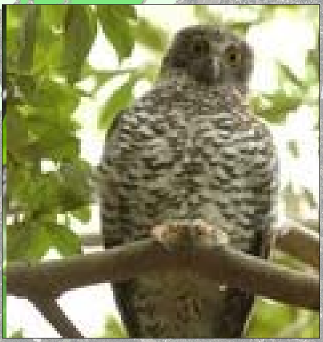
Flinders to Greenbank - Karawatha Corridor: Part A



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EXECUTIVE SUMMARY

The Flinders to Greenbank – Karawatha Ecological Corridor (FGK Corridor) is a 40km corridor that extends from just south of the City of Ipswich at Flinders Peak, to Karawatha Forest in Brisbane's outer suburbs. The corridor crosses the four local government boundaries of Ipswich City Council, Logan City Council, Scenic Rim Regional Council and Brisbane City Council.

Chenoweth EPLA has been contracted to provide an assessment of the FGK Corridor with a view to identifying the major threats to the ongoing ecological integrity of the Corridor, and any priority actions to prevent any further degradation.

To achieve this aim the project shall consist of three separate studies:

A. General corridor information and ecological theory;
B. Locating pinch points in existing corridor link; and
C. Identifying any properties of significance, supported by an overall review of the corridor and its critical 'pathways'.

This document was produced to address Part A of the project and to provide a desktop review of the proposed FGK Corridor. To achieve this aim Chenoweth EPLA undertook the following steps:

- Provided an overview of ecological corridor design and theory;
- Generated a consolidated species list, based on readily available database searches, of previously identified fauna species within the corridor;
- Determined the movement requirements for identified fauna species and thereby the minimum corridor width requirements in order to facilitate their movement;
- Examined the corridor based upon contemporary spatial data and mapping to determine corridor characteristics, with a view to identify particular fauna populations that may be impacted by the narrowing and / or degradation of the corridor;
- Identified areas of the corridor where width and / or permeability has been reduced and therefore inhibits the movement of fauna species.

A review of the Birdata Atlas, DERM's Wildnet Database, and the Queensland Herbarium's HERBRECS databases revealed some 493 fauna species previously recorded in the FGK Corridor, along with a number of plant species.

A literature review was undertaken to gain an insight into the dispersive patterns of identified fauna species and it was found that there was considerable variation in fauna habitat requirements, home range sizes, and individual ability for dispersion through a landscape matrix. The literature review also revealed that ecological corridors at the

regional scale have been recommended to have minimum width of 300-500 metres (DECC, 2004; Bond, 2003; Bennett, 2003, Jevons, 2000). While Recher, (1987) recommends that corridors should have a minimum width of 250m in order to fully facilitate the movement of a broad suite of fauna species.

With this in mind fauna species were broadly grouped based upon their dispersing capabilities and a decision hierarchy established in assessing the permeability of the FGK Corridor.

Analysis of the FGK Corridor identified a Core Corridor where relatively continuous remnant vegetation provides habitat and movement opportunities to a diversity of wildlife. This Core Corridor is compromised in 12 locations where the minimum width has been reduced. To ensure the overall functionality of the FGK Corridor is not further undermined it will be necessary to ensure these Narrowings are not further compromised. To enhance the overall functionality of the FGK Corridor the following should be considered at each location:

- Expand the width of vegetation to at least 350m;
- Manage existing remnant vegetation to ensure it is not further degraded by weeds, inappropriate fire regimes, rubbish dumping or illegal access;
- Facilitate the maturation of regrowth vegetation to remnant vegetation (this will be further addressed in Part C of this study);
- As a priority, mitigate the impact of linear barriers that are present in these locations (this will be further addressed in Part B of this study); and
- Where feasible undertake on ground fauna studies to confirm the findings of this desktop analysis.

ACRONYMS USED IN REPORT

BAMM – Biodiversity Assessment Mapping Methodology
CEPLA – Chenoweth Environmental Planning and Landscape Architecture
DERM – Department of Environment and Resource Management
DIP – Department of Infrastructure and Planning
EPA – Environmental Protection Agency
FGK – Flinders to Greenbank – Karawatha
HERBRECS – Queensland Herbarium's Record System
MOU – Memoradum of Understanding
SEQ – South East Queensland

1. BACKGROUND

1.1 CORRIDORS – A SEQ PERSPECTIVE

Broadly the value of retaining and enhancing environmental corridors has long been acknowledged. In SEQ the importance of corridors is recognised in a number of statutory and non statutory documents. The SEQ Regional plan acknowledges that habitat fragmentation is a cause of major concern for the region. Specifically it notes "*Habitat areas have been extensively fragmented through past development*" and "*Continued clearing and fragmentation of natural areas and further degradation of natural environmental processes will adversely affect the region's biodiversity, resilience to climate change, air and water quality, agriculture, economic potential and public health. Unless prevented, managed or reversed, these factors will continue to threaten regional sustainability*." The plan strives to address the maintenance of habitat connectivity through 2 targeted policies:

> 2.1.5 Within biodiversity networks, protect significant biodiversity values, improve ecological connectivity, enhance habitat extent and condition, and rehabilitate degraded areas.
> 2.1.6 Optimise biodiversity conservation outcomes by locating environmental and carbon offsets within identified biodiversity networks and other suitable areas, giving a high priority to the protection or rehabilitation of significant biodiversity values.

The SEQ NRM Plan includes the Nature Conservation Target "*Vegetation fragmentation and connectivity*" acknowledging that *"Large areas of vegetation (greater than 5000 ha) provide significant areas of habitat. Vegetated corridors between tracts may provide opportunities for gene flow and animal movement that can increase plant and animal population viability. Bushland that is well connected provides a habitat network that has greater resilience to the effects of disturbance, including climate change, than small, isolated areas of bushland. Large numbers of smaller but significant areas of bushland are spread across the landscape; activity to connect them to the larger tracts and with each other will enhance corridor networks in SEQ*".

1.2 THE FLINDERS TO GREENBANK - KARAWATHA ECOLOGICAL CORRIDOR

The Flinders to Greenbank - Karawatha Ecological Corridor is recognised as one of the region's most significant ecological corridors, providing movement opportunities for a range of species that are locally and regionally significant.

The Department of Environment and Resource Management utilises the Biodiversity Assessment and Mapping Methodology (BAMM) to generate Biodiversity Planning Assessments (BPAs) for each of Queensland's bioregions to advise on a range of planning or decision making processes. The BAMM is applied in two stages, with the first utilising existing data to assess ecological concepts such as rarity, diversity, fragmentation, habitat condition, resilience, threats, and ecosystem processes in a uniform and reliable way across a bioregion. The second stage uses expert knowledge to identify features such as wildlife corridors and areas with special biodiversity value (eg centres of endemism or wildlife refugia), and includes data that may not be available uniformly across the bioregion. The Southeast Queensland South Landscape Expert Panel Report (2006) identified "Mt Barney to Karawatha Terrestrial Corridor" as of State Significance. The corridor is described as follows:

"Mt Barney to Karawatha Terrestrial Corridor: *Extends from Mount Barney National Park to Flinders Peak to Karawatha (via Knapp Creek, Flinders Peak and Mount Perry Conservation Parks).*

- links a major east-west State terrestrial corridor in the south, 47, to four Regional terrestrial corridors in the North;
- intersects with riparian corridors;
- incorporates altitudinal and climatic gradients;
- connects large fragmented patches of lowland remnant vegetation to remnant at higher elevations at the Southern end point of the corridor;
- links EPA Estates"

This study focuses on the northern portion of this corridor (see **Figure 1**).

In 2006 a Memorandum of Understanding (MOU) was endorsed by the mayors of Brisbane, Ipswich and (the former) Beaudesert Shires, the Regional Manager of the Commonwealth Department of Defence and the Queensland Minister for the Environment with the aim of developing a framework for the co-ordinated management of the Corridor. Other parties to the MOU include the Oxley Creek Catchment Association and SEQ Catchments.

The FGK Corridor extends for 40km from Flinders Peak, to the south of the city of Ipswich, to Karawatha Forest on Brisbane's outer suburbs, encompassing the Greenbank Military Reserve. In recognition of its significance the FGK Corridor has been explicitly identified in the South East Queensland Regional Plan 2009 – 2031 as a multiple value landscape corridor (DIP 2009). The Corridor includes critical habitats including rocky hills, wetlands, and eucalypt forests that are home to threatened species such as the

Wallum Froglet (*Crinia tinnula*), Powerful Owl (*Ninox strenua*), and the Brush Tailed Rock Wallaby (*Petrogale penicillata*).

Despite the recognition afforded to the FGK Corridor ongoing pressures continue to degrade its ecological integrity and function.

This study aims to provide an assessment of the Flinders to Greenbank – Karawtha Ecological Corridor (FGK Corridor) with a view to identifying the major threats to the ongoing ecological integrity of the FGK Corridor, and priority actions to prevent any further degradation of the Corridor.

To achieve this aim the project consists of three separate reports:

A. General corridor information and ecological theory;
B. Pinch points in existing corridor link; and
C. Identifying any properties of significance.

1.3 PURPOSE OF DOCUMENT

The purpose of this document is to address Part A of the project by providing an assessment of the minimum corridor requirements of species known from within the corridor in order to facilitate their unimpeded movement throughout the landscape.

To achieve this purpose this document:

- Provides an overview of ecological corridor design and theory;
- Provides a consolidated species list, based on readily available database searches, of previously identified fauna species within the corridor;
- Determines the movement requirements for identified fauna species and thereby the minimum corridor width requirements in order to facilitate their movement;
- Provides an examination of the corridor based upon contemporary spatial data and mapping to determine corridor characteristics, with a view to identify particular fauna populations that may be impacted by the narrowing and / or degradation of the corridor; and
- Identifies any areas of the corridor where width and / or permeability has been reduced and therefore inhibits the movement of fauna species.

2. CORRIDORS EXISTING KNOWLEDGE

2.1 OVERVIEW

Forest dependent species are sensitive to habitat loss and fragmentation due to specific habitat requirements, dispersal requirements and inability or reluctance to cross certain landscapes (e.g. urban matrix).

Lindenmayer and Fischer (2006) outline 5 strategies for managing landscapes aimed to conserve biodiversity:

1. Maintain and/or restore large and structurally complex patches of native vegetation;
2. Maintain and/or restore a matrix that is structurally similar to native vegetation;
3. Maintain and/or restore buffers around sensitive areas;
4. Maintain and/or restore corridors and stepping stones; and
5. Maintain and/or restore landscape heterogeneity and capture environmental gradients.

Corridors as per statement 5 of the above hierarchy are frequently recommended as a way to halt or reverse decline of species isolated in habitat patches. There is an increasing body of evidence to suggest that corridors can have the desired outcome, however predicting the likelihood of a particular corridor to achieve success is difficult due to variation in landscape permeability across different landscape elements (Driscoll, 2004). Habitat patches are rarely a spatially isolated unit as other kinds of vegetation cover (e.g. patches of remnant vegetation, scattered trees in a paddock, woody debris) often occurs in the surrounding landscape (Cunningham *et al.*, 2007). The degree of 'permeability' in the surrounding landscape can significantly affect the patterns of species richness and presence and abundance of individual species (Cunningham *et al.*, 2007). Areas of habitat may occur with a 'hard edge' (e.g. major highways) or a softer 'low contrast edge' (e.g. minor roads with vegetation either side). Because there are different degrees of hard and soft edges on a habitat patch, different species may persist and or move through fragmented landscapes depending upon and individual's ability to cross such barriers (Brearley *et al*, 2010).

Functionality of the corridor is also an important consideration. Functional connectivity depends on the behaviour and movement of the target species and is specific to that species and to the landscape. Fragmentation by urban infrastructure has the potential to completely functionally disconnect patches from nearby occupied areas (FitzGibbon *et al*, 2007). Corridor width appears as a factor affecting dispersal success of a range of small and large animals (Seiving *et al.*, 2000). If corridors are too narrow through a hostile matrix, animals may then be reluctant to enter (Seiving *et al.*, 2000).

Downes *et al* (1997) found that the number of Australian mammals utilising corridors that were distant to forest patches was less compared to the number of mammals using corridors close to forest and forest patches. This may be explained by energy expenditure relative to home range in linear habitats versus continuous habitats. Van der Ree and Bennett (2003) identified that animals occupying linear habitats travel a greater distance relative to home range size than those in continuous habitats for the purpose of territory defence and foraging (Tubelis *et al.,* 2007). They speculated that small patches of trees adjacent to linear corridors may allow individuals to reduce home range length.

Studies have indicated that animals are likely to disappear from patches that are smaller than their single home range size (Lindenmayer *et al.,* 1999). However, smaller patches should not be automatically disregarded and/or cleared. Small remnants, particularly within a matrix of marginal habitat, may be important as stepping stones to larger patches or valuable to other groups (plants and invertebrates) (Lindenmayer *et al*, 2000; Tubelis *et al.,* 2004; Soule *et al*., 2004). In Australia, where the entire continent is subject to highly variable climatic events, large areas of interconnected patches are important to a range of species and the loss of any particular patch or stepping stone may affect the whole system in way that is disproportional to the loss of this habitat alone (Soule *et al.*, 2004).

2.2 BEST PRACTICE CORRIDOR STRUCTURE FOR MULTIPLE SPECIES

In effect, all vegetation including remnant, non-remnant and scattered trees facilitate the movement of fauna between broader areas of integral habitat. The movement of fauna within this matrix is limited by the integrity of vegetation in addition to the presence of impassable barriers including urban development and linear infrastructure such as fences and roads.

The identification of discrete corridors within this matrix is necessary to protect ecological values and functions that are important at a regional scale including (EPA, 2002):

- The maintenance of long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;
- The maintenance of landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;
- The maintenance of large scale seasonal/migratory species processes and movement of fauna; and
- Maximising connectivity between large tracts/patches of remnant vegetation.

At a local scale, corridors are important for the day to day movement of fauna in the search for food, mates, nesting opportunities and dispersal.

Species differ in their requirements for habitat within corridors (Lindenmayer & Nix, 1993), connectivity between habitat patches (Lone & Hobbs, 1991) and their tolerance of severance and barriers. Birds and other highly mobile species may move across a mosaic of disturbed and natural landscape, but may need specific habitat and resources at regular spacing ('stepping stones'); while small shy understorey mammals may find even a powerline easement an impassable obstacle. Edge effects, such as predation or displacement of woodland birds by more aggressive edge-dwellers, can extend the width of an apparently narrow break such that it becomes a wide gap in useable habitat; whereas a relatively simple link such as a culvert can provide an effective link beneath a highway for some species.

A frequently asked question is; how wide should a corridor be? Unfortunately the scientific literature currently does not provide a concise answer to this question. Variables such as vegetation type, species assemblages (both existing and desired), vegetation condition, whether vegetation is planted or remnant, the nature of adjoining land uses and the condition of the ground layer (e.g. are there logs and leaf litter) are some of the factors that affect the actual use of corridors. However it is clearly understood that there is a positive relationship between corridor width and animal use (Tubelis *et al*., 2007 and Sieving *et al.*, 2000). Corridors that will allow regional scale movement for a diversity of wildlife; to provide connectivity over longer periods of time for entire populations or sub-populations; and to support viable communities of species within the corridor itself need to be at least 300-500 metres at a minimum (DECC, 2004; Bond, 2003; Bennett, 2003).

In order to cater for the movement of the greatest diversity of wildlife it is broadly accepted that wide corridors of integral vegetation are mandatory (Chenoweth EPLA, 2003). Wide corridors are also valuable in areas where adjacent incompatible land uses continually degrade edges. A study of fauna corridors in Eden, New South Wales (Recher, 1987) found the following:

- Corridors of 250m width retained a complete suite of bird species; and
- Corridors of >100m width retained the full suite of arboreal mammals apart from the Yellow bellied glider, which was only recorded in the widest (250m) corridor.

Recher's (1987) study took place in native forest buffered by pine plantations. In the absence of this buffering capacity, additional buffers are required to reduce edge effects. Murcia (1995) found that most abiotic and direct biological edge effects extend 0-50m into bushland. Therefore, vegetated buffers of 50m width from the outside edge of existing vegetation are desirable in addition to the corridor width. Therefore, a buffered 250m wide corridor would be 350m in width.

The principles of conservation biology and landscape ecology indicate that broad corridor bands of interconnected habitat are required to allow regional scale movement for a diversity of wildlife; to provide connectivity over longer periods of time for entire populations or sub-populations; and to support viable communities of species within the corridor itself (Hess and Fischer, 2001; Morrison and Boyce, 2008). Recognising width and buffer requirements, corridors at the regional scale have been recommended to encompass a width of 300-500 metres at a minimum (DECC, 2004; Bond, 2003; Bennett, 2003, Jevons, 2000). On this basis, best practice indicates that regional scale corridors should be 500m in width.

Given the above we should consider the following in relation to the FGK Corridor:

- Corridors of 250m width are likely to allow passage for the most forest wildlife;
- Corridors of 350m are likely to be well buffered and thus serve as robust corridors in the long term; and
- Corridors of 500m wide are considered to be the minimum necessary for 'regional scale' connectivity.

Clearly for planning purposes regional scale corridors should be 500m in width. However, in terms of functionality corridors as little as 350m in width would allow adequate passage of wildlife. Corridors less than 250m in width are likely to compromise the passage of some wildlife. However, corridors less than 250m in width or fragmented vegetation should not be discounted as *all* vegetation plays a role in providing habitat and facilitating the movement of at least some wildlife. For this reason the principles identified in Table 1 below should also be considered when planning corridors.

Table 1: Descriptions and illustrations of corridor considerations

Recognizing the current/future value of cleared areas

The identification of areas supporting high value biophysical attributes is an important first step to prioritize significant habitat contributing to the corridor core. However, some areas that are degraded (e.g. with Camphor laurel) or devoid of vegetation may be located in critical points along the corridor that provide continuity in corridor habitat. It is therefore important to recognize and map these areas so as to ensure the 'gate is not closed' on the future capacity to restore an unimpeded corridor.

Further, cleared areas between isolated patches may not pose a gap for some species (e.g. koalas in some rural areas) and the incorporation of intermediate landscapes in a corridor may be valid. Therefore the maintenance of these areas free of development maybe sufficient to retain some level of connectivity.

Recognizing the potential value of isolated patches, or 'stepping stones'

The notion that corridors are linear features in the landscape needs to be carefully considered. Isolated patches may also be important to the overall viability of habitat provided within a corridor. For instance, isolated patches may form highly significant 'stepping stones' within the corridor for altitudinal migrants or raptors.

Recognizing the value of rehabilitation in beneficial locations

Linking some isolated patches to broader habitat areas may improve the overall viability of these patches and in turn improve the overall functionality of the corridor. The retention and restoration of intermediate areas may therefore be an important component of the corridor network. This does not necessarily imply that each patch would need be linked by broad (300-500m) wide corridors as in some instances a far narrower linkage may suffice (e.g. the viability of some glider metapopulations could be improved by re-instating narrow links between patches).

Recognizing fauna movement barriers and the importance of barrier mitigation techniques

Management of fauna corridors within a disturbed setting must consider the multitude of physical barriers present within a developed environment. Such physical barriers may impact upon landscape integrity (such as nutrient cycling), reduce fauna movement permeability and, as a consequence, reduce biodiversity (Bissonette, 2009). Barriers include:

- *Natural watercourses* - This however is not a major threat with most fauna capable of crossing most urban streams;
- *Fences* - Generally small wire strand fences represent little barrier to large vertebrates, whereas tall (2m) chain wire fences and timber fences represent a problem. Small impenetrable fences such as concrete barriers along roadways are a significant obstacle to all ground dwelling fauna; and
- *Linear infrastructure* – These types of infrastructure create significant gaps that may adversely affect fauna and include Roadways, Rail lines; and Utility corridors.

Major physical barriers, such as highways, may require significant investment to mitigate the barrier such as land bridges, fauna underpasses and other engineered solutions. Research has demonstrated that many species will use crossing structures (Van der Ree, 2009, Van der Grift, 2009).

The most appropriate location for crossing structures may not align with the existing extent of mapped vegetation.

3. KNOWN WILDLIFE OF THE FGK CORRIDOR

3.1 DATABASE SEARCHES

Database searches collate information on flora and fauna species identified in the region from previous surveys, community records and other sources. A review of these databases facilitates the formulation of specific field survey and /or management techniques to target known wildlife. Database searches undertaken for the FGK Corridor include the Birdata Atlas, DERM's Wildnet Database, and the Queensland Herbarium's HERBRECS search by using the mapped extend of the Corridor to 'capture' records.

To complement information attained from these databases a number of key stakeholders who maintain records for the corridor were also consulted, specifically:

- The Karawatha Protection Society
- Birds Australia (SEQ Branch)
- The Oxley Creek Catchment Association
- Quoll Spotters Network.

Although the latter had not undertaken any work in the study area per se, it had undertaken an extensive study in the area extending from New Beith through to Park Ridge (Burnett and Whyte, 2006). The study recorded a number of quoll sightings in areas to the immediate east of Spring Mountain, which is continuous with the wooded environments of the FGK Corridor.

The results of these database searches revealed that 493 fauna species are known from the area covered by the FGK Corridor (Appendix A). HERBRECS confirmed the presence of 511 native species of plant for the corridor. This confirms a strong diversity with the corridor and the presence of plant species that rely on fauna to pollinate and/or move their seeds through their reproductive material. For example, *Corybas aconitiflorus*, which occurs in the corridor, is likely to be pollinated by small gnats (Benson & McDougal, 2005). It is considered that habitat fragmentation and lack of connectivity may cause the decline in populations of such pollinators (Bickerton & Robertson, 2000).

3.2 HABITAT AND MOVEMENT REQUIREMENTS FOR CORRIDOR FAUNA

Given the widely diverse nature of the identified species, where possible similar species have been grouped together in terms of their habitat and dispersal requirement for ease of comparison. Here, the term 'dispersal requirements' captures the characteristic of corridors (e.g. width) necessary to facilitate fauna movement. The result of this process is outlined below in Table 2.

Table 2: Identified Fauna Species Previously Recorded in the FGK Corridor Area.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
Flight	Seasonal Migrants (pitta, honeyeaters, flycatchers	Bentley and Catterall (1997) study encompassed corridors and linear remnants. Corridor width was between 20m and 350 m; linear remnant width was between 50m and 350 m, with no more than a 50m break between remnants. The majority of both corridors and linear remnants were between 50–250 m wide.	Species that migrate to SEQ were found to use corridors and linear remnants much more than species that were resident (Bentley and Catterall, 1997). Species tended to be most abundant in either riparian bushland or riparian corridors in urban areas (Bentley and Catterall, 1997).	Bentley, J.M. and Catterall, C.P., 1997, *The use of bushland, corridors and linear remnants by birds in southeasetern Queensland, Australia,* Conservation Biology 11 (5): 1173-1189
	Raptors	Raptors are often wide ranging over many habitat types (McDonald *et al.,* 2003). Raptors in greater Brisbane area tend to be largely sedentary. Some evidence does exist of local movements due to post-breeding season dispersion, non-breeding and season nomadism (BCC 2008).	Breeding habitat is a limiting factor of habitat utilisation. Some species (the Brown Falcon) can use isolated nest trees (McDonald *et al.,* 2003). In Brisbane, habitat associations can include large forest and woodland remnants, riverine and vegetated corridors, and extensive lightly timbered areas (eg. golf courses), including adjacent parks and gardens (BCC 2008)	Brisbane City Council (BCC) (2008). *Wildlife Movement Solutions*. Brisbane City Council. McDonald, P.G., Olsen, P.D., and Baker-Gabb, D.G. (2003). *Territory Fidelity, Reproductive Success and Prey Choice in the Brown Falcon, Falco berigora: A Flexible Bet-Hedger?* Australian Journal of Zoology, 51:399-414.
	Owls		Powerful owls were determined to be old growth forest specialists but recent data shows they are able to exist in urban fringes provided there is adequate structural diversity to allow for roosting sites and that there is sufficient prey (Cooke *et al.,* 2006).	Cooke, R., Wallis, R., Hogan, F., White, J. and Webster, A., 2006, *The diet of powerful owls (Ninox strenua) and prey availability in a continuum of habitats from disturbed urban fringe to protected forest environments in south-eastern Australia,* Wildlife Research 33: 199-206

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Honeyeater, Silvereye, Spinebills	A study on two forest dependent species showed that species were unlikely to cross a gap greater than 65-85m however would cross a gap up to 260m when scattered trees were present (Robertson and Radford, 2009). Sieving *et al* (2000) showed that width was the predominant predictor for corridor utilisation by small bird species. Strips less than 10m were generally not used as habitat, but birds were occasionally noted moving through them. Anecdotally, vegetated strips of similar width have been shown to facilitate small bird passage over land bridges in Brisbane (Jones, 2009).	Smaller insectivore and nectivores were likely to be affected by patch size in agricultural, peri-urban and urban landscapes (Watson *et al.,* 2005). Most nectivores and folivores affected by variation in width and less likely to occur in narrow (50-100m wide) eucalypt forest patches (Tubelis *et al.,* 2007). More individuals were recorded in wide (greater than 300m) patches (Tubelis *et al.,* 2007). Small bodied birds may have a higher minimum patch size requirement relative to home range size as they are more susceptible to small environmental disturbances common on edges (Watson *et al.,* 2005).	Robertson, O.J. and Radford, J.Q. (2009). *Gap Crossing Decisions of Forest Birds in a Fragmented Landscape*. Austral Ecology, 34:435-446. Seiving, K.E., Willson, M.F. and De Santo, T.L. (2000). *Defining Corridor Functions for Endemic Birds in Fragmented South-temperate Rainforest.,* Conservation Biology 14 (4): 1120-1132. Tubelis, D.P., Lindenmayer, D.B. and Cowling, A., 2007, *Bird populations in native forest patches in south-eastern Australia: the roles of patch width matrix type (age) and matrix use.* Landscape Ecology 22:1045-1058. Watson J.E.M., Whittaker, R.J. and Freudenberger, D., 2005, *Bird community responses to habitat fragmentation: how consistent are they across landscapes?,* Journal of Biogeography 32:1353-1370.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Ground Birds (quail, rail)	Ground birds and cover-dependent species are likely to have gap tolerances that are shorter than 65-85m and be less inclined to cross gaps at all (Robertson and Radford, 2009). Cleared land is a barrier to the movement of individuals, and that gaps greater than 100 m might significantly reduce functional connectivity for some species (Robertson and Radford, 2009).	Quails and Rails habitat requirements range from marshy vegetation, low scrub, crops and dense grassland (Flegg 2002).	Robertson, O. J. and Radford, J.Q. (2009). *Gap Crossing Decisions of Forest Birds in a Fragmented Landscape*. Austral Ecology, 34:435-446. Flegg, J. (2002). *Photographic Field Guide to Birds of Australia*. New Holland Publishers, Sydney, Australia.
	Flying Foxes	Highly mobile species that move in response to seasonal food resources. Forage to roost distances differs seasonally. Due to high mobility (up to 50km's travelled to forage) flying foxes can access resources distributed patchily across the landscape (Palmer and Woinarski, 1999).	Have specific requirements for roosting sites including mangroves, rainforest, melaleuca swamps and vegetation along river banks (Palmer and Woinarski, 1999).	Palmer, C. and Woinarski, J.C.Z, 1999, *Seasonal roosts and foraging movements of the black flying fox (Pteropus alecto) in the Northern Territory: resource tracking in a landscape mosaic,* Wildlife Research 26:823-838
	Microbats	The spatial separation between roosts and foraging areas in a highly modified environment has the potential to affect energetic costs of foraging and exposure to predators (Lumsden and Bennett 2002a; Lumsden and Bennett 2002b)	Bats have the capability to utilise a diverse range of structures such as diurnal roost sites, including caves, tree hollows cavities formed under bark, foliage, tents, bird's nests and anthropogenic structures such as buildings. Roosting requirements may vary between males and females, and individual species with different reproductive conditions (Lumsden and Bennett 2002a; Lumsden and Bennett 2002b).	Lumsden, L. F., Bennett, A. F., and Silins, J. E. (2002a). *Selection of roost sites by the lesser long-eared bat (Nyctophilus geoffroyi) and Gould's wattled bat (Chalinolobus gouldii) in South-eastern Australia*. Journal of Zoology 257, 207–218. Lumsden, L. F., Bennett, A. F., and Silins, J. E. (2002b). *Location of roosts of the lesser long-eared bat Nyctophilus geoffroyi and Gould's wattled bat Chalinolobus gouldii in a fragmented landscape in southeastern Australia*. Biological Conservation 106, 237–249.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
Terrestrial	Small Mammals (Antechinus Native Rats)	Antechinus have home ranges between 0.04 and 0.66ha. Animals within narrow linear strips may move outside of the vegetation strip into areas generally associated with isolated trees up to 100m beyond the patch (Marchesan and Carthew, 2008).	Habitat for a diversity of native small mammals is influenced by vegetation condition. Species richness increased with increased density of logs and structural diversity (Holland and Bennett, 2007). Smallest patches that native mammals were found in were Bush rat – 0.5ha and Antechinus 0.8ha (Holland and Bennett, 2007). Antechinus are able to persist in very small patches or linear strips of vegetation (less than 1 ha) (Marchesan and Carthew, 2008). For many small mammals such as the Planigale, habitat structure is important for persistence in urban forest fragments (Garden *et. al*., 2007).	Holland, G.J. and Bennet, A.F., 2007, *Occurrence of small mammals in a fragmented landscape: the role of vegetation heterogeneity*. Wildlife Research 34: 387-397 Marchesan, D., and Carthew, S.M., 2008, *Use of space by the yellow-footed antechinus, Antechinus flavipes, in a fragmented landscape in South Australia,* Landscape Ecology 23:741-752 Garden, J.G., McAlpine, C.A., Possingham, H.P. and Jones, D.N., 2007, *Habitat structure is more important than vegetation composition for local-level management of native terrestrial reptile and small mammal species living in urban remnants; A case study from Brisbane, Australia.* Austral Ecology 32:669-685.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Mid size Mammals (Bandicoots, Quolls)	May disperse along thin but densely vegetated corridors and across sealed roads (FitzGibbon *et al.,* 2007). To fully facilitate movement a 60m riparian buffer should be maintained (FitzGibbon 2010). Quolls are highly mobile which is reflected in their large home ranges (Catling *et al*, 2000; Claridge *et al*, 2005).	Bandicoots can use thin strips of vegetation fringing a waterway as long as it is connected to a larger habitat patch and the smallest occupied patch was less than 5 ha (FitzGibbon *et al*., 2007). Quolls have an average home range size of 992ha (males) and 244ha (females) (Claridge *et al.,* 2005). Quolls prefer undisturbed habitats with a high basal area of trees and often high-elevation forests (Catling *et al.,* 2000). Quolls were commonly sighted in farmlands in the 1980's and therefore is expected to be able to use cleared areas especially when adjacent to large forested areas (Lunney and Matthews, 2001)	Catling, P.C., Burt, R.J. and Forrester, R.I., 2000, *Models of the distribution and abundance of ground-dwelling mammals in the eucalypt forests of north-eastern New South Wales in relation to habitat variables,* Wildlife Research 27:639-654. Claridge, A.W., Paull, D., Dawson, J., Mifsud, G., Murray, A.J., Poore, R. and Saxon, M.J., 2005, *Home range of the spotted-tailed quoll (Dasyurus maculatus) a marsupial carnivore, in a rainshadow woodland,* Wildlife Research 32: 7-14. FitzGibbon, S.I., Putland, D.A. and Goldizen, A.W., 2007, *The importance of functional connectivity in the conservation of a ground-dwelling mammal in an urban Australian landscape*., Landscape Ecology 22:1513-1525. FitzGibbon, S.I. (2010). In: *The Regenerator: Community Care for Bushland, Wetlands and Waterways*, Brisbane City Council. Lunney, D. and Matthews, A., 2001, *The contribution of the community to defining the distribution of a vulnerable species, the spotted-tailed quoll, Dasyurus maculatus,* Wildlife research 28:537-545

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Large Mammals (Kangaroos)	Large mammals (eg. Eastern Grey Kangaroo and Black wallaby) are capable of moving across pasture between isolated remnants (Downes *et al.,* 1997)	For some species a high quality habitat environment will include both foraging and sheltering habitat. This may often be open feeding grounds (particularly for grazers) and areas with high cover for sheltering (Le Mar and McArthur, 2005)	Downes, S.J., Handasyde. A. and Elgar, M.A., 1997, *The use of corridors by mammals in fragmented Australian Eucalypt forests,* Conservation Biology 11(3): 718-726. Le Mar, K. and McArthur, C., 2005, *Comparison of habitat selection by two sympatric macropods, Thylogae billardierei and Macropus rufogriseus rufogriseus, in a patchy eucalypt- forestry environment,* Austral Ecology 30: 674-683
	Large Reptiles (Goannas, dragons, carpet pythons)		Snakes home range size for a range of body sizes is between 1-25ha. Pythons appeared to require cover, but could utilise cover in modified suburban environments as well (Pearson *et al.,* 2005)	Pearson, D., Shine, R. and Williams, A., 2005, *Spatial ecology of a threatened python (Morelia spilota imbricata) and the effects of anthropogenic habitat change*, Austral Ecology, 30: 261-274
	Small Reptiles (Skinks, snakes)	Reptiles have small home ranges that often overlap. Reptile distribution may be limited not only by habitat quality but by remnant width. Driscoll (2004) found that reptiles may be limited by narrow corridors of 10-100m wide. Agricultural land may be relatively impermeable to reptile dispersal (Schutz and Driscoll, 2008)	Linear remnants are better than cleared areas as some species can exist in this habitat type (Driscoll, 2004). Habitat structural complexity is important for the occurrence of native reptiles in a fragmented urban environment (Garden et al, 2007; Hamer and McDonnell, 2010).	Driscoll, D.A., 2004, *Extinction and outbreaks accompany fragmentation of a reptile community*, Ecological Applications 14 (1):220-240. Schutz, A.J. and Driscoll, D.A., 2008, *Common reptiles unaffected by connectivity or condition in a fragmented farming landscape,* Austral Ecology 33 (5): 641-652

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
Semi arboreal	Koala	Koala dispersal is skewed towards young males however females also disperse. Most males travel between 1-3km from their natal home range and most females dispersed within 2km of their natal home range (Dique *et al.,* 2003). A high proportion of Koala's are killed moving through urban areas by cars or domestic dogs (Dique *et al.*, 2003).		Dique, D.S., Thompson, J., Preece, H.J., de Villiers, D.L. and Carrick, F.N., 2003, *Dispersal patterns in a regional Koala population in south-east Queensland,* Wildlife Research 30 (3): 281-290.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
Arboreal	Gliders & Possums, Phascogales	Sugar gliders can disperse along roadside strips and are not always confined to treed habitat. Some young have been found to move across at least 200m of paddock to reach small isolated forest patches (Suckling, 1983). However, most movements are strictly arboreal and as such require habitat buffers up to 30m wide to prevent barriers to small gliders (BCC, 2005a). The approx. distance that gliders can glide (volplane) has been calculated for the different species as listed below (Chenoweth 2003): ▪ Feathertail Glider = 20m; ▪ Sugar Glider = 50m; ▪ Squirrel Glider = 50m; ▪ Yellow bellied ≥ 60m; & ▪ Greater Glider = 100m Subject to the height of launch trees, it is necessary to maintain gaps no greater than those listed above to enable the movement of these species. Phascogales have been found to travel between isolated woodland fragments across cleared ground. It has been found that generally cleared ground between 20-285m was crossed (Van der Ree *et al.,* 2001)	Interior habitats are ideal to maintain large stable populations but low contrast edges (soft edges eg minor roads with vegetation either side) containing key site level resources should not be underestimated as gliders are capable of using these areas (Brearley *et al.,* 2010). Habitats in dry sclerophyll forests with high proportion of taller trees were highly used by arboreal mammals. Possums and gliders encountered in this study were also found in poorer habitat types although in lower densities (Wormington *et al.,* 2002) The home range of Pascogales in Victoria ranges from 2.3–8 hectares in high quality habitat. In lower quality habitat, also in Victoria, the species home range averaged 37.05 hectares for females and 86.13 hectares for males (BCC, 2005b)	Suckling, G.C., 1984, *Population ecology of the Sugar Glider, Petaurus breviceps, in a system of Fragmented Habitats.* Australian Wildlife Research 11: 49-75 Van der Ree, R. and Bennett, A.F., 2003, *Home range of the squirrel glider (Petaurus norfolkensis) in a network of remnant linear habitats,* Journal of the Zoological Society of London 259:327-336 Wormington, K.R., Lamb, D., McCallum, H.I. and Moloney, D.J., 2002, *Habitat requirements for the conservation of arboreal marsupials in dry sclerophyll forests of southeast Queensland, Australia*, Forest Science 48 (2): 217-227. Van Der Ree, R., Soderquist, T.R. and Bennett, A.F., 2001, *Home-range use by the brush-tailed phascogale (Phascogale tapoatafa) (Marsupialia) in high quality, spatially limited habitat,* Wildlife Research 28:517-525

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Geckoes	In a study on *Gehrya viriegata*, it was found that movements if this species in a 150m by 100m continuous plot of riverine woodland, were rarely more than 40m (Gruber and Henle, 2004).	Some geckoes are highly territorial and remain in the vicinity of certain trees feeding on insects (Gruber and Henle, 2004).	Gruber, B. and Henle, K., 2004, *Linking habitat structure and orientation in an arboreal species Gehyra variegata (Gekkonidae)*, Oikos 107:406-414
Semi Aquatic	Amphibians	Some amphibians disperse between breeding habitats and non-breeding habitats making them vulnerable to barrier effects of habitat fragmentation by roads and other isolating factors (Hamer and McDonnell, 2010). Most amphibians require connectivity from habitat patches to wetlands and/or streams (Hamer and McDonnell, 2010).	Frogs were found to maintain a population over 20years within a stream section embedded within unsuitable habitat (pine plantation) (Lemckert *et al.,* 2005). Some frog species are able to survive well in urbanised habitats due to life history traits such as high fecundity and ability to utilise degraded aquatic habitats or those wetland areas converted to permanent ponds (Hamer and McDonnell, 2010). However structural habitat complexity is important for herpetofauna, often more so than patch size or vegetation type (Hamer and McDonnell, 2010).	Lemckert, F., Brassil, T. and Towerton, A., 2005, *Native vegetation corridors in exotic pine plantations provide long-term habitat for frogs* Ecological Management and Resotration 6(2):132-134 Hamer, A.J. and McDonnell, M.J., 2010, *The response of herpetofauna to urbanization: inferring patterns of persistence from wildlife databases,* Austral Ecology 35:568-580
	Reptiles (Turtles)	Turtles may move between wetlands which mean single wetlands alone should not represent a habitat unit (Roe *et al.,* 2009). In this study turtles moved between approximately 400m-700m overland between wetlands.		Roe, J.H., Brinton, A.C. and Georges, A., 2009, *Temporal and spatial variation in landscape connectivity for a freshwater turtle in a temporally dynamic wetland system,* Ecological Applications 19 (5): 1288-1299

Locomotor Type	Fauna Group	Dispersal	Habitat associations	References
	Insects	Flying species of beetle were able to disperse while the capacity of flightless species was reduced (Driscoll and Weir, 2005).	A number of habitat classes were recognised for the purpose of a study of the effect of fragmentation on beetles; these were underground species, flightless species, above ground species, on ground and flying species (Driscoll and Weir, 2005). Underground and flightless species were found in sites that were least disturbed whereas on ground and flying species were most commonly found in disturbed sites.	Driscoll, D.A. and Weir, T. 2005, *Beetle responses to habitat fragmentation depend on ecological traits, habitat condition and remnant size*. Conservation Biology, 19 (1): 182-194

4. CORRIDOR VIABILITY FOR FGK FAUNA

Where the width of remnant vegetation in the FGK Corridor is equal to or greater than 350m there is likely to be minimal impact on the movement of wildlife. However, where the width of remnant vegetation is less than 250m then the movement of some species are likely to be compromised. This said, analysis of Table 2 indicates that some faunal groups have the capacity to move through narrower corridors or on occasion through treeless environments.

