Gateway Upgrade Project

16. Terrestrial Ecology

16

Return to Contents Page

16. Terrestrial Ecology

16.1 Introduction

TOR Requirements: Terrestrial Flora
This section should discuss the terrestrial flora for the study site in relation to vegetation communities, native species and weed species.

A map of the terrestrial vegetation communities should be provided at a suitable scale for the Project area. Map unit descriptions should correspond to the Environmental Protection Agency's regional ecosystem classifications. Sensitive or important vegetation types should be highlighted and there value as habitat for conservation of rare and threatened flora species or community types.

The description should contain a review of published information regarding the significance of the vegetation to conservation, recreation, scientific, educational and historical interests.

The existence of rare and threatened species under Commonwealth and State legislation should be addressed. This should include lists of all rare and threatened flora species for the wider project area as identified from relevant databases and published literature and an indication as to whether each species is present, or likely to be present, within the project area.

The terrestrial vegetation communities within the affected areas should be described at an appropriate scale (ie 1:10,000) with mapping produced from aerial photographs and ground truthing, showing the following:

- Location and extent of vegetation types using the EPA's regional ecosystem classifications in accordance with The Conservation Status of Queensland's Bioregional Ecosystems (Sattler PS & Williams RD 1999) or the EPA's Regional Ecosystem Description Database (REDD) for updated regional ecosystem descriptions
- Location and extent of 'endangered', 'of concern' and 'no concern at present' regional ecosystems with discussion of conservation status provided as per the *Vegetation Management Act 1999*, the EPA's Regional Ecosystem Description Database biodiversity status and the *Brisbane City Council Natural Assets Planning Scheme Policy*
- Location of species afforded additional protection under Commonwealth and State legislation and those species identified as significant flora species as per the *Brisbane City Council Natural Assets Planning Scheme Policy*
- Any plant communities of cultural, commercial or recreational significance should be identified

Detailed methodologies and a flora species list should be provided as an appendix to the report. A list of those native flora species suitable for revegetation is also to be provided. Revegetation species need to be assessed against the risk to aircraft movement due to the potential attraction to avifauna.

The EIS should describe the existing environmental values for nature conservation that may be affected by the project. These should include:

- integrity of ecological processes, including rare and threatened species;
- conservation of resources;
- biological diversity, rare and threatened species;
- integrity of landscapes and places including wilderness and similar natural places; and
- terrestrial ecosystems.

The EIS should identify issues relevant to sensitive areas, or areas that may have low resilience to environmental change. The proximity of any project Infrastructure to any biologically sensitive areas should be described.

TOR Requirements: Terrestrial Fauna
The terrestrial fauna occurring or likely to occur within the wider project area should be described, noting the broad distribution patterns in relation to vegetation. The description of the fauna present or likely to be present in the area should include:

- Species diversity (ie a species list) and abundance of animals, including amphibians, birds, reptiles and mammals (including microchiropteran bats);
- Habitat requirements and sensitivity to changes, including movement corridors and barriers to movement;
- The existence of feral or exotic animals;
- Existence of any rare and threatened or otherwise noteworthy species as per International Treaties, Commonwealth and State legislation and the Brisbane City Council Natural Assets Planning Scheme Policy; and
- Discussion should be provided on the range, habitat, breeding, feeding and movement requirements and current level of protection of all rare and threatened species identified from relevant fauna database searches of the wider project area.

Detailed methodologies and a fauna species list should be provided as an appendix to the report. Surveys are to be conducted at an appropriate time of the year to maximise species detection, particularly for migratory species afforded additional protection under the EPBC Act.

Site data should be recorded in a format compatible with the EPA WildNet database.

The EIS should describe the existing environmental values for nature conservation that may be affected by the project. These should include:

- integrity of ecological processes, including habitats of rare and threatened species;
- conservation of resources; and
- biological diversity, including habitats of rare and threatened species.

The fauna communities should be described, in particular those that are rare or threatened, in environmentally sensitive localities, including waterways, riparian zones, and wilderness and habitat corridors.

The EIS should identify issues relevant to sensitive areas, or areas that may have low resilience to environmental change. The proximity of any Project infrastructure to any sensitive habitat areas should be described.

A terrestrial flora and fauna assessment has been undertaken to provide information on the existing baseline environment and an assessment of the potential impacts on terrestrial flora associated with the development during construction and operational phases of the GUP. Mitigation and management measures have been recommended were appropriate to minimise the identified potential impacts and the acceptability of residual impacts has been determined.

16.2 Mt Gravatt-Capalaba Road to Cleveland Branch Rail Line

16.2.1 Existing Flora

Methodology

A number of existing studies were used to gain information relevant to this assessment. These are noted within the text and included in the reference section of this EIS.

Representative sample sites were also surveyed along the GUP corridor and adjacent areas in early to mid 2004. These were chosen on the basis of their accessibility, their area (large blocks of vegetation were given precedence over small sites which appeared highly disturbed from aerial photography) and to give a representative spread of sites along the GUP corridor. A Random Meander Technique as described by Cropper (1993) was utilised at each survey site to search for species.

It is important to note that due to seasonal limitations, all flora species at the sampled areas may not have been recorded. This could be attributed to the extent of the sample areas, plants being unidentifiable due to lack of fertile material, or plants lying dormant (eg terrestrial orchids) at the time of the survey.

Regional Ecosystems

The geology and vegetation along this section of the GUP corridor indicates a mosaic of the following Regional Ecosystems (REs) along this section (as described in Sattler and Williams eds. 1999):

- RE 12.9/10.4 *Eucalyptus racemosa* woodland on sedimentary rocks;
- RE 12.9/10.10 *Melaleuca nodosa* low open forest on sedimentary rocks;
- RE12.11.5 Mixed tall open forest with *Corymbia citriodora*, *Eucalyptus siderophloia*, *E.major* on metamorphics ± interbedded volcanics;
- RE 12.3.6 *Melaleuca quinquenervia*, *Eucalyptus tereticornis*, *Lophostemon sauveolens* woodland on coastal alluvial plains; and
- RE12.1.3 Mangrove shrubland to low closed forest on marine clay pans and estuaries along the banks of Bulimba Creek. This vegetation type is addressed in more detail in Section 17.

The general distribution of these REs is shown in Figure 16.1a and a detailed description is given below.

RE12.9/10.10 is listed as "Of Concern" under the current regulations of the *Vegetation Management Act 1999* (VM Act) and was confined to Survey Area 6 (CH9900). The other REs are listed as "Not of Concern", however RE 12.1.3 is considered to be of local/Citywide significance under the BCC's Natural Assets Register.

Under the VM Act a permit to clear is required for the removal of REs mapped as remnant vegetation. However, since operational works conducted by MR are considered exempt development under Part 3 of Schedule 8 of IPA, a development application is not required for such works. Any clearing of vegetation by MR that is associated with building works will be 'self-assessable development' under IPA. In performing such works MR will need to comply with any codes in place for vegetation clearance under the Act. Despite the limited legal limitations

stated above MR needs to consider any regional vegetation management plans prepared under the VM Act.

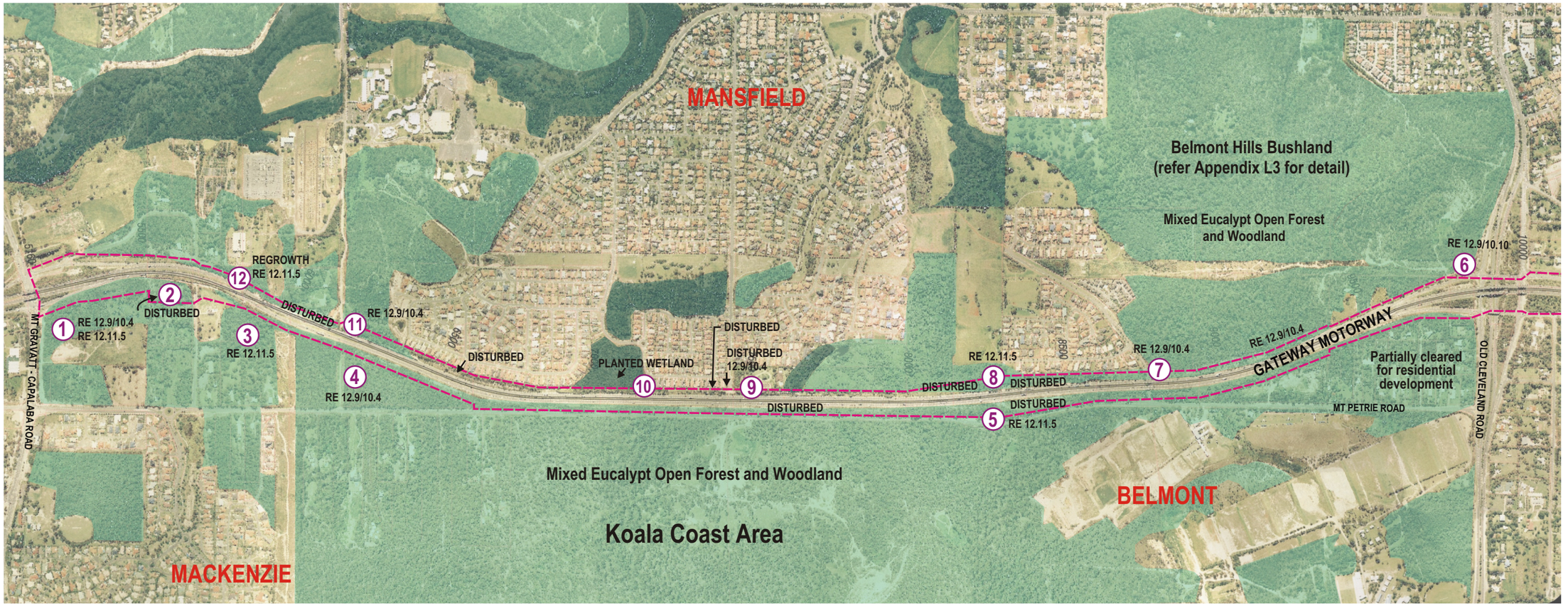
It should be noted however that within the existing Motorway corridor that much of the vegetation would be classified as regrowth due to past earthworks associated with the construction of the existing Motorway. Such vegetation would not fulfil the current definition of a RE under the definition of the VM Act, that is, the predominant canopy covers more than 50% of the undisturbed canopy; averages more than 70% of the vegetation's undisturbed height and composed of species characteristic of the vegetation's undisturbed predominant canopy.

Table 16.1 provides a description of terrestrial vegetation identified for survey areas adjacent to the proposed GUP (refer Figure 16.1a and 16.1b). This table also lists the appropriate RE for each survey area. The ecological integrity of each survey area is also included with the following ratings (in relation to the Gateway Motorway corridor):

- Low – Highly disturbed with a high percentage of exotic species or small isolated patches;
- Moderate – Mainly regrowth with some remnant patches and low percentage of introduced species. Larger patches which have some degree of connectivity to other bushland areas; and
- High – Largely undisturbed with weed infestations generally confined to edges with a high degree of connectivity to other bushlands.

Table 16.1 Vegetation Description for Survey Areas

Survey Area	Chainage	Vegetation Description	Regional Ecosystem	VM Act Status	EPA Status	BCC Status
1	5150	Mainly regrowth with scattered mature trees. Connected to Koala Coast bushland to the north by areas 2, 3 and 4. A gully runs close to the Gateway Motorway. Integrity: Moderate.	12.9/10.4 12.11.5	Not of Concern Not of Concern	NCaP	local/ Citywide significance
2	5600	Private garden with scattered remnant native trees. Integrity: Low.	Disturbed	NA	-	-
3	5800	Remnant open forest in fair condition. Integrity: Moderate.	12.11.5	Not of Concern	NCaP	-



KEY

- Mixed Eucalypt Open Forest and Woodland
- Eucalypt/Melaleuca Woodlands
- Melaleuca Open Forest and Woodland
- Primarily Riparian Vegetation
- (3) Terrestrial Ecology Survey Sites
- RE 12.9/10.4 Regional Ecosystem Classification
- -------- Project Corridor

Note: Amenity landscaping occurs within the GUP corridor at various locations. Vegetation community mapping outside GUP corridor is based on the Brisbane Koala Bushland Management Plan (BCC 2000)

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0 250 500m
SCALE

FIGURE 16.1a
Ecological Features
Mt Gravatt-Capalaba Road to Old Cleveland Road

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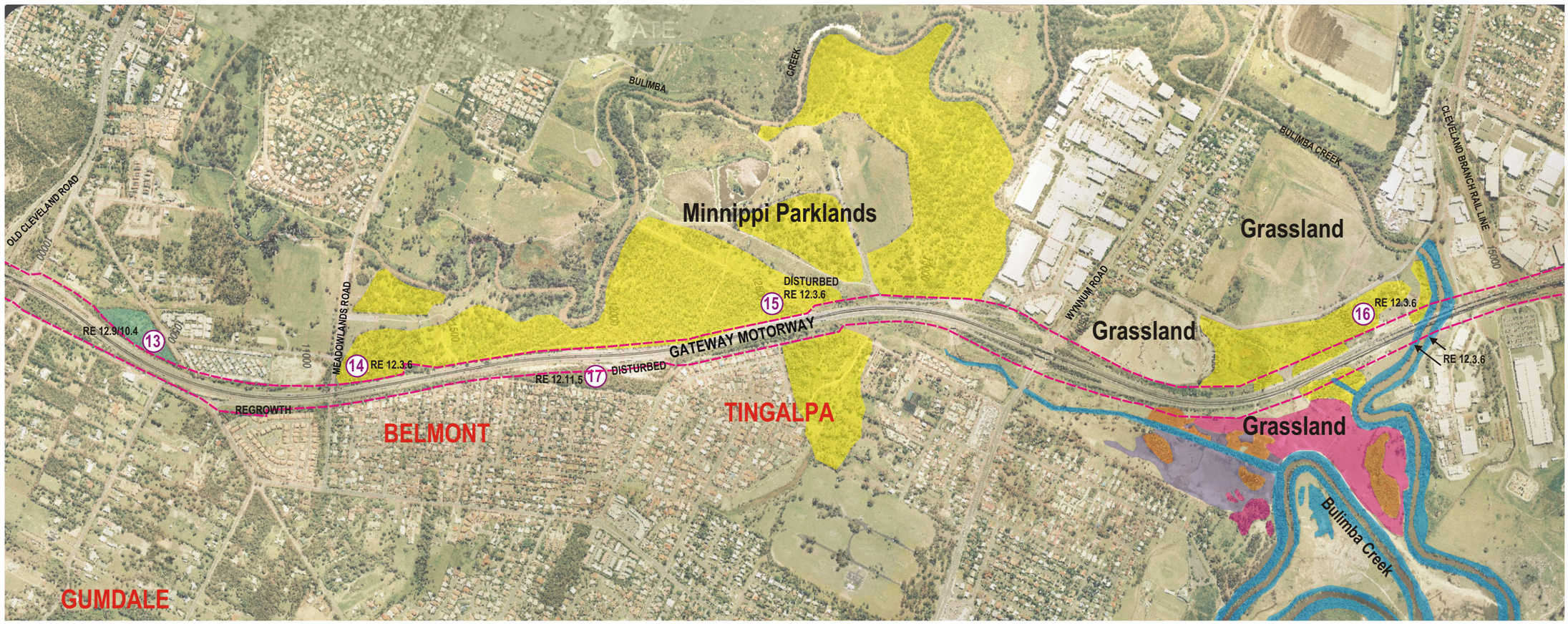

KEY

- Mixed Terrestrial and Marine Community
- Mixed Eucalypt Open Forest and Woodland
- Melaleuca and Eucalypt Woodland
- Mangroves
- Saltmarsh
- Mangroves and Saltmarsh
- (3) Terrestrial Ecology Survey Sites
- RE 12.9/10.4 Regional Ecosystem Classification
- Project Corridor

Note: Amenity landscaping occurs within the GUP corridor at various locations.
Vegetation community mapping outside GUP corridor is based on limited field investigations

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Queensland Government Department of Main Roads
Australian Government Department of Transport and Regional Services
Connell Wagner

FIGURE 16.1b
Ecological Features
Old Cleveland Road to Cleveland Branch Rail Line

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Survey Area	Chainage	Vegetation Description	Regional Ecosystem	VM Act Status	EPA Status	BCC Status
4	6250	Remnant open forest in good condition. Weed invasion generally confined to disturbed edges. More or less contiguous with the large block of Koala Coast bushland between Mt Gravatt-Capalaba Road and Old Cleveland Road. Integrity: Moderate to High.	12.9/10.4	Not of Concern	NCaP	local/ Citywide significance
5	8250	Remnant open forest in fair condition. A dead stag with hollows was noted at the top of the road embankment. Adjoins Koala Coast bushland. Integrity: Moderate.	12.11.5	Not of Concern	NCaP	-
6	9850	This area is dominated by Prickly Paperbark *(Melaleuca nodosa)* with scattered mature Eucalypts. Prickly Paperbark occurs as dense regrowth within the powerline easement. Integrity: Moderate.	12.9/10.10	Of Concern	Of Concern	-
7	8750	Part of a large patch of open forest in good condition, which includes Belmont Hills Bushland. Integrity: Moderate to High.	12.9/10.4	Not of Concern	NCaP	local/ Citywide significance
8	8250	A narrow strip of remnant vegetation between residential housing and open paddocks and the Gateway Motorway. Generally in poor condition with a high level of weed invasion. Integrity: Low.	12.11.5	Not of Concern	NCaP	local/ Citywide significance
9	7500	Scattered mature remnant native trees with a ground storey dominated by exotic grasses. Integrity: Low.	12.9/10.4	Not of Concern	NCaP	local/ Citywide significance

Survey Area	Chainage	Vegetation Description	Regional Ecosystem	VM Act Status	EPA Status	BCC Status
10	7250	Some remnant and regrowth native vegetation but mainly planted native trees and shrubs including an artificial wetland between the Gateway Motorway and the eastern end of Oakley Street, Carindale. Some young specimens of Eprapah Wattle *(Acacia perangusta)* were found in the artificial wetland. This species is listed as "Vulnerable" under the *Nature Conservation (Wildlife) Regulations 1994*. These were outside the proposed road works and are unlikely to be a natural occurrence. Integrity: Low.	Disturbed	NA	-	-
11	6200	This is part of a larger area of remnant open forest to the north of Wecker Road. The area adjacent to the Gateway Motorway is in good condition with weed infestation generally confined to the Wecker Road edge. A small watercourse runs close to the Motorway. Integrity: Moderate to High.	12.9/10.4	Not of Concern	NCaP	local/ Citywide significance
12	5800	This is a patch of mature trees with a grassy understorey. It is in generally good condition with weed invasion confined to the edges. Integrity: Moderate.	12.11.5/ Regrowth	Not of Concern	NCaP	local/ Citywide significance
13	10500	This is a small isolated patch of dense regrowth to 7m in height with a grassy understorey. Integrity: Low.	Disturbed 12.9/10.4	Not of Concern	NCaP	local/ Citywide significance
14	11100	This area includes Meadowlands Park. The area closest to the Gateway Motorway includes wetland, which is heavily infested with weeds. Integrity: Low.	12.11.6	Not of Concern	NCaP	-

Survey Area	Chainage	Vegetation Description	Regional Ecosystem	VM Act Status	EPA Status	BCC Status
15	12500	This area adjoins Minnippi Parklands. The area is low lying and highly disturbed with scattered mature trees and a ground storey dominated by exotic grasses. Integrity: Low.	Disturbed 12.11.6	Not of Concern	NCaP	-
16	14500	The vegetation in this area includes mangrove forest along the banks of Bulimba Creek and open forest dominated by Paperbarked Tea Tree *(Meleleuca quinquenervia)* with understorey/groundstorey dominated by exotic grasses and introduced trees. Integrity: Low to Moderate.	12.11.6	Not of Concern	NCaP	-
17	11900	The vegetation in this area is mainly Eucalypt Open Forest with a grassy ground storey. The edges along Glenlavon/ Ambara Streets have been planted with exotic garden plants in some sections and have a high weed load in others. Integrity: Moderate.	12.11.5/ Disturbed	Not of Concern	NCaP	local/ Citywide significance

Table Notes:
NCaP = No Concern at Present

Belmont Hills Bushland Area

The EPA REs mapping (DNRM 2004) designates this area to be RE 12.11.5 and Regrowth. Ground surveys during this study confirm that the vegetation and geology indeed correspond to RE 12.11.5 which is classified as not of concern under the current regulations of the VM Act.

