



Chapter 6.0 - Fauna Assessment

Document No.: 60047441_EAR_RP_006_0

J:\Projects\60047441\6. Draft Docs\6.1

Reports\Environment\EAR_FinalDraft_PublicRelease\60047441_EAR_RP_006_0.doc

Table of Contents

6.0	Fauna Assessment	6-1
6.1	Overview	6-1
6.2	Approach and Methodology	6-1
6.2.1	Desktop Review	6-1
6.2.2	Field Survey	6-3
6.3	Description of Existing Environment	6-7
6.3.1	Available Habitat Types	6-9
6.3.2	Habitat Assessment	6-16
6.3.3	Other Considerations - <i>Phascolarctos cinereus</i> (Koala)	6-19
6.4	Potential Impacts and Mitigations Measures	6-20
6.4.1	Threatened and Significant Species	6-20
6.4.2	Mitigation Measures for Design, Construction and Operation	6-27
Appendix 6-A	Significant Species Likely to Occur within the Project Area	6-A
Appendix 6-B	Fauna List	6-B

List of Tables

Table 6.1:	Total Numbers of Listed Species	6-8
Table 6.2:	Significant Species assessed in desktop studies as Highly Likely to Occur within the Open Forest and/or Riparian Rainforest	6-11
Table 6.3:	Significant Species assessed in desktop studies as Highly Likely to Occur within Freshwater Environments	6-14
Table 6.4:	Significant Bird Species assessed in desktop studies as Highly Likely to Occur within the Mangrove Environment	6-16
Table 6.5:	Significant Bird Species assessed in desktop studies as Highly Likely to Occur within Gardens and Parks	6-16
Table 6.6:	Habitat Assessment	6-17
Table 6.7:	Potential Impacts and Mitigation Measures	6-28

List of Figures

Figure 6.1:	Species of Concern	6-2
Figure 6.2:	Site Assessment: Section and Sampling Units	6-6
Figure 6.3:	Regional Ecosystems, Essential Habitat and Fire Ant Restricted Zone	6-10
Figure 6.4:	Species and Habitats of Interest	6-13

6.0 Fauna Assessment

6.1 Overview

The purpose of this chapter is to describe the existing terrestrial and aquatic fauna within the study area, potential impacts to fauna existing or likely to exist within the corridor, and provide recommendations on mitigation measures for these potential impacts.

6.2 Approach and Methodology

Terrestrial and aquatic fauna likely to be impacted by the KBP were investigated by:

- undertaking a desktop review of existing literature and databases;
- conducting site-specific fauna surveys;
- field surveys for terrestrial and aquatic fauna; and
- targeted assessment based on a third party report.

6.2.1 Desktop Review

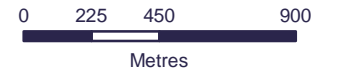
Commonwealth, Queensland and local databases and reports were consulted to determine the fauna species that were likely to occur within the project area and nearby surrounds. Databases were searched at first instance for threatened species records within two kilometres of coordinates 27° 31' 17.97" S; 152° 56' 07.60" E (Kingfisher Park). An additional database search was then undertaken with a minimum distance of two kilometres from the corridor extremities, representing a total investigation area of 2,587.23 ha (Figure 6.1). This search was undertaken to identify the location of listed species highlighted on the Wildlife Online search with confirmed and unconfirmed sightings of animals in this area.

The following databases and reports were consulted:

- Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) *Environment Protection and Biodiversity Conservation Act (EPBC Act) Protected Matters Search Tool* (2008);
- Queensland Environmental Protection Agency (EPA) Wildlife Online (2008b);
- EPA Essential Habitat Mapping (EPA 2008a);
- Department of Primary Industries and Fisheries (DPIF) Restricted Area Search Engine (for Red Imported Fire Ants) (2008a); and
- GHD (2008) Environmental Assessment, Kenmore Bypass, prepared for DMR.

Wildlife Online records post-1980 were requested. The locations of the threatened species that are historically recorded within the project area have been mapped in Figure 6.1. The occurrence of species identified in the desktop studies was then assessed based on previous records within the area and suitable habitat available (Appendix 6-A).

It is noted that some of the logged sightings in the study area were confirmed. Further, a number of the reported sightings are not consistent with the habitat at their logged locations.



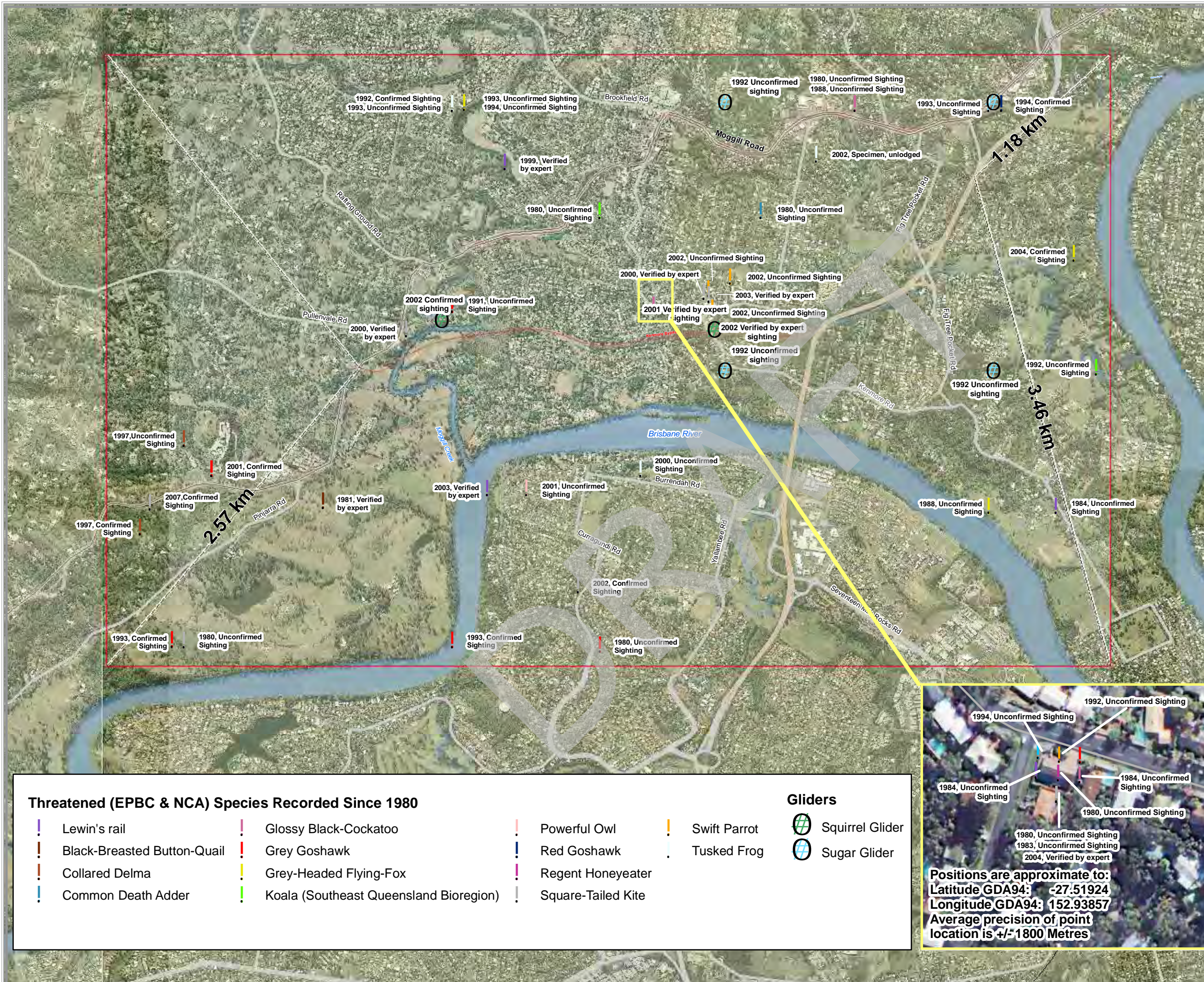
1:25,000 (when printed at A3)

Date - 13 May 2009



Legend

- Centenary Motorway
- Kenmore Bypass
- Moggill Road
- River/creek
- Distance lines
- KBP Data AOI



Threatened (EPBC & NCA) Species Recorded Since 1980

- | | | |
|-----------------------------|--|--------------------|
| Lewin's rail | Glossy Black-Cockatoo | Powerful Owl |
| Black-Breasted Button-Quail | Grey Goshawk | Red Goshawk |
| Collared Delma | Grey-Headed Flying-Fox | Regent Honeyeater |
| Common Death Adder | Koala (Southeast Queensland Bioregion) | Square-Tailed Kite |

Gliders

- | |
|-----------------|
| Squirrel Glider |
| Sugar Glider |

Positions are approximate to:
 Latitude GDA94: -27.51924
 Longitude GDA94: 152.93857
 Average precision of point location is +/-1800 Metres

Data sources:
 Roads, railway, rivers etc - Copyright 2006, MapData Sciences PTY LTD, PSMA

Aerial Imagery:
 Copyright Qasco Surveys Pty Limited (2005).

Air Quality Information provided by ENSR Australia, Brisbane for the Kenmore Bypass Environmental Study.

KENMORE BYPASS FAUNA

Species of Concern

DRAFT

6.2.2 Field Survey

The project area was divided into five (5) broad areas; referred to as Sections, and further divided into numbered Sampling Units, that occur within each broad area:

- Section A: Centenary Motorway to Kenmore Road;
- Section B: Kenmore Road to Gem Road;
- Section C: From the pony club, Gem Road to Moggill Creek;
- Section D: Moggill Creek, two kilometres north and south from the proposed alignment crossing; and
- Section E: Moggill Creek to western end of alignment from Moggill Road.

These Sections and Sampling Units are detailed in Figure 6.2 and are referred to in this chapter of the EAR.

6.2.2.1 Terrestrial Fauna

A fauna field survey was conducted for eight (8) days from 5 to 13 September 2008. A specific targeted search for *Phascolarctos cinereus* (koala) was undertaken on the morning of 5 November 2008 by senior AECOM staff. A further targeted search was undertaken on 15 and 16 January 2009 in response to the receipt of the report entitled "*Kenmore By-Pass Koala Habitat Study; Past, Present and Future*" (Natrass, 2008).

The weather conditions during the primary survey period were suitable for detecting most fauna species likely to occur within the project area. Heavy rainfall was experienced on 4 September 2008 and a flash thunderstorm occurred in the late afternoon on 12 September 2008. The remaining days were calm with temperatures ranging between 11.2°C and 25°C (BoM 2008). The terrestrial survey consisted of the following methodology.

Elliott Trapping

Elliott A (46), Elliott B (10) and cage traps (5) were set on the ground within a range of habitat areas in Sections A, B and D. Traps were baited with a mixture of honey, rolled oats, peanut butter, vanilla essence and fish oil and set in the late afternoon for a total duration of five (5) nights. Traps were inspected in the early morning to ensure that captured animals were not confined within the trap for an extended period. Traps remained closed during the day to avoid animal capture.

Habitat Assessment

A habitat assessment of Sections A, B, C and E was conducted for terrestrial fauna. An evaluation of the availability of water, vegetation structure and composition, microhabitat characteristics, level of disturbance and available food was undertaken by two (2) scientists. An overall habitat rating was provided based on these characteristics.

Bird Call Play Back

Sections A and E were identified as potential *Ninox strenua* (powerful owl) and *Rallus pectoralis* (Lewin's rail) habitat respectively. A taped call of these birds were played at their potential habitat sites through a megaphone for a two (2) minute playback with a five (5) minute listening period between each playback, repeated three (3) times. Bird call back methodology is an effective means to locate and identify inconspicuous species.

