4. Existing environment

4.1 Landscape context

4.1.1 Site location and description

The project is within Sydney's inner west and passes through Marrickville, Ashfield and Leichardt local government areas. The proposed SLRE follows an existing goods rail line built in the early 20th century (between 1910 and 1922), which is now disused.
The GreenWay includes parts of the goods rail line, urban parkland, streets and waterways/canals. Waterways in the study area consist of concrete stormwater channels and do not support the original aquatic biodiversity (Leichardt Council 2009).

The study area is highly urbanised and according to available broad scale vegetation mapping (e.g. Tozer et al. (2006)) has been cleared of native vegetation.

The highly urbanised inner western suburbs of Sydney provide limited habitat for fauna with the exception of disturbance tolerant species and urban opportunists that are able to exploit these habitats. Interrupted vegetated corridors exist along Whites Creek, Johnston's Creek and Hawthorne Canal, but these contain little native vegetation. Although fragmented, this corridor has been identified as an important urban green corridor. It provides a wildlife corridor and habitat for a range of animals. Possums and birds are common (Ashfield Council 2009; Leichardt Council 2009). A total of 115 species of bird, eight species of reptiles four mammals and four frogs have been recorded within Leichardt local government area (Leichardt Council 2009), including Threatened species and populations such as the Eastern Bentwing Bat, Pied Oyster Catcher, Grey-headed Flying-fox and an Endangered population of Long-nosed Bandicoots.

Marrickville, Leichardt and Ashfield councils have developed a masterplan for this corridor (GreenWay). The aims relating to biodiversity are to:

- create a corridor that enhances biodiversity and provides habitat and protection for the Long-nosed Bandicoot
- develop a strategy and implement a biodiversity in backyards program to expand the effectiveness of the bush link corridor
- naturalise sections of the shorelines/stream bank of Hawthorne Canal and Cooks River in conjunction with Bushcare sites.

A summary of the site locality is provided in Table 3.1.

Table 4-1 Site locality

Criteria	Location
Council	Marrickville, Leichardt and Ashfield
Bioregion	Sydney Basin
Catchment Management Area (CMA)	Sydney Metro
Botanical Subdivision	Central Coast
Mitchell landscape	Majority of the study area is Ashfield Plains Northern portion of the GreenWay in Port Jackson Basin Southern portion near Jack Shanahan Park in the Woronora Plateau
Noxious weed control area	Leichhardt Municipal Council, Marrickville Council and the Council of the Municipality of Ashfield

4.2 Vegetation communities and habitats within the study area

The study area is largely cleared of native vegetation. However, the study area would have once supported the Turpentine Ironbark Forest vegetation community (Benson & Howell 1990) and there are remnants of this community in the surrounding area (Transport NSW 2010c). Although the study area is largely cleared of vegetation, it contains Bushcare sites that have been revegetated with native plant species, as well as urban gardens, parks, street plantings, and extensive weed infestations (refer Figures 4.1a to 4.1e).

Figure 4.1a Vegetation types

Note: Indicitive only, subject to detail design.

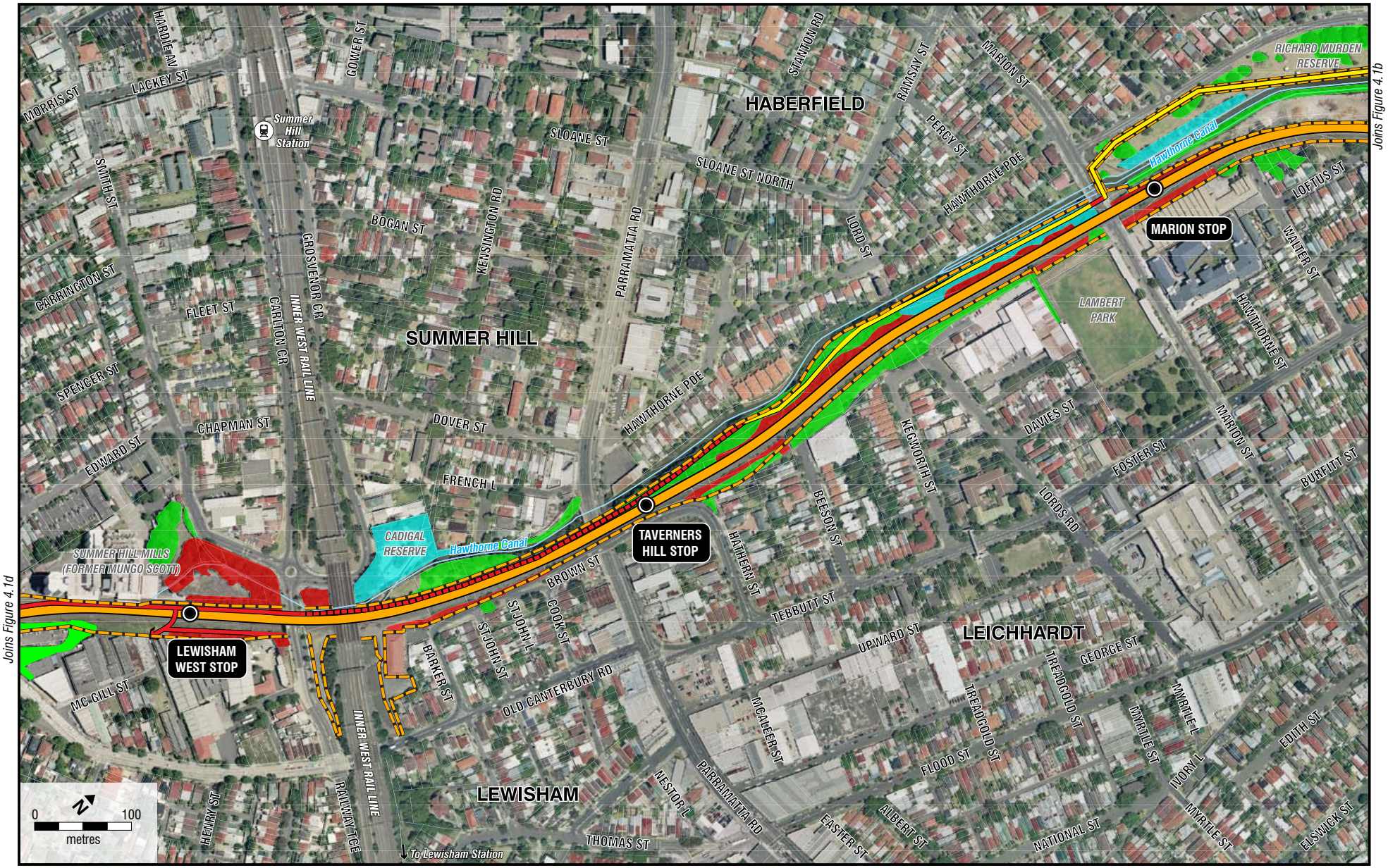
Light rail alignment
Proposed light rail stops
Local government area boundary
Watercourse

Existing GreenWay shared path (upgraded)
New GreenWay on-street cycle path
New GreenWay shared path (at-grade)
New GreenWay shared path (elevated)

Construction footprint
Weed growth
Parkland and street plantings
Bushcare site

Figure 4.1b Vegetation types

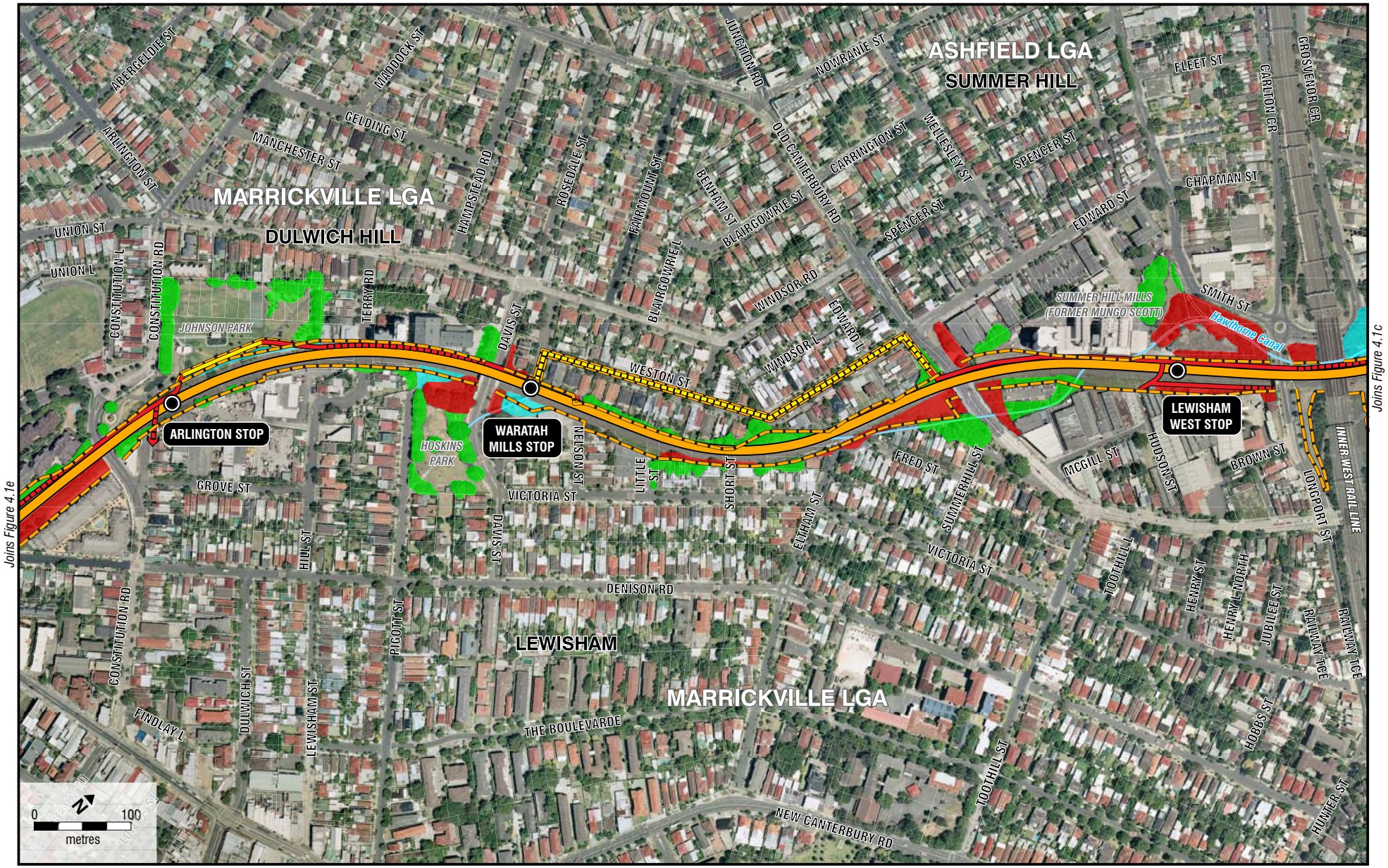
Note: Indicitive only, subject to detail design.



Light rail alignment
Proposed light rail stops
Local government area boundary
Watercourse
Existing GreenWay shared path (upgraded)
New GreenWay on-street cycle path
New GreenWay shared path (at-grade)
New GreenWay shared path (elevated)
Construction footprint
Weed growth
Parkland and street plantings
Bushcare site

Figure 4.1c Vegetation types

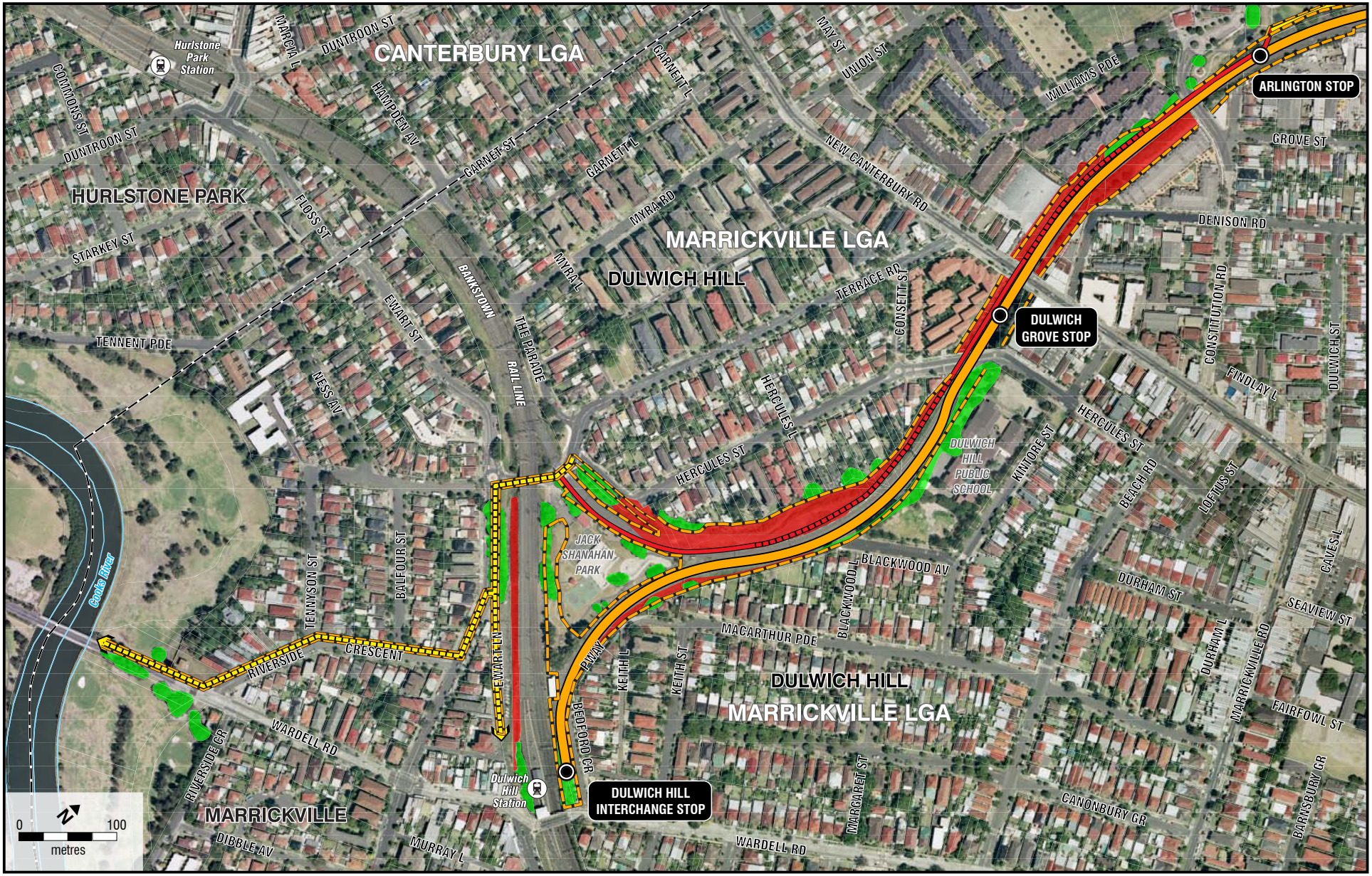
Note: Indicitive only, subject to detail design.



Light rail alignment
Proposed light rail stops
Local government area boundary
Watercourse
Existing GreenWay shared path (upgraded)
New GreenWay on-street cycle path
New GreenWay shared path (at-grade)
New GreenWay shared path (elevated)
Construction footprint
Weed growth
Parkland and street plantings
Bushcare site

Figure 4.1d Vegetation types

Note: Indicitive only, subject to detail design.



Joins Figure 4.1d

Light rail alignment
Proposed light rail stops
Local government area boundary
Watercourse
Existing GreenWay shared path (upgraded)
New GreenWay on-street cycle path
New GreenWay shared path (at-grade)
New GreenWay shared path (elevated)
Construction footprint
Weed growth
Parkland and street plantings
Bushcare site

Figure 4.1e Vegetation types

Note: Indicitive only, subject to detail design.

4.2.1 Bushcare sites

There are six Bushcare sites within the Hawthorne Canal catchment (refer Figure 1.1), with three of these sites in the Rozelle freight rail corridor (refer Figures 4.1a to 4.1e). These are managed by a local community Bushcare group, the Inner West Environment Group (IWEG). Their work forms the Creating a Bush Link, part of the broader environmental vision of a GreenWay from the Cooks River to Iron Cove (Ashfield Council 2009; Marrickville Council 2009). The work also helps support the Green Web Sydney project which aims to establish natural vegetation linkages across the metropolitan area (Green Web 2002). Overall, the condition of vegetation and fauna habitats in the Bushcare areas was moderate.

4.2.1.1 Richard Murden Reserve, Haberfield

This site is within Richard Murden Reserve, adjacent to Hawthorne Canal. It is a long rectangular site (150 x 10 m), north from Marion St (refer Figure 4.1c and Photo 4.1). The site was established in 2000 with most of the revegetation works now complete. Approximately 27 local species of plant species occur within the site including *Eucalyptus paniculata, Syncarpia glomulifera and Eucalyptus robusta*. Ground cover species include *Microlaena stipoides, Commelina cyanea* and *Bidens pilosa** (Inner West Environment Group 2010b).

The site provides habitat for a large diversity of bird species, including the Sacred Kingfisher, Brown Goshawk and Superb Fairy Wren (refer Appendix A).

Photo 4.1 The Bushcare site at Richard Murden Reserve Haberfield

4.2.1.2 Lords Road, Lewisham

The Lords Road site is small (approximately 50 x 10 m), bounded by Hawthorne Canal and the railway embankment, Lords Road and Marion street (refer Figure 4.1c). This area provides an existing shared pathway. The site was established in 2001 and approximately 12 local plant species have been planted. Work at this site has focussed on weed control. Most of the work on this site has been to control weed growth. The key weed species in this area is *Bidens pilosa**. The Eastern Water Skink is commonly seen here, in the brick-lined drainage channel.

