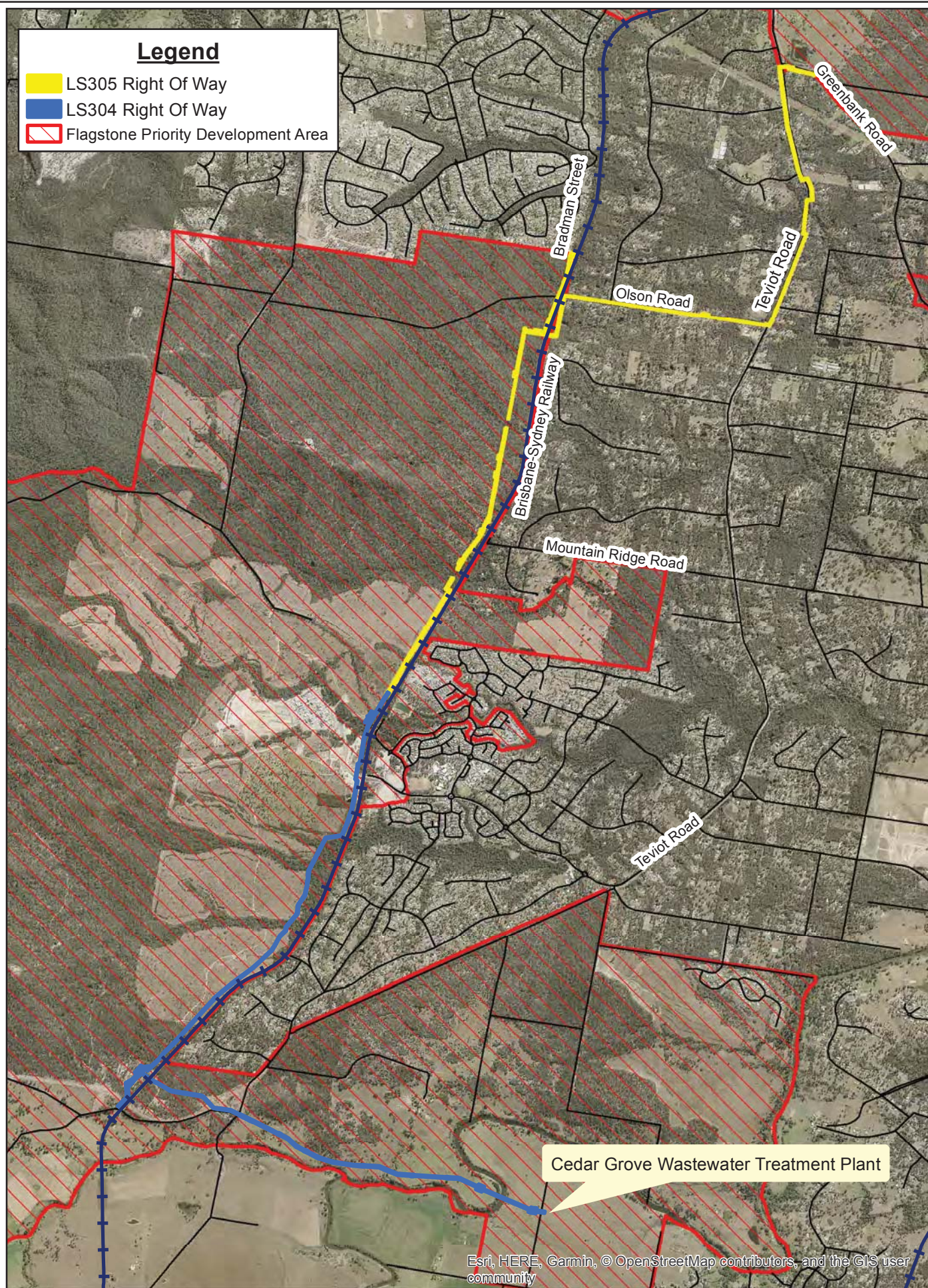
1 INTRODUCTION

Logan Water Infrastructure Alliance (LoganWIA) has identified that significant human population growth is expected in the Greater Flagstone Priority Development Area (PDA), a key greenfield development front within South East Queensland, with the population forecast to increase from approximately 2,000 to more than 140,000 Equivalent Persons (EP) at ultimate development.

The Greenbank to Flagstone Central Conveyance Pipeline project (LS305 Project) involves the development of a series of wastewater pipelines (i.e. rising mains and gravity mains) and pump stations along the alignment. This conveyance system is to serve the Greenbank and North Maclean development sections of the Greater Flagstone PDA. Following a number of planning studies it has been determined that the most appropriate servicing strategy for the catchment is to convey wastewater to the Cedar Grove Waste Water Treatment Plant (WWTP) by linking the LS305 Project into the LS304 conveyance system (as shown in **Figure 1**). The total length of the alignment for the LS305 conveyance system is 9.7 km.

To establish the LS305 conveyance system, up to three (3) temporary construction laydown areas will be required. These areas will likely contain: a work area, a material storage area and workers' car parking. Construction laydown areas will be in areas of cleared land to avoid unnecessary disturbance to existing vegetation. Project activities will be limited to the construction footprint Right of Way (ROW) and will include vegetation clearing and trimming, construction of the wastewater conveyance system, backfilling and reinstatement activities. The ROW will be between 10 m – 20 m in width (typically 15 m), reduced to <15 m in areas of high environmental value such as at creek crossings and in remnant vegetation, where possible.

In order to assess the potential impact of these LS305 Project a desktop and field-based ecological assessment was completed to identify potential ecological constraints and impacts. The aim of the ecological assessment was to assess the likelihood of occurrence of Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and Matters of State Environmental Significance (MSES) to occur within the construction ROW. The results of this assessment has been used to inform the LS305 Project design so as to avoid and mitigate impacts to ecologically sensitive areas.



LS305 Conveyance System

Figure 1: Proposed LS305 alignment in relation to other projects in the area

Designed by: R.Z.
Produced by: R.Z.
14/11/2018

2 METHODOLOGY

2.1 Desktop Assessment Methodology

Prior to undertaking the ecological field surveys, a comprehensive review of background information was completed by a suitably qualified ecologist. This desktop assessment involved collation and review of relevant information concerning species likely to occur in the ROW locality. The purpose of the desktop assessment was to:

- refine a list of threatened species and ecological communities to be targeted during field surveys due to their potential likelihood of occurring within or adjacent to the ROW;
- source available information concerning the specific habitat requirements of the threatened species to aid in identifying the target species or their critical habitat features; and
- identify the location and general nature of other features of potential ecological significance (e.g. watercourses and wetlands).

A range of database resources and mapping products were utilised as part of the desktop review. Presented below is a list of the key database and mapping resources used, where applicable the outputs from these searches have been presented in **Appendix A**.

- The Wildlife Online database which is maintained by the Queensland Department of Environment and Science (DES).
- The EPBC Act Protected Matters Search Tool.
- The Atlas of Living Australia (ALA) database.
- The Regulated Vegetation Management Map produced by the Department of Natural Resources, Mines and Energy (DNRME) for the ROW locality.
- The Pre-clearing Regional Ecosystems map produced by DES for the ROW locality.
- Protected Plants Flora Survey Trigger Map.
- State koala habitat mapping.
- Waterway mapping.
- High resolution aerial photography sourced from Nearmap.

The EPBC Act Protected Matters Search was based on the ROW with a 5 km buffer. All other mapping searches were centred on -27.7678°, 152.9625° with a 5 km buffer, or Lot 1 on RP43903.

The process of refining the list of wildlife species, and ecological communities to be targeted involved reviewing the known and specific habitat requirements for each species and ecological community against the known or expected availability of such resources within the ROW locality. For each identified species and ecological community an assessment of the likelihood of occurrence was undertaken with each species and ecological community being assigned to one of the following categories.

- **Confirmed:** The species or ecological community has been positively recorded within the ROW during the current field surveys.
- **Known:** The species or ecological community has been positively recorded within the ROW by a qualified ecologist during past 30 years.
- **Likely:** Suitable habitat for the species or ecological community occurs within the ROW and proximate records¹ exist.
- **Possible:** Suitable habitat for the species or ecological community occurs within the ROW but no recent records from the ROW or proximate areas exist OR suitable habitat for the species or ecological community may not occur within the ROW but recent records from proximate areas exist.
- **Unlikely:** Suitable habitat for the species or ecological community does not occur within the ROW, and no recent records from the ROW or proximate areas exist.

2.2 Field Assessment Methodology

Ecological field surveys of the LS305 Project ROW were completed by two Logan Water Infrastructure Alliance (LoganWIA) personnel on 24 May, 16 and 17 August and 12 September 2018. The field surveys covered the full alignment of the ROW that traverses the following Lots:

- 500100/SP303089
- 2/SP303089
- 910/RP857850
- 4/RP45728
- 1/RP43903
- 4/RP43903
- 191/SP130088
- 2/RP43902
- 900/SP286344
- 65/CP851200
- Unnamed Road reserve (unformed)
- Olson Road Reserve (unformed)
- Olson Road
- Teviot Road

¹Proximate records are highly reliable records (i.e. identified through GPS precision or an accurate location description) that fall within the search area that are <50years in age.

- Greenbank Road

Refer to **Appendix B** for the alignment of the surveyed ROW.

The LS305 Project ROW and surrounding areas were surveyed, with all vegetated areas traversed on foot and cleared areas either driven or walked. The field surveys specifically targeted those threatened species and ecological communities identified by desktop assessment as potentially occurring within the broader LS305 Project area. The details of the timing, methods and locations of field surveys are provided in **Table 2-1**.

Table 2-1 Survey Effort

Date	Survey Techniques	Survey Area
24 May 2018	Vegetation Assessment (Quaternary Site Assessment) Opportunistic fauna assessment Opportunistic weed and pest assessment	The entire preliminary alignment of the ROW was traversed, with all vegetated areas traversed on foot and cleared areas either driven or walked.
16 & 17 August 2018	Vegetation Assessment (Quaternary Site Assessment) Koala Rapid Assessment Method (KRAM) Spotlighting Survey Call Playback Camera Trap Diurnal Observations	50010/SP303089 2/SP303089 900/SP286344 65/CP851200 Road Reserve (unformed) 910/RP857850 4/RP45728 1/RP43903 4/RP43903 Unformed Road Olson Road Teviot Road Greenbank Road Olson Road Reserve (unformed)
12 September 2018	Vegetation Assessment (Quaternary Site Assessment) Spotlighting Survey Call Playback Diurnal Observations	4/RP45728 1/RP43903 Olson Road Teviot Road Olson Road Reserve (unformed)

2.2.1 Spotlighting

The majority of the LS305 Project ROW was spotlighted over the course of two evenings (16 August and 12 September 2018). The only areas not traversed by spotlighting were areas identified as being a safety risk or where access could not be achieved. Spotlighting efforts covered over 15.4 km and involved 12 person hours of survey effort over the two evenings.