Spotlighting

Spotlighting was conducted using a 50 watt hand-held spotlight at Sections A, C and E for about one (1) hour at each location over three (3) days to detect nocturnally active fauna species such as arboreal mammals (eg. gliders, possums), ground mammals (eg. bandicoots, potaroos) as well as nocturnal reptiles and birds. Spotlighting commenced just after dark and consisted of a random meander through accessible habitat. Binoculars were used to identify any species spotlighted at a distance.

DRAFT

Ultrasonic Bat Detection

An AnaBat II Detector was used to detect the calls of microbat activity within Sections A, C and E. The AnaBat II is a sophisticated instrument that measures the ultrasonic calls emitted by bats that are inaudible to the human ear. The instrument employs the frequency division technique to make the bat calls audible (Tidemann & Nelson 2004) and recorded calls were subsequently identified. The Anabat detection and the spotlighting survey were conducted simultaneously, for about one (1) hour per day, whilst meandering the site.

Amphibian Survey

An amphibian survey was conducted on 5 September 2008 at Sections A, B and E. Heavy rainfall on 4 September 2008 made conditions conducive for amphibian detection.

Diurnal Bird Survey

Bird surveys were conducted over a two hectare area for 20 minutes at Sections A, C and E, every dawn and dusk for five (5) sampling days. A single bird survey was also conducted at Section B. Birds were identified based on actual observations or indirectly by bird calls. Any birds or calls identified opportunistically outside the 20 minute survey were also recorded.

Hair Tube Traps

Arboreal and ground hair tubes were randomly placed within a range of habitat types at Sections A (10), C (20) and E (20) for a total duration of six (6) nights and days. Traps were baited with a mixture of honey, rolled oats, peanut butter and vanilla essence. Traps were not placed within Section B due to the relatively open nature of the park and risk of urban interference.

Opportunistic Observation

Any fauna, scats, tracks and scratch marks observed during the fauna survey were recorded and subsequently identified.

6.2.2.2 Aquatic Fauna

Hydrobiology undertook a snapshot survey of fish and macroinvertebrate fauna in Moggill Creek estuary. The objective of the snapshot survey was to provide:

- an understanding of the diversity and abundance of fish and benthic invertebrates living in Moggill Creek estuary, particularly in parts of Moggill Creek potentially affected by the construction of the KBP; and
- an understanding of the condition of aquatic habitat potentially impacted by the KBP.

Surveys were carried out over two (2) days on 17 and 18 September 2008. This coincided with spring tides, which ultimately resulted in large fluctuations in water level and strong tidal currents at the time of the survey. This may have reduced the efficiency of some of the trapping methods used. Sampling was undertaken at Section D, at two (2) sites upstream and two (2) sites downstream of the KBP crossing of Moggill Creek as detailed in Figure 6.2.

Baited Box Traps

Baited box fish traps (10) were deployed at each site at Section D and set for two (2) hours each. The identity and abundance of fish captured was recorded. Fish were subsequently returned to the waterway.

Gill Nets

A single 10 m long gill net was deployed with 2 m drops at each site in Section D. Gill nets were nylon monofilament nets with stretched meshes of 25 mm, 35 mm and 40 mm. The identity and abundance of fish captured was recorded. Fish were subsequently returned to the waterway.

van Veen Grab Sampler

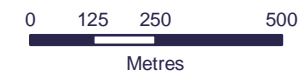
Benthic macroinvertebrates were sampled from sub-littoral, soft-bottom habitats at four (4) sites in Moggill Creek. These habitats included relatively consolidated mud near the fringes of the mangrove zone and less consolidated mud near the main channel. Benthic macroinvertebrates occurring in soft sediments were sampled using a 0.025 m² van Veen grab sampler. Sediment collected in the grab

DRAFT

sampler was washed through a 500 µm mesh sieve. Benthic organisms retained in the sieve were then placed into a labelled sample bag and preserved in methyl alcohol. Five (5) replicate samples were collected from each site. Benthic invertebrates were later counted and identified under a stereo dissector microscope in the laboratory. Where possible, taxa were identified to family level. Cobble-sand habitats in the main channel represented another major benthic habitat type in the study area. No benthic fauna data was collected for this habitat type due to the inability of the van Veen grab sampler to effectively sample the cobble-sands.

Habitat Assessment

Unlike freshwater ecosystems, where techniques such as State of the Rivers can be applied, no standard technique exists for assessing the condition of estuarine habitat. For this study, the habitat assessment sheet of the DPIF fish survey data proforma was used to assess habitat conditions. Given the broad similarities in habitat condition between study sites, results of this assessment are summarised across all sites.



1:15,000 (when printed at A3)

Date - 13 May 2009



Legend

Centenary Motorway

Kenmore Bypass

Moggill Road

River/creek

Ecology Site Assessment

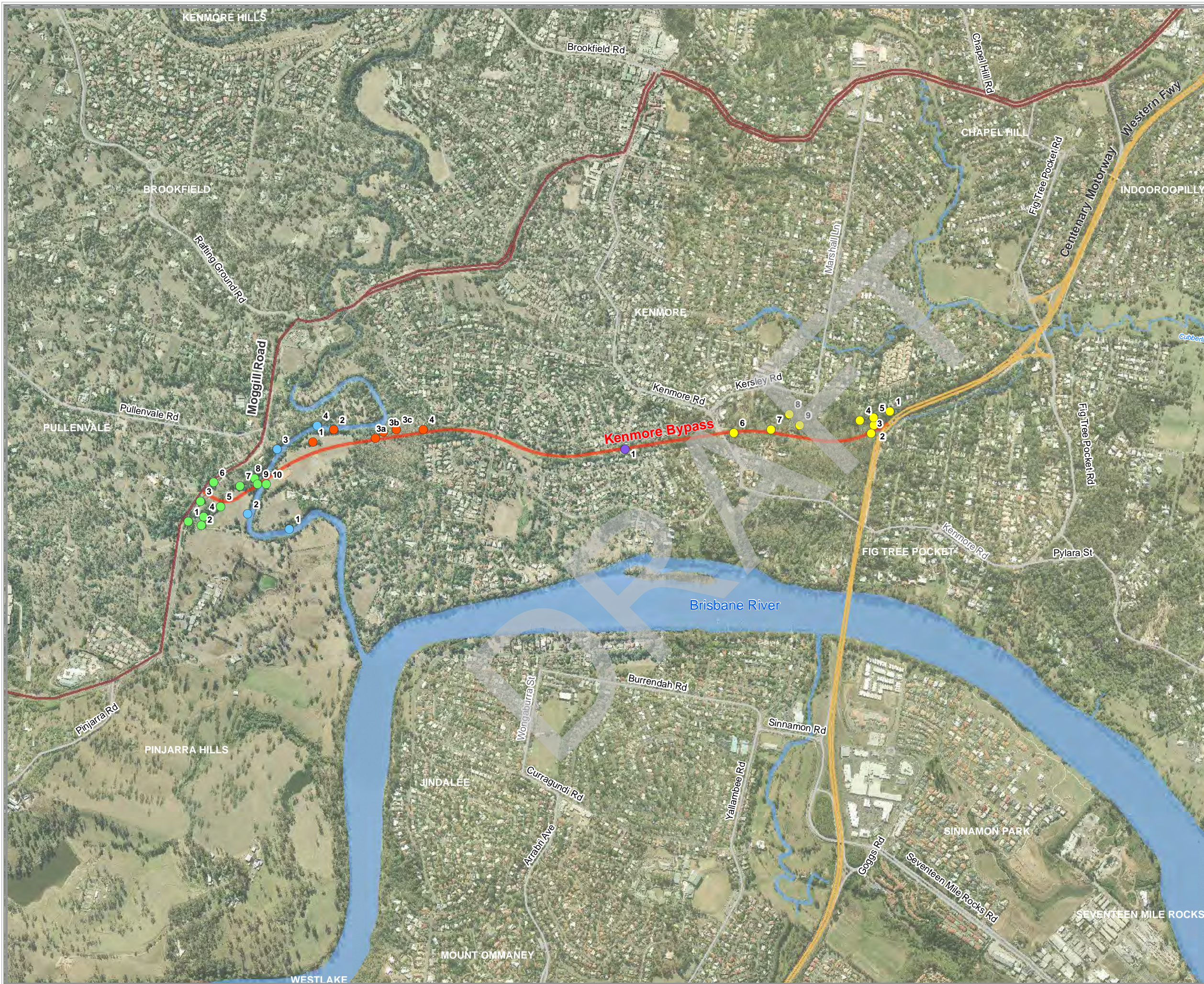
SECTION - A

SECTION - B

SECTION - C

SECTION - D

SECTION - E



Data sources:
Roads, railway, rivers etc - Copyright 2006, MapData Sciences
PTY LTD, PSMA

Aerial Imagery:
Copyright Qasco Surveys Pty Limited (2005).

Air Quality Information provided by ENSR Australia,
Brisbane for the Kenmore Bypass Environmental Study.

**KENMORE BYPASS
FAUNA**

**SITE ASSESSMENT
Section and Sampling Units**

Figure 6.2

6.3 Description of Existing Environment

The proposed alignment for the KBP intercepts a variety of habitat types. This section describes the habitat within the corridor and makes specific reference to the migratory, threatened (Commonwealth and Queensland) and the locally significant species that are likely to use these resources.

Threatened species are those that have been listed under the *EPBC Act* and the *Nature Conservation Act (NC Act)*.

The *EPBC Act* lists threatened species as critically endangered, endangered, and vulnerable and protects migratory species listed under the following international agreements:

- *Japan - Australia Migratory Bird Agreement (JAMBA)*;
- *China - Australia Migratory Bird Agreement (CAMBA)*;
- *Republic of Korea - Australia Migratory Bird Agreement (ROKAMBA)*; and
- *Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)*.

The *NC Act* is administered through the EPA and protects scheduled species listed as endangered, vulnerable, rare or least concern and common in the *Nature Conservation (Wildlife) Regulation 2006*.

At a local scale, significant species listed under the *BCC Natural Assets Planning Scheme Policy, Schedule 4*, refer to vertebrate fauna species considered significant to Brisbane.

The likelihood of Commonwealth, Queensland and locally significant species occurring in the project area was assessed based on previous sightings within two kilometres of the project area and suitable habitat available within the corridor (as listed in Appendix 6-A).

Fauna pest species were identified based on the declared Queensland pest species listed under the *Land Protection (Pest and Stock Route Management) Act 2002* and are categorised according to the following criteria:

- Class 1: not common in Queensland and if introduced would cause an adverse economic, environmental or social impact. They are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests;
- Class 2: established in Queensland and have, or could have, a substantial adverse economic, environmental or social impact. The management of these pests requires coordination by stakeholders and they are subject to programs led by local government, community or landowners;
- Class 3: established in Queensland and have, or could have, an adverse economic, environmental or social impact. Landholders are not required to control Class 3 pests unless their land is adjacent to an environmentally significant area. There are currently no declared Class 3 pest species; and
- Non-declared: There are 32 non-declared animals and include species kept for commercial or social benefit and non-native animals that are widespread but have minimal commercial, environmental or social adverse impacts.

Table 6.1 shows the total number of species listed under the specific pieces of legislation:

- a) identified through database records;
- b) likely to occur in the project area based on preferred habitat; and
- c) species observed within the project area during the fauna survey.