Photo 4.2 The Bushcare site at Lords Road Lewisham

4.2.1.3 Cadigal Reserve, Lewisham

This Bushcare site is approximately 80 x 60 m, and includes a long narrow strip between the pathway and Hawthorne Canal (refer Figure 4.1d). Revegetation work within this reserve began in 1977 and there are now approximately 40 local provenance plant species planted (Appendix A) including species characteristic of Turpentine Ironbark Forest such as *Eucalyptus paniculata, Syncarpia glomulifera* and *Acmena smithii*. A site management plan has not yet been prepared. The groundcover consists of Themeda australis, as well as weeds such as *Bidens pilosa** (Inner West Environment Group 2010b).

A large diversity of bird species have been recorded within the site including the Sacred Kingfisher, Brown Goshawk and Superb Fairy Wren (refer Appendix A).

Photo 4.3 The edge of the Cadigal Reserve Bushcare site at Lewisham

4.2.1.4 Dulwich Hill and Lewisham

Three Bushcare sites occur in the rail corridor between Constitution Road and Nelson Street in Dulwich Hill and Lewisham (refer Figure 4.1e). This area was surveyed as part of study of Marrickville local government area (AMBS 2007) and was found to contain remnant and planted vegetation. Surveys at this site included small mammal trapping (hair tubes, Elliott traps and cage traps), diurnal bird and herpetofauna surveys, Anabat and spotlighting. These surveys recorded 33 species (Appendix B). Of the total of 87 species recorded across the LGA, two are listed as Threatened species (Grey-headed Flying-fox and Eastern Bentwing-bat). During these 2007 surveys, a Long-nosed Bandicoot carcass was also observed at this location (within area 3). This population has subsequently been listed as Endangered under the *Threatened Species Conservation Act 1995*.

Area 1- triangle north of Davis St

This Bushcare site is approx 70 m x 40 m. It is a triangular site bounded by the active railway, Hawthorne Canal and Davis St (refer Figure 4.1e and Photo 4.4). The site was planted in October 2003, with over 30 local provenance plant species being established to date including *Eucalyptus paniculata, Eucalyptus fibrosa, Syncarpia glomulifera* and *Eucalyptus globoidea*. Native grasses and shrubs are now starting to self-seed, but a significant portion of the site (and especially the Davis St embankment) is still dominated by *Lantana camara**. The site provides habitat for small birds and reptiles (Inner West Environment Group 2010b).

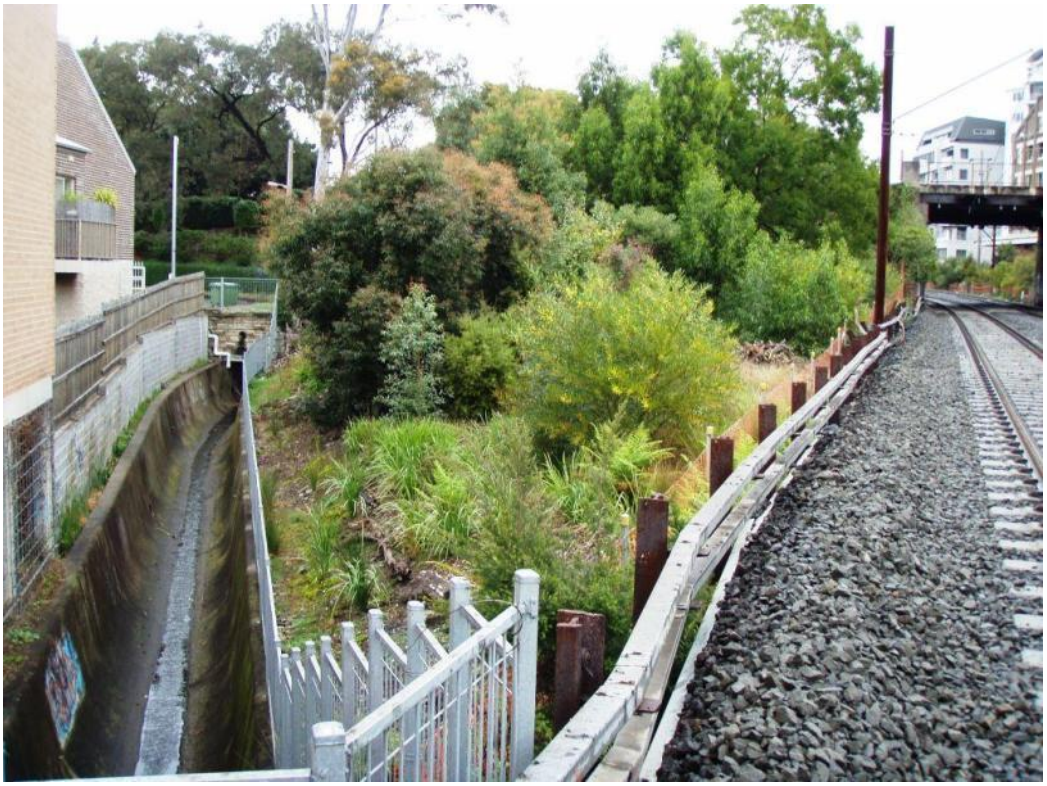


Photo 4.4 The Davis Street Bushcare Site at Dulwich Hill

Area 2- Piggot Street, adjacent to Hoskins Park

This site is within the Rozelle goods railway corridor. It is approximately 80 m x 20 m and is bounded by the active railway and Hoskins Park, and stretches between Davis St and Hill St Dulwich Hill (refer Figure 4.1e and Photo 4.5).

This site was first planted in May 2004, with almost 50 local provenance species including *Eucalyptus paniculata, Eucalyptus fibrosa* and *Syncarpia glomulifera*. A significant area of the site has not yet been established (approximately 50%) and is dominated by weeds (Inner West Environment Group 2010b).

Photo 4.5 The Piggot Street Bushcare site at Lewisham

Area 3 – Waratah Mills, Terry Road

This site is within the Rozelle goods railway corridor, between Davis St and Constitution Rd Dulwich Hill. It is a long narrow site (approximately 250 m x 8 m) within the Rozelle goods railway corridor (refer Figure 4.1e and Photo 4.6).

The site was established in 2003 and approximately 70% of the site is now established, with almost 70 different local species. No large trees have been planted within the site due to the 32 kV overhead transmission line. Native grasses and shrubs are now self-seeding, and have created an almost complete grass and shrub cover.

Two Long-nosed Bandicoot carcasses were found near this site in 2007. Small birds and reptiles use this site.

Two additional areas have been established including a small triangular area (approx 200 m^2) adjacent to the Annex building at Waratah Mills, and along the embankment above the visitor car park (Inner West Environment Group 2010b).

Photo 4.6 The Waratah Mills Bushcare site at Dulwich Hill

4.2.2 Parklands, gardens and street plantings

As much of inner western Sydney has been cleared for urban and industrial development large areas of vegetated land are now composed of plantings in the form of parklands, gardens and street trees. While many parts of the study area contain plantings, six areas that contain a significant number of plantings were identified (refer Figures 4.1a to 4.1e). Overall, the condition of vegetation and fauna habitats in these areas was low.

Blackmore Oval

Blackmore Oval, situated to the west of the proposed Leichardt North Stop, is a large sports oval surrounded by landscaped plantings (refer Figure 4.1b and Photo 4.7). Tree species including *Corymbia citriodora, Eucalyptus botryoides, Eucalyptus tereticornis, Eucalyptus saligna, Lophostemon confertus, Melaleuca quinquenervia, Acacia implexa*, and *Cupressus** spp. have been planted around the margins of the field.

Blackmore Oval provides little fauna habitat and is suitable for common aggressive native birds such as the Noisy Miner and Rainbow Lorikeet, and introduced birds such as the Rock Dove.

Photo 4.7 Planted *Eucalyptus* spp. and *Lophostemon confertus* at Blackmore Oval

Hawthorne Canal Reserve and Richard Murden Reserve

Hawthorne Canal Reserve and Richard Murden Reserve are situated adjacent to the Hawthorne Stop and form part of the GreenWay (refer Figures 4.1b and 4.1c and Photo 4.8). Tree species including *Ficus macrophylla, Lophostemon confertus, Allocasuarina littoralis, Melaleuca quinquenervia*, and *Eucalyptus* spp. have been planted within the parklands.

The open grassland areas and planted trees at Hawthorne Canal and Richard Murden Reserve are suitable for a range of common native bird species including the Silver Gull, Sulphur-crested Cockatoo, Red Wattlebird, Willie Wagtail, Australian Magpie and Noisy Miner. Introduced birds including the Rock Dove and Common Myna are also common. The Threatened Grey-headed Flying-fox was observed in this area during spotlighting.

Photo 4.8 Planted trees at Richard Murden Reserve Haberfield

Adjacent to Darley Road

A row of *Melaleuca quinquenervia* has been planted between Darley Road and the freight line, from Blackmore Oval to adjacent the Hawthorne Stop (refer Figures 4.1b and 4.1c and Photo 4.9). Other species including *Callistemon citrinus* and *Eucalyptus* spp. are also present.

These street plantings are suitable for a range of common native bird species including the Sulphur-crested Cockatoo, Red Wattlebird, New Holland Honeyeater, Willie Wagtail, Australian Magpie and Noisy Miner. Introduced birds including the Rock Dove and Common Myna are also common.

Photo 4.9 Planted Melaleuca quinquenervia along Darley Road

Along the Hawthorne Canal between Marion Stop and Taverners Hill Stop

A large area of planted vegetation exists between Marion Street and Parramatta Road along the Hawthorne Canal (refer Figures 4.1c and 4.1d). This area is composed of species including *Ficus microcarpa*, *Acacia implexa*, *Allocasuarina littoralis* and *Eucalyptus* spp. with a dense understorey of *Lantana camara** and *Cestrum parqui** (refer Photo 4.10).

The dense vegetation in this area is suitable for a range of common native bird species including the Yellow Thornbill, White-plumed Honeyeater, Grey Fantail and Willie Wagtail. The *Environment Protection and Biodiversity Conservation Act 1999* listed Migratory Black-faced Monarch has been recorded in this area by the IWEG. The introduced Black Rat was recorded in this area during spotlighting.

Photo 4.10 Current pathway adjacent to the Hawthorne Canal with planted *Ficus microcarp*a

Johnson Park and Hoskins Park

Johnson Park is a large park in Dulwich Hill used for sporting activities that also contains a children's playground (refer Figure 4.1e and Photo 4.11). The boundaries of Johnson Park have been planted with species including *Ficus rubiginosa*, *Lophostemon confertus*, *Syncarpia glomulifera, Phoenix canariensis** and *Cinnamomum camphora**. A dense hedge of *Viburnum tinus** is present between Johnson Park and the rail corridor.

Photo 4.11 Planted *Syncarpia glomulifera* and *Phoenix canariensis at Johnson Park Dulwich Hill**

Hoskins Park, located between Pigott Street and Davis Street in Lewisham, contains a children's playground and is used mostly for passive recreation (refer Figure 4.1e and Photo 4.12). The planted trees are dominated by species including *Lophostemon confertus* and *Cinnamomum camphora**.

Photo 4.12 Planted Lophostemon confertus at Hoskins Park Lewisham

The tree plantings are suitable for a range of common native bird species including the Rainbow Lorikeet, Musk Lorikeet, Sulphur-crested Cockatoo, Red Wattlebird, New Holland Honeyeater, Willie Wagtail, Australian Magpie and Noisy Miner. The Threatened Grey-headed Flying-fox was recorded in this area during spotlighting. The open grassland areas near dense vegetation cover at the park edges are suitable as foraging habitat for the Long-nosed Bandicoot, although none were observed in this area.

Jack Shanahan Park

Jack Shanahan Park is a skate park in Dulwich Hill fringed by planted trees including *Allocasuarina littoralis* and *Eucalyptus* spp. (refer Figure 4.1e and Photo 4.13). Little fauna habitat is present as the park is dominated by the concrete skate park. Common native birds such as the Australian Magpie and Noisy Miner and introduced species such as the Rock Dove utilise this habitat.

Photo 4.13 Plantings at Jack Shanahan Park Dulwich Hill

4.2.3 Weed growth

Large portions of the study area directly adjacent to and within the rail corridor have been left unmaintained. Consequently, these areas have developed dense weed infestations (refer Photo 4.14 and Photo 4.15). Areas dominated by weed species also included areas of previous landscape plantings that have become overgrown (refer Figures 4.1a to 4.1f). Overall, the condition of vegetation in these areas was low. However, the thick weed growth provides moderate condition habitat for fauna groups including ground dwelling mammals and small birds.

The areas of weed growth within the study area were fairly homogenous in composition. Dominant species included *Lantana camara*, Cinnamomum camphora*, Ligustrum* spp., Ricinus communis*, Ageratina adenophora*, Parietaria judaica*, Cestrum parqui** and *Bidens pilosa**. Exotic climbers including *Anredera cordifolia**, *Cardiospermum grandiflorum** and

*Lonicera japonica** were also present. Native species including *Acacia* spp. and *Eucalyptus* spp. were also present in low abundance throughout these areas. Large areas of grassy and herbaceous weeds were also present in the rail corridor.

The dense thickets of weeds along the length of the rail line adjacent to the tracks provide suitable habitat for a range of native bird species that rely on dense cover such as the Superb Fairy-wren. The area of dense weed growth near the Lewisham West Stop, adjacent to the corner of Longport Street and Smith Street, provides breeding habitat for the Australian White Ibis. The dense cover provided by the weed growth is also suitable as sheltering habitat for the Long-nosed Bandicoot and is likely to be a contributing factor to this species presence in the study area (Leary et al. unpublished).

Photo 4.14 An example of dense weed growth between the Hawthorne Canal and the rail line

Photo 4.15 Dense growth of herbaceous and grass weeds within the rail corridor

4.2.4 Developed areas

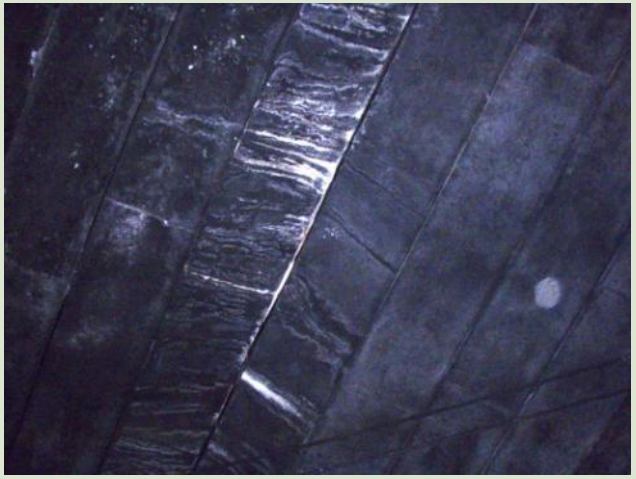
Developed areas included existing infrastructure, housing and industrial developments that have removed native vegetation and habitats (refer Photo 4.16). These areas generally do not provide habitat for native animals, except those species adapted to exploit urbanised environments. The fauna habitats of the developed areas were in poor condition.

Developed areas are suitable for a range of common native bird species including the Silver Gull, Sulphur-crested Cockatoo, Red Wattlebird, New Holland Honeyeater, Willie Wagtail, Australian Magpie and Noisy Miner. Introduced birds including the Rock Dove and Common Myna are also prevalent. Bridges, culverts and buildings also provide potential habitat for species of microchiropteran bat including the Threatened Eastern Bentwing-bat that has been identified in previous surveys. Table 4.2 outlines the man made habitats within the study area and their suitability for animals.

Photo 4.16 An example of the developed areas within the locality

A small drainage area is present within the rail corridor near Lilyfield. As identified by Biosis Research (2010b), the drainage line ranges from approximately 1 to 2 m in width and contained stagnant water. Vegetation cover was patchy over the length of the drainage line but included vegetation dominated by *Typha orientalis*. This habitat is likely to be suitable for common frog species such as the Common Eastern Froglet and Eastern Dwarf Tree Frog.

Table 4.2 Man made habitats within the study area

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Hercules Street Overbridge			Moderate. The Hercules Street Overbridge has deep cracks in the roof that may provide roosting habitat for microchiropteran bats.
New Canterbury Road Overbridge			Low. The Canterbury Road Overbridge possesses fewer suitable roosting cracks than the Hercules Street Overbridge; however, microchiropteran bats may still utilise the roof of the bridge for roosting.

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Constitution Road Overbridge			Low. The Constitution Road Overbridge possesses fewer suitable roosting cracks than the Hercules Street Overbridge; however, microchiropteran bats may still utilise the roof of the bridge for roosting.
Davis Street Overbridge			Low. The Davis Street Overbridge possesses fewer suitable roosting cracks than the Hercules Street Overbridge; however, microchiropteran bats may still utilise the roof of the bridge for roosting.

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Old Canterbury Road Overbridge			Low. The Old Canterbury Road Overbridge possesses fewer suitable roosting cracks than the Hercules Street Overbridge; however, microchiropteran bats may still utilise the roof of the bridge for roosting.
Longport Street Overbridge			Low. The Longport Street Overbridge possesses fewer suitable roosting cracks than the Hercules Street Overbridge; however, microchiropteran bats may still utilise the roof of the bridge for roosting.

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Parramatta Road Rail Bridge			Low Few cracks or spaces under bridge suitable for microchiropteran bats.
Inner West Rail Line			Moderate This is a very large bridge with a number of suitable spots for microchiropteran bats.

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Old warehouse at Leichardt North Stop			Low. The old warehouse at the Leichardt North Stop may provide suitable roosting habitat for microchiropteran bats. The beams provide good roosting habitat for introduced birds such as the Rock Dove.
City West Link rail corridor tunnel			Low. The City West Link rail corridor tunnel may provide suitable roosting habitat for microchiropteran bats.

Habitat feature	Photographs		Suitability as habitat
	Outside view	Internal view	
Balmain Road Overbridge			Low. The Balmain Road Overbridge may provide suitable roosting habitat for microchiropteran bats. The beams provide good roosting habitat for introduced birds such as the Rock Dove.
Catherine Street Overbridge			Low. The Catherine Street Overbridge may provide suitable roosting habitat for microchiropteran bats. The beams provide good roosting habitat for introduced birds such as the Rock Dove.