A spectrum of habitat integrity exists in the corridor ranging from remnant (which is presumed to posses the highest level of integrity) through to cleared and alienated environments that have little to no value to wildlife. An intermediate habitat class is regrowth vegetation. Mapping prepared to enforce the 'regrowth' provisions of the *Vegetation Management Act 1999* was used to define the extent of this habitat class. Whilst the mapping incorporates some cleared and developed areas, it serves as a suitable surrogate for the purpose of this study.

Regrowth vegetation can connect otherwise isolated patches of remnant vegetation from the core/continuous remnant areas of the corridor. This connection essentially extends the habitat range of some faunal groups. Isolated patches of remnant vegetation can only be seen as stepping stone habitat relative to the overall core corridor (although some of these patches serve as extensive habitat areas in their own right).

A relatively continuous vegetated connection exists between the Flinders Peak region through to Karawatha predominately including remnant and some minor areas of regrowth. This continuous vegetation has been delineated as the **Core Corridor** in Figure 2. To assist in identifying where the Core Corridor has been reduced to a width that impacts the movement of fauna, a hierarchy has been developed that identifies the thresholds at which certain groups of fauna will be affected (see table 3 below). Areas where the minimum threshold has been met, that are where there is likely an impact on wildlife movement, have been identified as **Narrowings**.

Table 3: Decision Hierarchy for Assessing Corridor Permeability:

Habitat Continuity	Description	Rating	Fauna Grouping (from Table 1)
Continuous Remnant Habitat	▪ ≥ 350m width	Fully Permeable	▪ All Species
'Connected' Remnant Habitat patches	▪ Considered part of the Core Corridor where remnant vegetation is generally >350m wide	Highly Permeable	Connectivity compromised by intervening regrowth vegetation, but movement still likely to occur for the following groups ▪ Seasonal migratory birds ▪ Ground birds ▪ Large / medium / small mammals ▪ Arboreal / Semi arboreal species ▪ Flying foxes ▪ Large / small reptiles ▪ Geckoes ▪ Amphibians ▪ Most insects
Remnant vegetation of reduced width (**Narrowings**)	▪ < 350m wide	Reduced Permeability	▪ Some species compromised

NOTE: Some species require certain structural habitat characteristics are in-situ in order to facilitate landscape movement. For the purposes of this decision hierarchy it is assumed that such features exist.

Areas outside of the Core Corridor play a vital role in the functionality of the overall FGK Corridor. Elements within the matrix of remnant, regrowth and scattered unmapped trees form a crucial extension of habitat within the Core Corridor. Without this network of vegetation the overall extent of habitat in the FGK Corridor is significantly reduced. Although the width, or absence, of connecting vegetation limits the movement of some wildlife focus needs to be provided on maintaining **Linkages** throughout the habitat matrix. Linkages were identified through analysis of remnant and regrowth mapping and aerial photo interpretation.

Individual distribution of Linkages and Narrowings are illustrated in Figure 2, with the latter discussed further in Table 4 below.

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Table 4: Reduced Viability for Specific Fauna Group

LOCATION	NARROWING	DESCRIPTION
A	Illaweena Street	Located immediately to the west of Karawatha Forest and to the north of the intersection of the Gateway and Logan Motorways. This area consists of fragmented remnant and regrowth vegetation, with an approximate 200m gap across the Gateway from the suburb of Drewvale on the west and Karawatha Forest on the east. **Likely Affected Fauna:** Terrestrial Mammals; Honeyeater/ Silvereye/ Spinebills; Ground Birds; All Reptiles; Arboreal species; Amphibians; Flightless insects.
B	Logan Motorway (East)	Situated at Drewvale, the Logan Motorway forms a barrier to the movement of fauna to the north and south. This area contains highly fragmented patches of remnant vegetation linked by regrowth, south of which, separated by a 100m gap is a large isolated patch of remnant vegetation. **Likely Affected Fauna:** Terrestrial Mammals; Honeyeater/ Silvereye/ Spinebills; Ground Birds; All Reptiles; Arboreal species; Amphibians; Flightless insects.
C	Mount Lindesay Highway	Flanked by the Logan Motorway and Browns Plains Rd, the highway at this location splits an area of remnant and regrowth vegetation to the east and west. To the east of which, separated by an 80m gap is a large patch of isolated remnant vegetation. **Likely Affected Fauna:** Terrestrial Mammals; Honeyeater/ Silvereye/ Spinebills; Ground Birds; All Reptiles, Arboreal species; Amphibians; Flightless insects.
D	Logan Motorway (West)	Here the continuity of the corridor narrows to approximately 500m. Located in Parkinson to the west of Beaudesert Rd, the Motorway at this location separates patches of remnant and regrowth vegetation to the north and south. **Likely Affected Fauna:** Terrestrial Mammals; Honeyeater/ Silvereye/ Spinebills; Ground Birds; All Reptiles; Arboreal species; Amphibians; Flightless insects.
E	Oxley Creek	The Corridor narrows at Forestdale to approximately 500m and consists of a continuous patch of regrowth vegetation linking small patches of remnant vegetation, that have been completely severed by disturbance. Approximately 200m to the east of this location Paradise Rd fragments a remnant patch of vegetation further contributing to the overall reduction in permeability at this location. **Likely Affected Fauna:** Microbats; Small Mammals; Mid Sized Mammals; Small Reptiles; Geckoes; Semi Aquatic species.
F	Stapylton Road	Located in the outer suburb of Heathwood, at this location Stapylton Rd forms a barrier between the regrowth vegetation on the east, and the remnant vegetation on Greenbank on the west. At this location remnant vegetation has been completely cleared to the east of Stapylton Road, with a gap of approximately 680m before running into another patch of remnant forest. It is likely that the fencing surrounding Greenbank will contribute to the reduction in reduced fauna movement at this location. **Likely Affected Fauna:** Honeyeater/ Silvereye/ Spinebills; Microbats; Small Mammals; Mid Sized Mammals; Large and Small Reptiles; Geckoes; Semi Aquatic species.
G	Springfield Beaudesert Connection Road	Located in the southwest corner of Greenbank, here the Springfield Beaudesert Connection Rd splits the continuity of remnant vegetation by approximately 80m. Also affected by this split and immediately adjacent to this location is a large patch of fragmented regrowth vegetation. Continued development at Springfield will further affect this area. **Likely Affected Fauna:** Ground Birds**;** Large and Small Reptiles; Microbats; Mid Size Mammals; Small Mammals; Amphibians, Flightless Insects.

LOCATION	NARROWING	DESCRIPTION
H	Tully Road (East)	At New Bieth, Tully Road is adjacent to Oxley Creek through a narrow valley flanked by steep hills. At this location a large patch of continuous remnant vegetation is fragmented leaving two narrow corridors approximately 60m wide. Surrounding these corridors are fragmented patches of regrowth vegetation, interspersed with cleared areas. **Likely Affected Fauna**: Honeyeater/ Silvereye/ Spinebills; Ground Birds; Large Reptiles**;** Small Reptiles; Microbats; Quolls; Mid Size Mammals; Small Mammals; Amphibians.
I	Tully Road (West)	Located approximately 1.5km to the west of Tully Road (East) in the suburb of Lyons, continuous remnant forest narrows to three corridors ranging from 60m – 200m in width. The narrow corridors are surrounded by mapped regrowth vegetation and cleared areas. Overall it is likely connectivity at this location is only marginally compromised. **Likely Affected Fauna:** Honeyeater/ Silvereye/ Spinebills; Ground Birds; Large Reptiles**;** Small Reptiles; Microbats; Small Mammals; Amphibians.
J	Ripley Road	Ripley Road located in the suburb of South Ripley is situated immediately to the east of Mount Perry Conservation Park. The continuity of remnant forest is channelled along a ridgeline and forming a bottleneck up to 400m wide. Either side of this bottleneck are small patches of regrowth vegetation, beyond which has been cleared for rural development. **Likely Affected Fauna:** Microbats; Mid Sized Mammals; Semi Aquatic species
K	Mount Blaine South	Located in a valley between Mount Blaine to the north and Flinders Peak to the southwest, the corridor has been fragmented by rural development. The vegetation matrix in this area is situated on steep topography and consists predominantly of regrowth connecting large isolated patches of remnant vegetation, interspersed with cleared areas. **Likely Affected Fauna:** Honeyeater/ Silvereye/ Spinebills; Ground Birds; Large Reptiles; Small Reptiles; Geckoes; Microbats; Quolls; Mid Size Mammals; Small Mammals; Amphibians.
L	Flinders Peak South	Situated to the south of Flinders Peak ranging between Mt Elliot and Mt Welcome that includes incised topography and fragmented vegetation. Vegetation integrity is likely to be a limiting factor in this location. **Likely Affected Fauna:** Honeyeater/ Silvereye/ Spinebills; Ground Birds; Large Reptiles**;** Small Reptiles; Geckoes; Microbats; Quolls; Mid Size Mammals; Small Mammals; Amphibians.

5. ECOLOGICAL IMPACT OF REDUCED FGK CORRIDOR & RECOMMENDATIONS

Analysis of the FGK Corridor identified a Core Corridor where relatively continuous remnant vegetation provides habitat and movement opportunities to a diversity of wildlife. This Core Corridor is compromised in 12 locations where the minimum width has been reduced. To ensure the overall functionality of the FGK Corridor is not further undermined it will be necessary to ensure these Narrowings are not further compromised. To enhance the overall functionality of the FGK Corridor the following should be considered at each location:

- Expand the width of vegetation to at least 350m;
- Manage existing remnant vegetation to ensure it is not further degraded by weeds, inappropriate fire regimes, rubbish dumping or illegal access;
- Facilitate the maturation of regrowth vegetation to remnant vegetation (this will be further addressed in Part C of this study);
- As a priority, mitigate the impact of linear barriers that are present in these locations (this will be further addressed in Part B of this study); and
- Where feasible undertake on ground fauna studies to confirm the findings of this desktop analysis.

The Linkages within the broader habitat matrix of the FGK Corridor also require ongoing management. Ground truthing being undertaken as part of Part B of this study will provide an opportunity to refine these links and identify what measures are likely to be required to improve their functionality. Preliminary assessment indicates the following:

- Retain and enhance remnant and regrowth vegetation along each linkage;
- Restore gaps in the linkages where they occur;
- Mitigate barriers within the linkage network (this will be further addressed in Part B of this study); and
- Where feasible undertake on ground fauna studies to assist in prioritising linkages for restoration works.

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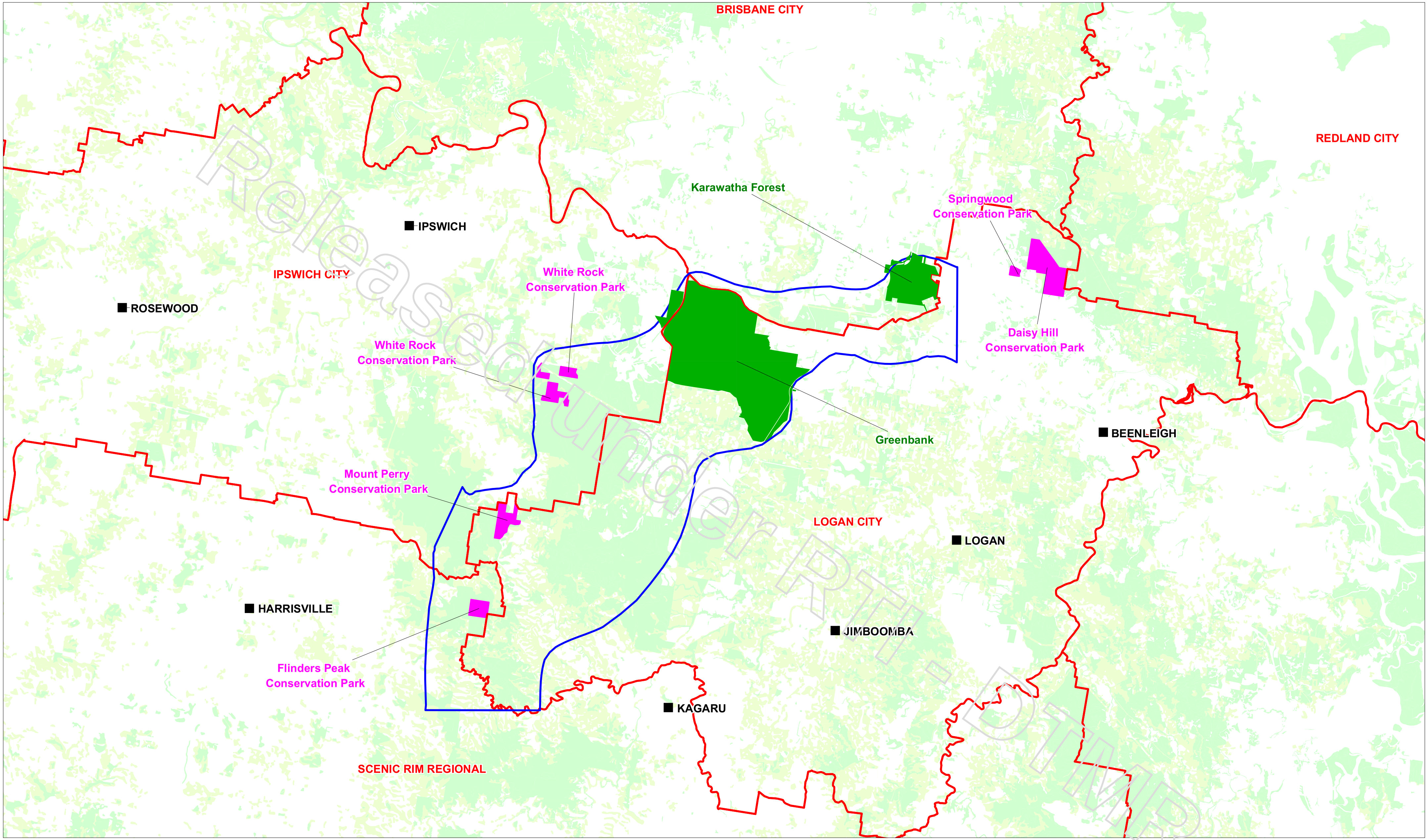


LEGEND

- Major Towns
- Local Government Boundaries
- Protected Estate
- Corridor Study Area
- Remnant Vegetation
- Regrowth Vegetation
- Greenbank Army Reserve and Karawatha Forest

0 2.5 5
Kilometres

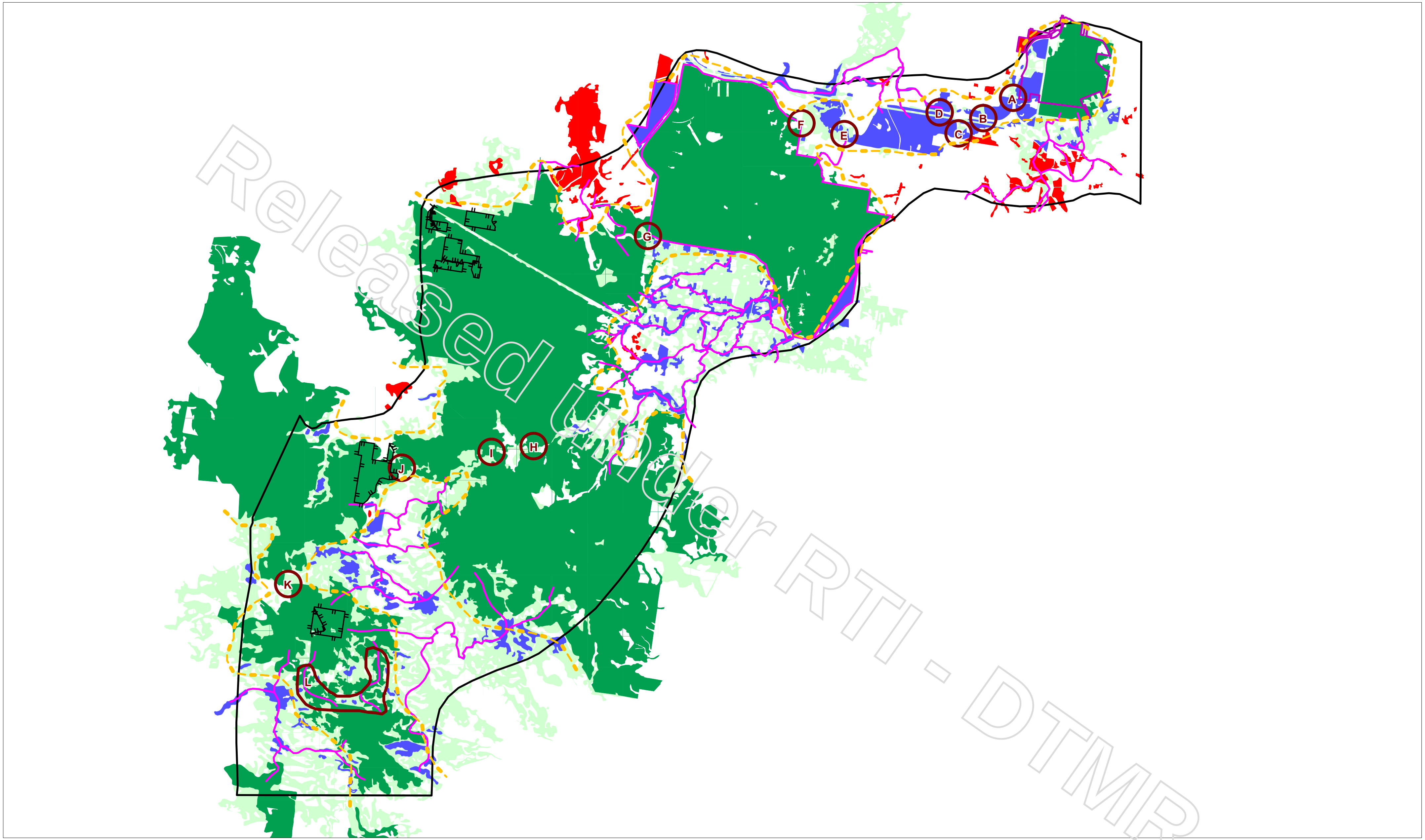
Flinders to Greenbank-Karawatha Corridor

Locality

FIGURE 1

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:Fig1.WOR
Date: 25/11/2010
10CH074 Dwn: AP



LEGEND

- Continuous remnant habitat
- 'Connected' remnant habitat patches
- Isolated remnant habitat patches
- Regrowth vegetation
- Corridor Study Area
- Core Corridor
- Linkages
- Narrowings
- Protected Estate
- Karawatha Forest
- Greenbank Army Reserve

N

0 2.5 5
Kilometres

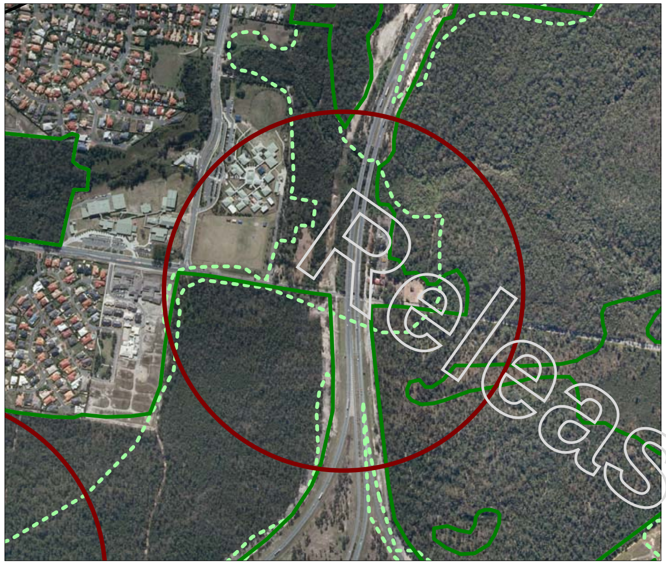
Flinders to Greenbank-Karawatha Corridor

Connectivity of Remnant Vegetation

FIGURE A-2

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:Fig1.WOR
Date: 24/11/2010
10CH074 Dwn: AP

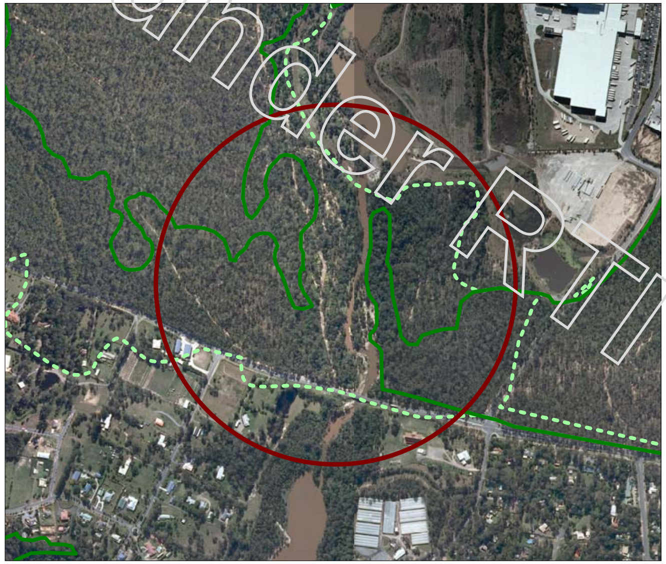


A

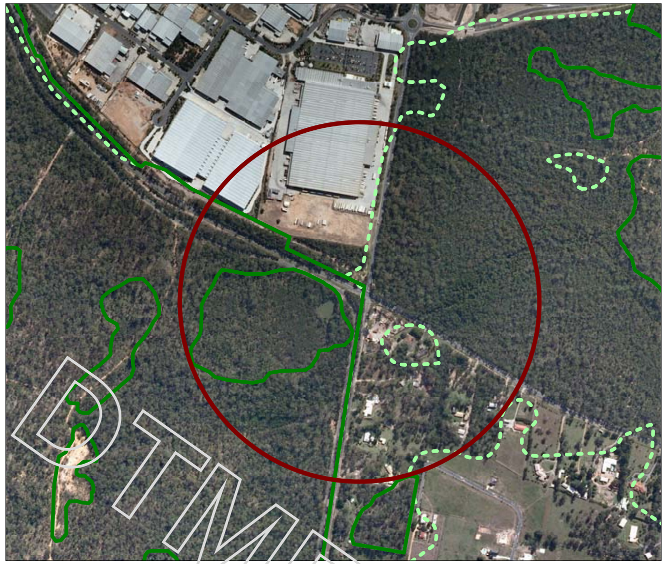
B

C

D



E



F

LEGEND
- Narrowings
- Remnant vegetation
- Regrowth Vegetation

N

0 0.5 1
kilometres

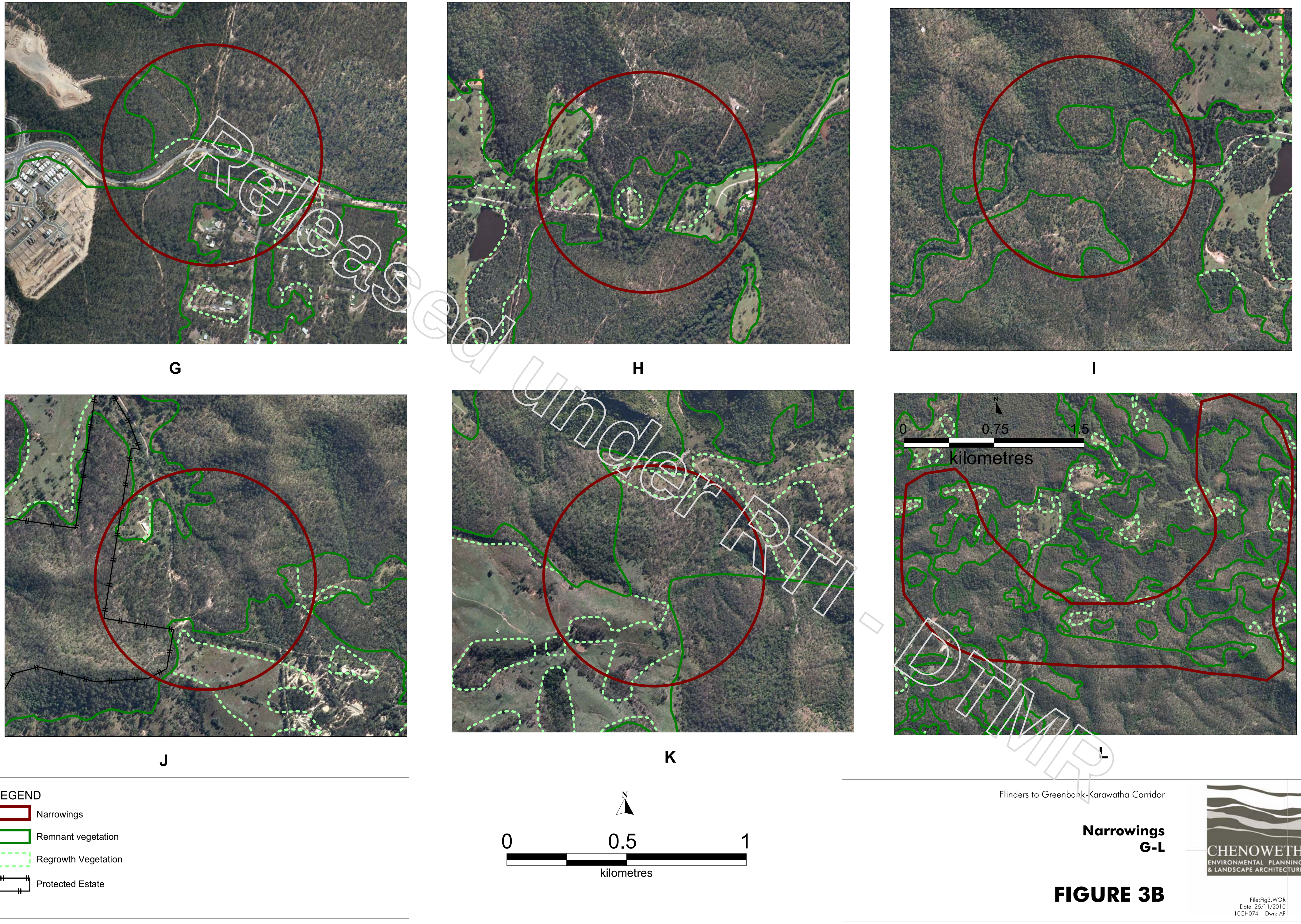
Flinders to Greenbank-Karawatha Corridor

Narrowings A-F

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

FIGURE 3A

File:Fig3.WOR
Date: 25/11/2010
10CH074 Dwn: AP



Flinders to Greenbank-Karawatha Corridor

Narrowings G-L

FIGURE 3B

File:Fig3.WOR
Date: 25/11/2010
10CH074 Dwn: AP

APPENDIX

A

Combined Fauna List

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Amphibian	Tusked Frog	*Adelotus brevis*	V		√		√
Amphibian	Beeping Froglet	*Crinia parinsignifera*	C		√		√
Amphibian	Clicking Froglet	*Crinia signifera*	C		√		√
Amphibian	Wallum Froglet	*Crinia tinnula*	V		√		√
Amphibian	Greenstripe Frog	*Cyclorana alboguttata*	C		√		√
Amphibian	Striped Marshfrog	*Limnodynastes peronii*	C		√		√
Amphibian	Spotted Grassfrog	*Limnodynastes tasmaniensis*	C		√		√
Amphibian	Scarlet Sided Pobblebonk	*Limnodynastes terraereginae*	C		√		√
Amphibian	Green Thighed Frog	*Litoria brevipalmata*	NT		√		√
Amphibian	Common Green Treefrog	*Litoria caerulea*	C		√		√
Amphibian	Bleating Treefrog	*Litoria dentata*	C		√		√
Amphibian	Eastern Sedgefrog	*Litoria fallax*	C		√		√
Amphibian	Graceful Treefrog	*Litoria gracilenta*	C		√		√
Amphibian	Broad Palmed Rocketfrog	*Litoria latopalmata*	C		√		√
Amphibian	Striped Rocketfrog	*Litoria nasuta*	C		√		√
Amphibian	Cascade Treefrog	*Litoria pearsoniana*					√
Amphibian	Emerald Spotted Treefrog	*Litoria peronii*	C		√		√
Amphibian	Ruddy Treefrog	*Litoria rubella*	C		√		√
Amphibian	Southern Laughing Treefrog	*Litoria tyleri*	C		√		√
Amphibian	Eastern Stony Creek Frog	*Litoria wilcoxii*	C		√		√
Amphibian	Great Barred Frog	*Mixophyes fasciolatus*	C		√		√
Amphibian	Ornate Burrowing Frog	*Platyplectrum ornatum*	C		√		√
Amphibian	Red Backed Broodfrog	*Pseudophryne coriacea*	C		√		√
Amphibian	Great Brown Broodfrog	*Pseudophryne major*	C		√		√
Amphibian	Copper Backed Broodfrog	*Pseudophryne raveni*	C		√		√
Amphibian		*Pseudophryne sp.*					√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Amphibian	Cane Toad	*Rhinella marina*			√		√
Amphibian	Dusky Gungan	*Uperoleia fusca*	C		√		
Amphibian	Eastern Gungan	*Uperoleia laevigata*					√
Amphibian	Chubby Gungan	*Uperoleia rugosa*					√
Bird	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	C		√		
Bird	Striated Thornbill	*Acanthiza lineata*	C		√	√	
Bird	Yellow Thornbill	*Acanthiza nana*	C		√	√	
Bird	Brown Thornbill	*Acanthiza pusilla*		EN King Is	√	√	
Bird	Buff-rumped Thornbill	*Acanthiza reguloides*	C		√	√	
Bird	Eastern Spinebill	*Acanthorhynchus tenuirostris*	C		√	√	
Bird	Collared Sparrowhawk	*Accipiter cirrocephalus*	C		√	√	√
Bird	Brown Goshawk	*Accipiter fasciatus*		EN Christmas Is	√	√	
Bird	Grey Goshawk	*Accipiter novaehollandiae*	NT		√		
Bird	Australian Reed-warbler	*Acrocephalus australis*	C		√	√	
Bird	Australian Owlet-nightjar	*Aegotheles cristatus*	C		√		√
Bird	Australian Brush-turkey	*Alectura lathami*	C		√	√	
Bird	Australian King-parrot	*Alisterus scapularis*	C		√	√	
Bird	Pale-vented Bush-hen	*Amaurornis moluccana*	C		√		
Bird	Chestnut Teal	*Anas castanea*	C		√		
Bird	Grey Teal	*Anas gracilis*	C		√	√	
Bird	Northern Mallard	*Anas platyrhynchos*			√	√	
Bird	Australasian Shoveler	*Anas rhynchotis*	C		√		
Bird	Pacific Black Duck	*Anas superciliosa*	C		√	√	√
Bird	Darter	*Anhinga melanogaster*					√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Australasian Darter	*Anhinga novaehollandiae*	C		√	√	
Bird	Magpie Goose	*Anseranas semipalmata*	C		√	√	
Bird	Little Wattlebird	*Anthochaera chrysoptera*	C		√	√	
Bird	Australasian Pipit	*Anthus novaeseelandiae*	C		√		
Bird	Fork-tailed Swift	*Apus pacificus*			√	√	
Bird	Wedge-tailed Eagle	*Aquila audax*	C		√	√	√
Bird	Cattle Egret	*Ardea ibis*	C		√	√	
Bird	Intermediate Egret	*Ardea intermedia*	C		√	√	
Bird	Eastern Great Egret	*Ardea modesta*	C		√	√	
Bird	White-necked Heron	*Ardea pacifica*	C		√	√	√
Bird	Dusky Woodswallow	*Artamus cyanopterus*	C		√		√
Bird	White-breasted Woodswallow	*Artamus leucorynchus*	C		√	√	
Bird	Little Woodswallow	*Artamus minor*	C		√		
Bird	Masked Woodswallow	*Artamus personatus*	C		√		
Bird	Pacific Baza	*Aviceda subcristata*	C		√	√	√
Bird	Hardhead	*Aythya australis*	C		√	√	
Bird	Australian Ringneck	*Barnardius barnardi*			√		
Bird	Musk Duck	*Biziura lobata*	C		√		
Bird	Bush Stone-curlew	*Burhinus grallarius*	C		√		
Bird	Sulphur-crested Cockatoo	*Cacatua galerita*	C		√	√	
Bird	Little Corella	*Cacatua sanguinea*	C		√	√	
Bird	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	C		√	√	√
Bird	Pallid Cuckoo	*Cacomantis pallidus*	C		√		
Bird	Brush Cuckoo	*Cacomantis variolosus*	C		√	√	
Bird	Sharp-tailed Sandpiper	*Calidris acuminata*	C		√	√	
Bird	Red-Tailed Black-cockatoo	*Calyptorhynchus banksii*	C		√		
Bird	Yellow-tailed Black-cockatoo	*Calyptorhynchus funereus*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Glossy Black-cockatoo	*Calyptorhynchus lathami*	V		√		
Bird	Glossy Black-cockatoo (eastern)	*Calyptorhynchus lathami lathami*	V		√		
Bird	European Goldfinch	*Carduelis carduelis*			√		
Bird	White-eared monarch	*Carterornis leucotis*	C		√		
Bird	Pheasant Coucal	*Centropus phasianinus*	C		√	√	√
Bird	Azure Kingfisher	*Ceyx azureus*	C		√	√	
Bird	Little Kingfisher	*Ceyx pusilla*	C		√		
Bird	Horsfield's bronze-cuckoo	*Chalcites basalis*	C		√	√	
Bird	Shining Bronze-Cuckoo	*Chalcites lucidus*	C		√	√	√
Bird	Little Bronze-Cuckoo	*Chalcites minutillus*			√	√	
Bird	Emerald dove	*Chalcophaps indica*	C		√	√	
Bird	Australian Wood duck	*Chenonetta jubata*	C		√	√	
Bird	White-backed swallow	*Cheramoeca leucosterna*	C		√		
Bird	Whiskered Tern	*Chlidonias hybrida*	C		√		
Bird	Silver Gull	*Chroicocephalus novaehollandiae*				√	
Bird	Horsfields Bronze-Cuckoo	*Chrysococcyx basalis*					√
Bird	Speckled Warbler	*Chthonicola sagittata*	C		√	√	
Bird	Brown Songlark	*Cincloramphus cruralis*	C		√		
Bird	Rufous Songlark	*Cincloramphus mathewsi*	C		√		
Bird	Spotted Quail-thrush	*Cinclosoma punctatum*	C		√		
Bird	Swamp Harrier	*Circus approximans*	C		√		
Bird	Spotted Harrier	*Circus assimilis*	C		√		
Bird	Golden-headed Cisticola	*Cisticola exilis*	C		√	√	√
Bird	Brown Treecreeper	*Climacteris picumnus*	C		√		
Bird	Grey Shrike-thrush	*Colluricincla harmonica*	C		√	√	√
Bird	Little Shrike-thrush	*Colluricincla megarhyncha*	C		√		
Bird	White-headed Pigeon	*Columba leucomela*	C		√		√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Rock dove	*Columba livia*			√		
Bird	Barred Cuckoo-shrike	*Coracina lineata*	C		√	√	
Bird	Ground Cuckoo-shrike	*Coracina maxima*	C		√	√	
Bird	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	C		√	√	
Bird	White-bellied Cuckoo-shrike	*Coracina papuensis*	C		√	√	
Bird	Cicadabird	*Coracina tenuirostris*	C		√	√	
Bird	White-throated Treecreeper	*Cormobates leucophaea*	C		√	√	
Bird	White-throated Treecreeper (southern)	*Cormobates leucophaea metastasis*	C		√		
Bird	Torresian crow	*Corvus orru*	C		√	√	√
Bird	Stubble Quail	*Coturnix pectoralis*	C		√		
Bird	Brown Quail	*Coturnix ypsilophora*	C		√	√	
Bird	Pied Butcherbird	*Cracticus nigrogularis*	C		√	√	
Bird	Australian Magpie	*Cracticus tibicen*	C		√	√	
Bird	Grey Butcherbird	*Cracticus torquatus*	C		√	√	√
Bird	Oriental Cuckoo	*Cuculus optatus*	C		√		
Bird	Black Swan	*Cygnus atratus*	C		√	√	
Bird	Blue-winged Kookaburra	*Dacelo leachii*	C		√		
Bird	Laughing Kookaburra	*Dacelo novaeguineae*	C		√	√	√
Bird	Lesser Wanderer	*Danaus chrysippus petilia*			√		
Bird	Monarch	*Danaus plexippus plexippus*			√		
Bird	Varied Sittella	*Daphoenositta chrysoptera*	C		√	√	√
Bird	Wandering Whistling-Duck	*Dendrocygna arcuata*	C		√	√	√
Bird	Plumed Whistling-Duck	*Dendrocygna eytoni*	C		√	√	
Bird	Mistletoebird	*Dicaeum hirundinaceum*	C		√	√	
Bird	Spangled Drongo	*Dicrurus bracteatus*	C		√	√	
Bird	Spangled drongo (eastern Australia)	*Dicrurus bracteatus bracteatus*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Emu	*Dromaius novaehollandiae*					√
Bird	Little Egret	*Egretta garzetta*	C		√	√	
Bird	White-faced Heron	*Egretta novaehollandiae*	C		√	√	
Bird	Eastern Reef Egret	*Egretta sacra*	C		√		
Bird	Black-shouldered Kite	*Elanus axillaris*	C		√	√	
Bird	Black-fronted Dotterel	*Elseyornis melanops*	C		√	√	√
Bird	Blue-faced Honeyeater	*Entomyzon cyanotis*	C		√	√	
Bird	Galah	*Eolophus roseicapillus*	C		√	√	
Bird	Eastern Yellow Robin	*Eopsaltria australis*	C		√	√	
Bird	Black-necked Stork	*Ephippiorhynchus asiaticus*	NT		√	√	
Bird	Red-kneed dotterel	*Erythrogonys cinctus*	C		√		
Bird	Eastern Koel	*Eudynamys orientalis*	C		√	√	
Bird	Common crow	*Euploea core corinna*			√		
Bird	White-throated Nightjar	*Eurostopodus mystacalis*	C		√		
Bird	Dollarbird	*Eurystomus orientalis*	C		√	√	
Bird	King Quail	*Excalfactoria chinensis*	C		√		
Bird	Brown Falcon	*Falco berigora*	C		√		
Bird	Nankeen Kestrel	*Falco cenchroides*	C		√	√	√
Bird	Grey Falcon	*Falco hypoleucos*	NT		√		
Bird	Australian Hobby	*Falco longipennis*	C		√	√	
Bird	Peregrine Falcon	*Falco peregrinus*	C		√		√
Bird	Crested shrike-tit	*Falcunculus frontatus*	C		√		
Bird	Eurasian Coot	*Fulica atra*	C		√	√	
Bird	Latham's snipe	*Gallinago hardwickii*	C		√		
Bird	Dusky Moorhen	*Gallinula tenebrosa*	C		√	√	
Bird	Buff-Banded Rail	*Gallirallus philippensis*	C		√		√
Bird	Gull-billed Tern	*Gelochelidon nilotica*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Diamond Dove	*Geopelia cuneata*	C		√		
Bird	Bar-shouldered Dove	*Geopelia humeralis*	C		√	√	
Bird	Peaceful dove	*Geopelia placida*					√
Bird	Peaceful Dove	*Geopelia striata*	C		√	√	
Bird	Mangrove Gerygone	*Gerygone levigaster*	C		√		√
Bird	Brown Gerygone	*Gerygone mouki*	C		√	√	
Bird	White-throated Gerygone	*Gerygone olivacea*	C				√
Bird	Musk Lorikeet	*Glossopsitta concinna*	C		√		
Bird	Little Lorikeet	*Glossopsitta pusilla*	C		√	√	√
Bird	Magpie-lark	*Grallina cyanoleuca*	C		√	√	√
Bird	Brolga	*Grus rubicunda*	C		√		
Bird	Australian Pied Oystercatcher	*Haematopus longirostris*				√	
Bird	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	C		√	√	√
Bird	Brahminy Kite	*Haliastur indus*				√	
Bird	Whistling Kite	*Haliastur sphenurus*	C			√	
Bird	Little Eagle	*Hieraaetus morphnoides*	C		√		
Bird	Black-winged Stilt	*Himantopus himantopus*	C		√	√	
Bird	White-throated Needletail	*Hirundapus caudacutus*	C		√		
Bird	Welcome Swallow	*Hirundo neoxena*	C		√	√	
Bird	Caspian Tern	*Hydroprogne caspia*	C		√		
Bird	Comb-crested Jacana	*Irediparra gallinacea*	C		√	√	
Bird	Black Bittern	*Ixobrychus flavicollis*	C		√		
Bird	Varied Triller	*Lalage leucomela*	C		√	√	
Bird	White-winged Triller	*Lalage sueurii*	C		√	√	
Bird	Swift Parrot	*Lathamus discolor*	E	E	√	√	
Bird	Wonga Pigeon	*Leucosarcia picata*	C		√	√	
Bird	Yellow-faced Honeyeater	*Lichenostomus chrysops*	C		√	√	