DRAFT

Table 6.1: Total Numbers of Listed Species

Group	Total number		
	Located in database records	Potentially occurring in project area	Observed
Listed under both <i>EPBC Act</i> and <i>NC Act</i>	12	4	0
Listed under only <i>EPBC Act</i>	1	1	1
Listed under only <i>NC Act</i>	6	6	2
Migratory & Marine	25	14	9
Locally significant (BCC)	33	16	3
Pest species	0	0	9 ⁽¹⁾

The alignment is predominantly located within the fire ant restricted zone as shown in Figure 6.3. Under the *Land Protection (Pest and Stock Route Management) Act 2002*, *Solenopsis. invicta* (fire ants) are a notifiable pest and suspected sightings must be reported to the DPIF. According to the DPIF, a fire ant restricted area is any past or current treatment area. For the purpose of treating infested areas a buffer is created around any discovered nesting site. This treatment area is then demarcated as a fire ant restricted zone and is subject to restrictions. Construction and operation of the KBP involving the movement of high risk materials (such as soil and turf) out of and within the restricted zone will be subject to commercial regulations. Construction contractors are required to follow an Approved Risk Management Plan (ARMP) to prevent the spread of fire ants. The ARMP must be approved by the DPIF.

Essential Habitat is mapped to the south of the KBP alignment. Essential Habitat is an area or location with essential resources for the maintenance of populations of priority taxa, typically vulnerable, rare or near threatened species. Essential Habitat may be defined from known records or considered potential according to expert knowledge of habitat relationships.

Regional ecosystems (RE) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. For this study, the bioregion refers to SEQ. The status of REs is gazetted under the *Vegetation Management Act 1999* (their Vegetation Management Status) as Endangered, Of-concern or Not-of-concern.

An RE is listed as Endangered under the *Vegetation Management Act 1999* if remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares.

An RE is listed as Of-concern under *Vegetation Management Act 1999* if remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares.

An RE is listed as Not-of-concern under the *Vegetation Management Act 1999* if remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares.

Remnant woody vegetation is defined as vegetation where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Regional Ecosystems (RE) mapped Of-concern and Not-of-concern are located to the south-east of the alignment. RE 12.3.11 ('Of-Concern') is located to the south of the preserved corridor, along the Brisbane River upstream of the Centenary Motorway Bridge. An area of the 'Not-of-Concern (RE 12.5.11) was located to the southeast of the persevered corridor and adjacent to the Centenary

¹total number includes those species where evidence of occurrence were observed

DRAFT

Motorway. Portions of both these areas of RE were also mapped by the Queensland EPA as Essential Habitat for *Phascolarctos cinereus* (koala). Neither area of RE or Essential Habitat will be directly impacted by the proposed KBP. None of the vegetation along the preserved corridor is mapped remnant in the EPA's RE maps of the area

6.3.1 Available Habitat Types

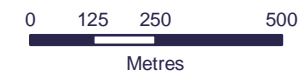
This section provides a description of the location of habitat available, a table detailing the significant fauna likely to use the habitat and, where appropriate, describes the least concern species that were observed within that habitat. The *EPBC Act* and *NC Act*'s significant species are discussed in more detail in Section 6.4. Locally significant species are not described in detail in this EAR; however, their habitat and impacts on their habitat are addressed in Sections 6.3.2 and Section 6.4.

The habitat types that occur within the corridor have been categorised into:

- open forest and riparian forest;
- freshwater environment;
- brackish environment;
- mangrove environment; and
- gardens and parks.

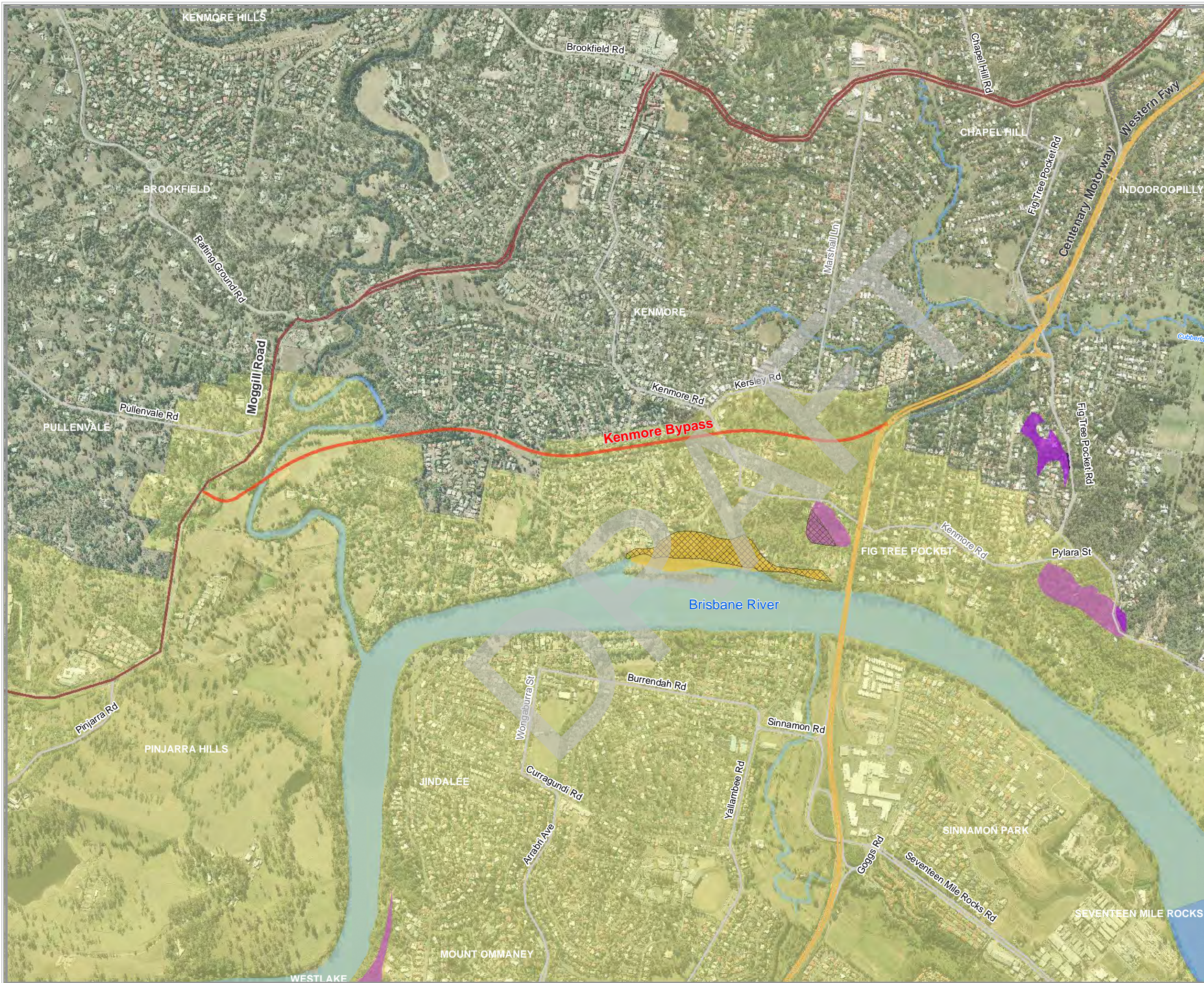
The locations of the above habitats are described with reference to the specific Sections (A to E). These Sections have been mapped for easy reference and are illustrated in Figure 6.2. The description of each habitat does not include details of the flora species unless the flora species is specific to the habitat values of a particular fauna species. For further details on Flora species refer to Chapter 7.0 (Flora).

The following section provides a broad view of the type of habitat available within the corridor, where they were located and those species that may use these habitat areas. A habitat assessment detailing site-specific habitat values, where possible, addresses particular habitat characteristics within those broadly grouped habitat types.











1:15,000 (when printed at A3)

Date - 13 May 2009



Legend

-  Centenary Motorway
-  Kenmore Bypass
-  Moggill Road
-  River/creek
- Regional Ecosystem**
-  Dominant - of concern
-  Not of concern
-  Essential Habitat
-  Fire Ant Restricted Zone

Data sources:
Roads, railway, rivers etc - Copyright 2006, MapData Sciences
PTY LTD, PSMA

Aerial Imagery:
Copyright Qasco Surveys Pty Limited (2005).

Air Quality Information provided by ENSR Australia,
Brisbane for the Kenmore Bypass Environmental Study.

**KENMORE BYPASS
FAUNA**

**Regional Ecosystems,
Essential Habitat and
Fire Ant Restricted Zone**

Figure 6.3

DRAFT

6.3.1.1 Open forest and Riparian Rainforest

Sections A and C are disturbed open eucalypt forest habitat. Section E contains a small area of highly degraded riparian rainforest. This habitat ran the length of the small tidal waterway and extended up to 10 m from the waterway banks. Sections A and C are approximately 10.4 ha and 5 ha respectively, and although, fragmented and disturbed, provided habitat values for a range of potential species. Significant individual trees that were likely to provide hollows included a few large native trees in Section A, a mature *Corymbia citriodora* over 40 m tall, a *Eucalyptus tereticornis* and other mature native trees in Section C and a large hollow bearing dead tree near Section E. These trees may provide hollows for a variety of arboreal species. The location of the large *C. citriodora*, *E. tereticornis* and hollowed trees are detailed in Figure 6.4.

Based on desktop studies as outlined in Section 6.2.1, the following threatened, migratory and locally significant species were rated highly likely to occur within the open forest and riparian rainforest located within the project area. As noted in Table 6.2 not all species/or evidence of species identified in the desktop study were found as part of the field survey.

Table 6.2: Significant Species assessed in desktop studies as Highly Likely to Occur within the Open Forest and/or Riparian Rainforest

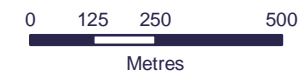
Scientific name	Common name	Observed in field	EPBC Act	NC Act	BCC
Mammals					
<i>Phascolarctos cinereus</i>	koala	No	-	Vulnerable	√
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	Yes	Vulnerable	-	-
<i>Rattus fuscipes</i>	bush rat	Yes	-	-	√
Birds					
<i>Accipiter novaehollandiae</i>	grey goshawk	No	-	Rare	√
<i>Accipiter fasciatus</i>	brown goshawk	Yes	-	-	√
<i>Aquila audax</i>	wedge-tailed eagle	No	-	-	√
<i>Calyptorhynchus lathami</i>	glossy black-cockatoo	No	-	Vulnerable	√
<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo	No	-	-	√
<i>Coracina lineata</i>	barred cuckoo-shrike	No	-	-	√
<i>Erythrotriorchis radiatus</i>	red goshawk	No	Vulnerable	Endangered	√
<i>Eurystomus orientalis</i>	dollarbird	Yes	Marine	-	-
<i>Hirundo neoxena</i>	welcome swallow	Yes	Marine	-	-
<i>Lathamus discolor</i>	swift parrot	No	Endangered	Endangered	-
<i>Lophoictinia isura</i>	square-tailed kite	No	-	Rare	-
<i>Lopholaimus antarcticus</i>	topknot pigeon	No	-	-	√
<i>Merops ornatus</i>	rainbow bee-eater	No	Marine & Migratory	-	-
<i>Ninox strenua</i>	powerful owl	No	-	Vulnerable	√
<i>Pitta versicolor</i>	noisy pitta	No	-	-	√
<i>Ptilonorhynchus violaceus</i>	satin bowerbird	No	-	-	√
<i>Rhipidura rufifrons</i>	rufous fantail	Yes	Migratory & Marine	-	√

DRAFT

Scientific name	Common name	Observed in field	EPBC Act	NC Act	BCC
<i>Xanthomyza Phrygia</i>	regent honeyeater	No	Endangered	Endangered	-
<i>Zosterops lateralis</i>	silveryeye	Yes	Marine	-	-
Reptiles					
<i>Varanus varius</i>	lace monitor	No	-	-	√
Amphibians					
<i>Uperoleia laevigata</i>	smooth toadlet / eastern gungan	No	-	-	√

Least concern native species recorded within the forest habitat included a number of bird species (Appendix 6-B), *Isoodon macrourus* (northern brown bandicoot), *Morelia spilota* (carpet python), *Physignathus lesueurii* (eastern water dragon), *Tiliqua scincoides* (blue tongue skink) and *Trichosurus vulpecular* (common brush-tailed possum). Additionally ten species of least concern microbats were detected on the AnaBat (Appendix 6-B). No bat roosting sites such as caves, large culverts, or hollows were identified in the corridor. Other arboreal mammals recorded (Wildlife Online) within the KBP include *Acrobates pygmaeus* (feathertail glider) and *Petaurus breviceps* (sugar glider).