Belmont Hills Bushland area is predominantly Eucalypt Open Forest with shrub understorey. The dominant species include *E. microcorys* (Tallow wood), *E. propinqua var major* (Grey Gum), *E. drepanophylla* (Grey Ironbark) and *Lophostemon confertus* (Brush box). Other vegetation includes heath, rainforest, and riparian communities. Locally significant communities within the Belmont Hills Bushland are "Belmont Scrub" (drier rainforest or notophyll closed forest) mapped as hickory wattle woodland and scribbly gum (*Eucalyptus racemosa*) woodland (Friend and Associates cited in BCC 2003). Ground surveys during this study noted is a small area of RE 12.9/10.10 *Melaleuca nodosa* low open forest on sedimentary rocks south of Old Cleveland Road (CH9900) (refer Figure 16.1a). This area was not identified by the EPA REs mapping as it is too small to be detected at a regional scale. As noted earlier this RE is listed as "Of Concern" under the current regulations of the VM Act. The area is listed under the BCC's Natural Assets Register because of a number of attributes including its wildlife habitat and botanical values.

South of Belmont Hills Bushland adjacent to the corridor are remnant patches of *E. seeana* (narrow-leaved red gum) and *E. racemosa* (Scribbly gum) with heath understorey exist along with residential gardens.

Koala Coast Area

The Koala Coast Area extends from north of Old Cleveland Road and extends to the east of the GUP corridor encompassing Mt Petrie Bushland (refer Figure 16.1b). The EPA REs Ecosystems mapping (DNRM 2004) designates this area to be RE 12.11.5 and RE 12.9/ 10.4. Ground Surveys during this study confirm that the vegetation and geology correspond to these REs. These REs are classified as Not of Concern under the current regulations of the VM Act.

The Mt Petrie Bushlands is listed on BCC's Natural Assets Register (Brisbane City Plan 2000).

The vegetation communities are characterised by high species diversity with 210 species recorded (BCC 2000). The area is dominated by open eucalypt forest and melaleuca woodland and includes species such as *E. microcorys*, *E. major*, *E. drepanophylla,* which are important koala food sources (Queensland Herbarium 2001, Queensland Museum 1995). Other dominant species include *Corymbia trachyphloia*, *Corymbia citriodora* var *variegata, Eucalyptus seeana*, *Acacia* spp. *Banksia* spp., *Xanthorrhoea johnsonii*.

Bulimba Creek

A targeted survey of the Bulimba Creek area was conducted by Cardno MBK in November 2003. This survey concluded that both sides of Bulimba Creek contain a mosaic of vegetation communities. These communities consist of:

- Fringing mangrove and marine plant vegetation on the northern and southern banks between 2-5 metres in width;
- A stand of trees on the southern bank, dominated by *Eucalyptus tereticornis* (Forest red gum), *Melaleuca quinquenervia* (Paperbarked Tea Tree) and *Eucalyptus crebra* (Narrow-leaved ironbark), with an understorey dominated by *Lantana camara* (Lantana) and other weed species;
- Pasture grassland dominated by introduced grasses and weed species on the southern bank, currently grazed by horses; and
- Highly disturbed land to the north of the creek, dominated by introduced grasses and herbaceous weeds that form a blanket over the entire area. A number of trees are growing on either side of the Motorway bridge, especially on the western side. These trees appear to have been planted and include *Grevillea robusta* (silky oak), *Cupaniopsis anacardioides* (Tuckeroo), *Castanospermum australe* (Black bean), *Melaleuca quinquenervia* (Broad-leaved paperbark) and *Delonix regia* (Poinciana).

Significant Flora Species

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened flora species pursuant to the EPBC Act. Previous studies of bushland adjacent to the GUP corridor were consulted to ascertain the likely presence of scheduled species under the *Nature Conservation (Wildlife) Regulation 1994* of the *Nature Conservation Act 1992* and the species listed as significant under the BCC's Natural Assets Register. The flora species listed in these documents are summarised in Table 16.2.

Table 16.2 Summary of Significant Flora Species that may occur within GUP Corridor

Species	Status	Habitat	Comment
Corchorus cunninghamii (Native jute)	Endangered (Q) (A) (BCC)	Rainforest fringes or margins in areas now largely Brisbane suburbs (Stanley and Ross, 1986). Often appears with Brush Box (Logan River Branch S.G.A.P. Qld Region Inc. 2002).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Acacia perangusta (Eprapah wattle)	Vulnerable (Q) (A) (BCC)	Restricted to the banks of small streams south and south east of Brisbane, and on the Burrum River, north of Maryborough. Commonly cultivated as an ornamental in south-eastern Queensland (Stanley and Ross 1983).	Found within study area during this and previous studies. Most occurrences appear to be the result of ornamental plantings.
Bosistoa selwynii (Heart-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Bosistoa transversa (Three-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Lack of suitable habitat within the study area– unlikely to occur within GUP corridor.
Cryptostylis hunteriana (Leafless tongue-orchid)	Vulnerable (A)	It is chiefly a coastal species but can be found in a range of habitats including areas bordering swamps to open forest. Its distribution is from southern Queensland through to Victoria.	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003) – unlikely to occur within GUP corridor.

Table Notes:

(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
(BCC) = Brisbane City Council's Natural Assets Register.

Species	Status	Habitat	Comment
Cupaniopsis shirleyana (Wedge-leaf tuckeroo)	Vulnerable (Q) (A) (BCC)	Depauperate rainforests from Brisbane to Bundaberg (Stanley and Ross 1983).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Hydrocharis dubia (Frogbit);	Vulnerable (Q) (A) (BCC)	South eastern Queensland, floating in deep water or rooted in shallow water, in pools, lakes or slow moving streams (Stanley and Ross 1983).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Macadamia integrifolia (Queensland nut)	Vulnerable (Q) (A) (BCC)	South east Queensland rainforests (Stanley and Ross 1983).	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Zieria furfuracea (subsp Belmont Scrub)	Endangered (Q)	No information at present.	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003).
Eucalyptus grandis (Flooded gum)	Restricted distribution (BCC)	Moist eucalypt forest, riverine forest and rainforest margins (Stanley and Ross 1986; Logan River Branch S.G.A.P. Qld Region Inc. 2002).	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003).
E. seeana (Narrow leaved red gum)	Restricted distribution (BCC)	Poorly drained clayey soils on low ridges and flats (Stanley and Ross 1986; Logan River Branch S.G.A.P. Qld Region Inc. 2002).	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003).

Table Notes:

(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
(BCC) = Brisbane City Council's Natural Assets Register.

Species	Status	Habitat	Comment
Pseudovanilla foliata (Giant climbing orchid)	Restricted distribution (BCC)	Rainforest on decaying logs or stumps (Stanley and Ross, 1989; Logan River Branch S.G.A.P. Qld Region Inc. 2002).	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003). Lack of suitable habitat within the study area – unlikely to occur within GUP corridor.
Corymbia henryi (Large leaved spotted gum)	Restricted distribution (BCC)	Sandy clay or sandy soils (Stanley and Ross 1986).	Previous studies of adjacent areas have noted its presence in the Koala Coast Bushland (BCC 2000).

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
(BCC) = Brisbane City Council's Natural Assets Register.

A full list of the flora recorded during field work for this study is included in Appendix L1. Significant species include some small specimens of Eprapah Wattle *(Acacia perangusta)* which is listed as Vulnerable under the *Nature Conservation (Wildlife) Regulations 1994* and under the EPBC Act was found in Survey Area 10. This is unlikely to be a natural occurrence.

This species also occurs within the Belmont Hills Bushland (BCC 2003) and was also found growing on the constructed roadside edges of the Gateway Motorway in a previous study by Cardno MBK (2003). It was concluded that these individuals have been planted as part of the roadside landscaping and are not naturally occurring.

Weed species observed along the GUP corridor that are declared under the *Land Protection (Pest and Stock Management) Act 2002* are also included in Appendix L1.

16.2.2 Existing Habitat Values

The bushland within the Koala Coast Area is significant at a regional level due to its relatively undisturbed koala habitat. It includes numerous species that are utilised as a food source by koalas including *Corymbia citriodora* var *variegata, C. intermedia, Eucalyptus crebra, E. microcorys, E. planchoniana, E. propinqua, E. resinifera, E. siderophloia, E. racemosa,* and *E. tereticornis* (Barnes & Moran 2001).

The Belmont Hills Bushland, as has been previously noted, is listed under BCC's Natural Assets Register because of a number of attributes including its wildlife habitat values. It also includes numerous species that are utilised as a food source by koalas including *Corymbia citriodora* var *variegata, C. intermedia, Eucalyptus crebra, E. microcorys, E. propinqua, E. siderophloia, E. racemosa,* and *E. tereticornis* (Barnes & Moran 2001).

It should be noted that there are few koala food trees within the existing road reserve due to past construction activities but koalas are nevertheless moving across the carriageway as is discussed below.

Ecosystem connectivity between the lands adjoining the Gateway Motorway to the east and west has generally been severed as a result of the construction of the Motorway. Some ecosystem connectivity has been maintained in the area of the Motorway viaduct over Bulimba Creek and at Greendale Way road bridge. A number of Australian Museum Business Services (AMBS) studies found large structures such as road bridges to be better for fauna movement, especially for larger fauna such as macropods (1997, 2001, 2002).

It is probable that macropods (ie kangaroos and wallabies) are moving between Belmont Hills Bushland and the Koala Coast Area via the underpass at Greendale Way, Carindale as a wallaby was observed hopping along Greendale Way (in the opposite direction) during the vegetation surveys conducted in March 2004. Wallabies may also cross the carriageway in other places where the topography and a lack of fencing allows. Potential also exists for terrestrial fauna to migrate east to west under the Bulimba Creek crossing and MEL culverts.

Observations made during the EIS study including scats, scratchings and sightings indicate that macropods are moving from north to south between the fragments of bushland on the western side of the Gateway Motorway, at least between Mt Gravatt-Capalaba Road to Old Cleveland Road. The bushland east of the Gateway Motorway between Mt Gravatt-Capalaba Road and Old Cleveland Road is more or less contiguous and so there is little impediment to movement within this area.

Observations from this study and others indicate that a number of birds and microbats are likely to move between the habitat east and west of the Gateway Motorway due to ability to utilise open habitats and the relative continuity of habitats to the carriageway edge. Species more commonly associated with the forest interior also have the potential to move east and west of the Gateway Motorway, however, the likelihood of movement is lower as less structurally diverse edge habitats fringe the Gateway Motorway.

There appears to be little in the way of habitat for small ground dwelling reptiles such as leaf litter and coarse woody debris within the existing Motorway corridor however the adjoining bushland provides more of these resources. Adjacent to the Motorway in the Belmont Hills Bushland area there are some piles of fallen trees which are not only potential refuges for reptiles but also potential forage areas for small birds such as fairy-wrens and scrub-wrens. Frogs and reptiles are likely to move between east and west, via the numerous existing culverts under the Motorway and at Greendale Way and Bulimba Creek.

16.2.3 Existing Fauna

Methodology

A number of existing studies were used to gain information relevant to this study (eg BCC 2000) BCC 2001). These are noted within the text and included in the references of this EIS. Additional fauna was recorded incidentally over the three days of vegetation survey during March 2004 using direct observation, call recognition, scats and signs (scratch marks, diggings etc). Two three (3) hour nocturnal surveys were carried out by using a portable spotlight in March 2004. Additional nocturnal surveys were conducted between 29 June and July 2 targeting bats in particular microchiroptera with the use of an ANABAT. During the survey, culverts and overpass/bridge structures along the Gateway Motorway were located and checked for evidence of their use for roosting. The fauna observation areas covered are indicated in Figure 16.1 and the numbering corresponds with the Terrestrial Ecology Survey Areas. A full list of species observed is included in Appendix L2. The WildNet Data for the area between Belmont and Mansfield is also included.

Within the greater Bulimba Creek catchment, 21 species of frogs have been identified, 172 species of birds, 23 species of mammals and 23 species of reptiles (EPA/BCC - The Bulimba Creek Catchment Management Plan). Within the Belmont Hills Bushland area, eight species of frog have been identified, 85 species of bird, nine species of mammal and 13 species of reptile.

Birds

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened bird species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained. Table 16.3 gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.4 gives the migratory species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.3 Summary of Significant Bird Species that may occur with GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); E(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees (Higgins 1999).	Extensive searches in SEQ have not located this species in Greater Brisbane area to date. Unlikely to occur within GUP corridor.
Lathamus discolor (Swift Parrot)	Endangered (A) (Q)	Associated with dry open eucalypt forests and woodlands with winter flowering eucalypts (Marchant and Higgins 1999). Winter flowering eucalypts in the study area include the Forest Red Gum (*E. tereticornis*) (Law et al. 2000). Often located in urban areas and farmlands with remnant eucalypts. It is found predominantly in Victoria and New South Wales though there are recent records from the Gold Coast, Noosa, Toowoomba, Warwick and Lockyer Valley (Swift Parrot Recovery Team 2001). Breeds in Tasmania and migrate to the rest of south eastern Australia.	Given the presence of a number of their preferred food trees within the study area it is likely that the bushland adjacent to the existing road corridor provides significant habitat for this species, however previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Suitable habitat occurs adjacent to and within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
Ja = Japan Australia Migratory Bird Agreement
Ca = China Australia Migratory Bird Agreement
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Xanthomyza phrygia (Regent Honeyeater)	Endangered (A)	The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, riparian forests of River Oak (*Casuarina cunninghamiana*) (SFNSW 1995, Garnett 1993). Reliant on locally abundant nectar sources, especially flowering eucalypts that occur mainly in dry open woodland (SFNSW 1995), on richer soil types with different flowering times to provide reliable supply of nectar (Environment Australia 2000). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have bee observed to be utilised (NPWS 1997, SFNSW 1995). Range does not include Greater Brisbane area (Pizzey & Knight 1999).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Unlikely to occur within GUP corridor.
Erythrotriorchis radiatus (Red Goshawk)	Vulnerable (Q) (A); S(BCC)	Open forest and woodland near water, rainforest edges (Pizzey & Knight 1999). Need large areas of habitat because of low population densities and large home ranges. Breeding pairs use the same territories year after year (Marchant & Higgins 1993).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
Ja = Japan Australia Migratory Bird Agreement
Ca = China Australia Migratory Bird Agreement
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Geophaps scripta scripta (Squatter Pigeon)	Vulnerable (A)	Woodlands/ grasslands. Range mainly north and west of Greater Brisbane area. Prefer areas of sandy soil dissected by low gravelly ridges, which have the shortest cover of grasses. Nearly always found near permanent water (Marchant & Higgins 1993).	Lack of suitable habitat within the study area. Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003) – unlikely to occur within GUP corridor.
Rostratula australis (Australian Painted Snipe)	Vulnerable (Q) (A); S(BCC)	Freshwater (occasionally Brackish) wetlands. Mostly south east Australia. Possibly part-migratory moving north into Queensland in summer (Marchant & Higgins 1993).	Although suitable habitats exist, previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003) – unlikely to occur within GUP corridor.
Turnix melanogaster (Black-breasted Button-quail).	Vulnerable (Q) (A); S(BCC)	Dry rainforest and forests with some tolerance to lantana due to its protective structure. South east Queensland and north east NSW (Pizzey & Knight 1999).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
Ja = Japan Australia Migratory Bird Agreement
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S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Ninox strenua (Powerful Owl)	Vulnerable (Q); S(BCC)	Pairs occupy large and permanent home ranges in a wide variety of wet and dry forest and woodland types with suitable prey species such as arboreal mammals, flying foxes and birds (Environment Australia 2000; Debus & Chafer 1994). It is widely dispersed within its range and has a large home range. Unconfirmed estimates suggest that home ranges vary between 400-1000ha, with some estimates to be a minimum of 800 hectares (Kavanagh 1988). Pairs occupy permanent territories containing a number of roost sites. It has been suggested that pairs are often spaced 5 – 10km apart (Schodde & Mason 1980 cited in Dames and Moore). Breeds in large trees with hollows 8-20metres or more from ground level and at least 0.5m deep (Environment Australia 2000).	The Koala Coast Area (Mt Petrie bushland) provides habitat for this species (BCC 2000). Suitable habitat occurs adjacent to and within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
Ja = Japan Australia Migratory Bird Agreement
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N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Table 16.4 Summary of Migratory Bird Species that may occur within GUP Corridor

Species	Status	Habitat Associations	Comment and Likely Occurrence
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); Migratory Terrestrial (A); S(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees. (Higgins 1999).	Extensive searches have occurred in SEQ and have not been located in Greater Brisbane area to date.
Numenius madagascariensis (Eastern Curlew)	Rare (Q); Ja, Ca; S(BCC)	Estuaries, bays, inlets and coastal lagoons with large intertidal sand or mudflats (Marchant & Higgins 1993).	Previous studies of adjacent areas have noted its presence along Bulimba Creek (GHD 2003b). Unlikely to occur within GUP corridor.
Ardea ibis (Cattle Egret)	Ja, Ca	Freshwater wetlands and adjoining pasture areas. Nests colonially in melaleuca forests.	Noted in WildNet records for the area. Suitable habitat occurs within GUP corridor.
Ardea alba (Great Egret)	Ja, Ca	Freshwater wetlands and intertidal mudflats. Nests colonially in trees.	Noted in WildNet records for the area. Suitable habitat occurs within GUP corridor.
Merops ornatus (Rainbow Bee-eater)	Ja	Aerial species found over coastal woodlands, open forests and mangroves. Nests in burrows in sandy banks and ground.	Noted in WildNet records for the area. Suitable habitat occurs within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Gallinago hardwickii (Latham's Snipe)	Migratory Wetland Species CA/ JA; (A); S(BCC)	Soft wet ground or shallow water with tussocks and other green or dead growth to scrub or open woodland; samphire areas on saltmarshes and mangrove fringes. Although it doesn't breed in Australia, it is a regular summer migrant with its stronghold in south east Queensland to southern South Australia (Pizzey and Knight 1999).	A previous study of adjacent areas has noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs adjacent to GUP corridor around Bulimba Creek.
Haliaeetus leucogaster (White-bellied Sea Eagle)	Migratory CA/ JA; (A); S(BCC)	Large freshwater lakes, dams and rivers and in coastal areas around saltwater lakes, estuaries and coastal islands. They generally nest on tree branches especially of Forest Red Gum (*Eucalyptus tereticornis*) (Pizzey and Knight 1999). Less common in urban areas than other marine raptors (eg Osprey, Brahminy Kite).	A previous study of adjacent areas has noted its presence in the Brisbane Koala Bushland (BCC 2000). Unlikely to occur within GUP corridor.
Hirundapus caudacutus (White-throated Needletail)	Migratory (A)	Aerial over forests, woodlands, farmlands, plains, lakes coasts and towns. Feeding frequently along favoured hilltops and timber ranges. Although not breeding in Australia, this species migrates to eastern Australia between October and April (Pizzey and Knight 1999).	A previous study of adjacent areas has noted its presence in the Brisbane Koala Bushland (BCC, 2000). Suitable habitat occurs within GUP corridor.
Monarcha melanopsis (Black-faced Monarch)	Migratory (A)	Prefers wet sclerophyll forest; rainforest, open forest and mangrove forest but will utilise gardens. It nests on tree branches, generally 1-12 metres above the ground in south east Australia from August to April.	A previous study of adjacent areas has noted its presence in the Brisbane Koala Bushland (BCC, 2000). Suitable habitat occurs within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Monarcha trivirgatus (Spectacled Monarch)	Migratory (A); S(BCC)	Understorey of mountain/lowland rainforests; thickly wooded gullies; waterside vegetation; mostly well below canopy. Summer breeding migrant to se Queensland-north east NSW from September to May	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Suitable habitat occurs within GUP corridor.
Myiagra cyanoleuca (Satin Flycatcher)	Migratory (A); S(BCC)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, tree in open country and gardens. Summer breeding in se Australia and winters in north east Queensland.	A previous study of adjacent areas has noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs within GUP corridor.
Nettapus coromandelianus albipennis (Australian Cotton Pygmy-goose)	Migratory Wetland Species (A)	Deeper freshwater swamps, lagoons, dams with waterlilies and other semi emergent water plants mainly in eastern Queensland. Nesting sites are high in hollow tree near water with breeding November to April. Species is locally dispersive in dry season (Pizzey & Knight 1999).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Unlikely to occur within GUP corridor.
Rhipidura rufifrons (Rufous Fantail)	Migratory (A); S(BCC)	Undergrowth of rainforests/ wetter eucalypt forests/ gullies; monsoon forests, paperbarks, sub inland and coastal scrubs; mangroves, watercourses; parks and gardens. Breeding migrant to south east Australia (Pizzey & Knight 1999).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
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N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

None of the bird species observed during the EIS study are listed as "Endangered, Vulnerable or Rare" under the *Nature Conservation (Wildlife) Regulations 1994* or the EPBC Act. Most species were common and widespread species with the exception of White-browed Scrubwren *(Sericornis frontalis)* and Yellow-faced Honeyeater *(Lichenostomus chrysops)* which are forest specialists (Caterall *et al*. 1991).