4.3 Species of plant

To obtain an overview of the species present at all locations within the study area, the results of the present survey were combined with those of previous surveys. Overall, 298 species of plant have been recorded within the study area of which 189 species (63%) were native (refer Appendix A). No threat-listed species of plant has been recorded in the study area.

The study area traverses three noxious weed control areas: Leichhardt Municipal Council, Marrickville Council and the Council of the Municipality of Ashfield. Of the 109 exotic species of plant recorded, 10 are listed under the *Noxious Weeds Act 1993* (refer Table 4.3).

Table 4.3 Noxious weeds within the study area

Scientific Name	Common Name	*Noxious Weeds Act 1993* control class[1]	Weeds of National Significance (Thorp & Lynch 2000)
Cestrum parqui	Green Cestrum	3	
Cortaderia selloana	Pampas Grass	3	
Lantana camara	Lantana	5 (all of NSW); 4	Yes
Ligustrum lucidum	Large-leaved Privet	4 (not listed in Marrickville)	
Ligustrum sinense	Small-leaved Privet	4 (Ashfield only)	
Opuntia stricta	Prickly Pear	4 (all of NSW)	
Parietaria judaica	Pellitory	4	
Ricinus communis	Castor Oil Plant	4	
Rubus fruticosus	Blackberry	4 (all of NSW)	Yes
Toxicodendron succedaneum	Rhus Tree	4	

Notes 1 Control Categories under the *Noxious Weeds Act 1993*:. Class 3: The plant must be fully and continuously suppressed and destroyed. Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Class 5: The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with.

4.4 Species of animal

Taking into account the results of past biodiversity surveys combined with the survey undertaken for this assessment, 87 species of vertebrate animal have been recorded in the study area (refer Appendix A). This includes 74 native species (85%). Birds were the most diverse group of terrestrial fauna recorded in the Study Area followed by mammals, reptiles and amphibians (refer Table 4-4 4-4). One Threatened species, the Grey-headed Flying-fox, was recorded during this survey. Previous surveys have also identified the presence of the Long-nosed Bandicoot which is listed as an Endangered population under the *Threatened Species Conservation Act 1995* within inner western Sydney.

Table 4-4 Summary of species of animal identified in the Study Area

Fauna group	Species diversity
Birds	71 (8 introduced) (2 Migratory)
Mammals	8 (4 introduced) (1 Vulnerable species and 1 Endangered population)
Reptiles	5
Amphibians	2

Feral and domestic animals including the European Red Fox and domestic dogs and cats are common throughout the study area. Cats were commonly recorded via remote cameras placed in the rail corridor by Biosis Research (2010) and were seen during the day in the corridor during the current surveys (refer Photo 4.17).

Photo 4.17 A cat recorded within the rail corridor near Waratah Mills

5. Threatened biodiversity and migratory species

5.1 Threatened ecological communities

Twenty Threatened ecological communities listed under the *Threatened Species Conservation Act 1995* and/or *Environment Protection and Biodiversity Conservation Act 1999* have been identified as having potential to occur within the locality (refer Table 5-1).

The study area would have once supported Turpentine Ironbark Forest (Benson & Howell 1990) and there are remnants of this community in the surrounding area (Transport NSW 2010c). Two Endangered ecological communities are still known to occur within Ashfield Local Government Area (LGA). Remnant species from the Sydney Turpentine Ironbark Forest community can be found at Ashfield Park and Sydney Coastal Estuary Swamp Forest Complex is now restricted to a few isolated *Eucalyptus robusta* trees in Robson Park (Ashfield Council 2009).

No remnants of these or any other Threatened ecological community has been recorded within the study area during previous surveys (Biosis Research 2010b) or during the current survey. However, Bushcare sites in Dulwich Hill have been revegetated with species that exist within the Turpentine - Ironbark Forest community (Biosis Research 2010b). It should be noted that the bushcare areas possess no original native vegetation and have highly disturbed soil profiles from the construction of the railway. As Sydney Turpentine Ironbark Forest is being revegetated within its historic distribution, the plantings may be considered part of this Endangered ecological community. However, the size of the bushcare areas is too small to be considered part of the *Environment Protection and Biodiversity Conservation Act 1999* community. Due to the history of disturbance and lack of original vegetation and soil profile, this community is not considered any further in this report.

Table 5-1 Threatened ecological communities listed on *Threatened Species Conservation Act 1995* and *Environment Protection and Biodiversity Conservation Act 1999* predicated to occur in the locality

Threatened ecological community*	TSC Act	EPBC Act	Occurs within the study area?
Blue Gum High Forest[1]	CE	CE	No
Castlereagh Swamp Woodland Community	E		No
Coastal Saltmarsh in the NSW North Coast; Sydney Basin and South East Corner Bioregions	E		No
Cooks River/ Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E		No
Cumberland Plain Woodland[2]	CE	CE	No
Duffys Forest Ecological Community in the Sydney Basin Bioregion	E		No
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion[3]	E	E	No
Hygrocybeae Community of Lane Cove Bushland Park	E		No

Threatened ecological community*	TSC Act	EPBC Act	Occurs within the study area?
Littoral Rainforest in the NSW North Coast; Sydney Basin and South East Corner Bioregions[4]	E	E	No
Moist Shale Woodland in the Sydney Basin Bioregion	E		No
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions	E		No
Shale Gravel Transition Forest in the Sydney Basin Bioregion[2]	E	CE	No
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	E	E	No
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E		No
Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions	E		No
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions	E		No
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E		No
Sydney Turpentine-Ironbark Forest[5]	E	CE	The Bushcare sites in Dulwich Hill have been revegetated with species from the Turpentine-Ironbark Forest community. However, no natural vegetation exists in these areas and the soil profile has been extensively disturbed and modified by the construction of the railway.
Themeda australis grassland on seacliffs and coastal headlands in the NSW North Coast; Sydney Basin and South East Corner bioregions	E		No
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E		No

Source: *Threatened species, populations and communities database* (Department of Environment Climate Change and Water 2010b), Sydney Metro CMA, Pittwater A and/or Cumberland sub-catchments (Sydney Metro CMA, Pittwater A and/or Cumberland sub-catchments subregion; List of EPBC list of Threatened ecological communities (Department of the Environment Water Heritage and the Arts 2010a)

Notes: *There are significant similarities in these TSC and EPBC Act listed communities, however, not all occurrences will fit both listings. Under the EPBC Act, these communities are listed as:
1) Blue Gum High Forest of the Sydney Basin Bioregion 2) Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest 3) Eastern Suburbs Banksia Scrub of the Sydney Region 4) Littoral Rainforest and Coastal Vine Thickets of Eastern Australia 5) Turpentine-Ironbark Forest in the Sydney Basin Bioregion

5.2 Endangered populations

Nine endangered populations listed under the *Threatened Species Conservation Act 1995* have been identified as occurring in the Sydney Metro CMA, Pittwater A and/or Cumberland sub-catchments (refer Table 4.2). Only two of these are known to occur within the vicinity of the study area: White fronted Chat, and Long-nosed Bandicoot (refer Table 4.2). The preferred habitats of these two species are provided in Appendix D.

No Endangered populations were recorded during the survey. However, based on past survey work, it is known that the Long-nosed bandicoot population: Inner Western Sydney occurs within the study area.

Table 5-2 Endangered populations predicted to occur in the Sydney Metro CMA, Pittwater A and Cumberland sub-catchment

Endangered population	Occurs within the study area?
Acacia prominens (Gosford wattle) population in the Hurstville and Kogarah LGAs	No. Study area is not within Hurstville or Kogarah LGAs
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs	No. Study area is not within Hornsby or Ku-ring-gai LGAs
White-fronted Chat Population in the Sydney Metropolitan Catchment Management Authority Area	No, suitable habitat is not present in the study area. While the study area is close to the Newington Nature Reserve, birds are unlikely to cross 8 km of urbanised land to the unsuitable habitat in the study area (see Section 5.2.2 below)
Little Penguin population in the Manly point area	No. Study area is not in the Manly point area
Long-nosed Bandicoot population; Inner Western Sydney	**Yes. This Long-nosed Bandicoot population is known to occur in the study area**
Long-nosed Bandicoot population at North Head	No. Study area is not at North Head
Koala population in the Pittwater LGA	No. Study area is not within Pittwater LGA
Pomaderris prunifolia (a shrub) population in the Parramatta; Auburn; Strathfield and Bankstown LGAs	No. Study area is not within Parramatta; Auburn; Strathfield or Bankstown LGAs
Wahlenbergia multicaulis (Tadgell's Bluebell) population in the Auburn; Bankstown; Baulkham Hills; Canterbury; Hornsby; Parramatta and Strathfield LGAs	No. Study area is not within Auburn; Bankstown; Baulkham Hills; Canterbury; Hornsby; Parramatta and Strathfield LGAs

Source: (Department of Environment Climate Change and Water 2010b)

5.2.1 Long-nosed Bandicoot, inner western Sydney population

The Long-nosed Bandicoot was thought to have disappeared from the inner west of Sydney in the late 1950's, until rediscovered in 2007 (AMBS 2007). Further surveys undertaken by DECCW identified and mapped locations of Long-nosed Bandicoots based on sightings of individuals and diggings. Areas of sightings included Petersham, Lewisham and Dulwich Hill (Marrickville Council 2009). The Inner West Environment Group (IWEG) have also made opportunistic sightings of Long-nosed Bandicoots in these areas.

Habitat preferences of the Long-nosed Bandicoots in inner western Sydney appear to be urban backyards and parks for foraging and underneath old buildings for nesting (Leary et al. unpublished).

5.2.2 White-fronted Chat Population in the Sydney Metropolitan Catchment Management Authority Area

Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area: one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay (Department of Environment Climate Change and Water 2009). The study area lies approximately 8 km south east of the Newington Nature Reserve population and is separated by high density urban development. It is unlikely that the White-fronted Chat would fly across the inhospitable urban landscape to reach the study area. Considering that the study area does not possess suitable habitat in the form of saltmarsh it is unlikely that the Endangered White-fronted Chat population would utilise the study area. Consequently, the Endangered White-fronted Chat population and the White-fronted Chat are not considered further in this report.

5.3 Threatened species

5.3.1 Flora

A total of 38 Threatened species of plant listed under the *Threatened Species Conservation Act 1995* and/or *Environment Protection and Biodiversity Conservation Act 1999* are known or predicted to occur in the locality (refer Appendix B).

No Threatened species of plant has been recorded in previous surveys of the study area (Biosis Research 2010b). Additionally, the current survey did not record any Threatened species of plant. Based on preferred habitats and known distributions, together with known vegetation and geological associations, no Threatened species of plant is considered to have a moderate or high likelihood of occurrence within the Study Area (refer Appendix B). It is unlikely that the Threatened flora identified in the desktop assessment would be affected by the project for one or more of the following reasons:

- no suitable habitat was recorded
- the study area is outside the normal range of the species and records are likely to be invalid
- the species is considered locally extinct.

The habitat requirements for the Threatened species of plant and the reasons for not considering these species likely to occur in the study area are provided in Appendix B.

5.3.2 Fauna

A total of 72 Threatened species of animal listed under the *Threatened Species Conservation Act 1995* and/or *Environment Protection and Biodiversity Conservation Act 1999* is known or predicted to occur in the locality (Appendix C).

One species of Threatened animal, the Grey-headed Flying-fox, was recorded within the study area during the current survey. The Threatened Eastern Bentwing-bat has also been recorded within the study area during previous surveys by AMBS. Additionally, based on preferred habitats and known distributions, two Threatened species (Little Lorikeet and Swift Parrot), have a moderate likelihood of occurrence within the study area. Impact assessments completed for the Grey-headed Flying-fox and other Threatened species with a moderate or high likelihood of occurrence are provided in Appendix D.

It is unlikely that any of the remaining Threatened fauna species would be affected by the project (refer Appendix C), for one or more of the following reasons:

- no suitable habitat was recorded in the study area
- the study area is outside the normal range of the species and records are likely to be of vagrants or invalid
- the species is considered locally extinct.

The habitat requirements for each of the remaining Threatened species of animal and the reasons for not considering these species likely to occur in the Study Area are provided in Appendix C.

5.4 Migratory species

Migratory species are protected under the international agreements to which Australia are a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered matters of National Environmental Significance and are protected under the *Environment Protection and Biodiversity Conservation Act 1999*.

Twenty four Migratory species have been predicted to occur within the project locality, based on the DEWHA Protected Matters Search Tool (Department of the Environment Water Heritage and the Arts 2010b) (refer Appendix C). One Migratory species, the Fork-tailed Swift, was recorded within the Study Area during the field surveys. An additional Migratory species, the Black-faced Monarch, has been previously recorded in the study area by the IWEG.

Under the *Environment Protection and Biodiversity Conservation Act 1999*, an action is likely to have a significant impact on a Migratory species if it substantially modifies, destroys or isolates an area of important habitat for the species (Department of the Environment Water Heritage and the Arts 2009b). For all species of Migratory bird that occur or are considered likely to occur, the study area is not considered to compromise important habitat, as it does not contain:

- habitat used by a Migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat that is of critical importance to the species at particular life-cycle stages

- habitat used by a Migratory species that is at the limit of the species' range
- habitat within an area where the species is declining (Department of the Environment Water Heritage and the Arts 2009b).

As such, impacts of the project on Migratory species are not considered further in this report. Details of species requirements and reasons for not considering impacts further for Migratory species are provided in Appendix C.

5.5 Other key biodiversity values - corridors and connectivity

Wildlife corridors can be defined as 'retained and/or restored systems of (linear) habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation' (Wilson & Lindenmayer 1995). Corridors can assist ecological functioning at a variety of spatial and temporal scales, from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographical regions.

Corridors serve a number of different functions in terms of biodiversity conservation including:

- providing increased foraging area for wide-ranging species
- providing cover for movement between habitat patches, particularly for cover-dependent species and species with poor dispersal ability and enhancing the movement of animals through sub-optimal habitats
- reducing genetic isolation
- facilitating access to a mix of habitats and successional stages to those species which require them for different activities (for example, foraging or breeding)
- providing refuge from disturbances such as fire
- providing habitat in itself
- linking wildlife populations and maintaining immigration and recolonisation between otherwise isolated patches. This in turn may help reduce the risk of population extinction (Wilson & Lindenmayer 1995).

The study area forms part of the Cooks River to Iron Cove GreenWay corridor that extends five kilometres from Iron Cove at Haberfield in the north to the Cooks River at Earlwood in the south. The vegetated GreenWay is a linear corridor that follows the Hawthorne Canal to Lilyfield and the Rozelle goods railway corridor that runs adjacent to the canal to a junction above the Cooks River at Dulwich Hill. The GreenWay passes through the Local Government Areas (LGAs) of Marrickville, Leichhardt, Canterbury and Ashfield (GreenWay Coordination Strategy Working Group 2009).

The GreenWay is an example of an almost continuous vegetated corridor, although dominated by weed growth, in the highly urbanised environment of inner western Sydney. Studies of fauna populations within various areas of the GreenWay suggest that it possesses much higher levels of diversity compared to the adjacent urbanised environments. Therefore, the GreenWay can be considered a landscape linkage that is of importance for the dispersal of fauna and flora in a highly fragmented landscape (GreenWay Coordination Strategy Working Group 2009).

6. Potential impacts

This section describes the potential impacts of the proposal on the biological environment. Management measures to avoid, minimise and mitigate these potential impacts are discussed in Section 7. These impacts have been separated into impacts likely to occur during construction and impacts likely to occur during operation of the project as these phases differ in the impacts that may occur to biodiversity.

The project would result in a range of direct impacts on existing biodiversity within the construction corridor and potential indirect impacts on biodiversity in the surrounding landscape. These impacts include:

- clearing of vegetation
- removal of fauna habitats
- habitat fragmentation
- direct mortality to plants and less mobile animals
- invasion and establishment of weeds
- increased noise
- altered hydrology.

These impacts have the potential to affect the Threatened biodiversity identified as occurring, or likely to occur, in the study area. The impacts listed above contribute to the overall cumulative impacts within the locality and to Key Threatening Processes. Additionally, the project has the potential to have positive impacts to biodiversity.

6.1 Impacts during construction

6.1.1 Vegetation clearing

Clearing of native and exotic vegetation (land clearing) would be the major direct impact of the project on biodiversity in the study area. Clearing of native vegetation is known to affect Threatened species of flora and fauna and is recognised as a key threatening process under both the *Threatened Species Conservation Act 1995* and *Environment Protection and Biodiversity Conservation Act 1999,* under the following final determination titles:

- Clearing of native vegetation (*Threatened Species Conservation Act 1995*).
- Land clearance (*Environment Protection and Biodiversity Conservation Act 1999*).

Under the *Threatened Species Conservation Act 1995*, native vegetation is made up of plant communities, comprising primarily indigenous species. Clearing is defined as the destruction of a sufficient proportion of one or more strata layers within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands (NSW Scientific Committee 2001).

Clearing of vegetation, native and exotic, has many adverse effects on both flora and fauna. These include:

- loss of local populations of individual species
- fragmentation of remnants of ecological communities
- reduction in the viability of ecological communities resulting from loss or disruption of ecological functions
- destruction of flora and fauna habitat and associated loss of biological diversity (habitat removal may include removal of hollow bearing trees, loss of leaf litter layer, changes to soil biota)

- soil erosion, increased salinity and loss of productive land
- riparian zone degradation
- increased habitat for invasive species (adapted from NSW National Parks and Wildlife Service 2001; NSW Scientific Committee 2004).

The majority of vegetation removal will be composed of exotic species. Furthermore, vegetation clearing has been avoided where possible through the selection and design process. Nonetheless, total avoidance of vegetation clearing is not possible and approximately 1.82 ha of vegetation (including 1.7 ha of weeds) will be cleared as a result of the project (refer Table 6.1). This equates to approximately 8.3% of the vegetated land within the study area.

Table 6-1 Potential loss of vegetation within the study area

Vegetation type	Extent within study area (ha)	Vegetation clearing (ha)		Total clearing (ha)	Clearing as percentage of existing extent
		Construction compounds and Stops	GreenWay		
Bushcare sites	1.4	0.02	0.05	0.07	5.0
Planted Trees	12.4	0.00	0.05	0.05	0.4
Weed growth	8.0	1.40	0.30	1.70	21.2
Totals	**21.8**	**1.42**	**0.40**	**1.82**	**8.3**

Note: All areas are approximate and are based on the construction map provided by Transport NSW.