2.2.2 Koala KRAM Surveys

Koala surveys followed the Koala Rapid Assessment Methodology (KRAM) described by Woosnam-Merchez et al. (2012). The KRAM is flexible and relies on practitioners to develop their own methodology that is based on set parameters. Fifteen 100 m KRAM transects were positioned in suitable vegetation with three 10x10 m plots established at randomised intervals along alternating sides of the transect as illustrated in **Plate 1** below. Where the transect coincided with an existing access track, the 10 m quadrats started from the outside edge of the disturbed track area. Within each 10x10 m plot all trees greater than 150 mm diameter at breast height (DBH) were searched for presence of individuals, scats (both around the base and beneath canopy of tree) and signs such as scratches.

The following survey techniques completed are also suitable for detection of koala:

- Incidental diurnal survey observations;
- Call playback;
- Spotlighting; and
- Potential detection via camera trap.

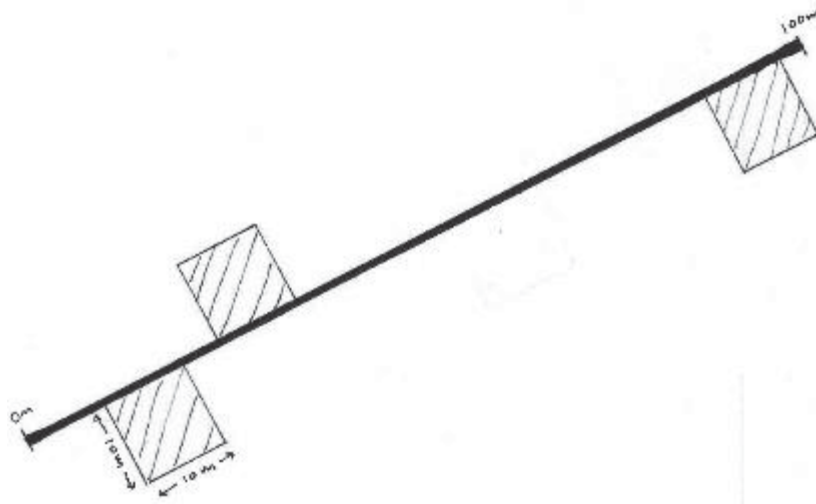


Plate 1: Typical configuration of a KRAM Site

3 RESULTS

3.1 Desktop Assessment Results

3.1.1 Vegetation Communities

The proposed LS305 Project ROW is located within a mixture of Category X (Non-remnant) vegetation which is not regulated under the *Vegetation Management Act 1999 (VM Act)*, as well as Category B (Remnant) Regional Ecosystems (REs) and Category C (High-value regrowth vegetation). Approximately 35% of the 9.7 km long ROW is located within Category B (Remnant) vegetation.

The following remnant REs are mapped in the ROW:

- 12.3.7 - *Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland, which has a Least Concern status pursuant to the VM Act;
- 12.3.11 - *Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open forest on alluvial plains usually near coast, which has an Of Concern status pursuant to the VM Act;
- 12.9-10.2 - *Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks, which has a Least Concern status pursuant to the VM Act;
- 12.9-10.7 - *Eucalyptus crebra* +/- *E. tereticornis*, *Corymbia tessellaris*, *Angophora* spp., *E. melanophloia* woodland on sedimentary rocks, which has an Of Concern status pursuant to the VM Act; and
- 12.9-10.12 - *Eucalyptus seeana*, *Corymbia intermedia*, *Angophora leiocarpa* woodland on sedimentary rocks, which has an Endangered status pursuant to the VM Act.

The locations of different remnant and regrowth REs along the LS305 Project alignment are illustrated in **Figure 2**.

There are no additional REs identified on pre-clearing mapping for the LS305 Project ROW.

Essential Habitat for koala is mapped as occurring within the ROW and surrounding area in association with REs 12.3.7 and 12.3.11. In addition, Essential Habitat is mapped for all remnant and regrowth vegetation within 1 km of a species record at the railway end of Mountain Ridge Road

3.1.2 Threatened Ecological Communities

One threatened ecological communities (TECs) is considered “likely to occur” within a 5km radius of the ROW as identified in the EPBC Protected Matters Search Report (refer to **Appendix A**). This community is listed as:

- Swamp Tea-Tree (*Melaleuca irbyana*) Forest of South-east Queensland (Critically Endangered).

An additional three TECs “may occur” within a 5km radius of the ROW as identified in the EPBC Protected Matters Search Report (refer to **Appendix A**). The details of these communities are listed below:

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland (Endangered).
- Lowland rainforest of Subtropical Australia (Critically Endangered).

- White Box-Yellow Box- Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered).

None of the above TECs are associated with any of the REs as mapped as occurring in the locality.

3.1.3 Threatened Flora

The LS305 Project does not traverse any areas identified on the Protected Plants Flora Survey trigger Map as a High Risk Area.

The desktop assessment identified a number of threatened flora species listed under the provisions of the EPBC Act and / or the *Nature Conservation Act 1992* (NC Act) as potentially occurring within the vicinity of the ROW. The results of the desktop assessment are provided as **Table 3-1**.

Table 3-1 Flora Species Desktop Assessment Results

Scientific Name	Common Name	EPBC Status	NC Act Status	Likelihood of Occurrence
<i>Bosistoa transversa</i>	Three-leaved Bosistoa	VU	-	Unlikely – Habitat unlikely to be present
<i>Cycas ophiolitica</i>	-	EN	EN	Unlikely – Habitat unlikely to be present
<i>Dichanthium setosum</i>	Bluegrass	VU	-	Unlikely – Habitat unlikely to be present
<i>Macadamia integrifolia</i>	Macadamia Nut	VU	VU	Unlikely – Habitat unlikely to be present
<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	VU	VU	Unlikely – Habitat unlikely to be present
<i>Melaleuca irbyana</i>	Swamp tea-tree	-	EN	Known – Individuals detected proximate to ROW
<i>Notelaea ipsviciensis</i>	Cooneana Olive	CE	EN	Unlikely – Habitat unlikely to be present
<i>Notelaea lloydii</i>	Lloyd's Olive	VU	VU	Unlikely – Habitat unlikely to be present
<i>Phaius australis</i>	Lesser Swamp-orchid	EN	EN	Unlikely – Habitat unlikely to be present
<i>Samadera bidwillii</i>	Quassia	VU	VU	Unlikely – Habitat unlikely to be present
<i>Thesium australe</i>	Austral Toadflax	VU	VU	Unlikely – Habitat unlikely to be present

3.1.4 Threatened Fauna

The desktop assessment identified a number of threatened fauna species listed under the provisions of the EPBC Act and / or the NC Act as potentially occurring within the vicinity of the ROW. The results of the desktop assessment are provided as **Table 3-2**.

Table 3-2 Fauna Species Desktop Assessment Results

Scientific Name	Common Name	EPBC Status	NC Act Status	Likelihood of occurrence
BIRDS				
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	EN	Possible – Suitable habitat present.
<i>Botaurus poeciloptilus</i>	Australasian Bittern	EN	-	Unlikely – Habitat unlikely to be present
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	EN	Unlikely – Habitat unlikely to be present
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	EN	EN	Unlikely – Habitat unlikely to be present
<i>Erythrorhynchus radiatus</i>	Red Goshawk	VU	EN	Possible – Possible opportunistic use for foraging.
<i>Geophaps scripta</i>	Squatter Pigeon (southern)	VU	VU	Possible – Possible suitable habitat however nearest ALA record 45 km south-west
<i>Grantiella picta</i>	Painted Honeyeater	VU	VU	Unlikely – Habitat unlikely to be present
<i>Lathamus discolor</i>	Swift Parrot	CE	EN	Possible – Possible opportunistic use for foraging during winter migration north.
<i>Ninox strenua</i>	Powerful owl	-	VU	Possible – Suitable habitat present
<i>Numenius madagascariensis</i>	Eastern Curlew	CE	EN	Unlikely – Habitat unlikely to be present
<i>Poephila cincta</i>	Southern Black-throated Finch	EN	EN	Possible – Possible suitable habitat however nearest ALA record 22 km south-west
<i>Rostratula australis</i>	Australian Painted Snipe	EN	VU	Unlikely – Habitat unlikely to be present
<i>Turnix melanogaster</i>	Black-breasted Button-quail	VU	VU	Unlikely – Habitat unlikely to be present
FISH				
<i>Maccullochella mariensis</i>	Mary River Cod	EN	-	Unlikely – Habitat unlikely to be present
<i>Argynnis hyperbius inconstans</i>	Australian Fritillary	CE	-	Unlikely – host plant <i>Viola betonicifolia</i> not located and unlikely to be present due to absence of Melaleuca wetland habitats.
MAMMALS				
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	VU	VU	Unlikely – Habitat unlikely to be present
<i>Dasyurus maculatus</i>	Spot-tailed Quoll	EN	VU	Possible – Possible opportunistic foraging

Scientific Name	Common Name	EPBC Status	NC Act Status	Likelihood of occurrence
<i>Petauroides volans</i>	Greater Glider	VU	VU	Possible – Possible opportunistic foraging, insufficient large hollows.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	VU	VU	Unlikely – Habitat unlikely to be present
<i>Phascolarctos cinereus</i>	Koala	VU	VU	Confirmed – Low level usage
<i>Potorous tridactylus</i>	Long-nosed Potoroo	VU	VU	Unlikely – Habitat unlikely to be present
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	VU	-	Confirmed – Individuals recorded foraging in area
REPTILES				
<i>Delma torquata</i>	Adorned Delma	VU	VU	Unlikely – Habitat unlikely to be present
<i>Furina dunmalli</i>	Dunmall's Snake	VU	VU	Unlikely – Habitat unlikely to be present
<i>Saiphos reticulatus</i>	Three-toed Snake-tooth Skink	VU	-	Unlikely – Habitat unlikely to be present

3.1.5 Migratory Fauna Species

The desktop assessment identified a number of migratory fauna species listed under the provisions of the EPBC Act as potentially occurring within the vicinity of the ROW. The results of the desktop assessment are provided as **Table 3-3**.

