Summary of Ecological Constraint Assessments

1.0 Introduction

This Summary of Ecological Constraint Assessments has been prepared to support referral of the Border to Gowrie Project to the Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The objective of this document is to provide a summary of ecological assessments that have been completed by Eco Logical Australia Pty Ltd in support of the corridor options review process for the Border to Gowrie Project, with a specific focus on aspects that are relevant to the Conceptual Alignment and wider Study Area.

The following reports have been reviewed for the purpose of preparing this summary:

a. Eco Logical Australia (2016). Inland Rail Alignment – Yelarbon-Gowrie: Ecological Constraints Assessment. Prepared for AECOM (Eco Logical Australia, 2016).

b. Eco Logical Australia (2017). Inland Rail Alignment – Yelarbon-Gowrie: Karara/Leyburn and Warwick Additional Options, Ecological Constraints Assessment. Prepared for AECOM (Eco Logical Australia, 2017).

2.0 Scope of Constraint Assessments

2016 Constraints Assessment

This study included a desktop assessment of environmental values, two four day field surveys (during April and September 2016) and a comparison of the ground-truthed information with the values previously documented in the original environmental assessment of the alignment conducted in 2010 (Parsons Brinckerhoff, 2010).

2017 Constraints Assessment

This study included a desktop assessment of environmental values, a four day field survey (during October 2016) and an assessment of ecological constraints along each of three alternative corridor options, based on the ground-truthed information in conjunction with existing state-wide mapping.

3.0 Methods

3.1 Desktop Assessment

A desktop assessment was undertaken prior to the field assessment to identify potential ecological features and constraints that may occur within the Study Area. The following databases and maps were reviewed:

- EPBC Act Protected Matters Search Tool (PMST)
- Wildlife Online Database Search
- Atlas of Living Australia database
- Regional Ecosystem (RE) mapping and the Department of Environment and Science (DES) “former” high-value regrowth (HVR) mapping
- Queensland Matters of State Environmental Significance (MSES) mapping which includes wetlands, Essential Habitat, Endangered and Of Concern remnant vegetation etc.
- DES’s Protected Plants Flora Survey Trigger Area mapping

- DES's Wetland mapping
- *Vegetation Management Act 1999* (VM Act) stream order mapping
- Aerial imagery.

3.2 Field Assessment

The following ecological field surveys were undertaken by Eco Logical Australia to inform the constraints assessments:

Table 3-1 Summary of ecological field surveys

Dates	Resources	Scope
26-29 April 2016	2 x Ecologists	· Survey of Modified Base Case alignment and original sub-options. · Identification of type and extent of REs/ Threatened Ecological Communities (TECs), weeds, pests, fauna habitat and fauna species.
12-15 September 2016	2 x Ecologists	· Survey of additional sub-options to the Modified Base Case. · Identification of type and extent of REs/TECs, weeds, pests, fauna habitat and fauna species.
25-28 October 2016	2 x Ecologists	· Survey of three alternative corridor options as a component of the corridor options review process. · Identification of type and extent of REs/TECs, weeds, pests, fauna habitat and fauna species.

3.2.1 Survey Site Locations

Preliminary survey site locations were selected using information obtained during the desktop review prior to undertaking the field assessments. Site locations were selected with the aim of surveying all areas identified as ecological constraints from the desktop assessment, as well as representative sites across the range of environmental values in the region. Site selection was mainly (with the exception of one property) constrained to public roads and other public lands.

Additional sites supporting ecological constraints that were not identified as occurring, or accessible, during the desktop assessment, were added when identified during the field survey.

3.2.2 Flora

Quaternary surveys were undertaken in accordance with Queensland Herbarium survey guidelines (Neldner, 2012) by one ecologist. These sites were used to confirm the identification and mapping of REs, TECs, and allow for additional data to be collected on the occurrence of weed species and the structure and composition of vegetation communities. Information collected at each survey point included:

- dominant and common native species for the upper, mid and ground layer
- structure (cover and height) of the upper, mid and ground layer
- land form and zone
- RE/TEC classification
- brief condition assessment (remnant or regrowth status, weed species and cover)
- comparison with state-wide mapping
- photograph and GPS location.

Ad hoc searches for threatened flora species identified in the desktop assessments were made at all sites. All plant identifications were carried out by an experienced botanist with the aid of available botanical reference material. Where identifications could not be made in the field, samples were collected for subsequent identification.

3.2.3 Fauna and Habitat

Fauna surveys were conducted by one ecologist in association with the vegetation survey to determine the presence of fauna habitat and species. Information collected at habitat assessment sites included:

- density of ground and shrub layers
- presence of fallen logs (>10 cm diameter)
- decorticating bark
- coarse litter (>2 cm diameter)
- fine litter (<2 cm diameter)
- proximity to water, and water features present
- soil cracks present
- presence of tree hollows and stags
- presence of rocks and rocky outcrops
- presence of termite mounds
- presence of soil cracks
- presence of caves and man-made structures suitable as microchiropteran bat roost sites
- vegetation connectivity and proximity to neighbouring areas of intact vegetation
- presence of habitat considered suitable for threatened fauna species identified as part of the desktop assessment
- presence of nests or other fauna signs like scats, scratching and diggings.

A total of 134 sites were surveyed for fauna and habitat values during the three ecological surveys. Time spent at each site usually ranged from 5-30 minutes depending on the complexity of the site. The habitat data was used to help inform and assessment of habitat suitability for listed fauna species at each site.

A bat call detector (Song Meter – Wildlife Acoustics) was deployed on three consecutive nights (26th, 27th and 28th April 2016) at three different sites during the first field survey, and deployed on two consecutive nights (13th and 14th September 2016) at two different sites during the second field survey.

The three sites during the first field survey were located at Canning Creek, the Condamine River and near to on Gowrie Creek. For the second field survey, the bat call detector was deployed along Macintyre Brook near Inglewood (-28.41, 151.078) and on the Inglewood bypass north of Gore Highway option (-27.911, 151.066).

The bat call detector was placed at the sites between 4pm and 5pm and collected between 6.30am and 10.30am the following morning. The bat call detector was placed within open areas adjacent to or within riparian areas of waterways likely to be utilised as flight paths or foraging areas for a range of species. This collected data were analysed by local expert Greg Ford from Balance Environmental.

3.3 Data Analysis

An assessment of the likelihood of occurrence of EPBC Act or *Nature Conservation Act 1992* (NC Act) listed flora and fauna from the database searches was made across all combined Route Corridor options. This utilised mapped and observed habitat and the existing species records, by applying the following criteria:

- **Known:** Recorded within the alignment.
- **Likely:** Preferred habitat observed or mapped on the alignment, known to occur in the region surrounding the alignment and distribution overlaps with the alignment.
- **Potential:** Marginal habitat observed or mapped on the alignment, known to occur in the region surrounding the alignment and distribution overlaps with the alignment.
- **Unlikely to occur:** Preferred habitat or marginal habitat present but not known from surrounding region or distribution does not overlap with the alignment.
- **Does not occur:** Not known from the surrounding region and distribution does not overlap with the study area (usually associated with errors in databases searched) or no preferred or marginal habitat present on the alignment.

4.0 Results

4.1 Regional Ecosystems

A total of 504 quaternary surveys were conducted during the three field surveys. Table 4-1 lists 24 REs identified from the desktop assessment and field survey as occurring on or adjacent to the Preliminary Alignment. REs from the Brigalow Belt South Bioregion begin with the number 11, while REs from the Nandewar Bioregion begin with the number 13. Following is a general description of the REs under the dominant broad landscape types

4.1.1 Broad Vegetation Types

Drainage Lines and Alluvial Plains

River Red Gum *(Eucalyptus camaldulensis)* and/or Forest Red Gum (*E. tereticornis)* woodlands (RE 11.3.25) occur on fringing drainage lines that are within the Study Area. Most of these drainage lines are ephemeral and even the larger rivers, which include the Macintyre Brook and Condamine River, do not generally flow all year round. An exception is Gowrie Creek, which has a more permanent flow associated with waste and other water from Toowoomba.

Areas with broader alluvial/flood plains support Poplar Box (*E. populnea* – RE 11.3.2) and/or Forest Red Gum (RE 11.3.4) woodlands although many of these areas have been extensively cleared, particularly in the more fertile valleys surrounding the Macintyre Brook and the Condamine River.

Areas of natural grassland (REs 11.3.21 and 11.3.24) previously occurred on the alluvial plains of the Darling Downs in the northern parts of the Study Area although there is little of this vegetation type remaining intact and no remnant areas (as defined under the VM Act) were mapped or observed on or adjacent to the Conceptual Alignment during the field surveys.