6.1.2 Removal of fauna habitats

Clearing of native and exotic vegetation would result in the removal of fauna habitats. Fauna use elements of this habitat for shelter, to hide from predators, find food, avoid extreme weather conditions and for breeding. A total of approximately 1.82 ha of broad-scale fauna habitat would be removed, including approximately 1.7 ha of dense weed growth that provides suitable habitat for the Long-nosed Bandicoot and approximately 0.05 ha of foraging habitat for the Grey-headed Flying-fox, Eastern Bentwing-bat, Swift Parrot, and Little Lorikeet in the form of planted trees (refer Table 6.1).

For the Long-nosed Bandicoot, the dense weed growth within the study area is likely to provide a resource. Due to the absence of natural habitats in the study area, the Long-nosed Bandicoot may use the dense weed growth for shelter (Leary et al. unpublished). For the remaining species, the Grey-headed Flying-fox, Eastern Bentwing-bat, Swift Parrot, and Little Lorikeet, the habitat within the study area is likely to only provide marginal foraging habitat. Bridges and overpasses in the study area may provide roosting habitat for the Eastern Bentwing-bat. Specifically, the overbridges at Hercules Street, New Canterbury Road, Constitution Road, Davis Street, and Longport Street may be modified.

6.1.3 Habitat fragmentation

Habitat fragmentation is the process of sub-dividing a continuous habitat into smaller isolated fragments (Andren 1994; Ford et al. 2001) and can have adverse affect on both flora and fauna. The project may result in the fragmentation at each of the stops along the route to varying degrees. Some stops will result in the severing of the vegetated corridor while others will reduce the overall corridor width.

Habitat fragmentation as a result of the project will occur during construction. However, fragmentation will be an ongoing impact of operation of the project.

Although a roughly continuous vegetated corridor exists along the alignment, some fragmentation exists as a result of past land use. The additional fragmentation resulting from the project would be unlikely to have a significant impact on the viability of species that occur. Plant species remaining in the alignment have a high level of resilience to disturbance and would continue to produce viable seed and germinate in the presence of disturbance factors. Animal assemblages are, with the exception of the Long-nosed Bandicoot, dominated by generalist species that are tolerant of a high level of habitat disturbance.

The species most likely to be adversely affected by fragmentation are those that are less mobile, such as the Long-nosed Bandicoot. The project may form a barrier to the movement of this species throughout the alignment by breaking up areas of habitat by introducing stops and through the movement of light rail creating a barrier to crossing the tracks. The habitat fragmentation associated with the project is unlikely to affect highly mobile flying species such as the Grey-headed Flying-fox, Eastern Bentwing-bat, Swift Parrot, and the Little Lorikeet.

6.1.4 Direct mortality to plants and less mobile animals

Fauna injury or death could occur as a result of construction activities, such as:

- vegetation (fauna habitat) clearing
- collision with vehicles or plant
- incidental trapping or drowning in trenches or other earthworks.

While some mobile species, such as birds, may be able to move away from the path of clearing, other species that are less mobile, or those that are nocturnal, may find it difficult to move rapidly over large distances.

Fauna injury or death has the greatest potential to occur during the break-out phase of construction when vegetation and habitats are being cleared. The Threatened population that could be most affected by the clearing is the Long-nosed Bandicoot.

6.1.5 Proliferation of weeds

The Project has the potential to disperse weeds into Bushcare areas and cleared areas within the study area. The invasion of exotic perennial grasses, such as *Pennisetum clandestinum** and *Eragrostis curvula** that were recorded within the study area, is recognised as a Key Threatening Process under the *Threatened Species Conservation Act 1995*. Several other invasive weeds are listed as a Key Threatened Process under the *Threatened Species Conservation Act 1995* including *Lantana camara** and *Ipomoea indica** that have been recorded within the study area. In addition to these, other invasive weeds recorded in the study area include R*icinus communis*, Cortaderia selloana*, Rubus fruticosus** and *Ligustrum** spp.

The most likely causes of weed dispersal associated with the project would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery.

Existing disturbed vegetation within the study area, however, has considerable weed growth already; therefore, the overall extent of weed invasion into the study area is not likely to increase significantly.

6.1.6 Noise and other human disturbance

Construction activities would be likely to increase noise levels, and general disturbance would be associated with the presence of humans within the study area. Increased noise levels could be a cause of disturbance for native animals, particularly Long-nosed Bandicoots, resulting in displacement of individuals out of the affected area, disturbance to foraging patterns and disturbance to breeding cycles.

The majority of the species of the animals observed, or likely to occur, within the study area were generalist species that are known to be accustomed to residential and industrial noises.

6.2 Impacts during operation

The operation of the project would involve the running of light rail between the Dulwich Hill Interchange Stop and the Lilyfield Stop (and continuing onto the existing light rail network into the Sydney CBD). Other track and utility undertakings would be required within the rail easement to ensure the project remains a safe, clean and reliable component of the greater rail network.

6.2.1 Noise

The main potential operational impact of the project on biodiversity would be noise disturbance from light rail operations. The introduction of light rail noise would not be a significant contribution to the post-construction noise levels in the study area. The majority of the species likely to occur within the study area are species that would be accustomed to residential and industrial noises. Considering the previous operation of the rail line as a freight corridor, there has historically been considerable noise sources in the study area. The only Threatened biodiversity likely to be affected by light rail noise is the Endangered Long-nosed Bandicoot, inner western Sydney population and the Eastern Bentwing-bat if it is roosting in any bridges or culverts in the vicinity of the track. However, due to the noisy nature of the urban environment in which these species exist, a significant impact would not be likely.

6.2.2 Light

Studies relating to the effect of light pollution on fauna have indicated light pollution from a variety of sources can trigger behavioural and physiological responses including (but not limited to):

- an extension of daylight or twilight foraging behaviour into the night-time environment (sometimes referred to as the 'night light niche' where reptiles, microchiropteran bats, and some diurnal birds will forage for insects under artificial lighting (Schwartz & Henderson 1991)
- a disruption of seasonal day length cues which trigger critical behaviours (Longcore & Rich 2004)
- a disruption to predator-prey relationships (Longcore & Rich 2004).

The creation of stops will introduce a new source of light into the study area. The immediate area around the stops and along the length of the GreenWay will be subject to lighting essentially creating permanent 'daylight' conditions. Lighting for the GreenWay would be based on pole mounted fixtures at a spacing of 20 m. Lighting on the path may operate up to 10 pm. Low level lighting (bollard or similar) would be used in some parts of the path including near bushcare areas. Lighting design would seek to minimise light spill impacts and would be finalised during detailed design. Light rail will also provide an intermittent source of light as the light rail vehicles move along the track at night. The light rail vehicles are

expected to run until the hours of 11 pm Monday to Thursday and 12:30 am Friday to Saturday.

Light pollution may potentially affect nocturnal fauna by interrupting their life cycle in any one of the manners outlined above. Due to the sustained nature of the lighting around the stops and the frequency of light rail services, it is unlikely that animals will habituate to the light disturbance and an impact in the area of lighting is likely. This may be important for nocturnal species including the Long-nosed Bandicoot. Some positive impacts for microchiropteran bat species may occur due to increased prey (insect) abundance and availability around lighting sources.

6.2.3 Light rail collision with fauna

International studies have shown that dead carcasses attract scavengers on rail tracks, which can increase the collision of raptors with trains (Krone *et al.* 2000). Other studies have focused on the impacts of train collision with local populations of large mammals (Wells et al. 1999). However, there are no data available on the mortality rates of Australian fauna due to train collision and it is difficult to predict the extent of impacts associated with increased movements.

The effect of train traffic mortality on fauna populations is often difficult to measure since factors such as area, quality and spatial configuration of the habitat along rail lines, also play a role (Catharinus et al. 2006). Data sets on wildlife mortalities from trains are difficult to obtain because of the relative inaccessibility of railway lines; the lack of experienced individuals to observe, identify, and record railway kills; and the inherent difficulty of identifying and investigating railway wildlife (Wells et al. 1999).

The proposal would result in frequent light rail movements and is likely to result in some level of collision with native fauna, including possibly the Endangered Long-nosed Bandicoot population, throughout the length of the line as a consequence. Areas where there are likely to be higher chances of collision include areas where the route traverses through areas of dense weed growth that provide habitat for ground dwelling mammals.

6.2.4 Barrier effects

The creation and continued effects of barriers associated with the project would persist throughout the construction and operational phases. Barriers, both physical and biological, would be created and maintained as part of the proposal. Rail lines can act as a barrier through either increased mortality or avoidance (Catharinus et al. 2006; Wells et al. 1999). The local habitat corridor that occurs along the edges of the rail line would not be significantly affected since the project would occur on the existing rail tracks. Stops may provide a new barrier to animal movement due to the clearing of vegetation and construction of platforms; however, revegetation and landscaping would serve to reconnect the corridor.

Barrier effects are likely to be the most significant in areas where the study area traverses the larger patches of vegetation. This is particularly the case for ground-dwelling species including reptiles, amphibians and the Threatened Long-nosed Bandicoot population that may be affected by the light rail movements. Local populations of mobile faunal species, including birds and bats, are unlikely to be significantly disrupted by barrier effects of the project.

6.2.5 Changed hydrology/surface run-off

Changed hydrology can alter ecosystems including vegetation communities and fauna habitats. Run-off from contaminated surfaces could also have a negative effect on the

ecology of flora and fauna in nearby habitats. Alterations to hydrological regimes would primarily be associated with the construction phase; however, the long-term concentration of flows would be similar to current levels. As such, it is anticipated that changed hydrology will not affect local populations of flora and fauna during operation.

Improved hydrology through the implementation of Water Sensitive Urban Design (WSUD) may provide a positive impact to the ecology of plants and animals in nearby habitats.

6.3 Cumulative and consequential impacts

The potential biodiversity impacts of the project have been considered. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the project in a strategic context. This is necessary so that the impacts associated with the project and other activities in the region are examined collectively.

The project is located in a highly modified landscape dominated by high-density urban and industrial development in which the remaining areas of vegetation and associated habitat are highly fragmented and isolated. This existing landscape is not expected to change significantly in the near future due to the highly developed nature of inner western Sydney limiting development potential. Therefore, impacts to existing biodiversity from future development in the locality are likely to be limited.

6.4 Key threatening processes

Threatening processes are those that threaten, or have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities.

A process can be listed as a key threatening process if it could:

- Cause a native species or ecological community to become eligible for inclusion in a Threatened list (other than the conservation dependent category).
- Cause an already listed Threatened species or Threatened ecological community to become more endangered.
- Adversely affect two or more listed Threatened species or Threatened ecological communities.

Key Threatening Processes are listed under Schedule 3 of the NSW *Threatened Species Conservation Act 1995* and also under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Key Threatening Processes relevant to the project are listed in Table 6.2. The magnitude of the project contributing to the Key Threatening Processes listed in Table 6.2 is low as many are already in operation and are well established. Mitigation measures associated with the project, such as weed control and pest control, will serve to reduce the impact of these Key Threatening Processes on the study area.

Table 6-2 Key Threatening Processes relevant to the project

TSC Act listed Key Threatening Process	EPBC Act listed	Proposal would increase threat?
Pest species		
Competition and grazing by the feral European rabbit	Competition and land degradation by rabbits	No. The project is unlikely to increase the incidence of rabbits
Predation by the European Red Fox	Predation by European red fox	No. Foxes are already well established in the study area
Predation and hybridisation by feral Dogs (*Canis lupus familiaris*)	-	No. Dogs are already prevalent in the study area
Predation by feral cats	-	No. Cats are already prevalent in the study area
Weeds		
Invasion and establishment of exotic vines and scramblers	-	No. Exotic vines and scramblers are already established in the study area
Invasion, establishment and spread of *Lantana camara**	-	No. *Lantana camara** is already established in the study area
Invasion of native plant communities by exotic perennial grasses	-	No. Exotic perennial grasses are already established in the study area
-	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	No. Garden plants are already established in the study area
Habitat loss or change		
Clearing of native vegetation[1]	Land clearance	Yes

6.5 Species specific impacts

Table 6.3 provides a summary of the specific impacts likely to affect each of the Endangered populations and Threatened species recorded or likely to occur in the study area. The location of each Threatened species recorded in the study area and the extent of suitable habitat is provided in the Threatened species profiles supporting the impact assessments (refer Appendix D).

The project would have direct impacts on habitat for Threatened species as a result of vegetation clearing. Assessments of the significance of these impacts are provided in Section 8 and Appendix D.

Table 6-3 Potential impacts on Threatened biodiversity

Species or community	Status		Direct and indirect impacts across the study area
	TSC Act[1]	EPBC Act[2]	
Long-nosed Bandicoot, inner western Sydney population	E2	-	Loss of 1.7 ha of potential sheltering, foraging and breeding habitat[3]
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Loss of 0.05 ha of foraging habitat
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	Loss of 0.05 ha of foraging habitat. Disturbance to bridges (potential roosting sites).
Swift Parrot (*Lathamus discolor*)	E	E	Loss of 0.05 ha of foraging habitat
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Loss of 0.05 ha of foraging habitat

1. Conservation status as listed under the *Threatened Species Conservation Act 1995*. E = endangered. V = vulnerable, E2 = endangered population.
2. National conservation status as listed under the *Environment Protection and Biodiversity Conservation Act 1999*. V = Vulnerable E = Endangered
3. No bandicoots were recorded in during the studies associated with the Light Rail Extension – Stage 1, but have been recorded in similar habitat (i.e. disturbed and modified vegetation) in the past

The potential impact of the project on the Eastern False Pipistrelle was also considered as part of this assessment. No suitable habitat has been identified near to the project area which is considered suitable to support the Eastern False Pipistrelle.

6.6 Positive impacts to biodiversity

As discussed above in Section 5.5, the Cooks River to Iron Cove GreenWay is an important vegetated corridor that extends five kilometres from Iron Cove at Haberfield in the north to the Cooks River at Earlwood in the south following the line of the disused Rozelle freight corridor.

On 19 July 2010, the NSW Government announced that the GreenWay would be included in the SLRE Stage 1 (the Inner West extension) project. The community strongly favoured the inclusion of the GreenWay including a shared walking and cycling path in the corridor, along with a number of Bushcare sites.

The project provides for additional Bushcare sites and vegetation remediation areas in order to provide for existing biodiversity and to promote an increase in local habitat for fauna. As the GreenWay is an example of an almost continuous vegetated corridor in the highly urbanised environment of inner western Sydney, it is an important landscape linkage for the dispersal of fauna and flora. Consequently, the contribution of the project to the creation and functioning of the GreenWay can be seen as a positive biodiversity impact.

Positive impacts to waterways, particularly the Hawthorne Canal, resulting from WSUD may occur as the impact of rapid urban stormwater passage and pollutants will be reduced resulting in benefits to water quality and habitats.

7. Mitigation

7.1 Management of the mitigation process

Prior to construction, detailed flora and fauna mitigation measures would be developed and presented as part of a Flora and Fauna Management plan relating to the construction and operation of the project. The plan would form part of the construction environmental management plan (CEMP) and would address:

- staff and contractor inductions, in particular the location of sensitive biodiversity and roles and responsibilities relating to protection of all native biodiversity
- vegetation clearing protocols, including pre-clearing surveys and fauna salvage/translocation
- rehabilitation and restitution of adjoining habitat
- weed control
- pest management.

The plan would include clear objectives and actions for the project including:

- limiting the clearing of vegetation to that required to construct the project
- minimising human interferences to flora and fauna
- minimising impact to Threatened species, populations and communities
- minimising impacts to aquatic habitats and species.
- the management of vegetation and habitats surrounding the construction footprint including control of weeds and pest species
- the actions to be undertaken to rehabilitate affected areas including revegetation of areas for conservation purposes
- flora and fauna monitoring undertaken at regular intervals.

7.2 Mitigation measures

The general principle to minimise impacts to biodiversity, should in order of consideration, endeavour to:

- avoid impacts on habitat, through the planning process
- minimise impacts on habitat, through the planning process
- mitigate impacts on habitat, though the use of a range of mitigation measures.

The avoidance of impacts can best be achieved through the planning and route selection process. The project largely follows the predefined route of the disused Rozelle goods line corridor and therefore opportunities to reposition the light rail route were not available. A number of possible stop locations and construction compounds were examined for impacts on the environment and other factors (for example, economic and social considerations). The proposed stops and construction areas that best fit the environmental, social and economic criteria were then chosen. The route selection for the GreenWay shared path has been chosen to minimise impacts on existing vegetation where possible and provide for bushcare areas.

Minimising impacts involves reducing the loss of habitat or significant species as far as practicable. The proposed stops and construction compounds are generally loosely defined within the broad corridor. Through detailed surveys within these corridors, it is usually possible to fine-tune the final locations and the width of the footprint to minimise loss of important vegetation communities or habitats and avoid significant plant species or habitat features. The final alignment and construction footprints are also subject to engineering constraints and safety standards.

Residual impacts that cannot be avoided or minimised are mitigated wherever possible. Depending on vegetation and project type, mitigation measures generally employed during construction can include the following:

- fauna exclusion fencing
- landscaping and revegetation
- site rehabilitation.

The following mitigation measures are also recommended (refer Table 7.1).