Mammals

A number of mammals were observed directly or were identified from scats. None of the species observed within the GUP corridor during this study are listed as "Endangered, Vulnerable or Rare" under the *Nature Conservation (Wildlife) Regulations 1994* or the EPBC Act. However, a number are listed as "significant fauna species" under the BCC's Natural Assets Register. These are noted in Appendix L2.

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened mammal species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained.

Table 16.5 gives the threatened or locally significant species that were listed in the EPBC Protected Matter Report, the WildNet Search or in previous studies, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.5 Summary of Significant Fauna Species that may occur within GUP Corridor

Species	Status	Habitat Associations	Comment and Likely Occurrence
Chalinolobus dwyeri (Large-eared Pied Bat)	Vulnerable (A) Rare (Q)	Variety of habitats including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves (Churchill 1998).	Although suitable habitats exist, previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003).
Dasyurus maculatus maculatus (SE Mainland Population) (Spotted-tailed Quoll)	Endangered (Q) (A); E(BCC)	Range of forest communities including wet and dry sclerophyll forests and rainforests (Mansergh 1984). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows and burrows (Environment Australia 2000).	Although suitable habitats exist, previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Unlikely to occur within GUP corridor.
Phascolarctos cinereus (Koala)	Vulnerable (Q) (A); S(BCC)	Wet and dry Eucalypt forests that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990) with acceptable Eucalypt food trees.	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs adjacent to the GUP corridor.
Potorous tridactylus tridactylus (Long-nosed Potoroo)	Vulnerable (Q) (A); S(BCC)	Habitat is usually coastal heath or wet eucalypt forest. Requires thick ground cover and numbers seem to be concentrated in areas that have light, sandy soil. Usually restricted to those areas that have an annual rainfall of not less than 760mm (Queensland Museum 1995).	Previous studies of adjacent areas have not noted its presence (BCC 2000; BCC 2003). Unlikely to occur within GUP corridor.

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(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
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N(BCC) = Noteworthy animals - animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Pteropus poliocephalus (Grey-headed Flying-fox)	Vulnerable (A)	Wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Eby 1998). This species feeds opportunistically on blossoms of various native and exotic trees including figs. They range throughout Brisbane City from their daytime camps often in mangrove forests. The closest camps are at Indooroopilly Island, and the intersection of Port of Brisbane Motorway and Bulimba Creek.	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs within and close to the GUP corridor.
Petaurus norfolcensis (Squirrel Glider)	S(BCC)	Associated with dry hardwood forest and woodlands (Menkhorst et al. 1988, Quin 1993, Traill 1991). Habitats typically include gum barked and high nectar producing species, including winter flower species (Menkhorst et al. 1988). The presence of hollow bearing eucalypts is a critical habitat value (Quin 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003).
Petaurus breviceps (Sugar Glider)	N(BCC)	Generally wetter or high altitude habitats or rainforest with acacias (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs within the Belmont Hills Bushland (BCC 2003).

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(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
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N(BCC) = Noteworthy animals - animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Wallabia bicolour (Swamp Wallaby)	N(BCC)	Various habitats including swamps, ferny gullies, open forest and woodland, lantana thickets, heath and scrubby watercourses (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs within the GUP corridor.
Macropus rufogriseus (Red-necked Wallaby)	N(BCC)	Dry open forests with some bushy shrubby understorey, grasslands, road verges, paddocks and gardens (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs within the GUP corridor.
Tachyglossus aculeatus (Short-beaked Echidna)	N(BCC)	Various habitats with groundcover and ants (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Suitable habitat occurs within the GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals - animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals - animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

The Grey-headed Flying Fox *(Pteropus poliocephalus)* is likely to use resources within the GUP corridor. An unidentified species of flying fox was observed during the GUP EIS.

The survey conducted along this section of the gateway corridor revealed that none of the culverts or bridge structures were utilised by microbats for roosting or maternal sites. In a survey of the surrounding areas however, four species of bats were detected: the White-striped Mastiff Bat *(Tadorida australis)*, Eastern Freetail Bat *(Monopterus norfolkensis)*, the Large Bent Wing Bat *(Miniopterus schreibersii)*, and a species that was unable to be positively identified.

None of the species detected during this survey are listed on the National List of Threatened Fauna or the *Nature Conservation (Wildlife) Regulations 1994*. Although the Bent Wing Bat *(Miniopterus schreibersii)* is listed by the DEH as a Mammal that is Conservation Dependent, this applies only to the southern form of the species which is restricted to eastern South Australia and Western Victoria.

Koalas were observed directly and indirectly (via scratches, scats etc.) within the GUP corridor during this study, koalas are known to live adjacent to the Motorway corridor and traverse the Motorway (refer below for further details). Koalas are now listed as "Vulnerable" under the *Nature Conservation (Wildlife) Regulation 1994* for the SEQ bioregion. Koala is also listed as a significant fauna species under the BCC's Natural Assets Register because they are "animals that are rare in Brisbane, or animals that are uncommon in Brisbane and are becoming rare" (Brisbane City Plan 2000).

Belmont Hills on the western side of the Motorway has an approximate population of 18 koalas (Friend and Associates 1999), whilst 3,000-5,000 koalas inhabit the Koala Coast Area on the eastern side of the Motorway (BCC 2000). However for much of the GUP corridor, habitat for this species is scattered and poor due to previous construction activities.

Koalas are known to move between the Koala Coast Area and Mackenzie, crossing the Gateway Motorway between the CH5160 and 6000. The QPWS South East Queensland Koala database record that twenty (20) koalas have been killed and four (4) have been sighted within this area (refer Figure 16.2).

Data gathered from the QPWS SEQ Koala Database demonstrates that koalas move between the Belmont Hills habitat and the adjacent Koala Coast Area between CH8000 and CH10000. Twenty six (26) koalas have been killed while crossing the Gateway Motorway and five (5) sighted adjacent to the Motorway in the years from 1997 to the present (refer Figure 16.2).

Other recordings of dead or sighted koalas have been made between these two areas but in lesser numbers (refer Figure 16.2). QPWS SEQ Koala database results between Mt Gravatt-Capalaba Road and Old Cleveland Road are provided in Appendix L4.

The Koala Coast Area (Mt Petrie bushland) also provides habitat for Swamp Wallaby (*Wallabia bicolour*), Red-necked Wallaby (*Macropus rufogriseus*) and Echidna *(Tachyglossus aculeatus*) (EPA/BCC - Bulimba Creek Catchment Management Plan).

Red-necked wallabies (*Macropus rufogiseus*) and swamp wallabies (*Wallabia bicolor*) have been sited in the area during previous studies. Red-necked Wallabies were also observed directly or indirectly via scats in Survey Areas 4, 6, 7 and 10 (CH6250, 9850, 8750 and 7250, respectively) adjacent to the GUP corridor and within the road reserve in Survey Areas 6 and 7 during the study. Swamp Wallaby was also observed in Survey Areas 7 and 11 (CH8750 and 6200). These observations indicate that red-necked wallabies and swamp wallabies are probably moving between habitats on both sides of the existing Motorway. Both species tend only to persist where sufficient areas of habitat remain.

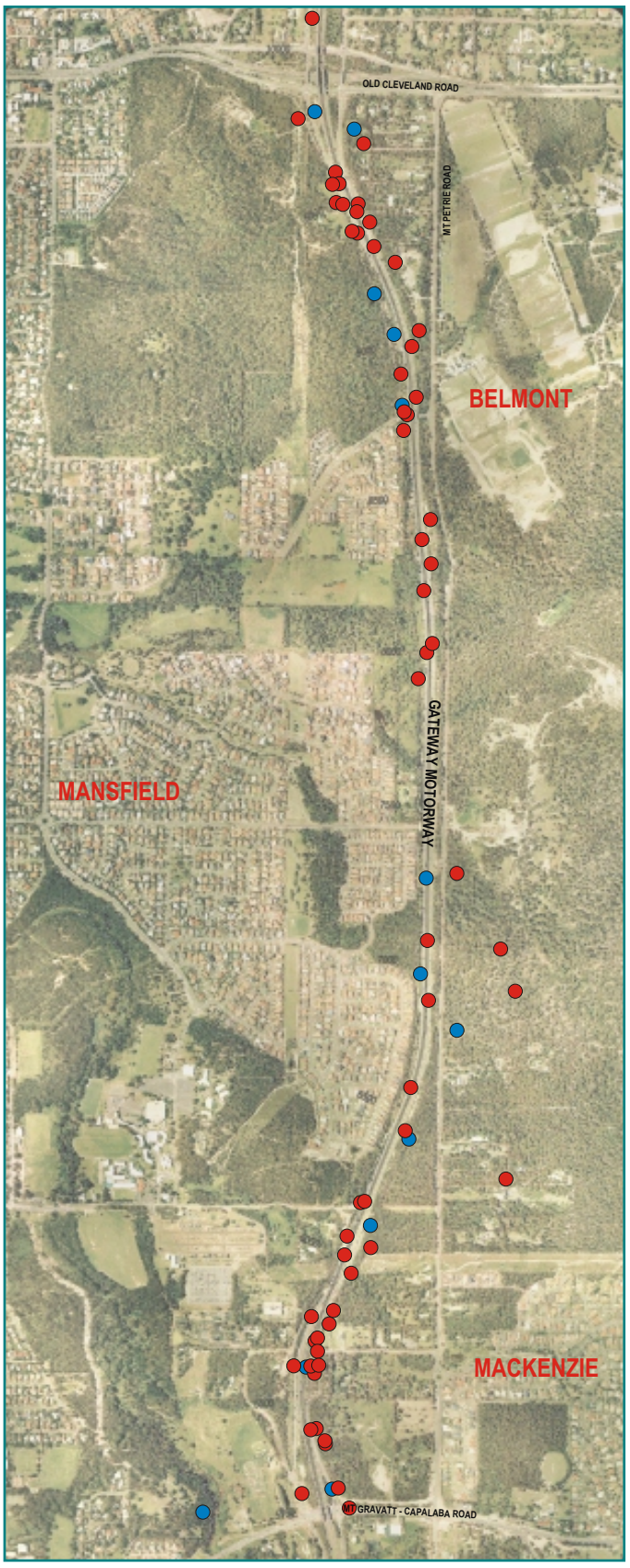
The Belmont Hills Bushland is considered potential habitat for sugar gliders (*Petaurus breviceps*) though no sightings have been recorded in this area (BCC 2003).

Anecdotal records suggest the feathertail glider (*Acrobates pygmaeus*) also be present in the Belmont Hills bushland (Draft Management Plan for Belmont Hills Bushland, October 2001) and it has been recorded in the Brisbane Koala Bushland (BCC 2000).

A large colony of Squirrel Glider (*Petaurus norfolcensis*) has been identified within the lower Bulimba catchment (Old Cleveland Road – Brisbane River) and another colony within the Minnippi Parklands (CH10700-12900) and it has been recorded in the Brisbane Koala Bushland (BCC 2000) and the Belmont Hills Bushland (BCC 2003). Squirrel Gliders though reasonably common in SEQ are considered rare and threatened in New South Wales and Victoria. Suitable habitat occurs within and close to the GUP corridor (for further information see Table 16.5).

Amphibians and Reptiles

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened amphibian and reptile species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained. The following table gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.



KEY

- Dead - Koala Condition (koalas off the alignment were results of road hits)
- Sighted - Koala Condition

N

0 250 500m

SCALE

Queensland Government Department of Main Roads

Australian Government Department of Transport and Regional Services

Connell Wagner

FIGURE 16.2
Koala Sightings
Mt Gravatt-Capalaba Road to Old Cleveland Road

L:\graphics\jobs\579210NZ\Koala Sightings.cdr June\ 2004

Table 16.6 Summary of Significant Amphibians and Reptiles that may occur within the GUP Corridor

Species	Status	Habitat Associations	Comment and Likely Occurrence
Mixophyes iteratus (Southern barred frog)	Endangered (Q) (A)	Found on forested slopes in riparian vegetation, subtropical and dry rainforest and wet sclerophyll forests. This species is associated with flowing streams with high water quality, though habitats may contain weed species (Ehmann 1997), feeding on insects and smaller frogs.	As there is very little suitable habitats remaining it is unlikely that this species exists in the GUP corridor and has not been noted in previous studies of adjacent areas.
Litoria freycineti (Wallum Rocketfrog)	Vulnerable (Q)	A terrestrial acid frog. Inhabits a wide variety of habitats from heath to forest (Cogger 2000).	Previous studies of adjacent areas have noted its presence in the Belmont Hills Bushland (BCC 2003).
Coeranoscincus reticulatus (Three-toed Snake-tooth Skink)	Vulnerable (Q) (A)	Rainforests and adjacent wet sclerophyll forests, where it is usually found in rotting logs or in soil under fallen timber (Cogger 2000).	As very few suitable habitats exist. Unlikely to occur within GUP corridor due to lack of suitable habitat.
Hoplocephalus bitorquatus (Pale-headed Snake)	S(BCC)	Partly arboreal found in a variety of habitats including rainforest, wet sclerophyll forest and drier slopes of NSW and inland Qld (Cogger 2000).A nocturnal species frequently found beneath the peeling bark of senescent or dead trees, or in hollow trunks and limbs of live or dead trees, especially in the vicinity of watercourses (NPWS 1999).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000). May occur within GUP corridor.

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E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Varanus varius (Lace Monitor)	N(BCC)	Forest and woodland, arboreal (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs within GUP corridor.
Chlamydosaurus kingii (Frilled Lizard)	E(BCC)	Dry sclerophyll forest and woodland, arboreal but also forages on ground (Cogger 2000; Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs within GUP corridor.
Chelodina longicollis (Eastern Long-necked Turtle)	S(BCC)	Standing water and ephemeral wetlands (Queensland Museum 1995).	Previous studies of adjacent areas have noted its presence in the Brisbane Koala Bushland (BCC 2000). Suitable habitat occurs within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals - animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals - animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

None of the four species of native frogs observed in or adjacent to the GUP corridor during this study are listed as "Endangered, Vulnerable or Rare" under the *Nature Conservation (Wildlife) Regulations 1994* or the EPBC Act. These are listed in Appendix L2.

Two species of reptiles were observed during this study adjacent to the GUP corridor in Survey Area 7, they were the Wall skink (*Cryptoblepharus virgatus*) and the Common Bearded Dragon (*Pagona barbata*). Both species are common and widespread.

Fire Ants

The Department of Primary Industries and Fisheries (DPIF) has declared a treatment/restricted areas within the GUP corridor as follows:

- East and west of the Motorway from Lytton Road to Wynnum Road; and
- East of the Motorway from approximately Wynnum Road to Kinsella Street, Belmont.

The declaration of a treatment/restricted area imposes restrictions on the movement of high risk materials from inside the restricted area to outside the restricted area. High risk materials include soil, baled hay and straw, pot plants and potting mix, mulch and green waste, landscaping and construction materials, machinery and equipment, and material that may have come into contact with the ground.

The boundaries of the treatment/restricted areas are reviewed by the DPIF as required and therefore may change or be amended further before site works commence.

16.2.4 Potential Impacts

TOR Requirements: Terrestrial Flora
This section is to define and describe the potential impacts of the Project on terrestrial flora and provide mitigation measures to minimise or avoid such impacts.

The discussion should cover all likely direct and indirect environmental harm on flora. Strategies for protecting any rare and threatened vegetation communities or species should be described, including any obligations imposed by State or Commonwealth legislation or local government policy.

The potential environmental harm to the ecological values of the area affected arising from the construction, decommissioning of the site and operation of the project including clearing, salvaging or removal of vegetation should be described, and the indirect effects on remaining vegetation should be discussed. Short-term and long-term effects should be considered with comment on whether the effects are reversible or irreversible. Any departure from no-net-loss of ecological values should be detailed.

The potential impact on flora from any alterations to the surface and ground water environment should be discussed with specific reference to potential impacts on riparian vegetation, wetlands and other sensitive vegetation communities.

TOR Requirements: Terrestrial Fauna
This section is to define and describe the potential impacts of the project on terrestrial fauna and provide mitigation measures to minimise or avoid such impacts.

The discussion should cover all likely direct and indirect impacts on fauna species and their habitats. Strategies for protecting any rare and threatened species should be described, and any obligations imposed by State or Commonwealth legislation or policy or international treaty obligations (ie JAMBA, CAMBA) should be discussed.

Short-term and long-term effects should be considered with comment on whether the effects are reversible or irreversible. Mitigation measures should be proposed for adverse impacts to species and fauna habitat, including loss of habitat, barriers to fauna movement and feeding and breeding patterns. Impacts and mitigation measures as they affect aircraft movement should be discussed.

The principles and objectives for facilitating safe fauna movement should be developed in accordance with published literature including the Main Roads publication, 'Fauna Sensitive Road Design: Volume 1 - Past and Existing Practices'.

Flora

The potential impacts on flora will involve minimal clearing of remnant native bushland and the associated decrease in biodiversity. The GUP includes widening toward the centre median where possible. Some realignment is required along with some widening to the outer verges. The upgrade north of Wynnum Road will require widening to the outer verges and installation of a new bridge over Bulimba Creek.

The loss of native vegetation as a result of the GUP is not considered significant due to the relatively small area (refer Table 16.7) to be cleared when compared with the areas of remnant native vegetation remaining in adjacent areas. This includes approximately 3,000ha within the Koala Coast Area and 107ha of contiguous bushland, which includes the Belmont Hills Bushland.