Areas of non-riverine wetlands (RE 11.3.27) were mapped as part of a mosaic on the Condamine River floodplain. However, ground truthing and inspection of aerial photography verified that this RE did not occur along the Conceptual Alignment.

Yelarbon Desert

This unique vegetation type (RE 11.5.14) occurs in the south western parts of the Study Area around the town that gives the vegetation community its name. This vegetation is associated with sodic (saline) soils with extensive areas of bare ground known as ‘scalds’ and with sparse vegetation. There are often scattered trees such as Bull Oak (*Allocasuarina luehmannii)* and Paperbark (*Melaleuca densispicata)*.

The ground layer is dominated by a sparse cover of spinifex (*Triodia scariosa*), other grasses (*Aristida* spp., *Eragrostis* spp.) and forbs (e.g. *Portulaca oleracea*, *Atriplex* spp.). (Department of Environment and Resource Management, 2010) noted that ephemeral wetlands were a common component of this ecosystem, although these were not observed during field surveys along the Conceptual Alignment.

Eucalypt Woodlands with Cypress Pine/Bulloak on Plains

There are extensive areas of flat to undulating plains on texture contrast soils with a sandy surface. These areas mainly occur where the Conceptual Alignment traverses the Bringalily State Forest to the east of Yelarbon and between Inglewood and Millmerran. The vegetation group includes a series of eucalypt woodlands dominated by Poplar Box (RE 11.3.18), Poplar Box or Narrow Leaved-ironbark (*E. crebra* – RE 11.5.1), Gum Topped Box (*E. woollsiana* – REs 11.5.20 - 11.9.13) and Dirty Gum (*E. chloroclada* – RE 11.5.4), with a low tree layer usually dominated by Cypress Pine (*Cypress glaucophylla*) and Bull Oak.

Mountain Coolibah on Undulating Rises and Low Hills

Mountain coolibah *(E. orgadophila)* woodlands occur on the crests and lower slopes hills of mainly basalt (RE 11.8.5) or less often sediments (RE 11.9.2). These areas predominantly occur on the Darling Downs east of the Condamine River floodplain. There were some areas adjacent to the Conceptual Alignment of steeper hills with rock outcrops. Small areas on lower slopes of basalt hills are mapped as natural grasslands (RE 11.8.11) although no areas of this RE were observed during the field surveys.

Brigalow Woodland and Semi Evergreen Vine Thicket on Undulating Plains

Brigalow (*Acacia harpophylla*) and/or Belah (*Casuarina cristata*) woodlands (REs 11.3.1, 11.4.3, 11.9.5) occur scattered across flat and gently undulating clay plains, mainly in the southern half of the Study Area, although scattered patches were also recorded to the east of the Condamine River floodplain. Most of these areas have been cleared and only isolated remnants/regrowth patches remain. There were small areas of Semi Evergreen Vine Thicket (SEVT – 11.8.3) mapped and observed north of Millmerran and also near Gowrie adjacent to the Conceptual Alignment.

Regrowth

Regrowth habitat occurs in numerous small to moderate sized patches within the Study Area. These areas vary greatly in age and size classes ranging from low (< 5 m) scattered trees to woodland up to 15 m high.

Grazing and Cultivation

Agricultural areas which were generally dominated by introduced pastures and cultivated species (e.g. sorghum, cotton) were common along all parts of the Study Area with the exception of state forest between Yelarbon and Millmerran.

4.1.2 Endangered and Of Concern REs

Endangered REs

In most cases the areas mapped as Endangered Brigalow REs (11.4.3 and 11.9.5) in the state mapping were confirmed at the sites visited during field surveys.

No areas of remnant Endangered grassland REs (11.3.21 and 11.3.24) were observed adjacent to the Conceptual Alignment during the field surveys. These REs do occur in the surrounding region, but all areas observed adjacent to the Conceptual Alignment were very small (<0.1 ha), or dominated by exotic weed species, and therefore do not meet the criteria to be considered remnant Endangered REs.

Of Concern REs

Most of the Of Concern REs were verified as occurring within the Study Area. This included the Yelarbon Desert (RE 11.5.14) which occurs to the south of Yelarbon. Small areas of Of Concern grassland on basalt (11.8.11) were observed in the field adjacent to the Conceptual Alignment in the northern Darling Downs.

The extent of Of Concern REs was often found to be less than that shown on the state-wide RE mapping. This was invariably associated with areas where the Of Concern ecosystems, particularly Poplar Box on alluvium (RE 11.3.2), were mapped as part of a mosaic with other Least Concern ecosystems surrounding riparian areas. The field surveys showed that in this situation an Of Concern RE was often not present within the Study Area.

Table 4-1 List of Regional Ecosystems identified from desktop assessment and field survey

RE code	Short description	VM Act class	Observed
11.3.21	*Dichanthium sericeum* and/or *Astrebla* spp. Grassland on alluvial plains. Cracking clay soils	Endangered	No – small degraded areas dominated by exotic species
11.4.3	*Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains*	Endangered	Yes
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Endangered	Yes
11.3.1	*Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains*	Endangered	Yes – mainly small areas of regrowth
11.3.24	*Themeda avenacea grassland on alluvial plains. Basalt derived soils*	Endangered	No – small degraded areas dominated by exotic species
11.4.10	*Eucalyptus populnea or E. woollsiana, Acacia harpophylla, Casuarina cristata open forest to woodland on margins of Cainozoic clay plains*	Endangered	No
11.4.12	*Eucalyptus populnea woodland on Cainozoic clay plains*	Endangered	No
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Of concern	yes
11.3.4	*Eucalyptus tereticornis* and/or E*ucalyptus* spp. Woodland on alluvial plains	Of concern	Yes
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Of concern	Yes
11.9.7	*Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	Of concern	Yes
11.9.13	*Eucalyptus moluccana* open forest on fine grained sedimentary rocks	Of concern	Yes
11.5.14	*Triodia sp.* Grassland with emergent trees on Cainozoic sand plains and/or remnant surfaces. Highly alkaline soils	Of concern	Yes
11.8.3	Semi-evergreen vine thicket which may have emergent *Acacia harpophylla, Casuarina cristata and Eucalyptus spp.* Occurs on Cainozoic igneous rocks. Generally restricted to steeper, rocky hillsides	Of concern	Yes
11.8.9	*Callitris spp. +/- vine thicket woodland on Cainozoic igneous rocks*	Of concern	Yes
11.3.14	*Eucalyptus spp., Angophora spp., Callitris spp. Woodland on alluvial plains*	Least concern	Yes
11.3.18	*Eucalyptus populnea*, *Callitris glaucophylla*, *Allocasuarina luehmannii* shrubby woodland on alluvium	Least concern	Yes
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Least concern	Yes
11.3.27	Freshwater wetlands	Least concern	Yes - small area between Inglewood and Millmerran

RE code	Short description	VM Act class	Observed
11.5.1	Eucalyptus crebra and/or E. populnea, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	Yes
11.5.4	Eucalyptus chloroclada, Callitris glaucophylla, C. endlicheri, Angophora leiocarpa woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	Yes
11.5.20	*Eucalyptus moluccana* and/or *E. woollsiana* +/- E. *crebra* woodland on Cainozoic sand plains	Least concern	Yes
11.8.4	*Eucalyptus melanophloia* open woodland on Cainozoic igneous rocks.	Least concern	Yes
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	Least concern	Yes
11.9.2	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks	Least concern	Yes

4.2 Threatened Ecological Communities

Desktop searches identified six EPBC Act listed TECs as potentially occurring within the Study Area. Two of these communities, Brigalow and Semi Evergreen Vine Thicket (SEVT), were mapped and observed in the field surveys adjacent to the Conceptual Alignment, while a further three, White Box, Myall and grassland were identified as having potential to occur within the broader Study Area.

Brigalow

The Brigalow TEC is equivalent to the two Brigalow REs (11.4.3 and 11.9.5) in remnant areas, but also equivalent to additional areas of non-remnant vegetation mapped as HVR or not appearing on any state-wide map. These latter areas are generally considered regrowth and therefore not included in the remnant RE mapping or are too small (<5 ha) to be included in the remnant or HVR mapping.

These previously unmapped areas of the Brigalow TEC need to be quantified through more detailed interpretation of imagery and associated ground-truthing along the entire Conceptual Alignment. The previously unmapped areas are generally small, with less than 1 ha likely to be directly impacted in any single instance. This implies that constraints from this source may be avoided by small deviations in the rail alignment, or that any residual impacts may be mitigated or offset in a cost effective manner.