Table 7-1 Proposed mitigation measures

Impact	Mitigation
Vegetation and habitat loss	▪ limit disturbance of vegetation to the minimum necessary for all construction ▪ clearly mark the limits of clearing and install fencing around areas not to be cleared prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal ▪ an ecologist will inspect all vegetation to be cleared for Long-nosed Bandicoots prior to disturbance. Any Long-nosed Bandicoots located during the pre-clearing surveys will be relocated (if caught) to an appropriate location within the rail corridor that will not be cleared ▪ an ecologist will conduct pre-clearing inspections of any bridges and tunnels that work will be carried out on for the presence of microchiropteran bat species. Any bats found roosting in the bridges or tunnels will be relocated and excluded from roosting in the structures until works have finished ▪ restrict equipment storage and stockpiling of resources to designated areas in cleared land ▪ revegetation of cleared land will take place as soon as practicable after completion of works to reinstate native vegetation and provide habitat for fauna
Fragmentation and connectivity	▪ connectivity will be maintained through revegetation of the GreenWay with native species of local provenance ▪ all areas utilised for construction compounds will be returned to original condition or revegetated with native plant species depending upon their location and future planned use of the site

Impact	Mitigation
Mortality	▪ In order to minimise the likelihood of fauna injury or death during the clearing of vegetation, the following measures would be developed and presented as part of the environmental management plans. ▪ A vegetation clearing protocol would be developed and put in place. The protocol would include: ‣ All areas of potential Long-nosed Bandicoot habitat in the area to be cleared would be identified (by survey) and marked ‣ Marked habitat areas will be disturbed by a person prior to clearing to encourage animals to disperse into adjacent habitat ‣ After disturbance the habitat may be cleared ‣ All contractors would have the contact numbers of wildlife rescue groups should animals be injured during clearing.
Weeds	▪ weed management actions will be developed to manage weeds during the construction phase. This will specifically include the management of weeds listed under the *Noxious Weeds Act 1993* ▪ vegetation to be cleared will not be stockpiled on site and will be disposed of immediately offsite at a suitable waste facility licensed to accept green waste ▪ vehicles and other equipment to be used in clearing within the construction zone and general construction equipment are to be cleaned so that they are completely free of soil, seeds and plant material before entering and leaving the site to prevent the introduction and spread of exotic plant species and pathogens ▪ a weed control program will be developed in consultation with the Inner West Environment Group and local councils. The weed control program will aim to manage weed infestations and to prevent weed encroachment into bushcare sites ▪ competitive planting with native species should be undertaken to decrease the prevalence of weeds within the rail corridor ▪ all landscape plantings are to be of locally indigenous native species to prevent future weed invasion
Noise impacts on fauna	▪ none required. The impact of construction noise to fauna will be minimal in this highly urbanised landscape
Altered hydrology	▪ during detailed design of pavements, other hard surfaces and drainage infrastructure WSUD would be considered to avoid directly potentially contaminated runoff into vegetated areas
Cumulative impacts	▪ the project is in a highly disturbed landscape that possesses little natural vegetation or habitats. The revegetation proposed for the GreenWay and within the rail corridor will seek to reverse the cumulative impacts that have occurred within the locality
Key Threatening Processes	▪ weed control will be conducted throughout the corridor to reduce the potential for establishment and spread of weed species ▪ A suitable land management strategy will be implemented that includes pest control during operation

Impact	Mitigation
Positive impacts	▪ revegetation of construction compounds and construction of the GreenWay will enhance the functioning of the existing vegetation as a wildlife corridor and improve its value as habitat for native fauna ▪ the provision of new bushcare sites will be a positive impact for biodiversity and the community ▪ the project will seek to mitigate habitat compartmentalisation through construction of the GreenWay

8. Impact assessment

For Threatened biodiversity listed under the *Threatened Species Conservation Act 1995*, the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Conservation/ Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation & Department of Primary Industries 2005) must be utilised. The guidelines present methods to consider the impacts on biodiversity of Proposals assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*, including presenting heads of consideration for determining the significance of impacts.

One State and Commonwealth listed Threatened species; the Grey-headed Flying-fox (listed as Vulnerable under the *Threatened Species Conservation Act 1995* and *Environment Protection and Biodiversity Conservation Act 1999*), was recorded in the study area during the survey. Additionally, previous biodiversity surveys within the study area have recorded the Endangered Long-nosed Bandicoot Inner Western Sydney population and the Vulnerable Eastern Bentwing-bat, both listed under the *Threatened Species Conservation Act 1995*, as present. As such, significance assessments have been prepared for these species and population in accordance with the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Conservation/ Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation & Department of Primary Industries 2005). An assessment in accordance with *EPBC* Act - Principal Significant Impact Guidelines 1.1. Matters of National Environmental Significance for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* has been prepared for the Grey-headed Flying-fox. Significance assessments have also been prepared for the Swift Parrot and Little Lorikeet as they are considered to have a moderate likelihood of occurrence within the study area (refer Appendix D).

Although a small amount of habitat removal may occur due to the project, it is unlikely to result in a significant impact to the Endangered Long-nosed Bandicoot population or Threatened species listed under the *Threatened Species Conservation Act 1995* as the project will not:

- affect current disturbance regimes
- significantly affect habitat connectivity
- affect critical habitat.

For the Threatened species listed under the *Environment Protection and Biodiversity Conservation Act 1999*, the Grey-headed Flying-fox and Swift Parrot, the project is unlikely to result in a significant impact as the project will not:

- lead to a long-term decrease in the size of a population of the species'
- reduce the area of occupancy of the species'
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of the species'
- disrupt the breeding cycle of a population

- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to an endangered species becoming established in the endangered species´ habitat
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

Table 8-1 Summary of likely impacts to Threatened biodiversity

Threatened biodiversity		TSC Act[1]	EPBC Act[2]	Significant impact
Scientific name	Common name			
Endangered populations				
Perameles nasuta - Inner Western Sydney population	Long-nosed Bandicoot, inner western Sydney population	E2	-	No
Fauna				
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	No
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	No
Lathamus discolor	Swift Parrot	E	E	No
Glossopsitta pusilla	Little Lorikeet	V	-	No

Notes:

1) TSC Act - *Threatened Species and Conservation Act 1995*. E = Endangered V = Vulnerable E2= Endangered Population

2) EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999*. E = Endangered V = Vulnerable

9. Residual impacts and compensatory measures

Residual impacts are those that remain after the implementation of the project and all associated mitigation and other environmental management measures have been put in place. There are likely to be minimal residual impacts associated with the project, as the subject site currently exists in a highly modified and non natural state. However, the study area provides habitat to the Endangered Long-nosed Bandicoot, inner western Sydney population and some residual habitat loss may occur due to removal of habitat. A time lag will be present between the removal of the habitats and the growth of replacement plantings. Sheltering habitat for the Long-nosed Bandicoot will be absent from the affected areas until the plantings mature.

9.1 Compensatory measures

It should be recognised that the success of compensatory biodiversity measures largely relies on the time lag between habitat loss and replacement of resources. To minimise the time lag between any vegetation removal and revegetation works, revegetation will be undertaken prior to construction in areas where works will not be carried out.

Existing Bushcare sites that may be lost to the project will be offset through establishment of new Bushcare sites as outlined in the GreenWay Bushcare Management Plan (Inner West Environment Group 2010a). Future Bushcare sites have been identified (refer Figures 1a – 1e) and currently occupy an area of approximately 1.7 ha of land. The detailed design process, undertaken with Transport NSW and the IWEG will further refine the locations and areas of the future Bushcare sites.

10. Conclusion

The project is located in the highly modified landscape of inner western Sydney that is dominated by rural-residential and low density urban development in which the remaining areas of remnant vegetation and associated habitat are highly fragmented and isolated. The project incorporates improvement of a large urban bushland corridor, the GreenWay, an important refuge for plant and animal species and an important landscape linkage for fauna movement.

Although highly disturbed and urbanised, the study area contains a range of biodiversity values. The study area is known to provide habitat for the Endangered inner western Sydney Long-nosed Bandicoot population and the Threatened Eastern Bentwing-bat and Grey-headed Flying-fox. Other threatened animal species including the Swift Parrot and Little Lorikeet may also utilise the habitats within the study area on occasion. Several Bushcare sites exist within the study area that have been revegetated with species that formerly composed the Sydney Turpentine-Ironbark Forest community that would have once occupied the landscape.

Mitigation measures outlined in this document would reduce and mitigate impacts to biodiversity that will occur as a result of construction and operation of the project. However, disturbance to areas of vegetation and habitat during construction and operation of the project is unavoidable. While small areas of habitat for Threatened species will be removed, they will however be reinstated through revegetation and the establishment of Bushcare sites. These impacts were assessed as unlikely to be significant to the Endangered inner western Sydney Long-nosed Bandicoot population, the Grey-headed Flying-fox, Eastern Bentwing-bat, Little Lorikeet or Swift Parrot.

Positive impacts are likely to result from the project due to the GreenWay. The project provides for additional Bushcare sites and vegetation remediation areas in order to provide for existing biodiversity and to promote an increase in local habitat for fauna. These works will promote the GreenWay as an important landscape linkage for plant and animal species in the highly urbanised environment of inner western Sydney.

11. References

AMBS 2007, Fauna study, Marrickville LGA, AMBS, Sydney.

Andren, H 1994, 'Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review', Oikos, vol. 71, pp. 355-66.

Ashfield Council 2009, State of the environment report 2004-2009, Ashfield Council.

Benson, D & Howell, J 1990, Taken for granted, the bushland of Sydney and its suburbs, Kangaroo Press in association with the Royal Botanic Gardens, Sydney.

Biosis Research 2010a, Assessment of Significance: Rozelle Goods Line Track Maintenance and Reconstruction, Biosis Research, Sydney.

Biosis Research 2010b, Preliminary ecological assessment: Sydney Light Rail Extension, Stage 1, Biosis Research, Sydney.

Catharinus, F, Jaarsma, A, Langevelde, F & Botma, H 2006, 'Flattened fauna and mitigation: Traffic victims related to road, traffic, vehicle, and species characteristics', Transportation Research, vol. D, no. 11, p. 264/76.

Cropper, SC 1993, Management of Endangered Plants, CSIRO Australia, Melbourne.

Department of Environment and Climate Change 2007a, Introducing the NSW threatened species priorities action statement (PAS), Department of Environment and Climate Change,, Sydney South NSW.

Department of Environment and Climate Change 2007b, Threatened species assessment guidelines. The assessment of significance, Department of Environment and Climate Change, Hurstville.

Department of Environment and Conservation 2004, Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft), Department of Environment and Conservation, Hurstville.

Department of Environment and Conservation & Department of Primary Industries 2005, Draft guidelines for Threatened species assessment under Part 3A, Department of Environment and Conservation, Hurstville.

Department of Environment Climate Change and Water 2009, White-fronted Chat Population in the Sydney Metropolitan Catchment Management Authority Area - profile, Department of Environment Climate Change and Water, viewed 27 August 2010 2010, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20144>.

Department of Environment Climate Change and Water 2010a, Atlas of NSW Wildlife, Department of Environment Climate Change and Water, <http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp>.

Department of Environment Climate Change and Water 2010b, Threatened species, populations and communities database Department of Environment, Climate Change and Water, <http://www.threatenedspecies.environment.nsw.gov.au/>.

Department of the Environment and Heritage 2006, EPBC Act Policy Statement 1.1 Significant Impact Guidelines, Department of the Environment and Heritage, Canberra.

Department of the Environment Water Heritage and the Arts 2009a, Census of Australian Vertebrates, Department of Environment, Water, Heritage and the Arts, <http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/index.html>.

Department of the Environment Water Heritage and the Arts 2009b, EPBC Act Policy Statement 1.1 Matters of National Environmental Significance, Significant Impact Guidelines, Department of the Environment Water Heritage and the Arts, Canberra.

Department of the Environment Water Heritage and the Arts 2010a, EPBC Act List of Threatened Ecological Communities, Department of the Environment Water Heritage and the Arts, <http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl>.

Department of the Environment Water Heritage and the Arts 2010b, Protected Matters Search Tool, Department of the Environment, Water, Heritage and the Arts, <http://www.deh.gov.au/erin/ert/epbc/index.html >.

ecological 2010, Greenway bushcare management plan, preliminary report, ecological, Sutherland.

Ford, HA, Barrett, GW, Saunders, DA & Recher, HF 2001, 'Why have birds in the woodlands of Southern Australia declined?' Biological Conservation, vol. 97, pp. 71-88.

GHD 2010, Sydney Light Rail - Inner West extension study, GHD, Sydney

Green Web 2002, Leichardt and Ashfield revegetation actions related to green web 1996-2002,

GreenWay Coordination Strategy Working Group 2009, Cooks River to Iron Cove Greenway master plan and coordination strategy Marrickville Council, Marrickville.

Harden, G 1992, Flora of New South Wales Volume 3, University of New South Wales Press Ltd., Kensington.

Harden, G 1993, Flora of New South Wales Volume 4, University of New South Wales Press Ltd., Kensington.

Harden, G 2000, Flora of New South Wales Volume 1 (Revised Edition), University of New South Wales Press Ltd., Kensington.

Harden, G 2002, Flora of New South Wales Volume 2 (Revised Edition), 2nd edn, vol. 2, University of New South Wales Press Ltd., Kensington.

Inner West Environment Group 2010a, GreenWay Bushcare Management Plan, Inner West Environment Group, Sydney.

Inner West Environment Group 2010b, Inner West Environment Group, Inner West Environment Group, viewed 30 August 2010 2010, <http://www.iweg.org.au/>.

Krone, O, Langgemach, T, Sömmer, P & Kenntner, N 2000, 'Causes of mortality in White-tailed Sea Eagles from Germany', paper presented to Proceedings Swedish Society for Nature Conservation, Stockholm, Sweden.

Leary, T, Kwok, A, Khan, B & Ibbetson, P unpublished, 'Yuppie bandicoots of inner west Sydney - in hiding or urban renewal?'

Leichardt Council 2009, State of the environment report 2008-2009, Leichardt Council.

Longcore, T & Rich, C 2004, 'Ecological Light Pollution', Frontiers in Ecology and the Environment, vol. 2, no. 4, pp. 191-8.

Marrickville Council 2009, State of the environment report 2008-2009, Marrickville Council.

NSW Department of Environment and Conservation 2007, Field Data Sheets for BioMetric (Version 1.8), NSW Department of Environment and Conservation, Hurstville.

NSW National Parks and Wildlife Service 2001, Clearing of native vegetation as a key threatening process - an overview. Threatened species information fact sheet, NSW National Parks and Wildlife Service,, Hurstville,

NSW Scientific Committee 2001, Final determination to list the clearing of native vegetation as a key threatening process, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 2004, Clearing of native vegetation - key threatening process declaration, Department of Environment and Conservation, Hurstville.

Royal Botanic Gardens 2010, PlantNet - The Plant Information Network System of Botanic Gardens Trust (version 2.0), Royal Botanic Gardens, <http://plantnet.rbgsyd.nsw.gov.au/>.

Schwartz, A & Henderson, RW 1991, Amphibians and Reptiles of the West Indies: descriptions, distributions, and natural history, University of Florida Press, Gainesville.

Thackway, R & Cresswell, ID 1995, An Interim Biogeographic Regionalisation of Australia, Australian Nature Conservation Agency, Canberra.

Thorp, J & Lynch, R 2000, The Determination of Weeds of National Significance, National Weeds Strategy Executive Committee, Launceston.

Tozer, M, Turner, K, Simpson, C, Keith, D, Beukers, P, MacKenzie, B, Tindall, D & Pennay, C 2006, Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands. Version 1.0, Department of Environment and Climate Change, Hurstville.

Transport NSW 2010a, Light rail and GreenWay integration plan, Transport NSW, Sydney,

Transport NSW 2010b, Rozelle Goods Line- rail track maintenance and reconstruction, Review of Environmental Factors, Transport NSW, Sydney.

Transport NSW 2010c, Sydney Light Rail Extension- Stage 1- Inner West Extension. Preliminary Environmental Assessment, Transport NSW, Sydney.

Ward, A 2010, Greenway- Cooks River to Iron Cover. Flora and fauna literature review, Ashfield Council, Ashfield.

Wells, P, Woods, JG, Bridgewater, G & Morrison, H 1999, Wildlife Mortalities on railways: Monitoring methods and mitigations strategies, Canada.

Wilson, A & Lindenmayer, DB 1995, Wildlife Corridors and the Conservation of Biodiversity: A Review., National Corridors of Green Program, Green Australia Ltd., Canberra.