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Fuscous Honeyeater	*Lichenostomus fuscus*	C		√	√	
Bird	Yellow-tufted Honeyeater	*Lichenostomus melanops*	C		√		
Bird	Brown Honeyeater	*Lichmera indistincta*	C		√	√	
Bird	Bar-tailed Godwit	*Limosa lapponica*	C		√		
Bird	Chestnut-breasted mannikin	*Lonchura castaneothorax*	C		√		
Bird	Nutmeg Mannikin	*Lonchura punctulata*			√		
Bird	Topknot Pigeon	*Lopholaimus antarcticus*	C		√		
Bird	Brown Cuckoo-Dove	*Macropygia amboinensis*	C		√	√	
Bird	Pink-eared Duck	*Malacorhynchus membranaceus*	C		√		
Bird	Superb Fairy-wren	*Malurus cyaneus*	C		√	√	√
Bird	Variegated Fairy-wren	*Malurus lamberti*	C		√	√	√
Bird	Red-backed Fairy-wren	*Malurus melanocephalus*	C		√	√	√
Bird	Noisy Miner	*Manorina melanocephala*	C		√	√	√
Bird	Tawny Grassbird	*Megalurus timoriensis*	C		√	√	
Bird	Lewin's Honeyeater	*Meliphaga lewinii*	C		√	√	
Bird	White-throated Honeyeater	*Melithreptus albogularis*	C		√	√	√
Bird	Black-chinned Honeyeater	*Melithreptus gularis*	NT		√		
Bird	White-naped Honeyeater	*Melithreptus lunatus*	C		√	√	
Bird	Budgerigar	*Melopsittacus undulatus*				√	
Bird	Rainbow Bee-Eater	*Merops ornatus*	C		√	√	√
Bird	Little Pied Cormorant	*Microcarbo melanoleucos*	C		√	√	
Bird	Jacky Winter	*Microeca fascinans*	C		√	√	
Bird	Horsfield's bushlark	*Mirafra javanica*	C		√		
Bird	Black-faced Monarch	*Monarcha melanopsis*	C		√	√	
Bird	Satin Flycatcher	*Myiagra cyanoleuca*	C		√		
Bird	Restless Flycatcher	*Myiagra inquieta*	C		√	√	
Bird	Leaden Flycatcher	*Myiagra rubecula*	C		√	√	√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Dusky Honeyeater	*Myzomela obscura*	C		√		
Bird	Scarlet Honeyeater	*Myzomela sanguinolenta*	C		√	√	√
Bird	Plum-headed Finch	*Neochmia modesta*	C		√		
Bird	Red-browed Finch	*Neochmia temporalis*	C		√		
Bird	Red-browed Finch	*Neochmia temporalis*				√	
Bird	Cotton Pygmy-goose	*Nettapus coromandelianus*	NT		√	√	√
Bird	Southern Boobook	*Ninox boobook*	C		√	√	√
Bird	Barking Owl	*Ninox connivens*				√	
Bird	Powerful Owl	*Ninox strenua*	V		√	√	
Bird	Little Curlew	*Numenius minutus*	C		√		
Bird	Whimbrel	*Numenius phaeopus*				√	
Bird	Nankeen Night-Heron	*Nycticorax caledonicus*	C		√	√	
Bird	Cockatiel	*Nymphicus hollandicus*	C		√		
Bird	Crested Pigeon	*Ocyphaps lophotes*	C		√	√	
Bird	Olive-backed Oriole	*Oriolus sagittatus*	C		√	√	√
Bird	Australian Logrunner	*Orthonyx temminckii*				√	
Bird	Golden Whistler	*Pachycephala pectoralis*	C	VUL Norfolk Is	√	√	
Bird	Rufous Whistler	*Pachycephala rufiventris*	C		√	√	√
Bird	Salvin's Prion	*Pachyptila salvini*					√
Bird	Eastern Osprey	*Pandion cristatus*	C		√	√	
Bird	Spotted Pardalote	*Pardalotus punctatus*	C		√	√	√
Bird	Striated Pardalote	*Pardalotus striatus*	C		√	√	√
Bird	House Sparrow	*Passer domesticus*			√	√	
Bird	Australian Pelican	*Pelecanus conspicillatus*			√	√	
Bird	Fairy Martin	*Petrochelidon ariel*	C		√	√	
Bird	Tree Martin	*Petrochelidon nigricans*				√	
Bird	Scarlet Robin	*Petroica boodang*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Red-capped Robin	*Petroica goodenovii*	C		√		
Bird	Rose Robin	*Petroica rosea*	C		√	√	
Bird	White-tailed Tropicbird	*Phaethon lepturus*					√
Bird	Great Cormorant	*Phalacrocorax carbo*	C		√	√	
Bird	Little Black Cormorant	*Phalacrocorax sulcirostris*	C		√	√	
Bird	Pied Cormorant	*Phalacrocorax varius*	C		√	√	
Bird	Common Bronzewing	*Phaps chalcoptera*	C		√	√	√
Bird	Little Friarbird	*Philemon citreogularis*	C		√	√	√
Bird	Noisy Friarbird	*Philemon corniculatus*	C		√	√	√
Bird	Frogmouth	*Philydrum lanuginosum*	C		√		
Bird	Yellow-billed Spoonbill	*Platalea flavipes*	C		√		
Bird	Royal Spoonbill	*Platalea regia*	C		√	√	
Bird	Pale-headed Rosella	*Platycercus adscitus*	C		√	√	
Bird	Pale-headed Rosella (southern form)	*Platycercus adscitus palliceps*	C		√		
Bird	Crimson Rosella	*Platycercus elegans*	C		√		
Bird	Eastern Rosella	*Platycercus eximius*	C		√	√	
Bird	Striped Honeyeater	*Plectorhyncha lanceolata*	C		√	√	
Bird	Glossy Ibis	*Plegadis falcinellus*	C		√	√	
Bird	Tawny Frogmouth	*Podargus strigoides*	C		√	√	
Bird	Great Crested Grebe	*Podiceps cristatus*	C		√		
Bird	Hoary-headed Grebe	*Poliocephalus poliocephalus*	C		√		
Bird	Grey-crowned Babbler	*Pomatostomus temporalis*	C		√	√	
Bird	Purple Swamphen	*Porphyrio porphyrio*	C		√	√	
Bird	Baillon's crake	*Porzana pusilla*	C		√		
Bird	Red-rumped Parrot	*Psephotus haematonotus*	C		√		
Bird	Eastern Whipbird	*Psophodes olivaceus*	C		√	√	

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Superb fruit-dove	*Ptilinopus superbus*	C		√		√
Bird	Satin Bowerbird	*Ptilonorhynchus violaceus*				√	
Bird	Grey Fantail	*Rhipidura albiscapa*	C		√	√	
Bird	Willie Wagtail	*Rhipidura leucophrys*	C		√	√	√
Bird	Rufous Fantail	*Rhipidura rufifrons*	C		√	√	√
Bird	Australian painted snipe	*Rostratula australis*	V	V	√		
Bird	Painted Snipe	*Rostratula benghalensis*					√
Bird	Channel-billed Cuckoo	*Scythrops novaehollandiae*	C		√	√	
Bird	White-browed Scrubwren	*Sericornis frontalis*	C		√	√	
Bird	Large-billed Scrubwren	*Sericornis magnirostra*	C		√		
Bird	Regent Bowerbird	*Sericulus chrysocephalus*	C		√		
Bird	Regent Bowerbird	*Sericulus chrysocephalus*					√
Bird	Weebill	*Smicrornis brevirostris*	C		√	√	√
Bird	Australasian Figbird	*Sphecotheres vieilloti*	C		√	√	
Bird	Freckled Duck	*Stictonetta naevosa*	NT		√		√
Bird	Southern Emu-wren	*Stipiturus malachurus*	V		√		
Bird	Pied Currawong	*Strepera graculina*	C	VUL Lord Howe Is	√	√	
Bird	Pied Currawong (eastern Australia)	*Strepera graculina graculina*	C		√		
Bird	Spotted Dove	*Streptopelia chinensis*			√	√	
Bird	Common Myna	*Sturnus tristis*			√	√	
Bird	Common Starling	*Sturnus vulgaris*			√	√	
Bird	spectacled monarch	*Symposiarchus trivirgatus*	C		√		
Bird	Australasian Grebe	*Tachybaptus novaehollandiae*	C		√	√	
Bird	Double-barred Finch	*Taeniopygia bichenovii*	C		√	√	
Bird	Zebra Finch	*Taeniopygia guttata*	C		√		
Bird	Australian White Ibis	*Threskiornis molucca*	C		√	√	√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Bird	Straw-necked Ibis	*Threskiornis spinicollis*	C		√	√	√
Bird	Collared kingfisher	*Todiramphus chloris*	C		√		
Bird	Forest Kingfisher	*Todiramphus macleayii*	C		√	√	√
Bird	Red-backed Kingfisher	*Todiramphus pyrrhopygius*	C		√		
Bird	Sacred Kingfisher	*Todiramphus sanctus*	C		√	√	√
Bird	Pale-yellow Robin	*Tregellasia capito*	C		√		
Bird	Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotis*	C		√	√	√
Bird	Rainbow Lorikeet	*Trichoglossus haematodus*			√	√	√
Bird	Red-collared Lorikeet	*Trichoglossus haematodus rubritorquis*	C		√		
Bird	Wood Sandpiper	*Tringa glareola*	C		√		
Bird	Common Greenshank	*Tringa nebularia*	C		√		
Bird	Marsh Sandpiper	*Tringa stagnatilis*	C		√	√	
Bird	Black-breasted Button-quail	*Turnix melanogaster*	V	V	√		
Bird	Red-chested Button-Quail	*Turnix pyrrhothorax*					√
Bird	Painted Button-quail	*Turnix varius*	C	VUL Abrolhos	√	√	√
Bird	Barn Owl	*Tyto alba*					√
Bird	Eastern Barn Owl	*Tyto javanica*	C		√		
Bird	Masked Lapwing	*Vanellus miles*			√	√	
Bird	Masked Lapwing (northern subspecies)	*Vanellus miles miles*	C		√		
Bird	Masked Lapwing (southern subspecies)	*Vanellus miles novaehollandiae*	C		√		
Bird	Banded Lapwing	*Vanellus tricolor*	C		√		
Bird	Regent Honeyeater	*Xanthomyza phrygia*					√
Bird	Silvereye	*Zosterops lateralis*	C		√	√	
Bird	Silvereye (eastern)	*Zosterops lateralis cornwalli*	C		√		
Fish	Agassiz's Glassfish	*Ambassis agassizii*			√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Fish	Mosquitofish	*Gambusia holbrooki*			√		
Fish	Firetail Gudgeon	*Hypseleotris galii*			√		
Fish	Southern Purple-spotted Gudgeon	*Mogurnda adspersa*			√		
Fish	Tailed Emperor	*Polyura sempronius sempronius*			√		
Fish	Swordtail	*Xiphophorus helleri*			√		
Insect	Glasswing	*Acraea andromacha andromacha*			√		
Insect	Bronze Ant-blue	*Acrodipsas brisbanensis brisbanensis*			√		
Insect	Copper Ant-blue	*Acrodipsas cuprea*			√		
Insect	Copper Pencilled-blue	*Candalides cyprotus pallescens*			√		
Insect	Black Jezebel	*Delias nigrina*			√		
Insect	Large Grass-yellow	*Eurema hecabe phoebus*			√		
Insect	Small Grass-yellow	*Eurema smilax*			√		
Insect	Blue Triangle	*Graphium sarpedon choredon*			√		
Insect	Wide-brand Sedge-skipper	*Hesperilla crypsigramma*			√		
Insect	Swift Sedge-skipper	*Hesperilla sarnia*			√		
Insect	Moonlight Jewel (eastern subspecies)	*Hypochrysops delicia delicia*			√		
Insect	Orange Ringlet	*Hypocysta adiante adiante*			√		
Insect	Meadow Argus	*Junonia villida calybe*			√		
Insect	Common Evening-brown	*Melanitis leda bankia*			√		
Insect	Yellow Grass-skipper	*Neohesperilla xanthomera*			√		
Insect	Bronze Flat (southern subspecies)	*Netrocoryne repanda repanda*			√		
Insect	Dull-purple Azure (coastal subspecies)	*Ogyris olane ocela*			√		
Insect	Silky Azure	*Ogyris oroetes oroetes*			√		
Insect	Northern Purple Azure (southern	*Ogyris zosine zosine*			√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
	subspecies)						
Insect	Orchard Swallowtail (Australian subspecies)	*Papilio aegeus aegeus*			√		
Insect	White-banded Plane (southern subspecies)	*Phaedyma shepherdi shepherdi*			√		
Insect	Blue Tiger	*Tirumala hamata hamata*			√		
Insect	Varied Sword-grass brown (Queensland subspecies)	*Tisiphone abeona rawnsleyi*			√		
Insect	Banded Grass-skipper	*Toxida parvulus*			√		
Insect	Dingy Skipper	*Toxidia peron*			√		
Insect	Yellow Admiral	*Vanessa itea*			√		
Insect	Australian Painted lady	*Vanessa kershawi*			√		
Insect	Common Grass-blue (Australian subspecies)	*Zizina labradus labradus*			√		
Mammal	Feathertail Glider	*Acrobates pygmaeus*	C		√		
Mammal	Rufous Bettong	*Aepyprymnus rufescens*	C		√		
Mammal	Yellow-footed Antechinus	*Antechinus flavipes*	C		√		
Mammal	Brown Antechinus	*Antechinus stuartii*	C		√		
Mammal	Dog	*Canis familiaris*			√		
Mammal	Dingo	*Canis lupus dingo*			√		
Mammal	Goat	*Capra hircus*			√		
Mammal	Gould's Wattled bat	*Chalinolobus gouldii*	C		√		
Mammal	Hoary Wattled bat	*Chalinolobus nigrogriseus*	C		√		
Mammal	Spotted-tailed Quoll (southern subspecies)	*Dasyurus maculatus maculatus*	V	E	√		
Mammal	Horse	*Equus caballus*			√		
Mammal	Cat	*Felis catus*			√		
Mammal	Water Rat	*Hydromys chrysogaster*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Mammal	Northern Brown Bandicoot	*Isoodon macrourus*	C		√		
Mammal	Brown Hare	*Lepus capensis*			√		
Mammal	Black-striped Wallaby	*Macropus dorsalis*	C		√		
Mammal	Eastern Grey Kangaroo	*Macropus giganteus*	C		√		
Mammal	Whiptail Wallaby	*Macropus parryi*	C		√		
Mammal	Common Wallaroo	*Macropus robustus*	C		√		
Mammal	Red-necked Wallaby	*Macropus rufogriseus*	C		√		
Mammal	Grassland Melomys	*Melomys burtoni*	C		√		
Mammal	Fawn-Footed Melomys	*Melomys cervinipes*	C		√		
Mammal	Little Bent-wing Bat	*Miniopterus australis*	C		√		
Mammal	Common Bent-winged bat	*Miniopterus schreibersii*					√
Mammal	Eastern Bent-wing bat	*Miniopterus schreibersii oceanensis*	C		√		
Mammal	Beccari's Freetail bat	*Mormopterus beccarii*	C		√		
Mammal	East Coast Freetail bat	*Mormopterus norfolkensis*	C		√		
Mammal	Freetail Bat	*Mormopterus sp.*			√		
Mammal	Eastern Freetail bat	*Mormopterus sp. 2*	C		√		
Mammal	House Mouse	*Mus musculus*			√		
Mammal	Large-footed Myotis	*Myotis macropus*	C		√		
Mammal	Northern Long-eared bat	*Nyctophilus bifax*	C		√		
Mammal	Lesser Long-eared bat	*Nyctophilus geoffroyi*	C		√		
Mammal	Gould's Long-eared bat	*Nyctophilus gouldi*	C		√		
Mammal	Long-eared bay	*Nyctophilus sp.*			√		
Mammal	Platypus	*Ornithorhynchus anatinus*	C		√		
Mammal	Rabbit	*Oryctolagus cuniculus*			√		
Mammal	Long-nosed Bandicoot	*Perameles nasuta*	C		√		
Mammal	Greater Glider	*Petauroides volans*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Mammal	Yellow-bellied Glider (southern subspecies)	*Petaurus australis australis*	C		√		
Mammal	Sugar Glider	*Petaurus breviceps*	C		√		
Mammal	Squirrel Glider	*Petaurus norfolcensis*	C		√		
Mammal	Glider sp.	*Petaurus sp.*			√		
Mammal	Brush-tailed Rock-wallaby	*Petrogale penicillata*	V	V	√		
Mammal	Brush-tailed Phascogale	*Phascogale tapoatafa*					√
Mammal	Koala (southeast Queensland bioregion)	*Phascolarctos cinereus (southeast Queensland bioregion)*	V		√		
Mammal	Common Planigale	*Planigale maculata*	C		√		
Mammal	Common Ringtail Possum	*Pseudocheirus peregrinus*	C		√		
Mammal	Eastern Chestnut mouse	*Pseudomys gracilicaudatus*					√
Mammal	Black Flying-fox	*Pteropus alecto*	C		√		
Mammal	Grey-headed Flying-fox	*Pteropus poliocephalus*	C	V	√		
Mammal	Little red Flying-fox	*Pteropus scapulatus*	C		√		
Mammal	Flying - fox sp.	*Pteropus sp.*			√		
Mammal	Bush Rat	*Rattus fuscipes*	C		√		
Mammal	Swamp Rat	*Rattus lutreolus*	C		√		
Mammal	Black Rat	*Rattus rattus*			√		
Mammal	Pale Field-rat	*Rattus tunneyi*	C		√		
Mammal	Yellow-bellied Sheathtail bat	*Saccolaimus flaviventris*	C		√		
Mammal	Greater Broad-nosed bat	*Scoteanax rueppellii*	C		√		
Mammal	Little Broad-nosed bat	*Scotorepens greyii*					√
Mammal	South-eastern Broad-nosed bat	*Scotorepens orion*	C		√		
Mammal	Broad -nosed Bat	*Scotorepens sp.*			√		
Mammal	Common Dunnart	*Sminthopsis murina*					√
Mammal	Pig	*Sus scrofa*			√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Mammal	Short-beaked Rchidna	*Tachyglossus aculeatus*	C		√		
Mammal	White-striped Freetail bat	*Tadarida australis*	C		√		
Mammal	Short-eared Possum	*Trichosurus caninus*	C		√		
Mammal	Common Brushtail Possum	*Trichosurus vulpecula*	C		√		
Mammal	Little Cave Eptesicus	*Vespadelus pumilus*					√
Mammal	Fox	*Vulpes vulpes*					√
Mammal	Swamp Wallaby	*Wallabia bicolor*	C		√		
Reptile	Common Death Adder	*Acanthophis antarcticus*					√
Reptile	Verreaux's Skink	*Anomalopus verreauxii*					√
Reptile	Brown Tree Snake	*Boiga irregularis*					√
Reptile	White-crowned Snake	*Cacophis harriettae*					√
Reptile	Southern Dwarf Crowned Snake	*Cacophis krefftii*					√
Reptile	Golden-crowned Snake	*Cacophis squamulosus*					√
Reptile	Scute-snouted Calyptotis	*Calyptotis scutirostrum*					√
Reptile	Burnett's Skink	*Carlia foliorum*					√
Reptile	Shaded-litter Rainbow-skink	*Carlia munda*					√
Reptile	Open-litter Rainbow Skink	*Carlia pectoralis*					√
Reptile	Rainbow Skink	*Carlia schmeltzii*	C		√		
Reptile	Lively Skink	*Carlia vivax*					√
Reptile	Broad-shelled River Turtle	*Chelodina expansa*					√
Reptile	Eastern Snake-necked turtle	*Chelodina longicollis*	C		√		
Reptile	Frilled Lizard	*Chlamydosaurus kingii*					√
Reptile	Elegant Snake-eyed Skink	*Cryptoblepharus pulcher*					√
Reptile	Elegant Snake-eyed skink	*Cryptoblepharus pulcher pulcher*	C		√		
Reptile	Wall Skink	*Cryptoblepharus virgatus*					√
Reptile		*Cryptoblepharus virgatus sensu lato*	C		√		

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Reptile	Small-eyed Snake	*Cryptophis nigrescens*					√
Reptile		*Ctenotus arcanus*	C		√		
Reptile	Eastern Striped Skink	*Ctenotus robustus*					√
Reptile	Copper-tailed Skink	*Ctenotus taeniolatus*					√
Reptile	Pink-tongued Skink	*Cyclodomorphus gerrardii*					√
Reptile	Common Delma	*Delma plebeia*					√
Reptile	Yellow-faced Whip Snake	*Demansia psammophis*					√
Reptile	Green Tree Snake	*Dendrelaphis punctulata*					√
Reptile	Stone Gecko	*Diplodactylus vittatus*					√
Reptile	Tommy Roundhead	*Diporiphora australis*	C		√		
Reptile	Eastern Ranges Rock-skink	*Egernia modesta*					√
Reptile	Brisbane River Short-necked Turtle	*Emydura macquarii*					√
Reptile	Murray turtle	*Emydura macquarii macquarii*	C		√		
Reptile	Broad-banded Sand-swimmer	*Eremiascincus richardsonii*					√
Reptile	Martin's Skink	*Eulamprus martini*					√
Reptile	Eastern Water Skink	*Eulamprus quoyii*	C		√		
Reptile		*Eulamprus sp.*			√		
Reptile		*Eulamprus tenuis*	C		√		
Reptile	Red-naped Snake	*Furina diadema*					√
Reptile	Dubious Dtella	*Gehyra dubia*					√
Reptile	Variegated Dtella	*Gehyra variegata*					√
Reptile	Grey Snake	*Hemiaspis damelii*					√
Reptile	Marsh Snake	*Hemiaspis signata*					√
Reptile	Asian House Gecko	*Hemidactylus frenatus*					√
Reptile	Pale-headed Snake	*Hoplocephalus bitorquatus*					√
Reptile	Secretive Skink	*Lampropholis amicula*					√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Reptile	Garden Skink	*Lampropholis delicata*					√
Reptile	Burton's Snake Lizard	*Lialis burtonis*					√
Reptile		*Lygisaurus foliorum*	C		√		
Reptile	Carpet Python	*Morelia spilota*					√
Reptile		*Morethia boulengeri*	C		√		
Reptile	North-eastern Firetail Skink	*Morethia taeniopleura*					√
Reptile	Clouded Gecko	*Oedura jacovae*					√
Reptile	Robust Velvet Gecko	*Oedura robusta*	C		√		
Reptile	Southern spotted Velvet gecko	*Oedura tryoni*	C		√		
Reptile	Yolk-bellied Snake-skink	*Ophioscincus ophioscincus*					√
Reptile	Eastern Water Dragon	*Physignathus lesueurii*					√
Reptile	Common Bearded Dragon	*Pogona barbata*					√
Reptile	Spotted Black Snake	*Pseudechis guttatus*					√
Reptile	Red-bellied Black Snake	*Pseudechis porphyriacus*					√
Reptile	Eastern Brown Snake	*Pseudonaja textilis*					√
Reptile	Blind Snake	*Ramphotyphlops*					√
Reptile	Small-headed Blind Snake	*Ramphotyphlops affinis*					√
Reptile	Robust Blind Snake	*Ramphotyphlops ligatus*					√
Reptile	Proximus Blind Snake	*Ramphotyphlops proximus*					√
Reptile	Brown-snouted Blind Snake	*Ramphotyphlops wiedii*					√
Reptile	Eastern Small-eyed snake	*Rhinoplocephalus nigrescens*	C		√		
Reptile	Coral Snake	*Simoselaps australis*	C		√		
Reptile	Eastern Blue-tongue Lizard	*Tiliqua scincoides*					√
Reptile	Rough-scaled Snake	*Tropidechis carinatus*					√
Reptile	Freshwater Snake	*Tropidonophis mairii*					√
Reptile	Yellow-spotted Monitor	*Varanus panoptes*					√

Type	Common Name	Species Name	Status		Source		
			NCA	EPBC	Wildnet	Birds Australia	QLD Museum
Reptile	Lace Monitor	*Varanus varius*					√
Reptile	Bandy Bandy	*Vermicella annulata*					√
Reptile	Saw-shelled Turtle	*Wollumbinia latisternum*	C		√		