Table 16.7 Approximate Area of Terrestrial Vegetation to be Cleared (Mt Gravatt-Capalaba Road to Cleveland Branch Rail Line)

Generalised Vegetation Type	Area (ha)
Mixed Eucalypt Open Forest Woodland	5
Primarily Riparian Vegetation	0.2
Melaleuca and Eucalypt Woodland	1.1

The existing Motorway creates an edge effect to adjacent bushland, the extent of which is not known. Considering the width of the existing Motorway, it is considered that the proposal is not likely to result in a markedly larger edge effect, rather, it is likely to move this edge further into vegetation.

The existing Motorway edge does not contain design features, nor is it subject to management practices, which are intended to mitigate this impact. As such, the use of design features, such as revegetation using suitable locally endemic native species, removal of weeds and fauna movement measures such as underpasses and fauna proof fences (refer Section 16.2.5), are likely to provide a level of mitigation which currently does not exist.

Due to low fertility and moisture retention, the soils in the GUP corridor are generally not conducive to weed growth, particularly south of Meadowlands Road (CH11000). As such, revegetation and regeneration of native species is likely to be successful in such areas.

While these measures alleviate rather than remove edge effects, they have the potential to address both existing impacts and those likely to arise from the GUP. As such, it is considered that with the adoption of suitable mitigative measures the net edge effect arising from the proposal is not considered likely to be significant.

The area of RE12.9/ 10.10 *Melaleuca nodosa* low open forest on sedimentary rocks, located adjacent to the GUP corridor, will not be affected by the proposed earthworks in the short or long term.

Of the nationally, state or locally significant species located or likely to be found within the GUP corridor, only the locally significant narrow leaved red gum (*Eucalyptus seeana*) is likely to be affected by the proposed roadworks. However the number of mature specimens to be removed is likely to be small and is unlikely to affect the viability of the species long term.

To minimise the potential impacts of clearing of vegetation mitigation measures will be implemented as outlined in Section 16.2.5 and the EMP (refer Section 23).

Significant Birds

This section addresses the birds identified as significant at a national, state or local level and likely to use resources within the GUP corridor or to move across it.

Suitable resources for swift parrot occur within the GUP corridor including Spotted Gum (*Corymbia citriodora* var. *variegata*); Gum Topped Box *(Eucalyptus melliodora)*; Swamp Mahogany *(Eucalyptus robusta)*; and Forest Red Gum (*Eucalyptus tereticornis*). However the numbers of these species likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area as well as the replacement of some species as a part of the landscape works.

Collisions with chain link fences, windows and cars are a significant cause of adult Swift Parrot mortality in Tasmania where they breed (Swift Parrot Recovery Team 2001). It has not been noted as an issue in SEQ. Given the above factors it is therefore unlikely that the GUP will have a significant impact on Swift Parrot numbers.

There are large areas of suitable Powerful Owl habitat with a measure of protection in adjacent Belmont Hills Bushland and the Koala Coast Area. Given the likely home range of the Powerful Owl it is unlikely that the amount of potential habitat to be cleared will cause a significant direct impact for this species. The Powerful Owl is a large mobile animal the proposed road widening is not likely to cause any significant impediment to the movement of individuals throughout their home ranges. However there is an increased risk of vehicle strike due to the increase in vehicle lanes and volume and this may have a significant impact if numbers of fatalities outnumber natural recruitment (Pavey 1993).

Eastern Curlew was not sighted during the EIS survey. The habitat around Bulimba Creek is unlikely to be critical or to support a large number if any. Most critical habitat is located in Moreton Bay proper and associated islands. The nature of the disturbance caused by the construction of a second bridge is likely to be small and short term providing the area is allowed to regenerate after construction. The GUP is unlikely to have a significant impact on this species in the long term.

Cattle Egret is a generally widespread and common species and is reasonably tolerant of human disturbance. It tends to follow livestock, which were not evident within the GUP corridor. Their nesting areas tend to be highly visible due to the large number of individuals involved and the large size of their nests and none were noted within or adjacent to the corridor. A comparatively small area of potential habitat will be removed but this is unlikely to have a significant impact on overall species numbers in the region in the long term.

The general requirements for Great Egret are similar to that of Cattle Egret though it seems less amenable to habitat disturbance. A comparatively small area of potential habitat will be removed but this is unlikely to have a significant impact on overall species numbers in the region in the long term.

Rainbow Bee-eater is generally common and widespread and aerial in habit hawking for insects above the tree canopy. It seems generally tolerant of some disturbance (Pizzey and Knight 1999). The area of potential habitat likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term.

Latham's Snipe is a migratory wader with its main feeding and roosting habitat in Moreton Bay. A comparatively small area of potential habitat will be removed but this is unlikely to have a significant impact on overall species numbers in the region in the long term.

White-throated Needle-tail is an aerial feeder that tends to perch on any tall structure natural or artificial to rest. They are quite tolerant of habitat disturbance and urban development. The GUP is therefore unlikely to have a significant impact on overall species numbers in the region in the long term.

Black-faced Monarch is tolerant of some urbanisation but generally requires intact bushland for its survival (Simpson and Day 1993). A comparatively small area of potential habitat will be removed but this is unlikely to have a significant impact on overall species numbers in the region in the long term.

Spectacled Monarch is a forest specialist. Given that this species has not been recorded in the area even though suitable habitat is present suggests it may only be present in small numbers if at all. A comparatively small area of potential habitat will be removed but this is unlikely to have a significant impact on overall species numbers in the region in the long term.

Satin Flycatcher is generally a forest specialist. A small area of potential habitat within the GUP corridor will be removed but when compared with the areas of habitat reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area this is not likely to be significant. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term.

Rufous Fantail is tolerant of some urbanisation but generally requires intact bushland for its survival. The area of potential habitat likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term.

Significant Mammals

This section addresses the mammals identified as significant at a national, state or local level and likely to use resources within the GUP corridor.

Large-eared pied bat has not been recorded for adjacent areas of the GUP corridor it is therefore unlikely to occur in significant numbers within the corridor. A search of road culverts and bridges via ultrasound and forage evidence failed to locate any evidence that microchiropteran bats were using these as roosting sites. The area of potential habitat likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term.

The removal of habitat within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. However as has been noted earlier the existing Motorway has been the site of a number of koala fatalities over recent times.

This situation is likely to be exacerbated by the construction of the extra lanes and the installation of a median barrier, which will provide a barrier to koalas completing movements across the carriageway. A recent study of dispersal patterns of koalas in SEQ found that attacks from domestic dogs and collisions with vehicles accounted for 80% of the mortality associated with koala dispersal and that this may impact on the species survival in urban areas (Dique et al 2003). This could have long term negative impacts on overall koala numbers particularly within the Belmont Hills Bushland, which is relatively small and somewhat isolated from the Koala Coast Area.

The road forms a barrier to the dispersal of juvenile koalas between the two areas and may prevent the recolonisation of the Belmont Hills Bushland in the event of a catastrophic event such as disease or bushfire. In addition there is the prospect of increased inbreeding and suppressed genetic variation within this population which would increase its vulnerability to catastrophic disturbance (inbreeding depression).

The movement of Grey-Headed Flying fox is unlikely to be affected by the widening of the Motorway. The area of potential foraging habitat likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term as some of the species feeding resources will be replaced as part of the proposed landscape works.

Populations of squirrel gliders occur on both sides of the existing Motorway in Belmont Hills Bushland and Koala Coast Area. The road is likely to act as a barrier between these two populations and this situation is likely to be exacerbated by the construction of the extra lanes. This species can volplane up to 50m (Jackson 1999) but the distance travelled would depend on the height of the surface from which the animal launched. The distance between the trees on either side of the carriageway is presently approximately 40m. The topography on the Belmont

Hills side of the carriageway is higher than that on the Koala Coast side, so it is probable that an animal can glide across the Motorway in that direction. However it is unlikely that an animal could successfully volplane in the other direction.

The proposed widening will increase this distance to at least 60m. Roads wider than 60m and devoid of suitable large emergent trees can be a barrier to some glider species (AMBS January 2001). This could prevent the dispersal of juveniles between the two areas and may prevent the recolonisation of the Belmont Hills Bushland in the event of a catastrophic event such as disease or bushfire. In addition there is the prospect of increased in-breeding and suppressed genetic variation within this population which would increase its vulnerability to catastrophic disturbance (inbreeding depression). This may compromise the long-term viability of the Belmont Hills squirrel glider population.

The area of potential squirrel glider foraging habitat likely to be removed within the GUP corridor is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the short term.

Sugar gliders do not appear to be occupying the Belmont Hills Bushland even though there is suitable habitat and it may be that the construction of the existing Motorway contributed to the demise of that population if there was one. The area of potential foraging habitat likely to be removed within the GUP corridor on the Koala Coast Area side of the carriageway is likely to be insignificant when compared with the areas of these species reserved in the adjacent Belmont Hills Bushland and the Koala Coast Area. The GUP is unlikely to have a significant impact on overall species numbers in the region in the long term.

Swamp wallaby and red-necked wallaby populations occur on both sides of the existing carriageway. The proposed road widening is likely to increase the likelihood of vehicle strike and act as an impediment to dispersal of young and the movement of adults across the carriageway along much of this section of the GUP. This could have long term negative impacts as described previously for squirrel gliders. However in the area of Greendale Way (CH8800) it is likely that these species are using the existing road underpass as a passage form one side of the carriageway to the other. The construction of an extra bridge is unlikely to affect this movement unless there is a dramatic increase in traffic along Mt Petrie Road and Greendale Way.

The increased volume of traffic may increase the risk to Red-necked wallabies from vehicle strike when feeding on the grass at the side of the road. This is less of a problem for swamp wallabies which feed on coarse browse such as bracken fern.

Common Fauna

This following section addresses the common fauna likely to use resources within the GUP corridor or to move across it. The potential impacts of the GUP on common native fauna are outlined below.

Road kills of native fauna are likely to continue, and may increase in number due to increased traffic volumes, and the widening of the carriageway and the construction of a concrete median which will provide a barrier to fauna moving across the carriageway. This may lead to a decrease in the interchange of individuals particularly of terrestrial fauna between populations of species living on either side of the Motorway. This may lead to the eventual localised extinction of some populations within smaller habitat areas on the western side of the Motorway such as the Belmont Hills Bushland.

There is also the potential for an increased number of road kills due to fauna such as birds of prey scavenging the carcasses of other fauna killed on the carriageway and due to fauna, particularly reptiles using the road surface as a heat source. These are only likely to be significant impacts if the numbers of fatalities outnumber natural recruitment.

Traffic noise and the visual disturbance by the movement and headlights of vehicles as well as the associated pollutants may cause some species of fauna to avoid roads and add to their affects as barriers once they are constructed (AMBS January 2001). Construction noise is also likely to be a short term impact.

Importing Red Imported Fire Ants (RIFA) during construction phase could have a significant long term effect on terrestrial fauna in the vicinity of the GUP corridor due to their aggressive nature and their painful sting.

To minimise the potential impact of the project on native fauna species that utilise the fauna habitat within and adjacent to the GUP mitigation measures will be implemented as outlined in Section 16.2.5 and the EMP.

16.2.5 Mitigation Measures

To minimise the potential of the GUP on terrestrial ecology values of the area the following mitigation measures should be implemented:

Design

A wide range of native and introduce species have been shown to use a variety of fauna underpasses under highways in a number of studies by AMBS over a number of years from 1997. The native species which have been noted to occur or highly likely to occur, adjacent to the GUP corridor are listed in the Table 16.8.

Table 16.8 Summary of Fauna Species Likely to use Fauna Underpasses within the Area

Species	Common Name
Mammals	
Hydromys chrysogaster	Water Rat
Isoodon macrourus	Northern Brown Bandicoot
Macropus rufogriseus	Red-necked Wallaby
Phascolarctos cinereus	Koala
Rattus fuscipes	Bush Rat
Tachyglossus aculeatus	Short-beaked Echidna
Trichosurus vulpecula	Common Brushtail Possum
Wallabia bicolor	Swamp Wallaby
Reptiles	
Eulamprus quoyii	Eastern Water Skink
Morelia spilota spilota	Diamond Python
Physignathus lessueurii	Eastern Water Dragon

Species	Common Name
Tiliqua scincoides	Blue Tongued Lizard
Amphibians	
Limnodynastes peronii	Striped Marshfrog

Source: Adapted from AMBS 1997-2001 see References

Consider installing fauna underpasses at Wecker Road (CH6100) and the culvert east of Coventry Court (CH7100). These may be dual purpose to accommodate stormwater flows or to facilitate pedestrian/bicycle access. These positions have been chosen for the following reasons:

- To give a good spread of underpasses along this section of the GUP corridor. This gives several underpasses to provide alternate routes to avoid disturbance, predators and to allow for a more natural population distribution (AMBS 1997);
- Because the topography allows them to be installed without altering the vertical profile of the road;
- Because there is medium to high quality habit on both sides of the GUP corridor in these locations, which is more or less linked to larger areas of habitat beyond; and
- These locations are away from sources of disturbance such as houses that may deter use by fauna from using the underpasses (AMBS 1997).

It is recommended that 3m x 3m box culverts be used. A structure length of 20m or less seems to be optimal (AMBS 2001b) so the design should minimise the length of culvert structures. Although 2.4m high box culverts may be utilised over short distances they may be avoided by certain fauna such as macropods once the length increases significantly over 20m because there needs to be a clear line of sight (AMBS 2001b).

The gradient at the entrances to the culverts needs to be gentle enough for fauna to negotiate them. The gradient should also ensure that the drainage does not allow water to pond inside the underpass.

Small animals such as antechinus, rats and lizards travelled on structures inside underpasses such as logs and travel along the sides of the underpass (AMBS 2001a). To accommodate these construct shelves along the outside edges to accommodate small terrestrial fauna. These shelves should be furnished with logs and rock scree to provide cover. However tree stumps and other furnishings may deter wallabies from using underpasses so keep the centres clear.

A dirt or gravel floor allows for the growth of vegetative cover (AMBS 1997) and provides traction for fauna. The particle size of floor material will be dictated by the likely peak hydraulic flows through the culverts.

The underpasses will need to accommodate small terrestrial species and macropods so a mosaic of open grass and structurally diverse vegetation will need to be provided around the underpass entrances. The presence of a cleared area or pond immediately adjacent to the entrance may deter some species from entering the underpass (AMBS 1997) so avoid such impediments near underpass entrances. Do not obstruct the view of, or disguise the entrance of the underpass as this will deter fauna (AMBS 1997). Keep clearance of adjoining natural vegetation to a minimum and replant/ regenerate cleared area after construction to encourage fauna to use the underpasses (AMBS 1997).

Avoid the use of artificial lighting inside underpasses as this deters nocturnal animals (AMBS 1997).

Another fauna underpass to be considered is "the arbour tunnel". This is a specially built tunnel for koalas and other animals, using logs suspended off the ground to provide safe passages between habitats (O'Rourke 2004).

Consider installing fauna exclusion fencing on both sides of the Motorway between Mt Gravatt-Capalaba Road (CH1500) and Old Cleveland Road (CH9900) for the safety of fauna and road users alike and to funnel fauna towards suggested underpasses at CH6100 and 7100 and Greendale Way (CH8800). Exclusion fencing should be located to funnel animals towards underpasses and to prevent them entering the carriageway. The following types are recommended:

- Floppy top fences consisting of chain wire with the top 20cm unsupported and fence posts angled away from the carriageway at the top.

- Chain-wire fencing with a 600mm wide strip of sheet metal or plastic attached to the upper part of the fence. By attaching the sheeting to the non-carriageway side of the fence, animals can still climb the fence from the carriageway side of the fence and escape from the traffic. This is the preferred fence type for excluding koalas. A clear zone with no trees should be maintained for 3 metres either side of the fence to maintain its effectiveness (MR 2000).

- Variations of fauna exclusion fences that should be considered include sheet metal fencing and a mesh/sheet metal combination fence. The mesh/sheet metal combination fence involves the sheet metal being located at the bottom of the fence and the mesh at the top without requiring a "Floppy Top".

  The sheet metal fencing has a flat surface making gripping or climbing by fauna difficult (RTA 2000).

- Exclusion fencing may be particularly important in this section of the GUP corridor where there are a number of state and locally significant fauna species adjacent to the GUP corridor. Such species are generally in lower numbers and therefore deaths caused by vehicular collision are more significant when compared with common species. Such fencing needs to be inspected and maintained after construction to ensure its continual effectiveness.

- Landscaping on the verges adjacent to the Motorway should be confined to native trees and shrubs (as appropriate for safety) to deter macropods from grazing close to the Motorway where they are likely to come into collision with motor vehicles.

Liaise with the appropriate agency to carry out a long term study of population dynamics and movement patterns of koalas, squirrel gliders, sugar gliders and other significant species with populations on both sides of the GUP corridor to ascertain what effects if any the road is having on local populations.

It should be noted that selection of the particular style of fencing should be carried out by the detail designer in consultation with relevant government agencies and conservation groups.

Construction

- Ensure an animal spotter and catcher is present during the initial clearing to relocate any fauna that is disturbed;

- Except where this compromises safety, retain hollow habitat trees and other large trees within the road reserve. Where these need to be removed salvage the hollow sections and relocate them to trees without hollows adjacent to the Motorway;

- Except where this compromises safety, retain koala food trees and plant additional koala food trees in the vicinity of Greendale Way. Suitable species include: forest red gum (*Eucalyptus tereticornis*), spotted gum (*Corymbia citriodora* var. *variegata*); pink bloodwood (*C. intermedia*), narrow leaved ironbark (*Eucalyptus crebra*), tallowwood (*E. microcorys*), small fruited grey gum (*E. propinqua*), grey ironbark (*E. siderophloiai*), and scribbly gum (*E. racemosa*) (Barnes & Moran 2001);

- Except where this compromises safety, plant large emergent eucalypt (and corymbia) species on either side of the carriageway particularly in the vicinity of Greendale Way to facilitate the movement of squirrel gliders across the carriageway. Monitor research into fauna overpasses and consider their installation across the roadway if their efficacy for this and other arboreal local significant species is proven in future;

- Minimise the area of disturbance along the banks of Bulimba Creek and implement stormwater management plans to minimise the entry of sediment into Bulimba Creek; and

- Avoid loss of significant canopy vegetation and works that will lead to enhanced proliferation of weed species and implement a weed management plan.

The works are within a Red Imported Fire Ant (RIFA) restricted zone, therefore controls on the movement of materials that may be of risk of transporting RIFA are required. The management actions detailed below reflect the "Red Imported Fire Ant Procedure" of Roads and Drainage Provider Unit.

Table 16.9 Red Imported Fire Ant Management Plan

Investigation Threshold	Strategy	Management Action
Inspection of site for RIFA not undertaken prior to commencement and monthly thereafter.	To inspect the site for the presence of fire ants prior to the start of works and at monthly intervals during the works period.	*Prior to commencement of works, a DPIF approved person shall carry out an inspection of the site*. This inspection will identify whether the site is visually free or visually infested with RIFA. *The inspection of the site shall be repeated every 28 days*. The approved inspector will complete the Site Inspection Form (Issued by the DPIF).

Investigation Threshold	Strategy	Management Action
Importation to the site of materials capable of transporting fire ants without inspection and clearance.	To only source restricted items (soil, plants etc) which are free of RIFA.	*All incoming restricted items (soil, plants etc) must be visually inspected by an DPIF authorised person prior to entry into the site and shall only be sourced from providers outside the restricted area or with a DPIF Approved Risk Management Plan, and be accompanied by a written assurance that the material is Fire Ant free.*
No records of imported materials from the restricted area.	To maintain records of any imported materials from the restricted area.	*All incoming restricted items must be recorded* detailing the nature, quantity and source of materials imported to the site. All records to be held on site by Construction Contractor.
Importation to the site of materials capable of transporting fire ants without inspection and clearance.	To minimise the risk of RIFA being transported to the site by equipment and machinery.	*All equipment and machinery to be visually free of loose soil or other material* capable of containing Fire Ants *prior to entry* on to site.
Materials being exported from the site without inspection and clearance.	Movement of materials from the site shall not increase the risk of spread of RIFA.	*Materials shall only leave the site within 28 days of a site inspection, which finds no visible evidence of RIFA.*
Visual evidence of RIFA on site.	Visual evidence or suspicion of RIFA to be reported.	*In the event that RIFA are detected or reasonable suspicion is held that RIFA are present on the site, the Project Manager shall be immediately notified.* The area under suspicion shall be barricaded and works in that area shall cease. The Construction Contractor should notify the Department of Primary Industries.
	Additional management measures to be implemented on detection of RIFA.	In the event of RIFA being detected on site, additional management measure shall be implemented which are in accordance with Attachment 4 of the Red Imported Fire Ant Risk Management Plan.