The introduced non-declared pest species *Lepus europeus* (European hare), *Mus domesticus* (house mouse) and *Rattus rattus* (black rat) were observed within this habitat. The declared Class 2 pest *Vulpes vulpes* (red fox) inhabits these areas. During the field survey, a feeding *V. vulpes* was disturbed and fled. The remains of a juvenile hare were observed at its feeding location. Evidence of the declared Class 2 pests *Canis familiaris* (dog) and *Sus scrofa* (pig) (tracks and spoor respectively) were observed within and adjacent to the forested areas in Section E.



1:15,000 (when printed at A3)

Date - 13 May 2009



Legend

- Centenary Motorway
- Kenmore Bypass
- Moggill Road
- River/creek

Specimens of Interest

- Threatened Species
- Migratory Species
- Locally Significant Species
- Habitat Tree

Specimens and Habitats of Interest

1. *Rallus pectoralis*
2. *Pteropus poliocephalus*
3. *Adelotus brevis*
4. *Ardea alba*
5. *Rhipidura rufifrons*
6. *Accipiter fasciatus*
7. *Rattus fuscipes*
8. Dead Hollow tree
9. Dead Hollow tree
10. *Eucalyptus tereticornis*
11. *Corymbia citriodora*

Data sources:
Roads, railway, rivers etc - Copyright 2006, MapData Sciences
PTY LTD, PSMA

Aerial Imagery:
Copyright Qasco Surveys Pty Limited (2005).

Air Quality Information provided by ENSR Australia,
Brisbane for the Kenmore Bypass Environmental Study.

**KENMORE BYPASS
FAUNA**

**Species and Habitats
of Interest**

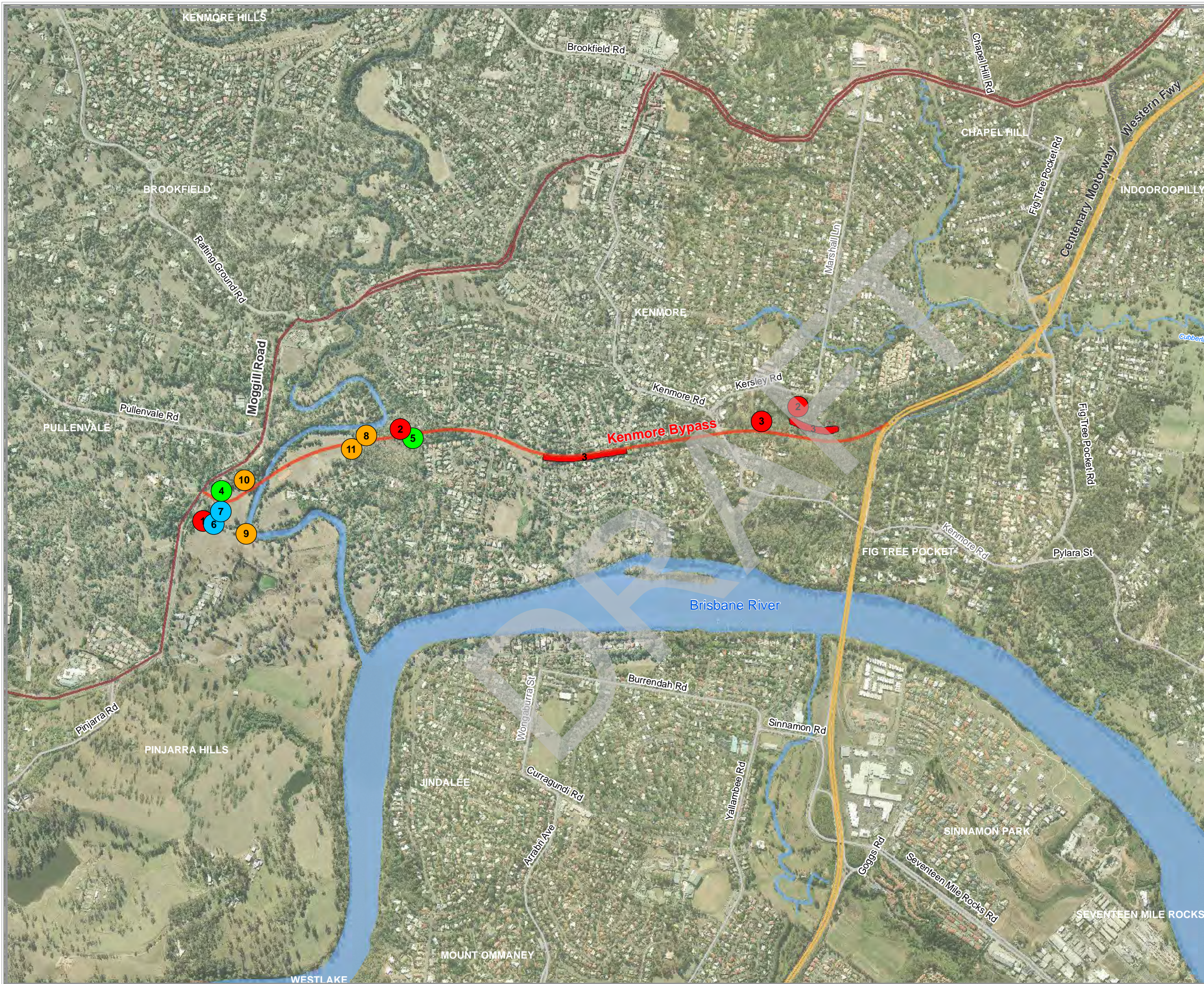


Figure 6.4

DRAFT

6.3.1.2 Freshwater Environment: Swamps, Wetlands, Ponds and Drainage Lines

Sections A, B and E provided the following disturbed freshwater habitat:

- Section A contained a natural drainage line running west to east, with seasonal pools of water accumulating in small puddles along the drainage line. A small pond approximately 120 m² was located at the edge of a property off Plumeria Close.
- Section B contained a weed infested and concreted drainage line running the length of the area, east to west.
- Section E contained an abandoned grassed paddock with a small swampy wetland and a standing open freshwater pond.

Based on desktop studies as outlined in Section 6.2.1, the following threatened, migratory and locally significant species were rated highly likely to occur within the freshwater environments located in the project area:

Table 6.3: Significant Species assessed in desktop studies as Highly Likely to Occur within Freshwater Environments

Scientific name	Common name	Observed in field	EPBC Act	NC Act	BCC
Birds					
<i>Ardea alba</i>	great egret	Yes	Migratory & Marine	-	-
<i>Ardea ibis</i>	cattle egret	Yes	Migratory & Marine	-	-
<i>Grallina cyanoleuca</i>	magpie-lark	Yes	Marine	-	-
<i>Hirundo neoxena</i>	welcome swallow	Yes	Marine	-	-
<i>Porphyrio porphyrio</i>	purple swamp-hen	Yes	Marine	-	-
<i>Rallus pectoralis</i>	Lewin's rail	Yes	-	Rare	√
Reptiles					
<i>Chelodina longicollis</i>	eastern snake-necked turtle	No	-	-	√
Amphibians					
<i>Adelotus brevis</i>	tusked frog	Yes	-	Vulnerable	-

The wetland was home to resident *Gallinula tenebrosa* (dusky moorehens), *Porphyrio porphyrio* (purple swamp-hens), and was regularly visited by a *Platalea regia* (royal spoonbill) and the migratory *Ardea alba* (great egret). Notably one (likely two) *Rallus pectoralis* (Lewin's rail) individuals were identified inhabiting the swampy vegetated surrounds of the wetland. The native rodents, *Melomys burtoni* (grassland melomys) and *Rattus lutreolus* (swamp rat) inhabited the swampy environment at Section E. Numerous *Isoodon macrourus* (northern brown bandicoot) diggings were encountered during dawn surveys, in addition to a captured specimen in Section E, Sampling Unit 2, suggesting their high usage of this area.

Aquatic fauna using the open water habitat at Section E included *Litoria fallax* (eastern sedge frog), *Physignathus lesueurii* (eastern water dragon), which was observed in the nearby forested area, and a turtle species. *Litoria fallax* (eastern sedge frog) was recorded at the pond in Section A and *Limnodynastes peronii* (striped marsh frog) was located in conjunction with *A. brevis* at Section A, and Section B near the foot path. *A. brevis* was located in numerous locations in Section B and D. The locations of these aquatic fauna are detailed in Figure 6.4.

The non-declared pest *Bufo marinus* (cane toad) and *Rattus rattus* (black rat) were observed and the noxious species *Gambusia* sp (mosquito fish), declared under the *Fisheries Act 1994 (Fisheries Regulation 2008)*, were highly abundant in the standing pools of freshwater at Section E.

6.3.1.3 Tidal Environment: Moggill Creek

No significant species with a preference for brackish waters were rated as highly likely to occur within this habitat area in the KBP corridor.

DRAFT

Three species of fish (*Ambassis marianus*, *Mugil cephalus* and *Mugilogobius platystoma*) and one species of crustacean (*Macrobrachium* sp.) were captured during the survey. In total, 17 individuals were caught (refer to Appendix 6-B for full listing). All species captured were native species and are not currently listed as threatened under Commonwealth or Queensland legislation. The number of individuals caught should not be taken to be representative of actual abundances as it is likely that greater numbers are present but not captured due to:

- the survey being a 'snapshot study' rather than a long-term baseline assessment; and
- presence of strong tidal currents at time of sampling that are likely to have reduced trapping efficiency.

In addition to fish captured by gill netting and box trapping, an unidentified eel elver (Anguillidae) was captured in one of the benthic invertebrate grab samples and toad fish (Tetraodontidae) were commonly observed during the survey. Mud crab traps were also observed during the survey, indicating *Scylla serrata* (mud crabs) occur in Moggill Creek.

Macquaria novemaculeata (Australian bass) has not been previously recorded in Moggill Creek, but may use the creek. This species is catadromous (moves from freshwater to brackish water to breed) and undertakes downstream migration between May and August. If this species does occur in the Moggill Creek catchment, it may already be adversely affected by fish passage barriers in the freshwater reaches (e.g. the weir in Brookfield).

Gambusia holbrooki (mosquito fish) are known to occur in freshwater reaches of Moggill Creek catchment and can also live in brackish water. This exotic fish is a known pest and can threaten local aquatic fauna. However, this species does not tolerate strong currents well and tidal movement may prevent it becoming well established in the narrow channel of estuarine reaches of Moggill Creek. No individuals were captured or observed during the snapshot survey.

A total of 299 individuals belonging to six families of macroinvertebrate were collected during the snapshot survey (refer to Appendix 6-B for full listing). Among these were two species of gastropod snail (*Conuber* sp. and *Nozema* sp.), one bivalve species (*Laternula* sp.), one polychaete worm species (*Ceratonereis* sp.) and two crustacean (*Apseudes* sp.) and an unidentified sphaeromatid isopod. The number of taxa found in this study is similar to that found in previous studies within the mid-lower Brisbane River.