Table 3-3 Migratory Species Desktop Assessment Results

Scientific Name	Common Name	Identified in the Field?	Likelihood of occurrence within impact area
<i>Apus pacificus</i>	Fork-tailed Swift	No	Likely – An almost exclusively aerial wide-ranging species.
<i>Cuculus optatus</i>	Oriental Cuckoo	No	Likely – Suitable open forest habitat present in species non-breeding range.
<i>Hirundapus caudacutus</i>	White-throated Needletail	No	Likely – An almost exclusively aerial non-breeding migratory species.
<i>Monarcha melanopsis</i>	Black-faced Monarch	No	Unlikely – Suitable habitat not present
<i>Monarcha trivirgatus</i>	Spectacled Monarch	No	Possible – Suitable habitat limited but species records exist in broader locality
<i>Motacilla flava</i>	Yellow Wagtail	No	Unlikely – Potentially suitable habitat present but no records of occurrence
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	No	Possible – Preferred tall moist open forest habitat not present

Scientific Name	Common Name	Identified in the Field?	Likelihood of occurrence within impact area
<i>Rhipidura rufifrons</i>	Rufous Fantail	No	Possible – Preferred tall moist open forest habitat not present
<i>Actitis hypoleucos</i>	Common Sandpiper	No	Unlikely – Suitable habitat not present
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	No	Unlikely – Suitable habitat not present
<i>Calidris ferruginea</i>	Curlew Sandpiper	No	Unlikely – Suitable habitat not present
<i>Calidris melanotos</i>	Pectoral Sandpiper	No	Unlikely – Suitable habitat not present
<i>Gallinago hardwickii</i>	Latham's Snipe	No	Unlikely – Suitable habitat not present
<i>Numenius madagascariensis</i>	Eastern Curlew	No	Unlikely – Suitable habitat not present
<i>Pandion haliaetus</i>	Osprey	No	Unlikely – Suitable habitat not present
<i>Tringa nebularia</i>	Common Greenshank	No	Unlikely – Suitable habitat not present

3.1.6 Waterways

The proposed ROW crosses two named watercourses, these being:

- Flagstone Creek (152.956/ -27.789)
- Abrade Creek (152.961/ -27.776)

The proposed ROW will also cross 4 unnamed drainage features.

Flagstone Creek, Abrade Creek and the other unnamed drainage features flow in a generally easterly direction and are tributaries of the Logan River. At each crossing point, the creeks are ephemeral and have an incised channel.

Works at watercourses and all but one of the unnamed drainage features will be via trenchless technology, however some vegetation clearing will be required for vehicular and machinery access. It is expected that existing access tracks and a crossing point will be utilised at Abrade Creek and no additional vegetation clearing will be required. It is also expected that no to very minimal clearing will be undertaken at Flagstone Creek, and no vehicle or machinery access will be required in this area. All works within waterways will be in accordance with best practice and necessary Riverine Protection Permits under the *Water Act 2000* and Waterway Barrier Works under the *Fisheries Act 1994*.

3.1.7 Assessment Results from Broader Area

Ecological assessments have been completed to support a number of EPBC Referrals within the broader surrounding area. **Table 3-4** provides the results of the review of these submissions, identifying ecological triggers within the broader area.

Table 3-4 Details of other EPBC Referral Submissions

EPBC Referral No.	Proponent	Description of activity	Ecological Values Triggered	Decision
2018/8190	Logan City Council	Construction of a 8.5 km long below ground wastewater conveyance system from Flagstone Central to Cedar Grove.	Koala Grey-headed Flying-fox	Not a controlled action
2017/8109	Pacific International Development Corporation Pty Ltd	Development of a master planned community across 2,015 hectares of land at Undullah.	Koala Grey-headed Flying-fox	Controlled Action
2014/7319	Pacific International Development Corporation Pty Ltd	15.6 linear hectares of vegetation clearance for the construction of 7km of external corridor Road.	<i>Melaleuca irbyana</i> individuals not the community Koala	Not a controlled action
2016/7817	Mirvac Queensland Pty Ltd	Development of a 410 hectare master planned residential community within the Greater Flagstone Priority Development Area	Koala Grey-headed Flying-fox	Controlled Action
2016/7772	Pacific International Development Corporation Pty Ltd	Construction and operation of a 1,028 hectare master planned multi-use residential development within the Greater Flagstone Priority Development Area	Koala <i>Melaleuca irbyana</i> individuals not the community Grey-headed Flying-fox	Controlled Action
2015/7530	Pioneer Fortune Pty Ltd	To construct and operate a 1,024 hectare master planned residential development in the Greater Flagstone Priority Development Area	Koala <i>Melaleuca irbyana</i> individuals not the community	Controlled Action
2014/7206	PEET Flagstone City Pty Ltd	To construct a mixed-use development (including residential, commercial and community developments and associated infrastructure) on 1,245.26 ha site at Flagstone	Spotted Tail Quoll Koala	Controlled Action

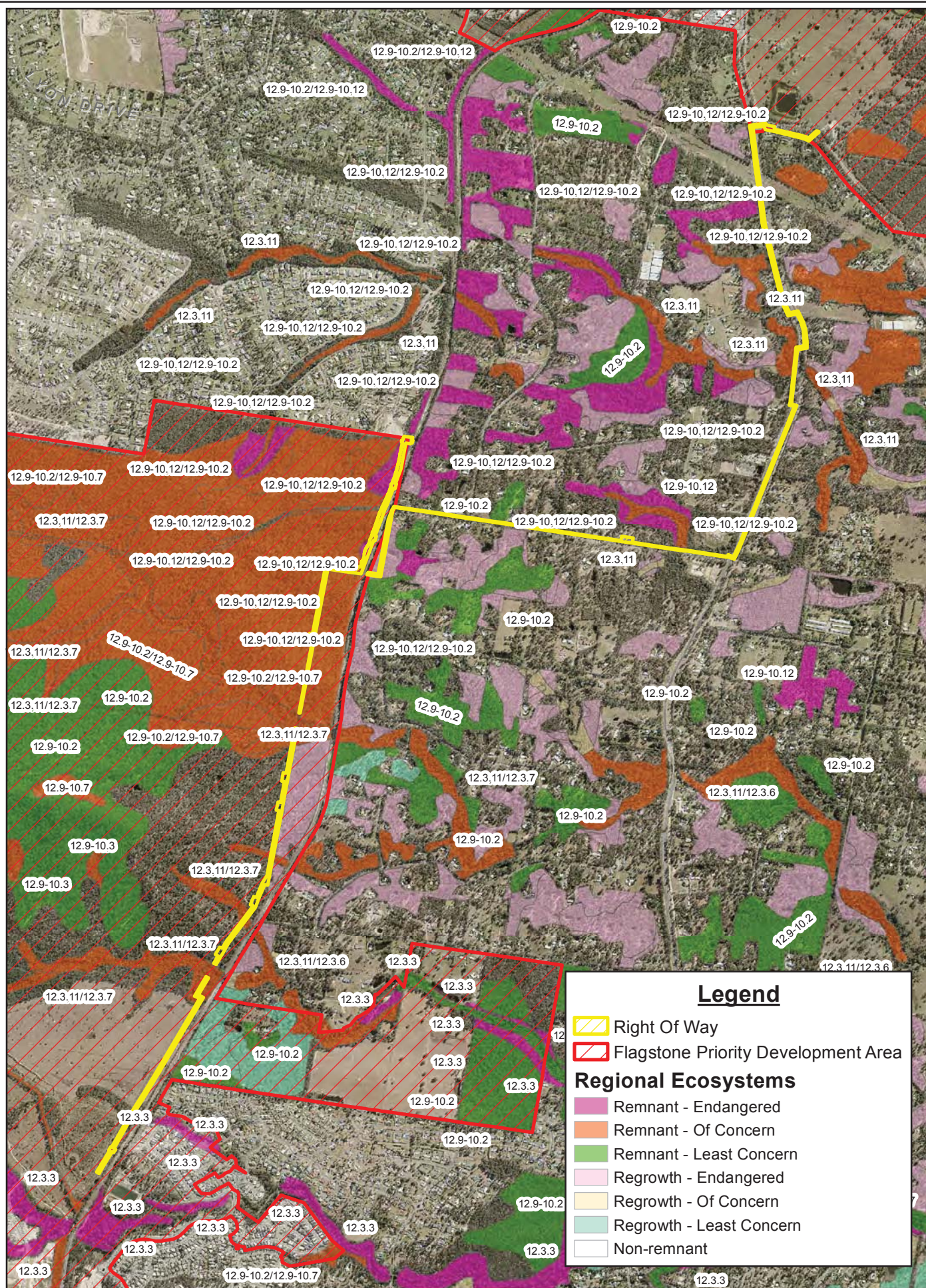
3.2 Field Assessment Results

3.2.1 Vegetation Communities

Seven quaternary level vegetation assessments were completed within areas of mapped Category B (Remnant) vegetation during surveys in August and September 2018. Another five quaternary level assessments within areas mapped as Category X (Non-remnant) vegetation. The results of these assessments are provided as **Appendix C**. As shown in **Table 3-5**, generally vegetation within the ROW was consistent with the mapped Regional Ecosystems (REs). The mapped distributions of Category B (Remnant) REs along the proposed LS305 Project ROW are shown in **Figure 2**.