16.3 Cleveland Branch Rail Line to Pinkenba Rail Line

16.3.1 Existing Flora

Methodology

Dr Mike Olsen from Landscape Assessment, Management and Rehabilitation Pty Ltd (LAMR) and the Planning Study have carried out previous surveys of the flora in this section of the GUP.

Representative sample sites were also surveyed along this section and adjacent areas between March and June 2004. These were based on accessibility and the presence of remnant vegetation as determined by looking at aerial photos. A Random Meander Technique as described by Cropper (1993) was utilised to search for species.

It is important to note that due to seasonal limitations, all flora species at the sampled areas may not have been recorded. This could be attributed to the extent of the sample areas, plants being unidentifiable due to lack of fertile material, or plants lying dormant (eg terrestrial orchids) at the time of the survey.

Regional Ecosystems

The EPA REs mapping indicates there are no mappable, intact terrestrial Regional Ecosystems in this section of the GUP corridor. This was confirmed by ground truthing. The only intact regional ecosystem is RE 12.1.3 Mangrove Shrubland to low closed forest on marine clay pans and estuaries along the banks of Brisbane River. This RE is dealt with in detail in Section 17.

Vegetation Descriptions

There are small areas of remnant native vegetation within the GUP corridor in this area. Most of the vegetation, however, has been planted as part of the existing Gateway Motorway landscaping, the recently completed Port of Brisbane Motorway and the Royal Queensland Golf Club. Therefore the ecological integrity of this section is low.

On the Gateway Bridge southern bank (approximate CH16500 to 16950) much of the area within the GUP corridor is disturbed grassland. Along the river edge, small mangroves are scattered amongst the rocks and further along the bank are a small grove of large fig trees.

An area of particular interest at this site is a patch of trees (mainly eucalypts) under the existing bridge, some of which are remnant. Two trees in particular, both of them large remnant *E. tereticornis* (Forest Red Gums) standing side by side, both with diameters at breast height of greater than one metre and heights of approximately 30m. Other trees in this area of interest are also well established natives with some weed species and garden escapees.

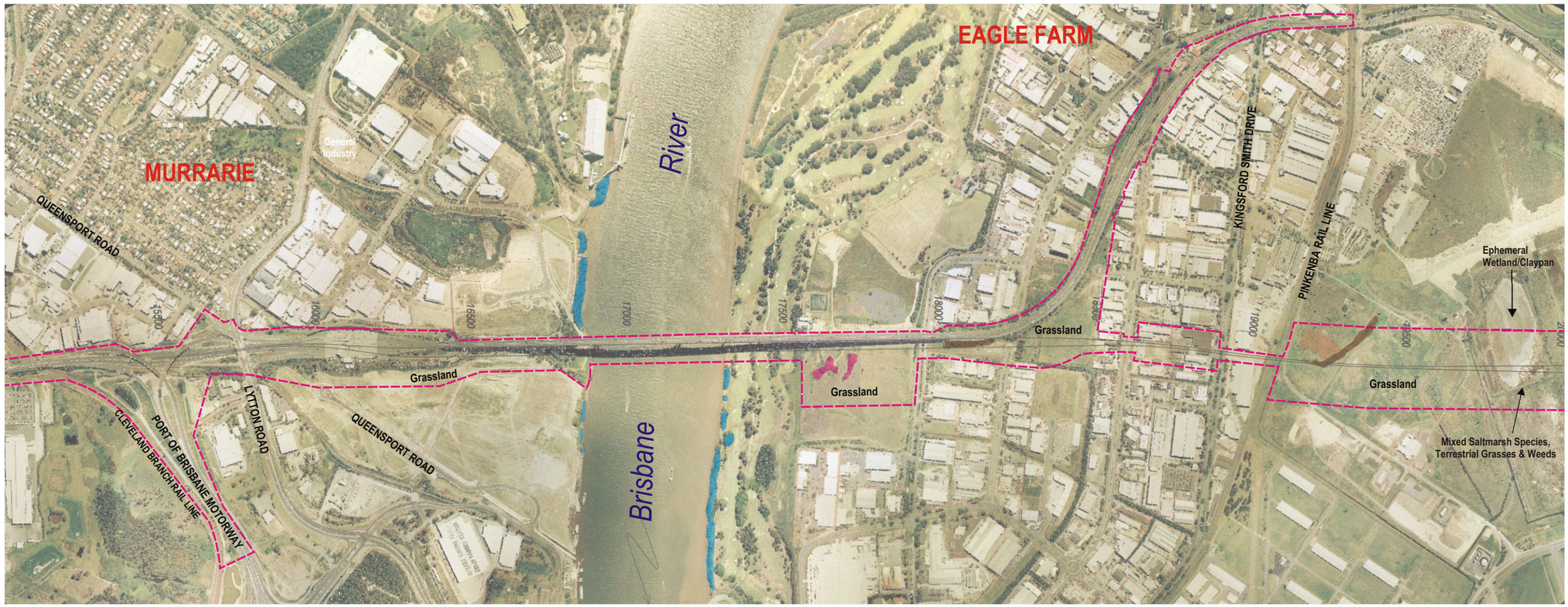
The northern bank of the Brisbane River includes Percival Park and vacant RQGC area (approximate CH17500 to 18500). Percival Park is largely a mown grassed area along side the Gateway Motorway with some landscape amenity planting made up of a mix of native and exotic ornamentals. Other species identified in the Park that were not included in amenity planting schemes are made up of garden escapees, native and weed species. A full species list of all plants identified in this area is included in Appendix L1.

A drainage channel leading towards the vacant RQGC area from Percival Park was densely populated by Cumbungi with some remnant eucalypts growing along side. In the mown grassed area a large number of weeds were present.

The vacant area in the RQGC land below the Gateway Bridge consists mainly of grasses with some trees and vines growing near or on the fence line along Curtin Avenue. The trees in this area were mature and regrowth trees consisting of native ornamental tree and weed species.

The general lack of vegetation is illustrated in Figure 16.1c.

Gateway Upgrade Project



KEY

- Saltmarsh
- Mangroves
- Brackish Wetland
- Exotic Vegetation
- Coastal Vegetation
- Freshwater Wetland and Sedge
- Saltmarsh/Mudflats
- (3) Terrestrial Ecology Survey Sites
- RE 12.9/10.4 Regional Ecosystem Classification
- Project Corridor

Note: Amenity landscaping occurs within the GUP corridor at various locations. Vegetation community mapping outside GUP corrodor is based on limited field investigations.

0 250 500m
SCALE

Queensland Government Department of Main Roads
Australian Government Department of Transport and Regional Services
Connell Wagner

FIGURE 16.1c
Ecological Features
Cleveland Branch Rail Line to Pinkenba Rail Line

Q:\graphics\graphics\jobs\57921\0NZ\Terrestrial Ecology Features B.cdr June 2004

Significant Flora Species

An EPBC Act Protected Matters Report was obtained for this section from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened flora species pursuant to the EPBC Act. The flora species listed in these documents are shown in Table 16.10.

Table 16.10 Summary of Significant Flora Species that may occur within GUP Corridor

Species	Status	Habitat	Comment
Corchorus cunninghamii (Native jute)	Endangered (Q) (A) (BCC)	Rainforest fringes or margins in areas now largely Brisbane suburbs (Stanley and Ross 1986). Often appears with Brush Box (Logan River Branch S.G.A.P. Qld Region Inc. 2002).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Bosistoa selwynii (Heart-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Bosistoa transversa (Three-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Hydrocharis dubia (Frogbit);	Vulnerable (Q) (A) (BCC)	South eastern Queensland, floating in deep water or rooted in shallow water, in pools, lakes or slow moving streams (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Macadamia integrifolia (Queensland nut)	Vulnerable (Q) (A) (BCC)	South east Queensland rainforests (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

A full list of the flora recorded during field work for this study is in Appendix L1. Only *Acacia perangusta*, listed as "Vulnerable" under the Schedules 1994 of the *Nature Conservation Act 1992*, was observed within the landscaping of the toll booths on the southern bank of the Brisbane River, but no natural occurrences of this species were observed within the GUP corridor.

Therefore, it can be concluded that no species listed under the *Queensland Nature Conservation Act 1992* or the EPBC Act are likely to occur naturally within the GUP corridor. This was confirmed during the EIS study.

Appendix L1 provides a list of the weed species observed along the GUP corridor that are declared under the *Land Protection (Pest and Stock Management) Act 2002*.

16.3.2 Existing Habitat Values

Dredging for shipping has resulted in the profile of the river no longer representing a natural condition, with little opportunity for the colonisation of mangroves, limited intertidal areas and, therefore, reduced amounts of feeding habitat for birds, such as listed migratory shorebirds (Brett Lane & Associates 2003).

The area under the Gateway Bridge on the southern bank of the river has value in terms of habitat status with the large Forest Red Gums which include hollows that would be a likely nesting site for Rainbow Lorikeets (seen feeding). Scratch marks on the tree also indicate the presence of Brush-tailed Possums.

There is already considerable fracturing of wildlife corridors in this area due to roads, residential and industrial developments. The residential and industrial areas provide a more severe impact in this respect.

The proposed bridge is located in an area where water, sediment and nutrients may enter the river and potentially impact on the Moreton Bay Ramsar wetland and associated shorebird habitats.

16.3.3 Existing Fauna

Methodology

A number of existing studies were used to gain information relevant to this assessment. These are noted within this section and included in the references for the EIS. Additional fauna was recorded incidentally during the vegetation survey between March and June 2004 using direct observation, call recognition, anabat, scats and signs (scratch marks, diggings etc).

Birds

An EPBC Act Protected Matters Report was obtained for this section and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened bird species pursuant to the EPBC Act.

Table 16.11 gives the threatened species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.12 gives the migratory species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

In addition, the WildNet Fauna Data (refer Appendix L2) has been analysed and the bird species likely to be using the GUP corridor at present are also common and widespread species, which are tolerant of a high degree of habitat disturbance.

Table 16.11 Summary of Significant Bird Species that may occur within GUP Corridor

Species	Status	Habitat Associations	Comment and Likely Occurrence
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); Migratory Terrestrial (A); S(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees. (Higgins 1999).	Extensive searches have occurred in SEQ and have not been located in Greater Brisbane area to date.
Erythrotriorchis radiatus (Red Goshawk)	Vulnerable (Q) (A); S(BCC)	Open forests, woodlands, especially near rivers, wetlands; rainforest fringes. Coastal and sub coastal in north and northeast Australia rarely seen south of Queensland Border (Pizzey & Knight 1999).	Few suitable Habitats exist in this area and no sightings were recorded during this study.
Accipiter novaehollandiae (Grey Goshawk)	Rare (Q); S(BCC)	Rainforests, forests; forest gullies and valleys; taller woodlands, timber on watercourses Pizzey and Knight 1999).	Although some suitable habitats exist, no sighting have been recorded in the area.
Geophaps scripta scripta (Squatter Pigeon) (southern)	Vulnerable (A)	Never far from water in grassed woodlands; foothills, watercourses, riverflats, grassy plains; environs of homesteads. Not often found in settled areas Pizzey and Knight 1999).	Although some suitable habitats exist, no sighting have been recorded in the area. As the area is also heavily altered by humans, it is unlikely that they would be found.

Table Notes:
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(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Lathamus discolor (Swift Parrot)	Endangered (A) (Q)	Open forest and woodland but will utilise well-vegetated parks and gardens. Nest in tree hollows high above the ground. Breed in Tasmania and migrate to the rest of south eastern Australia. They feed on blossoms of the following: • Grass tree *(Xanthorrhoea glauca)*; • Spotted Gum (*Corymbia citriodora* var. variegata); Gum Topped Box *(Eucalyptus melliodora)*; • Swamp Box *(Eucalyptus robusta)*; • Coastal Banksia *(Banksia integrifolia)*; • Red Honeysuckle *(B. serrata)*; and • Broad Leaved Banksia *(B. robur)*.	Given the presence of a number of their preferred food trees within the study area. This species may use the resources within the GUP corridor.
Rostratula australis (Australian painted snipe)	Vulnerable (Q) (A); S(BCC)	Freshwater (occasionally Brackish) wetlands. Mostly south-east. Australia. Possibly part-migratory moving north into Queensland in summer (Marchant & Higgins 1993).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Turnix melanogaster (black-breasted button-quail).	Vulnerable (Q) (A); S(BCC)	Dry Rainforest and forests with some tolerance to lantana. South east Queensland and North east NSW (Pizzey & Knight 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Table 16.12 Summary of Significant Migratory Species that may occur within GUP Corridor

Species	Status	Habitat Associations	Comment and Likely Occurrence
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); Migratory Terrestrial (A); S(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees. (Higgins 1999).	Extensive searches have occurred in SEQ and have not been located in Greater Brisbane area to date.
Gallinago hardwickii (Latham's snipe)	Migratory Wetland Species CA/ JA; (A); S(BCC)	Soft wet ground or shallow water with tussocks and other green or dead growth to scrub or open woodland; samphire areas on saltmarshes and mangrove fringes. Although it doesn't breed in Australia, it is a regular summer migrant with its stronghold in south east Queensland to southern South Australia (Pizzey and Knight 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Haliaeetus leucogaster (White-bellied sea eagle)	Migratory CA/ JA; (A); S(BCC)	Large freshwater lakes, dams and rivers and in coastal areas around saltwater lakes, estuaries and coastal islands. They generally nest on tree branches especially of Forest Red Gum (*Eucalyptus tereticornis*) (Pizzey and Knight 1999). Less common in urban areas than other marine raptors (eg Osprey, Brahminy Kite).	Some suitable habitat within the study area. May occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Hirundapus caudacutus (White-throated needletail)	Migratory (A)	Aerial over forests, woodlands, farmlands, plains, lakes coasts and towns. Feeding frequently along favoured hilltops and timber ranges. Although not breeding in Australia, the migrate to eastern Australia between October and April (Pizzey and Knight 1999).	Suitable habitat occurs within the study area. May occur within GUP corridor.
Monarcha melanopsis (Black-faced monarch)	Migratory (A)	Prefers wet sclerophyll forest; rainforest, open forest and mangrove forest but will utilise gardens. It nests on tree branches, generally 1-12 metres above the ground in south eastern Australia from August to April.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Monarcha trivirgatus (Spectacled monarch)	Migratory (A); S(BCC)	Understorey of mountain/lowland rainforests; thickly wooded gullies; waterside vegetation; mostly well below canopy. Summer breeding migrant to SEQ north east NSW from September to May.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Myiagra cyanoleuca (Satin flycatcher)	Migratory (A); S(BCC)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, tree in open country and gardens. Summer breeding in se Australia and winters in north east Queensland.	Some suitable habitat within the study area. May occur within GUP corridor.
Nettapus coromandelianus albipennis (Australian cotton pygmy-goose)	Migratory Wetland Species (A)	Deeper freshwater swamps, lagoons, dams with waterlilies and other semi emergent water plants mainly in eastern Queensland. Nesting sites are high in hollow tree near water with breeding November to April. Species is locally dispersive in dry season (Pizzey & Knight 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Associations	Comment and Likely Occurrence
Rhipidura rufifrons (Rufous Fantail)	Migratory (A); S(BCC)	Undergrowth of rainforests/ wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub inland and coastal scrubs; mangroves, watercourses; parks and gardens. Breeding migrant to se Australia (Pizzey & Knight 1999).	Some suitable habitat within the study area. May occur within GUP corridor.
Rostratula benghalensis s. lat.	Migratory Wetland Species (A); S(BCC)	Terrestrial shallow freshwater (occasionally) brackish wetlands including lakes, swamps, claypans, saltmarsh and a variety of artificial wetlands.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Mammals

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened mammal species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained.

Table 16.13 gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.13 Summary of Significant Mammal Species, which may occur within GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Chalinolobus dwyeri (Large-eared pied bat)	Vulnerable (A) Rare (Q)	Variety of habitats including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves (Churchill 1998).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Dasyurus maculatus maculatus (SE Mainland Population) (Spotted tailed quoll)	Endangered (Q) (A); E(BCC)	Range of forest communities including wet and dry sclerophyll forests and rainforests (Mansergh, 1984) Maternal den sites are logs with cryptic entrances; rock outcrops; windrows and burrows (Environment Australia 2000).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Potorous tridactylus tridactylus (Long-nosed potoroo)	Vulnerable (Q) (A); S(BCC)	Habitat is usually coastal heath or wet eucalypt forest. Requires thick ground cover and numbers seem to be concentrated in areas that have light, sandy soil. Usually restricted to those areas that have an annual rainfall of not less than 760mm.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
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(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Pteropus poliocephalus (Grey-headed flying-fox)	Vulnerable (A)	Wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Eby 1998). This species feeds opportunistically on blossoms of various native and exotic trees including figs. They range throughout Brisbane City from their daytime camps often in mangrove forests. The closest camps are at Indooroopilly Island, and the intersection of Port of Brisbane Motorway and Bulimba Creek.	Suitable habitat occurs within and close to the GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

During the EIS study the only terrestrial mammal observed was the introduced Brown Hare *(Lepus capensis)*. An unidentified species of flying fox was also sighted. The only significant species likely to use this section of the GUP corridor is the Grey-headed Flying Fox *(Pteropus poliocephalus)*, which is listed as Vulnerable under the EPBC Act. This species feeds opportunistically on blossoms of various native and exotic trees including figs. They range throughout Brisbane City from their daytime camps often in mangrove forest. The closest camp is at Hemmant where the Port of Brisbane Motorway crosses Bulimba Creek approximately 2km east of the GUP corridor.

Surveys conducted during the EIS along this section of the GUP revealed that none of the bridge structures were utilised by microbats. In a survey of the surrounding areas however, four species of bats were detected: the White-striped Mastiff Bat *(Tadorida australis)*, Eastern Freetail Bat *(Monopterus norfolkensis)*, the Large Boat Wing Bat *(Miniopterus schreibersii)*, and a species that was unable to be positively identified.

None of the species detected during this survey are listed on the National List of Threatened Fauna or the *Nature Conservation (Wildlife) Regulation 1994*. Although the Boat Wing Bat *(Miniopterus schreibersii)* is listed by the DEH as a Mammal that is Conservation Dependent, this applies only to the southern form of the species which is restricted to eastern South Australia and Western Victoria.

Amphibians and Reptiles

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened amphibian and reptile species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained.

Table 16.14 gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.14 Summary of Significant Amphibian and Reptile Species that may occur within GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Mixophyes iteratus (Southern barred frog)	Endangered (Q) (A)	Terrestrial inhabitants of rainforests, Antarctic Beech or wet sclerophyll forests, feeding on insects and smaller frogs.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Coeranoscincus reticulatus (Three-toed snake-tooth skink)	Vulnerable (Q) (A)	Rainforests and adjacent wet sclerophyll forests, where it is usually found in rotting logs or in soil under fallen timber.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
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S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

No amphibians were observed during the EIS study and none were noted within the WildNet Data for the area. Any species present are likely to be common and widespread species and the introduced Cane Toad *(Bufo marinus)*. Historic records indicate that the Salmon-striped Frog *(Limnodynastes salmini)* a species listed as Common but declining in the Greater Brisbane area was once found in the Eagle Farm area. This species is likely to be locally extinct within Brisbane (Ingram 2003 cited in Lambert & Rehbein 2004).