APPENDIX

B

Combined Flora List

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Cyperaceae		Abildgaardia vaginata				√
Malvaceae		Abutilon oxycarpum			√	
Mimosaceae		Acacia amblygona				√
Mimosaceae		Acacia aulacocarpa			√	
Mimosaceae		Acacia blakei subsp. blakei				√
Mimosaceae		Acacia complanata				√
Mimosaceae		Acacia concurrens			√	
Mimosaceae		Acacia concurrens				√
Mimosaceae	Brisbane golden wattle	Acacia fimbriata			√	
Mimosaceae		Acacia fimbriata				√
Mimosaceae		Acacia hispidula				√
Mimosaceae		Acacia irrorata subsp. irrorata				√
Mimosaceae		Acacia julifera subsp. julifera				√
Mimosaceae		Acacia juncifolia				√
Mimosaceae	Maiden's wattle	Acacia maidenii			√	
Mimosaceae	blackwood	Acacia melanoxylon			√	
Mimosaceae		Acacia obtusifolia			√	
Mimosaceae		Acacia obtusifolia				√
Mimosaceae		Acacia quadrilateralis				√
Mimosaceae	doolan	Acacia salicina			√	
Mimosaceae		Acacia salicina				√
Mimosaceae		Acacia suaveolens				√
Mimosaceae		Acacia ulicifolia				√
Orchidaceae		Acianthus fornicatus				√
Rutaceae		Acronychia imperforata				√
Rutaceae	glossy acronychia	Acronychia laevis			√	
Rutaceae		Acronychia laevis				√
Ericaceae		Acrotriche aggregata				√
Adiantaceae		Adiantum aethiopicum			√	
Adiantaceae		Adiantum hispidulum			√	
Adiantaceae		Adiantum hispidulum var. minus				√
Lamiaceae		Ajuga australis				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Cornaceae		Alangium villosum			√	
Euphorbiaceae	native holly	Alchornea ilicifolia			√	
Sapindaceae		Alectryon tomentosus			√	
Casuarinaceae		Allocasuarina littoralis			√	
Casuarinaceae		Allocasuarina torulosa			√	
Poaceae		Alloteropsis semialata				√
Rhamnaceae	soap tree	Alphitonia excelsa			√	
Zingiberaceae	wild ginger	Alpinia caerulea			√	
Apocynaceae		Alyxia ruscifolia			√	
Apocynaceae		Alyxia ruscifolia				√
Physciaceae		Amandinea punctata				√
Basidiomycota		Amanita sp. 10b				√
Loranthaceae		Amyema congener subsp. congener				√
Myrtaceae		Angophora costata			√	
Myrtaceae	rusty gum	Angophora leiocarpa			√	
Myrtaceae		Angophora subvelutina			√	
Basidiomycota		Antrodia				√
Ulmaceae		Aphananthe philippinensis			√	
Aphanopetalaceae	gumvine	Aphanopetalum resinosum			√	
Aphanopetalaceae		Aphanopetalum resinosum				√
Araucariaceae	hoop pine	Araucaria cunninghamii			√	
Poaceae		Aristida benthamii var. benthamii				√
Poaceae		Aristida gracilipes			√	
Poaceae		Aristida lignosa				√
Poaceae		Aristida vagans				√
Poaceae		Aristida warburgii				√
Aristolochiaceae		Aristolochia meridionalis subsp. meridionalis				√
Laxmanniaceae		Arthropodium paniculatum				√
Aspleniaceae		Asplenium australasicum			√	
Araliaceae		Astrotricha latifolia				√
Sapindaceae		Atalaya salicifolia			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Fabaceae	bloodvine	Austrosteenisia blackii			√	
Poaceae		Austrostipa pubescens				√
Poaceae		Austrostipa rudis				√
Euphorbiacae	scrub bloodwood	Baloghia inophylla			√	
Restionaceae		Baloskion pallens				√
Proteaceae		Banksia integrifolia			√	
Proteaceae		Banksia integrifolia subsp. compar				√
Proteaceae		Banksia robur				√
Caesalpiniaceae		Barklya syringifolia				√
Cyperaceae		Baumea teretifolia				√
Rutaceae		Boronia polygalifolia				√
Rutaceae		Boronia rosmarinifolia				√
Fabaceae		Bossiaea prostrata var. (Tuan Creek M.S.Clemens AQ22827)				√
Sterculiaceae		Brachychiton discolor			√	
Ericaceae		Brachyloma daphnoides subsp. daphnoides				√
Phyllanthaceae		Breynia oblongifolia				√
Phyllanthaceae		Bridelia exaltata				√
Physciaceae		Buellia				√
Physciaceae		Buellia curatellae				√
Physciaceae		Buellia dissa				√
Orchidaceae	grain-of-wheat orchid	Bulbophyllum minutissimum			√	
Orchidaceae		Bulbophyllum minutissimum				√
Colchicaceae		Burchardia umbellata				√
Burmanniaceae		Burmannia disticha				√
Orchidaceae		Caladenia carnea				√
Orchidaceae		Caladenia carnea var. carnea				√
Portulacaceae		Calandrinia pickeringii				√
Caliciaceae		Calicium robustellum				√
Orchidaceae		Calochilus campestris				√
Asteraceae		Calotis dentex				√
Dicranaceae		Campylopus				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Parmeliaceae		Canoparmelia aptata				√
Capparaceae	brush caper berry	Capparis arborea			√	
Cyperaceae		Carex breviculmis				√
Asteraceae		Cassinia subtropica				√
Vitaceae	hairy grape	Cayratia acris			√	√
Vitaceae	slender grape	Cayratia clematidea			√	
Vitaceae		Cayratia saponaria				√
Celastraceae	large-leaved staffvine	Celastrus subspicata			√	√
Poaceae		Cenchrus caliculatus				√
Asteraceae		Centratherum punctatum			√	
Asteraceae		Centratherum riparium				√
Caesalpiniaceae		Chamaecrista concinna				√
Adiantaceae	bristly cloak fern	Cheilanthes distans			√	
Adiantaceae		Cheilanthes sieberi			√	
Orchidaceae		Chiloglottis diphylla				√
Cyperaceae		Chorizandra cymbaria				√
Fabaceae		Chorizema parviflorum				√
Thelypteridaceae		Christella dentata				√
Asteraceae	yellow buttons	Chrysocephalum apiculatum			√	
Chrysothricaceae		Chrysothrix candelaris				√
Vitaceae		Cissus antarctica			√	
		Clematicissus opaca			√	
		Clematis glycinoides			√	
Rutaceae		Coatesia paniculata				√
Coccocarpiaceae		Coccocarpia dissecta				√
		Codonocarpus attenuatus			√	
Polygalaceae		Comesperma hispidulum				√
	wandering jew	Commelina diffusa			√	
Laxmanniaceae	large-leaved palm lily	Cordyline petiolaris				√
Laxmanniaceae	red-fruited palm lily	Cordyline rubra			√	
Asteraceae		Coronidium oxylepis subsp. oxylepis				√
Myrtaceae	spotted gum	Corymbia citriodora			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Myrtaceae		Corymbia henryi				√
Myrtaceae	pink bloodwood	Corymbia intermedia			√	
Myrtaceae		Corymbia intermedia				√
Myrtaceae	Moreton Bay ash	Corymbia tessellaris			√	
Myrtaceae		Corymbia trachyphloia subsp. trachyphloia				√
		Crassula sieberiana			√	
		Crotalaria montana			√	
Rhamnaceae		Cryptandra propinqua				√
Rhamnaceae		Cryptandra rigida				√
Lauraceae		Cryptocarya obovata				√
Sapindaceae	Boonah tuckeroo	Cupaniopsis tomentella	V		√	√
Asteraceae		Cyanthillium cinereum				√
		Cyclophyllum coprosmoides			√	
		Cymbidium suave			√	
Apocynaceae	bowman's milkvine	Cynanchum bowmanii			√	√
Cyperaceae		Cyperus aquatilis				√
Cyperaceae		Cyperus bowmannii				√
Cyperaceae		Cyperus cyperoides				√
Cyperaceae		Cyperus difformis				√
Cyperaceae		Cyperus fulvus				√
Cyperaceae		Cyperus haspan subsp. haspan				√
Cyperaceae		Cyperus laevis				√
Cyperaceae		Cyperus leiocaulon				√
Cyperaceae		Cyperus platystylis				√
Cyperaceae		Cyperus polystachyos var. polystachyos				√
Cyperaceae		Cyperus trinervis				√
Goodeniaceae		Dampiera sylvestris				√
		Davallia pyxidata			√	
Fabaceae		Daviesia squarrosa			√	
Fabaceae		Daviesia ulicifolia subsp. stenophylla				√
Fabaceae		Daviesia umbellulata				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Fabaceae		Daviesia villifera				√
Fabaceae		Daviesia wyattiana				√
Polytrichaceae		Dawsonia longiseta				√
	climbing deeringia	Deeringia arborescens			√	
	slender orchid	Dendrobium gracilicaule			√	
		Dendrobium kingianum subsp. kingianum			√	
		Dendrobium monophyllum			√	
		Dendrobium speciosum			√	
	giant stinging tree	Dendrocnide excelsa			√	
	shiny-leaved stinging tree	Dendrocnide photinophylla			√	
	native derris	Derris involuta			√	
Fabaceae		Desmodium brachypodum				√
Fabaceae		Desmodium gangeticum				√
Fabaceae		Desmodium rhytidophyllum			√	√
		Dianella			√	
Hemerocallidaceae		Dianella caerulea var. assera				√
Hemerocallidaceae		Dianella caerulea var. vannata				√
Hemerocallidaceae		Dianella revoluta var. revoluta				√
Convolvulaceae		Dichondra repens				√
Poaceae		Digitaria ramularis				√
	native yam	Dioscorea transversa			√	
	black plum	Diospyros australis			√	
	scaly ebony	Diospyros geminata			√	
		Diplocyclos palmatus			√	
Graphidaceae		Diploschistes sticticus				√
Orchidaceae		Dipodium variegatum				√
Physciaceae		Dirinaria applanata				√
Physciaceae		Dirinaria consimilis				√
	tongue orchid	Dockrillia linguiformis			√	
Sapindaceae		Dodonaea triangularis				√
Sapindaceae		Dodonaea triquetra				√
Sapindaceae		Dodonaea viscosa			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
	prickly rasp fern	Doodia aspera			√	
		Doodia caudata			√	
		Drosera indica			√	
Polypodiaceae		Drynaria rigidula			√	√
Putranjivaceae	grey boxwood	Drypetes deplanchei			√	√
Chenopodiaceae		Dysphania carinata				√
Asteraceae		Eclipta platyglossa				√
		Einadia hastata			√	
Elaeocarpaceae	blueberry ash	Elaeocarpus obovatus			√	√
Cyperaceae		Eleocharis atricha				√
Cyperaceae		Eleocharis cylindrostachys				√
Cyperaceae		Eleocharis equisetina				√
Poaceae		Entolasia stricta				√
Poaceae		Eragrostis brownii				√
Poaceae		Eragrostis spartinoides				√
Poaceae		Eremochloa bimaculata				√
Poaceae		Eriochloa procera				√
		Erythrina vespertilio			√	
Myrtaceae		Eucalyptus acmenoides			√	
Myrtaceae		Eucalyptus baileyana				√
Myrtaceae	narrow-leaved red ironbark	Eucalyptus crebra			√	
Myrtaceae		Eucalyptus curtisii	NT			√
Myrtaceae		Eucalyptus fibrosa subsp. fibrosa				√
Myrtaceae	mountain grey gum	Eucalyptus major			√	
Myrtaceae		Eucalyptus melanophloia			√	
Myrtaceae		Eucalyptus microcorys			√	
Myrtaceae		Eucalyptus planchoniana				√
Myrtaceae		Eucalyptus propinqua				√
Myrtaceae		Eucalyptus racemosa subsp. racemosa				√
Myrtaceae		Eucalyptus resinifera				√
Myrtaceae		Eucalyptus seeana				√
Myrtaceae		Eucalyptus tereticornis			√	√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Myrtaceae		Eucalyptus tereticornis subsp. tereticornis				√
Euphorbiaceae		Euphorbia tannensis subsp. eremophila				√
		Everistia vacciniifolia var. nervosa			√	
		Evolvulus alsinoides			√	
	creek sandpaper fig	Ficus coronata			√	
		Ficus obliqua			√	
		Ficus opposita			√	
		Ficus platypoda			√	
		Ficus virens			√	
Cyperaceae		Fimbristylis tristachya				√
	flemingia	Flemingia parviflora			√	
Cyperaceae		Gahnia clarkei				√
Rubiaceae		Galium leptogonium				√
		Galium migrans			√	
	scrambling lily	Geitonoplesium cymosum			√	
Orchidaceae		Genoplesium acuminatum				√
Orchidaceae		Genoplesium archeri				√
Orchidaceae		Genoplesium fimbriatum				√
Orchidaceae		Glossodia major				√
Orchidaceae		Glossodia minor				√
Fabaceae		Glycine				√
Fabaceae		Glycine clandestina var. clandestina				√
Fabaceae		Glycine microphylla				√
Fabaceae		Glycine sp.				√
Fabaceae		Glycine tomentella				√
	white beech	Gmelina leichhardtii			√	
Fabaceae		Gompholobium latifolium				√
Fabaceae		Gompholobium pinnatum				√
Haloragaceae		Gonocarpus chinensis subsp. verrucosus				√
Haloragaceae		Gonocarpus tetragynus				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Goodeniaceae		Goodenia bellidifolia subsp. argentea				√
Goodeniaceae		Goodenia delicata				√
		Goodenia rotundifolia			√	
Myrtaceae		Gossia bidwillii				√
Myrtaceae		Gossia hillii				√
Proteaceae		Grevillea banksii				√
Surianaceae		Guilfoylia monostylis				√
	guioa	Guioa semiglauca			√	
Araceae	settler's flax	Gymnostachys anceps			√	√
Asteraceae		Gynura drymophila var. drymophila				√
Asteraceae		Gynura drymophila var. glabrifolia				√
Proteaceae		Hakea florulenta				√
Haloragaceae		Haloragis heterophylla				√
Fabaceae		Hardenbergia violacea			√	√
		Harpullia pendula			√	
Heterodeaceae		Heterodea muelleri				√
Physciaceae		Heterodermia speciosa				√
	black speargrass	Heteropogon contortus			√	
Dilleniaceae		Hibbertia diffusa				√
Dilleniaceae		Hibbertia linearis var. floribunda				√
Dilleniaceae		Hibbertia stricta				√
Dilleniaceae		Hibbertia vestita				√
		Hibiscus heterophyllus			√	
Malvaceae	pink hibiscus	Hibiscus splendens			√	√
Rubiaceae		Hodgkinsonia ovatiflora				√
Euphorbiaceae		Homalanthus stillingiifolius				√
Fabaceae		Hovea heterophylla				√
Fabaceae		Hovea planifolia				√
		Hoya australis			√	
Apocynaceae		Hoya australis subsp. australis				√
		Hybanthus enneaspermus			√	
		Hybanthus monopetalus			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Araliaceae		Hydrocotyle laxiflora				√
Araliaceae		Hydrocotyle paludosa				√
		Hypericum gramineum			√	
Hypoxidaceae		Hypoxis hygrometrica var. villosisepala				√
Hypoxidaceae		Hypoxis pratensis var. pratensis				√
	blady grass	Imperata cylindrica			√	
Fabaceae		Indigofera baileyi				√
Fabaceae		Indigofera hirsuta				√
Fabaceae		Indigofera linnaei				√
Colchicaceae		Iphigenia indica				√
Convolvulaceae		Ipomoea plebeia				√
		Jacksonia scoparia			√	
		Jagera pseudorhus			√	
Juncaceae		Juncus planifolius				√
Juncaceae		Juncus prismatocarpus				√
Juncaceae		Juncus usitatus				√
Asteraceae		Lagenophora gracilis				√
		Lastreopsis microsora			√	
Dryopteridaceae		Lastreopsis munita			√	√
Laxmanniaceae		Laxmannia gracilis				√
Lecanoraceae		Lecanora				√
Lecanoraceae		Lecanora caesiorubella				√
Lecideaceae		Lecidea				√
		Legnephora moorei			√	
Cyperaceae		Lepidosperma laterale				√
Cyperaceae		Lepidosperma laterale var. laterale				√
Myrtaceae		Leptospermum juniperinum				√
Myrtaceae		Leptospermum lamellatum				√
Myrtaceae	small-fruited tea-tree	Leptospermum microcarpum			√	√
Myrtaceae	tantoon	Leptospermum polygalifolium			√	√
Myrtaceae		Leptospermum variabile				√
		Lespedeza juncea			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Basidiomycota		Leucopaxillus				√
Scrophulariaceae		Lindernia sp. (Bribie Island S.T.Blake 7089)				√
Campanulaceae		Lobelia gibbosa				√
Campanulaceae		Lobelia stenophylla				√
Loganiaceae		Logania pusilla				√
Laxmanniaceae		Lomandra confertifolia subsp. pallida				√
		Lomandra filiformis			√	
Laxmanniaceae		Lomandra laxa				√
		Lomandra longifolia			√	
Laxmanniaceae		Lomandra multiflora subsp. multiflora				√
Myrtaceae	brush box	Lophostemon confertus			√	
Myrtaceae	swamp box	Lophostemon suaveolens			√	
Lycopodiaceae		Lycopodiella cernua				√
Schizaeaceae		Lygodium microphyllum				√
Lecideaceae		Malcolmiella				√
	red kamala	Mallotus philippensis			√	
Apocynaceae		Marsdenia coronata	V			√
Apocynaceae		Marsdenia micradenia				√
Apocynaceae		Marsdenia rostrata				√
		Maytenus bilocularis			√	
Celastraceae		Maytenus silvestris				√
Myrtaceae		Melaleuca comboynensis				√
Myrtaceae		Melaleuca nodosa				√
Myrtaceae	swamp paperbark	Melaleuca quinquenervia			√	
Myrtaceae		Melaleuca sieberi				√
Myrtaceae		Melaleuca styphelioides				√
Myrtaceae		Melaleuca thymifolia				√
Myrtaceae		Melaleuca viminalis				√
Meliaceae	white cedar	Melia azedarach			√	√
Ericaceae	honey gorse	Melichrus urceolatus			√	√
		Melodorum leichhardtii			√	

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Lamiaceae		Mentha diemenica				√
Poaceae		Microlaena stipoides var. stipoides				√
Orchidaceae		Microtis parviflora				√
Loganiaceae		Mitrasacme alsinoides				√
Loganiaceae		Mitrasacme paludosa				√
Ericaceae		Monotoca scoparia				√
Rubiaceae		Morinda canthoides				√
Moss		Moss				√
Polygonaceae		Muehlenbeckia rhyticarya				√
Commelinaceae		Murdannia graminea				√
Myoporaceae		Myoporum montanum				√
Myrsinaceae		Myrsine howittiana				√
Myrsinaceae		Myrsine variabilis			√	√
Lauraceae		Neolitsea dealbata				√
Chlorophyceae		Nitella				√
Oleaceae		Notelaea lloydii	V			√
Oleaceae		Notelaea longifolia forma glabra				√
		Notelaea microcarpa			√	
Oleaceae		Notelaea ovata				√
Viscaceae		Notothixos subaureus				√
Menyanthaceae		Nymphoides geminata				√
	barbed-wire weed	Nyssanthes diffusa			√	
Pertusariaceae		Ochrolechia				√
Oleaceae		Olea paniculata				√
	Ipswich daisy	Olearia nernstii			√	
Rubiaceae		Opercularia diphylla				√
Hydrocharitaceae		Ottelia ovalifolia				√
		Pandorea jasminoides			√	
Bignoniaceae	wonga vine	Pandorea pandorana			√	√
Poaceae		Panicum simile				√
		Pararchidendron pruinosum			√	
Parmeliaceae		Parmelina conlabrosa				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Parmeliaceae		Parmotrema poolii				√
Parmeliaceae		Parmotrema praesorediosum				√
Parmeliaceae		Parmotrema saccatilobum				√
Parmeliaceae		Parmotrema tinctorum				√
Apocynaceae	northern silkpod	Parsonsia lanceolata			√	√
	monkey rope	Parsonsia straminea			√	
Poaceae		Paspalidium criniforme				√
		Passiflora			√	
Passifloraceae		Passiflora aurantia var. aurantia				√
		Patersonia glabrata			√	
Iridaceae		Patersonia sericea var. sericea				√
		Pavetta australiensis			√	
		Pellaea falcata			√	
	heart fern	Pellaea paradoxa			√	
Piperaceae		Peperomia blanda var. floribunda			√	√
Asteraceae		Peripleura hispidula var. setosa				√
Pertusariaceae		Pertusaria				√
Pertusariaceae		Pertusaria thiospoda				√
Poaceae		Phragmites australis				√
		Phyllanthus gunnii			√	
Phyllanthaceae		Phyllanthus mitchellii				√
Phyllanthaceae		Phyllanthus triandrus subsp. (Mt May P.I.Forster+ PIF11778)				√
Fabaceae		Phyllota phylicoides				√
Pittosporaceae		Pittosporum angustifolium				√
		Planchonella cotinifolia			√	
Sapotaceae		Planchonella eerwah	E		√	√
		Planchonella pubescens			√	
		Platycerium bifurcatum			√	
	staghorn fern	Platycerium superbum			√	
Fabaceae		Platylobium formosum				√
Apiaceae		Platysace ericoides				√
Lamiaceae	flea bush	Plectranthus graveolens			√	√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Lamiaceae		Plectranthus habrophyllus	E			√
		Plectranthus parviflorus			√	
	wiry grape	Pleogyne australis			√	
	native plumbago	Plumbago zeylanica			√	
Poaceae		Poa sieberiana				√
Annonaceae		Polyalthia nitidissima				√
Convolvulaceae		Polymeria calycina				√
	celery wood	Polyscias elegans			√	
Rhamnaceae		Pomaderris queenslandica				√
		Pomax umbellata			√	
Phyllanthaceae		Poranthera microphylla				√
	pastel flower	Pseuderanthemum variabile			√	
Psilotaceae	skeleton fork fern	Psilotum nudum			√	√
Rubiaceae		Psychotria daphnoides			√	√
Rubiaceae	hairy psychotria	Psychotria loniceroides			√	
Rubiaceae		Psydrax odorata			√	
Rubiaceae		Psydrax odorata forma buxifolia			√	√
Rubiaceae		Psydrax odorata subsp. australiana				√
	common bracken	Pteridium esculentum			√	
Orchidaceae		Pterostylis				√
Orchidaceae		Pterostylis nutans				√
Orchidaceae		Pterostylis parviflora				√
Cyperaceae		Ptilothrix deusta				√
Ptychomitriaceae		Ptychomitrium				√
Fabaceae		Pultenaea flexilis				√
Fabaceae		Pultenaea microphylla				√
Fabaceae		Pultenaea myrtoides				√
Fabaceae		Pultenaea petiolaris				√
Fabaceae		Pultenaea retusa				√
Fabaceae		Pultenaea villosa				√
Parmeliaceae		Punctelia pseudocoralloidea				√
	rock felt fern	Pyrrosia rupestris			√	

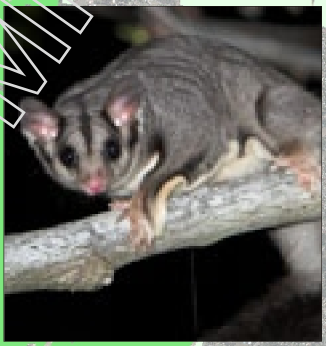
Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Myrtaceae		Rhodamnia dumicola				√
Myrtaceae		Rhodamnia maideniana				√
Asteraceae		Rhodanthe anthemoides				√
Ripogonaceae	small-leaved supplejack	Ripogonum brevifolium			√	√
Bryaceae		Rosulabryum billardierei				√
	pink-flowered native raspberry	Rubus parvifolius			√	
Myrtaceae		Sannantha collina				√
		Sarcomelicope simplicifolia			√	
		Sarcostemma viminale subsp. australe			√	
Goodeniaceae		Scaevola ramosissima				√
Schizaeaceae		Schizaea bifida				√
Cyperaceae		Schoenoplectus litoralis				√
Cyperaceae		Schoenoplectus validus				√
Cyperaceae		Schoenus apogon var. apogon				√
Cyperaceae		Schoenus brevifolius				√
Cyperaceae		Schoenus villosus				√
Cyperaceae		Scleria rugosa				√
Cyperaceae		Scleria tricuspidata				√
	Scoparia	Scoparia dulcis			√	
		Secamone elliptica			√	
Asteraceae		Senecio amygdalifolius			√	√
Asteraceae		Senecio bathurstianus				√
Asteraceae		Senecio pinnatifolius var. pinnatifolius				√
Aizoaceae		Sesuvium portulacastrum				√
Malvaceae		Sida nematopoda				√
	ivorywood	Siphonodon australis			√	
Smilacaceae	barbed-wire vine	Smilax australis			√	√
	devil's needles	Solanum stelligerum			√	
	austral ladies tresses	Spiranthes sinensis			√	
	giant Parramatta grass	Sporobolus fertilis			√	
Stylidiaceae		Stylidium debile				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Fabaceae		Templetonia stenophylla				√
Fabaceae		Tephrosia juncea				√
Fabaceae		Tephrosia sp. (The Grampians L.H.Bird AQ565381)				√
	shining grape	Tetrastigma nitens			√	
Elaeocarpaceae		Tetratheca thymifolia				√
	kangaroo grass	Themeda triandra			√	
Cladoniaceae		Thysanothecium scutellatum				√
		Thysanotus tuberosus			√	
	snakevine	Tinospora smilacina			√	
Araliaceae		Trachymene incisa subsp. incisa				√
Araliaceae	creeping wild parsnip	Trachymene procumbens			√	√
Euphorbiaceae		Tragia novae-hollandiae				√
Ulmaceae		Trema tomentosa			√	√
Ulmaceae		Trema tomentosa var. aspera			√	√
Johnsoniaceae		Tricoryne elatior				√
Juncaginaceae		Triglochin multifructum				√
		Trophis scandens			√	
Meliaceae		Turraea pubescens				√
Araceae		Typhonium brownii				√
Poaceae		Urochloa foliosa				√
Usneaceae		Usnea dasaea				√
Goodeniaceae		Velleia spathulata				√
Scrophulariaceae		Veronica plebeia				√
Campanulaceae		Wahlenbergia queenslandica				√
Campanulaceae		Wahlenbergia stricta subsp. stricta				√
Parmeliaceae		Xanthoparmelia				√
Parmeliaceae		Xanthoparmelia neoquintaria				√
Parmeliaceae		Xanthoparmelia subtropica				√
Xanthorrhoeaceae		Xanthorrhoea latifolia				√
Asteraceae		Xerochrysum bracteatum				√
Proteaceae		Xylomelum benthamii				√
Xyridaceae		Xyris complanata				√

Family	Common Name	Species Name	Status		Source	
			NCA	EPBC	Wildnet	Herbrecs
Rutaceae		Zieria scopulus				√
		Zieria smithii			√	
Fabaceae		Zornia floribunda				√
Fabaceae		Zornia muriculata subsp. angustata				√

Flinders to Greenbank - Karawatha Corridor:

Part B



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EXECUTIVE SUMMARY

The Flinders to Greenbank – Karawatha Ecological Corridor (FGK Corridor) is a 40km corridor that extends from just south of the City of Ipswich at Flinders Peak, to Karawatha Forest in Brisbane's outer suburbs. The corridor crosses the four local government boundaries of Ipswich City Council, Logan City Council, Scenic Rim Regional Council and Brisbane City Council.

Chenoweth EPLA has been contracted to provide an assessment of FGK Corridor with a view to identifying the major threats to the ongoing ecological integrity of the Corridor, and any priority actions to prevent any further degradation.

To achieve this aim the project shall consist of three separate studies:

A. General corridor information and ecological theory;
B. Locating pinch points in existing corridor link; and
C. Identifying any properties of significance, supported by an overall review of the corridor and its critical 'pathways'.

The purpose of this document is to address Part B of the project and provides a review of any existing pinch points in the current corridor links, identifies any additional corridor pinch points; and makes an assessment of any proposed remediation methods.
To achieve this aim Chenoweth EPLA undertook the following steps:

- Reviewed available literature that have previously identified pinch points in the Corridor;
- Assessed the currency of previously identified pinch points;
- Identified any additional pinch points;
- Determined any actions required to mitigate and manage all pinch points; and
- Provided a ranking of pinch points for further priority actions.

A review of the latest available aerial photos and infrastructure developments was undertaken as a desktop exercise to define and map Corridor pinch points. This was accompanied by a desktop search to locate historical studies that identified pinch points across the Corridor. These, along with any recommended mitigation measures, were reviewed to assess their currency.

Field work was subsequently then carried out in December 2010 to further develop the findings of the desktop study, and to gain an understanding of any topographic and other constraints that can dictate the feasibility to construct and/or retrofit fauna crossing structures.

ACRONYMS USED IN REPORT

BAMM - Biodiversity Assessment and Mapping Methodology
BCC – Brisbane City Council
CEPLA – Chenoweth Environmental Planning and Landscape Architecture
DERM – Department of Environment and Resource Management
DIP – Department of Infrastructure and Planning
FGK - Flinders to Greenbank – Karawatha
MOU - Memorandum of Understanding
NRM – Natural Resources and Mines
SEQ – South East Queensland
VCA – Voluntary Conservation Agreement

1. BACKGROUND TO PART B

Part A of this study identified the value of corridors within the region and the specific value of the Flinders to Greenbank – Karawatha (FGK) Ecological Corridor. This document is to address Part B of the project and provides a review of any existing pinch points in the current corridor links, identifies any additional corridor pinch points; and makes an assessment of any proposed remediation methods.

Broadly this report:

- Reviews available literature that has previously identified pinch points in the Corridor;
- Provides an assessment of the currency of previously identified pinch points;
- Identifies any additional pinch points;
- Determines any actions required to mitigate and manage all pinch points; and
- Provides a ranking of pinch points for further priority actions.

The final component of this study is Part C addressing any properties of significance within the Corridor.

2. PREVIOUS PINCH POINT STUDIES AND RECOMMENDATIONS

Historically, several studies have been undertaken that discuss 'pinch points' in the FGK Corridor including Kinhill (1998); Glen Ingram & Assoc. (1998a) and Glen Ingram & Assoc. (1998b)

In 2003 Chenoweth EPLA undertook a study in the Greenbank to Karawatha section of the Corridor, incorporating this previous work and identifying additional pinch points through the interpretation of aerial photography, previous knowledge of area and interpretation of planning commitments within the existing vegetated corridor (CEPLA 2003). In summary, the following 'pinch points' were identified:

1. Intersection of Stapylton and Johnson Roads;
2. Forestdale Estate, Logan City;
3. Johnson Road bridge over Oxley Creek;
4. Paradise Road;
5. Sydney – Brisbane Railway;
6. Transmission Line;
7. Logan Motorway;
8. Beaudesert Road (North);
9. Beaudesert Road (South);
10. Illaweena Street (West); and
11. Gateway Motorway.

Field surveys were undertaken at the eleven locations listed above in August 2003, a description and summary of their recommended structures and mitigation actions made at the time is provided below in Table 1.

Table 1: Description of Previously Identified Pinch Points (CEPLA 2003).

Pinch Point	Location	2003 Description	2003 Structures and Actions
1	Intersection of Stapylton and Johnson Roads	Although relatively narrow as compared to other barriers in the corridor, the intersection of Stapylton and Johnson Roads represents a complex crossing point. The presence of a nursery in the southeast corner of the intersection precludes movement to the east of most fauna. Vegetation in the northwest corner of the intersection is limited to a narrow band of vegetation approximately 30m wide. This band is, for the most part, is in good condition with few weeds and a diverse native understorey. However, where the vegetation abuts existing industrial buildings the understorey is dense with native grasses (e.g. Blady Grass) and/or weeds, which limits the capacity for koalas to move through the area, although both scats and scratches were observed. All pipes leading under the road are too small to cater for most fauna. The intersection is at grade and there appears to be no capacity to increase pipe diameters without major earthworks and disruption to native vegetation. A single Scribbly Gum adjacent to Stapylton Road on the northern side of the intersection shows numerous scratches of both koalas and gilders. The road cuts very close to the tree's base.	Actions and structures nominated for this site included: • Manage the integrity of the 30m wide band of vegetation in the northwest corner of the intersection through buffer plantings within industrial allotments, maintenance of natural hydrological regimes flowing into the band, preventing illegal dumping through installation of bollards at the roadside edge and undertaking ecological burns; • Install rumble strips and signage at intersection approaches; • Protect existing trees close to road through guard rail and/or significant vegetation signage; • A small drain in the northwest corner of the intersection represents a barrier to koalas and should be piped or repaired to include inclines <1:2; • Vegetation adjacent to the powerline on Johnson Road should be selectively allowed to regenerate (i.e. select for smaller species through active management). The use of aerial bundle cabling will allow for the establishment of taller vegetation suitable for glider movement; • Barron areas in the northwest of the intersection should be rehabilitated; and • Encourage the Greenbank Military Training Area to establish native vegetation in favour of the existing pine plantation.

Pinch Point	Location	2003 Description	2003 Structures and Actions
2	Forestdale Estate, Logan City	Existing rural residential development in Logan City. Many properties retain good stands of native vegetation and fauna friendly fencing. Some areas adjacent to Oxley Creek require revegetation	Liaise with Logan City Council to encourage residents to retain all trees and utilize fauna friendly fencing. Gaps in vegetation adjacent to Oxley Creek Should are rehabilitated.
3	Johnson Road bridge over Oxley Creek	The bridge over Oxley Creek allows for dry passage of fauna along the creek bank. The use of rocks for bank stabilisation provides excellent cover for small fauna movement. Native vegetation is not continuous under the bridge. This has allowed for the establishment of grassy areas that are ideal for wallaby and kangaroo movement. Despite this some revegetation could be warranted. The lack of tall vegetation adjacent to the road limits movement opportunities for gliders.	Actions and structures nominated for this site included: • Guide fencing on the approaches (approx 150m) either side of bridge; • Glider poles and ropeways on the eastern and western sides of the intersection; and • Educative signage and rumble strips. Some selective regeneration including koala food trees and wattles
4	Paradise Road	Paradise Road is currently unsealed. In many locations along the road there is canopy connectivity.	In its current state the road represents a minor barrier to some faunal groups. As the road is unsealed, speed levels are reduced, thereby improving fauna safety. In the instance that the road is to be upgraded canopy connectivity should be retained and other barrier mitigative structures and actions implemented.
5	Sydney – Brisbane Railway	The rail is currently unfenced and is at grade in a number of locations. It therefore represents little barrier to faunal movement. However, the rail separates most trees by a distance greater than 30m and hence forms a barrier to small gliders. Approximately 500m north of Johnson Road a 1.5m wide pipe runs under the line over a 30m width. Some faunal tracks were noted in the muddy bottom of this drain.	If in future the rail is to be fenced, it will be necessary install either an overpass structure near Johnson Road where the rail enters a cut or upgrade the pipe (500m north of Johnson Road) to a 3x3m culvert. Currently vegetation needs to be retained as close to the rail as possible. To maintain glider connectivity the installation of a glider pole will be necessary.

Pinch Point	Location	2003 Description	2003 Structures and Actions
6	Transmission Line	The Swanbank – Loganlea / Blackwall – Bellmont Transmission Line is likely to represent a barrier to exclusively arboreal animals and small ground dwelling fauna.	Actions and structures nominated for this site included: • Revegetating links through the drainage lines with low stature species; • Encouraging and maintaining natural regrowth of wattles in several key locations; • Revegetation areas should incorporate rubble and debris to facilitate the movement of small animals, particularly where a vegetative canopy is not permissible; and • Glider poles are recommended to ensure the minimum volplane distance between is <20m.
7	Logan Motorway	The Logan Motorway forms a major barrier to all groups of fauna. The proposed corridor crosses the Logan Motorway between the Sydney-Brisbane Railway and Beaudesert Road. Three existing culverts cut under the motorway in this location. The most westerly culvert consists of two 2.4m diameter corrugated iron pipes. The southern side of this culvert is connected to areas identified as Conservation in Cityplan and the northern side is connected to a relatively narrow corridor of vegetation aligned with a waterway in the proposed Ridgewood Estate. In its current state, it is likely that this culvert will cater for most terrestrial fauna, including Eastern Grey Kangaroos in extreme circumstances. However, the relatively narrow corridor within the Ridgewood estate is unlikely to cater for the movement of Eastern Grey Kangaroos. No changes are recommended in this location. The most easterly culvert consists of a single 1.5m diameter corrugated iron pipe. The southern entrance to the culvert is located at the base of a steep concreted	The central culvert and surrounding area offers the best opportunity for facilitating fauna movement across the Logan Motorway. However, the length of the existing structure is prohibitive to utilisation by both koalas and Eastern Grey Kangaroos. It is therefore recommended that a minimum of one, but preferably two, 3x3m culverts are installed either side of the existing structure. These culverts are to incorporate furniture including rocks and debris, koala escape poles (internal and external to the culverts); vegetation planted at each entrance and must ensure dry passage during all weather. For this tunnel to function effectively it will be necessary to fence the motorway with koala proof fencing in order to funnel fauna to the desired crossing point. Prior to installation it is recommended that monitoring be undertaken (e.g. infrared cameras) to determine the faunal groups currently utilizing the tunnel. Immediately to the east of the central culvert is a small section of road at grade. The scattered Grey Gums (*Eucalyptus propinqua*) in the road

Pinch Point	Location	2003 Description	2003 Structures and Actions
		incline. The tunnel is not fauna friendly, although may be used by some small mammals and reptiles. It is not possible to increase the diameter of the culvert or enhance the southerly access due to topographic constraints. No changes are recommended in this location. The central culvert consists of a single 2.4m diameter corrugated iron pipe that is approximately 60m in length. Excellent habitat will be retained on the northern and southern entrances, which are at grade with the pipe. Immediately to the east of this culvert is the only section of the motorway where the road is at grade.	reserve in this location support both koala and glider scratch marks. The protection of the trees through guard rail and possible advisory signage to road workers is required. The use of glider poles and ropeways in this location is also required to maintain glider and possum connectivity.
8	Beaudesert Road (North)	Located immediately to the north of the Beaudesert Road / Logan Motorway Interchange is a significant narrowing in the corridor. Residential properties to the west and degraded vegetation to the west further compound the difficulties of this crossing. Wallaby road kills have been reported in this location and their movement through the area was further confirmed during field investigations by the presence of scats, wallaby runs and a wallaby skull located within the road reserve on the western side of the road.	The road represents a major obstacle to faunal movement. To mitigate against this substantial break in the corridor it will be necessary to install either a vegetated fauna overpass or a wide faunal underpass. Both options will require the establishment of vegetative links and guide fencing to facilitate faunal movement through the mitigate structure. In the interim it is strongly recommended that rumble strips are installed on the approaches to the crossing in addition to the installation of educative signage. The use of glider poles and ropeways in this location is also required to maintain glider and possum connectivity.

Pinch Point	Location	2003 Description	2003 Structures and Actions
9	Beaudesert Road (South)	Planning commitments to the east of Beaudesert Road (Mt Lindsay Highway) reduces the viability of this area as a link for some faunal groups such as the macropods. Furthermore, site investigations of the Logan Motorway between the Beaudesert Road Interchange and the Gateway Motorway Interchange indicated that there are few opportunities for north-south links across the Motorway. This stretch of road is virtually entirely at grade and hence there are no opportunities to establish underpass or overpass structures without major disturbance to remnant vegetation. For this portion of the corridor to function effectively for all faunal groups it will be necessary to establish an overpass to the south of Beaudesert Road / Logan Motorway Interchange and an additional overpass structure between the Beaudesert Road Interchange and the Gateway Motorway Interchange on the Logan Motorway. Fencing will be necessary around all retained vegetation to funnel fauna to the desired overpass structures.	When the proposed overpass/underpass structure to the north of the Beaudesert Road / Logan Motorway Interchange (i.e. pinch point 8) is installed there may be no need for two additional overpasses. To confirm this is necessary that monitoring existing faunal use through the area and the effectiveness of other mitigative measures once implemented. Mitigative structures at this location were aimed at maintaining connectivity for gliders and small terrestrial animals. A small section of the road to the south of the interchange and to the north of the cut is at grade and represents a location where east – west movement of small terrestrial fauna may be expected. This link is compromised by the lack of native vegetation on the eastern side of the road. It is therefore desirable to enhance this link for small fauna through the revegetation and the possible installation of a small underpass (approx. 0.5m diameter) at a later date. At this stage fencing has not been recommended to the east of the Beaudesert Road (Mt Lindsey Highway). Concrete crash barriers around the interchange have the potential to trap fauna within the road corridor. The retrofitting of timber strips and plastic meshing to allow fauna to climb / scramble out of the roadway is recommended.

Pinch Point	Location	2003 Description	2003 Structures and Actions
10	Illaweena Street (West of Gateway Motorway)	The corridor runs through Drewvale north toward the junction of Illaweena Street and the Gateway Motorway. The Gateway Motorway forms a significant barrier to east –west movement of fauna. Illaweena Street forms only a minor barrier to the north-south movement of fauna. Remnant vegetation on the north and south of Illaweena Street is separated by a distance of approximately 15m and hence glider connectivity is maintained. The significant number of wallaby road kills recorded in the area clearly indicates that fauna are moving north-south across Illaweena Street. Fauna friendly fencing has been installed by Brisbane City Council either side of Illaweena Street to the west of the Gateway Motorway. It is probable that fauna may be moving under the Gateway Motorway where it passes over Illaweena Street.	The actions and structures nominated for this site included: • Educative signage and rumble strips; and • Extensive regeneration. Additionally, rumble strips and educative signage should be installed on Illaweena Street to the east of the Gateway Motorway in response to the high number of roadkills reported in this area. The current 15m separation of vegetation should be retained and enhanced along the length of Illaweena Street. Although fencing on the northern and southern sides of Illaweena Street has been designed with fauna movement in mind, monitoring of its effectiveness in facilitating the movement of the larger macropods (e.g. Eastern Grey Kangaroos) is recommended.
11	Gateway Motorway	To the north of Illaweena Street the east-west movement of fauna is inhibited by the Gateway Motorway until the bridge crossing at Scrubby Creek. The wide span bridge has retained wide banks and a diversity of habitat. The height of the bridge and dual lanes has allowed the retention of and establishment of good native vegetation cover.	The lack of tall vegetation adjacent to the Gateway Motorway coupled with its elevation above the surrounding landscape reduces opportunities for glider movement. The planting of tall vegetation either side and between the lanes at the Scrubby Creek Bridge will assist in reinstating connectivity.