Table 3-5 REs mapped and identified within the ROW

Regional Ecosystem (RE)	RE Description	Identified within Proposed ROW?
RE 12.3.7 (Least Concern)	<i>Eucalyptus tereticornis</i> , <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> +/- <i>Melaleuca</i> spp. fringing woodland.	Yes – vegetation representative of RE 12.3.7 identified within the ROW. Does not correspond with any EPBC listed TEC.
RE 12.3.11 (Of Concern)	<i>Eucalyptus tereticornis</i> +/- <i>Eucalyptus siderophloia</i> , <i>Corymbia intermedia</i> open forest on alluvial plains usually near coast.	Yes – vegetation representative of RE 12.3.11 identified within the ROW. Does not correspond with any EPBC listed TEC.
RE 12.9-10.2 (Least Concern)	<i>Corymbia citriodora</i> subsp. <i>variegata</i> +/- <i>Eucalyptus crebra</i> open forest on sedimentary rocks	Yes – vegetation representative of RE 12.9-10.2 identified within the ROW. Does not correspond with any EPBC listed TEC.
RE 12.9-10.7 (Of Concern)	<i>Eucalyptus crebra</i> +/- <i>E. tereticornis</i> , <i>Corymbia tessellaris</i> , <i>Angophora</i> spp., <i>E. melanophloia</i> woodland on sedimentary rock	Yes – vegetation representative of RE 12.9-10.7 identified within the ROW. Does not correspond with any EPBC listed TEC.
RE 12.9-10.12 (Endangered)	<i>Eucalyptus seeana</i> , <i>Corymbia intermedia</i> , <i>Angophora leiocarpa</i> woodland on sedimentary rocks.	Yes – vegetation representative of RE 12.9-10.12 identified within the ROW. Does not correspond with any EPBC listed TEC.



3.2.2 Threatened Ecological Communities

The field surveys confirmed that none of the TECs identified by desktop assessment or any other EPBC Act listed TECs, occur within or immediately adjacent to the ROW.

3.2.3 Threatened Flora

A single *Melaleuca irbyana* individual was identified during the ROW, refer to **Table 3-6**. The specimen is located within 5 m of the edge of the LS305 Project ROW. Given the proximity to the ROW the individual will be clearly identified and fenced for the duration of works in the area.

Table 3-6 Survey details of *Melaleuca irbyana*

ID	GPS	General Description	Habitat Description
MI1	-27.78812, 152.95383	Single mature individual	Non-remnant vegetation, located as a standalone tree along edge of existing access track.

No other threatened flora species were detected within the LS305 Project ROW. A total of 117 flora species, including 70 native and 47 exotic species, were detected in the LS305 Project ROW. A full list of all native and exotic flora species detected during the field surveys is provided as **Appendix D**.

3.2.4 Threatened Fauna

Two threatened fauna species were confirmed during the field surveys of the ROW, these being:

- Koala (*Phascolarctos cinereus*) – listed as Vulnerable under both the EPBC and NC Act; and
- Grey-headed Flying-fox (*Pteropus poliocephalus*) listed as Vulnerable under the EPBC Act.

Further details of the survey findings with respect to these species are provided below.

3.2.4.1 Koala

Koalas were detected within and proximate to the LS305 ROW through direct observation methods (i.e. spotlighting and call playback) and indirect signs (i.e. scats and scratches). A single Koala was sighted whilst spotlighting approximately 40 m west of the ROW (**Figure 3**). The KRAM survey results located a scat beneath seven of the 91 surveyed trees distributed across 45 survey plots and 15 survey transects. **Table 3-7** below details the results of the KRAM surveys at fifteen sites within the ROW.

The Koala activity level was highest in the areas close to Bradman Street (i.e. Transects K7 & K8) and in the vicinity of Abrade Creek (i.e. Transects K14). The areas showing the higher Koala usage were generally observed as having very large, preferred mature Koala feed trees such as *Eucalyptus tereticornis*.

Refer to **Figure 3** below that provides a geographical reference of Koala evidence recorded throughout the LS305 Project ROW.

Table 3-7 Koala KRAM details and results

Transect no.	Plot Distance (m)	No. of Trees Surveyed in Each Plot	No. of Trees with Koala Scat	Koala Signs	Other observation/s
K1	81	4	0	-	Wallaby scats at two trees
	82	1	0	-	Wallaby scat
	90	1	0	-	
K2	11	2	0	-	
	64	2	0	-	
	77	2	0	-	
K3	27	1	0	-	
	39	1	0	-	
	60	1	0	-	
K4	1	2	0	-	Wallaby scat
	31	3	0	-	
	57	1	0	-	
K5	16	4	0	-	Wallaby scat
	25	2	0	-	Wallaby scat
	80	1	0	-	
K6	36	1	0	-	
	59	2	0	-	
	100	3	0	-	Possum scat, wallaby scat
K7	39	2	2	Scratches	
	49	2	1	-	
	82	1	0	-	
K8	26	2	2	-	
	46	3	0	-	Possum scats
	53	2	0	-	
K9	40	4	0	-	
	52	2	0	-	
	64	4	0	-	
K10	20	1	0	-	
	68	1	0	-	
	88	3	0	-	
K11	62	1	0	-	
	74	2	0	-	
	78	1	0	-	Wallaby
K12	27	1	0	-	
	36	1	0	-	
	61	1	0	-	Wallaby
K13	14	4	0	-	
	50	3	0	-	Possum scats
	60	1	0	-	
K14	8	4	2	-	
	48	5	0	-	

Transect no.	Plot Distance (m)	No. of Trees Surveyed in Each Plot	No. of Trees with Koala Scat	Koala Signs	Other observation/s
	56	1	0	-	
K15	61	2	0	-	
	76	2	0	-	
	82	1	0	-	
TOTAL	45 plots (4,500 m²)	91	7	1	NA



Transect K1



Transect K2



Transect K3



Transect K4



Transect K5



Transect K6



Transect K7



Transect K8



Transect K9



Transect K10



Transect K11



Transect K12



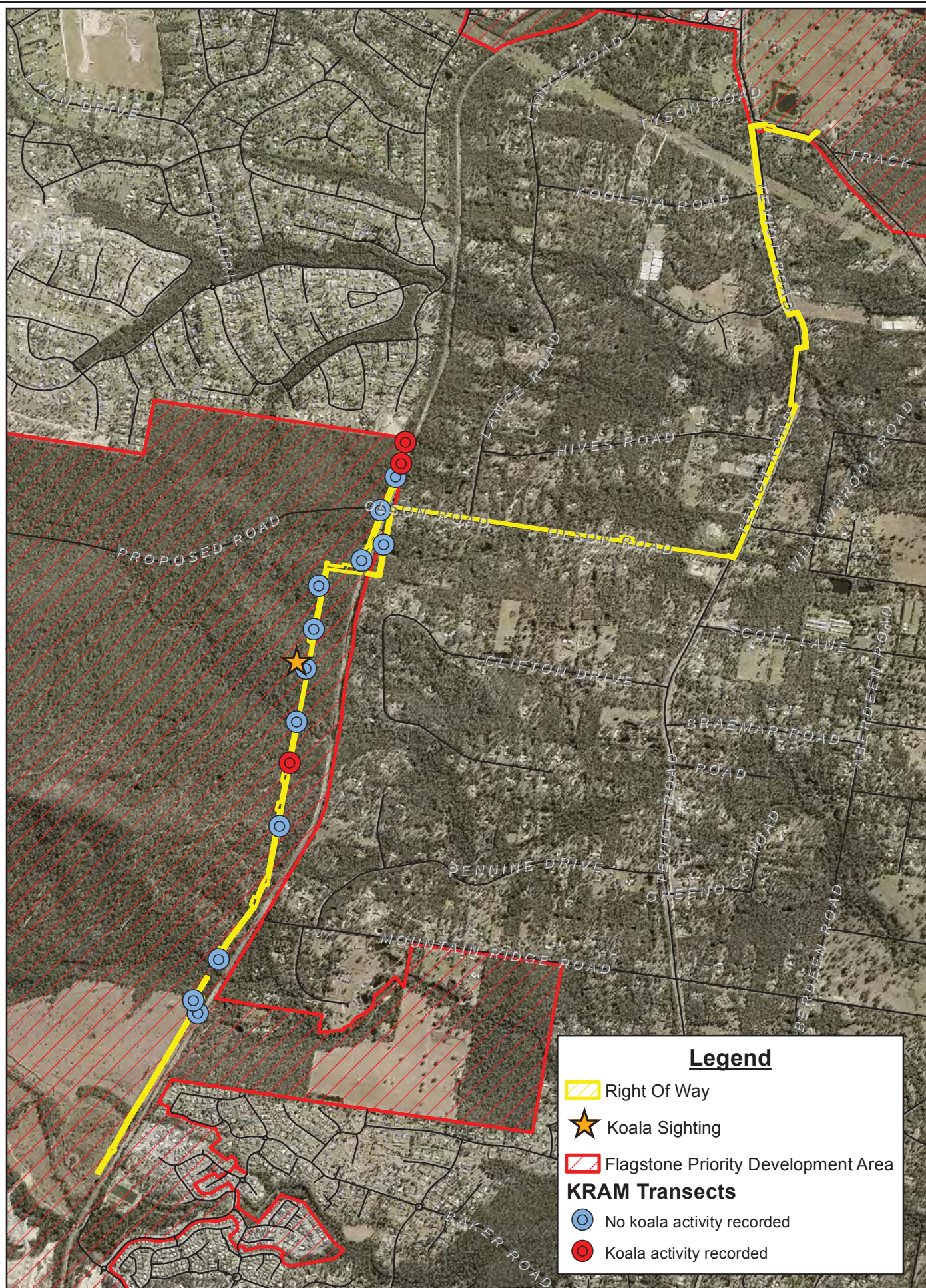
Transect K13



Transect K14



Transect K15



LS305 Conveyance System

Figure 3: Locations of KRAM sites

Although the LS305 Project ROW is not located within a Koala Assessable Development Area under the provisions of the *Planning Act 2016*, the Queensland State Planning Policy (SPP) Koala Habitat Values mapping indicates that the LS305 Project ROW is made up of Koala Bushland Habitat of Low and Medium Value, and areas Suitable for Rehabilitation of Low and Medium Value (**Figure 4**). For vegetated areas on the western side of the Brisbane-Sydney Railway, Koala habitat value was typically found to correspond with the SPP mapping.