Appendix A

Species recorded in the study area

Table A1 Species of plant recorded within the study area (species marked with an '*' are introduced species)

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
Acanthaceae	*Pseuderanthemum variabile*			✓						
	*Thunbergia alata**	Black-eyed Susan							✓	
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair							✓	
	Cheilanthes sieberi									✓
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach							✓	
Alliaceae	*Agapanthus praecox**	Agapanthus							✓	✓
Amaryllidaceae	*Clivia miniata**	Clivia								✓
Anacardiaceae	*Mangifera indica**	Mango								✓
	*Schinus areira**	Pepper Tree								✓
	*Toxicodendron succedaneum**	Rhus Tree								✓
Anthericaceae	*Chlorophytum comosum**								✓	✓
Apiaceae	*Centella asiatica*	Pennywort					✓		✓	
	*Foeniculum vulgare**	Fennel							✓	✓
Apocynaceae	*Nerium oleander**	Oleander							✓	✓
Araceae	*Monstera deliciosa**	Fruit Salad Plant							✓	✓
Araliaceae	*Hedera helix**	English Ivy								✓
	Polyscias sambucifolia									
	*Schefflera actinophylla**	Umbrella Tree							✓	✓
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine								✓
	*Araucaria heterophylla**	Norfolk Island Pine							✓	
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm							✓	✓
Asclepiadaceae	*Araujia sericifera**	Moth Vine							✓	✓
	*Gomphocarpus physocarpus**	Balloon Cotton Bush							✓	✓
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern								✓
Asteraceae	*Ageratina adenophora**	Crofton Weed							✓	✓
	*Arctotheca calendula**	Capeweed								✓
	*Bidens pilosa**	Cobbler's Pegs							✓	✓
	Calotis cuneifolia	Purple Burr-Daisy		✓						
	Cassinia arcuata			✓						
	Cassinia longifolia			✓						
	Chrysocephalum apiculatum			✓						

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	*Cirsium vulgare**	Spear Thistle								✓
	*Conyza bonariensis**	Flaxleaf Fleabane								✓
	*Conyza sumatrensis**								✓	✓
	*Galinsoga parviflora**									✓
	*Gazania linearis**									✓
	*Hypochaeris radicata**	Catsear								✓
	*Lactuca serriola**	Prickly Lettuce								✓
	Olearia microphylla			✓			✓		✓	
	Ozothamnus diosmifolius	White Dogwood		✓			✓		✓	✓
	*Sonchus asper**	Prickly Sowthistle							✓	✓
	*Sonchus oleraceus**	Common Sowthistle								✓
	*Tagetes minuta**	Stinking Roger							✓	
	*Taraxacum officinale**	Dandelion								✓
Balsaminaceae	*Impatiens wallerana**									✓
Basellaceae	*Anredera cordifolia**	Madeira Vine							✓	✓
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda							✓	✓
	Pandorea pandorana	Wonga Wonga Vine		✓	✓	✓	✓		✓	✓
Blechnaceae	*Blechnum indicum*	Swamp Water Fern							✓	
Brassicaceae	*Brassica** sp.								✓	✓
	*Capsella bursa-pastoris**									✓
Cactaceae	*Opuntia stricta**	Prickly Pear							✓	✓
Callitrichaceae	*Callitriche stagnalis**	Common Starwort							✓	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling or Australian Bluebell		✓	✓	✓	✓			✓
Caprifoliaceae	*Abelia* X *grandiflora**									✓
	*Lonicera japonica**	Japanese Honeysuckle							✓	✓
	*Viburnum tinus**	Viburnum								✓
Casuarinaceae	*Allocasuarina littoralis*	Black Sheoak								✓
	Casuarina cunninghamiana	River Oak	✓	✓		✓	✓	✓	✓	✓
	Casuarina glauca	Swamp Oak							✓	✓
Chenopodiaceae	*Einadia hastata*	Berry Saltbush			✓	✓	✓	✓	✓	✓
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	✓	✓	✓	✓	✓	✓	✓	✓
	*Tradescantia fluminensis**	Wandering Jew							✓	✓
Convolvulaceae	*Convolvulus erubescens*								✓	✓

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	Dichondra repens	Kidney Weed				✓	✓	✓	✓	✓
	*Ipomoea cairica**								✓	
	*Ipomoea indica**	Blue Morning Glory							✓	
	Polymeria calycina								✓	
Crassulaceae	*Bryophyllum delagoense**	Mother of millions							✓	✓
Cunoniaceae	*Callicoma serratifolia*	Black Wattle								✓
Cupressaceae	*Cupressus** sp.									✓
Cyatheaceae	*Cyathea cooperi*	Straw Tree fern							✓	
Cyperaceae	*Carex appressa*			✓			✓			✓
	*Cyperus eragrostis**	Umbrella Sedge							✓	
	Cyperus gracilis					✓	✓	✓		
	*Cyperus papyrus**								✓	
	Lepidosperma laterale				✓	✓	✓			
	Schoenus apogon									✓
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern							✓	✓
Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern		✓						
Dilleniaceae	*Hibbertia aspera*			✓						
	Hibbertia scandens			✓			✓		✓	
Doryanthaceae	*Doryanthes excelsa*	Gymea/Giant Lily								✓
Ericaceae	*Leucopogon juniperinus*			✓						
	Lissanthe strigosa			✓						
Euphorbiaceae	*Breynia oblongifolia*			✓			✓			
	Glochidion ferdinandi	Cheese Tree				✓	✓			✓
	Homalanthus populifolius	"Bleeding Heart, Native Poplar"							✓	✓
	Phyllanthus gasstroemii			✓						
	Poranthera microphylla			✓						
	*Ricinus communis**	Castor Oil Plant							✓	✓
	*Triadica sebifera**	Chinese Tallowwood							✓	
Fabaceae (Caesalpinioideae)	*Bauhinia variegata**	Pink Orchid Tree							✓	
	*Senna didymobotrya**								✓	
	Senna pendula var. *glabrata**									✓
Fabaceae (Faboideae)	*Daviesia ulicifolia*			✓		✓	✓	✓		✓

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	Desmodium rhytidophyllum			✓			✓			
	Dillwynia parvifolia			✓						
	Dillwynia retorta			✓		✓	✓			✓
	Dillwynia sieberi			✓						✓
	Glycine clandestina								✓	✓
	Glycine tabacina									✓
	Hardenbergia violacea	False Sarsaparilla	✓	✓		✓	✓	✓	✓	✓
	Indigofera australis			✓	✓	✓	✓	✓	✓	✓
	Kennedia rubicunda			✓			✓	✓	✓	
	*Medicago polymorpha**	Burr Medic							✓	✓
	Podolobium ilicifolium			✓						
	Pultenaea villosa			✓						
	*Trifolium repens**	White Clover							✓	✓
	*Vicia sativa**								✓	✓
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle								✓
	Acacia falcata		✓	✓	✓	✓	✓	✓	✓	✓
	Acacia floribunda	White Sally								✓
	Acacia implexa	Hickory Wattle								✓
	Acacia linifolia	Flax-leaved Wattle							✓	✓
	Acacia longifolia var. *longifolia*			✓	✓	✓	✓	✓	✓	✓
	Acacia melanoxylon	Blackwood							✓	✓
	Acacia myrtifolia	Red-stemmed Wattle	✓	✓	✓	✓	✓	✓		
	Acacia parramattensis	Parramatta Wattle			✓	✓	✓		✓	✓
	*Acacia podalyriifolia**	Queensland Silver Wattle							✓	
	Acacia prominens	Gosford Wattle								✓
	*Acacia saligna**	Golden Wreath Wattle							✓	✓
	Acacia stricta	Straight Wattle		✓		✓				
	Acacia suaveolens	Sweet Wattle		✓		✓	✓	✓		
	Acacia terminalis	Sunshine Wattle		✓						
	Acacia ulicifolia	Prickly Moses		✓		✓	✓			✓
	Paraserianthes lophantha subsp. *lophantha**	Crested Wattle							✓	

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
Fumariaceae	*Fumaria muralis**								✓	✓
Geraniaceae	*Geranium* sp.								✓	
Gleicheniaceae	*Gleichenia dicarpa*								✓	✓
Goodeniaceae	*Goodenia bellidifolia*			✓						
	Goodenia hederacea			✓						
	Goodenia heterophylla			✓			✓			
	Goodenia ovata			✓						
Haloragaceae	*Gonocarpus teucrioides*			✓	✓	✓	✓			
Juncaceae	*Juncus continuus*						✓			
	Juncus subsecundus						✓			
	Juncus usitatus								✓	✓
Lamiaceae	*Prostanthera incana*			✓						
	Westringia longifolia								✓	
Lauraceae	*Cassytha pubescens*									✓
	*Cinnamomum camphora**	Camphor Laurel							✓	✓
Linaceae	*Linum marginale*			✓						
Lobeliaceae	*Lobelia alata*	Angled Lobelia							✓	
	Pratia purpurascens	White root			✓	✓	✓	✓	✓	✓
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	✓	✓	✓	✓	✓	✓	✓	✓
	Lomandra multiflora				✓		✓			
Malaceae	*Cotoneaster glaucophyllus**									✓
	*Cotoneaster pannosus**								✓	✓
	*Eriobotrya japonica**	Loquat								✓
Malvaceae	*Abutilon grandifolium**								✓	✓
	*Malva parviflora**	Small-flowered Mallow								✓
	*Sida rhombifolia**	Paddy's Lucerne							✓	✓
Moraceae	*Ficus benjamina**	Weeping Fig							✓	✓
	*Ficus elastica**								✓	
	Ficus macrophylla									✓
	*Ficus microcarpa**									✓
	Ficus rubiginosa	"Port Jackson Fig, Rusty Fig"							✓	✓
	*Morus nigra**	Black Mulberry							✓	✓
Myrtaceae	*Angophora floribunda*	Rough-barked Apple				✓			✓	

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	Callistemon citrinus	Crimson Bottlebrush							✓	✓
	Corymbia citriodora								✓	✓
	Eucalyptus botryoides	Bangalay								✓
	Eucalyptus crebra	Narrow-leaved Ironbark								✓
	Eucalyptus elata	River Peppermint		✓						
	Eucalyptus fibrosa				✓					
	Eucalyptus globoidea				✓					✓
	Eucalyptus gummifera	Red Bloodwood		✓						
	Eucalyptus haemastoma	Broad-leaved Scribbly Gum		✓						
	Eucalyptus longifolia	Woolly butt		✓						
	Eucalyptus microcorys	Tallowwood								✓
	Eucalyptus paniculata	Grey Ironbark		✓	✓	✓		✓		
	Eucalyptus pilularis	Blackbutt								✓
	Eucalyptus piperita	Sydney Peppermint		✓						
	Eucalyptus punctata	Grey Gum		✓						
	Eucalyptus resinifera	Red Mahogany		✓						
	Eucalyptus robusta	Swamp Mahogany								✓
	Eucalyptus saligna	Sydney Blue Gum							✓	✓
	Eucalyptus sideroxylon	Mugga Ironbark								✓
	Eucalyptus sp.								✓	✓
	Eucalyptus tereticornis	Forest Red Gum								✓
	Kunzea ambigua	Tick Bush		✓		✓	✓	✓	✓	✓
	Leptospermum polygalifolium			✓			✓	✓		
	Lophostemon confertus	Brush Box							✓	✓
	Melaleuca armillaris								✓	✓
	Melaleuca decora			✓		✓			✓	
	Melaleuca linariifolia						✓			✓
	Melaleuca nodosa			✓			✓		✓	✓
	Melaleuca quinquenervia	Broad-leaved Paperbark							✓	✓
	Syncarpia glomulifera	Turpentine		✓	✓	✓		✓	✓	✓
Nyctaginaceae	*Bougainvillea glabra**								✓	
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant								✓

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
Oleaceae	*Jasminum mesnyi**									✓
	*Ligustrum lucidum**	Large-leaved Privet							✓	✓
	*Ligustrum sinense**	Small-leaved Privet								✓
	*Notelaea longifolia**	Large Mock-olive			✓	✓	✓		✓	✓
	Olea europaea ssp. *cuspidata**								✓	✓
Oxalidaceae	*Oxalis exilis*								✓	
Phormiaceae	*Dianella caerulea*		✓	✓	✓	✓	✓	✓	✓	✓
	Dianella longifolia			✓		✓			✓	
	Dianella revoluta			✓						
Pinaceae	*Pinus** sp.								✓	✓
Pittosporaceae	*Billardiera scandens*									
	Bursaria spinosa	Native Blackthorn	✓	✓	✓	✓	✓	✓	✓	✓
	Pittosporum revolutum			✓			✓		✓	✓
	Pittosporum undulatum	Sweet Pittosporum							✓	✓
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues							✓	✓
Poaceae	*Andropogon virginicus**	Whisky Grass							✓	✓
	Aristida sp.								✓	
	Aristida vagans						✓			
	Austrodanthonia fulva			✓						
	Austrodanthonia setacea						✓	✓		
	Austrodanthonia sp.								✓	
	Austrodanthonia tenuior		✓	✓		✓	✓	✓		
	Austrodanthonia vulva or linkii var. *linkii*		✓	✓	✓	✓	✓	✓		
	*Avena** sp.								✓	
	Bothriochloa macra	Red Grass			✓	✓	✓		✓	
	*Bromus catharticus**	Prairie Grass								✓
	*Chloris gayana**	Rhodes Grass							✓	✓
	*Cortaderia selloana**	Pampas Grass							✓	✓
	Cymbopogon refractus	Barbed Wire Grass			✓	✓	✓		✓	✓
	*Cynodon dactylon**	Common Couch							✓	✓
	Danthonia longifolia	Long-leaved Wallaby Grass		✓						
	Dichelachne crinita	Longhair Plume grass		✓						

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	Dichelachne micrantha			✓		✓	✓	✓		
	Dichelachne rara						✓	✓		
	Dichelachne sp.								✓	
	Dichelachne crinita			✓	✓	✓	✓	✓		
	*Digitaria sanguinalis**	Crab Grass							✓	✓
	Echinopogon caespitosus var. *caespitosus*		✓	✓	✓	✓	✓			
	Echinopogon ovatus	Forest Hedgehog Grass							✓	✓
	*Ehrharta erecta**	Panic Veldt grass							✓	
	Entolasia marginata						✓			
	Entolasia stricta					✓	✓			
	Eragrostis brownii				✓		✓			
	*Eragrostis curvula**	African Lovegrass							✓	✓
	Imperata cylindrica	Blady Grass		✓			✓		✓	✓
	Lachnagrostis filiformis						✓			
	*Lolium perenne**	Perennial Ryegrass								✓
	*Melinis repens**	Red Natal Grass							✓	✓
	Microlaena stipoides			✓	✓	✓	✓	✓	✓	✓
	Oplismenus aemulus				✓	✓	✓			✓
	*Panicum maximum**	Guinea Grass								✓
	*Paspalum dilatatum**	Paspalum							✓	✓
	*Paspalum urvillei**	Vasey Grass							✓	✓
	*Pennisetum alopecuroides**	Swamp Foxtail								✓
	*Pennisetum clandestinum**	Kikuyu Grass							✓	✓
	Phragmites australis	Common Reed								✓
	*Phyllostachys aurea**	Fish pole Bamboo							✓	✓
	Poa affinis				✓	✓	✓			
	*Poa annua**	Winter Grass								✓
	*Setaria gracilis**	Slender Pigeon Grass							✓	✓
	Stipa pubescens			✓						
	Themeda australis	Kangaroo Grass		✓	✓	✓	✓	✓	✓	✓
Polygonaceae	*Acetosa sagittata**	Rambling Dock							✓	✓
	Persicaria decipiens	Slender Knotweed							✓	✓

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
	*Rumex brownii**									✓
Primulaceae	*Anagallis arvensis**	Scarlet/Blue Pimpernel								✓
Proteaceae	*Banksia ericifolia*	Heath Banksia							✓	✓
	Banksia integrifolia			✓			✓			✓
	Banksia serrata									✓
	Grevillea buxifolia			✓			✓			✓
	*Grevillea robusta**	Silky Oak							✓	✓
	*Grevillea** sp. Hort.								✓	✓
	Hakea sericea			✓	✓	✓	✓	✓		
	Hakea teretifolia			✓					✓	
	Persoonia linearis			✓						
Psilotaceae	*Psilotum nudum*	Skeleton Forked Fern							✓	
Pteridaceae	*Pteris tremula*	Tender Brake		✓						
	*Pteris vittata**	Chinese Brake								✓
Rhamnaceae	*Pomaderris* sp.								✓	
Rosaceae	*Rubus fruiticosus**	Blackberry complex							✓	✓
Rubiaceae	*Galium aparine**	Goosegrass							✓	✓
	Opercularia varia			✓						
	*Richardia brasiliensis**	Mexican Clover								✓
Rutaceae	*Zieria smithii*	Sandfly Zieria			✓	✓	✓			
Sapindaceae	*Cardiospermum grandiflorum**	Balloon Vine							✓	✓
	Cupaniopsis anacardioides	Tuckeroo								✓
	Dodonaea falcata								✓	✓
	Dodonaea triquetra		✓	✓	✓	✓	✓	✓		✓
Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell			✓	✓	✓			
Selaginellaceae	*Selaginella* sp.			✓						
Simaroubaceae	*Ailanthus altissima**	Tree of Heaven							✓	✓
Smilacaceae	*Smilax glyciphylla*			✓						
Solanaceae	*Cestrum parqui**	Green Cestrum							✓	✓
	*Solanum chenopodinum**									✓
	*Solanum linnaeanum**	Apple of Sodom							✓	✓
Stackhousiaceae	*Stackhousia viminea*			✓						
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree								✓
Typhaceae	*Typha domingensis*	Narrow-leaved							✓	✓

Family name	Scientific name	Common name	Previous surveys							Current survey[8]
			Lords Rd[1]	Cadigal[2]	Area 1[3]	Area 2[4]	Area 3[5]	Annex[6]	Freight corridor[7]	
		Cumbungi								
	Typha orientalis	Broad-leaved Cumbungi								✓
Ulmaceae	*Celtis sinensis**	Chinese Nettle Tree							✓	✓
Urticaceae	*Parietaria judaica**	Pellitory							✓	✓
Verbenaceae	*Lantana camara**	Lantana							✓	✓
	*Verbena officinalis**								✓	✓
Violaceae	*Viola hederacea*						✓			✓
	*Viola** sp.									✓

Notes:

1) Lords Road Lewisham Bushcare site recorded by the Inner West Environment Group (2010).

2) Cadigal Reserve Lewisham Bushcare site recorded by the Inner West Environment Group (2010).

3) Dulwich Hill Area 1 – north of Davis Street recorded by the Inner West Environment Group (2010).

4) Dulwich Hill Area 2 – Piggot Street adjacent to Hoskins Park recorded by the Inner West Environment Group (2010).

5) Dulwich Hill Area 3 – Terry Road Waratah Mills recorded by the Inner West Environment Group (2010).

6) Adjacent to the Annex building at Waratah Mills recorded by the Inner West Environment Group (2010).

7) Results of the freight corridor study prepared by Biosis Research (2010).

8) Species recorded during the current survey.