3. BEST PRACTICE TECHNIQUES FOR BARRIER MITIGATION

The functionality of corridors within a fragmented environment must consider the multitude of artificial physical barriers present within a city. Anthropogenic barriers to fauna movement include:

- **Physical barriers**. These include buildings, drains and fencing. Generally small wire-strand fences represent little barrier to large vertebrates, whereas tall (2m) chain wire fences and timber fences represent a problem. Small impenetrable fences such as concrete barriers along roadways are a significant obstacle to all ground dwelling fauna; and
- **Gaps**. Breaks in habitat needn't be wide to prohibit wildlife movement. For example, a 3m wide dirt track consisting of 2 dirt strips inhibited the movement of Prairie Voles (*Microtus ochrogaster*) and Cotton Rats (*Sigmodon hispidus*) in Kansas (DMR 2000); prior to mitigation, a 2 lane road separated male and female populations of the Endangered Pygmy Possum (*Burramys parvus*) in Victoria (Heinze and Mansergh (2009); and small forest birds were prohibited by a 4 lane road in Brisbane (Jones 2009). The major man made gaps that adversely affect fauna include:
  - **Roads**. Roads remain the most widespread and significant barrier to fauna. Roads not only represent a physical barrier, but also include the added hazard of vehicular traffic, and often incorporate fencing, services and sever watercourses.
  - **Rail lines**. Railways themselves represent little obstacle in Queensland, the fencing surrounding them and the need to maintain a vegetation free environment does however. Overhead electric wires allow for little opportunity to introduce mitigative measures above electrified rail lines.
  - **Utility corridors**. Although most services are incorporated within roadways, both transmission lines and pipelines often have their own dedicated corridors/easements that can represent a barrier to fauna. Furthermore, powerlines represent an addition hazard to fauna such as Flying Foxes.
  - **Breaks in aquatic habitat.** Although fish passage facilities are well developed for northern hemisphere species, these techniques are not transferable to Australian species. Standard culverts present a significant barrier owing to high velocity conditions, shallow water and often water surface drop (Kapitske 2009).

Pinch point mapping for this study focused on gaps as discussed above. This was initially based on desktop review to define major barriers within the corridor. Major barriers included those that are likely to prohibit the movement of a high diversity of wildlife and affect the width of the corridor. Despite focussing on gaps, physical barriers can significantly affect connectivity and as such were considered during field investigations.

3.1 DIVERSITY OF TECHNIQUES

Fauna mitigation techniques need to be designed with the specific requirements of each location taken into consideration. Broadly classified as being underpasses, overpasses, or barriers, and there are a number of options available for achieving fauna sensitive roads as briefly discussed below. Sections 3.1.1 to 3.1.8 below summarise information presented in The Department of Transport and Main Roads (DTMR) (2010) Fauna Sensitive Road Design Volume 2: Preferred Practices. This document would serve as the principle reference to guide the establishment or retrofit of structures within the FGK Corridor.

3.1.1 UNDERPASS: CULVERT

Culvert tend to be rectangular, square, or half circle in shape and have the benefit of being purpose built fauna (aquatic and / or terrestrial) passage and water drainage, or a combination of both.

The DTMR Road Design Manual identifies that culverts are suitable for permitting the passage of aquatic species (i.e. fish, frogs) and terrestrial species (i.e. mammals, reptiles). When considering the design of culverts there are a number of factors that determine the effectiveness for species movement such as:

- Location;
- Flow velocity;
- Flow depth;
- Turbulence;
- Debris blockage;
- Sediment;
- Length;
- Width;
- Water level at inlet and outlet;
- Slope;
- Flooring;
- Size;
- Furniture – such as lights, refuge poles and ledges;
- Silt traps; and
- Vegetation.

3.1.2 UNDERPASS: BRIDGE

A bridge underpass is a structure that either maintains road level or elevates traffic above the surrounding land, thus permitting fauna to pass under the road. These structures usually double as water draining structures. Bridges are suitable structures for all fauna groups and can include single span, multi – span, viaduct and Grid Bridge designs.

When designing such structures there are a number of considerations including:

- Location of in-stream supports;
- Flow conditions;
- Erosion management;
- Light penetration across multi-lane roads;
- Wherever possible, the structure should be 90^0 to the waterway;
- Future maintenance requirements; and
- Construction materials.

3.1.3 UNDERPASS: TUNNEL

Tunnel underpasses are usually roundpipes of relatively small diameter (< 1.5m) and, depending on dimensions and seasonality, are suitable for small-sized fauna passage.

Design considerations for tunnel underpasses are consistent with that of culverts as described in the DTMR Road Design Manual.

3.1.4 OVERPASS: LAND BRIDGE

These are bridges that typically extend over a road that has severed patches of fauna habitat, usually between 20m and 70m wide. Land bridges are covered in vegetation, soil and various other habitat features such as rocks and logs (DTMR 2010). Such structures are suitable for the passage of all fauna species, with the exception of aquatic species.

The DTMR Road Design Manual (2010) outlines the following considerations when designing a land bridge:

- Surrounding topography and environment;
- Location;
- Bridge width;
- Drainage;
- Soil depth – which in turn acts as a limiting factor for vegetation;
- Vegetation type;
- Fencing;
- Furniture – such as glider poles, rocks, logs etc; and
- Maintenance considerations.

3.1.5 OVERPASS: CUT AND COVER TUNNEL

In a Cut and Cover Tunnel traffic passes below ground through a tunnel leaving the area above free for revegetation and fauna passage. As with Land Bridges; this structure is suitable for the passage of all fauna species, with the exception of aquatic species.

Design considerations for Cut and Cover Tunnels are consistent with that of Land Bridges as described in the DTMR Road Design Manual.

3.1.6 OVERPASS: CANOPY BRIDGE

A canopy bridge can be described as a rope or suspended bridge over a road, either from trees or vertical poles with a view to provide canopy connectivity for arboreal and scansorial (climbing) species. These can be in the form of a rope tunnel, rope ladder, or a single rope crossing.

There are no defined standards when choosing which type of Canopy Bridge is the most suitable. There are a number of considerations when designing a canopy crossing:

- The size of the largest animal likely to use the crossing;
- Adjacent vegetation;
- Adjacent structures (i.e. power lines);
- Number of crossings;
- Clearance from road (minimum 7 metres); and
- Maintenance requirements.

3.1.7 OVERPASS: POLES

Typically, these are vertical poles situated in median strips and road verges, or on overpasses to provide target fauna species with escape or landing points and /or launch opportunities. These also have the ability to act as refuge and disperse points in more open areas. Species within the FGK Corridor likely to use these structures include koalas (escape poles) and gliders (launch and land).

Design requirements may depend on the species present but should include the following factors:

- Local fauna movement corridors;
- Surrounding vegetation;
- Local topography;
- Use of juveniles – tending to have shorter glide distances;
- Adjacent infrastructure (i.e. power lines);
- Pole height;
- Pole furniture (i.e. cross bars);
- Distance between poles;
- Clearance from road; and
- Maintenance requirements.

3.1.8 BARRIERS: FENCING

Fencing can be deployed to prevent fauna from crossing roads and/or directing ground dwelling fauna to underpasses or overpasses. They are therefore integral in guiding fauna species to safe crossing structures and passages. Fencing is suitable for all species except invertebrates, some reptiles and flighted birds.

When designing fencing for fauna crossing can depend upon a number of factors including:

- Species;
- Purpose;
- Land Use;
- Topography;
- Vegetation;
- Property Access requirements;
- Type of fencing (i.e. exclusion fencing, floppy top, etc)
- Gates and their location;
- Other fauna crossing structures; and
- Other structures in the area.

3.2 TECHNIQUES APPLICABLE TO FGK FAUNA

Each of the structures outlined above can be used to target fauna species that have been identified within the FGK Corridor. The location and design on the suitability of each structure is partly driven by the location and movement of targeted species within the Corridor, but also where there are opportunities to reconnect habitat. Table 2 below outlines the major fauna groups found in the FGK Corridor and outlines which of the fauna structures discussed above can facilitate their movement.

Table 2: Major Fauna Groups and Suitable Movement Structures.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
Flight	Seasonal Migrants (pitta, honeyeaters, flycatchers)	Bentley and Catterall (1997) study encompassed corridors and linear remnants. Corridor width was between 20m and 350 m; linear remnant width was between 50m and 350 m, with no more than a 50m break between remnants. The majority of both corridors and linear remnants were between 50–250 m wide.	Species that migrate to SEQ were found to use corridors and linear remnants much more than species that were resident (Bentley and Catterall, 1997). Species tended to be most abundant in either riparian bushland or riparian corridors in urban areas (Bentley and Catterall, 1997).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; and • Underpass – Bridge.	Bentley, J.M. and Catterall, C.P., 1997, *The use of bushland, corridors and linear remnants by birds in southeasetern Queensland, Australia,* Conservation Biology 11 (5): 1173-1189.
	Raptors	Raptors are often wide ranging over many habitat types (McDonald *et al.,* 2003). Raptors in greater Brisbane area tend to be largely sedentary. Some evidence does exist of local movements due to post-breeding season dispersion, non-breeding and season nomadism (BCC 2008).	Breeding habitat is a limiting factor of habitat utilisation. Some species (the Brown Falcon) can use isolated nest trees (McDonald *et al.,* 2003). In Brisbane, habitat associations can include large forest and woodland remnants, riverine and vegetated corridors, and extensive lightly timbered areas (eg. golf courses), including adjacent parks and gardens (BCC 2008)	• Overpass - Land Bridges; and • Overpass – Cut and Cover Tunnel.	Brisbane City Council (BCC) (2008). *Wildlife Movement Solutions*. Brisbane City Council. McDonald, P.G., Olsen, P.D., and Baker-Gabb, D.G. (2003). *Territory Fidelity, Reproductive Success and Prey Choice in the Brown Falcon, Falco berigora: A Flexible Bet-Hedger?* Australian Journal of Zoology, 51:399-414.
	Owls		Powerful owls were determined to be old growth forest specialists but recent data shows they are able to exist in urban fringes provided there is adequate structural diversity to allow for roosting sites and that there is sufficient prey (Cooke *et al.,* 2006).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; and • Underpass – Bridge.	Cooke, R., Wallis, R., Hogan, F., White, J. and Webster, A., 2006, *The diet of powerful owls (Ninox strenua) and prey availability in a continuum of habitats from disturbed urban fringe to protected forest environments in south-eastern Australia,* Wildlife Research 33: 199-206.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
	Honeyeater, Silvereye, Spinebills	A study on two forest dependent species showed that species were unlikely to cross a gap greater than 65-85m however would cross a gap up to 260m when scattered trees were present (Robertson and Radford, 2009). Sieving *et al* (2000) showed that width was the predominant predictor for corridor utilisation by small bird species. Strips less than 10m were generally not used as habitat, but birds were occasionally noted moving through them. Anecdotally, vegetated strips of similar width have been shown to facilitate small bird passage over land bridges in Brisbane (Jones, 2009).	Smaller insectivore and nectivores were likely to be affected by patch size in agricultural, peri-urban and urban landscapes (Watson *et al.,* 2005). Most nectivores and folivores affected by variation in width and less likely to occur in narrow (50-100m wide) eucalypt forest patches (Tubelis *et al.,* 2007). More individuals were recorded in wide (greater than 300m) patches (Tubelis *et al.,* 2007). Small bodied birds may have a higher minimum patch size requirement relative to home range size as they are more susceptible to small environmental disturbances common on edges (Watson *et al.,* 2005).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; and • Underpass – Bridge.	Robertson, O.J. and Radford, J.Q. (2009). *Gap Crossing Decisions of Forest Birds in a Fragmented Landscape*. Austral Ecology, 34:435-446. Seiving, K.E., Willson, M.F. and De Santo, T.L. (2000). *Defining Corridor Functions for Endemic Birds in Fragmented South-temperate Rainforest.* Conservation Biology 14 (4): 1120-1132. Tubelis, D.P., Lindenmayer, D.B. and Cowling, A., 2007, *Bird populations in native forest patches in south-eastern Australia: the roles of patch width matrix type (age) and matrix use.* Landscape Ecology 22:1045-1058. Watson J.E.M., Whittaker, R.J. and Freudenberger, D., 2005, *Bird community responses to habitat fragmentation: how consistent are they across landscapes?* Journal of Biogeography 32:1353-1370.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
	Ground Birds (quail, rail)	Ground birds and cover-dependent species are likely to have gap tolerances that are shorter than 65-85m and be less inclined to cross gaps at all (Robertson and Radford, 2009). Cleared land is a barrier to the movement of individuals, and those gaps greater than 100 m might significantly reduce functional connectivity for some species (Robertson and Radford, 2009).	Quails and Rails habitat requirements range from marshy vegetation, low scrub, crops and dense grassland (Flegg 2002).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Robertson, O.J. and Radford, J.Q. (2009). *Gap Crossing Decisions of Forest Birds in a Fragmented Landscape*. Austral Ecology, 34:435-446. Flegg, J. (2002). *Photographic Field Guide to Birds of Australia*. New Holland Publishers, Sydney, Australia.
	Flying Foxes	Highly mobile species that move in response to seasonal food resources. Forage to roost distances differs seasonally. Due to high mobility (up to 50km's travelled to forage) flying foxes can access resources distributed patchily across the landscape (Palmer and Woinarski, 1999).	Have specific requirements for roosting sites including mangroves, rainforest, melaleuca swamps and vegetation along river banks (Palmer and Woinarski, 1999).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; and • Underpass – Bridge.	Palmer, C. and Woinarski, J.C.Z, 1999, *Seasonal roosts and foraging movements of the black flying fox (Pteropus alecto) in the Northern Territory: resource tracking in a landscape mosaic,* Wildlife Research 26:823-838.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
	Microbats	The spatial separation between roosts and foraging areas in a highly modified environment has the potential to affect energetic costs of foraging and exposure to predators (Lumsden and Bennett 2002a; Lumsden and Bennett 2002b)	Bats have the capability to utilise a diverse range of structures such as diurnal roost sites, including caves, tree hollows cavities formed under bark, foliage, tents, bird's nests and anthropogenic structures such as buildings. Roosting requirements may vary between males and females, and individual species with different reproductive conditions (Lumsden and Bennett 2002a; Lumsden and Bennett 2002b).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; and • Underpass – Bridge.	Lumsden, L. F., Bennett, A. F., and Silins, J. E. (2002a). *Selection of roost sites by the lesser long-eared bat (Nyctophilus geoffroyi) and Gould's wattled bat (Chalinolobus gouldii) in South-eastern Australia*. Journal of Zoology 257, 207–218. Lumsden, L. F., Bennett, A. F., and Silins, J. E. (2002b). *Location of roosts of the lesser long-eared bat Nyctophilus geoffroyi and Gould's wattled bat Chalinolobus gouldii in a fragmented landscape in southeastern Australia*. Biological Conservation 106, 237–249.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
Terrestrial	Small Mammals (Antechinus Native Rats)	Antechinus have home ranges between 0.04 and 0.66ha. Animals within narrow linear strips may move outside of the vegetation strip into areas generally associated with isolated trees up to 100m beyond the patch (Marchesan and Carthew, 2008).	Habitat for a diversity of native small mammals is influenced by vegetation condition. Species richness increased with increased density of logs and structural diversity (Holland and Bennett, 2007). Smallest patches that native mammals were found in were Bush rat – 0.5ha and Antechinus 0.8ha (Holland and Bennett, 2007). Antechinus are able to persist in very small patches or linear strips of vegetation (less than 1 ha) (Marchesan and Carthew, 2008). For many small mammals such as the Planigale, habitat structure is important for persistence in urban forest fragments (Garden *et. al*., 2007).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Holland, G.J. and Bennet, A.F., 2007, *Occurrence of small mammals in a fragmented landscape: the role of vegetation heterogeneity*. Wildlife Research 34: 387-397 Marchesan, D., and Carthew, S.M., 2008, *Use of space by the yellow-footed antechinus, Antechinus flavipes, in a fragmented landscape in South Australia,* Landscape Ecology 23:741-752 Garden, J.G., McAlpine, C.A., Possingham, H.P. and Jones, D.N., 2007, *Habitat structure is more important than vegetation composition for local-level management of native terrestrial reptile and small mammal species living in urban remnants; A case study from Brisbane, Australia.* Austral Ecology 32:669-685.
	Mid size Mammals (Bandicoots, Quolls)	May disperse along thin but densely vegetated corridors and across sealed roads (FitzGibbon *et al.,* 2007). To fully facilitate movement a 60m riparian buffer should be maintained (FitzGibbon 2010). Quolls are highly mobile which is reflected in their large home ranges (Catling *et al*,	Bandicoots can use thin strips of vegetation fringing a waterway as long as it is connected to a larger habitat patch and the smallest occupied patch was less than 5 ha (FitzGibbon *et al*., 2007). Spotted-tailed Quolls are a forest dependant species relying on mature and old growth forests, including rainforests, woodlands, wet and dry sclerophyll forests and open pasture.	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Belcher, C. (2004). *The Largest Surviving Marsupial Carnivore on Mainland Australia: the Tiger or Spotted-tailed Quoll Dasyurus maculates, a Nationally Threatened, Forest Dependant Species.* In: *The Conservation of Australia's Forest Fauna (2nd Ed)*. Edited by Daniel Lunney, Royal Zoological Society of NSW, Mosman, Australia. Catling, P.C., Burt, R.J. and

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
		2000; Claridge *et al*, 2005).	Habitat use is significantly correlated to prey densities, as well as the presence of the availability of rock dens (Belcher 2004). Quolls have an average home range size of 992ha (males) and 244ha (females) (Claridge *et al.,* 2005). Quolls prefer undisturbed habitats with a high basal area of trees and often high-elevation forests (Catling *et al.,* 2000). Quolls were commonly sighted in farmlands in the 1980's and therefore is expected to be able to use cleared areas especially when adjacent to large forested areas (Lunney and Matthews, 2001)		Forrester, R.I. 2000, *Models of the distribution and abundance of ground-dwelling mammals in the eucalypt forests of north-eastern New South Wales in relation to habitat variables,* Wildlife Research 27:639-654. Claridge, A.W., Paull, D., Dawson, J., Mifsud, G., Murray, A.J., Poore, R. and Saxon, M.J., 2005, *Home range of the spotted-tailed quoll (Dasyurus maculatus) a marsupial carnivore, in a rainshadow woodland,* Wildlife Research 32: 7-14. FitzGibbon, S.I., Putland, D.A. and Goldizen, A.W., 2007, *The importance of functional connectivity in the conservation of a ground-dwelling mammal in an urban Australian landscape*. Landscape Ecology 22:1513-1525. FitzGibbon, S.I. (2010). In: *The Regenerator: Community Care for Bushland, Wetlands and Waterways*, Brisbane City Council. Lunney, D. and Matthews, A., 2001, *The contribution of the community to defining the distribution of a vulnerable species, the spotted-tailed quoll, Dasyurus maculatus,* Wildlife research 28:537-545.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
	Large Mammals (Kangaroos)	Large mammals (e.g. Eastern Grey Kangaroo and Black wallaby) are capable of moving across pasture between isolated remnants (Downes *et al.,* 1997)	For some species a high quality habitat environment will include both foraging and sheltering habitat. This may often be open feeding grounds (particularly for grazers) and areas with high cover for sheltering (Le Mar and McArthur, 2005)	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Downes, S.J., Handasyde, A. and Elgar, M.A., 1997, *The use of corridors by mammals in fragmented Australian Eucalypt forests,* Conservation Biology 11(3): 718-726. Le Mar, K. and McArthur, C., 2005, *Comparison of habitat selection by two sympatric macropods, Thylogae billardierei and Macropus rufogriseus rufogriseus, in a patchy eucalypt- forestry environment,* Austral Ecology 30: 674-683.
	Large Reptiles (Goannas, dragons, carpet pythons)		Snakes home range size for a range of body sizes is between 1-25ha. Pythons appeared to require cover, but could utilise cover in modified suburban environments as well (Pearson *et al.,* 2005)	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Pearson, D., Shine, R. and Williams, A., 2005, *Spatial ecology of a threatened python (Morelia spilota imbricata) and the effects of anthropogenic habitat change*, Austral Ecology, 30: 261-274
	Small Reptiles (Skinks, snakes)	Reptiles have small home ranges that often overlap. Reptile distribution may be limited not only by habitat quality but by remnant width. Driscoll (2004) found that reptiles may be limited by narrow corridors of 10-100m wide. Agricultural land may be relatively impermeable to reptile dispersal (Schutz and	Linear remnants are better than cleared areas as some species can exist in this habitat type (Driscoll, 2004). Habitat structural complexity is important for the occurrence of native reptiles in a fragmented urban environment (Garden et al, 2007; Hamer and McDonnell, 2010). Habitat models of *Carlia tetradactyla* showed that this species responded to	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Driscoll, D.A., 2004, *Extinction and outbreaks accompany fragmentation of a reptile community*, Ecological Applications 14 (1):220-240. Schutz, A.J. and Driscoll, D.A., 2008, *Common reptiles unaffected by connectivity or condition in a fragmented farming landscape,* Austral Ecology 33 (5): 641-652.

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
		Driscoll, 2008).	landscape scale and microhabitat variables such as canopy cover, presence of spiders, and ground layer attributes (Newell and Goldingay 2004).		Newell, D. and Goldingay, R. (2004). *Conserving Reptiles and Frogs in the Forests of NSW*. In: *The Conservation of Australia's Forest Fauna (2nd Ed)*. Edited by Daniel Lunney, Royal Zoological Society of NSW, Mosman, Australia.
Semi arboreal	Koala	Koala dispersal is skewed towards young males however females also disperse. Most males travel between 1-3km from their natal home range and most females dispersed within 2km of their natal home range (Dique *et al.,* 2003). A high proportion of Koala's are killed moving through urban areas by cars or domestic dogs (Dique *et al.*, 2003).		• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Overpass – Poles (escape); • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Dique, D.S., Thompson, J., Preece, H.J., de Villiers, D.L. and Carrick, F.N., 2003, *Dispersal patterns in a regional Koala population in south-east Queensland,* Wildlife Research 30 (3): 281-290.
Arboreal	Gliders & Possums, Phascogales	Sugar gliders can disperse along roadside strips and are not always confined to treed habitat. Some young have been found to move across at least 200m of paddock to reach small isolated forest patches (Suckling, 1983). However, most movements are strictly arboreal and as such require habitat buffers up to 30m wide to prevent barriers to small gliders (BCC, 2005a). Squirrel Gliders have been observed using woodland	Interior habitats are ideal to maintain large stable populations but low contrast edges (soft edges e.g. minor roads with vegetation either side) containing key site level resources should not be underestimated as gliders are capable of using these areas (Brearley *et al.,* 2010). Habitats in dry sclerophyll forests with high proportion of taller trees were highly used by arboreal mammals. Possums and gliders encountered in this study were also found in poorer habitat types although in lower densities	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Overpass – Canopy Bridge; • Overpass – Poles (launch and land); • Underpass - Culvert; • Underpass – Bridge; and • Barriers – Fencing.	Goldingay, R.L. and Sharpe,D.J. (2004). *How do we Conserve the Squirrel Glider in Brisbane's Urban Matrix?* In: *The Conservation of Australia's Forest Fauna (2nd Ed)*. Edited by Daniel Lunney, Royal Zoological Society of NSW, Mosman, Australia. Suckling, G.C., 1984, *Population ecology of the Sugar Glider, Petaurus breviceps, in a system of Fragmented Habitats.* Australian Wildlife Research 11: 49-75 Van der Ree, R. and Bennett, A.F.,

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
		strips of 20-50m width and reportedly foraging in isolated clumps of trees up o 240m from remnant habitat. This suggests that these gliders have the capacity to disperse amongst isolated habitats and attempt to cross gaps of moderate width (Goldingay and Sharpe 2004). The approx. distance that gliders can glide (volplane) has been calculated for the different species as listed below (Chenoweth 2003): ▪ Feathertail Glider = 20m; ▪ Sugar Glider = 50m; ▪ Squirrel Glider = 50m; ▪ Yellow bellied ≥ 60m; & ▪ Greater Glider = 100m Subject to the height of launch trees, it is necessary to maintain gaps no greater than those listed above to enable the movement of these species. Phascogales have been found to travel between isolated woodland fragments across cleared ground. It has been found that generally cleared ground between 20-285m was crossed (Van der Ree *et al.,*	(Wormington *et al.,* 2002) The home range of Pascogales in Victoria ranges from 2.3–8 hectares in high quality habitat. In lower quality habitat, also in Victoria, the species home range averaged 37.05 hectares for females and 86.13 hectares for males (BCC, 2005b)		2003, *Home range of the squirrel glider (Petaurus norfolkensis) in a network of remnant linear habitats,* Journal of the Zoological Society of London 259:327-336 Wormington, K.R., Lamb, D., McCallum, H.I. and Moloney, D.J., 2002, *Habitat requirements for the conservation of arboreal marsupials in dry sclerophyll forests of southeast Queensland, Australia*, Forest Science 48 (2): 217-227. Van Der Ree, R., Soderquist, T.R. and Bennett, A.F., 2001, *Home-range use by the brush-tailed phascogale (Phascogale tapoatafa) (Marsupialia) in high quality, spatially limited habitat,* Wildlife Research 28:517-525

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
		2001)			
	Geckoes	In a study on *Gehrya variegata*, it was found that movements if this species in a 150m by 100m continuous plot of riverine woodland, were rarely more than 40m (Gruber and Henle, 2004).	Some geckoes are highly territorial and remain in the vicinity of certain trees feeding on insects (Gruber and Henle, 2004).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Tunnel; • Underpass – Bridge; and • Barriers – Fencing.	Gruber, B. and Henle, K., 2004, *Linking habitat structure and orientation in an arboreal species Gehyra variegata (Gekkonidae)*, Oikos 107:406-414

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
Semi Aquatic	Amphibians	Some amphibians disperse between breeding habitats and non-breeding habitats making them vulnerable to barrier effects of habitat fragmentation by roads and other isolating factors (Hamer and McDonnell, 2010). Most amphibians require connectivity from habitat patches to wetlands and/or streams (Hamer and McDonnell, 2010). The limited understanding of the dispersal ability of frogs makes it difficult to predict their sensitivity to fragmentation (Newell and Goldingay 2004).	Frogs were found to maintain a population over 20years within a stream section embedded within unsuitable habitat (pine plantation) (Lemckert *et al.,* 2005). Some frog species are able to survive well in urbanised habitats due to life history traits such as high fecundity and ability to utilise degraded aquatic habitats or those wetland areas converted to permanent ponds (Hamer and McDonnell, 2010). However structural habitat complexity is important for herpetofauna, often more so than patch size or vegetation type (Hamer and McDonnell, 2010). A study on *Mixophyes iteratus* showed that they stayed within 20m of streams. During the day they sheltered under leaf litter or alert in dense vegetation. *Litoria spenceri* showed a negative association of frog abundance in areas exhibiting human disturbance. It was found that this species remained close to their ponds within 5 nights after breeding events, while sheltering in dense vegetation and leaf litter during the day (Newell and Goldingay 2004).	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Tunnel; • Underpass – Bridge; and • Barriers – Fencing.	Lemckert, F., Brassil, T. and Towerton, A., 2005, *Native vegetation corridors in exotic pine plantations provide long-term habitat for frogs* Ecological Management and Resotration 6(2):132-134 Hamer, A.J. and McDonnell, M.J., 2010, *The response of herpetofauna to urbanization: inferring patterns of persistence from wildlife databases,* Austral Ecology 35:568-580. Newell, D. and Goldingay, R. (2004). *Conserving Reptiles and Frogs in the Forests of NSW*. In: *The Conservation of Australia's Forest Fauna (2nd Ed)*. Edited by Daniel Lunney, Royal Zoological Society of NSW, Mosman, Australia. Newell, D. and Goldingay, R. (2004). *Conserving Reptiles and Frogs in the Forests of NSW*. In: *The Conservation of Australia's Forest Fauna (2nd Ed)*. Edited by Daniel Lunney, Royal Zoological Society of NSW, Mosman, Australia.
	Reptiles (Turtles)	Turtles may move between wetlands which mean single wetlands alone should not represent a habitat unit (Roe		• Underpass - Culvert; • Underpass – Tunnel; • Underpass – Bridge; and	Roe, J.H., Brinton, A.C. and Georges, A., 2009, *Temporal and spatial variation in landscape connectivity for a freshwater turtle*

Locomotor Type	Fauna Group	Dispersal	Habitat associations	Suitable Structures (DTMR, 2000; DTMR, 2010)	References
		et al., 2009). In this study turtles moved between approximately 400m-700m overland between wetlands.		• Barriers – Fencing.	*in a temporally dynamic wetland system,* Ecological Applications 19 (5): 1288-1299
	Insects	Flying species of beetle were able to disperse while the capacity of flightless species was reduced (Driscoll and Weir, 2005).	A number of habitat classes were recognised for the purpose of a study of the effect of fragmentation on beetles; these were underground species, flightless species, above ground species, on ground and flying species (Driscoll and Weir, 2005). Underground and flightless species were found in sites that were least disturbed whereas on ground and flying species were most commonly found in disturbed sites.	• Overpass - Land Bridges; • Overpass – Cut and Cover Tunnel; • Underpass - Culvert; • Underpass – Tunnel; and • Underpass – Bridge.	Driscoll, D.A. and Weir, T., 2005, *Beetle responses to habitat fragmentation depend on ecological traits, habitat condition and remnant size,* Conservation Biology, 19 (1): 182-194

4. CURRENT STUDY METHODOLOGY

The methodology used in the current study can broadly be described into the following steps:

1. **Literature of previous pinch points:** Available previous reporting, mapping and documentation of the FGK Corridor were reviewed to gain an understanding of any previously identified pinch points along the Corridor.
2. **Assessment of previously identified pinch points**: This involved two stages including:

   2.1 A review of aerial mapping and infrastructure mapping to locate areas for ground assessment. Mapping was also reviewed to identify those locations where pinch points may be potentially mitigated.

   2.2 Field visit to ground truth the findings of the desktop process, and to evaluate any topographic constraints that can dictate the potential to establish and /or retrofit crossing structures. Any anecdotal evidence of fauna use (i.e. footprints) of existing structures was noted at the time of survey.
3. **Determine actions required to mitigate pinch points:** The feasibility of establishing crossing structures at each identified point was documented, along with appropriate structure options.
4. **Ranking of pinch points:** A consolidated list of pinch points was generated and ranked in terms of priority for action. The criteria used for ranking pinch points is outlined below in Table 3:

Table 3: Pinch Point Ranking Criteria

Priority	Criteria
1	• Location is within the Core Corridor; and • Corridor is completely severed to the movement of all but the most mobile of fauna.
2	• Location is within the Core Corridor; • Corridor is completely severed to the movement of all but the most mobile of fauna; and • Location represents a supplementary path for fauna movement.
3	• Location is within the Core Corridor; • A structure (eg. culvert, dedicated fauna underpass) exists in the area; • Movement of some fauna is impeded; and • Location represents a supplementary path for fauna movement.
4	• Location is external to Core Corridor; and • Location has the potential to provide linkages throughout the habitat matrix.
5	• No significant action necessary (except for possible guide fencing where absent).

5. **Mapping:** A consolidated map of constraining linear infrastructure, pinch points and potential mitigation sites was generated, incorporating field observations and literature review.

5. FINDINGS

5.1 OVERALL ASSESSMENT OF CORRIDOR

The study is focused on facilitating the movement of fauna through the Flinders Peak to Greenbank - Karawatha Corridor. ‘Pinch points’ identified in Table 4 adopt a linear viewpoint to corridor functionality. It is however unlikely that an individual animal will specifically make the journey along this corridor. Fauna will move into other areas outside of the nominated corridor. This is evident in Figure 1 which illustrates linkages outside the core Corridor and outside of integral vegetation. Maintaining these linkages is vitally important for overall Corridor functionality as they extend the overall habitat provided by the core Corridor. For example, fauna recorded in the current study moving under a bridge on Waller Road include wallabies, bandicoots and water rats. These occur within a corridor that is approximately 200m wide and separated from broad vegetation areas by over 1 km.

Fencing has been recommended in some locations with the specific intent of funneling fauna to desired crossing points. This fencing will also serve the purpose of reducing roadkills. Whilst fencing in the vicinity of movement structures is necessary, the more extensive use of fencing will assist in reducing road kills. Fencing needs to be targeted to the specific fauna group (e.g. Koala exclusion is different to that for frogs) and should include escape mechanisms should fauna be trapped in the carriageway.

Whilst the current study has focused on potential opportunities within the FGK Corridor (e.g. existing culverts that can be replaced or enhanced) and where there are significant narrowings and pinch points, additional survey work should be conducted to ascertain the traditional movement paths, particularly those of gliders. Prior to installation of glider poles or canopy bridges an assessment of their movement patterns should be made.

Monitoring the effectiveness of mitigative measures is regarded of high importance and should be incorporated as a budget item when planning projects. Monitoring before and after installation is necessary to gauge the effectiveness of mitigative measures and to guide how the measures can be improved. This should extend to determining whether there is an affect on population viability and genetics.

5.2 SPECIFIC DISCUSSION OF PINCH POINTS

The locations of pinch points considered as part of this study are illustrated in Figure 1. Each point is described below in Table 4 along with an analysis of enhancement recommendations for each location. They have also been ascribed with their priority based on the criteria outlined in Table 3.

Table 4: FGK Corridor Priority Linkage

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Wembley Road	A1	Potential Overpass	▪ Potential location for overpass of Wembley road	▪ None evident	2	▪ Vegetation to the north and south of road at this location. ▪ Logan City Council identified that a land bridge is desirable on Wembley Road. This location is one of 3 possible locations		▪ Possible land bridge.
Wembley Road	A2	Potential Overpass	▪ Potential location for overpass of Wembley road	▪ None evident	2	▪ Vegetation to the north and south of road at this location. ▪ Logan City Council identified that a land bridge is desirable on Wembley Road. This location is one of 3 possible locations.		▪ Possible land bridge.
Wembley Road	A3	Potential underpass / Overpass	▪ 3 x RCBC 2460mm x 920mm	▪ None evident	2	▪ As per A1 and A2 above ▪ There are also opportunities to provide a substantial underpass in this location as an alternative to overpass.		▪ Possible land bridge or substantial underpass.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Wembley Road	A4	Potential underpass	▪ Culvert 8m x 2m	▪ None evident	3	▪ Road works currently underway in this location. ▪ Wet pipes prohibit fauna movement		▪ Integrate dry passage and restore vegetation upstream and downstream.
Logan Motorway	B1	Underpass	▪ Bridge structure	▪ None evident	5	▪ Bridge offering good passage		▪ No action required.
Logan Motorway	B2	Potential underpass crossing of road	▪ No structure	▪ None evident	5	▪ Little opportunity here owing to creek going under Dennis Rd and hemmed in by development.		▪ No action, appears unviable for mitigative measures.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Logan Motorway	B3	Potential underpass crossing of road	▪ Creekline next to motorway flows to 7 x 3m x 3m RCBC	▪ none evident	4	▪ Provides excellent passage although cells on Anderson St are all wet.		▪ Provide dry passage and furniture.
Logan Motorway	B4	Possible overpass	▪ Powerline easement	▪ Wallaby scats ▪ Red back wren	2	▪ Potential location for land bridge over Logan Motorway. ▪ (Possible alternative to bridge located at B5)		▪ Establish land bridge utilising existing power easement to avoid impacts on existing vegetation.
Beaudesert Road	B5	Potential overpass	▪ Potential location for a land bridge	▪ None evident	2	▪ Potential location for land bridge over Beaudesert Road. ▪ (Possible alternative or compliment to bridge options located at B18 and B19)		▪ Establish land bridge.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Beaudesert Road	B6	Potential overpass	▪ Potential location for a land bridge	▪ None evident	2	▪ Potential location for land bridge over Beaudesert Road. ▪ (Possible alternative or compliment to bridge options located at B18 and B19)		▪ Establish land bridge
Logan Motorway	B7	Potential underpass	▪ In 2003 the structure was 1 x 1.5m dia corrugated iron pipe. ▪ Structure has not changed to date	▪ Not assessed	3	▪ Southern entrance to culvert is located at base of steep concrete incline ▪ May be used by small mammals and reptiles ▪ Not easy to increase culvert diameter or enhance southerly approach due to topographic constraints		▪ Not a fauna friendly structure. ▪ No changes recommended for this location.
Logan Motorway	B8	Potential underpass	▪ Pipe previously assessed	▪ none evident	2	▪ A large fence that limits access ▪ No dry route for fauna.		▪ Remove fence and ensure dry passage ▪ Rehabilitate gap between pipe and adjacent vegetation,

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Logan Motorway	B9	Potential underpass	▪ Two 2m diameter RCP's	▪ Non evident	2	▪ No dry passage		▪ Improve connecting vegetation ▪ Provide dry passage
Logan Motorway	B10	Potential underpass	▪ 7m tall bridge	▪ None evident	5	▪ Gabbion protection of east bank which is good to maintain this for fauna movement. ▪ Many weeds with evidence of dirt/trail bikes ▪ Some blocks have been put in place but may have been moved. ▪ No guide fencing		▪ Exclude degrading influences of dirt/trail bikes ▪ Provide guide fencing, entrance vegetation and glider poles.
Logan Motorway	B11	Potential underpass	▪ Three 3m diameter steel pipe with concrete mounted bar	▪ Rodent/bandicoot observed at southern entry	3	▪ Vegetation to the south is adequate. There is a gap that appears to have been recently planted. ▪ Barbed wire to the north may limit some accessibility		▪ Remove barbed wire and replace with guide fencing. ▪ Provide dry passage.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Logan Motorway	B12	Potential underpass	▪ One 2.5m x 3m cell (wet at time of inspection)	▪ None evident	3	▪ The culvert has light in the centre ▪ Northern entry is poor, no guide fencing, powerline present and barbwire fencing. Cobblestones are a problem at the entry. ▪ Southern entry only has a 25cm ledge and a small drop with scree. Some star picket fencing but poorly maintained.		▪ Provide guide fencing ▪ Widen ledge and extend entire way through ▪ Enhance entrance and exits by replacing rock pitch with earth / concrete. ▪ Enhance vegetation linkages to adjoining vegetation.
Stapylton Road	B13	Narrowing of vegetation	▪ Narrowing of vegetation	▪ N/A	2	▪ Road separates vegetation		▪ Install Rope Bridge at a minimum. ▪ Introduce traffic control to limit speed through corridor.
Logan Motorway	B14	Potential underpass	▪ 3 x 1m dia RCP	▪ None evident	5	▪ All RCP are wet. ▪ Good vegetation to the north and industrial areas to the south.		▪ No recommendations.