SEVT

The SEVT TEC identified adjacent to the Conceptual Alignment equated to RE 11.8.3. These areas were verified in the field, although generally occurred on steeper slopes adjacent to the Conceptual Alignment.

White Box

Scattered individual Yellow Box (*E. melliodora*) trees were observed in the vicinity of Gowrie, although not in large enough areas to meet the listing criteria for the White Box TEC. One area of White Box (*E. albens*) woodland that equated to RE 11.8.8 was observed near Captains Mountain to the west of Millmerran. Whilst this location is outside of the Study Area, there may be other areas of this TEC within the Study Area.

Myall

A small (<1 ha) patch of Myall TEC was observed within the Study Area near Pittsworth. Individual Weeping Myall trees are known from the surrounding area.

Generally this TEC is more common near Goondiwindi, west of Dalby (B Wilson pers ob.) and north of Oakey (G. Ford pers. comm). Therefore, while there may be others areas of this TEC on parts of the alignment that have not been ground-truthed, the total area is not likely to be extensive.

Grassland

Small areas of grassland (on basalt) were observed in the field within the Study Area. In the case of the grasslands on alluvium (equivalent to REs 11.3.21 and 11.3.24), all areas observed in the field were too small (<0.1 ha) or too dominated by exotic weed species to meet the listing criteria for this TEC (Threatened Species Scientific Committee, 2009).

Areas of grassland on basalt (RE 11.8.11) mapped on the state-wide RE mapping were generally not able to be ground-truthed directly during field surveys due to land access constraints. However, in at least two cases that were observed through binoculars from adjacent public roads, these areas were not the TEC grassland, as they appeared to be dominated by *Eucalyptus orgadophila* open woodland and therefore equated to RE 11.8.5 instead.

Other areas of grassland on basalt that met the definition of the TEC were observed outside of the Study Area. Therefore, there are possibly areas of this TEC within the Study Area, although further survey along the Conceptual Alignment is required to confirm its absence and/or quantify the extent of any impact.

Coolibah

The Coolibah TEC is unlikely to occur within the Study Area based on findings of the desktop assessment, field surveys and knowledge from extensive previous survey work carried out across the surrounding region (B Wilson pers. ob.). One small patch of Coolibah (*E. coolabah*) woodland was observed near the Study Area south of Yelarbon. However, this patch was less than 0.25 ha in area and therefore was too small to meet the listing criteria (5 ha) for the Coolibah TEC (Threatened Species Scientific Committee, 2011).

Table 4-2 List of TECs identified from desktop assessment and field survey

EPBC Act TEC	Abbreviation	Status	Likelihood
Brigalow (*Acacia harpophylla* dominant and codominant)	Brigalow	Endangered	Known
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	SEVT	Endangered	Known
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Natural Grasslands	Critically Endangered	Potential
Weeping Myall Woodlands	Weeping Myall	Endangered	Potential
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Yellow Box	Critically Endangered	Potential
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Coolibah	Endangered	Unlikely
Lowland rainforest of Subtropical Australia	Lowland rainforest	Critically Endangered	Unlikely

4.3 Watercourses and Wetlands

4.3.1 Watercourses and Waterways

Most of the larger watercourses are lined by River Red Gum (*E. camaldulensis*) or Forest Red Gum (*E. tereticornis*) riparian woodlands. These areas provide breeding fauna habitat such as hollows, and connectivity to other habits for a range of fauna species including the Greater Glider and Koala.

4.3.2 Wetlands

The PMST for the Study Area lists four wetlands of international importance (Banrock Station, Narran Lake, Riverland and the Coorong, and Lakes Alexandrina and Albert) as occurring in the search area. However, these wetlands are either greater than 1,000 km downstream, or in the case of Narran Lake, upstream (of the confluence of the Narran and Barwon Rivers) of the Study Area and therefore are not considered a relevant environmental constraint to the Project.

Based on the desktop assessment and field surveys, it is concluded that there are no substantial areas of non-riverine, non-artificial wetlands along or adjacent to the Study Area.

4.4 Reserves, State Forests and National Parks

4.5 Connectivity

Overall connectivity within the Study Area is generally low, with areas of remnant vegetation primarily small and/or narrow, surrounded by non-remnant grazing pastures and cultivation. Although these areas may provide some stepping-stone connectivity value, due to the highly disturbed state of these areas in general, their connectivity value is considered low.

Areas providing significant connectivity values include remnant vegetation associated with watercourses and the large areas of state forest. These areas provide movement corridors between larger patches of remnant vegetation.

4.6 EVNT Flora

Desktop assessment identified 33 threatened flora species listed under the EPBC Act, as potentially occurring within the Study Area. This list includes one Critically Endangered, eight Endangered and 24 Vulnerable.

No EVNT flora species were identified in the initial field surveys, although five species, *Picris evae*, *Homopholis belsonii, Rhaponticum australe, Macrozamia machinii* and *Sophora fraseri* have previously been recorded and are known to occur in the Study Area.

Only one site with existing EVNT flora records was accessible during both surveys. The two species previously recorded at this site, *Picris evae* and *Picris barbarorum*, were not identified during the survey. However, this does not mean that these species are not present as they are annual herbs, flowering between July and November.

A total of 13 threatened flora species were considered likely to occur because their preferred habitat is found within the Study Area and adjacent regions. Many of these species are often found in disturbed grassy vegetation on rail corridors and roadsides on the Darling Downs. Such areas are common in the Study Area and they are reasonably widespread in the region. Some of the species listed as potentially occurring due to only marginal habitat being observed, such as *Cadellia pentastylis*, *E. curtisii* and *E. virens* are distinctive tree species that are readily identifiable from a distance. The fact that these species were not observed in this study makes it less likely that that may be found in future surveys.

A preliminary assessment of the likelihood of occurrences of the listed species, based on their known distribution, preferred habitat and the habitats that were identified from the desktop assessment and field survey is summarised in

Table 4-3.

Table 4-3 – EVNT flora likelihood assessment

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Homopholis belsonii	Belson's Panic	V	It is known to occur in dry woodland habitats on poor soils, such as those derived from basalt. It occurs on rocky hills supporting White Box (*Eucalyptus albens*) and in Wilga (*Geijera parviflora*) woodland; flat to gently undulating alluvial areas supporting Belah (*Casuarina cristata*) forest; and soils and plant communities of Poplar Box (*Eucalyptus populnea*) woodlands. It may also be associated with shadier areas of Brigalow (*Acacia harpophylla*), Myall (*A. melvillei*), and Weeping Myall (*A. pendula*) communities; in Mountain Coolibah (*Eucalyptus orgadophila*) communities; and on roadsides. It is generally found among fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences (Department of the Environment, Water, Heritage and the Arts, 2008).	Known
Picris evae	Hawkweed	V	Hawkweed occurs in Eucalyptus open woodland with a grassy understorey composed of *Dichanthium* spp. Collections have been made along roadsides and in cultivated areas, such as paddocks, on black, dark grey or red-brown soils, reddish clay-loam or medium clay soils. Associated species include *Eucalyptus melliodora, E. crebra, E. populnea, E. albens, Angophora subvelutina, Allocasuarina torulosa*, and *Casuarina cunninghamiana* (Department of the Environment, Water, Heritage and the Arts, 2008).	Known
Macrozamia machinii		V	Most populations occur in sandy soils in flat areas of open forest dominated by Smooth-barked Apple (*Angophora leiocarpa*), Stringybark She-oak (*Allocasuarina inophloia*), White Cypress Pine (*Callitris glaucophylla*), and *Lysicarpus angustifolius*. One population occurs on a red lateritic ridge with Black Cypress Pine (*Callitris endlicheri*), Tumbledown Ironbark (*Eucalyptus panda*), and Inland White Mahogany (*E. apothalassica*) with an altitude range of 320–460 m (Department of the Environment, Water, Heritage and the Arts, 2008).	Known
Rhaponticum australe	Austral Cornflower	V	The Austral Cornflower usually grows on heavy black or red-brown clay, or clay loams derived from basalt. Populations are often confined to roadsides and cultivation headlands. Locations where the species occurs range in altitude up to 480 m above sea level.	Known
Sophora fraseri	Brush Sophora	V	It grows in moist habitats, often in hilly terrain at altitudes from 60–660 m on shallow soils along rainforest margins in Eucalypt forests or in large canopy gaps in closed forest communities (Department of the Environment, Water, Heritage and the Arts, 2008).	Known