Table A2 Species of animal recorded within the study area. Species marked with an '*' are introduced species

Family Name	Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Observation type[3]	AMBS[4]	Biosis[5]	IWEG[6]	Current survey[7]
Amphibians									
Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog			O		✓		
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet			O	✓	✓		✓
Reptiles									
Scincidae	*Eulamprus quoyii*	Eastern Water Skink			O	✓			
	Lampropholis guichenoti	Garden Skink			O	✓	✓		
	Lampropholis delicata	Grass Skink			O	✓	✓		
	Cryptoblepharus virgatus	Wall Lizard			O	✓			✓
	Saproscincus mustelinus	Weasel Skink			O	✓			
Birds									
Accipitridae	*Accipiter fasciatus*	Brown Goshawk			O			✓	
	Elanus axillaris	Black-shouldered Kite			O			✓	
Anatidae	*Anas castanea*	Chestnut Teal			O			✓	
	Anas superciliosa	Pacific Black Duck			O			✓	✓
Apodidae	*Apus pacificus*	Fork-tailed Swift		M	O				✓
Ardeidae	*Ardea intermedia*	Intermediate Egret			O			✓	
	Butorides striatus	Striated Heron			O			✓	
	Egretta novaehollandiae	White-faced Heron			O			✓	
Artamidae	*Gymnorhina tibicen*	Australian Magpie			O	✓	✓	✓	✓
	Cracticus torquatus	Grey Butcherbird			O		✓		✓
	Strepera graculina	Pied Currawong			O	✓	✓	✓	✓
Cacatuidae	*Cacatua roseicapilla*	Galah			O			✓	✓
	Cacatua galerita	Sulphur-crested Cockatoo			O			✓	✓
	Calyptorhynchus funereus	Yellow-tailed Black-cockatoo			O			✓	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike			O	✓	✓	✓	✓
Charadriidae	*Vanellus miles*	Masked Lapwing			O		✓	✓	✓

Family Name	Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Observation type[3]	AMBS[4]	Biosis[5]	IWEG[6]	Current survey[7]
Columbidae	*Ocyphaps lophotes*	Crested Pigeon			O	✓	✓	✓	✓
	Geopelia striata	Peaceful Dove			O				✓
Coraciidae	*Eurystomus orientalis*	Dollar bird			O			✓	
Corvidae	*Corvus coronoides*	Australian Raven			O	✓	✓	✓	✓
Cuculidae	*Eudynamys scolopacea*	Common Koel			O	✓			
	Cacomantis flabelliformis	Fan-tailed Cuckoo			O			✓	
Dicruridae	*Monarcha melanopsis*	Black-faced Monarch		M	O			✓	
	Rhipidura fuliginosa	Grey Fantail			O				✓
	Grallina cyanoleuca	Magpie-lark			O	✓	✓	✓	✓
	Dicrurus bracteatus	Spangled Drongo			O			✓	
	Rhipidura leucophrys	Willie Wagtail			O		✓	✓	✓
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra			O		✓	✓	✓
	Todiramphus sanctus	Sacred Kingfisher			O			✓	
Hirundinidae	*Hirundo ariel*	Fairy Martin			O			✓	
	Hirundo neoxena	Welcome Swallow			O		✓		✓
Laridae	*Sterna bergii*	Crested Tern			O			✓	
	Larus pacificus	Pacific Gull			O	✓		✓	
	Larus novaehollandiae	Silver Gull			O		✓	✓	✓
Maluridae	*Malurus cyaneus*	Superb Fairy-wren			O	✓	✓	✓	✓
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill			O			✓	
	Anthochaera chrysoptera	Little Wattlebird			O	✓			✓
	Phylidonyris novaehollandiae	New Holland Honeyeater			O	✓	✓	✓	✓
	Philemon corniculatus	Noisy Friarbird			O			✓	
	Manorina melanocephala	Noisy Miner			O	✓	✓	✓	✓
	Anthochaera carunculata	Red Wattlebird			O	✓	✓	✓	✓
	Phylidonyris nigra	White-cheeked Honeyeater			O				✓
	Lichenostomus penicillatus	White-plumed Honeyeater			O			✓	✓

Family Name	Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Observation type[3]	AMBS[4]	Biosis[5]	IWEG[6]	Current survey[7]
	Lichenostomus chrysops	Yellow-faced Honeyeater			O			✓	
Muscicapidae	*Acrocephalus stentoreus*	Clamorous Reed-Warbler			O	✓		✓	
Oriolidae	*Sphecotheres viridis*	Figbird			O		✓	✓	✓
	Oriolus sagittatus	Olive-backed Oriole			O			✓	
Pardalotidae	*Gerygone mouki*	Brown Gerygone			O	✓			
	Pardalotus punctatus	Spotted Pardalote			O		✓	✓	
	Sericornis frontalis	White-browed Scrub wren			O			✓	
	Acanthiza nana	Yellow Thornbill			O				✓
Passeridae	*Neochmia temporalis*	Red-browed Finch			O		✓		
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant			O			✓	
	Phalacrocorax melanoleucos	Little Pied Cormorant			O			✓	
	Glossopsitta concinna	Musk Lorikeet			O				✓
Psittacidae	*Platycercus eximius*	Eastern Rosella			O			✓	✓
	Trichoglossus haematodus	Rainbow Lorikeet			O	✓	✓	✓	✓
	Psephotus haematonotus	Red-rumped Parrot			O			✓	
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet			O	✓			
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt			O			✓	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis			O	✓	✓	✓	✓
	Platalea regia	Royal Spoonbill			O			✓	
Zosteropidae	*Zosterops lateralis*	Silvereye			O	✓	✓		
Columbidae	*Columba livia**	Rock Dove			O	✓	✓	✓	✓
	*Streptopelia chinensis**	Spotted Turtle-Dove			O	✓	✓	✓	✓
Fringillidae	*Carduelis carduelis**	European Goldfinch			O			✓	
Passeridae	*Passer domesticus**	House Sparrow			O			✓	
Passeridae	*Lonchura punctulata**	Nutmeg Manikin			O		✓		
Pycnonotidae	*Pycnonotus jocosus**	Red-whiskered Bulbul			O		✓		

Family Name	Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Observation type[3]	AMBS[4]	Biosis[5]	IWEG[6]	Current survey[7]
Sturnidae	*Acridotheres tristis**	Common Myna			O	✓	✓	✓	✓
	Sturnus vulgaris*	Common Starling			O		✓	✓	✓
Mammals									
Macropodidae	*Wallabia bicolor*	Swamp Wallaby			O	✓			
Muridae	*Rattus sp.*	rat			O		✓		
	*Rattus rattus**	Black Rat			O H				✓
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot	E2		O	✓			
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	O	✓			✓
Canidae	*Canis familiaris**	Dog (feral)			O	✓	✓		
	*Vulpes vulpes**	European Fox			O		✓		
Felidae	*Felis catus**	Cat (feral)			O	✓			✓
Muridae	*Mus musculus**	House Mouse			O	✓			

Notes:

1) V= Vulnerable, E2 = Endangered population (*Threatened Species Conservation Act 1995*).

2) V = Vulnerable, M = Migratory (*Environment Protection and Biodiversity Conservation Act 1999*).

3) O = Observed, H = Hair or feathers

4) Results of the survey of the Dulwich Hill Freight Corridor by Australian Museum Business Services (AMBS 2007).

5) Results of the survey conducted for the preliminary assessment of the SLRE Stage 1 by Biosis Research (Biosis Research 2010).

6) A full list of bird species recorded along the Hawthorne Canal by David Rudder of the Inner West Environment Group (Inner West Environment Group 2010).

7) Species recorded during the current survey.

Appendix A References

AMBS 2007, *Fauna study, Marrickville LGA*, AMBS, Sydney.

Biosis Research 2010, *Preliminary ecological assessment: Sydney Light Rail Extension, Stage 1*, Biosis Research, Sydney.

Inner West Environment Group 2010, *Inner West Environment Group*, Inner West Environment Group, viewed 30 August 2010 2010, <http://www.iweg.org.au/>.

Appendix B

Threatened species of plant predicted to occur within the locality

Table B.1 Threatened species of plant predicted to occur within the locality

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Asclepiadaceae	*Cynanchum elegans*	White-flowered Wax Plant	E	E	3Ei	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes (Harden 1992). This species typically occurs at the ecotone between dry subtropical forest/woodland communities (James 1997; NSW National Parks and Wildlife Service 2002a).	Low No suitable habitat is present in the study area
Casuarinaceae	*Allocasuarina portuensis*		E	E	2EiT	Known from only a single population within Sydney Harbour National Park. The single population has declined from only 10 individuals in 1986 to only a single female surviving in 2002, excluding re-introduced individuals (NSW National Parks and Wildlife Service 2004b).	Low No suitable habitat is present in the study area
Convolvulaceae	*Wilsonia backhousei*	Narrow-leafed Wilsonia	V			Occurs chiefly in the Sydney district but also common at Jervis Bay (Harden 2000). A salt tolerant species, it is found in intertidal saltmarshes and sometimes on seacliffs (NSW Scientific Committee 2000).	Low No suitable habitat is present in the study area
Dilleniaceae	*Hibbertia puberula*		E			Has not been seen for over 40 years. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains (Department of Environment and Climate Change 2008).	Low No suitable habitat is present in the study area
Dilleniaceae	*Hibbertia superans*		E			Occurs from Castle Hill to South Maroota where it grows in ridgetop woodlands usually near Shale/Sandstone Transition Forest. It is often associated with other threatened flora including *Pimelea curviflora* var. *curviflora*, *Darwinia biflora*, *Epacris purpurascens* var. *purpurascens*, *Leucopogon fletcheri* subsp. *fletcheri*, *Acacia bynoeana*, *Eucalyptus* sp. Cattai and *Persoonia hirsuta* (NSW Scientific Committee 2001).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Elaeocarpaceae	*Tetratheca glandulosa*		V	V	2V	Occurs from Mangrove Mountain to the Blue Mountains where it grows in sandy or rocky heath or scrub (Harden 1992). Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa*, and/or *E. sparsifolia*, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae (Department of Environment and Climate Change 2008).	Low No suitable habitat is present in the study area
Elaeocarpaceae	*Tetratheca juncea*	Black-eyed Susan	V	V	3Vi	Occurs in coastal districts from Buladelah to Port Macquarie where it grows in dry sclerophyll forest and occasionally swampy heath in sandy, (Harden 1992) low nutrient soils with a dense understorey of grasses. Specifically it is known to occur within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland (Payne *et al.* 2002).	Low No suitable habitat is present in the study area
Ericaceae	*Epacris purpurascens* var. *purpurascens*		V		2K	Occurs in Gosford and Sydney districts where it grows in sclerophyll forest, scrub and swamps (Harden 1992). Usually found in sites with a strong shale influence (NSW National Parks and Wildlife Service 2002b).	Low No suitable habitat is present in the study area
Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	E			Occurs in coastal regions of NSW where it grows on sand dunes near the sea (Harden 2000). Grows on fore-dunes and exposed headlands, often with Spinifex (*Spinifex sericeus*) (Department of Environment and Conservation 2005).	Low No suitable habitat is present in the study area
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V	V	2Vi	Occurs on the Cumberland Plain from the Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite (Harden 2002). Specifically, occurs within Castlereagh woodlands, particularly in shale gravel transition forest. Associated species include *Eucalyptus fibrosa, E. sclerophylla, Melaleuca decora, Daviesia ulicifolia, Dillwynia juniperina* and *Allocasuarina littoralis* (James 1997).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Fabaceae (Faboideae)	*Pultenaea pedunculata*	Matted Bush-pea	E			Restricted to Wianamatta Shales of the Cumberland Plain from Bankstown to Liverpool and on the South Coast in the Southeast Corner Bioregion at Bournda. If grows on a variety of soils in dry sclerophyll forest and disturbed sites (Harden 2000; NSW National Parks and Wildlife Service 2002c; NSW Scientific Committee 1999b). It is largely confined to loamy soils in dry gullies in populations in the Windellama area (Department of Environment and Climate Change 2008).	Low No suitable habitat is present in the study area
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E	V	3V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata* and *Angophora bakeri* (NSW National Parks and Wildlife Service 1999).	Low No suitable habitat is present in the study area
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	3Va	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones (Harden 2002; NSW National Parks and Wildlife Service 2003).	Low No suitable habitat is present in the study area
Fabaceae (Mimosoideae)	*Acacia terminalis* subsp. *terminalis*		E	E	2Ri	Grows in scrub and dry sclerophyll woodland between Botany Bay and the northern foreshore of Port Jackson. The locations from which several of the early collections were made no longer provide habitat, having been cleared for development of the eastern suburbs. Recent collections have been made only from Clifton Gardens, Dover Heights, Parsley Bay, Nielsen Park, Cooper Park, Chifley and Watsons Bay (NSW National Parks and Wildlife Service 2004a).	Low No suitable habitat is present in the study area
Grammitaceae	*Grammitis stenophylla*	Narrow-leaf Finger Fern	E			A fern which occurs in coastal regions from Queensland to the NSW south coast where it grows on rocks in rainforest and in wet sclerophyll forest (Harden 2000).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Gyrostemonaceae	*Gyrostemon thesioides*		E		2K	Confined to the Georges and Nepean Rivers where it occurs on river banks. It is a fire-opportunist (James 1997; NSW Scientific Committee 1998b; Royal Botanic Gardens 2005).	Low No suitable habitat is present in the study area
Haloragaceae	*Haloragodendron lucasii*		E	E	2Ea	Confined to the Sydney area where it grows in dry sclerophyll open forest on sheltered slopes near creeks on sandstone (Harden 2002). Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels (Department of Environment and Conservation 2005).	Low No suitable habitat is present in the study area
Lamiaceae	*Prostanthera marifolia*		E4	X	2X	Thought to be extinct. Previously occurred in Mangrove Mountain and Sydney districts usually near the coast. Recorded within sclerophyll forest and woodland in sandy loamy soils on sandstone Occurs in the Springwood area where it grows in woodland on lateritic soils (Harden 1992). The taxonomic status of this name is uncertain (Royal Botanic Gardens 2004).	Low No suitable habitat is present in the study area
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V		2Ri	Occurs chiefly from Georges to the Hawkesbury River where it grows in dry sclerophyll forest, open forest, scrubland or woodland on sandstone. Found in damp places, usually in gullies (Fairley & Moore 2002; Harden 2002; Robinson 1994). Within the Sydney region, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (NSW Scientific Committee 1999a).	Low No suitable habitat is present in the study area
Myrtaceae	*Darwinia biflora*		V	V	2Va	Occurs from Cheltenham to Hawkesbury River where it grows in heath on sandstone or in the understorey of woodland on shale-capped ridges (Harden 2002). Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open forest or scrub-heath (Department of Environment and Climate Change 2008).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Myrtaceae	*Eucalyptus camfieldii*	Heart-leaved Stringybark	V	V	2Vi	Restricted distribution in a narrow band with the most northerly records in the the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park (Department of Environment and Climate Change). Occurs within poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of *E. oblonga*, *E. capitellata* and *E. haemastoma* (Department of Environment and Climate Change).	Low No suitable habitat is present in the study area
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	3V	Occurs from Niangala to Glenn Innes where it grows in grassy sclerophyll woodland on shallow relatively infertile soils on shales and slates, mainly on granite (Harden, 1991; DLWC, 2001). Endemic on the NSW Northern Tablelands, of limited occurrence, particularly in the area from Walcha to Glen Innes; often on porphyry or granite (Brooker and Kleinig 1999).	Low No suitable habitat is present in the study area. Would exist only as street plantings
Myrtaceae	*Leptospermum deanei*		V	V	2V	Only occurs near the watershed of Lane Cove River where it grows on forested slopes (Harden 2002).Woodland on lower hills and slopes or near creeks, sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub- e.g. *Tristaniopsis laurina, Baeckea myrtifolia,* Woodland- e.g. *Eucalyptus haemstoma* and Open Forest - e.g. *Angophora costata, Leptospermum trinervium* and *Banksia ercifolia* (Department of Environment and Climate Change).	Low No suitable habitat is present in the study area
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	3R	Occurs in coastal districts, including western Sydney (e.g. Baulkham Hills, Liverpool shires) from Berowra to Nowra where it grows in wet heath on sandstone and shallow/skeletal soils near streams or perched swamps (Harden 2002; James 1997).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V	3Ri	Occurs between Buladelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (Department of Environment and Climate Change 2008).	Low No suitable habitat is present in the study area
Orchidaceae	*Caladenia tessellata*	Thick Lip Spider Orchid	E	V	3V	Occurs south of Swansea where it grows on clay loam or sandy soils (Harden 1993). Prefers low open forest with a heathy or sometimes grassy understorey (Bishop 2000). Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas (NSW Scientific Committee 2002).	Low No suitable habitat is present in the study area
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	V		3R	Grows in sparse sclerophyll forest and moss gardens over sandstone; from the Hunter Valley to Nowra district (Royal Botanic Gardens 2004).	Low No suitable habitat is present in the study area
Orchidaceae	*Microtis angusii*		E	E		This species exists as an underground tuber for most of the year, with leaves and flowering stems being produced in late winter and early spring (Gunninah Environmental Consultants 2003). Flowers from May to October (Jones 2006). Known from few small populations at Sunny Corner near Bathurst, Ingleside and Warringah. Known to occur within Duffy's Forest (Warringah Shire Council 2004). Habitat includes *Melaleuca quinquenervia* swamp forest (Tacoma) and ecotone between wet heathland/sedgeland and the upslope of *Angophora costata, Corymbia gummifera, Eucalyptus haemastoma, E. Capitellata, E. piperita, E. umbra* open forest (Gunninah Environmental Consultants 2003).	Low No suitable habitat is present in the study area
Orchidaceae	*Prasophyllum fuscum*	Slaty Leek Orchid	V	V	2V	Occurs in the Blue Mountains and Hawkesbury Sandstone where it grows in moist heath often along seepage lines (Harden 1993). It prefers brown silty sand on gentle slopes (Bishop 2000).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	E	E		Known now only from Freemans Reach to Picton district. Grows in Sydney Sandstone Gully Forest in shallow or skeletal soils over sandstone shelves, often near streams (Department of Environment and Climate Change 2007; Harden 1993; James 1997)	Low No suitable habitat is present in the study area
Orchidaceae	*Pterostylis* sp. 'Botany Bay'	Botany Bay Bearded Orchid	E		2EiT	Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. It grows in moist level sites on skeletal sandy soils derived from sandstone. It occurs in small localised populations, usually in areas within the heath where the canopy allows filtered light to reach the ground Associated vegetation is coastal heath dominated by *Melaleuca nodosa* and *Baeckea imbricata* (Department of Environment Climate Change and Water 2009)	Low No suitable habitat is present in the study area
Poaceae	*Deyeuxia appressa*		E	E	2E	Occurs in the Hornsby area on wet ground. (Harden 1993; Sharp & Simon 2002).	Low No suitable habitat is present in the study area
Proteaceae	*Grevillea caleyi*	Caley's Grevillea	E	E	2Ei	Occurs in the Terrey Hills-Belrose area north of Sydney where it grows in woodland on laterized sandstone ridgetops (Harden 2002).	Low No suitable habitat is present in the study area. Restricted to Terry Hills/Belrose area
Proteaceae	*Grevillea parviflora* subsp. *parviflora*	Small-flower Grevillea	V	V		Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct populations near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales (Harden 2002; NSW Scientific Committee 1998a).	Low No suitable habitat is present in the study area
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E	E	3Ki	Occurs in central coast and central tableland districts where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) and rarely shale (NSW Scientific Committee 1998c). Often occurs in areas with clay influence, in the ecotone between shale and sandstone (James 1997).	Low No suitable habitat is present in the study area

Family	Scientific name	Common name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Preferred habitat	Likelihood of occurrence within the study area[4]
Proteaceae	*Persoonia nutans*	Nodding Geebung	E	E	2Ei	Confined to the Cumberland Plain where it grows in Castlereagh Scribbly Gum Woodlands and Agnes Banks Woodlands (Harden 2002; James 1997; NSW National Parks and Wildlife Service 2001).	Low No suitable habitat is present in the study area
Thymelaeaceae	*Pimelea curviflora* var. *curviflora*		V	V		Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape (Harden 2000; James 1997; James *et al.* 1999; NSW Scientific Committee 1998d).	Low No suitable habitat is present in the study area
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	3Ei	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox - Ironbark Woodland with *Bursaria spinosa* and *Themeda australis*. In the Illawarra, it occurs on well structured clay soils in grassland or open woodland (Harden 2000; James 1997; NSW National Parks and Wildlife Service 2000).	Low No suitable habitat is present in the study area

Notes:

1. TSC Act - *Threatened Species and Conservation Act 1995*. CE = Critically Endangered, E = Endangered V = Vulnerable
2. EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999*. CE = Critically Endangered, E = Endangered V = Vulnerable, X = Extinct
3. ROTAP (Rare or Threatened Australian Plants (Briggs & Leigh 1996) is a conservation rating for Australian plants. Codes are:

1 Species only known from one collection
- 2 Species with a geographic range of less than 100 km in Australia
- 3 Species with a geographic range of more than 100 km in Australia
- X Species presumed extinct; no new collections for at least 50 years
- E Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
- V Vulnerable species at risk of long-term disappearance through continued depletion.
- R Rare, but not currently considered to be endangered.
- K Poorly known species that are suspected to be Threatened
- C Known to be represented within a conserved area
- a At least 1,000 plants are known to occur within a conservation reserve(s).
- i Less than 1,000 plants are known to occur within a conservation reserve(s).