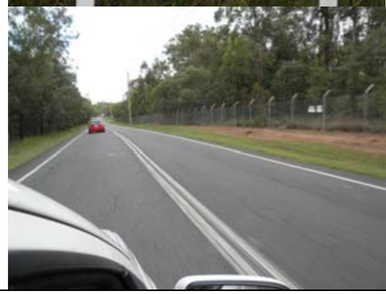
Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Logan Motorway	B15	Potential underpass	▪ Five 3m x 3m BOX CULVERT	▪ Eastern Water Dragon	3	▪ All box culverts are wet. ▪ There is excellent condition vegetation to the north but *Typha sp* and other wetland plants present at the culvert		▪ Integrate dry cell.
Logan Motorway	B16	Potential underpass of motorway	▪ Two 50cm diameter RCP ▪ Sound barrier with two BOX CULVERT 100 x 50cm	▪ None evident	5	▪ Culverts have no dry passage		▪ No recommendations.
Logan Motorway	B17	Potential underpass of motorway	▪ three approx 1m high RCP ▪ Tree 1m high RCP under a sound barrier	▪ none evident	5	▪ No vegetation present ▪ Pipes also under sound barrier ▪ Diameter of pipes would enable passage of small fauna		▪ No recommendations.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Logan Motorway	B18	Preferred overpass	▪ Preferred location for land bridge	▪ None evident	1	▪ Potential and preferred land bridge option of Logan Motorway to the B5 and B6 scenario.		▪ Establish land bridge
Beaudesert Road	B19	Preferred overpass	▪ Preferred location for land bridge	▪ None evident	1	▪ Potential and preferred land bridge option of Beaudesert Road to the B5 and B6 scenario		▪ Establish land bridge
Fifth Avenue (C)	C1	Gap in vegetation under powerline	▪ Gap in vegetation under powerline	▪ None evident	4	▪ Powerline severs vegetation connectivity.		▪ Introduce some vegetation and / or complicated habitat (i.e. rocks / logs) under lines along with glider poles.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Bayliss St	C2	Bridge	▪ Not assessed	▪ N/A	5	▪ Cells under bridge all wet ▪ Lacks vegetation on approaches		▪ Investigate options to retrofit benches to provide dry passage. ▪ Establish vegetation on approaches.
Waller Road	C3	Potential overpass	▪ Bridge 3m tall	▪ Wallaby tracks ▪ Bandicoot tracks ▪ Water rat	4	▪ Good vegetation either side of bridge. ▪ There are gaps for gliders. ▪ One of the better bridge structures inspected.		▪ Provide glider poles to enable minimum volplane distance of 50m above road.
Browns Plains Road	D1	Potential underpass crossing of road	▪ Culverts 5 cells of 1 x 2m box culvert.	▪ none evident	4	▪ All wet cells ▪ No vegetation on north side ▪ Not suitable crossing location		▪ Create dry cell passage. ▪ Establish vegetation between culverts and adjoining forest.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Johnson Road – Goodna	D2	Powerline	▪ NA	▪ None evident	4	▪ Some native vegetation underneath ▪ Gap is perhaps too wide for gliders.		▪ Provide glider poles to enable minimum volplane distance of 50m above road. ▪ Maintain vegetation under powerline
Browns Plains Road	D3	Potential overpass	▪ Bridge approx. 5m tall	▪ none evident	4	▪ Good but little scope for gliders despite large trees in the creek.		▪ Provide glider poles to ensure minimum volplane distance between is <20m
Sydney-Brisbane Railway	D4	Underpass of rail line	▪ Approx 500m north of Johnson Rd ▪ In 2003 the structure was a 1 x 3m x 3m culvert ▪ Structure remains same today	▪ Not assessed in current study	2	▪ Unfenced railline at location and represents little barrier to fauna movement. ▪ Rail easement separates tree by a distance greater than 30m therefore forms a barrier to small gliders.		▪ Investigate options for installing glider poles at location ▪ Increase the number and size of underpass structure.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Paradise Road	D5	Potential underpass	▪ Culvert	▪ N/A	5	No dry passage		▪ Introduce dry cells and enhance vegetation at culvert approaches.
Paradise Road	D6	Rope Bridge	▪ One of two rope bridges over Paradise Road	▪ Not assessed	3	▪ Not assessed		▪ Not assessed.
Johnson Road	D7	Bridge Crossing of Oxley Creek	▪ 5m tall bridge	▪ Not assessed	4	▪ In 2003 was a high set bridge with wide banks. ▪ Rock banks for stabilisation offered excellent cover for small fauna ▪ Structure remains consistent today.		▪ Install guide fencing on approaches. ▪ Install glider poles and ropeways on eastern and western side of intersection. ▪ Educative signing and rumble strips ▪ Revegetate with koala food trees and wattles.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Johnson Road	D8	Potential overpass	▪ No structure	▪ none evident	1	▪ Major dip in Johnson Rd to East, and Stapylton Rd to south of intersection. ▪ Allows potential connectivity through corridor block. ▪ Corner block is currently for sale. This point represents the most prominent narrowing in the corridor. ▪ Fencing to Greenbank is a significant barrier	 	▪ Consider attaining the corner block to widen the corridor at this critical point. ▪ Configuration of crossing structures at this location is difficult owing to the fencing at Greenbank Military area. ▪ Movement options are complicated and require further detailed consideration and engagement of the Military.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Johnson Road	D9	Potential underpass	▪ 5 x 2 x 2m box culvert over Blunder Creek	▪ None evident	3	▪ All cells wet.		▪ Introduce dry cells and revegetate between culvert and the adjacent forest.
Paradise Road	D10	Potential underpass	▪ Culvert	▪ N/A	5	▪ Culvert cells are all wet ▪ Flat area of road subject to flooding ▪ Major work required to make road and adjacent rail permeable		▪ No recommendations
Gateway Motorway	E1	Cutting on gateway	▪ NA	▪ None evident	1	▪ Broad cutting separating isolated portions of Karawatha Forest.		▪ Establish overpass to reconnect isolated pockets of Karawatha Forest,

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Gateway Motorway	E2	Underpass	▪ Bridge approx 5m tall.	▪ None evident	3	▪ There is a wide gap between the carriageway ▪ Little vegetation currently but good revegetation potential. ▪ Good fencing present but not entirely wildlife exclusion.		▪ Improve fencing to exclude wildlife from road ▪ Revegetate to increase cover
Gateway Motorway	E3	Underpass	▪ Bridge	▪ N/A	3	▪ The lack of tall vegetation adjacent to the Gateway Motorway coupled with its elevation above the surrounding landscape reduces opportunities for glider movement. ▪ To the north of Illawena Street the east-west movement of fauna is inhibited by the Gateway Motorway until the bridge crossing at Scrubby Creek. ▪ The wide span bridge has retained wide banks and a diversity of habitat. The height of the bridge and dual lanes has allowed the retention of and establishment of good native vegetation cover.		▪ The planting of tall vegetation either side and between the lanes at the Scrubby Creek will assist in reinstating connectivity.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Illaweena Street	F1	Powerline easement	▪ Powerline over cleared areas.	▪ Wallaby scats and prints to south of Illaweena Street	1	▪ Good native vegetation under easement on north of Illaweena Street ▪ No native vegetation on south of Illaweena Street	 	▪ Rehabilitate area to south of Illaweena St or add complex environment through use of logs and rocks. ▪ Install glider poles.
Illaweena Street	F2	Potential underpass	▪ Small RCP ▪ Wet.	▪ None evident	1	▪ Although too small to utilise pipe for an underpass, there is a need to reduce road kill on Illaweena St and to enhance north – south movement.		▪ Possibly close the road. ▪ Elevate the road to enable safe under passage.

Barrier	**Field Site Number**	**Attribute Assessed**	**Physical Description**	**Evident fauna use**	**Ranking**	**Discussion**	**Image**	**Recommendations**
Gowan Road	F3	Potential underpass crossing of road	▪ Five 1x2m box culvert all wet underneath an elevated footbridge	▪ None evident	3	▪ No dry passage available.		▪ Provide dry passage through culvert.
Gowan Road	F4	Potential underpass crossing of road	▪ Five 1x1m box culvert all wet	▪ Wallaby scats in vegetation 3m from culvert	3	▪ Culvert no dry passage ▪ Vegetation present but requires enhancement.		▪ Provide dry passage through culvert. ▪ Vegetation enhancement to the east of Gowan Rd.
Waterbrook Circuit	F5	Existing Underpass	▪ Five box culverts ▪ One is a dedicated drycell.	▪ None evident	3	▪ Dry cell too small for passage of wallabies. ▪ Rock pitching would reduce efficiency.		▪ Replace rock pitching with surface to enable passage. ▪ Consider improving passage for wallabies.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Wallum Drive	G1	Potential underpass crossing of road	▪ Bridge approx 2m tall in centre	▪ Dog ▪ Fox ▪ Bandicoot	3	▪ Good vegetation either side of bridge ▪ Good vegetation on either side		▪ No recommendations.
Wallum Drive	G2	Potential underpass	▪ Bridge approx 2m tall in centre	▪ Dog ▪ Fox ▪ Bandicoot	3	▪ Vegetation in good condition		▪ No recommendations
Paradise Road	H1	Potential underpass	▪ Two 1m diameter RCP	▪ None evident	3	▪ Major concrete dropping off ▪ Gap to vegetation that has been planted		▪ Given the nature of surrounding development the crossing may not require enhancement.

Barrier	**Field Site Number**	**Attribute Assessed**	**Physical Description**	**Evident fauna use**	**Ranking**	**Discussion**	**Image**	**Recommendations**
Centenary Highway	I1	Bridge	▪ Bridge over Sandy Creek	▪ Macropod scats found on eastern approach	2	▪ Stone pitched angle banks are not suitable to permit fauna passage. ▪ Fencing at adjacent Greenbank Military Reserve presents an additional barrier		▪ Restore vegetation on approaches and integrate glider poles (if gliders are active in the area). ▪ Investigateoptions for improving stone banks for fauna passage. ▪ Address fencing of Military reserve.
Centenary Highway	I2	Bridge	▪ Bridge over Opossum Creek	▪ N/A	3	▪ Excellent structure although vegetation requires enhancement.		▪ Restore vegetation and integrate glider poles (if gliders are active in the area).
Centenary Highway	I3	Bridge	▪ Bridge over Mountain Creek	▪ N/A	3	▪ Excellent structure although vegetation requires enhancement. ▪ Very damp at this location		▪ Restore vegetation and integrate glider poles (if gliders are active in the area). ▪ Ensure that structures are installed that provide dry passage for fauna.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Centenary Highway	I4	Potential underpass location	▪ 2 x 1m dia RCP	▪ Cat	4	▪ Pipes are long and habitat to the north is limited		▪ No recommendations.
Centenary Highway	I5	Potential underpass location	▪ 3 x 0.5m RCP's	▪ None evident	4	▪ No obvious outfall to north side of road.		▪ No recommendations.
Centenary Highway	I6	Bridge	▪ 8m high bridge structure	▪ None evident	4	▪ Excellent structure although vegetation requires enhancement.		▪ Restore vegetation and integrate glider poles (if gliders are active in the area).

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Centenary Highway	I7	Bridge	▪ 8m high bridge structure	▪ None evident	4	▪ Excellent structure although vegetation requires enhancement.		▪ Restore vegetation and integrate glider poles (if gliders are active in the area).
Springfield Beaudesert Connection Road	J1	Small drainage line Potential underpass crossing of road	▪ 3 x 1.5m RCBC	▪ None evident	4	▪ Culvert structure is too low to facilitate free water movement ▪ The fence and access track on the Greenbank side appear to impede water flows. ▪ Some weeds present.		▪ Poor structure for fauna passage. ▪ Investigate potential for retrofitting fauna friendly culvert that also improves water drainage. ▪ Investigate options for improving water flow through Greenbank reserve. ▪ Large tree and wide road verges may offer potential for fitting overpass structures for arboreal species.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Springfield Beaudesert Connection Road	J2	Potential underpass crossing of road	▪ 8 x 1.5m dia RCP	▪ Wallaby	4	▪ Culvert structure is too low to facilitate free water movement. ▪ Pipes remain wet with pooling at both ends of culvert ▪ The fence and access track on the Greenbank side appear to impede water flows. ▪ Greenbank fencing presents a barrier to fauna movement at this location, with numerous wallaby scats and footprints found. ▪ Some weeds and rubbish present		▪ Poor structure for fauna passage. ▪ Investigate potential for retrofitting fauna friendly culvert that also improves water drainage. ▪ Investigate options for improving water flow through Greenbank reserve. ▪ Large tree and wide road verges may offer potential for fitting overpass structures for arboreal species.
Springfield Beaudesert Connection Road	J3	Potential underpass crossing of road	▪ 8 x 1.5m dia RCP	▪ Dragon	4	▪ As per J2 above ▪ Property access tracks and vehicle lay-by stops adjacent to location		▪ As per J2 above.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Springfield Beaudesert Connection Road	J4	Potential underpass crossing of road	▪ 4 x 1.5m dia RCP	▪ None evident	4	▪ As per J2 above ▪ Property access tracks and vehicle lay-by stops adjacent to location		▪ As per J2 above
Springfield Beaudesert Connection Road	J5	Potential overpass crossing of road	▪ NA	▪ Dragon ▪ Wallaby	1	▪ This location represents one of this significant narrowing in the corridor. Tenure will enable its long term security, but movement opportunities in this location are restricted owing to the width of pavement and volume of traffic. Given the elevated topography of the area, the only structure that would facilitate the movement of all fauna groups utilising the FGK corridor would be a land bridge.		▪ . Establish a land bridge in this location. The widening of vegetation in this location through the enhancement of adjacent rural residential properties to the east would enhance habitat/corridor values. As with other locations, discussions are required with the Military to identify approaches to eliminating the barrier affect of the fencing surrounding the Greenbank Reserve.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Springfield Greenbank Arterial Road	J6	Andrew Josey Gully Potential underpass crossing of road	▪ Purpose built 2 lane road bridge.	▪ Goanna ▪ White Faced Heron ▪ Wallaby ▪ Dog / Fox ▪ Frog sp.	4	▪ Adequate groundcover approaching bridge ▪ Lacking furniture underneath bridge ▪ No guide fencing installed ▪ Some weeds and rubbish present		▪ A good structure that could be enhanced through additional planting and guide fencing. ▪ Monitoring of actual fauna use will inform other management measures.
Springfield Greenbank Arterial Road	J7	Opossum Creek Potential underpass crossing of road	▪ Purpose built 2 lane road bridge.	▪ Cat ▪ Wallaby ▪ Dog / Fox	4	▪ Adequate groundcover approaching bridge ▪ Lacking furniture underneath bridge ▪ No guide fencing installed ▪ Some weeds and rubbish present		▪ A good structure that could be enhanced through additional planting and guide fencing. ▪ Monitoring of actual fauna use will inform other management measures.
Sinnathanby Boulevard	J8	Bridge	▪ Bridge over Mountain Creek	▪ N/A	4	▪ Tall structure, with the underpass very pedestrian orientated. ▪ Lacks vegetation and adequate cover to facilitate fauna movement.		▪ Fauna passage could be enhanced through additional planting and guide fencing.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Main Street	J9	Bridge	▪ Bridge over Mountain Creek	▪ N/A	4	▪ Area recently subject of extensive parkland work by Council and Springfield Land Corp. ▪ Tall structure, with the underpass very pedestrian orientated. ▪ Although some vegetation is present it lacks adequate cover to facilitate fauna movement.		▪ Fauna passage could be enhanced through additional planting and guide fencing.
Sinnathanby Boulevard	J10	Bridge	▪ Bridge over Mountain Creek	▪ N/A	4	▪ Tall bridge but not oriented towards fauna movement		▪ Fauna passage could be enhanced through additional planting.
Cheviot Road	K1	Oxley Creek Potential corridor through rural residential	▪ Creekline corridor that runs adjacent to rural residential properties	▪ N/A	4	▪ Melaleuca lined creek running roughly North – South ▪ Creek is split by property boundaries and fencing. ▪ No fauna guide fencing present. ▪ Some weeds and rubbish present		▪ Location represents a small refuge in a fragmented landscape. ▪ Ongoing maintenance of Oxley Creek necessary for preserving links through rural residential landscape.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Cheviot Road	K2	Tributary of Oxley Creek Potential underpass crossing of road	▪ Possible fauna crossing location ▪ 2 x 1.5m dia RCP	▪ Eastern Sedgefrog	4	▪ Elevated road would aid in funnelling some fauna to the pipes, but given the lack of a dry passage it is unlikely to be effective. ▪ Heavy weed infestation ▪ No channel fencing ▪ Remains inundated after rain events ▪ Corridor linkage very narrow at this location ▪ Little opportunity for fauna movement through culvert		▪ Generally a poor structure for facilitating fauna movement. ▪ Undertake a weed management program ▪ Preserve and enhance native vegetation where possible
Thompson Road	L1	Oxley Creek Potential underpass crossing of road	▪ Possible fauna crossing location ▪ 6 x 1.5m dia RCP	▪ N/A	4	▪ All pipes were wet. ▪ Elevated road would aid in funnelling some fauna to the pipes, but given the lack of a dry passage it is unlikely to be effective. ▪ Oxley Creek provides a major linkage in this area ▪ Creek is split by property boundaries and fencing. ▪ No fauna guide fencing present. ▪ Some weeds and rubbish present		▪ Generally a poor structure for facilitating fauna movement. ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Undertake a weed management program
Thompson Road	L2	Andrew Josey Gully Potential underpass crossing of road	▪ Possible fauna crossing location ▪ 2 x 1m dia RCP	▪ N/A	4	▪ All culverts were completely silted up. ▪ Some weeds and rubbish present ▪ No fauna guide fencing present ▪ Linkage is approximately 25m wide at road crossing		▪ A very poor structure for facilitating fauna movement. ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Undertake a weed management program

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Lyndale Road	M1	Oxley Creek Potential linkage through rural residential	▪ Creekline corridor that runs adjacent to rural residential properties ▪ Continuation of N1 and O1	▪ Eastern Sedgefrog	4	▪ Oxley Creek represents a major linkage in this area. ▪ Corridor remains relatively wide through adjacent properties ▪ Minor weed infestation with some rubbish. ▪ Linkage is quite wide at this location		▪ Generally in good condition. ▪ Could be enhanced through fauna friendly fencing on property boundaries
Lyndale Road	M2	Tributary of Crewes Creek Potential underpass crossing of road	▪ Possible fauna crossing location ▪ 2 x 1.2m dia RCP ▪ 1 x 1.5m dia RCP	▪ N/A	4	▪ Crewes Creek is a major linkage in this area. ▪ Corridor remains relatively wide through adjacent properties ▪ Minor weed infestation with some rubbish. ▪ Pipes were wet and quite long at approx 30m. ▪ No guide fencing installed ▪ Elevated road would aid in funnelling some fauna to the pipes, but given the lack of a dry passage it is unlikely to be effective		▪ Opportunities to enhance the movement of arboreal fauna should be considered and informed by monitoring of fauna use of adjacent habitat. ▪ This culvert represents the only crossing location for fauna crossing in the south of Lyndale Road and could be enhanced through guide fencing and providing dry passage for ground fauna.
Kingfisher Road	M3	Crewes Creek Potential underpass crossing of road	▪ Single span bridge across minor road	▪ Eastern Sedgeforg ▪ Dragon sp x 2 ▪ High bird abundance ▪ Fairy Martin nests under structure ▪ Wallaby	4	▪ Bridge underpass was totally inundated ▪ No guide fencing in place ▪ Mature Eucalypt / Melaleuca species line creekline east and west of location ▪ Some weeds present ▪ Crewes creek represents an important linkage in rural residential landscape		▪ A good structure that could be enhanced through provision of dry fauna passage and guide fencing. ▪ Monitoring of actual fauna use will inform other management measures. ▪ Investigate options for overpass across trees lining roadway

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Attunga Road	N1	Tributary of Crewes Creek Potential underpass crossing of road	▪ 2 x 0.6m dia RCP	▪ Variegated Wrens in adjacent vegetation	4	▪ Very small culvert and drainage line at this location ▪ Creek is impounded at adjacent property for a small dam ▪ Pipes were all inundated ▪ Some weeds and rubbish present		▪ A very poor structure for facilitating fauna movement. ▪ Opportunities to enhance the movement of arboreal fauna to nearby patches should be considered informed by monitoring of fauna use of adjacent habitat.
Begley Road	N2	Crewes Creek Potential underpass crossing of road	▪ 4 x 1.5m dia RCP	▪ Dragon	4	▪ As per M2 above		▪ As per M2 above.
Huntigdale Drive	O1	Potential overpass crossing location	▪ NA	▪ None evident	4	▪ Huntingdale Road represents a barrier between the linkages to the east and the core corridor to the west. ▪ Mature Eucalypt trees line Huntingale Rd and adjacent properties at this location. ▪ Tree spacing across the road is approx 50 - 60m ▪ No underpass opportunities were evident.		o Opportunities to enhance the movement of arboreal fauna to from nearby linkages to the core corridor should be considered and informed by monitoring of fauna use of adjacent habitat.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Thornbill Drive	P1	Tributary of Crewes Creek Potential underpass crossing of road	▪ 3 x 1.8 dia RCP	▪ None evident	4	▪ Crossing point is adjacent to powerline easement which remains relatively well vegetated by low shrubs and trees. ▪ Culverts wet and blocked by flow debris. ▪ Very overgrown with weeds. ▪ Location provides linkage from rural residential on the east to Sprint Mtn Forest Park on the west. ▪ No guide fencing in place		▪ Generally a poor structure for facilitating fauna movement. ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Undertake a weed management program. ▪ Opportunities to enhance the movement of arboreal fauna to from nearby linkages to the core corridor should be considered and informed by monitoring of fauna use of adjacent habitat.
Thornbill Drive	P2	Tributary of Crewes Creek Potential underpass crossing of road	▪ 1 x 1.2m RCP ▪ Approx 30m long	▪ None evident	N	▪ Location provides a secondary linkage from rural residential on the east to Sprint Mtn Forest Park on the west. ▪ No guide fencing in place ▪ Culvert remains damp and steps in front of wingwall prevent access by small fauna ▪ Some erosion / weeds / rubbish present.		▪ Generally a poor structure for facilitating fauna movement ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Opportunities to enhance the movement of arboreal fauna to from nearby linkages to the core corridor should be considered and informed by monitoring of fauna use of adjacent habitat.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Thornbill Drive	P3	Tributary of Crewes Creek Potential underpass crossing of road	▪ 3 x 1.5m dia RCP ▪ Approx 30m wide	▪ Brown Honeyeater in riparian vegetation ▪ Juvenile Nankeen Night Heron ▪ High bird abundance	N	▪ Location provides a secondary linkage from rural residential on the east to Sprint Mtn Forest Park on the west. ▪ Structure was wet and blocked by flow debris. ▪ Adjacent property fencing provides some channelling towards culvert, although not likely to be used due to lack of dry passage. ▪ Weeds and rubbish present. ▪ Mature trees lining creekline and in adjacent properties may provide passage for arboreal species.		▪ Generally a poor structure for facilitating fauna movement ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Opportunities to enhance the movement of arboreal fauna to from nearby linkages to the core corridor should be considered and informed by monitoring of fauna use of adjacent habitat.
Tully Road	Q1	Minor drainage line Potential underpass and overpass crossing of road	▪ 1 x 0.8m dia RCP	▪ Wood Ducks	3	▪ Location represents a bottleneck from large continuous core habitat in the south to the north, cleared grazing land to the west, and a new subdivision to the east. ▪ Location is heavily infested with weeds. ▪ Signs of grazing disturbance. ▪ Structure was wet and too narrow to offer much for fauna movement. ▪ Remnant mature Eucalypt trees lining drainage line offer possible linkages for arboreal species.		▪ Generally a poor structure for facilitating fauna movement ▪ Investigate options for retrofitting culvert underpass and channel fencing for small fauna. ▪ Opportunities to enhance the movement of arboreal fauna to from nearby linkages to the core corridor should be considered and informed by monitoring of fauna use of adjacent habitat. ▪ Widen vegetation in this narrowing.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
	Q2	Oxley Creek Potential underpass and overpass crossing of road	▪ Single land timber bridge crossing	▪ Rainbow Bee-eater in adjacent vegetation	4	▪ Structure is low to the ground and likely to be inundated in large flow events. ▪ Lacking structure and adequate cover for fauna movement ▪ Riparian vegetation largely cleared at location ▪ Signs of grazing disturbance		o The structure is adequate for fauna movement but the lack of habitat complexity in the surrounding area is likely to represent a barrier to some fauna species.
	Q3	Oxley Creek Potential underpass and overpass crossing of road	▪ 2 x single lane causeway with 1 x 0.5m RCP	▪ Wood Ducks	N	▪ Structure is unlikely to impede fauna movement except in major flow events. ▪ Location narrows between adjacent grazing properties, with some grazing disturbance evident ▪ Mature Eucalypt sp line riparian zone offering refuge and passage for arboreal species. ▪ Weeds and some rubbish present. ▪ No fencing in place		▪ Generally a good structure for facilitating movement. ▪ Opportunities to enhance the movement of arboreal should be considered and informed by monitoring of fauna use of adjacent habitat. ▪ If Tully Rd requires upgrading in the future the use of a bridge or culvert underpass fitted with dry fauna passage should be considered.

Barrier	Field Site Number	Attribute Assessed	Physical Description	Evident fauna use	Ranking	Discussion	Image	Recommendations
Undullah Road	R1	Potential overpass crossing of road	▪ Small causeway x 2	▪ N/A	4	▪ Causeway represents minor impediment to fauna movement. ▪ Photo is indicative of locations		▪ Opportunities to enhance the movement of arboreal should be considered and informed by monitoring of fauna use of adjacent habitat.

The solutions recommended in the table above and following paragraphs provide a conceptual framework around which definitive solutions can be refined. Detailed assessment of fauna assemblages at each location, potential impacts on vegetation communities in addition to consideration of engineering constraints are likely to be necessary in order to refine solutions.

6. DISCUSSION

The 275kV powerline easement to the east of White Rock is perhaps the most significant linear infrastructure dissecting the western portion of the FGK corridor (currently Undullah Road represents little barrier). Whilst this easement does not represent a significant barrier per se, areas immediately to the immediate east including rural residential development of Greenbank and the urban development of Springfield begin to limit movement opportunities for wildlife. As indicated in Part A of this study, although the rural residential matrix is likely to allow for some movement of wildlife through several Linkages, the Core Corridor significantly narrows where it crosses the Springfield Beaudesert Road. This road represents a significant barrier to movement. Whilst movement is possible through Opossum and Mountain Creeks through points J7, J6 & I2 and J8, J9 & I3 respectively, this serves only to connect with supplementary Isolated Remnant Habitat Patches that are vital to the FGK corridor's wildlife, but not serving the desired role of a continuous corridor. As such, establishing a crossing that enables the movement of the greatest diversity of wildlife is important on the Springfield Beaudesert Road within Narrowing 'G' (identified in Part A of this study). Specifically, a dedicated land bridge would serve this purpose.

Whilst the Greenbank Military Camp represents a broad unencumbered area of habitat, it is permeable from the outside by species capable of passing over or through a chain wire fence. Rendering the fencing permeable to all fauna of the FGK corridor is a difficult endeavor owing to its specific purpose to exclude pedestrian access to military land. It is recommended that negotiations are undertaken with the Military to identify measures to address this issue. Land bridges in proximity to the Camp would be of reduced value should the barrier effect of the fence persist. Whilst access prohibited an inspection, aerial photographic review indicates that the Sydney – Brisbane Railway separates habitat areas within the Camp. As such, this break in habitat should be considered as part of any upgrades to the line.

The Core Corridor significantly narrows at the northeastern corner of the Greenbank Military Camp at the juncture of Stapylton and Johnson Roads (location D8). Given the narrowing, a number of alternative approaches should be considered to restore connectivity in this location including:

- Crossing the intersection diagonally with a land bridge; or
- Utilising two topographic low points on Stapylton Road and Johnson Road to create two bridges.

The latter option will require traversing freehold land. This parcel is currently for sale and represents an opportunity. It is understood from discussion with Logan City Council (LCC) officers that there are significant road works proposed at this juncture and Brisbane

City Council had been pursing the establishment of major fauna crossing infrastructure as part of this work. Although it is unclear whether these structures are likely to eventuate, it is understood that LCC is concentrating efforts on enhancing the link along Oxley Creek northwards from the Greenbank Military Camp. LCC is currently undertaking restoration work at Oxley Creek in this location. Owing to the presence of rural residential properties and elevated creek flow levels, the interface of Oxley Creek with the Greenbank Military Camp could not be assessed during the current study. However, in close proximity to this interface, the perimeter fence of the camp appears to remain a significant barrier. Given the tenuous connection provided through this area and the Stapylton/Johnson Road intersection, both areas are regarded of significance and both require ameliorative work.

Some connectivity northward of the Military Camp is also possible across Blunder Road via Blunder Creek, but again the Greenbank Military Camp's fencing represents a barrier and culverts on Johnson Road (location D8) would currently facilitate little movement.

The Logan Motorway represents a significant barrier to wildlife. Although some permeability exists, there are no existing structures that enable the free movement of all wildlife. Opportunities to enhance or create connectivity from the north of Johnson Road through to habitat to the south of Illaweena Street exist through numerous routes as tabulated below:

Table 5: Potential corridor routes

Route	Discussion
(D9)-B15-B13-D10-G1-B19	▪ The corridor is relatively narrow along this route and existing culverts are variable in their current capacity to facilitate wildlife movement. ▪ Crossing at D10 is tenuous and is likely to require significant work. ▪ G1 is located within a narrow linkage. ▪ B19 will require the establishment of a land bridge.
B10+B11+B12-D10-G1-B19	▪ A variety of crossing points available through B10, 11 and 12 are beneficial. ▪ D10-B19 as above.
D5+D6-D4-B9-G2-G1-B19	▪ Whilst excellent canopy bridges are provided over Paradise Road (D6), the existing culvert (D5) is not suitable for terrestrial wildlife. Despite this, the road is narrow and unencumbered by fencing. ▪ D4 is a narrow culvert under the Sydney-Brisbane Rail line. Enhanced passage under or over the rail would improve wildlife permeability. ▪ B9 is a relatively narrow culvert. ▪ G1 and G2 are located within a narrow linkage. ▪ B19 as above.
D5+D6-D4-B8-B19	▪ D4, 5 and 6 as above. ▪ D4 as above. ▪ B8 is encumbered by fencing on its northern entry. ▪ B19 as above.
D5+D6-D4-B18-B19	▪ D4, 5 and 6 as above. ▪ A land bridge crossing of Logan Motorway is necessary at B18. Vegetation to the north of the Logan Motorway in this location is approximately 300m wide. ▪ B19 as above.

Route	Discussion
D5+D6-D4-B6-B5	▪ D4, 5 and 6 as above ▪ A land bridge would be required at B6 in order to cross Beaudesert Road. B6 crosses into a portion of the corridor narrower (i.e. approx. 240m) than habitat provided to the north of the Logan Motorway. However, provided a land bridge is placed at B5 the distance of the narrow habitat is relatively short.
D5+D6-D4-B6-B4	▪ D4, 5 and 6 as above ▪ B6 as above. ▪ A land bridge at B4 would be required. This would be located approximately 2km to the east of B6. The intervening vegetation narrows to approximately 140m in width.

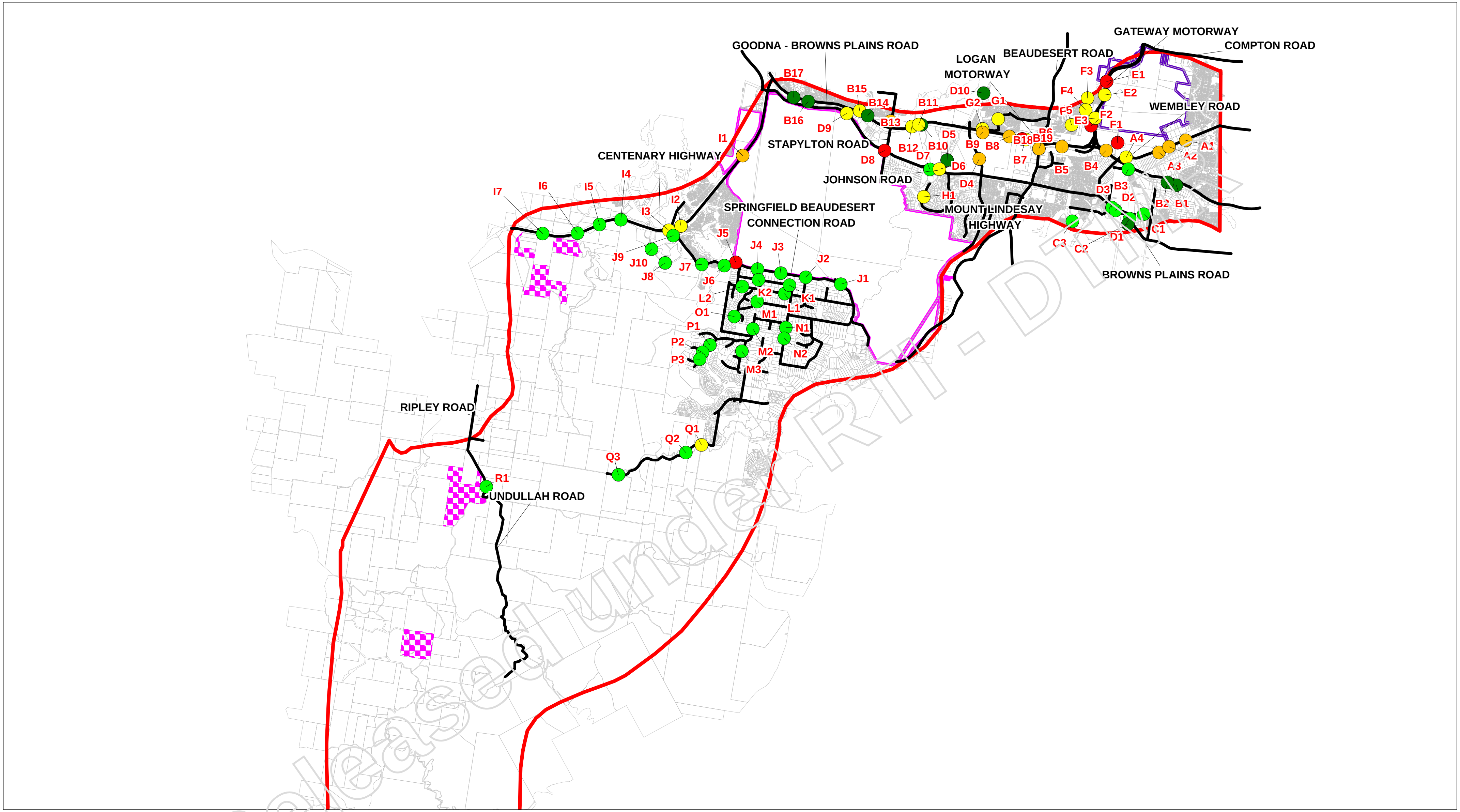
All of the routes discussed above are important to wildlife movement in this highly compromised length of the FGK corridor. The greater number of linkages and connection between isolated patches will increase the overall permeability of the corridor and overall habitat for wildlife. However, if only one route is achievable, the preferred option is D5+D6-D4-B18-B19 and followed by D5+D6-D4-B6-B5.

The final leg of the corridor requires the crossing of Illaweena Street. Whilst not a wide road, Illaweena Street represents a vulnerable point and historically has had several recorded road kills (Chenoweth EPLA, 2003) and requires further consideration. Multiple options that might be considered for Illaweena Street include:

- Close the road;
- Limited to no access at night;
- Provide slow points between Gowan Road and Wembley Road that are 'policed' by multiple fixed speed cameras;
- Elevate the road in places; and/or
- Create 1-2 land bridges located to the east and west of the Gateway.

Karathawa is divided by the Gateway Arterial and consideration should be given to reconnecting separated portions of habitat through the use of land bridges.

Connectivity of Karawatha Forest with the habitat areas of Berrinba Wetlands is also an important component of the overall corridor. Crossings of Wembley Road (A1-4) and the Logan Motorway (B3) should be enhanced in order to build greater robustness into the functionality of the FGK Corridor.