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Acacia lauta	Tara Wattle	V	The area where this species grows has a subhumid subtropical climate, with warm to hot, moist summers and cool to cold, dry winters. The localities are characterised by a gently undulating to flat landforms. Soils are moderately deep and hard-setting with a weakly acidic to neutral sandy loam surface grading into neutral to alkaline sandy clay subsoil. The vegetation varies from open forest to low woodland with a dense or moderately dense shrub layer. Tree species present at all sites include *Callitris glaucophylla* (White Cypress Pine) and *Allocasuarina luehmannii* (Bulloak) (Department of the Environment, Water, Heritage and the Arts, 2008).	Likely
Bertya opponens		V	Recorded growing in a variety of community types including mixed shrubland, lancewood woodland, mallee woodland, Eucalypt/Acacia open forest with shrubby understorey, Eucalypt/Callitris open woodland and semi-evergreen vine-thicket. The soils are recorded as generally shallow sandy loams or red earths associated mostly with sandstone, but also with rhyolite, shale and metasediments (Threatened Species Scientific Committee, 2016).	Likely
Bothriochloa bunyensis	Satin-top Grass	V	Satin-top Grass occurs on relatively fertile *krasnozem* (dark brown) soils derived from basalt on upper slopes and hill crests at altitudes of 600–1100 m, in grassland or woodland with a grassy understorey (Department of the Environment, Water, Heritage and the Arts, 2008).	Likely
Dichanthium queenslandicum	King Bluegrass	E	Known to occur as a component of Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (Natural Grasslands TEC) and is associated with other species of blue grasses (*Dichanthium spp.* and *Bothriochloa spp*.). The grassland community occurs on fine textured soils, typically cracking clays on derived from either basalt or fine-grained sedimentary rocks, on flat of gently undulating rise. These grasslands occur in areas with relatively high summer rainfall and where a tree canopy is usually absent (Department of Sustainability, Environment, Water, Population and Communities, 2013).	Likely
Dichanthium setosum	Bluegrass	V	Associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown (Department of the Environment, Water, Heritage and the Arts , 2008).	Likely

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Digitaria porrecta	Finger Panic Grass	E	Occurs in grasslands on extensive basaltic plains, and in undulating woodlands and open forests with an underlying basaltic geology. It grows on dark and fine textured soils with some degree of seasonal cracking. It also persists in disturbed habitats, such as fallow paddocks, but its capability to maintain a viable population is unknown (Threatened Species Scientific Committee, 2013).	Likely
Lepidium monoplocoides	Winged Pepper-cress	E	Occurs predominantly in mallee scrub in semi-arid areas. Sites are seasonally moist to water-logged with heavy, fertile soils and a mean annual rainfall of around 300 to 500 mm. The predominant vegetation is usually an open-woodland dominated by *Allocasuarina leuhmannii* and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box) (Leigh, 1992).	Likely
Lepidium peregrinum	Wandering Pepper-cress	E	This species grows in riparian open forest and fringing tussock grasslands. Herbarium specimens and observations in the wild suggest this species responds to disturbance events (found along walking tracks, native pine plantations and car parks) and therefore may undergo fluctuations in population numbers as a response to such events (Threatened Species Scientific Committee, 2003).	Likely
Philotheca sporadica	Kogan Waxflower	V	*Philotheca sporadica* occurs within the Condamine River catchment on soils derived from low fertility laterised Cretaceous sandstones (*Kumbarilla Beds*). Soils are shallow uniform sandy loams to clay loams or shallow texture contrast soils with loamy surfaces and medium clay subsoils. Ironstone gravel is usually present within the soil column. Topography of these areas is undulating to flat with low dissected flat top or rounded hills (Dawson, 1972; Halford, 1995).	Likely
Prostanthera sp. (Dunmore D.M.Gordon 8A)		V	This species is known from four locations in a small area west of Millmerran in southern Queensland. Its extent of occurrence is less than 100 km². One population occurs on private land and three in state forest, including one on the border with Wondul Range National Park (Queensland Herbarium, 2008). It grows in Eucalyptus and Callitris woodland in shallow sandy soil or Eucalyptus woodland on hard sandstone ridge tops (TSSC 2008)	Likely
Thesium australe	Toadflax	V	Austral Toadflax is semi-parasitic on roots of a range of grass species, notably Kangaroo Grass (*Themeda triandra*). It occurs in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams (Department of the Environment, 2013).	Likely

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Tylophora linearis		E	This species grows in dry scrub, open forest and woodlands associated with *Melaleuca uncinata*, *Eucalyptus fibrosa*, *E. sideroxylon*, *E. albens, Callitris endlicheri, C. glaucophylla, Allocasuarina luehmannii, Acacia hakeoides, A. lineata, Myoporum spp.*, and *Casuarina spp*. (Department of the Environment, Water, Heritage and the Arts , 2008).	Likely
Xerothamnella herbacea		E	Occurs in Brigalow (*Acacia harpophylla*) dominated communities in shaded situations, often in leaf litter and is associated with gilgais (shallow ground depressions) (Department of the Environment, Water, Heritage and the Arts, 2008).	Likely
Arthraxon hispidus	Hairy-joint grass	V	Hairy-joint Grass has been recorded in or on the edges of rainforest and in wet Eucalypt forest, often near creeks and swamps, as well as woodlands, around freshwater springs on coastal foreshore dunes, in shaded gullies, on creek banks, and on alluvium in creek beds in open forest (Department of the Environment, Water, Heritage and the Arts, 2008).	Potential
Cadellia pentastylis	Ooline	V	Ooline grows in dry rainforest, semi-evergreen vine thickets and sclerophyll ecological communities, often locally dominant or as an emergent (Department of the Environment, Water, Heritage and the Arts, 2008). Habitat in the vicinity of the alignment corridor is rocky slopes and gullies (B Wilson pers. ob).	Potential
Clematis fawcettii	Stream Clematis	V	Stream Clematis prefers canopy gaps on loam soils derived from basalt and mixed volcanic rocks usually near streams. Associated vegetation communities include dry rainforest, complex *Notophyll vineforest* (warm and cool subtropical rainforest), on the margins of semi-evergreen vine thickets and, at one site, in Eucalyptopen forest with scattered vine forest species (Department of the Environment, Water, Heritage and the Arts , 2008).	Potential
Eucalyptus virens	Shiny-leaved Ironbark	V	It inhabits plateaux, sandstone escarpments or sandy soils on low rises (Department of the Environment, Water, Heritage and the Arts, 2008).	Potential
Leucopogon sp. (Coolmunda D.Halford Q1635)		E	The vegetation is predominantly open forest to woodland with a dense lower stratum of heath to 1.5 m high (Department of the Environment, Water, Heritage and the Arts, 2008). Associated species include *Eucalyptus terrica, Corymbia trachyphloia, E. virens, Callitris endlicheri, Calytrix tetragona, Triodia sp., Grevillea floribunda, Boronia glabra, Xanthorrhoea johnsonii, Brachyloma daphnoides, Ricinocarpos linearifolius* and *Melichrus urceolatus* (Department of the Environment, Water, Heritage and the Arts, 2008).	Potential

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Macrozamia conferta		V	*Macrozamia conferta* occurs in open forest communities dominated by Lemon-scented Gum (*Corymbia citriodora var. variegata*), Broad-leaved Red Ironbark (*Eucalyptus fibrosa*), Yellow Box (*E. melliodora*), Narrow-leaved Ironbark (*E. crebra*) and Grey Box (*E. moluccana*). It grows on flat areas or low ridges in ash-grey to white, silty loam or on skeletal, grey-white soils on steep slopes (Department of the Environment, Water, Heritage and the Arts, 2008).	Potential
Westringia parvifolia		V	*Westringia parvifolia* grows with Baker's Mallee (*Eucalyptus bakeri*) and Green Mallee (*E. viridis*) and between clumps of Spinifex (*Triodia sp*.) on sandy and stony soils (Department of the Environment, Water, Heritage and the Arts, 2008).	Potential
Haloragis exalata subsp. velutina	Tall Velvet Sea-berry	V	In Queensland, the species occurs in rainforest and rainforest margins and adjacent grassland and open grassy woodland above 500 m altitude. Associated species include Broad-leaved Apple (*Angophora subvelutina*), Forest Redgum (*Eucalyptus tereticornis*), Green Wattle (*Acacia irrorata*), and *Scutellaria humilis* (Department of the Environment, Water, Heritage and the Arts, 2008).	Unlikely
Macadamia integrifolia	Macadamia Nut	V	The species grows in remnant rainforest, including complex mixed notophyll forest, prefers partially open areas such as rainforest edges (Department of the Environment, Water, Heritage and the Arts, 2008).	Unlikely
Microcarpaea agonis		E	Known only from the type locality between Goondiwindi and Millmerran, Southern Queensland, on the margins of an *Eleocharis- Cyperus* dominated seasonal swamp with approximately 10 plants known (Department of the Environment, Water, Heritage and the Arts , 2008).	Unlikely
Phebalium distans	Mt. Berryman Phebalium	CE	It is always found in semi-evergreen vine thicket on red volcanic soils or communities adjacent to this vegetation type (Department of the Environment, Water, Heritage and the Arts , 2008).	Unlikely
Sarcochilus hartmannii	Waxy Sarcochilus, Blue Knob Orchid	V	The species grows on volcanic rocks, shallow soils and exposed cliffs in sclerophyll forests, rainforest margins or open areas at 500–1000 m altitude. It is also found occasionally at the base of fibrous trunks of trees, including cycads and grasstrees (Department of the Environment, Water, Heritage and the Arts, 2008).	Unlikely