No terrestrial reptiles were observed during the current study and none were noted within the WildNet Data for the area. Any species present are likely to be common and widespread species.

16.3.4 Potential Impacts

Flora

The potential impacts on remnant flora will be minimal and may include removal of some minor areas of natural vegetation. However, large areas of amenity landscaping will need to be cleared. Much of this is likely to be reinstated as part of the proposed GUP.

Threatened Birds

Suitable resources for swift parrot occur within the GUP corridor namely Forest Red Gum *(Eucalyptus tereticornis)*. However, the numbers of this species likely to be removed, are negligible. Given that the breeding habitat for this species is in Tasmania and its main populations occur south of the Queensland border then the GUP is likely to affect numbers of this species.

Ramsar Wetlands and Migratory Birds

This section describes the potential impacts of the GUP on downstream Ramsar wetlands and the listed migratory bird species habitat of Moreton Bay. This has involved the application of basic ecological principles to identify the potential pathways, or ecological mechanisms, by which construction and operational activities might affect the condition of the downstream Moreton Bay Ramsar site and associated shorebird habitats.

The hydraulic connection between the bridge sites along the Brisbane River and Moreton Bay, is the primary pathway by which impacts might be propagated. It is important to note that the proposed second Gateway Bridge is approximately seven kilometres upstream from the Moreton Bay Ramsar site. The potential impacts of the GUP are discussed below.

Acid Sulphate Soils

The lower Brisbane River floodplain, which includes most of the affected area, is characterised by former marine clays, much of which are high in iron and aluminium sulphate. Excavation of these soils and their exposure to air (ie oxidation), may occur during construction of the GUP. Surface water and groundwater flows through these exposed soils can leach sulphuric acid in to waterways. As iron and aluminium are soluble under these acid conditions, metal pollution of downstream areas can occur, apart from the serious consequences of the acid flows themselves.

Water quality monitoring projects undertaken by WBM Oceanics have indicated that major changes in water chemistry due to drainage of acid sulfate soils presently occur in the vicinity of the GUP corridor within minor and major drains in the vicinity of Brisbane Airport and Northgate following significant catchment rainfall (Brett Lane & Associates 2003).

The potential for incremental impact from construction works associated with the GUP need to the considered in the light of these current conditions. A range of mitigation actions are available to manage the potential impact of construction on the generation of acid sulphate runoff (refer Section 23). Provided that these are adopted, no deleterious impacts from acid or polluted runoff from affected areas are anticipated.

Increased Sedimentation

Increased sedimentation in the affected watercourses could arise as a consequence of exposure of bare earth during construction to erosion by rainfall, delivering excessive quantities of eroded sediment to those waterways. Poor design of waterway crossing structures can also change flows, which in turn leads to erosion of watercourse bed and banks, delivering sediment downstream, including to Moreton Bay.

Excessive sediment delivered to the bay has the potential to contribute to higher turbidity, reducing light penetration and primary production, both in the water column (ie phytoplankton) and on the bed of the bay (ie microphytobenthos, seagrasses, etc). In addition, sedimentation has the potential to smother seagrasses, which is known to lead to their death and eventual loss from affected areas of seabed. As seagrasses are one of the most important sources of primary production in intertidal and sub-tidal ecosystems on which birds depend, a loss of seagrass can indirectly lead to reductions in shorebird and other bird numbers (Brett Lane & Associates 2003).

Sedimentation also interferes with the feeding mechanisms of intertidal and sub-tidal invertebrates, reducing their populations. These are an important source of food for intertidal-feeding waterbirds, such as the migratory shorebirds and any reduction in their availability will directly affect shorebird numbers and usage of an area (Brett Lane & Associates 2003).

Evaluation of the impacts of the GUP against the Administrative Guidelines on Significance under the EPBC Act is presented in Table 16.15.

Table 16.15 Evaluation of the Impact of the GUP and Bridge (north from the Brisbane River) against the Administrative Guidelines on Significance under the EPBC Act for Ramsar Wetlands

Guideline	Evaluation
Ramsar Wetlands	
Areas of the wetland being destroyed or substantially modified	No area of Ramsar wetland will be destroyed or modified by the proposal as the project does not lie within the wetland. Furthermore, the indirect impacts have been determined as being unlikely to lead to such change.
Substantial and measurable change in the hydrological regime	The hydraulic and hydrological impacts of the proposal on flows down local tributaries to the nearby Ramsar wetland areas are not considered to be significant.
Effect on the habitat or life-cycle of a wetland-dependent native species	As no significant physical or other ecological changes are anticipated to the Ramsar wetlands, and given the significant distance between works areas, neither indirect (eg pollution) nor direct (eg disturbance) disturbance is expected to wetland-dependent native species.

Guideline	Evaluation
Change in the physico-chemical status of the wetland	In view of the distances and dilution factors involved, and provided that appropriate and effective mitigation measures are taken to minimise or avoid erosion, significant water quality or flow-related physical impacts to the Moreton Bay Ramsar wetlands are likely to occur from the construction and operation of the GUP.
Establishment of invasive species	The proposed works areas are well away from the Ramsar wetlands of Moreton Bay and the risk of invasion of exotic species is considered to be low. In addition, weed prevention and management protocols, together with a high standard of revegetation of affected areas will be important components of the design and construction of the GUP.
Listed Migratory Birds	
Modify, destroy or isolate important habitat	The areas of habitat for migratory species along the GUP corridor are not extensive or well integrated with larger habitat further downstream in Moreton Bay. Recent survey work for the BAC indicates that the numbers of listed migratory species that visit the small areas of affected wetlands within the GUP corridor are minor compared with the tens of thousands that use Moreton Bay proper
Invasive species	Weed prevention and management protocols, together with a high standard of revegetation of affected areas will be important components of the design and construction of the GUP. Therefore, habitat for listed migratory species is unlikely to be affected by invasive species.
Seriously disrupt the life cycle of an ecologically significant proportion of the population	The number of individuals of listed migratory species that visit the small areas of affected wetlands within the GUP corridor are minor compared with the tens of thousands that use Moreton Bay proper. An ecologically significant proportion of the population of Moreton Bay's listed migratory species will not be affected. The nearby White-bellied Sea-eagles breed well away (up to 4km) from the proposed works area and have not been regularly recorded in it. They are therefore unlikely to be significantly disturbed by the proposed works.

In conclusion, the evaluation of the potential direct and indirect impacts of the GUP on matters of national environmental significance (ie Ramsar wetlands and listed migratory species) indicates that a significant impact on these matters is unlikely to occur.

Significant Mammals

The movement of Grey-headed Flying Foxes is unlikely to be affected by the works proposed in this section of the GUP. The area of potential foraging habitat likely to be removed is likely to be minor in comparison with areas available outside the project corridor. The effect is likely to be short term given that suitable forage species are likely to be reinstated.

Common Fauna

Traffic noise and the visual disturbance by the movement and headlights of vehicles as well as the associated pollutants may cause some species of fauna to avoid roads and add to their affects as barriers once they are constructed (AMBS January 2001). Construction noise is also likely to be a short term impact.

Importing RIFA during construction phase could have a significant long term effect on terrestrial fauna in the vicinity of the GUP corridor due to their aggressive nature and their painful sting. Due to the potential spread of RIFA a RIFA Management Plan will be implemented as outlined in Section 16.2.5 and the EMP.

16.3.5 Mitigation Measures

Design

- Design measures should be adopted for the new bridge crossing the Brisbane River to minimise localised erosion around piers.
- Supporting piers should stand a sufficient distance from the banks to ensure that existing mangrove communities remain or re-establish beneath or immediately adjacent to the bridge.
- During construction disturbance to mangroves and existing amenity landscaping should be minimised.

Construction

- The patch of large mature eucalypts adjacent to the existing Gateway Bridge should be retained and their root zones protected from vehicular traffic, the storage of materials and the deposition of deleterious materials such as cement.
- During vegetation clearing, an appropriately skilled "spotter and catcher" shall be engaged to visually check for any fauna present in trees or other vegetation. Fauna shall be either persuaded by reasonable means to leave or be captured and relocated in the local environment prior to felling or trimming.
- Site works, such as trenches and culverts, shall be checked each morning and after periods of inactivity, to ensure fauna are not trapped or likely to be harmed by construction activities.
- All native fauna is protected (including snakes) and shall not be intentionally harmed as a result of the works or worker actions.

16.4 Pinkenba Rail Line to Nudgee Road

16.4.1 Existing Flora

Methodology

A number of existing studies were used to gain information relevant to this assessment. These are noted within the text and included in the references of this EIS.

Representative sample sites were also surveyed along this section of the GUP corridor and adjacent areas between March and June 2004. A Random Meander Technique as described by Cropper (1993) was utilised to search for species.

It is important to note that due to seasonal limitations, all flora species at the sampled areas may not have been recorded. This could be attributed to the extent of the sample areas, plants being unidentifiable due to lack of fertile material, or plants lying dormant (eg terrestrial orchids) at the time of the survey.

Regional Ecosystems

The EPA REs mapping indicates there are no mappable, intact terrestrial REs in this section of the GUP corridor. This was confirmed by ground truthing. The Casuarina Plantations are mapped as "Plantation" and are therefore exempt under the *Vegetation Management Act 1999*.

RE 12.1.3 Mangrove Shrubland to low closed forest on marine clay pans and estuaries is the only intact RE along the banks of Brisbane River. This RE is dealt with in detail in Section 17.

Vegetation Descriptions

Pinkenba Rail Line to TradeCoast Central Site

None of the species observed during this assessment within this section of the GUP corridor are listed as "Endangered, Vulnerable or Rare" under the *Nature Conservation (Wildlife) Regulation 1994*. A full list is included in Appendix L1.

The area of vacant/disused land situated between the Pinkenba Rail Line and TCC site approaching the old airport area is dominated by rank grasslands with patches of bunchy sedge in low lying areas. Crossing through this area is a drainage channel densely populated by Cumbungi with other sparsely distributed plants close to the drain including Australian natives and weed species.

Closer to the rail line, the area has some stands of weed species and wattles scattered throughout the rank grasslands. Directly adjacent to the rail line is an area of untended landscape amenity planting along the roadside consisting predominantly of native species.

TradeCoast Central Site

The existing vegetation within the TCC site of the GUP corridor is a mosaic of open grassland with scattered native and introduced shrubs and trees, saltmarsh/mudflats and tidal drainage channels with mangroves and aquatic macrophytes. There were also a number of large areas of open water probably the result of tidal inundation. This area is also networked by a series of elevated bunds.

The open grassland is dominated by introduced grasses including Rhodes Grass *(Chloris gayana)*, Para Grass *(Brachiaria mutica)*, and Kikuyu Grass *(Pennisetum clandestinum)*. The native, Queenslands Bluegrass *(Dichantheum sericeum)* is also numerous in parts.

The saltmarsh/mudflat is dominated by Marine Couch *(Sprobolus virginicus)*, Sea Purslane *(Sesuvium portulacastrum)* and around CH20000 Swamp Club Rush *(Isolepis inundata)*.

The main species in and around the drainage channels are Grey Mangrove *(Avicennia marina var. australasica)* and Fringerush *(Fimbristylis tristachya)*.

Open waterbodies are located at CH19850 and 20140.

The existing vegetation within the GUP corridor on Brisbane Airport land includes the following broad vegetation communities:

- Casuarina plantation;
- Freshwater wetland and sedge;
- Open grasslands;
- Mangroves;
- Saltmarsh/mudflats;
- Coastal vegetation; and
- Amenity landscaping.

The terrestrial vegetation communities are described in detail below. A full species list is included in Appendix L1 and their general distribution is shown in Figure 16.1d.

Casuarina Plantation

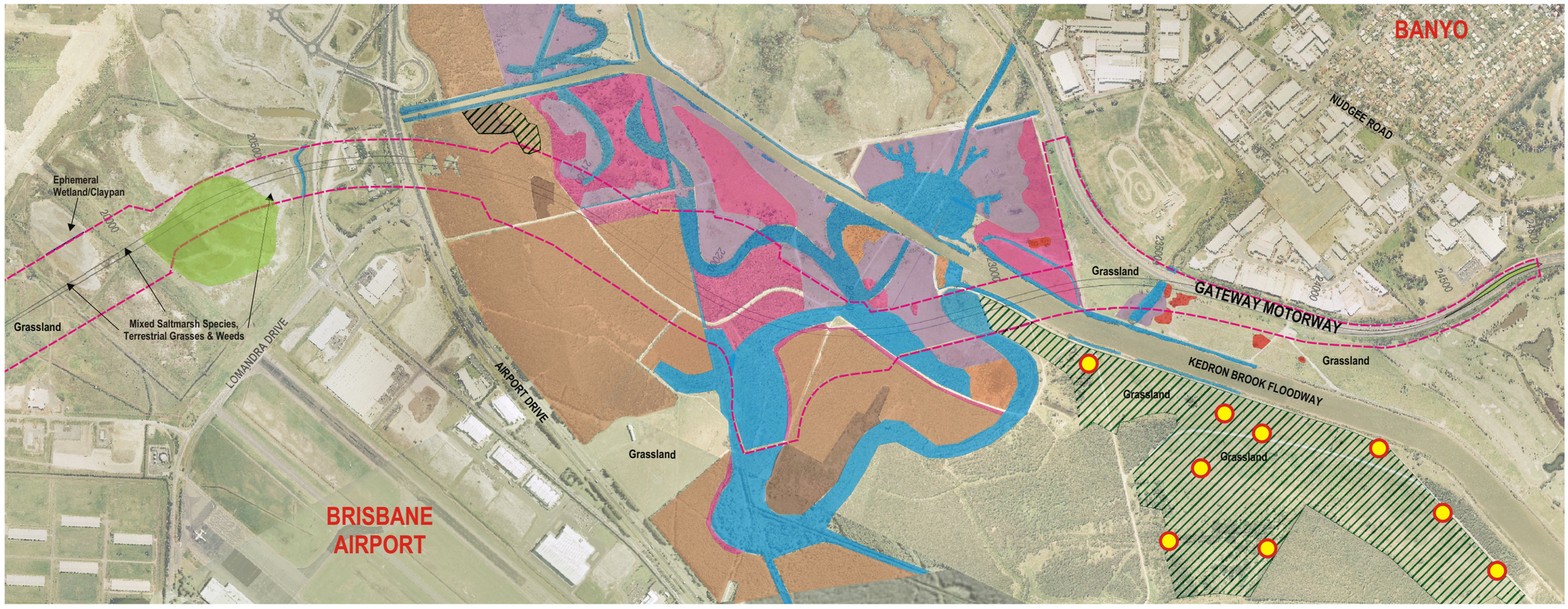
The Casuarina plantation consists of a monoculture of Swamp Oak trees that were planted due to their relatively poor fauna habitat values (BAC 1999). The plantation understorey contains weeds. The extent of infestation depends on factors such as Swamp Oak maturity, and other influences such as soils and salt water inundation.

The more established areas of Swamp Oaks have a canopy height of approximately 10-12m, with a dense shrub, vine and ground layer weed infestation. These areas include weeds such as Lantana, Wild Tobacco *(Solanum mauritanium)*, Green Cestrum *(Cestrum parqui)*, Brazilian Nightshade *(Solanum seaforthianum)* and White Moth Plant *(Araujia hortorum)*.

Areas with a Swamp Oak canopy height of approximately 6-10m generally have a moderate infestation of weeds in the shrub, vine and ground layer, with some areas showing evidence of periodic tidal inundation. These areas include weed species that occur in the more established areas, however at a lower density. Other dominant weed species that occur within these areas include Balloon Cotton Bush *(Gomphocarpus physocarpus)* and Coralberry *(Rivina humilis)*. In these areas, Marine Couch and patches of Swamp Oak leaf litter often dominate the ground layer.

Areas of Swamp Oak plantation that have a canopy height of less than 5m appear to be influenced by tidal inundation. The Swamp Oaks are relatively stunted in height, with only a sparse shrub layer, and a ground layer dominated by Marine Couch and other saltmarsh species. Weed species that occur within these areas include Lantana, Brazilian Nightshade and *Rhagodia hastata*.

Gateway Upgrade Project



KEY

Note: Vegetation community mapping outside the GUP corridor is based on The Brisbane Airport Vegetation Condition Assessment (ERM 2002) for BAC land and limited field investigations in other areas

- Casuarina Plantation
- Coastal Vegetation
- Freshwater Wetland and Sedge
- Mangroves
- Saltmarsh
- Mangroves and Saltmarsh
- Saltmarsh/Mudflats
- Mixed Grassland, Mudflats and Freshwater Wetland
- Mixed Terrestrial and Marine Community
- Known or probable Lewin's Rail Habitat (Lambert & Rehbein 2004)
- Locations where Lewin's Rail recorded (Lambert & Rehbein 2004)
- Project Corridor

0 250 500m
SCALE

Queensland Government Department of Main Roads
Australian Government Department of Transport and Regional Services
Connell Wagner

FIGURE 16.1d
Ecological Features
Airport Drive to Nudgee Road

Q:\graphics\graphics\jobs\57921\NZ\Terrestrial Ecology Features B.cdr June 2004

Freshwater Wetlands and Sedge Communities

Extensive areas of freshwater wetlands occur towards the middle of the western boundary of the Airport (BAC 1999). The wetland and sedge communities are dominated by a ground layer of the Common Reed *(Phragmites australis)*, with a height of up to 2.5m. Other species that occur within these communities include *Juncus continuus, Fimbrisylis sp.,* and Bunchy Sedge *(Cyperus polystachyos)*. Weed species that infest these areas include Wild Tobacco, Lantana, Kikuyu Grass, Groundsel Bush *(Baccharis halimifolia)*, Balloon Cotton Bush, Rhodes Grass, Paspalum and Purpletop *(Verbena bonariensis)* (ERM 2002).

Open Grassland

Grasslands occur within the GUP corridor on BAC land as roadside vegetation, regrowth in derelict land, pasture in a small area in the south eastern part of the GUP corridor, and mown grasslands on the verges of Airport Drive.

Among the most common grass species generally occurring are Kikuyu Grass, Marine Couch (in areas affected by salinity), Rhodes Grass *(Chloris gayana)*, and Giant Rat's Tail Grass *(Sporobolus indicus)*. Grass species that dominate 'roadside' areas include Rhodes Grass and Red Natal Grass *(Melinis repens)*. Few if any native species grow in these areas. The areas of mown grassland consist of numerous species (*Poaceae* spp.) with Couch and Paspalum *(Paspalum dilatatum)* dominating most areas.

Mangroves

For detailed discussion of this vegetation community see Section 17.

Saltmarsh Communities

For detailed discussion of this vegetation community see Section 17.

Amenity Landscaping

Amenity landscaping occurs predominantly along Airport Drive and Lomandra Drive. These areas were originally established in 1998 as part of the airport's construction. The landscaped area community is a strongly modified environment with single or small clusters of native and exotic trees and garden beds surrounded by mown grassed areas and/or roads and other infrastructure. Key landscape areas and their species composition include the following:

- Airport Drive – The most abundant tree species present across the landscaped areas on either side of Airport Drive include: Jacaranda *(Jacaranda mimosaefolia)*, Swamp oak *(Casuarina glauca)*, Cotton Tree *(Hibiscus tiliaceae)*, Pride of Bolivia *(Tipuana tipu)*, Broad-leaf Paperbark *(Melaleuca quinquenervia)* and Bottle Brushes (*Callistemon* spp.). Smaller trees and shrubs include Oleander *(Nerium oleander)*, Coast Banksia *(Banksia integrifolia)*, Primrose Jasmine *(Jasminium mesnyi)* and Bottle Brushes. Long-leaf Mat-rush *(Lomandra longifolia)* is a dominant understorey species occurring within both the median strip and either side of Airport Drive.