LEGEND

Crossing Priority
- Priority 1
- Priority 2
- Priority 3
- Priority 4
- Priority 5

- Assessed Roads
- FGK Corridor
- Protected Estate
- Cadastre

0 2.5 5
Kilometres

Flinders to Greenbank - Karawatha Corridor Study

Barriers and Potential and Existing Crossing Locations

FIGURE 1

CHENOWETH ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

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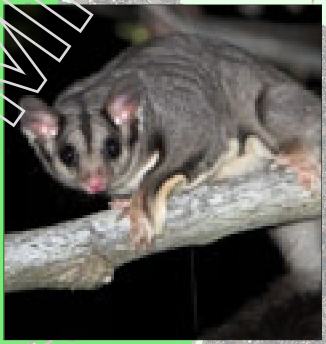
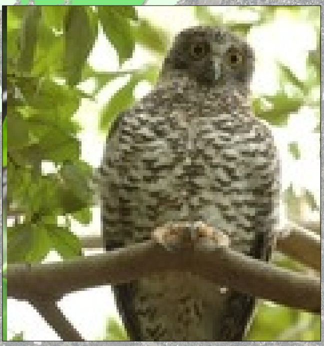


Flinders to Greenbank - Karawatha Corridor:

Part C



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EXECUTIVE SUMMARY

The Flinders to Greenbank – Karawatha Ecological Corridor (FGK Corridor) is a 40km corridor that extends from just south of the City of Ipswich at Flinders Peak, to Karawatha Forest in Brisbane's outer suburbs. The corridor crosses the four local government boundaries of Ipswich City Council, Logan City Council, Scenic Rim Regional Council and Brisbane City Council.

Chenoweth EPLA has been contracted to provide an assessment of FGK Corridor with a view to identifying the major threats to the ongoing ecological integrity of the Corridor, and any priority actions to prevent any further degradation.

To achieve this aim the project shall consist of three separate studies:

A. General corridor information and ecological theory;

B. Locating pinch points in existing corridor link; and

C. Identifying any properties of significance, supported by an overall review of the corridor and its critical 'pathways'.

The purpose of this document is to address Part C of the project and seeks to identify properties that are potentially suitable offset locations, and / or are strategically important for the continuing functionality of the Corridor. To achieve this aim Chenoweth EPLA undertook the following steps:

- As a GIS based desktop exercise, properties within the Corridor were reviewed to determine their suitability for use as an environmental offset under various offset policies including:
    - Use of Environmental Offsets Under the *Environmental Protection and Biodiversity Conservation Act 1999*;
    - Queensland Government Environmental Offsets Policy (QGEOP);
    - Policy for Vegetation Management Offsets - Version 2.4;
    - Fish Habitat Management Operational Policy; and
    - Offsets for Net Gain of Koala Habitat in South East Queensland Policy.
- A list of environmental values for identified lots within the Corridor was prepared based upon the task above;
- Strategically important properties were also identified that are crucial to the ongoing functionality of the Corridor (i.e. locations critical for barrier mitigation structures and large properties that co-incide with the only fauna movement passage location); and
- Once identified, these values were mapped according to their significance.

A total of 26,426 lots were assessed via a filtering process to ascertain their potential for offset locations and to provide a summary of their respective ecological values. Of all the lots assessed:

- 881 lots were determined to have 'strategic' value to the continued functioning of the Corridor;
- 1,378 lots were flagged as having potential for offsets under the VMA; and
- 1,468 lots were determined as having potential for offset under the Koala offsets policy.

No lots were identified as suitable for offsets under the EPBC or the QLD Fisheries Offset policies based on analysis of desktop information.

ACRONYMS USED IN REPORT

BAMM – Biodiversity Assessment and Mapping Methodology

BPA – Biodiversity Planning Assessment

CEPLA – Chenoweth Environmental Planning and Landscape Architecture

DERM – Department of Environment and Resource Management

DEWR – Department of Environment and Water Resources (Fed)

DOIW – Directory of Important Wetlands

EA – Environment Australia

EPA – Environmental Protection Agency

EPBC – *Environmental Protection and Biodiversity Conservation Act 1999* (Fed)

ESD – Environmentally Sustainable Development

EVR – Endangered, Vulnerable and Rare (species)

FGK – Flinders to Greenbank – Karawatha

NCA – *Nature Conservation Act 1992*

NES - National Environmental Significance

PMAV – Property Map of Assessable Vegetation

QGEOP – Queensland Government Environmental Offsets Policy

RE – Regional Ecosystems

SEQ – South East Queensland

SEWPC – Department of Sustainability, Environment, Water, Population and Communities (Fed)

SPRP – State Planning Regulatory Provision

VMA – *Vegetation Management Act 1999*

1. BACKGROUND TO PART C

Part A of this study identified the value the Flinders to Greenbank – Karawatha (FGK) Ecological Corridor and the locations along the Corridor where it narrows to a point where functionality may be compromised. Part B then provided a review of known pinch points, identified additional corridor pinch points; and recommended actions to mitigate and manage all pinch points.

This report addresses Part C of the FGK Corridor study and seeks to identify properties with significant environmental or strategic value. Broadly this report:

- Provides a summary of applicable offsets policies;
- Outlines the criteria used to identify suitable properties under each policy;
- Lists the environmental values of the properties identified using the criteria for each policy;
- Outlines those properties that are strategically important for the functionality of the Corridor; and
- Tabulates each property providing a description of its ecological values.

2. REVIEW OF CURRENT OFFSETS FRAMEWORK

2.1 GENERAL

Environmental offsets are increasingly being seen as a viable method for replacing environmental values lost in development. In order to manage environmental offsets the State of Queensland has initiated the Queensland Government Environmental Offsets Policy (QGEOP) to be used as a framework to guide the appropriate use of environmental offsets across terrestrial and aquatic ecosystems (EPA 2008).

This policy defines an environmental offset to be "an action taken to counterbalance unavoidable, negative environmental impacts that result from an activity or development" (EPA 2008, p 7). The policy also stresses that offsets are only applicable in the event that the impacts cannot be avoided or minimised.

Presently, Queensland currently has three 'specific-issue' offset policies that are supported by the QGEOP. These policies provide the mechanism for addressing specific environmental issues, and are aligned with state legislation that governs environmental management. Each is administered by its own Agency (EPA 2008):

- Vegetation Management – *Policy for Vegetation Management Offsets*, administered by the Department of Environment and Resource Management;
- Fish Habitat Management Operational Policy – *Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss*, administered by the Department of Primary Industries and Fisheries; and
- Koala Habitat – *Offsets for Net Gain, of Koala Habitat in South East Queensland Policy*, administered by the Department of Environment and Resource Management.

Each of these 'specific-issue' policies share the principle that environmental offsets need to provide a better, or at least equivalent environmental outcome, relevant to the values impacted, and administered in a way that ensures long-term viability. Furthermore, the Commonwealth through the EPBC Act has also developed a discussion paper on Environmental offsets.

Each of these offset policies and their applicability to the FGK Corridor is discussed in the following.

2.2 COMMONWEALTH

The Use of *Environmental Offsets Under the Environmental Protection and Biodiversity Conservation Act 1999* discussion paper outlines how offsets can compensate for the impacts of developments on matters of national environmental significance (NES) as protected by the EPBC Act (i.e. Ramsar sites, World Heritage Areas) (DEWR 2007). It is important to note that offsets under the EPBC are only able to focus on matters of NES and therefore is a much narrower scope of applicability to that of State offset policies.

Triggers

Offsets are triggered under the EPBC Act when they (DEWR 2007):

- Are necessary to protect a matter of NES, or to repair or mitigate damage to a matter of NES;
- Relate specifically to the matter being impacted; and
- Seek to ensure the health, diversity and productivity of the NES is enhanced and maintained.

Offsets should be located within the same general area (e.g. bioregion) as the development site to ensure that the NES does not become severely degraded. As there are no well documented matters of NES (such as threatened ecological communities) within the Corridor there is limited scope for offsets under the EPBC. This said, the FGK Corridor does support habitat for species listed as threatened under the EPBC such as the Spotted-tailed Quoll (*Dasyurus maculatus*).

2.3 QUEENSLAND

2.3.1 Queensland Government Environmental Offsets Policy

The QGEOP is based on seven different policy principles that that must be adhered to when applying offsets. These policy principles drive the way that offsets meaningfully contribute to environmentally sustainable development (ESD). These are:

Principle 1: Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy.

Environmental offsets cannot be used to make otherwise 'unacceptable' adverse environmental impacts 'acceptable' (i.e. the QGEOP would not allow a new tourism development in a protected area by proposing an offset as a solution to damage caused by the proposed development).

Principle 2: Environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact.

Prior to an offset being proposed, environmental impacts should be avoided (e.g. through careful project design and location) and minimised (e.g. through selective clearing of vegetation).

Principle 3: Offsets must achieve an equivalent or better environmental outcome.

If an offset is to be considered it must meet the minimum level of environmental outcome. In most circumstances the minimum level is an equivalent environmental outcome to the area being impacted. In other cases a better environmental outcome may be sought to address specific issues such as the scarcity of the habitat being destroyed, or its ecological significance in the region.

Principle 4: Offsets must provide environmental values as similar as possible to those being lost.

To achieve the necessary environmental outcome and be pertinent to the proposed impact, the environmental values afforded by the offset should be as similar as possible, if not identical, to those values being impacted upon. The proposed offset must address the same environmental issue as that being impacted (e.g. a koala habitat offset would be used for the loss of koala habitat; an offset to improve water quality would not be appropriate for mitigating this impact).

Principle 5: Offset provision should minimise the time-lag between the impact and delivery of the offset.

A proposed offset should be designed to replace the functions and characteristics of the impacted environmental value as soon as possible in order to ensure the ongoing viability of the ecological processes intrinsic to that value. Therefore, it is important to identify and secure an offset with as minimal a time-lag as is possible, and ideally, offsets should be secured ahead of need.

Principle 6: Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values.

Additional protection actions must be above and beyond any other environmental measures that are already required. Actions taken to avoid or minimise impacts or that are undertaken as part of best practice design or management, are not considered to be additional, and thus are not appropriate as an offset.

Principle 7: Offsets must be legally secured for the duration of the offset requirement.

Offsets must be legally secured for the duration of the offset requirement, with the proponent, a third party or the Queensland Government accepting ongoing management responsibilities of the offset.

Each specific issue offsets policy needs to conform to these seven overriding principles if a proposed offset is to be an acceptable solution to developmental works.

2.3.2 Vegetation Management Offsets

The *State Policy for Vegetation Management* (DERM 2009a) outlines the Queensland Government's policy on vegetation management by defining the principles that underlie the policy, the desired outcomes, and how these are to be achieved. The policy aims to ensure:

- conservation of biodiversity;
- maintenance of ecological processes;
- clearing does not cause land degradation;
- management of the environmental effects of clearing;

- reduction of greenhouse gases;
- balanced decision-making; and
- support for regional communities.

With regard to the topic of offsets, this policy defines the *Policy for Vegetation Management Offsets* for ensuring that the "extent of vegetation and associated environmental values are maintained or exceeded" (DERM 2009a, p 7).

The *Policy for Vegetation Management Offsets* was created in accordance with the provisions outlined in the *Vegetation Management Act 1999* (VMA), and applies to an offset proposed to meet a performance requirement under the *SEQ Regional Vegetation Management Code*. This Code is consistent with the South East Queensland Regional Plan, which endorses the protection of biodiversity through measures such as conserving regional ecosystems, maintaining habitat connectivity, and protecting regional biodiversity.

Triggers

Under the *SEQ Regional Vegetation Management Code*, an offset may be proposed by an applicant for particular development activities as a solution to meet specific performance requirements (PRs) that necessitate that a development maintain the current extent of a particular regional ecosystem. However, this may only occur where the applicant has first demonstrated to the assessing agency that the development has first avoided and mitigated the impacts of the development on vegetation prior to proposing an offset. This is consistent with Section 22A(2)(d) of the VMA which states that (DERM 2009a):

1. for a vegetation clearing application which is for a relevant purpose for establishing a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure, and the clearing for the relevant infrastructure can not reasonably be avoided or minimised; and
2. maintaining the current extent of a particular regional ecosystem by —
   i. not clearing the regional ecosystem; or
   ii. if subparagraph (i) is not reasonably practicable, ensuring the structure and function of the regional ecosystem is maintained; or
   iii. if subparagraphs (i) and (ii) are not reasonably practicable, imposing an offset as a condition of the development approval; and
   iv. the applicant proposes an offset to satisfy the required outcome.

Often an applicant is required to show that offsets are being legally secured prior to a clearing application being approved.

Criteria for Selection

For a proposed offset area to be accepted by an assessing agency the lot must meet the following criteria (DERM 2009a, p 5):

A proposed area:

a. *must be land-based, that is, an offset area must not be a financial contribution;*

b. *may be used to satisfy multiple offset requirements, where an offset is required under another Act or policy of Federal, State or local government for the one development application, providing the requirements of this Policy are met; and*

c. *may be located on land owned by the applicant or by a third party.*

The proposed offset area must not:

a. *be vegetation shown as remnant vegetation on a regional ecosystem or remnant map,*

   i. *unless the area has a valid clearing approval under the VMA issued by the chief executive that*

   ii. *would result in the area being cleared; or*

   iii. *the area is identified as an advance offset approved under this Offsets Policy and protected by a legally binding mechanism;*

b. *be vegetation that is required to be retained by an approval issued under any Act administered by the Federal, State or local government; or*

c. *be on land the subject of an offset arrangement administered by the Federal, State or local government; or*

d. *be a category A, B or C[1] area on a Property Map of Assessable Vegetation (PMAV); or*

e. *be land on which the vegetation is protected by an instrument of State Government, unless the area has a valid clearing approval under the VMA issued by the chief executive that would result in the area being cleared; or*

f. *be regulated regrowth that is a restricted area (essential regrowth habitat, stream protection zones, within wetland protection areas, on slopes greater than 12%) under the regrowth vegetation code.*

The policy also states that an offset area may be sourced from the following areas (DERM 2009a, p 5):

- *category X areas identified on a PMAV; or*
- *regulated regrowth vegetation, unless the area is a restricted area (see criteria F above) under the regrowth vegetation code; or*

[1] Note – We have clarified the exclusion of Category ‘C’ with DERM officers and confirm that Category ‘C’ can be used for offset purposes provided it is not a ‘restricted area’.

- *other regrowth vegetation that has the necessary functioning regional ecosystem/s.*

Mapped regrowth vegetation was compared to the cadastre for the FGK Corridor and lots were selected as being suitable based upon the following criteria (Table 1). For viability and cost reasons, lots with an area less than 2ha ('threshold area') were not considered as being suitable. Furthermore, whilst offsets can be sourced from either Category X or C on a PMAV, without detailed site information (e.g. contours) it is not possible to determine the impacts of 'restricted areas' on the viability of offsets sourced within PMAVs. Given this, the affect of restricted areas within the 2,200ha of PMAVs within the FGK Corridor has not been analysed.

Table 1: Criterion for classifying Lots with mapped Regrowth Vegetation.

Ranking	Criteria
High 1	• Lot is not a designated conservation area; • Lot mapped as supporting mapped regrowth vegetation; • Lot is above threshold area; and • The property has ≥ 70% of its area mapped as regrowth vegetation that is classified as being an 'endangered' ecosystem.
High 2	• Lot is not a designated conservation area; • Lot mapped as supporting mapped regrowth vegetation; • Lot is above threshold area; and • The property has ≥ 70% of its area mapped as regrowth vegetation that is classified as being an 'of concern' ecosystem.
High 3	• Lot is not a designated conservation area; • Lot mapped as supporting mapped regrowth vegetation; • Lot is above threshold area; and • The property has ≥ 70% of its area mapped as regrowth vegetation that is classified as being a 'least concern' ecosystem.
High 4	• Lot is not a designated conservation area; • The property has 30% to 70% of its area mapped as regrowth (supporting either endangered, of concern, and/or least concern regional ecosystem); and • Lot is above threshold area.
Moderate	• The property has < 30% of their area mapped as regrowth vegetation (supporting either endangered, of concern, and/or least concern regional ecosystem); • The property has < 70% mapped remnant vegetation; and • Lot is above threshold area.
Little to None	• The property has ≥ 70% of their area mapped as remnant vegetation; • The property has been ≤ 30% cleared; • Lot is classified as being within conservation estate; or • Lot is below threshold area.

2.3.3 Koala Offsets

The Offsets for Net Gain of Koala Habitat in Southeast Queensland Policy is the applicable policy that administers offsets for koalas and koala habitat. The objective of this policy is 'to ensure that environmental offsets for unavoidable impacts on higher quality koala habitat contribute to a net gain in bushland koala habitat' (DERM 2010, p1). In meeting this objective the policy requires the rehabilitation, establishment and protection of new koala habitat.

A suitable koala offset site must be situated in an area identified as being high value or medium value for rehabilitation habitat, and should contribute to, or form part of, strategic koala habitat networks (See Figure C-3). Koala habitat values across the southeast are identified in the *South East Queensland Koala Protection Area Koala Habitat Values Maps* for the *State Planning Policy 2/10: Koala Conservation in South East Queensland* (DERM 2010).

All koala offset sites must be protected from future development through the permanent acquisition of land for conservation purposes, which can be achieved in four ways:

1 a conservation agreement under the *Nature Conservation Act 1992*;

2 a covenant under the *Land Act 1994* or the *Land Title Act 1994*;

3 declaring an area of high conservation value under the *Vegetation Management Act 1999*; or

4 gifting the area to the State or applicable local government for addition to the Protected Area Estate or parkland for conservation purposes.

Triggers

The *South East Queensland Koala Conservation State Planning Regulatory Provision* (SPRP) in association with the *State Planning Policy 2/10* are planning tools used to regulate assessable development, and target areas where koalas are known to be under the most significant risks. The SPRP prohibits the clearing of bushland in koala priority areas in and outside of the Urban Footprint (as defined in the SEQ Regional Plan) with a view to bolster habitat for at risk populations.

SPRP Koala Habitat Values maps depicting koala habitat values occurring within assessable development areas, as defined under the SPRP, also show opportunities for lands potentially suitable for offsets. That is, along with showing areas of bushland, these maps show areas defined as having high to medium potential for rehabilitation.

Criteria for Selection

Properties mapped as having high to medium potential for rehabilitation as koala habitat within the FGK Corridor were favoured over other properites having low or no potential for rehabilitation for koala habitat. Table 2 below outlines the ranking criteria for koala habitat.

Table 2: Criterion for classifying Lots with Koala Habitat.

Ranking	Criteria
High	• Properties above threshold area having ≥ 70% of their area mapped as having high to medium potential for rehabilitation.
Moderate	• Properties above threshold area having ≥ 70% of their area mapped as having low value potential for rehabilitation; or • Properties above threshold area having 30% to 70% of their area as high to medium potential for rehab.
Low 1	• Properties above threshold area having < 30% of their area as high to medium potential for rehab; or • Properties above threshold area having < 70% of their area mapped as having low potential for rehabilitation.
Low 2	• Properties above threshold area mapped as having high to medium value bushland.
Low 3	• Properties above threshold area mapped as having low value bushland.
Non - Habitat	• Not suitable for koala offsets; or • Lot is below threshold area.

2.3.4 Fisheries Offsets

The *Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss* was produced to guide and assist the decision making process to achieve the mitigation of impacts through avoidance, minimisation, and compensation (offsets) for marine fish habitat losses resulting from development (Dixon and Beumer, 2002).

This scope of this policy applies to all proposed works under Section 51 of *the Fisheries Act 1994* where marine fish habitats (i.e. marines plants and lands within a declared Fish Habitat Area (FHA)) are to be permanently or temporarily modified or lost, resulting in a reduction of fish habitat and fisheries resources (Dixon and Beumer, 2002).

Triggers

Eight Policy Principles (PP's) that apply to compensation associated with marine habitat loss are defined in Dixon and Beumer (2002). PP's that are most relevant to the FGK Corridor include those that seek to reflect the assets being lost (PP1), and those that allow for in kind compensation measures such as restoration / rehabilitation projects (PP3) where values can not be fully matched.

Criteria for Selection

There is limited scope for including Fisheries offsets within the Corridor owing to its inland location. There may be some opportunities to improve fish passage through waterways within the Corridor by removing any existing barriers; however, these kinds of works are not explicitly supported by this policy.

3. METHOD

3.1 ECOLOGICAL VALUES

A number of ecological values were used to determine whether a particular lot was suitable for an environmental offset under policies currently operative in Southeast Queensland. These particular ecological values are briefly described in sections 3.1.1 to 3.1.7.

For all the environmental values below, for viability and cost reasons, lots with an area less than 2ha (threshold area) were not considered as being suitable for potential offsets.

3.1.1 REMNANT REGIONAL ECOSYSTEMS

Remnant regional ecosystems are shown in Figure C-1. Remnant regional ecosystems are mapped by the State for the purposes of delineating areas subject to the *Vegetation Management Act 1999*. Each regional ecosystem is ascribed with a conservation status based largely on how much remains in the landscape. A regional ecosystem can be regarded as either Endangered, Of Concern or Of Least Concern as declared under the *Vegetation Management Regulation 2000*. An ecosystem's status is determined by the following (DERM 2010b):

Endangered if:

- the area of remnant vegetation for the regional ecosystem is less than 10% of the pre-clearing extent of the regional ecosystem; or
- the area of remnant vegetation for the regional ecosystem is 10% to 30% of the pre-clearing extent of the regional ecosystem and less than 10,000 ha.

Of Concern if:

- the area of remnant vegetation for the regional ecosystem is 10% to 30% of the pre-clearing extent of the regional ecosystem; or
- the area of remnant vegetation for the regional ecosystem is more than 30% of the pre-clearing extent of the regional ecosystem and less than 10,000 ha.

Least Concern if:

- the area of remnant vegetation for the regional ecosystem is more than 30% of the pre-clearing extent of the regional ecosystem and more than 10,000 ha.

The vegetation management legislation in Queensland protects remnant vegetation on freehold and state land, as well as certain non-remnant vegetation on freehold and state land.

3.1.2 HIGH VALUE REGROWTH VEGETATION

High-value regrowth vegetation is mature native vegetation that hasn't been cleared since 31 December 1989 (See Figure C-2). Regulated regrowth vegetation is regrowth vegetation that fits into one of the following categories (DERM 2009c):

- identified on a regrowth vegetation map as High-value regrowth vegetation;
- located within 50m of a watercourse identified on a regrowth vegetation map as a regrowth watercourse; and
- contained within a category C area shown on a Property Map of Assessable Vegetation (PMAV).

As with remnant regional ecosystems, High-value regrowth vegetation can be regarded as having either Endangered, Of Concern or Least Concern classification under the VMA.

3.1.3 KOALA HABITAT AREAS

The *South East Queensland Koala Conservation State Planning Regulatory Provision* (SPRP) in association with the *State Planning Policy 2/10* are planning tools used to regulate assessable development, and target areas where koalas are known to be under the most significant risks. The SPRP prohibits the clearing of bushland in koala priority areas in and outside of the urban footprint with a view to bolster habitat for at risk populations.

SPRP Koala Habitat Values maps (See Figure C-3) that depict koala habitat values occurring within assessable development areas as defined under the SPRP show opportunities for lands potentially suitable for offsets. Along with showing areas of bushland, these maps show areas defined as having high to medium potential for rehabilitation as koala habitat, highlighting these areas as a potential koala offset sites.

3.1.4 THREATENED SPECIES

Database searches were conducted across the FGK Corridor (i.e. HERBRECS, Wildnet and Birds Australia) to locate any high precision records (i.e. those with a precision ≥ 100) of any threatened species to be included as an additional value of interest (See Figure C-4). These searches were accompanied by reviewing the Commonwealth EPBC listed Threatened Ecological Communities to determine if any analogous Regional Ecosystems are to be found within the FGK Corridor.

Any such identified communities, and locations of threatened species were overlaid on the cadastre to highlight lots containing high ecological value.

3.1.5 WETLANDS

Wetlands perform important functions in a landscape, while providing aesthetic scenic amenity, provide essential habitat and breeding habitat to a range of species, are refuges in time of drought, and provide water quality protection in the catchment by filtering pollutants such as sediments, nutrients, organic and inorganic matter and bacteria (DERM 2009). According to the Ramsar convention a wetland can be described as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (DEWR 2005).

The Directory of Important Wetlands (DOIW) (EA 2001), Ramsar Wetlands (SEWPC 2010), and Wetland Management Trigger Area's (DERM 2010c) were reviewed across the FGK Corridor to identify any areas of high ecological value (See Figure C-5). There were no Ramsar sites located within the study area, Karawatha Forest contained some DOIW listed sites, and a number of Wetlands Management Trigger areas were scattered across the Corridor, with the majority falling within Karawatha Forest and Greenbank reserve.

3.1.6 BIODIVERSITY PLANNING ASSESSMENT

The Biodiversity Assessment and Mapping Methodology (BAMM) has been prepared to provide a consistent approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis (EPA 2002).

BAMM is being used by DERM to generate Biodiversity Planning Assessments (BPAs) for bioregions in eastern Queensland that are under the most development pressure. BPA's are essentially the implementation of the BAMM that results in a map that outlines the biodiversity values according to a number of biodiversity significance criteria (EPA 2002). These biodiversity significance criterions used in the BPA mapping are summarised in Table 3 below:

Table 3: Biodiversity Significance Criteria.

Criteria	Description
A	Habitat for EVR taxa
B	Ecosystem value at three scales: • B1: State • B2: Regional • B3: Local
C	Tract Size
D	Relative size of Regional Ecosystem at three scales: • D1: State • D2: Regional • D3: Local
E	Condition
F	Ecosystem Diversity
G	Context & Connection (relationship to water, endangered ecosystems and physical connection between contiguous Remnant Units

The BAMM uses the above seven criteria (A to G) and is applied over two stages. The first stage uses the existing data to assess ecological concepts such as rarity, diversity, fragmentation, habitat condition, resilience, threats, and ecosystem processes in a uniform and reliable way across a given bioregion. These criteria are used to filter available data and provide an initial determination of significance and is generated via a GIS (EPA 2002). The second stage relies upon expert knowledge to refine the results of the first stage. It also incorporates expert knowledge to identify features such as wildlife corridors and areas with special biodiversity value and includes data that may not be available uniformly across the bioregion being queried (EPA 2002).

This biodiversity significance criterion classifies lots as having State, Regional, Local or other values, based upon a filtering process utilizing a number of combinations, which was accordingly was used as value adding to blocks selected for offsets and shown as Figure C-6.

3.1.7 CONSERVATION ESTATE

The overarching principle for managing conservation estates is to provide, to the greatest possible extent, for the permanent preservation of an area's natural condition and the ongoing protection of the area's cultural resources and values. State conservation estates are declared under the *Nature Conservation Act 1992* (NCA), which provides for a number of classifications of protected area including:

- National Park (Scientific)
- National Park (including Aboriginal, and Torres Strait Islander managed Parks)
- National Park (Recovery)
- Conservation Park
- Resources Reserves
- Nature Reserves
- Coordinated Conservation Areas
- Wilderness Areas
- World Heritage Management Areas
- International Agreement areas

Each of these conservation areas is administered according to a set of management principles and permitted activities also defined under the NCA. Of these, only Conservation Park is present within the FGK Corridor.

Local government areas also maintain their own conservation estate with these areas also afforded levels of protection through this mechanism. Local governmental conservation estates were sourced from Ipswich City Council, Logan City Council, and Brisbane City Council (part dataset).

Based on the available data, a number of state and local conservation areas have been identified across the FGK Corridor. These areas are already legally protected and therefore are unsuitable for offset opportunities. As such these areas were used as a 'screen' to remove any lots identified under any other criteria.

Note that this section includes Military Land (i.e. Greenbank Military Reserve). While, not strictly a conservation tenure per se, these areas are more or less 'protected' by their use.

3.2 STRATEGIC VALUE

In order to locate properties of strategic value to the connectivity of the Corridor, three 'categories' of properties were considered:

1. Properties determined as critical locations for the location of barrier mitigation structures;
2. Properties through which there is no alternative path for the corridor to pass or where a narrowing of habitat was identified; and
3. Large habitat areas that are not currently explicitly protected.

Properties determined to be critical locations are those properties in the vicinity of the crossing locations classified as having a ranking of 1 or 2 in Part B of this study (CEPLA 2010b), and are necessary for the establishment of a land bridge to improve connectivity (See Figure C-7). Properties through which there is no alternative path are areas where one or two lots span the width of the Core Corridor. Any property in the vicinity of a 'narrowing' that was identified in Part A of this study were also included in this study (CEPLA 2010a).

The identification of large habitat areas was based upon the following criteria:

- Property size is greater than 2 hectares;
- Greater than or equal to 50% of the property is classified as 'very high' under the BAMM criterion 'C'.

In keeping with other methodology used in this study, large habitat areas were further stratified to delineate those lots where $\geq$70% is occupied by remnant vegetation.

3.3 OFFSET OPPORTUNITIES

Offset opportunities were identified as a desktop GIS exercise incorporating all lots within the Corridor boundary. The analysis commenced with a filtering process that eliminated unsuitable lots on the basis of certain undesirable characteristics. Once all unsuitable lots were removed from the Corridor, opportunities for offsets were identified using the criteria outlined below in Table 4.

Table 4: Filtering process for Identifying Potential Offset Locations.

Values	Description
Undesirable	
Conservation Estates	Conservation Estates (Federal, State and Local) are already afforded a level of legal protection and are therefore unsuitable for offsets.
Remnant Vegetation	If a lot contains a large proportion of mapped remnant vegetation it is unlikely to be available for offsets.
Lot Size Thresholds	If a lot is below a threshold then it is unlikely to be viably used as an offset for practical and cost reasons. For the purposes of this exercise, the threshold has been set to 2ha.
Opportunity (Under current VMA and Koala Offset policies)	
Non Remnant Vegetation	Refer to Table 1
Koala Habitat Areas	Refer to Table 2

The result of this filtering process is a list of lots potentially being suitable for environmental offsets. The results of this process are presented as an electronic attachment as Appendix A and shown in Figure C-8 (VMA) and Figure C-9 (Koala Offset Policy).

4. RESULTS

4.1 ECOLOGICAL VALUES

Overall six ecological values were assessed and mapped across the FGK Corridor and presented as a number of Figures:

1. **Remnant Regional Ecosystems** – mapped remnant regional ecosystems (classified as 'endangered', 'endangered – subdominant', 'of concern',' of concern subdominant', 'least concern', and 'least concern subdominant', as shown in Figure C-1;
2. **Regrowth Vegetation** – mapped high value regrowth vegetation classified as above and shown as Figure C-2;
3. **Koala Habitat** – mapped koala habitat values across the FGK Corridor, as shown in Figure C-3;
4. **Threatened Species** – declared state and local council protected areas, along with high precision database records of sightings of threatened species observed within the Corridor, as shown in Figure C-4;
5. **Wetlands** – declared Ramsar wetlands, DOIW, and Wetlands Trigger Areas across the Corridor, as depicted in Figure C-5; and
6. **Biodiversity Planning Assessment** – mapped according to the results of the BAMM filtering process and shown as Figure C-6.

A total of 26,426 lots across the length of the FGK Corridor were assessed against the criteria described in Section 3.3. Each lot was tabulated with a summary of its ecological values. An example of this 'ecological report card' (after removing a number of null fields) is given below in Table 5:

Table 5: Lot Report Card.

Item	Value
Lot / Plan:	Lot 135 on Plan CC836
Area (ha):	41
Remnant Vegetation:	Yes
RE Type:	12.8.24 / 12.8.9 (E-dom / OC-Subdom)
Regrowth Vegetation:	Yes (OC-Subdom)
Koala Habitat:	No
Threatened Species (HERBRECS / Wildnet)	Yes - *Petrogale penicillata,* (V)
Wetland:	No
BPA:	Yes – State significance
Strategic Value:	Large Lot
VMA Offset:	High 4
Koala Offset:	Moderate

The resulting GIS table includes 74 fields that can be interrogated to identify specific known values on individual lots.

4.2 STRATEGIC VALUE

A total of 881 lots with a combined area of 26,446 ha have been selected for strategic value in the Corridor (shown in Figure C-7) and can be summarised as follows:

- Properties at critical locations for barrier mitigation structures (i.e. land bridge) – 14 lots (total area 751ha);
- Lots that provide linkages within the core Corridor and provide the only path for movement – 17 (total area 1,267 ha)
- Properties that provide the only path through the Corridor – 381 lots (total area 6,206 ha);
- Large habitat areas where ≥70% of a lot is occupied by remnant vegetation and not explicitly protected – 241 lots (total area 13,162 ha); and
- Large habitat areas where ≥50%-<70% of a lot is occupied by remnant vegetation and not explicitly protected – 112 lots (total area 3,312 ha)

Strategic values for lots are summarised in column 'Strategic_Value" in the accompanying 'CSV' file. Note that it is possible for some lots to fall into more than one category.

4.3 OFFSET OPPORTUNITIES

A total of 1,468 lots were identified as having potential for offsets under the VMA – these include lots which were assessed as having values of High 1 – 4 in Table 1. Offset opportunities were located at various locations across the Corridor, and are summarised below according to each specific issue offset policy. Note that it is possible for some lots may fall into more than one category:

VMA Offsets

See Figure C-8 for Lot locations.

- Lots with High 1 value – 228 (total area 662 ha);
- Lots with High 2 value – 48 (total area 687 ha);
- Lots with High 3 value – 13 (total area 59 ha);
- Lots with High 4 value – 1,179 (total area 35,959 ha)
- Lots with Moderate value – 20 (total area 983 ha); and
- Little to none – 24,938 (total area 12,124 ha)

Koala Offsets

A total of 1,378 lots were identified as having potential for offsets under the Koala Offsets Policy – this includes lots as having moderate to high value. See Figure C-9 for Lot locations.

- Lots with High value – 152 (total area 786 ha);
- Lots with Moderate value – 1,226 (total area 42,394 ha);
- Lots with Low 1 value – 24,285 (total area 6,691 ha);
- Lots with Low 2 value – 0 (total area 0 ha);
- Lots with Low 3 value – 0 (total area 0 ha); and
- Non habitat and other Lots – 763 (total area 604 ha).

No Lots with offset potential under the Marine Fish Habitat policy were identified within the Corridor.

5. CONCLUSION

The purpose of this document is to address Part C of the project and seeks to identify properties that are potentially suitable offset locations, and / or are strategically important for the ongoing long-term functionality of the Corridor. To this end, Chenoweth EPLA reviewed contemporary state and federal environmental offset policies prior to undertaking a desktop, GIS based assessment of property lots intercepted by the FGK Corridor.

Whilst current offset policies do not enable the use of remnant vegetation for environmental offsets unless they are already committed to being cleared, there is a great value in considering the possible use of strategically valuable land parcels for this purpose. The functionality of the FGK Corridor will be enhanced if the lots identified in this study as strategically important for offsets were secured for conservation purposes and restored.

A total of 26,426 lots were assessed during the desktop process to ascertain their potential for offset locations and to provide a summary of their respective ecological values. Of all the lots assessed:

- 881 lots were determined to have 'strategic' value to the continued functioning of the Corridor;
- 1,378 lots were flagged as having potential for offsets under the VMA; and
- 1,468 lots were determined as having potential for offset under the Koala offsets policy.

No lots were suitable for offsets under the EPBC or the Queensland Fisheries Offset policies based on analysis of desktop information.