Scientific Name	Common Name	EPBC Status[1]	Habitat	Likelihood
Sarcochilus weinthalii	Blotched Sarcochilus	V	The Blotched Sarcochilus occurs in rainforest, dry rainforest and drier scrub of sub-coastal ranges and associated foothills inland from the coast at altitudes of 400–700 m above sea level. In south-east Queensland, the Blotched Sarcochilus grows in a number of microphyll and notophyll rainforest types and also occurs in patches of isolated scrub (Department of the Environment, 2014).	Unlikely
Bulbophyllum globuliforme	Miniature Moss-orchid	V	The species grows only on Hoop Pines (*Araucaria cunninghamii*), colonising the upper branches of mature trees in upland rainforest (Department of the Environment, Water, Heritage and the Arts , 2008).	Does not occur
Eucalyptus infera	Durikai Mallee	V	The species grows in small drainage lines, in association with Grey Box (*E. moluccana*), Broadleaved Ironbark (*E. fibrosa subsp. fibrosa*) and Spotted Gum (*Corymbia citriodora subsp. variegata)* in undulating terrain. It occurs in sandy duplex soils derived from metamorphosed sediments (Department of the Environment, Water, Heritage and the Arts, 2008).	Does not occur

[1] CE – Critically Endangered; E-Endangered; V – Vulnerable

4.7 Weeds

Eleven weeds listed as Weeds of National Significance (WoNS) and/or 'restricted matter' under the *Biosecurity Act 2014* were identified during the field survey within or adjacent to the Route Corridor options (Table 4-4). The abundance of these species varied from a few scattered individuals to dense infestations (e.g. dense Tiger Pear along the Condamine River north of Leyburn).

In addition to these declared weeds listed in Table 4-4, a large number of non-declared exotic species including *Sorghum* spp., Red Natal Grass (*Melinis repens*) and Maynes Pest (*Verbena aristigera*) also occur.

Table 4-4 Declared weeds occurring within the Study Area identified during the field survey

Species Name	Common Name	WoNS	Restricted Matter
Asparagus africanus	Climbing Asparagus	ü	Category 3
Asparagus plumosus	Feathered Asparagus-fern	ü	Category 3
Bryophyllum spp.	Mother of Millions		Category 3
Dolichandra unguis-cati	Cat's Claw Vine	ü	Category 3
Harrisia martini	Harissa Catus		Category 3
Lantana camara	Lantana	ü	Category 3
Lycium ferocissimum	African Boxthorn	ü	Category 3
Opuntia aurantiaca	Tiger Pears	ü	Category 3
Opuntia stricta/tomentosa	Prickly Pears	ü	Category 3
Senecio madagascariensis	Fireweed	ü	Category 3
Sporobolus spp.	Giants Rats Tail Grass		Category 3

4.8 Fauna Diversity

A total of 102 terrestrial vertebrate species were directly or indirectly observed during the two rapid field surveys. This included four species of reptile (including one snake skin), one species of amphibian, 71 species of birds (including one exotic) and 13 species of mammals (including seven exotic). A further eight species of bats were confirmed from the analysis of the Song Meter data records, with at least a further two, and possibly up to a further six species present that were unable to be reliably confirmed to species level from the recordings.

Habitat features such as nests, hollow bearing trees, excavated termitaria, fodder/feed resources, ground logs, rocks, cracking clays, vegetative cover along with scats, scratches, diggings and other fauna traces were recorded for all sites and where possible habitat features/signs/traces were assigned to a species or group level. Presence/signs of exotic fauna species were also recorded. Fauna observations and habitat are detailed within the following fauna group sections.

4.8.1 Birds

A total of 71 bird species were detected across the field surveys, including records at all of the sites where quaternary sites were conducted and further opportunistic sightings within the Study Area. Surveys were undertaken throughout the day during all field surveys.

Bird species were observed across a variety of habitat types, including road reserve vegetation, regrowth, grazing and cultivation, riparian vegetation, Yelarbon Desert, Eucalypt woodlands with Cypress/Bulloak, Mountain Coolabah open woodlands, Ironbark woodlands and heath and Brigalow and Belah woodlands.

Sites surveyed included predominantly roadside or rail-side areas accessible from public roads and large tracts of vegetation occurring within the state forests. The presence of Mistletoe was noted throughout the majority of sites containing mature vegetation. Mistletoe present within Brigalow was in flower at the time of the April 2016 survey, allowing observation of a number of nectarivore species of birds such as Noisy Friarbird (*Philemon corniculatus*), Brown Honeyeater (*Lichmera indistincta*) and Striped Honeyeater (*Plectorhyncha lanceolata*).

Other Meliphagidae family species, such as the White-throated Honeyeater (*Melithreptus albogularis*) and Little Friarbird (*Philemon citreogularis*) were also observed on numerous occasions amongst vegetation areas of Brigalow/Belah, Eucalypt, Cypress and Bulloak woodland and heathland areas.

Species belonging to the Acanthizidae family were also present within these habitats, including the Weebill (*Smicrornis brevirostris*), White-throated Gerygone (*Gerygone albogularis*) and Thornbills (*Acanthiza* spp.). These species were observed frequenting Mistletoe flowers.

Small woodland bird species (such as those mentioned above) were especially abundant in Brigalow and Belah communities, riparian zones and areas of heathland. This contrasted to cleared agricultural lands or regrowth road reserves, where the Torresian Crow (*Corvus orru*), Noisy Miner (*Manorina melanocephala*), White-winged Chough (*Corcorax melanorhamphos*) and Apostlebird (*Struthidea cinerea*) were more abundant.

Mature, hollow-bearing Eucalypts were observed within the Study Area, especially within riparian zones along drainage lines. Hollow nesting birds were observed at a number of these sites and in some observations, species such as Galah (*Eolophus roseicapillus*), Sulphur Crested Cockatoo (*Cacatua galerita*), Little Corella (*Cacatua sanguinea*) and Pale-headed Rosella (*Platycercus adscitus*) were observed actively defending or entering/exiting hollows of both live and stag (dead) trees. The presence of large hollow-bearing trees provide roosting and nesting habitat for a variety of species, including Laughing Kookaburra (*Dacelo novaeguineae*) and Red-rumped Parrot (*Psephotus haematonotus*).

Avian nests were observed throughout the Study Area, including an active Black-shouldered Kite (*Elanus axillaris*) nest and those of Magpie Lark (*Grallina cyanoleuca*) and Noisy Miner (*Manorina melanocephala*). Nests suspected to be that of the Grey-crowned Babbler were located in areas of Eucalypt woodlands (*Pomatostomus temporalis*) within the state forests. Nests of species such as Flycatchers (*Myiagra inquieta*, *M. rubecula*), Grey Fantail (*Rhipidura albiscapa*) and Willie Wagtail (*Rhipidura leucophrys*) were recorded in vegetation with a dense mid and ground layer and located within riparian zones and state forest.

Observation of a number migratory and wader species was considered unlikely due to the seasonal timing of the survey. It was, however, possible to note potential habitat for such species, based upon previous records and habitat preferences. Habitat for wader species was limited at the time of the survey due to the ephemeral nature of waterbodies surveyed. One farm dam adjacent to the proposed alignment offered potential habitat, in addition to the riverine systems surveyed such as Canning Creek.