Conuber sp. and *Apseudes* sp. were the most commonly sampled species. These occurred at all four sampling units within Section D but were particularly abundant upstream (Sampling Units 3 and 4). Upstream sampling units featured a greater diversity and abundance than downstream sampling units. Sampling Unit 2 was particularly depauperate of benthic macroinvertebrate fauna. Factors contributing to this are unknown, given that the benthic habitats sampled at all four sites were broadly similar. However, benthic organisms are notoriously patchily distributed and given the limited temporal replication of sampling effort as part of this study; little reliance should be placed on the observed upstream-downstream trends in macroinvertebrate diversity and abundance. It should be noted that Sampling Unit 2 is located immediately downstream of an existing pipeline crossing. Results of this study do not indicate any long term effects of that crossing construction on benthic macroinvertebrates in the immediate vicinity.

Although not sampled as part of this study, cobble-sand substrata are likely to be dominated by small crustacea that utilise interstitial spaces, such as amphipods and isopods. These fauna are potentially more vulnerable to the impacts of increased sediment input, as deposited sediment can infill interstitial spaces between cobbles. However, strong tidal currents in the narrow channel of the Moggill Creek estuary may be sufficient to ensure that any deposited sediment is quickly scoured out and any deposition-related impacts are short lived.

DRAFT

6.3.1.4 Mangrove Environment

The current KBP design intercepts Moggill Creek at the western end of the alignment where Sections E and C meet at Section D. The creek is lined by a narrow mangrove community that desktop studies indicate may be used by the significant species listed below in Table 6.4.

Table 6.4: Significant Bird Species assessed in desktop studies as Highly Likely to Occur within the Mangrove Environment

Scientific name	Common name	Observed in Field	EPBC Act	NC Act	BCC
<i>Pitta versicolor</i>	noisy pitta	No	-	-	√

6.3.1.5 Gardens and Parks

The preserved KBP corridor is entirely bordered by an urban residential environment providing nearby gardens and parks for use by a range of bird species. Section B contained a maintained park that is used for recreation by local residents. Desktop studies indicate that the following birds listed in Table 6.5 as locally significant may use the garden and park surroundings.

Table 6.5: Significant Bird Species assessed in desktop studies as Highly Likely to Occur within Gardens and Parks

Scientific name	Common name	Observed in field	EPBC Act	NC Act	BCC
<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo	No	-	-	√
<i>Merops ornatus</i>	rainbow bee-eater	No	Migratory & Marine	-	-
<i>Pitta versicolor</i>	noisy pitta	No	-	-	√
<i>Ptilonorhynchus violaceus</i>	satin bowerbird	No	-	-	√
<i>Zosterops lateralis</i>	silvereeye	Yes	Marine	-	-

6.3.2 Habitat Assessment




6.3.2.1 Terrestrial Fauna Assessment





The fauna habitat within the KBP alignment was assessed based on the availability of water, vegetation structure and composition, microhabitat characteristics, presence/absence of hollow-bearing trees, density of groundcover resources and level of disturbance. These attributes were subjectively evaluated to provide an overall habitat value on a scale of low to high. These values represent an overall qualitative habitat assessment based on the following criteria:

- Low – highly disturbed with a high percentage of exotic species or small isolated patches, limited foraging and/or roosting resources;
- Moderate – Mainly regrowth with some remnant patches and a lower percentage of introduced species. Some hollows, breeding and foraging resources available; and
- High – Largely undisturbed with weed infestations generally confined to edges. Roosting/breeding opportunities and foraging resources available.

The habitat assessment is detailed in Table 6.6.

Table 6.6: Habitat Assessment

Section	Vegetation structure/ composition	Water availability	Terrain	Microhabitat	Disturbance	Available food	Fauna observations	Habitat value	Images
A	Freshwater pond at the end of property off Plumeria Close surrounded by bushland and some weed intrusion.	Open water body	Flat	Water body	Weed infested and clearing	Nectar from surrounding <i>Eucalyptus</i> spp	<i>Adelotus brevis</i> (tusked frog) (1 individual) and <i>Limnodynastes peronii</i> (eastern sedge frog) (>3 individuals)	Low-medium	
	Tall open eucalypt forest, with patchy dense weed understory (<i>Lantana camara</i> , bamboo)	Running freshwater drainage line	Gully	Some hollows, patchy leaf litter	Weed infested and clearing	High nectar source - <i>Eucalyptus</i> spp	<i>Isoodon macrourus</i> (northern brown bandicoot), <i>Pteropus poliocephalus</i> (grey headed flying fox), <i>Rattus rattus</i> (black rat), <i>Trichosurus vulpecular</i> (common brushtail possum), <i>Adelotus brevis</i> (tusked frog), <i>Limnodynastes peronii</i> (striped marsh frog), <i>Litoria fallax</i> (eastern sedge frog). Eucalypts attracted high numbers of lorikeets.	Low-medium	
B	Open park and with few native trees lining the outskirts. Drainage line running length of the park, highly weed infested. No mid story.	Concreted drainage line forming pools in some locations, (running east to west at southern end of parkland)	Gentle slope	Pools of water, some fallen debris	Recreation, weed infested, and clearing	Little fruit, little nectar, sparse hollows	<i>Adelotus brevis</i> (Tusked frog) (>3 individuals) and <i>Limnodynastes peronii</i> (striped marsh frog) (> 10 individuals)	Low-medium	
C	A community of <i>Aegiceras corniculatum</i> (river mangroves) and <i>Avicennia marina</i> (grey mangroves) line Moggill creek, with a riparian rainforest forest upper story. Under story comprised of bulrushes, reeds and para grass. Edge of horse paddock.	Saline water from Moggill Creek	Flat	Some fallen logs in river, some hollows	Fragmented: mangroves (not extensive), restricted to bank of creek and recreation (horse paddock)	Some fruit source from mangroves, seeds from rush (<i>Phragmites</i>)	<i>Bufo marinus</i> (cane toad), <i>Lepus euraepus</i> (European hare), <i>Morelia spilota</i> (carpet python), and <i>Rattus rattus</i> (black rat).	Medium-high	
	Open gum forest with some large mature riparian forest eucalypts remaining. Under story dominated by weeds and grasses.	None	Gentle slope and hills	Some fallen logs, weed thickets (<i>Asparagus africanus</i> and <i>Lantana camara</i>), some hollows, patchy leaf litter	Weed infested, recreation and clearing	Little fruit and seed sources and some nectar sources (<i>Eucalyptus</i> spp)	<i>Isoodon macrourus</i> (northern brown bandicoot) diggings, <i>Pteropus poliocephalus</i> (fly overs) (grey-headed flying fox) and <i>Rattus rattus</i> (black rat)	Medium	

Section	Vegetation structure/ composition	Water availability	Terrain	Microhabitat	Disturbance	Available food	Fauna observations	Habitat value	Images
E	Stand of approximately 0.3 ha containing pencil willow and broad leaf pepper tree. One mature <i>Eucalyptus tereticornis</i> located 20 m west of willow trees.	Marshy undergrowth with pools of seasonal water	Flat	Fallen logs, hollow and dead limbs in mature eucalypt	Weed infested and fragmented (clearing)	Fruit from broad leaved pepper trees	<i>Isoodon macrourus</i> (northern brown bandicoot), <i>Rattus rattus</i> (black rat)	Medium	
	Dense understory of bulrushes and sedges with upper story at edge of area containing <i>Casuarina glauca</i> and <i>Melaleuca bracteata</i> .	Permanent freshwater wetland marshy surrounding area and open water body	Flat	Some fallen logs in water	Grazing, weed infestation	Considerable seed (typha, sedges, exotic grasses and forbs), <i>C. Glauca</i> possible seed source for the glossy black cockatoo	<i>Dama dama</i> (red fallow deer), <i>Melomys burtoni</i> (grassland melomys), <i>Mus musculus</i> (house mouse), <i>Rattus lutreolus</i> (swamp rat), <i>Rattus rattus</i> (black rat), <i>Litoria fallax</i> (eastern sedge frog), <i>Gambusia holbrooki</i> (mosquito fish), and several bird species (see Appendix 6-B) including <i>Ardea ibis</i> (cattle egret), <i>Ardea modesta</i> (great egret), <i>Platalea regia</i> (royal spoonbill), 4 resident <i>Porphyrio porphyrio</i> (purple swamp-hen), and <i>Rallus pectoralis</i> (Lewin's rail). Extensive bandicoot diggings.	Medium-high	
	Riparian rainforest. Dense mid storey of exotic vines and weeds.	Small tidal waterway running length of area from wetland to Moggill Creek	Low hills	Tree hollows sparse, sparse fallen logs, patchy leaf litter, and some rocky crevices	Highly disturbed, and weed infested	Some fruit (<i>Celtis sinensis</i>) and nectar (<i>Lantana camara</i> and <i>Eucalypt</i> spp)	<i>Isoodon macrourus</i> (northern brown bandicoot), <i>Mus musculus</i> (house mouse), <i>Rattus rattus</i> (black rat), and <i>Physignathus lesueurii</i> (eastern water dragon)	Low-medium	
	<i>Avicennia marina</i> (grey mangrove) community along bank of Moggill creek. Dense rush and para grass in some areas, mid story mangrove shrubs.	Brackish water from Moggill Creek	Flat	Some fallen logs in river, open ground with no leaf litter	Fragmented: mangroves (not extensive), restricted to bank of creek	Some fruit source from mangroves, seeds from rush (<i>Phragmites</i>)	Although no animals were trapped, suspected <i>Mus musculus</i> (house mouse) or other small rodents use this area	Medium-high	

6.3.2.2 Aquatic Fauna Assessment

The reach of Moggill Creek estuary within the vicinity of the KBP corridor is characterised by:

- wetted stream widths of between five and ten metres at peak spring tide;
- maximum depths of less than two metres at peak spring tide;
- a generally continuous riparian zone, five metres wide or less, principally comprising mangroves such as *Aegiceras corniculatum* and *Avicennia marina*;
- shallow bare mud banks in the littoral zone and sand–cobble beds in the main channel; and
- limited complex habitat structure (i.e. few snags, rock banks and undercuts and no emergent vegetation apart from a narrow band of mangrove seedlings on each bank).

The reach of Moggill Creek studied was rated as being moderately disturbed based on the cumulative effects of:

- existing bridge and pipeline crossing construction;
- riparian vegetation clearing;
- some evidence of bank erosion and aggradation;
- urban rubbish; and
- the likely effects of diffuse runoff from urban sources, roads and semi-rural land use.

Parts of the Brisbane River catchment have been historically affected by sand and gravel extraction. It is unclear whether or not such activities have occurred in the Moggill Creek catchment and if so, what the impacts of these on aquatic fauna in the estuary may have been.

6.3.3 Other Considerations - *Phascolarctos cinereus* (koala)

There has been significant public concern that the preserved road corridor may be a habitat for *Phascolarctos cinereus* (koala), with a number of public statements and media reports. Some reports have suggested that there is a community of koalas currently based in the corridor. Given the significance of this species and DMR's policies with respect to minimising impacts on viable koala communities, significant effort has been dedicated to searching for signs of this species.

This has extended to widening the study area and searching the EPA Wildnet database for sightings since 1980 and additional field surveys specific for koala.

In March 2004, the status of the Koala under the *NC Act* was changed from "common" or of least concern to "vulnerable". On 10 August 2006 the *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 – 2016* (the Koala Plan) was released. In addition to the Koala Plan, the draft SEQ Koala State Planning Regulatory Provisions (SPRP) came into effect on 12 December 2008. The SPRP provides specific additional protective mechanisms for habitat areas (regulatory maps) already identified within the urban footprint. The KBP falls outside the areas identified in the regulatory maps.