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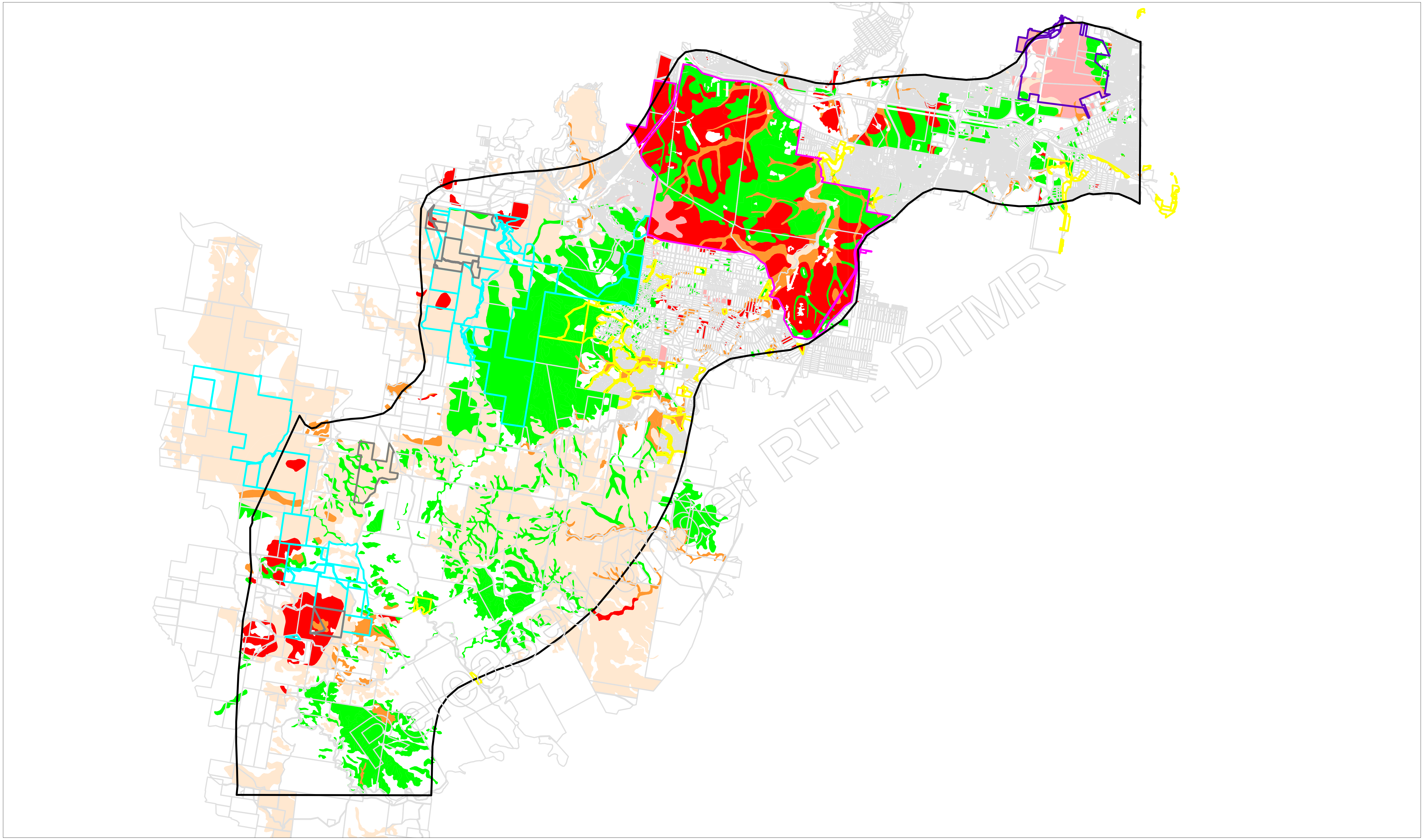
APPENDIX

A

Values and Offset Opportunities for Lots within the Corridor



Remnant Vegetation Status

- Endangered Dominant
- Endangered subdominant
- Of Concern dominant
- Of Concern subdominant
- Not Of Concern

Protected Estate

- State
- Ipswich City Council
- Logan City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

- Corridor Study Area
- Cadastre

N

0 2.5 5

Kilometres

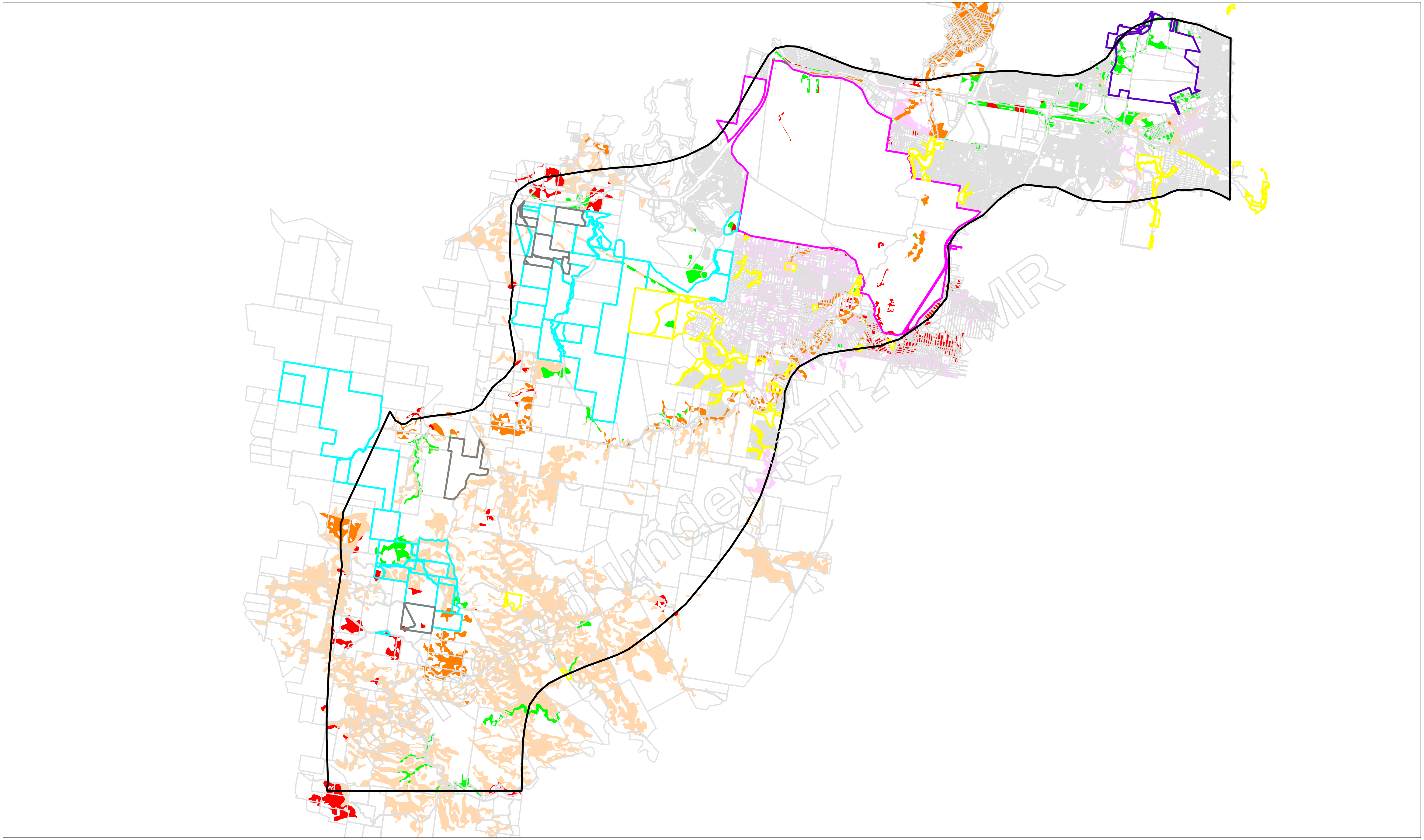
Flinders to Greenbank-Karawatha Corridor

Ecological Value 1
Remnant Vegetation

CHENOWETH ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

FIGURE C-1

File:FigC-1.WOR
Date: 20/12/2010
10CH074 Dwn: AP



Regrowth Status

- Endangered dominant
- Endangered subdominant
- Of Concern dominant
- Of Concern subdominant
- Of Least Concern

Protected Estate

- State
- Logan City Council
- Ipswich City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

Corridor Study Area

N

0 2.5 5

Kilometres

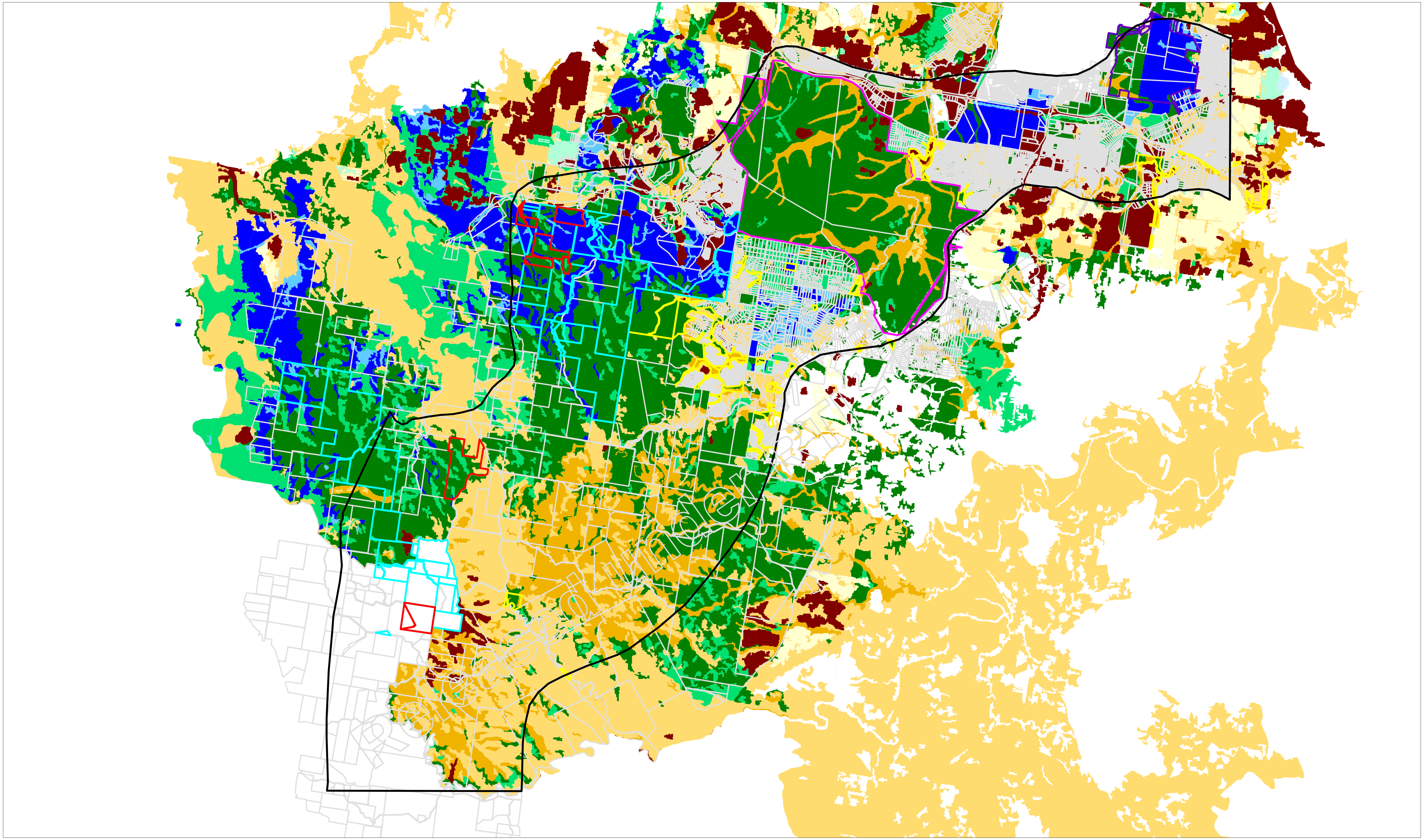
Flinders to Greenbank-Karawatha Corridor

Ecological Value 2
Regrowth Status

FIGURE C-2

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:FigC-2.WOR
Date: 20/12/2010
10CH074 Dwn: AP



Koala SPP Habitat Value

HV Bushland	MV Other
HV Rehab	LV Bushland
HV Other	LV Rehab
MV Bushland	LV Other
MV Rehab	Non Habitat

Protected Estate

- State
- Logan City Council
- Ipswich City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

- Corridor Study Area
- Cadastre

N

0 2.5 5
Kilometres

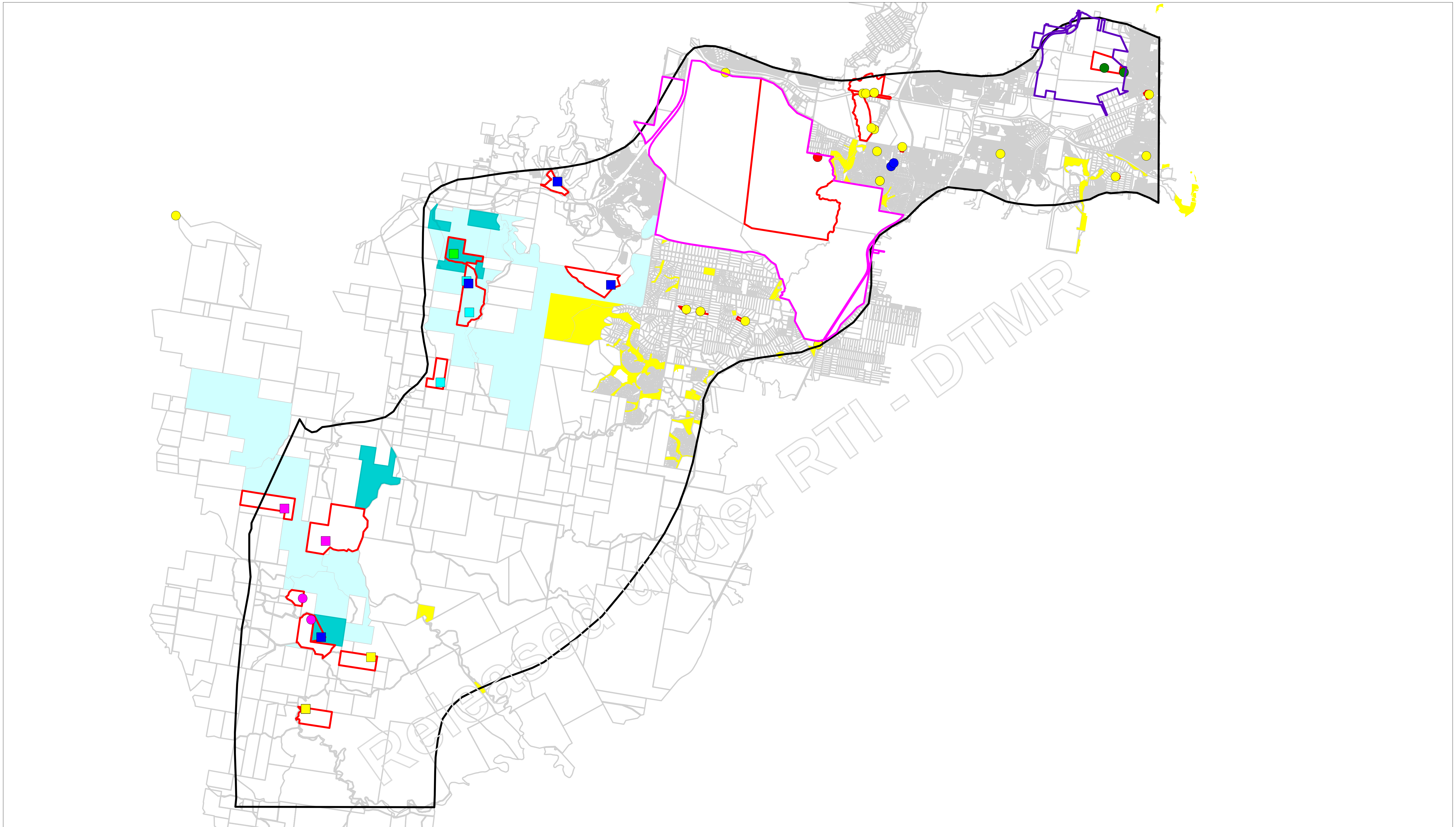
Flinders to Greenbank-Karawatha Corridor

Ecological Value 3
Koala SPP Habitat Value

FIGURE C-3

CHENOWETH
ENVIRONMENTAL PLANNING
& LANDSCAPE ARCHITECTURE

File:FigC-3.WOR
Date: 20/12/2010
10CH074 Dwn: AP



LEGEND

Property contains a high precision record

Corridor Study Area

Protected Estate

State

Ipswich City Council

Logan City Council

Brisbane City Council (Karawatha)

Greenbank Army Reserve

Wildnet (NCA, EPBC)

Crinia tinnula (V, -)

Dasyurus maculatus maculatus (V, E)

Litoria brevipalmata (NT, -)

Petrogale penicillata (V,V)

Phascolarctos cinereus (southeast Queensland bioregion) (V)

Birds Australia (NCA, EPBC)

Lathamus discolor (C, E)

Status is presented firstly under the NCA Act where V = Vulnerable, NT = Near Threatened, C = Common. Then under the EPBC Act where E = Endangered, V= Vulnerable, and '-' = not listed. High Precision Records are shown only. There are previous sightings of a listed species with the location accurately recorded to within 100m.

Herbrecs (NCA, EPBC)

Cupaniopsis tomentella (V, V)

Eucalyptus curtisii (NT, -)

Marsdenia coronata (V, V)

Notelaea lloydii (V,V)

Planchonella eerwah (E, -)

Plectranthus habrophyllus (E, -)

N

0 2.5 5

Kilometres

Flinders to Greenbank-Karawatha Corridor

Ecological Value 4
High Precision Threatened Species Records

FIGURE C-4

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:FigC-4.WOR
Date: 20/12/2010
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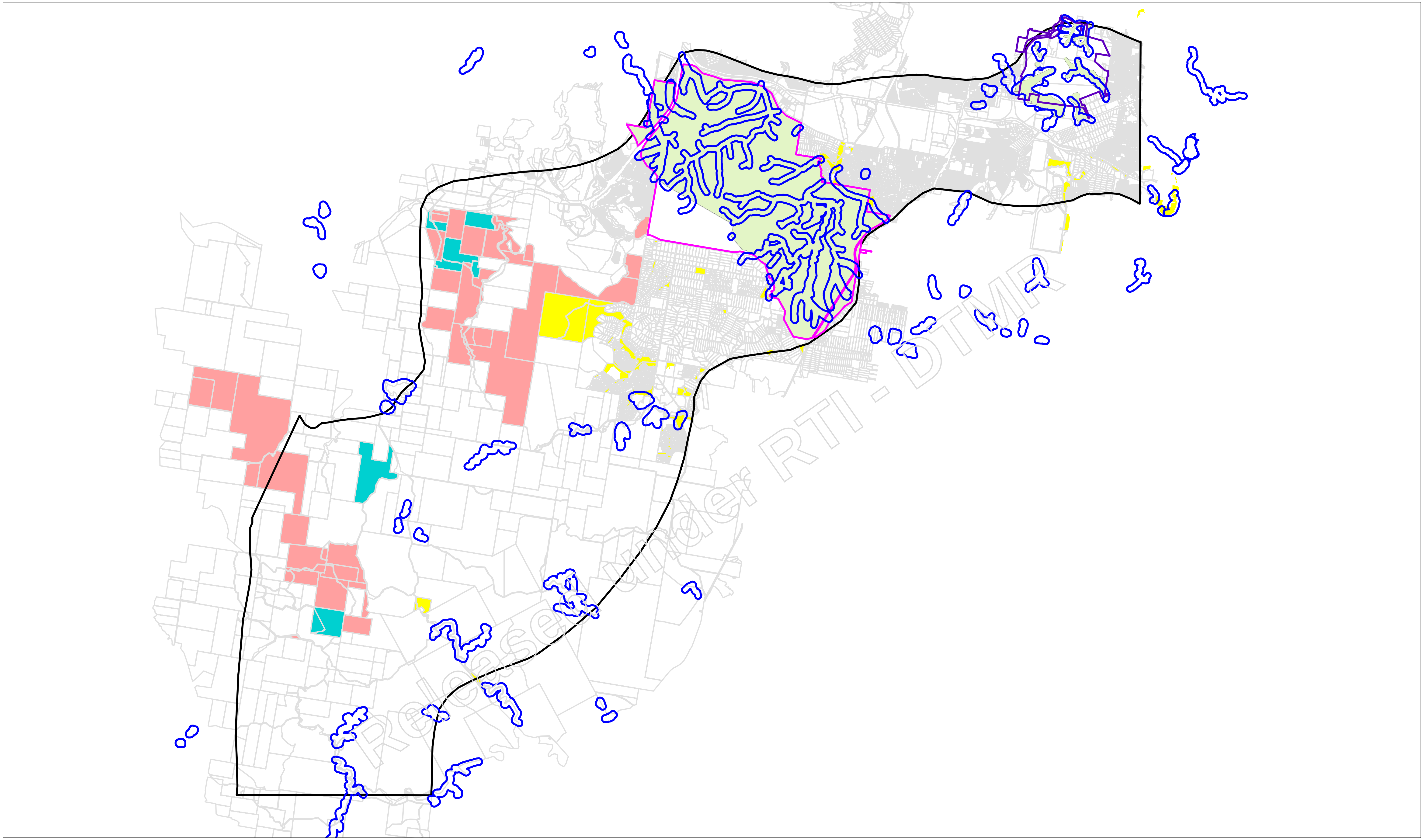

Corridor Study Area

Cadastre

Protected Estate

State

Logan City Council

Ipswich City Council

Brisbane City Council (Karawatha)

Greenbank Army Reserve

RAMSAR wetlands (DERM, 2010)

DERM (2010) Directory of Important Wetlands

WMA 100m Trigger Area

N

0 2.5 5

Kilometres

Flinders to Greenbank-Karawatha Corridor

Ecological Value 5
Wetlands

FIGURE C-5

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:FigC-5.WOR
Date: 20/12/2010
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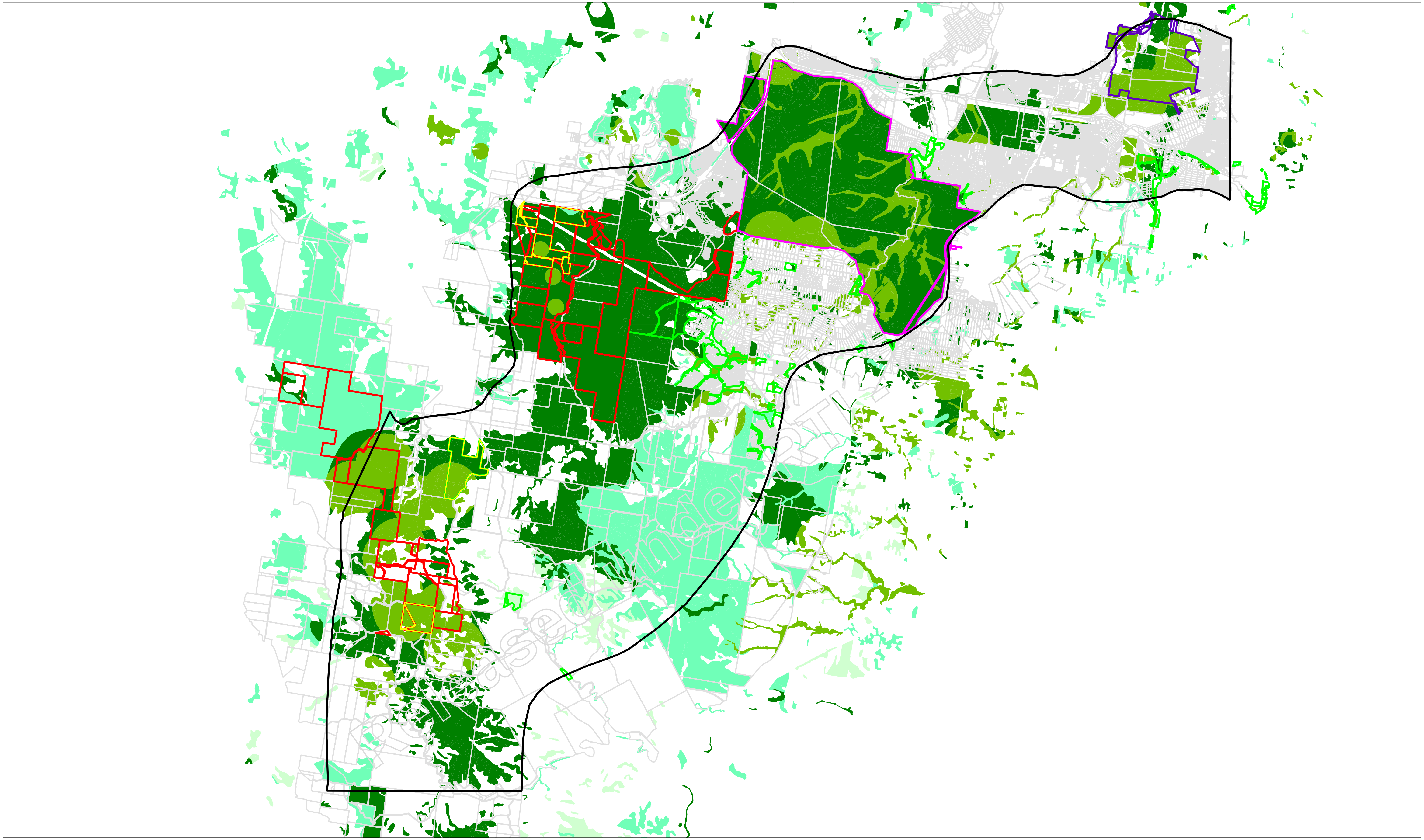

BPA Biodiversity Significance
- State
- State Habitat for EVR taxa
- Regional
- Local or Other Values

- Cadastre
- Corridor Study Area

Protected Estate
- State
- Ipswich City Council
- Logan City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

N

0 2.5 5

Kilometres

Flinders to Greenbank-Karawatha Corridor

Ecological Value 6
BPA Significance

FIGURE C-6

CHENOWETH
ENVIRONMENTAL PLANNING
& LANDSCAPE ARCHITECTURE

File:FigC-6.WOR
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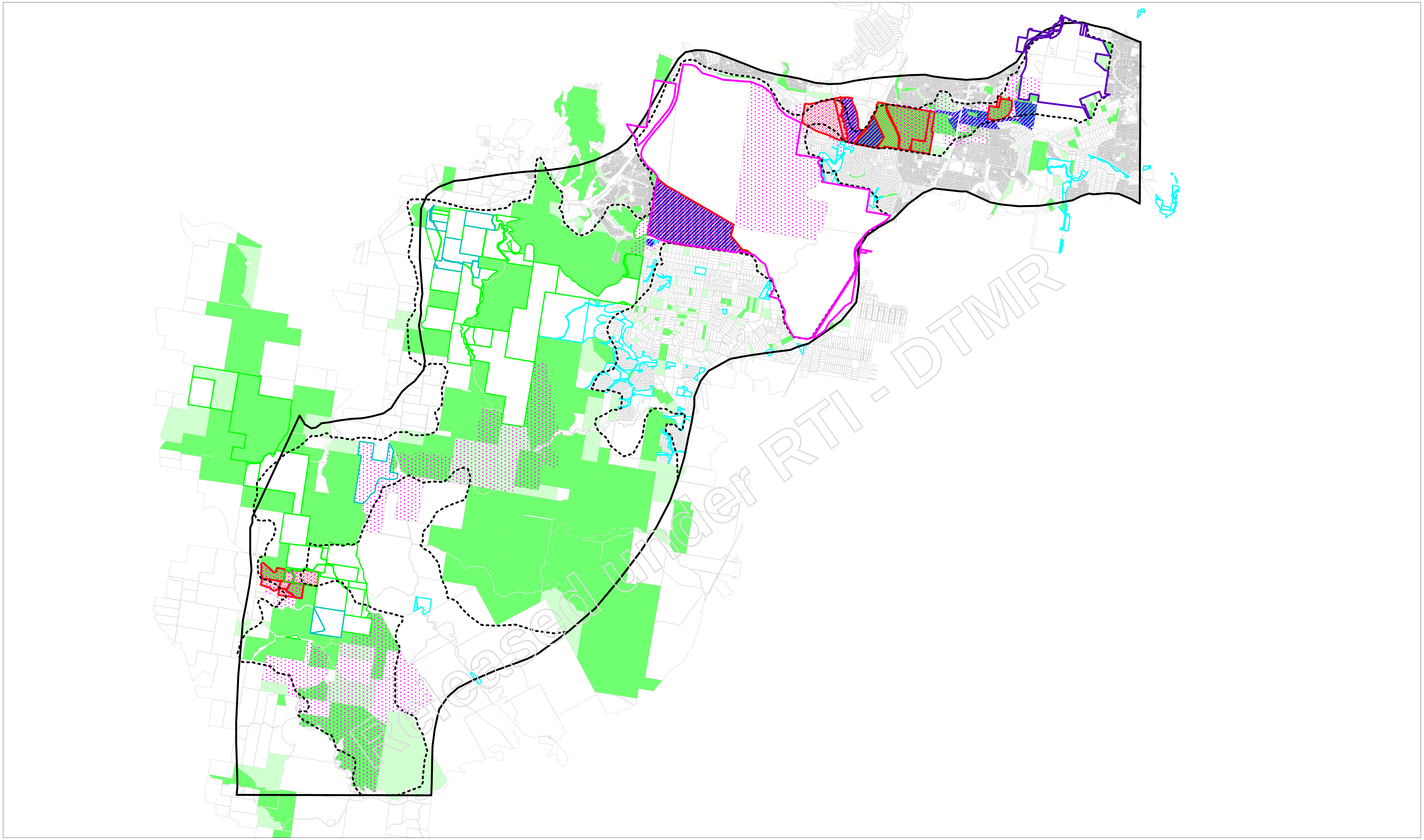


Strategic Value

- Properties at critical locations for barrier mitigation structures
- Properties that provide the only path through the core corridor
- Properties located at narrowings
- Large Habitat Area (50-70 percent remnant vegetation)
- Large Habitat Area (>70 percent remnant vegetation)

- Core Corridor
- Corridor Study Area
- Other Cadastre

Protected Estate

- State
- Ipswich City Council
- Logan City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

N

0 2.5 5

Kilometres

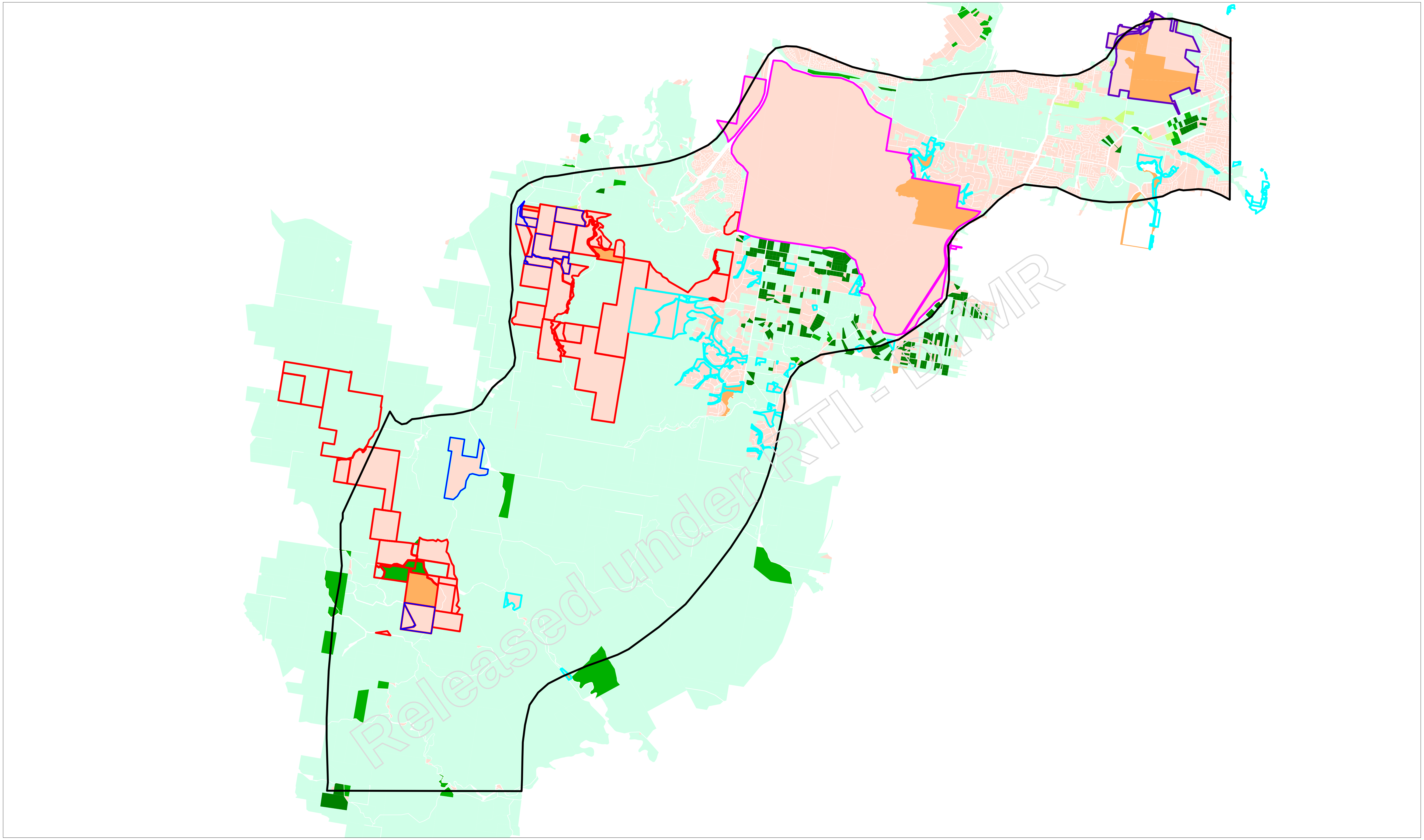
Flinders to Greenbank-Karawatha Corridor

Ecological Value 7
Strategic Value

FIGURE C-7

CHENOWETH ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

File:FigC-7.WOR
Date: 20/12/2010
10CH074 Dwn: AP



VMA Offset Opportunities
- High 1
- High 2
- High 3
- High 4
- Moderate
- Little to None

Corridor Study Area

Protected Estate
- State
- Logan City Council
- Ipswich City Council
- Brisbane City Council (Karawatha)
- Greenbank Army Reserve

Flinders to Greenbank-Karawatha Corridor

Ecological Value 8
VMA Offset Opportunities

CHENOWETH
ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

FIGURE C-8

File:FigC-8.WOR
Date: 21/12/2010
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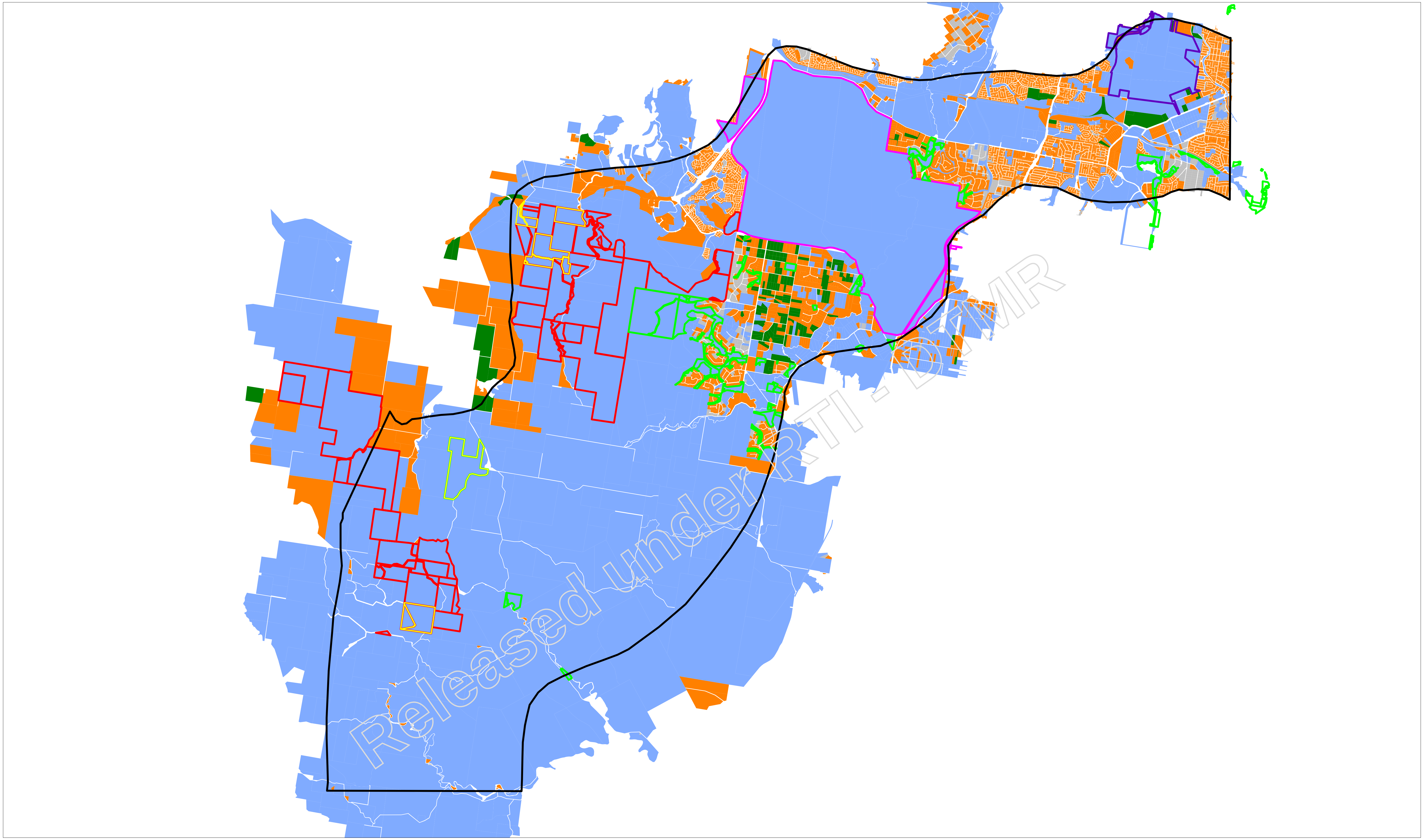

Flinders to Greenbank-Karawatha Corridor

Ecological Value 9
Koala Offset Opportunities

CHENOWETH ENVIRONMENTAL PLANNING & LANDSCAPE ARCHITECTURE

FIGURE C-9

File:FigC-9.WOR
Date: 21/12/2010
10CH074 Dwn: AP