4.8.2 Mammals

Diurnal opportunistic sightings were made of 13 species of mammals including seven introduced species (European Hare, *Lepus europaeus* and Red Fox, *Vulpes vulpes).* Other sightings were limited to Macropods, which was expected with the survey timing and methodology being diurnal active searches, with confirmed sightings of Red Necked Wallaby (*Macropus rufogriseus*) moving through grazing lands. Signs and traces of mammals including scratch marks, scats and diggings were recorded and assigned to macropods. Habitat features for mammals such as hollow bearing trees, dense grassland, feed resources (including listed Koala food species) and rocky areas were also identified during the field survey.

The riparian vegetation bearing hollows is likely to provide habitat for glider species, whilst the Eucalypt species are likely to provide preferred food resources for the Koala.

4.8.3 Bats

The bat call detector recorded at least 10 and possibly up to 14 different species of bat during the April 2016 field survey. Of these, eight species were able to be reliably confirmed with a further two species attributed to call types of two groups (*Nyctophilus* species and the *Scotorepens greyii/S* species) of species that cannot be reliably differentiated from call characteristics. *N. geoffroyi* and *N. gouldi*, were considered likely to be present at all three sites, whilst *N. corbeni* was considered to be highly probable at Canning Creek. Of the *Scotorepens greyii/S*. species, both species are common throughout the area

4.8.4 Reptiles

The rapid field survey targeted identification of potential habitat for EVNT reptile species. Five opportunistic reptile sightings were recorded during the field surveys, comprising two species of skinks and one dragon species, a Lace Monitor (*Varanus varius*) and Australian Water Dragon (*Physignathus lesueurii*).

Potential networks of tunnels/dens within embankments and root bases of fallen trees were recorded at several sites, especially within dry beds of waterways such as Bringalily Creek and the Condamine River. Dense leaf litter was also noted within riparian and State Forest areas, which provide important habitat for reptiles, especially the Common Death Adder (*Acanthophis antarcticus*) which has previously been recorded within the Bringalily State Forest.

4.8.5 Amphibians

Detection of amphibians was limited due to the diurnal timing of the surveys, disturbed nature of the survey locations and seasonal conditions. Calling was limited, with amphibian breeding activity generally slowing in the cooler months. One amphibian was observed during the survey on the bank of Canning Creek on the private property accessed via prior arrangement. This was a sub-adult Broad-palmed Rocket Frog (*Litoria latopalmata*).

A further two species were heard calling within a pooled area within the Bringalily State Forest. A greater diversity of frog species are likely to be present throughout wetter areas of the Study Area. However, these were not detected due to the rapid nature of the survey design.

4.9 EVNT Fauna

Desktop assessment identified 31 threatened fauna species as potentially occurring within the Study Area. Four Critically Endangered, eight Endangered and 19 Vulnerable. A preliminary assessment of the likelihood of occurrences of the listed species based on their known distribution and habitats mapped or observed on the alignment is summarised in

Table 4-5.

No EVNT fauna species were positively identified during the initial field surveys. However, existing records show that several species have previously been recorded in close proximity to the Study Area. A total of 18 threatened fauna species are considered likely or known to occur within the Study Area based on appropriate habitat being observed or mapped and their known distribution.

Habitat for threatened mammal species was detected throughout the Study Area, including for the Koala. Rocky knolls were present in small patches across the Study Area. These knolls present potential habitat for mammal species including the Spotted-tail Quoll (*Dasyurus maculatus*) which has been recorded within the Study Area. The Spotted-tailed Quoll was assessed as likely to occur based on the criteria used, with the closest recent records of this previously widespread species east of Clifton, north east of Leyburn and north-west of Wellcamp Airport. No observations of the species were made during the field surveys.

Habitat for threatened reptiles was observed throughout the Study Area. This included habitat of the Condamine Earless Dragon, which has previously been recorded in the Study Area in disturbed, sometimes cultivated sites, on cracking clay soils.

Other threatened reptiles assessed as likely to occur include the Five-clawed Worm-skink, Dunmall's Snake (both of which have previously been recorded adjacent to the Study Area), the Collared Delma (*Delma torquata*), Grey Snake (*Hemiaspis damelii*) and Yakka Skink. The Collared Delma is especially associated with dense leaf litter, which was observed in abundance within riparian zones. The other species utilise soil cracks (Grey Snake) and a variety of regrowth habitats (Yakka Skink), which were observed throughout the Study Area.

Four wetland-dependent species (Australian Painted Snipe, Common Greenshank, Curlew Sandpiper, and Latham's Snipe) were assessed as potentially occurring in the Study Area, with one likely to occur (Magpie Goose). Natural wetland habitats either did not occur in the Study Area or were only in association with riparian areas. These species are not generally associated with riparian wetlands.

Three species mainly dependent on rainforest (Black-breasted Button-quail, Oriental Cuckoo, and Rufous Fantail) potentially occur in the Study Area. Dry rainforest may occur within or adjacent to the Study Area in small patches.

The presence of Corben's Long-eared Bat (*Nyctophilus corbeni*) at the Canning Creek site was considered highly probable in the detector analysis report (Balance! Environmental, 2016). *N. corbeni* is a Vulnerable species listed under the EPBC Act. This species is known to roost within tree hollows, under exfoliating bark and may roost in dense vegetation (Threatened Species Scientific Committee, 2015).These habitat features were recorded within the Canning Creek site, indicating the potential presence of roosting habitat. There are also known records of this species in Bringalily State Forest and along Canning Creek (G. Ford pers. Comm.).

Further targeted surveys for the listed fauna species and their preferred habitats will be required to determine if there are significant fauna population values and or significant impacts under relevant legislation. These surveys will need to follow relevant State and Commonwealth fauna survey guidelines.