- Lomandra Drive – The dominant species here at Coast She-oak, Pride of Bolivia, *Melaleuca stypheliodes* and *Bauhinia galpinii*.

Conservation Values

Almost none of the terrestrial vegetation on the airport is remnant native bushland, with most vegetation planted or regenerated since the development of the present airport with the majority of vegetation communities infested by exotic plant species. On this basis, the conservation value of the terrestrial vegetation on the airport is low.

Under BCC's NAPS Policy, (none of the terrestrial vegetation within the) section of the GUP corridor within the airport land would be considered a Valuable Ecological Feature (Schedule 1).

On the basis of the above, a hierarchy of conservation values are summarised in Table 16.16.

Table 16.16 Summary of Conservation Values

Conservation Value	Community	Justification
Low	Casuarina plantation	• Planted species. • Severely infested by weeds.
Low	Landscaped areas	• Some value as wildlife habitat. • Relatively weed free. • Many species used for landscaping are exotic species.
Low	Open grasslands	• Continuously disturbed by mowing. • Infested by weeds.

Kedron Brook Floodplain

The vegetation on the Kedron Brook floodplain is mainly terrestrial grassland with lesser areas of mangrove forest, *Sporobolus virginicus* (Marine Couch) grassland and remnant/regrowth terrestrial forest. The distribution of the vegetation is shown in Figure 16.1d. Adjacent to this within the road reserve is some exotic and native ornamental trees and shrubs, which have been planted. These include figs (*Ficus* sp.), Norfolk Island Pines (*Araucaria heterophyllus*) and Hoop Pine (*Araucaria cunninghamii*).

The exotic, Rhodes Grass *(Chloris gayana)* dominates the terrestrial grassland in the drier areas with other exotic grasses and herbs in lesser numbers. A few native species also grow in these areas including a 30m Forest Red Gum (*Eucalyptus tereticornis*) and a 10m high Swamp Mahogany (*Eucalyptus robusta*) to the northern end of the subject area.

In the wetter areas Para Grass (*Brachiaria mutica*) is the dominant species to the exclusion of nearly all other species. There are two ephemeral freshwater/ brackish pools within the grassland south of Cannery Drain the southern most one dominated by Cumbungi (*Typha* sp) and the other smaller on dominated by Jointed Twigrush (*Baumea articulata*).

Just north of Cannery Drain is an area of remnant/regrowth terrestrial forest dominated by Paper Barked Tea Tree (*Melaleuca quinquenervia*) with other native and introduced shrubs and trees. Exotic grasses and herbs dominate the groundstorey.

Adjacent to the Gateway Motorway is some amenity landscaping exotic and native ornamental trees and shrubs, which have been planted. These include figs (*Ficus* sp.), Norfolk Island Pines (*Araucaria heterophyllus*) and Hoop Pine (*Araucaria cunninghamii*).

Significant Flora Species

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened flora species pursuant to the EPBC Act. Many of the species noted are also listed for the other sections to the south. Table 16.17 summarises the threatened flora species listed.

Table 16.17 Summary of Significant Flora Species that may occur within GUP Corridor

Species	Status	Habitat	Comment
Corchorus cunninghamii (Native jute)	Endangered (Q) (A) (BCC)	Rainforest fringes or margins in areas now largely Brisbane suburbs (Stanley and Ross 1986). Often appears with Brush Box (Logan River Branch S.G.A.P. Qld Region Inc. 2002)	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Phaius australis (Lesser Swamp Orchid)	Endangered (A)	Islands in Moreton Bay in the Moreton district, in swamps.	Area is highly disturbed and modified. Unlikely to occur within GUP corridor.
Arthraxon hispidus (Hairy-joint Grass)	Vulnerable (A)	Eastern area of SEQ often in damp shady places (Stanley and Ross 1983)	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Bosistoa selwynii (Heart-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Bosistoa transversa (Three-leaved Bosistoa)	Vulnerable (A)	Mainly lowland rainforest (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Cryptostylis hunteriana (Leafless tongue-orchid)	Vulnerable (A)	It is chiefly a coastal species but can be found in a range of habitats including areas bordering swamps to open forest. Its distribution is from southern Queensland through to Victoria.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Hydrocharis dubia (Frogbit);	Vulnerable (Q) (A) (BCC)	South eastern Queensland, floating in deep water or rooted in shallow water, in pools, lakes or slow moving streams (Stanley and Ross, 1983).	Area is highly disturbed and modified. Unlikely to occur within GUP corridor.
Macadamia integrifolia (Queensland nut)	Vulnerable (Q) (A) (BCC)	South east Queensland rainforests (Stanley and Ross 1983).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
(BCC) = Locally significant in the Brisbane City Council Area

The vegetation survey work of ERM (2002) failed to locate any nationally, state or regionally threatened plant species on the airport land. It concluded that none were likely to occur as the habitats were not suitable for those considered likely to occur within a 10km radius of the area.

16.4.2 Habitat Values

All of the vegetation which has been planted, or which has regenerated since the development of the current airport, consists of vegetation which is structurally immature and very poor in native plant species richness. It is also extensively infested with weeds. On this basis, most habitat provided within the GUP corridor on the Brisbane Airport land is relatively poor, and this is reflected in the native fauna species assemblage.

This habitat within the Casuarina plantation consists of a monoculture of planted Swamp Oak, with a high influx of weeds and, some exposure to saline water. Shrub vegetation ranges from sparse and intermittent (1-10% cover), to dense in more mature stands (30-70%). The ground layer vegetation cover was moderate to dense, with 30-70% of the cover consisting of litter.

The monoculture provides little diversity in food resources for herbivorous fauna. No hollows were observed within the mature trees, thereby limiting the nesting opportunities for arboreal fauna.

Occasional fallen logs and branches within the community may provide basking sites for reptiles such as snakes and lizards. Areas, which are moderately vegetated with grasses, weeds and other herbs, provide shelter for small fauna. Areas in which dense vegetation such as Lantana occurs, provide shelter opportunities for Feral Pigs.

No animal scats were detected within the habitat community. Apart from Feral Pig tracks and diggings, no other evidence of species presence were detected.

The Casuarina plantation is currently unlikely to sustain populations of rare or threatened fauna species. The vegetation community is likely to provide habitat for common reptiles such as snakes and lizards, mammals such as Feral Pigs, Rats (*Rattus* spp.) and House Mouse *(Mus musculus)*, and foraging birds from adjacent mangrove, sedgelands, freshwater wetlands and grasslands. This habitat therefore has a relatively low conservation and habitat value.

Open grasslands consist mostly of mown grasses which are structurally and floristically extremely simple and subject to weed influx, particularly along the edges which are not regularly mown.

However, numerous birds occur across the open grasslands, usually in large numbers. Major species include Ibis *(Threskiornis sp.)*, Common Starling *(Sturnus vulgaris)*, Egrets *(Ardea sp.)*, Herons *(Egretta/Ardea sp.)*, Welcome Swallow *(Hirundo neoxena)* and Torresian Crow *(Corvus orru)* (Pell and Jones 2002).

Particular habitat features that contribute to the presence of these birds include the grassy ground cover, drainage patterns, and lighting features. The grasses provide seed and provide habitat for insects for foraging birds. The extent to which seeds and insects are present is known to be dependent on the height of the grass, and the type of species present (van Tets *et al*. 1977). Shorter grasses that are more frequently mown are known to be less likely to produce many seeds and insects. The amount of rainfall and drainage of the area also has an impact on the feeding habitat for birds, with standing water flushing worms and other ground dwelling

animals out of the ground, thereby providing feed. The lights associated with the airport operations attract insects on which birds and bats forage.

The numbers of bird species in the open grassland community vary with season, with the number of birds being highest from June to August (Pell and Jones 2002).

Apart from birds, other species that occur within the open grasslands include the Brown Hare, Feral Pig, and various species of snake. The freshwater drainage areas that occur on the site may potentially provide habitat for amphibians.

No animal scats, diggings or tracks were detected within the habitat community.

The open grassland habitat is unlikely to sustain populations of rare or threatened fauna species. However, species listed under the migratory provisions of the EPBC Act occur within the community, facilitated by the close proximity of the airport to the Moreton Bay Ramsar site.

Nevertheless, birds recorded within the open grassland habitat are all common birds which occur widely within the region. Given the simple structure of the habitat and the relatively impoverished species diversity of overall fauna assemblages likely to be present, the open grassland community has been given a low habitat value.

There are no tree hollows or habitat of arboreal mammals. However, the planted understorey, which consists of species such as the Long Leaf Mat Rush *(Lomandra longifolia)* and Primrose Jasmine *(Jasminum mesnyi)* was dense, providing shelter for small fauna such as reptiles. While there were few areas within the habitat itself that contain logs or other basking sites for ground dwelling reptiles, a large number of lizards were observed killed on roads. It is likely that these lizards use the roads for basking.

No evidence (scats, tracks, or diggings) of ground dwelling mammals was observed within this habitat.

Many of the landscape species present have flowers that attract various species of nectivorous insects (such as bees) as well as nectivorous and insectivorous birds during flowering season. While the flowering season varies among the plant species present, most flower within the spring and summer seasons. Most birds and insects attracted to flowers would therefore occur around this time.

Corridors and Ecosystem Connectivity

The terrestrial vegetation communities within this section of the GUP do not connect or link with other terrestrial vegetated areas to provide habitat linkages. There are not likely to be any significant fauna movements between habitats on the airport, as these areas are developed with no large areas of remaining habitat.

While movements of terrestrial fauna are impeded within the local region around the airport by barriers such as the runways, Kedron Brook Floodway, the existing Gateway Motorway and the Brisbane River, these are of less relevance for airborne fauna such as birds and bats.

Ramsar Wetland and Shorebird Habitats

The boundaries of the Ramsar wetland lie along the high tide mark, adjacent to the north eastern bay shores of the Brisbane Airport. The GUP is located approximately four kilometres upstream, along the Kedron Brook Floodway.

The potential impacts of the GUP on the Moreton Bay Ramsar site are discussed in Section 16.3.5 and Section 17 and are relevant for this section of the GUP.

16.4.3 Fauna

Methodology

A number of existing studies were used to gain information relevant to this assessment. These are noted within the text and included in the references for the EIS. Additional fauna was recorded incidentally during the vegetation survey between March and June 2004 using direct observation, call recognition, scats and signs (scratch marks, diggings etc).

Much of the area between the Airport Drive and the Kedron Brook Floodway has been surveyed over the past 12 months by Lambert and Rehbein Pty Ltd as part of the BAC Fauna Study. The study scope included listed migratory species and nationally threatened species. The draft report BAC has made available a draft report for this study. The draft report forms the primary data source on the occurrence of listed migratory and nationally threatened species in the GUP corridor. Other species noted during their survey are listed in Appendix L2.

Birds

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor area and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened bird species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained. Table 16.18 summarises the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.19 summarises the migratory species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.18 Summary of Significant Bird Species that may occur within the GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); Migratory Terrestrial (A); S(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees. (Higgins 1999).	Extensive searches have occurred in SEQ and have not been located in Greater Brisbane area to date.
Accipiter novaehollandiae (Grey Goshawk)	Rare (Q); S(BCC)	Rainforests, forests; forest gullies and valleys; taller woodlands, timber on watercourses.	Some suitable habitats exist, sighting have been recorded in the area (Lambert and Rehbein 2004)
Ephippiorhynchus asiaticus (Black-necked stork)	Rare (Q)	Coastal and subcoastal northern and eastern Australia.	Although some suitable habitats exist, no sighting have been recorded in the area.
Erythrogonys cinctus (Red-kneed dotteral)	S(BCC)	Shallow freshwater wetlands; claypans, floodwaters, sewage ponds, tussocks, rushes; brackish waters and salt swamps.	Although some suitable habitats exist, no sighting have been recorded in the area.
Erythrotriorchis radiatus (Red Goshawk)	Vulnerable (Q) (A); S(BCC)	Open forests, woodlands, especially near rivers, wetlands; rainforest fringes. Coastal and sub coastal in north and north east Australia rarely seen south of Queensland Border (Pizzey & Knight 1999).	Few suitable Habitats exist in this area and no sightings have been recorded in studies of nearby areas.
Erythrura trichroa (Blue-faced parrot finch)	Rare (Q)	Coastal mangrove fringes to margins of, and grassey clearings in, mountain rainforests over 1000m (Pizzey & Knight 1999).	Few suitable Habitats exist in this area and no sightings have been recorded in studies of nearby areas.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Geophaps scripta scripta (Squatter Pigeon) (southern)	Vulnerable (A)	Never far from water in grassed woodlands; foothills, watercourses, riverflats, grassy plains; environs of homesteads. Not often found in settled areas.	Although some suitable habitats exist, no sighting have been recorded in the area. As the area is also heavily altered by humans, it is unlikely that they would be found.
Lathamus discolor (Swift Parrot)	Endangered (A) (Q)	Open forest and woodland but will utilise well-vegetated parks and gardens. Nest in tree hollows high above the ground. Breed in Tasmania and migrate to the rest of south eastern Australia. They feed on blossoms of the following: • Grass tree *(Xanthorrhoea glauca)*; • Spotted Gum (*Corymbia citriodora* var. variegata); Gum Topped Box *(Eucalyptus melliodora)*; • Swamp Box *(Eucalyptus robusta)*; • Coastal Banksia *(Banksia integrifolia)*; Red • Honeysuckle *(B. serrata)*; and • Broad Leaved Banksia *(B. robur)*.	Given the presence of a number of their preferred food trees within the study area it may use the GUP corridor.
Menura alberti (Albert's Lyrebird)	Rare (Q) (A)	Dense subtropical rainforests and scrubs.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Rostratula australis (Australian painted snipe)	Vulnerable (Q) (A); S(BCC)	Freshwater (occasionally Brackish) wetlands. Mostly south east Australia. Possibly part-migratory moving north into Queensland in summer (Marchant & Higgins 1993)	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Sterna albifrons (Little Tern)	Endangered (Q); S(BCC)	Coastal waters, bays, inlets, saline or brackish lakes, saltfields, sewage ponds near coast (Pizzey & Knight 1999).	Although some suitable habitats exist, no sighting have been recorded in the area.
Turnix melanogaster (black-breasted button-quail).	Vulnerable (Q) (A); S(BCC)	Dry Rainforest and forests with some tolerance to lantana. South East Queensland and North East NSW (Pizzey & Knight 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Table 16.19 Summary of Migratory Species that may occur within GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Charadrius bicinctus (Double-banded plover)	S(BCC); Migratory Wetland	Wide beaches, tidal mudflats, saltmarsh; wide sparsely vegetated margins of shallow saline and freshwater wetlands; paddocks with sparse vegetation; ploughed fields, airfields.	Some suitable habitat within the study area. May occur within GUP corridor.
Charadrius leschenaultii (Greater sand plover)	S(BCC); Migratory Wetland	Wide sandy or shelly beaches; sandpits, tidal mudflats, reefs, sand-clays,mangroves, saltmarsh, dune wilderness, bare paddocks; seldom far inland. (Pizzey and Knight 1999).	Some suitable habitat within the study area. May occur within GUP corridor.
Cuculus saturatus (Oriental Cuckoo)	Ja,Ca S(BCC); Migratory	Monsoon forests, rainforest edges; leafy trees in paddocks; river flats, roadsides, mangroves, islands (Pizzey and Knight 1999).	Some suitable habitat within the study area. May occur within GUP corridor.
Cyclopsitta diophthalma coxeni (Coxen's fig-parrot)	Endangered (Q) (A); Migratory Terrestrial (A); S(BCC)	Often found in ecotone between rainforest and sclerophyll forest containing fig trees. Breed in excavated hollows in dead or living trees. (Higgins 1999).	Extensive searches have occurred in SEQ and have not been located in Greater Brisbane area to date.

Table Notes:
(Q) = *Nature Conservation (Wildlife) Regulation 1994* (Queensland Government)
(A) = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia)
S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Gallinago hardwickii (Latham's snipe)	Migratory Wetland Species CA/ JA; (A); S(BCC)	Soft wet ground or shallow water with tussocks and other green or dead growth to scrub or open woodland; samphire areas on saltmarshes and mangrove fringes. Although it doesn't breed in Australia, it is a regular summer migrant with its stronghold in south east Queensland to southern South Australia (Pizzey and Knight, 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Haliaeetus leucogaster (White-bellied sea eagle)	Migratory CA/ JA; (A); S(BCC)	Large freshwater lakes, dams and rivers and in coastal areas around saltwater lakes, estuaries and coastal islands. They generally nest on tree branches especially of Forest Red Gum (*Eucalyptus tereticornis*) (Pizzey and Knight, 1999). Less common in urban areas than other marine raptors (eg Osprey, Brahminy Kite).	Some suitable habitat within the study area. May occur within GUP corridor.
Hirundapus caudacutus (White-throated needletail)	Migratory (A)	Aerial over forests, woodlands, farmlands, plains, lakes coasts and towns. Feeding frequently along favoured hilltops and timber ranges. Although not breeding in Australia, the migrate to eastern Australia between October and April (Pizzey and Knight 1999).	Suitable habitat occurs within the study area. Unlikely to occur within GUP corridor.
Monarcha melanopsis (Black-faced monarch)	Migratory (A)	Prefers wet sclerophyll forest; rainforest, open forest and mangrove forest but will utilise gardens. It nests on tree branches, generally 1-12 metres above the ground in se. Australia from August to April.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

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N(BCC) = Noteworthy animals – animals that are uncommon in Brisbane (Brisbane City Plan 2000).
E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

Species	Status	Habitat Association	Comment and Likely Occurrence
Monarcha trivirgatus (Spectacled monarch)	Migratory (A); S(BCC)	Understorey of mountain/lowland rainforests; thickly wooded gullies; waterside vegetation; mostly well below canopy. Summer breeding migrant to South East Queensland and north east NSW from September to May.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Myiagra cyanoleuca (Satin flycatcher)	Migratory (A); S(BCC)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, tree in open country and gardens. Summer breeding in south east Australia and winters in north east Queensland.	Some suitable habitat within the study area. May occur within GUP corridor.
Nettapus coromandelianus albipennis (Australian cotton pygmy-goose)	Migratory Wetland Species (A)	Deeper freshwater swamps, lagoons, dams with waterlilies and other semi emergent water plants mainly in eastern Queensland. Nesting sites are high in hollow tree near water with breeding November to April. Species is locally dispersive in dry season (Pizzey & Knight 1999).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Numenius madagascariensis (Eastern Curlew)	Rare (Q); Ja, Ca; S(BCC)	Estuaries, bays, inlets and coastal lagoons with large intertidal sand or mudflats (Marchant & Higgins 1993).	Suitable habitats occur within the study area and the species is likely to utilise habitats within and adjacent to the corridor, a recent study has recorded its presence in this area (Lambert and Rehbein 2004).
Rhipidura rufifrons (Rufous Fantail)	Migratory (A); S(BCC)	Undergrowth of rainforests/ wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub inland and coastal scrubs; mangroves, watercourses; parks and gardens. Breeding migrant to se Australia (Pizzey & Knight 1999).	Some suitable habitat within the study area. May occur within GUP corridor.

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S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
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Species	Status	Habitat Association	Comment and Likely Occurrence
Rostratula benghalensis s. lat. (painted snipe)	Vulnerable; Migratory Wetland Species; (Q)(A); S(BCC)	Terrestrial shallow freshwater (occasionally) brackish wetlands including lakes, swamps, claypans, saltmarsh and a variety of artificial wetlands.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Tringa stagnatillis (Marsh Sandpiper)	Migratory Wetland Species S(BCC)	Salt, brackish or freshwater wetlands; sewage ponds, commercial saltfields, mangroves, tidal mudflats, estuaries (Pizzey & Knight 1999).	Some suitable habitat within the study area. Occurs within GUP corridor (Lambert and Rehbein 2004).