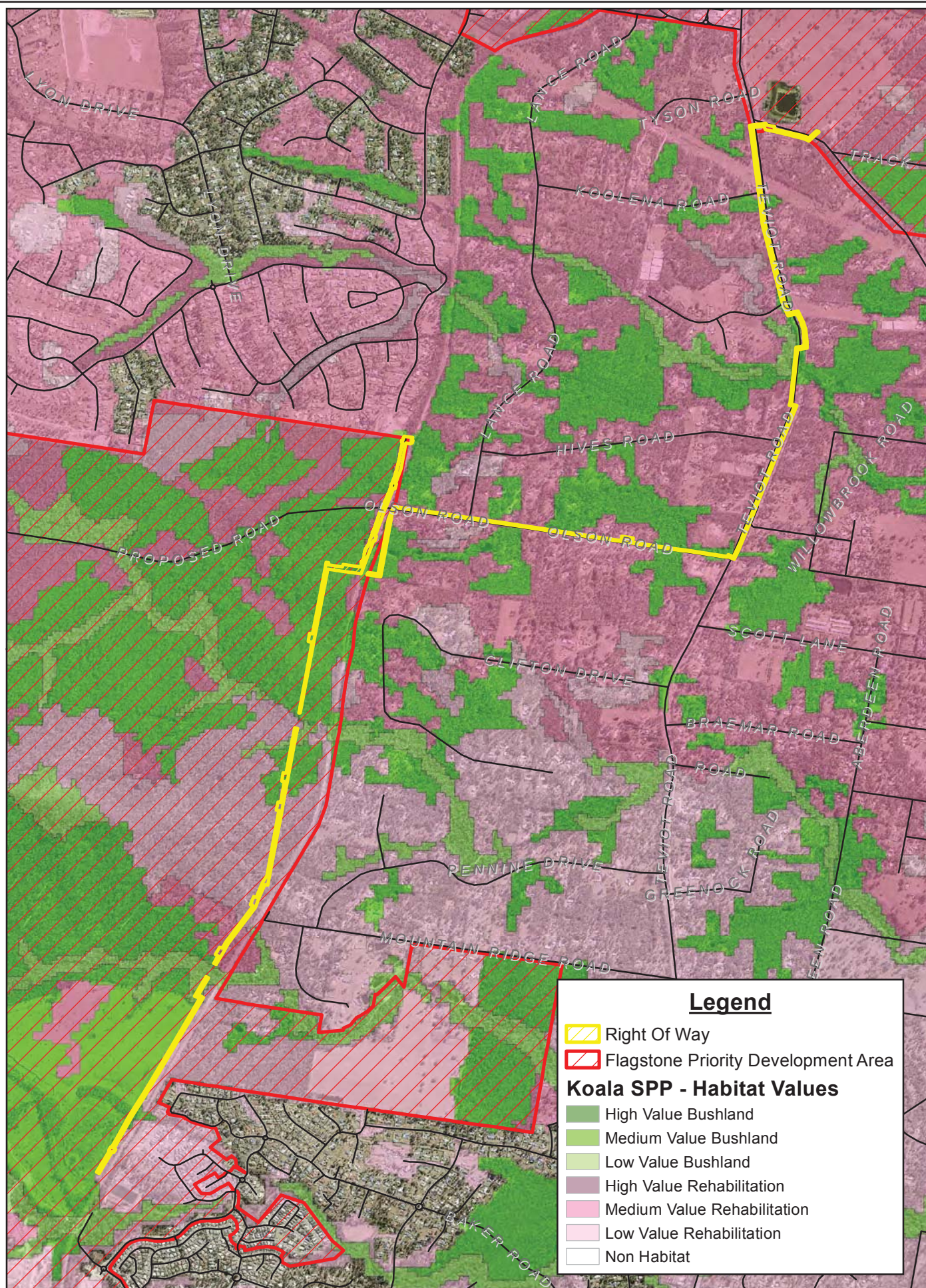
Updated koala habitat mapping has been completed for the LS305 Project ROW. The Koala SPP Habitat Values mapping was utilised as a foundation, with updates then made based on the following:

- exclusion of Road Reserve areas, (as these areas are typically highly disturbed and the expected impact is minimal through the retention of significant habitat trees);
- ground truthing of habitat conditions during field surveys; and
- aerial imagery interpretation (including the identification of recently cleared areas).

The updated Koala habitat mapping for the ROW is provided in **Figure 5**. Based on these updates the LS305 ROW is expected to have impact areas as outlined in **Table 3-8**.

Table 3-8 Koala Habitat Impact Areas

Habitat Value	Area (Ha)
Bushland (Medium Value)	4.5
Regrowth Vegetation Suitable for Rehabilitation (Low Value)	2.3
Non-habitat areas	7.3



LS305 Conveyance System
Figure 4: SPP Koala Habitat Mapping



Legend

ROW Koala Habitat Value

- Medium Value Bushland
- Low Value Regrowth
- Non-habitat

LS305 Conveyance System

Figure 5: ROW Ground-truthed Koala Habitat Value

Designed by: R.Z.
Produced by: R.Z.
14/11/2018



0 200 400 600 800
Meters

1:30,000

3.2.5 Grey-headed Flying-fox

Two Grey-headed Flying-foxes were detected within the ROW during two evenings of spotlighting on 16 August 2018 and 12 September 2018. Observations were of single individuals foraging during spotlighting on 16 August 2018 (**Figure 6**). The survey was conducted at a time when a number of Eucalyptus species were in flower, hence suitable for nectar foraging species.

3.2.6 Migratory, Special Least Concern, and Least Concern Fauna

No migratory fauna species were detected during the field surveys. During the spotlighting surveys, one colonial breeding species, the Squirrel glider (*Petaurus norfolcensis*), was recorded.

A total of 27 least concern fauna species were detected during surveys of the ROW. A full list of all fauna species detected is provided as **Appendix E**. It should be noted that most of these observations were made through opportunistic survey. It is likely that other fauna species occur within the vicinity of the LS305 Project ROW but were not detected during the survey.

3.2.7 Pests and Weeds

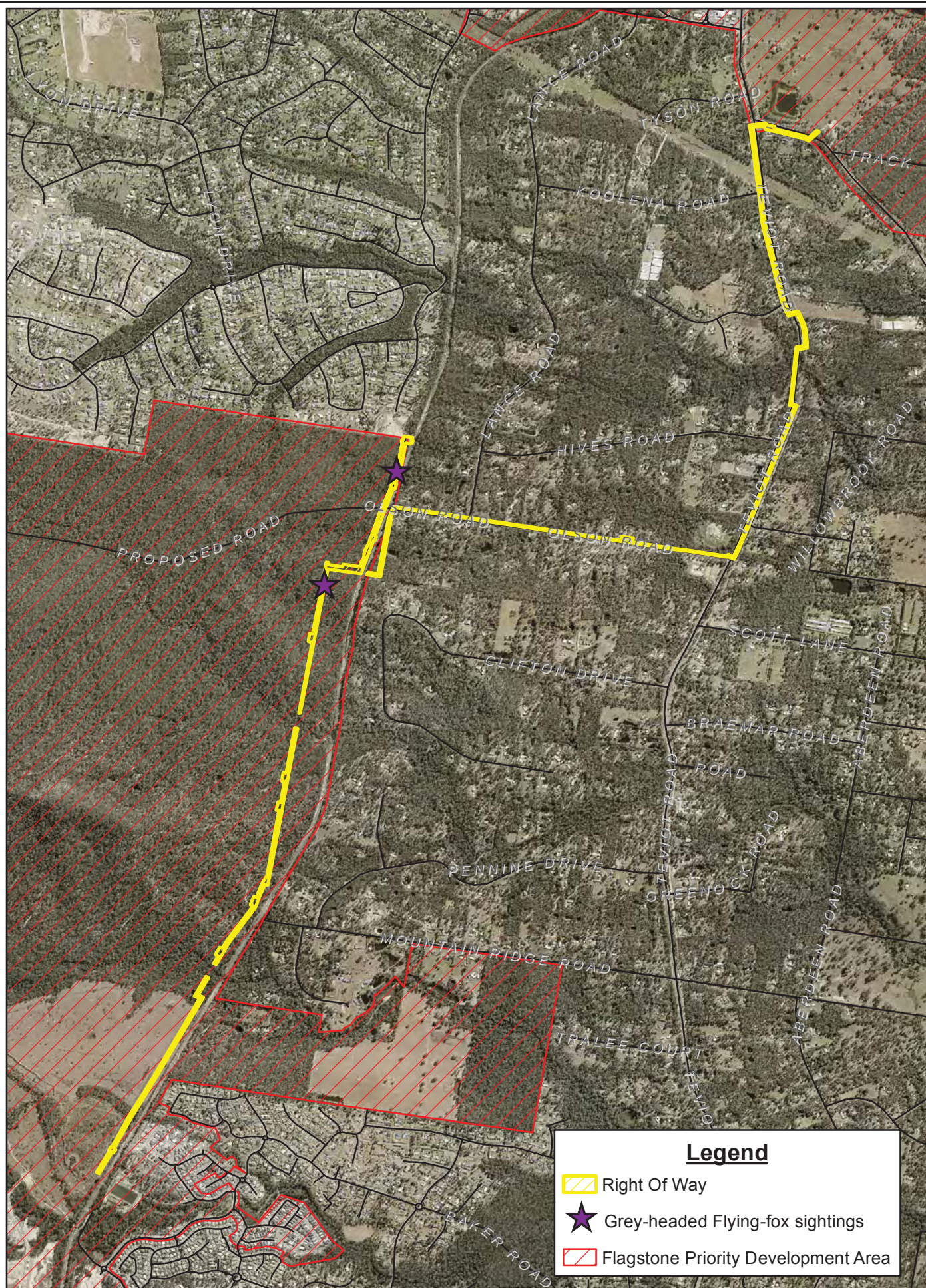
Whilst a dedicated weed survey was not completed as part of the ROW surveys, a number of weed species declared under the *Biosecurity Act 2014* were detected within the ROW. Details concerning the restricted weeds identified within the LS305 Project ROW are provided below in **Table 3-9**. A full list of all exotic flora species recorded within the LS305 Project ROW is provided in **Appendix D**.