Table 4-5 - EVNT fauna likelihood assessment

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Mammals	*Phascolarctos cinereus*	Koala (Qld, NSW and the ACT)	V	Associated with a wide range of temperate, tropical and sub-tropical forests as well as woodland and semi-arid communities containing species that are known koala food trees, or shrubland with emergent food trees. In the dry, subtropical to semi-arid environments in the western parts of the species' range, inhabit Eucalyptus-dominated forests and woodlands, particularly in the vicinity of riparian environments, and Acacia-dominated forests, woodlands and shrublands (Department of Sustainability, Environment, Water, Population and Communities, 2012).	Known
Reptiles	*Tympanocryptis condaminensis*	Condamine (Darling Downs) earless dragon	E	Only found in the remnant native grasslands, croplands and roadside verges of the eastern Darling Downs. These grasslands occur on black cracking clays of the Condamine River floodplain (Threatened Species Scientific Committee , 2016).	Known
Birds	*Anthochaera phrygia*	Regent Honeyeater	CE	The Regent Honeyeater in Queensland is generally located in dry Eucalypt woodland and open forest on wetter, more fertile areas around forest edges, wooded farmland and urban areas with that include mature eucalypts. These habitats are characterised by vegetation that provides copious amounts of nectar, including mugga ironbark (*Eucalyptus sideroxylon*), white box (*E. albens*), yellow box (*E. melliodora*), swamp mahogany (*E. robusta*), spotted gum (*Corymbia maculata*) or river she-oak (*Casuarina cunninghamiana*). Most communities are also associated with tall trees and needle-leaf mistletoe (*Amyena cambagei*) which provides nesting habitat (Department of the Environment , 2015).	Likely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Birds	*Erythrotriorchis radiatus*	Red Goshawk	V	Occurs over wooded and forested lands, associated with different vegetation mosaics between south-east Queensland, northern Queensland and Cape York Peninsula. Prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include Eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. Nesting habitat has been defined as a stand of tall trees within 1km of permanent water. The species is mainly associated with REs at risk with rugged terrain in southern and northern Queensland (Threatened Species Scientific Committee, 2015).	Likely
Birds	*Geophaps scripta scripta*	Squatter Pigeon (Southern Subspecies)	V	Open-forests to sparse, open-woodlands and scrub that are mostly dominated in the overstorey by Eucalyptus, Corymbia, Acacia or Callitris species; remnant, regrowth or partly modified vegetation communities; within 3 km of water bodies or courses (Threatened Species Scientific Committee, 2015).	Likely
Birds	*Grantiella picta*	Painted Honeyeater	V	Habitat includes mistletoes in Eucalypt forests, box-ironbark-yellow gum woodlands, paperbarks, casuarinas, mulga/acacias (Department of the Environment , 2015)	Likely
Birds	*Lathamus discolor*	Swift Parrot	CE	They can inhabit Eucalypt forests and woodlands, plantations and banksias, street trees, parks and gardens. Key habitats in northern NSW and south-eastern QLD include Narrow-leaved Red Ironbark *Eucalyptus crebra*, Forest Red Gum forests and Yellow Box forest. On the western slopes Mugga Ironbark *Eucalyptus sideroxylon* and Grey Box *Eucalyptus microcarpa* woodlands are used (Threatened Species Scientific Committee, 2016).	Likely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Mammals	*Dasyurus maculatus maculatus*	Spot-tailed Quoll, Tiger Quoll (SE mainland population)	E	This species prefers mature wet forest habitat, especially in areas with rainfall > 600 mm/year. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This subspecies has been recorded from: temperate and subtropical rainforests in mountain areas, wet sclerophyll forest, lowland forests, open and closed Eucalypt woodlands, inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests, dry 'rain shadow' woodland, sub-alpine woodlands, coastal heathlands, and occasional sightings from open country, grazing lands, rocky outcrops and other treeless areas (Threatened Species Scientific Committee, 2004).	Likely
Mammals	*Nyctophilus corbeni*	South-eastern Long-eared Bat	V	This species can occur in a range of inland woodland vegetation types, including box, ironbark, and cypress pine woodlands. Brigalow woodland and River Red Gum forests lining watercourses and lakes also provide habitat for the species. Throughout inland Queensland, the species habitat is dominated by various Eucalypt and bloodwood species and is most abundant in vegetation with a distinct canopy and a dense cluttered shrub layer. Captures have been made in open dry woodland and forest, which may include *Corymbia citriodora, C. bloxsomei, Eucalyptus crebra, E. melanophloia, E. populnea, E. major, E. pilligaensis, E. chloroclada, E. fibrosa, Angophora leiocarpa, Allocasuarina luehmannii, Dodonaea viscosa, Callitris glaucophylla, Acacia harpophylla, Ac. leiocalyx, Ac. conferta, Casuarina cristata* and *Geijera parviflora* (Threatened Species Scientific Committee, 2015).	Likely
Mammals	*Petauroides volans*	Greater Glider	V	Arboreal nocturnal marsupial, largely restricted to Eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising Eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist Eucalypt forests with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat (Threatened Species Scientific Committee, 2016). The greater glider favours forests with a diversity of Eucalypt species, due to seasonal variation in its preferred tree species.	Likely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Mammals	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	Typically camps in closed forests > 8 m high, > 1 ha in area, and dominated by rainforest, Broad-leaved Paperbark *Melaleuca quinquenervia*, mangrove, or Casuarina spp. Colonies also use highly modified vegetation in urban and suburban areas. Camps are generally within 50 km of the coast or < 65m elevation, near water, and on level ground or gentle slopes. This species feeds in a variety of forest and woodland communities, and urban and production landscapes. A diverse range of vegetation communities is required to access year-round food supplies (Threatened Species Scientific Committee, 2001).	Likely
Molluscs	*Adclarkia cameroni*	Brigalow Woodland Snail	E	Endemic to south-east Queensland, where it occurs in a small number of remnant and scattered *Acacia harpophylla* (brigalow) and eucalypt woodland patches (such as road verges and riparian corridors) on the Condamine River floodplain, especially in the area around Dalby and Chinchilla (Threatened Species Scientific Committee, 2016).	Likely
Ray-finned fishes	*Bidyanus bidyanus*	Silver Perch	CE	Silver perch are consistently reported by anglers and researchers to show a general preference for faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin (Department of the Environment, 2013).	Likely
Ray-finned fishes	*Maccullochella peelii*	Murray Cod	V	Occurs in larger waterholes in rivers and streams throughout the Murray Darling Basin (Threatened Species Scientific Committee, 2003).	Likely
Reptiles	*Anomalopus mackayi*	Five-clawed Worm-skink, Long-legged worm skink	V	In Queensland, it only occurs in Bluegrass (*Dichanthium sericeum*) and/or Mitchell Grass dominated grasslands (Department of the Environment, Water, Heritage and the Arts, 2008).	Likely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Reptiles	*Delma torquata*	Collared Delma	V	It normally inhabits dry Eucalypt dominated woodlands and open-forests on stony soils or rocky ridges with an understory of grasses and lantana (*Lantana montevidensis*). Typically on westerly facing ridgelines. Also recorded from Forest Red Gum *Eucalyptus tereticornis* and Brigalow *Acacia harpophylla* woodlands. Known from highly disturbed areas (Department of the Environment, Water, Heritage and the Arts, 2008).	Likely
Reptiles	*Egernia rugosa*	Yakka Skink	V	Not restricted to remnant - also occurs in regrowth and cleared areas. Known woodland habitats include Poplar Box *Eucalyptus populnea*, Mulga *Acacia aneura*, White Cypress Pine *Callitris glaucophylla* (usually in association with eucalypts such as Poplar Box, Silver-leaved Ironbark *Eucalyptus melanophloia*, or Carbeen *Corymbia tessellaris*), Ironbark (typically Silver-leaved Ironbark), and disturbed, treated and cleared areas where suitable microhabitat features remain. Also been recorded, though less frequently, in Brigalow *Acacia harpophylla*, Bendee *Acacia catenulata*, Belah *Casuarina cristata*, Gidgee Acacia cambagei, Lancewood *Acacia shirleyi*, and Bulloak *Allocasuarina luehmannii* woodlands (Department of the Environment, 2014).	Likely
Reptiles	*Furina dunmalli*	Dunmall's Snake	V	Found in a broad range of habitats, including Forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow (*Acacia harpophylla*), other Wattles (A*. burowii, A. deanii, A. leioclyx*), native Cypress (*Callitris* spp.) or Bull-oak (*Allocasuarina luehmannii*). Also known from Blue Spotted Gum (*Corymbia citriodora*), Ironbark (*Eucalyptus crebra* and *E. melanophloia*), White Cypress Pine (*Callitris glaucophylla*) and Bulloak open forest and woodland associations on sandstone derived soils, and dry vine scrub (Department of the Environment, 2014).	Likely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Birds	*Calidris ferruginea*	Curlew Sandpiper	CE	Commonly occur around the Australian coastline. Queensland records indicate that this species is more widespread in coastal areas south of Cairns. In Queensland, scattered records occur in the Gulf of Carpentaria also. There are sparsely scattered records inland (Department of the Environment, 2015).	Potential
Birds	*Rostratula australis*	Australian Painted Snipe	E	It is dependent on wetlands and can inhabit a variety of types including shallow terrestrial freshwater (occasionally brackish) wetlands, temporary and permanent lakes, swamps and clay pans. Preferred wetland habitats are characterised by emergent vegetation (including tussocks, grasses, sedges, rushes, reeds, Canegrass and/or paperbarks) where nesting will occur. Artificial habitats that are occasionally used include reservoirs, farm dams, sewage ponds, inundated grasslands, and leaking irrigation channels (Department of Sustainability, Environment, Water, Population and Communities, 2013).	Potential
Birds	*Turnix melanogaster*	Black-breasted Button-quail	V	Key habitat for the species is vine thickets and rainforests that are periodically water-stressed, such as semi-evergreen vine thicket, low microphyll vine forest, *Araucarian microphyll* vine forest, *Araucarian notophyll* vine forest and Brachychiton scrubs with Bottle Trees *Brachychiton rupestre* or Brigalow *Acacia harpophylla* and Belah *Casuarina cristata*, low thickets or woodlands with a dense understorey but with little ground cover that are typically dominated by Acacia spp., littoral dry vine scrubs and acacia thickets, and areas densely covered in shrubs such as Midgen Berry *Austromyrtus dulcis* (Threatened Species Scientific Committee, 2015).	Potential

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Mammals	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	Recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to this species. Records from south-east Queensland suggest that rainforest and moist Eucalypt forest habitats on other geological substrates (rhyolite, trachyte and basalt) at high elevation, are of similar importance to the species. Some populations would rely in part on the following threatened ecological communities: Brigalow (*Acacia harpophylla* dominant and co-dominant); and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Threatened Species Scientific Committee, 2012).	Potential
Mammals	*Petrogale penicillata*	Brush-tailed Rock-wallaby	V	Complex rock outcrops in habitats ranging from rainforest, to tall Eucalypt and open woodland (Department of the Environment, 2017).	Potential
Mammals	*Potorous tridactylus tridactylus*	Long-nosed Potoroo (SE Mainland)	V	It is generally found within 50 km of the coast, from sea level to > 800 m, in areas exceeding 760 mm rainfall. Dense coastal scrubs, wet heaths, woodlands with heath understory, and inland moist forests and rainforests. Not in treeless heath communities (Department of the Environment, 2017).	Potential
Molluscs	*Adclarkia dulacca*	Dulacca Woodland Snail	E	Endemic to south-east Queensland, where it occurs as a small number of isolated and fragmented populations in the area between Miles and Dulacca, and south to Meandarra. The species inhabits a variety of remnant and scattered habitats, such as vine thicket and *Acacia harpophylla* (brigalow) woodland patches on rocky outcrops with clay to loam soils, as well as Eucalyptus (ironbark) species and *Acacia shirleyi* (lancewood) woodlands on ridges (with and without rock), and *Eucalyptus woollsiana* (gum-topped box) woodland (Threatened Species Scientific Committee, 2016).	Potential