The Koala Plan identifies koala deaths on roads as the second biggest threat to koalas in South East Queensland after habitat clearing. In response to the significant impact roads (both by impact and clearing of roads corridors) have on koalas, DMR drafted the *Main Roads Koala Conservation Plan Policy*. As part of the Conservation Policy, DMR has identified a number of actions to reduce road related impacts; one of which is ongoing investigation via urban and bushland surveys in an attempt to investigate the size of koala populations.

On 4 January 2009, AECOM Australia Pty Ltd was provided with a consultant's report entitled "*Kenmore By-Pass Koala Habitat Study; Past, Present and Future*" by Mr Ric Natrass (2008). The report states that it is "*clear that there are wild and free ranging koalas still living in the Western Suburbs*". The evidence provided in the report primarily consists of detailed scratch analysis. The report also states that the survey was limited to areas of public access and therefore cannot be considered as a comprehensive survey of koala activity. Further, the author states that "*surveying on private lands will undoubtedly reveal far greater koala activity throughout the area*" although evidence as to why the author concluded this is not provided in the report.

DRAFT

In response to ongoing media and community concerns, AECOM undertook an additional targeted survey to investigate the likelihood of koala presence in the KBP corridor.

The initial search area was widened to a broader search of 2587.23 ha centred on the corridor. A desktop review of Wildlife Online records (EPA 2008b) found two (2) unconfirmed sightings of koalas; one sighting (1980) in the vicinity of Crestview Street approximately 800 meters to the north of the corridor and the other sighting (1992) in the vicinity of Lone Pine Sanctuary at Fig Tree Pocket approximately 1.5 km east of the corridor. RE mapping indicated that there was Essential Koala Habitat approximately 400 metres to the south of the preserved road corridor (Figure 6.3), however, this area falls outside the alignment and will not be directly impacted by the construction of the KBP.

A desktop assessment based on habitat availability and previous Wildlife Online records suggest koalas have a high likelihood to occur within the KBP however the results from a targeted koala survey provided no evidence to support the claims that a viable koala community that are dependant on this habitat will be displaced by the construction of the KBP.

Findings of the additional field surveys indicate there was a significant number of gum trees with scratch marks located on the ridges to the west of Gem Road. Scat samples were collected from many of these areas and were analysed. None of these scats were found to be koalas.

A detailed ground truthing exercise was undertaken on 15 and 16 January 2009. All of the scratchings reported by Natrass (2008) were sought and all trees in the vicinity of the corridor were examined. Investigators catalogued the apparent age of the scratches, searched extensively for koala scats², and scanned the canopy for the presence of animals. There was no evidence supporting a community of koalas in the corridor. There was evidence (scats) supporting the presence of other climbing species, notably possums and goannas.

There is reason to believe that there are viable communities of koalas in bushland significant distances to the west of the corridor, and there is the possibility that individuals may stray into the area from time to time. It is recommended therefore if the KBP proceeds that trained fauna spotter/catchers be utilised during the construction phase and if an animal is identified, the DMR policy on *P. cinereus* be strictly followed.

6.4 Potential Impacts and Mitigations Measures

The construction and operation of the KBP will have direct and indirect adverse impacts on all fauna species inhabiting or otherwise using the area. The purpose of this section of this EAR is to highlight those impacts and to suggest mechanisms to manage, reduce and offset the adversity of these impacts if possible. Whilst specific measures have been proposed for those species that were observed in the alignment, general precautions should be employed during the construction phase to ensure impacts on those species potentially using the area are minimised.

Potential impacts to terrestrial fauna within the study area have been assessed using the engineering design current as at 3 October 2008. Section 6.4.1 identifies impacts and potential mitigation measures to threatened and observed significant species. Section 6.4.2 refers to general mitigation measures during the construction and operation of the KBP.

6.4.1 Threatened and Significant Species

The fauna study identified ten (10) threatened species and four (4) migratory species that may be impacted by the construction and operation of the KBP. Two *NC Act* threatened species, *Adelotus brevis* (tusked frog) and *Rallus pectoralis* (Lewin's rail) will suffer direct adverse impacts and will therefore require species specific mitigation measures. In addition to these threatened species, several locally significant species will be subject to these impacts. This section refers only to the impacts and mitigation measures for those species listed as threatened and those observed locally

² The investigation took place approximately six (6) weeks after any storm event that may have removed any faecal evidence (scats).

DRAFT

significant species. General mitigation measures that apply to all species have been discussed in Section 6.4.2

6.4.1.1 EPBC Act Threatened Species

***Erythrorchis radiatus* (red goshawk)**

The New South Wales Recovery Program (2002) estimates a potential population of less than 1,000 individuals; however, data is not available to substantiate these figures. *E. radiatus* has a home range of approximately 200km² and are found in a variety of habitat types including coastal and subcoastal tall open forests, and woodlands, adjacent to rainforests and forested rivers. Nesting trees are restricted to trees taller than 20 metres and within one kilometre from a watercourse. *E. radiatus* hunt in open forest, preying on medium to large birds (NSW 2002, Ryan 2006).

E. radiatus potential nesting trees were available in the open forest areas. Sections A, C and E contained several mature native species ranging between 21 metres and 46 metres tall, but averaging approximately 30 metres in height. Further, Moggill Creek provides a water resource within one kilometre of these trees. A high abundance of birds within the area may also provide adequate food resources. The open forest habitat areas however, are relatively small compared to the size of *E. radiatus* home range and are unlikely to contribute significantly to its survival.

E. radiatus breeding and foraging habitat may be impacted by the clearance of the large, mature tree species within the corridor. This species has been recorded once since 1980 (EPA 2008a) within the vicinity of the project area; however, it was not observed during the field survey. Vegetation clearance for the KBP is not likely to have a significant impact on the survival of this species. The general mitigation measures outlined in Section 6.4.2, if employed, will help to minimise the impacts by identifying nesting trees and relocating nests to other suitable habitat areas.

***Lathamus discolor* (swift parrot)**

L. discolor breed in Tasmania in spring and then migrate across the Bass Strait and disperse over the Australian mainland during winter. The population decline is a result of habitat clearance and is now estimated at approximately 2,500 individuals. Throughout their range, *L. discolor* select the most mature trees to provide suitable nesting sites and foraging sources. *L. discolor* is capable of locating extensive areas of habitat and small fragmented and remnant habitat. *L. discolor* is less likely to forage in areas that are protected by aggressive competitors, such as *Trichoglossus haematodus* (rainbow lorikeet) (Saunders & Heinsohn 2008).

Although open forest and riparian rainforest areas are available for use by *L. discolor*, the high abundance of rainbow lorikeets attracted to the eucalypt blossoms, especially at Section A, makes these habitat areas unfavourable. Nevertheless, some mature trees located within the corridor may be suitable for nesting and the eucalypt blossoms may provide a food resource in the absence of aggressive competitors. *L. discolor* was not observed during the field surveys.

L. discolor may be impacted by the loss or reduction of food resources and nesting habitat within the area. Four individuals have been previously recorded in the area since 1980 (EPA 2008a). The KBP will remove a considerable amount of the available nectar providing trees and tall mature nesting trees in the immediate area. Indirect impacts to this species can not be avoided; however, the development of a Compensatory Habitat Program as is discussed in Table 6.7 would assist in compensating for these losses.

***Pteropus poliocephalus* (grey-headed flying-fox)**

P. poliocephalus roosts during the day in camps in highly vegetated riparian areas that provide protection from predators. At night *P. poliocephalus* may travel up to 50km from their camps to forage for food (Tidemann & Nelson 2004); however, 75% of their foraging activity is located within 20km of their roosting camps (Tidemann 1999). They feed predominantly on eucalypt blossom supplemented by native and exotic fruit (Tidemann & Nelson 2004).

This species was observed feeding on eucalypt blossoms in Sections A and C as shown in Figure 6.4. *P. poliocephalus* roosting camps were not observed during the field survey; although they are known

DRAFT

to exist in areas adjacent to the Brisbane River. The abundance of flowering eucalypt species located within this habitat type provide nectar, an important food source for *P. poliocephalus* (Eby 1998) and will likely attract many bats to the area.

Although indirect impacts to this species will include the loss of food resources, these losses will not have significant impacts on the survival of the population. Based on a self assessment, a referral to the DEWHA is deemed unnecessary. Implementation of a Compensatory Habitat Program would help compensate for the loss of foraging habitat.

***Xanthomyza phrygia* (regent honeyeater)**

The *X. phrygia* population is thought to be in decline due to the clearing of its woodland habitat (Munro & McFadden 2005). The population estimates vary between 500 to 2,000 individuals occurring within four known locations. This species is known to occur in the Granite Belt, from Warwick ranging west to Gore and south to Sundown National Park (DEWHA 2008a). *X. phrygia* inhabits eucalypt woodlands, open forest and urban areas. The breeding season occurs during August to January. This species feeds predominantly on nectar from eucalypts and insects and is known to aggressively protect a valuable nectar source from other honeyeaters. *X. phrygia* are well adapted to the unpredictability of eucalypt nectar supply and will fly locally or travel long distances in search of reliable and abundant sources (Franklin & Robinson 1989).

The forest habitat within the project area is likely to provide a source of eucalypt nectar for *X. phrygia* but this species was not observed during the fauna survey. Aggregations occur most often during autumn and winter at nectar sources and thus *X. phrygia* is more likely to be observed during those times of the year.

X. phrygia is known to travel long and short distances to find reliable nectar sources and thus it is expected that it will adapt to the loss of nectar resources. Consequently, the removal of food resources is unlikely to impact this species significantly. The Compensatory Habitat Program includes consideration of planting nectar providing flora.

6.4.1.2 Migratory Species

***Ardea alba* (great egret)**

A. alba is a common nomadic species and is protected under CAMBA and JAMBA. Its range includes a variety of wetlands throughout Australia. The main breeding season occurs between October and May (variable). *A. alba* usually feeds alone, predominantly on fish but also on molluscs, aquatic insects, amphibians, small reptiles and occasionally other small animals. It hunts in water, wading through the shallows or standing motionless before stabbing at prey (Simpson & Day 2004).

A single *A. alba* individual was frequently observed wading through the shallow water of the wetland at Section E as shown in Figure 6.4. The wetland provided habitat for potential prey species including observed amphibians and fish species.

It is unlikely this species is breeding within the study area due to its known breeding locations that have been recorded from locations in northern NSW and northern Queensland (Simpson & Day 2004). This species is nomadic and therefore does not show attachment to particular foraging areas. The loss of foraging habitat will not have significant impacts on the population and the development of a new artificial wetland (described for *Rallus pectoralis* in Section 6.4.1.3) is likely to provide adequate alternative foraging resources.

***Ardea ibis* (cattle egret)**

A. ibis is a partial migrant protected under the JAMBA and CAMBA international agreements. The breeding season occurs between October and March (McKilligan 2005) in large numbers concentrated in heronies along the coastal plain of eastern Australia. Some individuals may stay close to the heronry between breeding seasons; however, the majority migrate to South Australia, Tasmania and New Zealand in autumn and return in spring (McKilligan 2005).

DRAFT

A. ibis was observed flying over the project area but was not observed using the available wetland habitat. Nevertheless, *A. ibis* may find habitat and foraging value in the artificial wetland in Section E. The removal of the artificial wetland may reduce potential foraging resources for this bird; however, it is not expected to have significant impacts on the population. Furthermore, the creation of an artificial habitat for *Rallus pectoralis* (see Section 6.4.1.3) will provide alternative foraging habitat.