Table 3-9: Declared weed species found during survey

Scientific Name	Common Name	Biosecurity Act Status
<i>Ambrosia artemisiifolia</i>	Ragweed	Category 3
<i>Aristolochia elegans</i>	Dutchman's Pipe	Category 3
<i>Asparagus aethiopicus</i>	Ground asparagus fern	Category 3
<i>Bryophyllum delagoense</i>	Mother of millions	Category 3
<i>Lantana camara</i>	Lantana	Category 3
<i>Lantana montevidensis</i>	Creeping Lantana	Category 3
<i>Opuntia stricta</i>	Prickly pear	Category 3
<i>Schinus terebinthifolius</i>	Broad-leaved Pepper tree	Category 3
<i>Senecio madagascariensis</i>	Fireweed	Category 3
<i>Sporobolus pyramidalis</i>	Giant Rat's Tail Grass	Category 3

Three introduced fauna species were detected in the LS305 Project ROW, these being:

- Dog (*Canis lupus familiaris*) which is a Category 3, 4 and 6 Restricted matter under the *Biosecurity Act 2014*;
- Rabbit (*Oryctolagus cuniculus*) which is a Category 3, 4, 5 and 6 Restricted matter under the *Biosecurity Act 2014*; and
- Cane toad (*Rhinella marina*) which is not a listed species pursuant to the *Biosecurity Act 2014*.



4 EPBC ACT SIGNIFICANT IMPACT SELF-ASSESSMENT

Evidence of Koala and Grey-headed Flying-fox activity was detected throughout the LS305 Project ROW and as such EPBC Act significant impact self-assessments against relevant referral guidelines have been completed for these two species.

For the purposes of these assessments the following are noted.

- 1) Both the Koala and Grey-headed Flying-fox utilise the areas of remnant open forest traversed by the ROW as foraging habitat, and for the Koala these vegetated areas provide movement opportunities within an increasingly urbanised landscape.
- 2) The extent of open forest habitat clearance associated with the LS305 Project consists of approximately 6.8 ha of Koala habitat. This is made up of 4.5 ha of medium value bushland habitat and 2.3 ha of regrowth vegetation suitable for rehabilitation. The clearance will occur as relatively narrow (i.e. 10 to 20m) bands of clearance through approximately 4.3 km of remnant and regrowth open forest.
- 3) The extent of open forest clearance associated with the project is minor as it represents approximately 0.23% of the total extent of available bushland habitat located within a 5 km radius of the approximate centre of the LS305 ROW (-27.7676, 152.9624) (i.e. 6.3 ha of Koala habitat is required to be cleared and >2,900 ha of bushland habitat is present within a 5 km radius).
- 4) All vegetation clearance will be carried out in a controlled manner so as to avoid damage to adjacent areas of vegetation to be retained and harm to any fauna utilising the vegetation.
- 5) During the establishment of the underground infrastructure within the ROW appropriate controls will be implemented to minimise the potential for fauna entrapment or injury.
- 6) Following establishment of the wastewater pipelines within the ROW existing ground surface levels will be reinstated, restoration of vegetative cover will occur and there will be no impediment to the movement of native fauna.

The results of these assessments are provided in the following sections.

4.1 Koala

Koala has been confirmed within the LS305 Project ROW and surrounding locality. Koalas were detected in the proposed ROW by spot-lighting and the presence of scats during field surveys completed in August and September 2018. A historical Koala observation was recorded in 2005 along Olson Road adjacent to LS305 Project ROW (source and full credits to the Australian Koala Foundation, 2018).

Further, **Figure 7** shows Koala records obtained by Logan City Council from a variety of sources. Whilst there is no metadata to accompany these records so that the date and nature of these sightings could be confirmed, these records indicate that Koalas are known from the broader area.

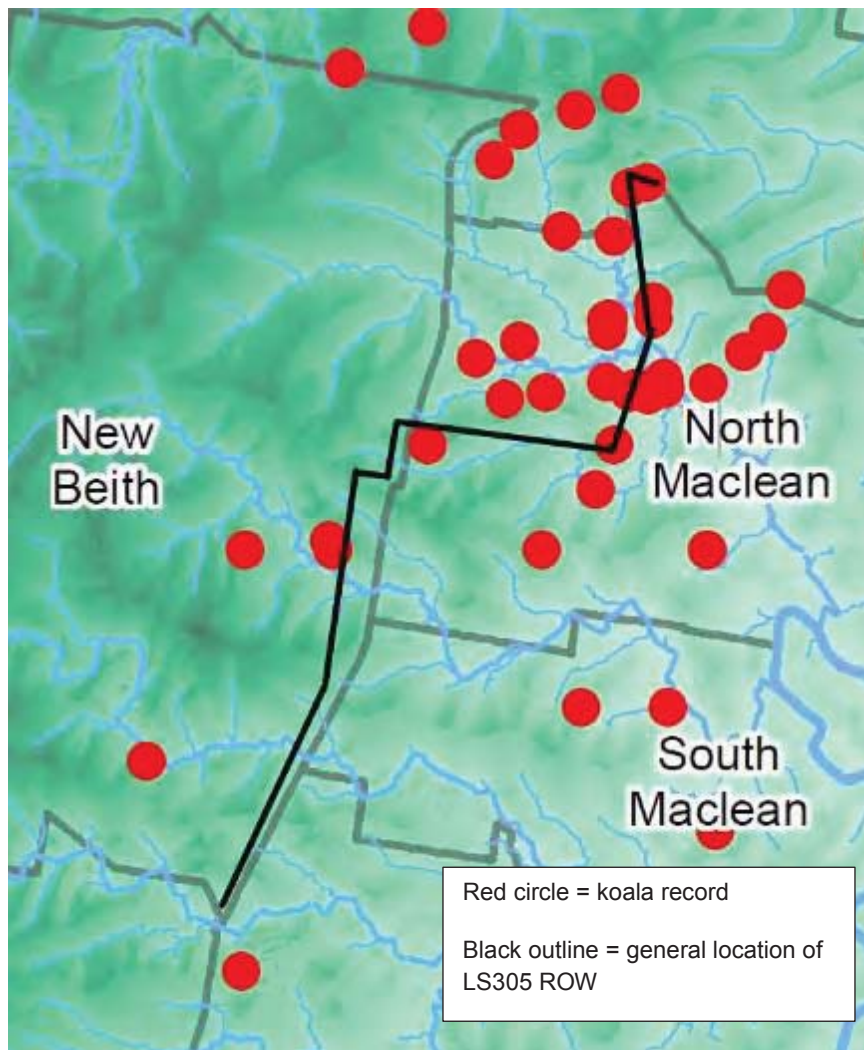


Figure 7 Logan City Council Koala Sightings within proximity to the LS305 Project

4.1.1 Koala Critical Habitat Assessment

An assessment of the Koala habitat within the LS305 Project was completed using the Koala Habitat Assessment Tool presented in Table 4 of the EPBC Act Referral Guidelines for the Vulnerable Koala ‘Koala referral guidelines’ (Department of the Environment, 2013). The results of that assessment are summarised in **Table 4-1** and indicate that the LS305 Project supports ‘habitat critical to the survival of the Koala’.

Table 4-1 Koala habitat assessment in accordance with the Koala referral guidelines

Attribute	Score	Assessment against coastal habitat characteristics
Koala occurrence	+2 (High)	There are numerous historical records of Koalas within and moving through the LS305 Project locality. The KRAM surveys for the LS305 Project found evidence of Koala along various sections of the alignment.
Vegetation composition	+2 (High)	The LS305 Project area supports reasonable number of primary Koala food tree species (OEH, 2018), such as: - Queensland Blue Gum (<i>E. tereticornis</i>) Secondary Koala food trees were also recorded within the LS305 Project. - Gum-topped Box (<i>E. moluccana</i>)

Attribute	Score	Assessment against coastal habitat characteristics
		It is considered likely that more primary and secondary Koala food trees will occur within the wider the area.
Habitat connectivity	+1 (Medium)	The northern and eastern sections of the ROW traverses areas that are highly fragmented by roads and rural residential development with limited connectivity. The southern section of the ROW is located in cleared land designated for urban residential development. To the west of the middle section of the ROW is currently open forest with connectivity to further western areas, however this area is earmarked for future urban purposes as part of the Greater Flagstone PDA (Appendix F). It is anticipated that only narrow corridors of open forest will be retained in this landscape. Whilst these corridors of habitat are connected to a large (i.e. > 500 ha) area of contiguous habitat to the west, the areas of habitat to be impacted will have a degraded level of connectivity to these areas due to the presence of adjacent urban development and the presence of roadway crossings of the retained corridors.
Key existing threats	+1 (Medium)	Whilst there are no registered records of Koala kills within the surrounding area due to either vehicle strike or dog attack, adjacent land to the east has an extensive history of use for urban purposes and Koala mortality associated with that use is likely to have occurred. The surrounding area to the LS305 Project is currently being rapidly developed into a residential community. This development will in turn lead to higher vehicle usage of the currently quiet roads and will also result in an increased density of dogs within the area as the development progresses, both of which will increase threats to the local Koala population.
Recovery value	+1 (Medium)	The LS305 Project currently intersects with habitat that has been retained in order to provide corridors through an urbanising landscape to allow for Koala movement through the development to areas of bordering habitat. The large areas of contiguous habitat to the west of the ROW are important to achieving the Interim Recovery Objectives for the Koala as they constitute a large, connected areas of Koala habitat of sufficient size to be genetically robust and operate as a viable sub-population. Whilst the areas of Koala habitat to be impacted do form part of a corridor network through an urbanising landscape they do not form a critical connection between otherwise disjunct large areas of Koala habitat. Additionally, it should be noted that the works will have limited impact in terms of minimal timeframe and will not create any long-term barriers to movement. As such it likely that the habitat to be impacted by the LS305 Project is not important for achieving the interim recovery objectives for the Koala within the broader locality.
Score	7	The LS305 Project is considered to contain 'habitat critical to the survival of the Koala'.

4.1.2 Koala Significance Impact Assessment

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment 2013).

These 'Significant Impact Criteria' for Vulnerable species states that, *"An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:*

- *Lead to a long-term decrease in the size of an important population of a species."* Where an, an important population is defined as, *"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:*
 - o *"likely to be key source populations either for breeding or dispersal*
 - o *likely to be necessary for maintaining genetic diversity, and/or*
 - o *at or near the limit of the species range."*
- *"reduce the area of occupancy of an important population;*
- *fragment an existing important population into two or more populations*
- *adversely affect habitat critical to the survival of a species;*
- *disrupt the breeding cycle of an important population;*
- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;*
- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;*
- *introduce disease that may cause the species to decline; or*
- *interfere substantially with the recovery of the species."*

An assessment against each of these criteria is provided in the following sections.