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Birds	*Botaurus poiciloptilus*	Australasian Bittern	E	Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. Favours permanent and seasonal freshwater habitats. Breeds in relatively deep, densely vegetated freshwater swamps and pools. (If population density is high, it may resort to open wetlands for nesting, e.g. in stunted Acacia swamps) (Threatened Species Scientific Committee, 2011).	Unlikely
Birds	*Poephila cincta cincta*	Black-throated Finch (southern)	E	Inhabits grassy open woodlands and forests, typically characterised by Eucalyptus, Acacia and Melaleuca. It is usually found within a few kilometres of water. It sometimes forages in modified habitats such as grassy roadsides, rail corridors, and beneath powerlines where these occur near more-or-less intact woodlands. Rarely found in highly modified peri-urban environments. Absent from urban areas. Known from open forest and ridges, and grassy hillsides (Threatened Species Scientific Committee, 2005).	Unlikely
Mammals	*Dasyurus hallucatus*	Northern Quoll/Digul	E	The species occupies a diversity of habitats across its range including Eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Threatened Species Scientific Committee, 2005). Northern Quoll are also known to occupy non rocky lowland habitats such as beach scrub communities in central Queensland (Sprat page). Northern Quolls appear to be most abundant in habitats within 150 km of the coast. Confined to main Range to east of the Study Area.	Unlikely
Mammals	*Pseudomys novaehollandiae*	New Holland Mouse	V	It is associated with open heathlands, open woodlands with a heathland understory and vegetated sand dunes (Department of the Environment, Water, Heritage and the Arts , 2010).	Unlikely
Reptiles	*Uvidicolus sphyrurus*	Border Thick-tailed Gecko	V	The Border Thick-tailed Gecko occurs only on the northern slopes and tablelands of NSW, from Tamworth in the south, to Moree in the west, as well as the adjacent Stanthorpe region in southern Queensland (Department of the Environment, Water, Heritage and the Arts , 2008).	Unlikely

Class	Scientific name	Common name	EPBC[1]	Habitat	Likelihood
Reptiles	*Wollumbinia belli*	Bell's Turtle	V	Occurs in small tributaries with narrow stream reaches (30 - 40 m) that provide both sandy and rocky river beds and deep pools (3 m). The Bell's turtle has been found in areas with reduced riparian habitat. Nesting occurs in loamy soils (Department of the Environment, Water, Heritage and the Arts, 2008).	Unlikely

[1] CE – Critically Endangered; E-Endangered; V – Vulnerable

4.10 Essential Habitat

The desktop assessment showed that one area of Essential Habitat for the Pale Imperial Hairstreak Butterfly (*Jalmenus eubulus*) is mapped along the Conceptual Alignment near Native Dog Creek in the Bringalily State Forest. The Essential Habitat factor listed for this species is old growth Brigalow (Office of Environment and Heritage, 2017). This community was observed during surveys, often as a sub-dominant in a Belah open forest. The extent of the Brigalow/Belah community observed during the field surveys was not as large as that mapped.

4.11 Koala Habitat

The survey identified potential fodder and habitat species as well as signs of Koala presence. Koala scat and scratches on large River Red Gums were recorded at sites on the Condamine River. Potential fodder and habitat flora species for Koala were identified at a number of other sites. There are existing records for the Koala within the Study Area.

The Koala was listed under the EPBC Act as Vulnerable on 2 May 2012. The Commonwealth Government released referral guidelines for the Koala in 2014 ((Department of the Environment and Energy, 2014)- 'the Koala guidelines') which define Koala habitat and ways to avoid significant impacts.

The Koala guidelines define Koala habitat as:

> *"any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees. This can include remnant and non- remnant vegetation in natural, agricultural, urban and peri-urban environments. Koala habitat is defined by the vegetation community present and the vegetation structure; Koalas do not necessarily have to be present."*

Species observed in the Study Area that are listed as Koala food trees in the Southern Downs and Toowoomba Region Local Government Areas (Australian Koala Foundation, 2015) include:

- Primary: *E. camaldulensis, E. tereticornis, E. chloroclada*
- Other: *E. microcarpa/pilligensis* (equivalent to *E. woollsiana*), *E. populnea, E. orgadophila*.

Therefore all of the Eucalypt woodlands and forests along and adjacent to the Conceptual Alignment are defined as Koala habitat under the Koala guidelines. This includes the extensive areas of Eucalypts with Bull Oak mid layer in the State Forests, on drainage line crossings and the fragmented *E. orgadophila* woodlands on the Darling Downs.

A determination of whether the Koala habitat along the Conceptual Alignment is 'habitat critical to the survival of the species' requires an assessment using the Koala habitat assessment tool from those guidelines. Where there is insufficient information to determine the score for a particular attribute using the tool, the guidelines require that further surveys be carried out or, if this is not possible, then either the maximum score is given for any uncertain attribute or it is assumed that the areas does contain critical habitat.

The koala habitat tool has been used to undertake a preliminary assessment of the koala habitat value that may be impacted by the Border to Gowrie Project. This preliminary assessment is presented in Table 4-6.

Table 4-6 – Preliminary Koala habitat assessment for the Border to Gowrie Project

Attribute	Score	Inland Population	Score	Appraisal
Koala occurrence	High (+2)	Evidence of one or more koalas within the last 5 years.	2	Koala scats and scratches were observed in close proximity to the Condamine River.
	Medium (+1)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.		
	Low (0)	None of the above.		
Vegetation composition	High (+2)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	2	Communities within the Study Area considered koala habitat contain two or more known Koala food trees (e.g. *E. camaldulensis, E tereticornis, E chloroclada, W woollsiana, E populnea*)
	Medium (+1)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.		
	Low (0)	None of the above.		
Habitat connectivity	High (+2)	Area is part of a contiguous landscape ≥ 1000 ha.	2	Much of the Study Area is highly modified / cleared with low connectivity. There are also substantial areas that are part of large contiguous remnant tracts. The maximum score given here reflects the latter areas.
	Medium (+1)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.		
	Low (0)	None of the above.		
Key existing threats	High (+2)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	2	No evidence of koala mortality was observed within the Study Area and many areas are mote from vehicle traffic with dog control (baiting) programs in place. Some areas of koala habitat along the alignment are adjacent to major highways where there may be high mortality The maximum score given here reflects the latter areas.
	Medium (+1)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.		
	Low (0)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the Study Area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.		

Attribute	Score	Inland Population	Score	Appraisal
Recovery value	High (+2)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in the Koala Referral Guidelines.	1	It is uncertain if the areas of kolas habitat identified are important for the recovery of the species
	Medium (+1)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in the Koala Referral Guidelines.		
	Low (0)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in the Koala Referral Guidelines.		
Total:			9	

The preliminary koala habitat assessment in Table 4-6 shows that potential koala habitat in the Study Area scores a value of 9 and is, therefore, considered 'habitat critical to the survival of the species'. The Koala guidelines state that clearing of more than 20 ha of this quality Koala habitat is "highly likely" to have a significant impact, while clearing between 2-20 ha "may" have a significant impact. However, an assessment of the significance of the impact of the Project cannot be made until design is advanced further.

4.12 Pest Species

Based on desktop assessment results, restricted matter (pests) were identified as potentially occurring within the Study Area (Table 4-7).

Table 4-7 Potentially occurring restricted matter

Species Name	Common Name
Bos taurus/indicus	Domestic Cattle
Felis catus	Cat
Oryctolagus cuniculus	Rabbit
Lepus capensis	Brown Hare
Ovis airies	Domestic sheep
Sus scrofa	Pig
Vulpes	Red Fox
Canis lupus familiaris	Wild Dog
Columba livia domestica	Feral Pigeon
Acridotheres tristis	Common Mynah

It is expected, based on the habitat assessment, that other feral species such as the House Mouse (*Mus musculus*), would also occur throughout the Study Area.

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