***Merops ornatus* (rainbow bee-eater)**

The migratory *M. ornatus* inhabits a range of habitats including forests, woodlands, watercourses, parks and gardens (Qld Museum 2007). They breed either in colonies or solitarily. Nests are constructed as large chambers at the end of a long burrow or tunnel in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. *M. ornatus* feeds on insects, earthworms, spiders and tadpoles ((DEWHA 2008b).

M. ornatus is most commonly seen during spring and summer; however, it was not observed during the fauna survey. Previous records indicate that *M. ornatus* had been observed 19 times in the study area and nearby surrounds since 1980 (EPA 2008a). This species will be impacted by the clearing of vegetation and subsequent loss of habitat and cover for nesting sites. *M. ornatus* nests in ground burrows during August to September. Any habitat clearing should avoid these times and an allocated environmental scientist should be employed on site to identify any burrows potentially used by this species.

***Rhipidura rufifrons* (rufous fantail)**

R. rufifrons is found in rainforest, wet forest, swamp woodlands, and mangroves. It prefers deep shade environs and is often seen on the ground. This species is an active feeder and constantly flicks its body and tail while foraging for insects. *R. rufifrons* builds a small compact cup nest made of fine grasses and spider webs. The bottom of the nest is usually drawn out into a long stem and is suspended from a tree fork approximately five metres from the ground.

R. rufifrons usually prefer more dense and wet habitats than that found within the KBP corridor, but have been seen in more urban environments during its winter migration. The removal of vegetation may result in habitat loss for this species and the loss of potential nesting trees. Any nests found should be relocated to alternative habitat sites. The general mitigation measures listed in Section 6.4.2 will help minimise the potential losses.

6.4.1.3 NC Act Threatened Species

***Adelotus brevis* (tusked frog)**

A. brevis is known to occur in rainforests, wet forests and grasslands. The population is estimated at up to 50,000 individuals over their entire range (Queensland and New South Wales) with a current decreasing status. They inhabit freshwater creeks, puddles, ditches and ponds. The females lay their eggs in a white frothy mass concealed in a nest that is constructed and attended by the male (Qld Museum 2007).

A. brevis was found to inhabit a natural extremely disturbed drainage line in Section A, and the extent of the concreted drainage line of Section B, where the water gathers in slow moving pools.

Despite the highly degraded urban habitat of Sections A and B, more than four individual vocalisations of *A. brevis* were identified near the foot bridge at the western end of the Kingfisher Park and at various other locations along the drain. Section A provided habitat areas for *A. brevis*, including the pond off Plumeria Close and at various seasonal pools of water along the drainage line, where a single individual and more than ten individuals were recorded respectively (Figure 6.4). The drainage line in Section A provides seasonal pools of water after rainfall, which *A. brevis* utilise. The freshwater wetland at Section E is not conducive to *A. brevis* habitat due to the high abundance of *Gambusia holbrooki* (mosquito fish), which are known predators of tadpoles and amphibian eggs.

Construction of the KBP will impact all available habitat for this species in Section B and may impact the seasonal habitat available at Section A. The drainage line running the length of the Kingfisher Park

DRAFT

in Section B is highly likely to be lost as a result of construction. Similarly, the drainage line creating the habitat in Section A may be impacted due to construction activities.

Measures to minimise these impacts should be considered and the following options are available:

- 1) With respect to Section A, the current KBP alignment design does not directly impact the seasonal habitat. Accordingly:
 - Any changes in the current design at Section A should avoid the natural drainage line running west to east and maintain the existing habitat along the drainage line; and
 - Gross Pollutant Traps (GPT) should be installed along the length of this area within the road corridor to avoid road runoff contaminants potentially polluting the habitat and other habitats outside the corridor. Temporary erosion and sedimentation controls (ESC) should also be considered during construction.
- 2) With respect to Section B, options to avoid significantly impacting this area are not presently possible within the narrow corridor. Therefore measures to compensate for the potential complete loss of the frog habitat could be developed and include an opportunity to rehabilitate the drainage line that flows south under Sunset Road and through Kingfisher Park. The rehabilitation and maintenance of this part of the drainage line will provide habitat for *A. brevis*. Components of this option include:
 - discussion with the relevant land owners and stakeholders;
 - a site investigation to ascertain the extent of this habitat available along the drainage line;
 - removal of weed species and rehabilitation of the drainage line with local provenance. Rehabilitation should commence as early as possible prior to disturbance to encourage movement and to provide an alternative habitat for individuals when construction commences;
 - ensuring the slow flowing water of the drainage line is maintained (similar to what is currently available in Section B);
 - conducting a monthly monitoring program during construction activities and to assess *A. brevis* abundance and to ensure construction does not negatively impact the rehabilitated drainage line; and
 - ensuring temporary ESC and permanent GPT protect the habitat area from road runoff pollutants.

A. brevis is known to use highly disturbed areas and can also adjust to temporary changes (as is seen with the adaptation to seasonally available water in Section A). Thus the implementation of this program is likely to provide suitable alternative habitat for *A. brevis*.

***Accipiter novaehollandiae* (grey goshawk)**

A. novaehollandiae inhabits a range of forest types, particularly tall closed forests. It feeds on birds, small mammals, reptiles and insects. *A. novaehollandiae* forms permanent breeding pairs that guard their territory. Nests are built in the forks of tall trees from sticks and leaves and are often re-used in the next breeding season (Australian Museum 2005).

A. novaehollandiae breeding and foraging habitat may be impacted by the removal of mature tree species within the corridor. *A. novaehollandiae*; however, is not known to occur in dense urban environments, was not observed during the field survey and had only been sighted twice since 1980 (EPA 2008a). The vegetation clearance for the KBP is not likely to have a significant impact on the survival of this species. The general mitigation measures outlined in Section 6.4.2, if employed, will help to minimise the impacts by identifying nesting trees and relocating nests to other suitable habitat areas.

***Calyptorhynchus lathami* (glossy black-cockatoo)**

C. lathami feed almost exclusively on the seeds of *Allocasuarina* and *Casuarina* spp. Previous studies have found that a single tree species was selected for feeding and preference was based on those trees that provided larger cone crops. Site selection may also be governed by habitat structure or risk of predation (Cameron & Cunningham 2006).

DRAFT

This species has been rated as highly likely to occur within the area. However, the preferred *Casuarina* habitat is largely limited and is unlikely to contribute substantially to the survival of this species. *Casuarina glauca* is mostly limited to the riparian corridor along Moggill Creek and in Section E where a few trees line the wetland. Removal of this vegetation may result in the loss of feeding resources for *C. lathamii*; however, this species has only been recorded once since 1980 (EPA 2008a) and was not detected during the fauna survey. Although it is unlikely that the removal of this vegetation will have significant impacts on *C. lathamii*, where design and safety considerations allow *Casuarina* species should be retained.

***Lophoictinia isura* (square-tailed kite)**

The total *L. isura* population is unlikely to exceed 10,000 mature individuals; however, declines at the fringes of the range may be accompanied by increases in other areas. *L. isura* is a specialised canopy predator, hunting for small birds, eggs, nestlings and insects. They have a preference for structurally diverse landscapes, primarily in open forests, woodlands and mallee communities, where passerines are abundant. *L. isura* breed during July to February in nests located near watercourses, in a tree fork or on a horizontal limb (Garnett & Crowley 2000).

L. isura sightings have been recorded nine times since 1980. It was not observed during the field survey. The removal of the forest vegetation may result in the loss of habitat and breeding sites. Potential mitigation measures have been prepared, as detailed in Table 6.7, to help minimise the losses.

***Rallus pectoralis* (Lewin's rail)**

R. pectoralis inhabit dense vegetation located near permanent to ephemeral, fresh to brackish wetlands. They are also known to inhabit artificial areas with similar habitat features. The primary threat to *R. pectoralis* is the drainage and diversion of rivers and subsequent loss of habitat. *R. pectoralis* wander and nest within the dense vegetation to avoid exposure to predators. They breed in spring and summer, producing three to five eggs. They feed mostly on invertebrates and occasionally birds' eggs and frogs (Garnett & Crowley 2000).

The fauna survey revealed the occupancy of *R. pectoralis* in the swampy grasses and rushes of Section E, Sampling Unit 4 (Figure 6.2 and Section 6.4). *R. pectoralis* is listed as rare under the *NC Act*. The dense grassy vegetation provides a refuge for this wetland bird; without which, it would not be able to persist in the urban Kenmore environment. *R. pectoralis* is likely to abandon the wetland if fringing habitat and vegetation are disturbed (Garnett & Crowley 2000).

This artificial wetland is critical to the survival of this particular individual (likely two individuals). The KBP design intercepts the wetland and therefore will require this area to be drained, cleared and likely filled. The artificial wetland habitat, on which *R. pectoralis* depend, will be removed and substitute habitat is not available in the vicinity.

Measures to avoid these impacts should be considered and the following options may be available:

- 1) Should there be no alternative other than to drain and fill the existing wetland a compensatory habitat should be developed. *R. pectoralis* was observed to tolerate artificial conditions and therefore, there is an opportunity to re-create an artificial freshwater wetland of similar size and in proximity to the existing wetland for both *R. pectoralis* and other native fauna. Actions to achieve this include:
 - Undertake a thorough field investigation for potential sites within proximity of the immediate area that could be used for the development of an artificial wetland. Consideration should be given to the suitability of current and future habitat values of the site. Potential sites may include DMR's current land within the road corridor or BCC land at Rafting Ground Reserve;
 - Construction of the artificial wetland should commence at a time that allows for the establishment of the habitat prior to the removal of the existing wetland and ensures sufficient time for vegetation to mature and provide adequate aquatic habitat;
 - Ensure a freshwater environment by designing the wetland to prevent potential inundation by brackish waters from Moggill Creek during high tide events;

DRAFT

- Vegetate the wetland and banks with local wetland provenance to provide habitat characteristics similar to that observed at the existing wetland;
- Stock the wetland with native macroinvertebrates and fishes to allow the ecosystem to develop;
- Prior to construction disturbance to or near the existing wetland, the avifauna should be captured and translocated to the new artificial habitat. The translocation should not be conducted during the breeding months, spring to summer, and should be considered prior to this time. Any established nests located at the existing wetland should be relocated to the new wetland and placed within an area of similar characteristics (near the water, against a log etc). Opportunities for wetland water treatment areas have been identified in Chapter 5, Hydrology and Hydraulics;
- Develop and undertake a weed and pest species management program to remove noxious weeds and exotic terrestrial and aquatic vertebrate pest species from within and around the wetland;
- Coordinate with the local catchment management group to undertake vegetation protection of the area;
- Commence a flora and fauna terrestrial and aquatic monitoring program on a weekly basis during the KBP construction and at three month intervals subsequent to the KBP construction to assess the current biodiversity and habitat values; and
- Prepare reports on the findings of the monitoring program.

Water treatment techniques must be included in the design of the KBP to ensure that runoff from the road surface does not impact on the wetland (refer Chapter 3, Surface Water).

***Ninox strenua* (powerful owl)**

N. strenua hunt in open forest, woodland and suburban gardens, taking mainly arboreal marsupials, fruit bats and roosting birds. It roosts during the day in heavy vegetation along creeks and gullies where the canopy provides protection from harassing currawongs, noisy miners, and butcherbirds (DECC 2008). Isaac *et al* (2008) found that breeding sites contained similar ecological characteristics despite the varying habitat types. Breeding sites were typically within 40 metres of a permanent water source, in highly vegetated areas and on a medium to steep slope. A two year study of the diet of a successful breeding pair of *N. strenua* in Mt. Coot-tha, Brisbane, revealed an assortment of selected prey items including eight mammal, 16 bird and two insect species. The most common prey items consumed were fruit-bats, common ringtail possums and scaly breasted lorikeets (Pavey *et al* 1994).