4.1.2.1 *Lead to a long-term decrease in the size of an important population of the species*

Individual Koala that reside within or move through the areas of remnant and modified eucalypt dominated open forest that are traversed by the LS305 Project ROW are not likely to be members of an important population, as defined in the Guideline, for the following reasons:

- those individuals are not located at or near the limit of the Koala's geographic range;
- those individuals are not known to be genetically distinct, or likely to be so, due to the high levels of Koala habitat connectivity that exist in the predominantly non-urban landscapes to the west of the ROW; and
- those individuals are not likely to be important to the conservation status of Koala via the process of breeding or dispersal given the predominately urbanised landscape that occupies land to the north and east.

Notwithstanding the above, the Koala that move through the habitat traversed by the ROW potentially play a role in maintaining some level of genetic exchange between the local Koala population occupying the non-urban landscapes to the west and the local Koala populations that inhabit the more heavily urbanised landscapes to the north and east.

Given the small area and narrow linear nature of Koala habitat to be impacted by the LS305 Project ROW, and the ability to avoid direct harm to the Koala during the construction phase of the project, it is unlikely that the project will lead to a long term decrease in the size of the local Koala population which is not considered to be an important Koala population.

4.1.2.2 Reduce the area of occupancy of an important population

The LS305 Project will not have a discernible impact on the extent of habitat occupied by an important Koala population. The narrow width of the required habitat clearance and underground nature of the infrastructure will allow Koala to occupy retained areas of habitat either side of the LS305 ROW.

In any event the small area (6.8 ha) and linear pattern of Koala habitat disturbance associated with the LS305 Project will not substantially reduce the area of occupancy of the local Koala population.

4.1.2.3 Fragment an existing important population into two or more populations

A large portion of the ROW and adjacent land has been previously cleared with the retention of some corridors of riparian and roadside vegetation that provide potential movement corridors for Koala. Whilst the LS305 Project will involve some narrow (i.e. approximately 15 m) linear clearance throughout these corridors this clearance will not have a significant adverse impact of the ability of Koala to move through these vegetated corridors due to:

- the narrow width of initial disturbance during the construction phase and the proposed revegetation of cleared areas of forested habitat;
- the short duration of the construction phase of the project; and
- the fact that the wastewater conveyance infrastructure to be located therein is below ground infrastructure.

As such the LS305 Project will not lead to the fragmentation of the local Koala population, which is not considered to be an important population.

4.1.2.4 Adversely affect habitat critical to the survival of a species

An assessment of the Koala habitat values of land traversed by the ROW completed using the Koala Habitat Assessment Tool is presented in Section 4.1.1. That assessment determined that the subject habitat satisfies the criteria for classification as “habitat critical to the survival of Koala”, with an overall habitat score of 7.

The nature and extent of disturbance to “habitat critical to the survival of Koala” would not result in a significant impact to the local or regional Koala populations. In this respect the following are noted.:

- The habitat score calculated for the impact area is relatively low (i.e. 7 out of 10) with the risk of significant impacts occurring increasing as the habitat score increases.

- The amount of Koala habitat being cleared is small (i.e. ~ 6.3 ha) in an absolute sense and will be distributed across the landscape.
- The amount of Koala habitat being cleared is also small in a relative sense constituting approximately 0.23% of the total existing extent of remnant open forest habitat within the broader locality².
- The method of clearing will be selective, in that only a narrow (i.e. 10 to 15 m wide) corridor of clearance will occur with adjacent areas of habitat being retained, and rehabilitation of native vegetation will occur in ecologically sensitive areas (i.e. riparian and greenspace corridors) following establishment of the below ground infrastructure.
- Field surveys indicate that the habitat to be impacted is subject to low levels of utilisation by Koala.
- The proposed action primarily involves the establishment of below ground linear infrastructure that will not cause fragmentation of Koala habitat.

It is noted that the Section 7 of the EPBC Act Referral Guidelines for the Vulnerable Koala 'Koala referral guidelines' indicates that a significant impact would not be expected if 5 hectares of Koala habitat scoring 9 or 10, or 10 hectares scoring 7 or 8, was selectively cleared. Given the limited extent (i.e. 6.8 ha) and selective nature (i.e. narrow linear corridor) of Koala habitat clearance associated with the LS305 Project, a significant residual impact is not expected.

4.1.2.5 Disrupt the breeding cycle of an important population

The nature of the LS305 Project, which involves the clearance of a relatively small narrow band of Koala habitat over a short period of time to facilitate the establishment of below ground infrastructure, is not likely to disrupt the breeding cycle of the local Koala population, which is not considered to be an important population.

4.1.2.6 Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Given the small area of Koala habitat to be impacted by the LS305 Project, and limited impacts to primary or secondary feed trees, and the availability of these habitat resources in the locality, it is unlikely the project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

4.1.2.7 Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The areas of Koala habitat to be impacted are in a disturbed condition and are subject to weed and pest invasion. The LS305 Project is unlikely to contribute towards increases in the abundance or distribution of any invasive species which may be harmful to the Koala, particularly given the inclusion of a weed management as part of the project specific environmental management plan (PSEMP) which will be implemented prior to, during, and post construction.

² There is >2,900 hectares of Koala Bushland Habitat within a 5km radius of the centre point of the LS305 Project ROW

4.1.2.8 *Introduce disease that may cause the species to decline*

Chlamydia is a bacterial infection which affects almost all Koalas in South East Queensland. It is unlikely that this disease or any others would be increased by the LS305 Project.

4.1.2.9 *Interfere substantially with the recovery of the species*

According to the EPBC Act referral guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Department of the Environment 2014), “impacts which are likely to substantially interfere with the recovery of the Koala may include one or more of the following.

- *introducing or increasing Koala fatalities in habitat critical to the survival of the Koala, due to dog attacks, to a level that is likely to result in multiple, ongoing mortalities*

The LS305 Project will not introduce or result in any increase Koala fatalities due to dog attack.

- *introducing or increasing Koala fatalities in habitat critical to the survival of the Koala, due to vehicle strikes, to a level that is likely to result in multiple, ongoing mortalities*

The LS305 Project has a very low probability of resulting in any Koala injuries or fatalities due to vehicular strike, as the operation of vehicles and other machinery during the construction phase of the project will occur during the daytime and at low speeds.

- *facilitating the introduction or spread of disease or pathogens to an area, for example Chlamydia or Phytophthora cinnamomi to habitat critical to the survival of the Koala, that are likely to significantly reduce the reproductive output of female Koalas or reduce the carrying capacity of the habitat*

The LS305 Project will not introduce or increase the prevalence of diseases or pathogens likely to adversely impact Koala or its habitat. Appropriate hygiene controls for machinery and materials will be implemented to manage the potential risk of introduction/spread of pathogens such as Die-back (*Phytophthora cinnamomi*) and Myrtle rust (*Uredo rangelii* or *Puccinia psidii*) that may adverse impact Koala habitat.

- *creating a barrier to movement between or within habitat critical to the survival of the Koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the Koala*

The narrow linear nature of habitat clearance and the underground nature of the infrastructure to be established means that the LS305 Project will not result in any functional fragmentation of Koala habitat.

- *changing hydrology, which degrades habitat critical to the survival of the Koala, to the extent that the carrying capacity of the habitat is reduced in the long term.*

The proposed action will not have any long-term impact on the hydrology of the catchments traversed by the ROW. Any changes during the construction phase of the project will be minor, localised and short-term.

4.2 Grey-headed Flying-fox

A number of Grey-headed Flying-foxes were observed foraging the LS305 Project ROW and a review of the Australian Government Department of the Environment National Flying-fox monitoring viewer indicates one Grey-headed Flying-fox camp is located within 5 km of the project (Refer to **Figure 8**). The Camp is not identified as a Nationally Important Flying-fox camp. No camps were identified in the LS305 Project ROW.

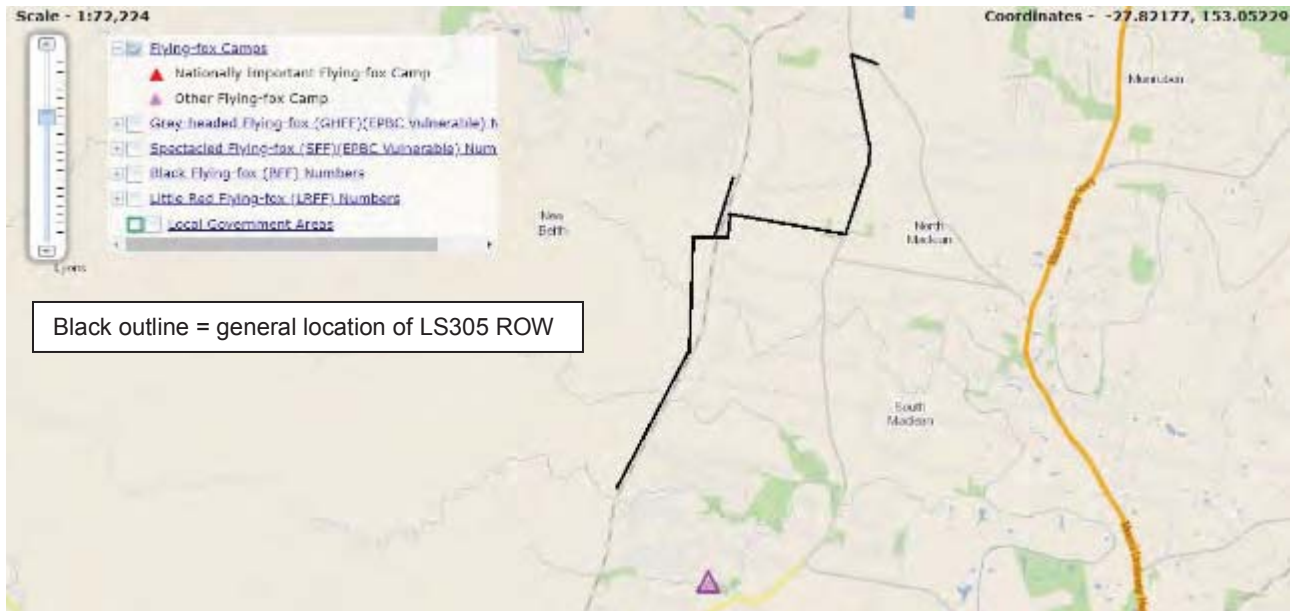


Figure 8 Flying-fox Camp locations

The Camp is located off Homestead Drive and is known as the Flagstone Camp (464), the co-ordinates of this camp are -27.8147, 152.963. The Camp also has recorded usage by the Grey-headed Flying-fox and Black Flying-fox.