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E(BCC) = Extinct animals – known or presumed to have occurred in Brisbane, but which are now strongly believed to be extinct.

All species of birds observed within the TCC site of the GUP corridor are listed as "common" under the *Nature Conservation (Wildlife) Regulation 1994*. One migratory species listed under the JAMBA/CAMBA agreements, the Marsh Sandpiper *(Tringa stagnitilis)* was also observed within the open water bodies. Other migratory species likely to use the open water bodies are Red-necked Stint *(Calidris ruficollis)*, Sharp-tailed sandpiper *(C. acuminata)*, Common greenshank *(Tringa nebularia)*, Great egret *(Ardea alba)*, Eastern curlew *(Numenius madagascariensis)*, Whimbrel *(Numenius phaeopus)*, Crested tern *(Sterna bergii)* and Caspian tern *(Sterna caspia)*. These were observed in an adjacent area in the study by Brett Lane & Associates 2003, however they were absent from the EPBC search.

Coastal areas support the White-bellied sea-eagle (*Haliaeetus leucogaster*), a nest of which is located in coastal trees about four kilometres from the proposed new Motorway near the mouth of the Kedron Brook floodplain. During the study, individual sea eagles were occasionally observed up to 2km upstream from Moreton Bay on the Kedron Brook floodplain. None were seen over the area to be affected by the proposed works (Brett Lane & Associates 2003).

Lambert & Rehbein (2003) has undertaken a Shorebird Assessment for the purpose of the EIS. Twelve species listed under CAMBA and/or JAMBA were recorded during surveys. Another species, the Spine-tailed swift (*Hirundapus caudactus*), was recorded as part of the surveying activities for the Brisbane Airport Fauna Study (Lambert & Rehbein 2004).

The rank grasslands and associated freshwater wetlands and sedge communities within the BAC land were found to contain the Lewin's Rail which is listed as "Rare" under the *Nature Conservation (Wildlife) Regulations 1994*. During the study by Lambert & Rehbein (2003) a number of significant species were noted within the Kedron Brook floodplain. Further suitable habitat was located between Kedron Brook Floodway and Landers Pocket Drain adjacent to the GUP corridor. Locations of known or probable Lewin's Rail habitat within and adjacent to the GUP corridor are shown in Figure 16.1d.

The Casuarina plantations within the BAC land provide nesting and foraging habitats for forest bird species with the highest biodiversity in areas with a thick understorey (Lambert & Rehbein 2004).

Within the open mown grasslands of the BAC land no specific survey was conducted. These areas as likely to contain fauna of very low conservational status and very low biodiversity made up of very common and/or introduced species with some bird species being attracted after mowing and are managed under airport operation procedures (Lambert & Rehbein 2004).

The mangrove/saltmarsh within the BAC land is an important habitat for various shorebirds for roosting and foraging including the Eastern Curlew, which is listed as "Rare" under the *Nature Conservation (Wildlife) Regulations 1994*.

The foreshore and associated areas within the BAC land was found to be of important conservational value. It is utilised by a large number (several thousand) of migratory wader birds with the majority of birds using this area subject to JAMBA and CAMBA status with the endangered Little Tern also using this foreshore area.

Eucalypt species on the Kedron Brook floodplain provide nesting for Dollar Birds which were also recorded nesting in a dead stag along with Red-rumped parrots within the vicinity of the northern end of the GUP corridor.

Other bird species considered Noteworthy in the BCC Natural Assets Planning Scheme observed within the BAC land (Lambert & Rehbein 2004). noted were:

- Pacific golden plover *(Pluvialis fulva)*;
- Collared fantail *(Rhipidura rufifrons)*;
- Mangrove honeyeater *(Lichenostomus fasciogularis)*; and
- Rufous fantail *(Rhipidura rufifrons)*.

"Significant" species not listed above in the BCC Natural Assets Planning Scheme noted by Lambert & Rehbein (2003a) were:

- Eastern long-necked turtle *(Chelodina longicollis)*;
- Chestnut teal *(Anas castanea)*;
- Osprey *(Pandion haliaetus)*;
- White-bellied sea-eagle *(Haliaeetus leucogaster)*;
- Swamp harrier *(Circus approximains)*;
- King quail *(Coturnix chinensis)*;
- Grass owl *(Tyto capensis)*;
- Speckled warbler *(Chthonicola sagittata)*; and
- Striated thornbill *(Acanthiza lineata)*.

Mammals

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened mammal species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained. Table 16.20 gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.20 Summary of Significant Mammal Species that may occur within GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Chalinolobus dwyeri (Large-eared pied bat)	Vulnerable (A) Rare (Q)	Variety of habitats including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves (Churchill 1998).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Dasyurus maculatus maculatus (SE Mainland Population) (Spotted tailed quoll)	Endangered (Q) (A); E(BCC)	Range of forest communities including wet and dry sclerophyll forests and rainforests (Mansergh 1984) Maternal den sites are logs with cryptic entrances; rock outcrops; windrows and burrows (Environment Australia 2000).	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Potorous tridactylus tridactylus (Long-nosed potoroo)	Vulnerable (Q) (A); S(BCC)	Habitat is usually coastal heath or wet eucalypt forest. Requires thick ground cover and numbers seem to be concentrated in areas that have light, sandy soil. Usually restricted to those areas that have an annual rainfall of not less than 760mm.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

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Species	Status	Habitat Association	Comment and Likely Occurrence
Pteropus poliocephalus (Grey-headed flying-fox)	Vulnerable (A)	Wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Eby 1998). This species feeds opportunistically on blossoms of various native and exotic trees including figs. They range throughout Brisbane City from their daytime camps often in mangrove forests. The closest camps are at Indooroopilly Island, and the intersection of Port of Brisbane Motorway and Bulimba Creek.	Suitable habitat occurs within and close to the GUP corridor.

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Within the TCC site of the GUP corridor two mammal species were observed. They were the introduced, Brown Hare *(Lepus capensis)* from scats and the native Northern Brown Bandicoot *(Isoodon macrourus)* from conical diggings and a footprint.

Feral Pig (*Sus scrofa*) and Fox (*Vulpes vulpes*) are known to utilise the BAC land (Clarke pers comm).

It is likely that the Grey-headed Flying Fox (*Pteropus poliocephalus*), which is listed as "Vulnerable" under the EPBC Act (Commonwealth of Australia) is likely to feed within the area. However no camps are known within the immediate area.

The rank grasslands and associated freshwater wetlands and sedge communities within BAC land were found to contain fauna assemblages of relatively high conservation value including mammals.

The casuarina plantations within the BAC land are of low biodiversity and contain fauna of relatively low conservation value. Microchiropteran bats were found to use the casuarina plantations but introduced mammals dominated on the ground.

Mammals using the mangroves/saltmarsh communities are mainly introduced species however Brush-tail possums, Flying foxes and Microchiropteran bats were recorded using these areas.

Amphibians and Reptiles

An EPBC Act Protected Matters Report was obtained for this section of the GUP corridor and one kilometre either side of it from Environment Australia's website, to assess the occurrence or likely occurrence of nationally threatened amphibian and reptile species pursuant to the EPBC Act. In addition the WildNet Data Extract for this area was also obtained.

Table 16.21 gives the threatened or locally significant species that were listed, their status, their preferred habitat and the likelihood that they use the GUP corridor or nearby habitats.

Table 16.21 Summary of Significant Amphibian and Reptile Species that may occur within the GUP Corridor

Species	Status	Habitat Association	Comment and Likely Occurrence
Mixophyes iteratus (Southern barred frog)	Endangered (Q) (A)	Terrestrial inhabitants of rainforests, Antarctic Beech or wet sclerophyll forests, feeding on insects and smaller frogs.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.
Coeranoscincus reticulatus (Three-toed snake-tooth skink)	Vulnerable (Q) (A)	Rainforests and adjacent wet sclerophyll forests, where it is usually found in rotting logs or in soil under fallen timber.	Lack of suitable habitat within the study area. Unlikely to occur within GUP corridor.

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S(BCC) = Significant animals – animals that are rare in Brisbane, or animals that are uncommon, in Brisbane and are becoming rare (Brisbane City Plan 2000).
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Within the TCC site of the GUP corridor no species of reptile were positively identified during the EIS study, but Red-bellied Black Snake *(Pseudechis porphyriacus)*, a species considered Noteworthy in the BCC Natural Assets Planning Scheme is likely to be found in this section.

The only amphibian observed within the TCC site of the GUP corridor was the common and widespread Striped Marsh Frog *(Limnodynastes peronii)*. The introduced Cane Toad *(Bufo marinus)* is also likely to utilise this section of the GUP corridor.

None of the species observed or likely to use the area are listed as Endangered, Vulnerable or Rare under the *Nature Conservation (Wildlife) Regulation 1994*.

The rank grasslands and associated freshwater wetlands and sedge communities within the BAC land were found to contain fauna assemblages of relatively high conservation value including amphibians and reptiles.

Reptiles and common amphibian species were found to use plantations within the Casuarina plantations within the BAC land.

In the mangrove/saltmarsh within the BAC land reptiles and amphibians were found with the Striped Rocketfrog, Cane Toad and the skink, *Eulamprus tenuis*, being recorded.

Red-bellied black snake *(Pseudechis porphyriacus)* a species considered Noteworthy in the BCC Natural Assets Planning Scheme was observed within the BAC land (Lambert & Rehbein 2004).

During the EIS study a Blue-tongued Skink (*Tiliqua scincoides*) was observed crossing a vehicle track in the grassland east of the Kedron Brook floodplain.

16.4.4 Potential Impacts

An area identified as core Lewin's rail habitat is outside the GUP corridor. The proposed Motorway will result in some minor disturbance to the Lewin's Rail habitat but the area affected is small and will not result in any significant habitat loss for this species.

The hydraulic connection between the bridge sites along the Kedron Brook floodplain, and Moreton Bay, is the primary pathway by which impacts might be propagated. The three potential concerns in this regard are:

- Changes in water flows to the wetlands due to changes in the floodplain from construction works;
- The potential generation of acid, toxic runoff from aerially exposed acid sulphate soils; and
- The delivery of sediment and pollutants from the new roads to these two principal waterways and, therefore, to the downstream bay wetlands.

Evaluation of the impacts of the GUP against the Administrative Guidelines on Significance under the EPBC Act is presented in Table 16.22.

Table 16.22 Evaluation of the Impact of the GUP and Bridge (north from the Brisbane River) against the Administrative Guidelines on Significance under the EPBC Act for Ramsar Wetlands

Guideline	Evaluation
Ramsar Wetlands	
Areas of the wetland being destroyed or substantially modified	No area of Ramsar wetland will be destroyed or modified by the proposal as the project does not lie within the wetland. Furthermore, the indirect impacts have been determined as being unlikely to lead to such change.
Substantial and measurable change in the hydrological regime	The hydraulic and hydrological impacts of the proposal on flows down local tributaries to the nearby Ramsar wetland areas are not considered to be significant.
Effect on the habitat or life-cycle of a wetland-dependent native species	As no significant physical or other ecological changes are anticipated to the Ramsar wetlands, and given the significant distance between works areas, neither indirect (eg pollution) nor direct (eg disturbance) disturbance is expected to wetland-dependent native species.
Change in the physico-chemical status of the wetland	In view of the distances and dilution factors involved, and that appropriate and effective mitigation measures will be implemented during design, construction and operation, the physical impacts to the Moreton Bay Ramsar wetlands from the GUP are likely to be minimal.
Establishment of invasive species	The proposed works areas are well away from the Ramsar wetlands of Moreton Bay and the risk of invasion of exotic species is considered to be low. In addition, weed prevention and management protocols, together with a high standard of revegetation of affected areas will be important components of the design and construction of the GUP.
Listed Migratory Birds	
Modify, destroy or isolate important habitat	The areas of habitat for migratory species along the GUP corridor are not extensive or well integrated with larger habitat further downstream in Moreton Bay. Recent survey work for the BAC indicates that the numbers of listed migratory species that visit the small areas of affected wetlands within the GUP corridor are minor compared with the tens of thousands that use Moreton Bay proper.
Invasive species	Weed prevention and management protocols, together with a high standard of revegetation of affected areas will be important components of the design and construction of the GUP. Therefore, habitat for listed migratory species is unlikely to be affected by invasive species.

Guideline	Evaluation
Seriously disrupt the life cycle of an ecologically significant proportion of the population	The number of individuals of listed migratory species that visit the small areas of affected wetlands within the GUP corridor are minor compared with the tens of thousands that use Moreton Bay proper. An ecologically significant proportion of the population of Moreton Bay's listed migratory species will not be affected. The nearby White-bellied Sea-eagles breed well away (up to 4km) from the proposed works area and have not been regularly recorded in it. They are therefore unlikely to be significantly disturbed by the proposed works.

Significant Mammals

The movement of Grey-headed Flying foxes is unlikely to be affected by the works proposed in this section of the GUP. The area of potential foraging habitat (primarily mangroves) likely to be removed is likely to be minor significance in comparison with suitable areas available outside the project corridor. Any impact is likely to be short term given that it is proposed to plant suitable forage species as part of the amenity landscaping associated with the GUP.

Common Fauna

Traffic noise and the visual disturbance by the movement and headlights of vehicles as well as the associated pollutants may cause some species of fauna to avoid roads and add to their affects as barriers once they are constructed (AMBS January 2001). Construction noise is also likely to be a short term impact.

Importing RIFA during construction phase could have a significant long term effect on terrestrial fauna in the vicinity of the GUP corridor due to their aggressive nature and their painful sting.

To minimise the potential impact of the project on native fauna species that utilise the fauna habitat, mitigation measures will be implemented as outlined in Section 16.2.5 and the EMP.

16.4.5 Mitigation Measures

Design

- Minimise the loss or disturbance of estuarine or freshwater wetland vegetation.
- Minimise habitat loss for migratory birds especially the Lewin's Rail habitat.
- Drainage design to continue the function of Kedron Brook Floodway and other tidal channels as ecological corridors and low tide feeding areas for waders.
- Retain existing rank grassland/freshwater wetland corridor potential also the eastern edge of Kedron Brook Floodway.
- Bridge designs using minimal footprints could conceivably accommodate this corridor on their approach (from the east) to Kedron Brook Floodway.
- Disturbance to the habitat on the southern side of the Kedron Brook floodplain should be minimised and allowed to regenerate once construction is completed.
- Sufficient distance should be maintained from the active White-bellied sea eagle nest (located outside GUP corridor just offsite on BAC land) and the Motorway and associated works.

- Bridges over Kedron Brook Floodway should contain a minimum footprint design, and the supporting piers should stand a sufficient distance from the banks to ensure that mangrove communities can survive or establish beneath or immediately adjacent to the bridge. Bridges should run perpendicular to channel direction in order to maintain the shortest possible span within the above constraints. Using a minimal footprint design (eg pylons) would also be advantageous in terms of minimising alteration to stream flows, particularly during flood events.

Construction

- During bridge construction, disturbance to mangroves should be kept to a minimum. Mangroves have important ecological functions as nursery grounds for fish, biofiltration beds and as providers of organic detritus to marine ecosystems. In the context of Kedron Brook Floodway, they also provide visual barriers for waders feeding at lowtide, helping reduce disturbance from human activities on the banks.

- Flagging tape, barricade webbing or similar highly visible markers shall be used to define the limits of clearing. Clearing in this area shall be restricted to 3m beyond the toe of the batter or cut, excepting areas required for erosion and sediment control.

- Trees with trunks outside the 3m line adjoining the edge of works site shall be trimmed (branch lopping) by sawing rather than felled where branches may interfere with the works or future traffic safety.

- Selective clearing and trimming only shall be undertaken in the area for topsoil and mulch stockpiling. A visual observation of this area should be undertaken prior to clearing and an assessment made by the Construction Contractor regarding the removal of individual trees and shrubs to allow a suitable area for stockpiling.

- Small trees and shrubs shall be removed in preference to large trees in this area and shall be felled to ground level with roots left in the ground. Vegetation to be removed shall be clearly marked by paint or flagging.

- Streetscape vegetation removal shall be limited to the removal of trunks within the works area and trimming of limbs overhanging the work area.

- Streetscape vegetation shall be inspected by the Construction Contractor prior to trimming and a determination of vegetation to be cleared or trimmed shall be made.

- Vegetation to be removed shall be clearly marked with paint or flagging tape prior to clearing.

- Riparian vegetation (vegetation along the edge of Bulimba Creek) removal shall be minimised to the smallest clearance area to undertake the bridge works and install the temporary bridge.

- Where practical, removal shall be limited to pruning branches or where the trunk is felled, leaving the root mass in place.

- A weekly inspection for weeds within and adjoining the works site shall be undertaken by an appropriately skilled officer.

- Where weeds are detected within the work site, the weeds shall be removed or destroyed. Herbicides shall not be used within 20m of the banks of watercourses and drainage lines.

- Revegetation of disturbed soil areas such as batters, inlets and outlets of drainage structures and street landscaping areas, shall be revegetated as soon as practical (but not more that 4 weeks) after completion of earthworks final trim or associated works. Revegetation shall be either through seeding, hydro mulching, or direct planting.

- Revegetation works shall be maintained (watered etc) to ensure establishment.

- During vegetation clearing, an appropriately skilled "spotter and catcher" shall be engaged to visually check for any fauna present in trees or other vegetation. Fauna shall be either persuaded by reasonable means to leave or be captured and relocated in the local environment prior to felling or trimming.

- Site works, such as trenches and culverts, shall be checked each morning and after periods of inactivity, to ensure fauna are not trapped or likely to be harmed by construction activities.

- All native fauna is protected (including snakes) and shall not be intentionally harmed as a result of the works or worker actions.

16.5 Conclusions

The southern section of the GUP between CH5100 and 15000 has large areas of remnant bushland adjacent to the corridor. However, only minor areas of remnant vegetation are likely to be affected by the proposed GUP in this section. The GUP is also unlikely to impact on significant flora within this area.

There are a number of species of significant fauna (eg koala macropods and gliders) which occupy these areas and whose movements may be affected by the proposed GUP. However, provided appropriate measures are implemented these impacts should be minimised.

The middle section of the GUP corridor between CH15000 and 19100 is generally disturbed with few areas of remnant vegetation. The major impact to the terrestrial flora in this section is likely to be removal of existing amenity landscaping between the new Port of Brisbane Motorway (CH15500) and the Brisbane River (CH16900). This is likely to be reinstated once works are completed. Impacts on the Grey-headed Flying fox and Swift Parrot which may use resources within the GUP corridor are expected to be minimal.

The construction of the northern section of the GUP CH19100 to 24800 will result in the removal of some more substantial areas of terrestrial vegetation. Given that the bulk of this is Casuarina plantation with low faunal diversity the likely long term impacts are unlikely to be significant to local or nationally significant fauna. Providing that the measures recommended within the EMP are implemented there should be no short or long term effects to the Ramsar wetlands of Moreton Bay or the migratory birds that utilise these areas.

The provision of extra lighting along the Gateway Motorway should not significantly increase the effects being experienced by fauna from the existing lighting. However, there is evidence that artificial light does have effects on fauna active at night. A study in Scandinavia (Rydell and Baagoe 1996) found that mercury vapour street lights provided important feeding habitats for several species of micro-bat attracted by the moths and other insects. However, it was found that sodium lamps did not attract insects to the same extent. The potential negative effects of lighting can be mitigated by adopting lighting design criteria minimises attraction to insects, whilst addressing the safety needs of Motorway users.

Overall the GUP is not likely to have significant short or long term effects on terrestrial flora or fauna within the region.