The mature open canopy of Section A was identified as ideal *N. strenua* habitat. Section A provided habitat for a range of observed prey items including bats, possums and lorikeets. Additionally, Section A is in close proximity to a permanent water source. Nevertheless *N. strenua* was not observed during the fauna survey and did not respond to the call playback. The removal of the vegetation at Section A may impact this species by reducing available habitat and foraging sites.

6.4.1.4 Locally Significant Species (Brisbane City Council)

Only the locally significant species that were observed have been discussed.

***Accipiter fasciatus* (brown goshawk)**

A. fasciatus is found in most forested areas and preys on small mammals, particularly rabbits, birds, insects and reptiles. This species builds a large stick nest lined with fresh eucalypt leaves on horizontal limbs of tall trees, often near a watercourse or the edge of forest. Established *A. fasciatus* pairs may reuse the same area for nesting each year (Australian Museum 2005).

A. fasciatus was frequently observed circling the air in Section E. The frequent observation suggests that this species may have a roosting site in the vicinity of Section E. Additionally, the *Lepus eureapus* (European hare) frequently observed in Section C, in the paddock of the pony club, could be their preferred food resource. The removal of tall mature trees may potentially impact this species by reducing breeding sites. Mitigation measures for nesting trees and nests are discussed in Section 6.4.2.

***Rattus fuscipes* (bush rat)**

This species occurs in a range of habitat types, including rainforest, thick gullies, lantana and bracken patches (Qld Museum 2007). It is unlikely that the construction of the KBP will have a significant impact on this species as it is common and surrounding areas provide adequate habitat to which it should adapt.

6.4.2 Mitigation Measures for Design, Construction and Operation

Mitigation measures are techniques used in the planning, design and construction phases of a project, in order to reduce adverse environmental impacts. Potential impacts and mitigation measures on fauna during the construction and operation phases have been listed in Table 6.7. The proposed mitigation measures in Table 6.7 detail site specific measures and make reference to those measures described under MRS11.51

DRAFT

Table 6.7: Potential Impacts and Mitigation Measures

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 01	Construction	Habitat loss	Drainage and fill of wetland in Section E	Employ species specific mitigation measures discussed in Section 6.4.1 for <i>Ardea alba</i> , <i>Ardea ibis</i> and <i>Rallus pectoralis</i> .
FA 02	Construction		Disturbance to the drainage lines in Section A and B	Employ species specific mitigation measures discussed in Section 6.4.1 for <i>Adelotus brevis</i> to the extent practical given the constraints of the narrow corridor.
FA 03	Construction		Removal of <ul style="list-style-type: none"> • 2.5ha at Section A; • 3.1ha at Section C; and • 0.5ha at Section E 	Minimise vegetation clearance and revegetate progressively with local provenance using a mosaic rehabilitation scheme (i.e. mixed vegetation community, age and structure).
FA 04	Construction			In accordance with MRS11.51 Clause 10.9.1, make use of already cleared areas i.e. the pony club and park area (Section D and B), for construction equipment and office sites.
FA 05	Construction			Minimise disturbance and clearing along Moggill Creek.
FA 06	Construction			In accordance with MRS11.51 Clause 10.9.1, logs, hollow logs, boulders, small trees and shrubs to be retained under bridges where possible, to provide protection for fauna movement along Moggill Creek or in hold points to create shelter habitat for terrestrial fauna.
FA 07	Construction			Construct the KBP in planned stages/phases (stage clearing works): <ul style="list-style-type: none"> • do not remove all vegetation within the area at the same time; and • allow remaining habitat at Section C (see Figure 6.2) to provide continuous connectivity to Rafting Ground Reserve. Revegetate as necessary.

DRAFT

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 08	Construction			<p>Develop a <i>Compensatory Habitat Program</i>:</p> <ul style="list-style-type: none"> • undertake a field visit to identify suitable existing areas for rehabilitation; • Rafting Ground Reserve (BBC owned) is an ideal location; • vegetate disturbed areas with local provenance, including species with a high food resource value (nectar and fruit); • where feasible, juvenile woody plants should be transplanted to the site; • mount artificial hollows (three for every one removed - standard best practice) to mature native trees to compensate for any hollows lost during clearing activities; • develop and undertake a weed and pest species management program to remove noxious weeds from area; • coordinate with the local catchment management group to undertake vegetation protection of the area; • initiate a monitoring program on a yearly basis to assess the habitat values; and • prepare a report on the findings of the program.
FA 09	Construction	Removal and depletion of food resources	Removal of trees providing nectar and fruit	In accordance with MRS11.51 Clause 10.9.1, minimise vegetation clearance.
FA 10	Construction		Depletion of food resources available in the area	Co-ordinate <i>Compensatory Habitat Program</i> to include flora species with a high food resource value (nectar and fruit provision).
FA 11	Construction			Revegetate areas disturbed by construction activities with flora species that provide a high food resources value. Ensure the placement of these species does not increase the chance of injury to fauna, eg do not plant food trees directly adjacent to the KBP.
FA 12	Construction	Removal of nesting and breeding sites	Removal of mature trees	Minimise the removal of mature native trees where possible, especially those trees greater than 20 metres in height and 0.5 metres in diameter. Notable species are identified in Figure 6.4.
FA 13	Construction			Minimise vegetation clearance and revegetate post construction with local provenance.

DRAFT

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 14	Construction		Removal of hollow bearing trees	Provide artificial hollows in nearby habitat areas (Rafting Ground Reserve) and/or in conjunction with the <i>Compensatory Habitat Program</i> .
FA 15	Construction			In accordance with MRS11.51 Clause 10.9.2, appoint a registered spotter-catcher to locate nests and tree hollows.
FA 16	Construction			Relocation of nests and hollows found in the KBP corridor to similar vegetation nearby (Rafting Ground Reserve and in conjunction with the <i>Compensatory Habitat Program</i>).
FA 17	Construction		Disturbance and/or removal of nesting trees during the breeding season	Construction activities involving the removal of mature trees are recommended outside breeding period particularly during spring and summer.
FA 18	Construction	Decreased numbers and diversity of aquatic fauna.	Increased bank and bed scour due to the placement of in-stream structures, i.e. bridge pylons and drainage structures	Careful selection of drainage structures to minimise creek bank and bed disturbance (Management Strategy WQ.02, refer to Chapter 5, Hydrology and Hydraulics (FA.01).
FA 19	Construction		Shading causing by the placement of permanent overhead structures, i.e. bridge deck and pylons.	Design bridge deck with minimal width required in order to minimise aquatic shading affects, FA.01 and design a split bridge structure such that the two (2) bridges far enough apart to maximise light penetration.
FA 20	Construction	Reduction of the photosynthetic potential for aquatic flora and consequent reduction of habitat and dissolved oxygen levels for in-stream fauna	Increased sedimentation in Moggill Creek due to vegetation clearing and general earthworks	Refer to Chapter 3 Surface Water Quality, WQ.03, incorporating the standard erosion, drainage and sediment control measures specified under WQ.03. Sedimentation effects can also be minimised by flagging-off a 'No-Go' Zones along the riparian area of Moggill Creek within the construction site.

DRAFT

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 21	Construction	Inhibition of fauna movement/ disruption to wildlife corridors	Construction of road, fragmenting Sections B and D	In accordance with MRS11.51 Clause 10.9.1, minimise vegetation clearance and progressively revegetate disturbed areas.
FA 22	Construction		Construction of bridge across Moggill Creek; disrupting movement of fauna along riparian strip	Retain /improve the fauna corridor along Moggill Creek.
FA 23	Construction			Incorporate fauna-friendly bridge design: <ul style="list-style-type: none"> • design to consider two bridge structures spaced appropriately apart with bridge clearance heights to allow for fauna-friendly passage; • bridge to allow for a dry passage route to allow access to traversing terrestrial fauna; and • revegetate under bridges with understory brackish-tolerant flora species.
FA 24	Construction	Injury to fauna	Direct loss or injury during intensive construction activities	Implement fauna exclusion devices to discourage species from entering the construction site.
FA 25	Construction			In accordance with MRS11.51 Clause 10.9.3, monthly reporting of any fauna injuries or deaths as a result of construction activities and initiate additional mitigation measures if required.
FA 26	Construction		Indirect loss or injury through use of materials/ equipment potentially hazardous to fauna	Avoid the use of barbed wire to fence off construction areas or other areas (especially to avoid entanglement of flying foxes and other bats).

DRAFT

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 27	Construction	Spread of introduced pest species	Drainage of wetland and potential spread of <i>Gambusia</i> spp.	When the wetland is drained ensure all <i>Gambusia</i> spp. are euthanized (heavy fines apply if kept or moved).
FA 28	Construction		Potential spread of fire ants	<p>Ensure an Approved Risk Management Program be prepared by the contractor and submitted to DPIF for approval prior to construction activities commencing and ensure it is strictly enforced:</p> <ul style="list-style-type: none"> • a site inspection must be conducted by a DPIF Inspector or Approved Person prior to moving or disturbing any soil; • businesses must not move <i>S. invicta</i> infested material outside the restricted area without the approval of a DPIF Inspector and only to approved disposal sites within a restricted area. Infested soil may only be moved to a DPIF Approved Disposal Site; • all high risk materials must be treated before being moved out of the restricted area; • materials not infested with <i>S. invicta</i> may be disposed within the restricted area using approved disposal sites only; • a business must have an ARMP or use a Fire Ant Declaration (FAD) form to move high risk materials (unless otherwise exempted or directed); and • all materials moved from within the restricted area must be accompanied by a Movement Certificate or FAD Form.
FA 29	Construction	Waterway habitat degradation	Erosion and runoff along banks of Moggill Creek due to removal of vegetation and potential for exposed soil surfaces	Hydromulching or matting earthwork areas.
FA 30	Construction			Do not remove vegetation along creek (preferably within 10m) and minimise vegetation clearing within close proximity to Moggill Creek.
FA 31	Construction	Disturbance to fauna	Construction activity within the corridor	Ensure storage of equipment and machinery is located on already disturbed areas. Where practicable areas outside the footprint should not be disturbed for these purposes.
FA 32	Construction			Ensure any waste material is disposed of properly.

DRAFT

Reference Code	Project Phase	Potential Impact	Trigger	Potential Mitigation Measures
FA 34	Operation	Injury to fauna	Road strikes	Install fauna exclusion fencing where appropriate.
FA 35	Operation			Don't plant habitat trees adjacent to the KBP.
FA 36	Operation			Install signage warning users of the potential for fauna crossing.
FA 37	Operation	Waterway habitat degradation	Runoff from roads and banks created by the raised road sections	Incorporate a filtration system into the drainage design in order to minimise pollutants entering Moggill Creek.
FA 38	Operation			Revegetate banks of raised road.
FA 39	Operation			Revegetate creek banks with local provenance.
FA 40	Operation	Reduced aquatic habitat quality	Increased concentrations of motor vehicle pollutants in Moggill Creek due to motor vehicle use on the newly constructed road	Refer to Chapter 3, Surface Water Quality, WQ.04, for maintenance of water sensitive urban design (WSUD) measures in accordance with design objectives in the Healthy Waterways' WSUD Action Plan.
FA 41	Operation	Spread of introduced pest species	Spread of weed species along transport corridor by passing vehicles	Monitoring and management of weed species to be implemented.
FA 42	Operation	Failure of mitigation measures	Lack of ongoing maintenance for mitigation measures	Monitoring regime as prescribed for <i>Compensatory Habitat Program</i> and the artificial wetland.
FA 43	Operation			Continued collaboration with local catchment groups.
FA 44	Operation			Maintain revegetated areas.
FA 45	Operation			Maintain wildlife proof fencing.
FA 46	Operation			Ongoing monitoring of local fauna and mitigation success.