Figure 9 below shows the Flagstone camp monitoring results for a period between November 2012 – November 2015, the camp has consistently remained as a small camp of up to 499 Grey-headed Flying-fox individuals over four monitoring events between November 2012 – November 2015. In the last two monitoring events no flying fox were recorded during the monitoring events, however the possibility exists that the camp site was occupied during a period that did not coincide with the monitoring events. Whilst **Figure 5** shows no counts for the years after 2015, it should not be assumed that the camp is no longer used as there are several factors that impact:

- whether or not a camp site is utilised, or the timing of that utilisation, in any given year; and
- the ability of the National Flying-fox Monitoring Program (NFFMP) to monitor all camps across Australia.

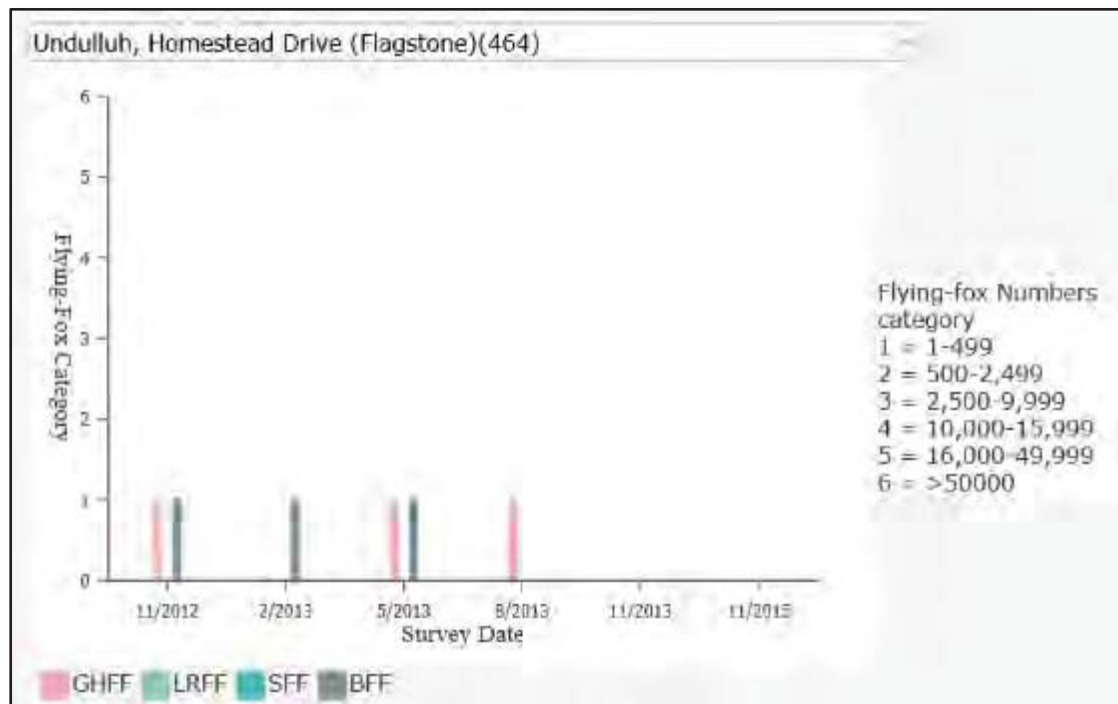


Figure 9 Flagstone Camp monitoring results

4.2.1 Grey-headed Flying-fox Significance Impact Assessment

The Grey-headed Flying-fox is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1.

4.2.1.1 Lead to a long-term decrease in the size of an important population of the species

Individual Grey-headed Flying-fox that periodically exploit the forage resources available within the LS305 Project ROW are not likely to be members of an important population, as defined in the Guideline, for the following reasons:

- those individuals are not located at or near the limit of the species' geographic range;
- those individuals are not known to be genetically distinct, or likely to be so, due to the highly mobile and wide ranging nature of species; and
- those individuals are not likely to be of any greater importance to the conservation of status of the species, via the process of breeding or dispersal, than any other individuals of this species.

The primary food sources for Grey-headed Flying-fox are flowering Eucalyptus and related genera, rainforest fruits and some commercial fruit crops. The vegetation communities used by the Grey-headed Flying-fox do not provide a continuous foraging resources throughout the year. Consequently the Grey-headed Flying-fox has complex and wide ranging movement patterns to access this ephemeral and patchy food resources.

Given the small area and narrow linear nature of habitat to be impacted by the LS305 Project and the ability to avoid direct harm to the Grey-headed Flying-fox during the construction phase of the project, it is unlikely that the LS305 Project will lead to a long term decrease in the size of any Grey-headed Flying-fox population.

4.2.1.2 Reduce the area of occupancy of an important population

The small area (6.8 ha) and linear pattern of habitat disturbance associated with the LS305 Project will not have a discernible impact on the area of habitat occupied by any Grey-headed Flying-fox population.

4.2.1.3 Fragment an existing important population into two or more populations

The Grey-headed Flying-fox is a very mobile and wide-ranging species that will not suffer any habitat fragmentation as a result of the LS305 Project.

4.2.1.4 Adversely affect habitat critical to the survival of a species

The LS305 Project ROW does not pass through or adjacent to any known roost sites for the Grey-headed Flying-fox. The nearest known Grey-headed Flying-fox roost site is approximately 2.25km to the south-east of the ROW in an area of riparian vegetation/parkland associated with Sandy Creek.

This roost/camp site is non-permanent, relatively small (i.e. 1-499 individuals) and not considered to be of National significance.

4.2.1.5 Disrupt the breeding cycle of an important population

The LS305 Project will not disrupt the breeding cycle of the Grey-headed Flying-fox either by way of interference with food resources or roosting sites.

4.2.1.6 Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The small extent and localised nature of impacts to available forage resources for the Grey-headed Flying-fox would not result in any discernible decline in this species population.

4.2.1.7 Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

There are no known invasive species that are harmful to the Grey-headed Flying-fox. The distribution and abundance of weed species and pathogens that may adversely impact the eucalypt open forests utilised by the Grey-headed Flying-fox would not be increased by the LS305 Project.

4.2.1.8 Introduce disease that may cause the species to decline

The LS305 Project will not introduce or increase the prevalence of Grey-headed Flying-fox pathogens such as the Australian bat Lyssavirus, Bat Paramyxovirus and Menangle Pig virus.

4.2.1.9 Interfere substantially with the recovery of the species

According to the Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) (Commonwealth of Australia 2017), recovery objectives for the Grey-headed Flying-fox may include:

- *Identify, protect and enhance native foraging habitat critical to the survival of the Grey-headed Flying-fox*
- *Camp management*
- *Monitor population trends*
- *Increase public awareness and build capacity to co-exist*

- *Decrease impact to horticulture industry*
- *Support research*
- *Reduce impact of electricity lines, and entanglement in barbed wire and netting*

The LS305 Project will not involve any activities that are inconsistent with achieving the recovery objectives for the Grey-headed Flying-fox. In that respect it is noted that the LS305 Project:

- has been designed to minimise impacts to areas of eucalypt dominated open forest which provide forage resources for the Grey-headed Flying-fox;
- will impact a small area of open forest habitat (i.e. 6.8 ha) which constitutes approximately 0.24% of the extent of remnant open forest habitat available within a 5 km radius of the approximate centre point of the LS305 Project;
- will not impact on any existing flying fox camps;
- will not substantially increase risks associated with overhead electricity lines, barbed wire or netting.

The other recovery objectives around camp management, increased public awareness, impacts to horticulture industry, population monitoring and supporting research are not things that the LWIA can directly contribute.

5 CONCLUSIONS AND RECOMMENDATIONS

This ecological assessment has identified a number of potential ecological constraints within the LS305 Project. The following findings are considered notable.

- A single *Melaleuca irbyana* individual was identified during the surveys within 5 m of the edge of proposed ROW. No impact is expected with appropriate fencing.
- As squirrel Gliders were detected within the ROW a high-risk species management plan for colonial breeding species under the NC Act is required to manage impacts to these species.
- Koala and Grey-headed Flying-fox were detected in the LS305 Project ROW. Whilst no significant impacts to these species are expected as a result of the proposed works the LS305 Project should nonetheless implement measures to ensure that impacts to these species are avoided, minimised and mitigated.
- Section 22A confirmation and clearing permits will be required under the VM Act for the following areas:
 - o Clearing of Category B Vegetation in Road Reserve areas;
 - o Clearing of Category C Vegetation on Freehold land outside the PDA; and
 - o Clearing of Category X Vegetation on Reserve land.

All other areas are deemed as exempt under the Planning Regulation 2017. Relevant approvals and permits will be attained prior to works commencing.

- There are two watercourses that will be traversed, via trenchless technology, by the proposed ROW. No vegetation clearance is expected in these areas, however if permits are required under the *Water Act 2000* or as Waterway Barrier Works under the *Fisheries Act 1994* they will be attained, and works managed in accordance with best practice.

The following management measures are recommended to avoid and minimise impacts to ecological values observed in the LS305 Project ROW.

- Trenchless technology should be considered for corridors of riparian vegetation, particularly mapped waterways under the VM Act and Water Act 2000.
- Minimise the length of open trenching at all times to minimise the potential for fauna entrapment. Any sections of trenching that need to be left open over-night should have timber ladders (or other suitable structures) secured within the open trench so as to provide a means for any entrapped fauna to climb out of the trench.
- Top soil and mulch to be stored and reinstated.
- Large Eucalypt spp. trees should be retained where possible.
- Clearing of vegetation overall should be avoided as much as practical.

- Prior to any clearing, clearly delineate areas for retention of vegetation with high visibility flagging tape or equivalent markings.
- Fell vegetation away from any vegetation which is to be retained.
- Clear vegetation in a manner that will prevent damage to vegetation to be retained.
- A suitably qualified fauna spotter catcher should be present to supervise and direct all vegetation clearing.
- Develop a Weed Management strategy as part of the PSEMP for pre-construction, delivery and post-construction.
- Owing to the presence of several watercourse crossings, appropriate erosion and sediment control is required. Soil erosion and sediment loss should be managed during site works as per a PSEMP and Erosion Sediment Control Plan.

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