4. Likelihood of Occurrence – see methods (see Section 3.5)

Appendix B References

Bishop, T 2000, *Field guide to the orchids of New South Wales and Victoria*, Second edn, University of New South Wales Press Pty. Ltd., Sydney.

Briggs, JD & Leigh, JH 1996, *Rare or Threatened Australian Plants*, CSIRO, Canberra.

Department of Environment and Climate Change *Threatened Species Profile: Eucalyptus camfieldii* Department of Environment and Climate Change, viewed 5th June 2009 <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10287>.

Department of Environment and Climate Change *Threatened Species Profile: Leptospermum deanei*, Department of Environment and Climate Change, viewed 9th June 2009 <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10468>.

Department of Environment and Climate Change 2007, *Threatened species, populations and ecological communities*, NSW Department of Environment and Conservation, 2006, <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>.

Department of Environment and Climate Change 2008, *Threatened species, populations and ecological communities*, NSW Department of Environment and Conservation, 2008, <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>.

Department of Environment and Conservation 2005, *Threatened species, populations and ecological communities*, NSW Department of Environment and Conservation, 2006, <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>.

Department of Environment Climate Change and Water 2009, *Threatened species, populations and communities database* Department of Environment, Climate Change and Water, <http://www.threatenedspecies.environment.nsw.gov.au/>.

Fairley, A & Moore, P 2002, *Native plants of the Sydney district. An identification guide*, Revised Edition edn, Kangaroo Press, Sydney.

Gunninah Environmental Consultants 2003, *Wyong ground orchid survey, Wyong Shire*, prepared for Wyong Shire Council, Crows Nest, NSW.

Harden, G 1992, *Flora of New South Wales Volume 3*, University of New South Wales Press Ltd., Kensington.

Harden, G 1993, *Flora of New South Wales Volume 4*, University of New South Wales Press Ltd., Kensington.

Harden, G 2000, *Flora of New South Wales Volume 1 (Revised Edition)*, University of New South Wales Press Ltd., Kensington.

Harden, G 2002, *Flora of New South Wales Volume 2 (Revised Edition)*, 2nd edn, vol. 2, University of New South Wales Press Ltd., Kensington.

James, T 1997, *Urban bushland biodiversity survey. Native flora in western Sydney.* , NSW National Parks and Wildlife Service, Hurstville,

James, T, McDougall, L & Benson, D 1999, *Rare bushland plants of western Sydney*, Royal Botanic Gardens, Sydney.

Jones, DL 2006, *A complete guide to to native orchids of Australia including island Territories*, Reed New Holland, Sydney.

NSW National Parks and Wildlife Service 1999, *Acacia bynoeana threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2000, *Pimelea spicata threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2001, *Persoonia nutans threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2002a, *Cynanchum elegans threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2002b, *Epacris purpurascens var. purpurascens threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2002c, *Pultenaea pedunculata threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2003, *Acacia pubescens threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2004a, *Acacia terminalis subsp. terminalis threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2004b, *Allocasuarina portuensis threatened species listing*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1998a, *Final determination to list Grevillea parvilfora ssp. parviflora as a vulnerable species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1998b, *Final determination to list Gyrostemon thesioides as an endangered species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1998c, *Final determination to list Persoonia hirsuta as an endangered species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1998d, *Final determination to list Pimelea curviflora var curviflora as a vulnerable species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1999a, *Final determination to list Callistemon linearifolius as a vulnerable species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 1999b, *Final determination to list Pultenaea pedunculata as an endangered species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 2000, *Final determination to list Wilsonia Backhousei as a vulnerable species*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 2001, *Final Determination to list Hibbertia superans (a low spreading shrub) as an Endangered species*, Department of Environment and Conservation,

<http://www.environment.nsw.gov.au/determinations/HibbertiaSuperansALowSpreadingShrubEndSpListing.htm>.

NSW Scientific Committee 2002, *Final determination to list Caladenia tessellata as an endangered species*, NSW National Parks and Wildlife Service, Hurstville.

Payne, R, Stevenson, D & Wellington, R 2002, *A standardised approach for counting black-eyed susan populations*, NSW National Parks and Wildlife, Hurstville.

Robinson, L 1994, *Field guide to the native plants of Sydney*, Kangaroo Press, Sydney.

Royal Botanic Gardens 2004, *PlantNet - The Plant Information Network System of Botanic Gardens Trust (version 2.0)*, Royal Botanic Gardens, Sydney,

Royal Botanic Gardens 2005, *PlantNet - The Plant Information Network System of Botanic Gardens Trust (version 2.0)*, Royal Botanic Gardens, Sydney,

Sharp, D & Simon, BK 2002, *AusGrass: Grasses of Australia, CD-ROM, Version 1.0*, Australian Biological Resources Study, Canberra, and Environmental Protection Agency, Queensland.,

Warringah Shire Council 2004, *http://www.warringah.nsw.gov.au/index.htm*, Warringah Shire Council.

Appendix C

Threatened species of animal predicted to occur within the locality

Table C.1 Threatened species and populations of animal predicted to occur within the locality

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Invertebrates					
Meridolum corneovirens	Cumberland Land Snail	E1		The Cumberland Land Snail is restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. It is typically found under logs and other debris, amongst leaf litter and bark around bases of trees. It is also sometimes found under grass clumps and where possible it will burrow into loose soil (NSW National Parks and Wildlife Service 1999c).	Low No suitable habitat is present in the study area
Amphibians					
Crinia tinnula	Wallum Froglet	V		The Wallum Froglet occurs along coast from south-eastern Queensland to Sydney. Mostly associated with swamps, dams and flooded roadside ditches, usually in heathland, where it is confined to acid, paperbark swamps and sedge swamps of the 'wallum' country. Males call any time of year. Breed in late winter (Anstis 2002; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat is present in the study area
Heleioporus australiacus	Giant Burrowing Frog	V	V	The Giant Burrowing Frog is argely confined to the sandstone geology of the Sydney Basin. There is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations the frog is associated with small headwater creeklines and along slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat (Cogger 2000; NSW National Parks and Wildlife Service 2001a).	Low No suitable habitat is present in the study area
Litoria aurea	Green and Golden Bell Frog	E1	V	The Green and Golden Bell Frog has a fragmented distribution of mainly near coastal locations from Lakes Entrance (Victoria) to south of the NSW-Queensland border; as far west as Bathurst in the more elevated southern tablelands and central slopes of NSW. Various types of habitat utilised has been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites (Department of Environment and Conservation 2004, 2005).	Low No suitable habitat is present in the study area
Litoria brevipalmata	Green Thighed Frog	V		Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain (Department of Environment and Climate Change 2009) . Breeding occurs following heavy rainfall in late spring and summer, with frogs aggregating around grassy semi-permanent ponds and flood-prone grassy areas.	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Mixophyes balbus	Stuttering Frog	E1	V	The Stuttering Frog is a terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (Cogger 2000; NSW Scientific Committee 2003).	Low No suitable habitat is present in the study area
Pseudophryne australis	Red-crowned Toadlet	V		The Red-crowned Toadlet occurs within 160 km of Sydney where it is restricted to Hawkesbury Sandstone. It breeds in deep grass and debris adjacent to ephemeral drainage lines. When not breeding individuals are found scattered on sandstone ridges under rocks and logs (Cogger 2000).	Low No suitable habitat is present in the study area
Birds					
Anseranas semipalmata	Magpie Goose	V		The Magpie Goose occurs in shallow wetlands such as large swamps and dams, especially with dense growth of rushes or sedges, and with permanent lagoons and grassland nearby. (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat is present in the study area
Anthochaera phrygia	Regent Honeyeater	E1	EM	The Regent Honeyeater occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Important food trees include *Eucalyptus sideroxylon, E. albens, E. melliodora* and *E. leucoxylon* (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Apus pacificus	**Fork-tailed Swift**		**M**	**The Fork-tailed Swift breeds from central Siberia eastwards through Asia, and is migratory, wintering south to Australia. Individuals never settle voluntarily on the ground and spend most of their lives in the air, living on the insects they catch in their beaks (Higgins 1999).**	**Present** **This species was recorded flying over the study area during the survey**
Ardea ibis	Cattle Egret		M	The Cattle Egret is found across the Indian subcontinent and Asia as far north as Korea and Japan, and in South-east Asia, Papua New Guinea and Australia (McKilligan 2005).	Low No suitable habitat is present in the study area
Ardea modesta	**Eastern Great Egret**		**M**	**Great Egrets are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands. In Australia, the breeding season of the Great Egret is normally October to December in the south and March to May in the north. This species breeds in colonies, and often in association with cormorants, ibises and other egrets (Australian Museum 2003).**	**Moderate** **The Great Egret may utilise the Hawthorne Canal for foraging**

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Botaurus poiciloptilus	Australasian Bittern	V		The Australasian Bittern occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat is present in the study area
Burhinus grallarius	Bush Stone-curlew	E1		The Bush Stone-curlew requires sparsely grassed, lightly timbered, open forest of woodland. In southern Australia they often occur where there is a well structured litter layer and fallen timber debris. Feed on a range of invertebrates and small vertebrates, as well as seeds and shoots (NSW National Parks and Wildlife Service 1999b, 2003b).	Low No suitable habitat is present in the study area
Calidris alba	Sanderling	V	M	The Sanderling is a coastal species found on low and open sand beaches exposed to open sea-swells. A migratory species, it has been recorded in NSW from September to May (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Calidris tenuirostris	Great Knot	V	M	The Great Knot is generally a coastal species found on tidal mudflats and sandy ocean shores. A migratory species visiting Australian waters between September and March (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Callocephalon fimbriatum	Gang-gang Cockatoo	V		The Gang-gang Cockatoo occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		The Glossy Black-Cockatoo occurs in eucalypt woodland and forest with Casuarina/Allocasuarina spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key Allocasuarina species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 1999d).	Low No suitable habitat is present in the study area
Charadrius leschenaultii	Greater Sand Plover	V	M	The Greater Sand Plover is entirely coastal in NSW foraging on intertidal sand and mudflats in estuaries, and roosting during high tide on sand beaches or rocky shores. A migratory species it is found in New South Wales generally during the summer months (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Charadrius mongolus	Lesser Sand Plover	V	M	The Lesser Sand Plover is a migratory bird that migrates from the northern hemisphere to coastal areas of northern and east coast of Australia (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Circus assimilis	Spotted Harrier	V		The Spotted Harrier occurs throughout the Australian mainland in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant & Higgins 1993). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The diet of the Spotted Harrier includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Department of Environment Climate Change and Water 2010c).	Low No suitable habitat is present in the study area. However, this species may fly over the study area on occasion.
Climacteris picumnus	Brown Treecreeper	V		The Brown Treecreeper occurs in eucalypt woodland and adjoining vegetation. Feeds on ants, beetles and larvae on trees and from fallen timber and leaf litter. Usually nests in hollows (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Daphoenositta chrysoptera	Varied Sittella	V		The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Department of Environment Climate Change and Water 2010d).	Low No suitable habitat is present in the study area
Dasyornis brachypterus	Eastern Bristlebird	E1	E	The habitat of the Eastern Bristlebird is characterised by low dense vegetation. Fire is a feature of all areas where known populations occur. Given the poor flight ability of the species it is though that few individuals survive the passage of fire, survival is dependant on the availability of fire refuges and recolonisation may be relatively slow. The bird is cryptic and camoflauged and rarely seen but may be detected by its distinctive, loud calls. Confined to NSW/Queensland border region, Illawarra region and NSW/Victorian border region (NSW National Parks and Wildlife Service 1997).	Low No suitable habitat is present in the study area
Diomedea exulans	Wandering Albatross	E1	VM	The Wandering Albatross is a nomadic marine species, that breeds in small colonies among grass tussocks, using a large mud nets, sometimes off the coast of NSW (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Ephippiorhynchus asiaticus	Black-necked Stork	E1		The Black-necked Stork feeds in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Epthianura albifrons	White-fronted Chat	V; E2		The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In New South Wales the White-fronted Chat occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, White-fronted Chats are found predominantly in saltmarsh vegetation although they are also observed in open grasslands and sometimes in low shrubs bordering wetland areas (Higgins *et al.* 2001).	Low The study area is close to the Newington Nature Reserve, however birds are unlikely to cross the 8 km of urbanised habitat to the study area
Erythrotriorchis radiatus	Red Goshawk	CE	VM	The Red Goshawk lives in coastal and sub-coastal tall open forests and woodlands, tropical savannas traversed by wooded or forested rivers and along edges of rainforest. Nests are only built in trees taller than 20 meters which occur within 1 kilometre of a watercourse or wetland. Has a home range of 200 square kilometres and hunts for medium to large birds in open forests and gallery forest (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Gallinago hardwickii	Latham's Snipe		M	Latham's Snipe occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Glossopsitta pusilla	**Little Lorikeet**	**V**		**The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins 1999).**	**Moderate** **The Little Lorikeet may occasionally utilise vegetation (particularly winter flowering eucalypts) within the study area as a foraging resource.**

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Grantiella picta	Painted Honeyeater	V		The Painted Honeyeater lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes that are largely restricted to older trees. Less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Haematopus fuliginosus	Sooty Oystercatcher	V		The Sooty Oystercatcher is found on rocky shorelines where it forages on intertidal flats (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Haematopus longirostris	Pied Oystercatcher	E1		The Pied Oystercatcher occurs in undisturbed beaches, sandspits, sandbars, tidal mudflats, estuaries and coastal islands. Occasionally found on rocky reefs, shores, rock stacks, brackish or saline wetlands and also in grassy paddocks, golf courses or parks near coast. Eggs are laid in shallow scrape in sand on open beach or among low growth behind beach (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	The White-bellied Sea-Eagle occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area. However, this species may fly over the study area on occasion.
Hieraaetus morphnoides	Little Eagle	V		The Little Eagle is distributed throughout the Australian mainland occupying habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant & Higgins 1993).	Low No suitable habitat is present in the study area. However, this species may fly over the study area on occasion.
Hirundapus caudacutus	White-throated Needletail		M	The White-throated Needletail occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey & Knight 2007).	Moderate The White-throated Needletail may use air space over the study area on occasion.

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Ixobrychus flavicollis	Black Bittern	V		The Black Bittern is usually found in dense vegetation in and fringing streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Feeds on aquatic fauna along streams, in estuaries and beside billabongs and pools. Breeding occurs in summer in secluded places in densely vegetated wetlands. It nests in trees that overhang the water (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low No suitable habitat is present in the study area
Lathamus discolor	**Swift Parrot**	**E1**	**E**	**The Swift Parrot breeds in Tasmania and the majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. In mainland Australia the Swift Parrot is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett & Crowley 2000; Swift Parrot Recovery Team 2001).**	**Moderate** **The Swift Parrot may occasionally utilise vegetation (particularly winter flowering eucalypts) within the study area as a foraging resource.**
Limicola falcinellus	Broad-billed Sandpiper	V	M	The Broad-billed Sandpiper is a migratory species that breeds in the northern hemisphere between June and August. Individuals feed both on exposed mudflats and while wading in water (NSW National Parks and Wildlife Service 1999a).	Low No suitable habitat is present in the study area
Limosa limosa	Black-tailed Godwit	V	M	The Black-tailed Godwit is a coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Melanodryas cucullata	Hooded Robin	V		The Hooded Robin is found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Garnett & Crowley 2000; Traill & Duncan 2000).	Low No suitable habitat is present in the study area
Melithreptus gularis gularis	Black-chinned Honeyeater	V		The Black-chinned Honeyeater is found in dry eucalypt woodland particularly those containing ironbark and box. The Black-chinned Honeyeater occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Merops ornatus	Rainbow Bee-eater		M	The Rainbow Bee-eater usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibilit, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins 1999).	Low No suitable habitat is present in the study area
Monarcha melanopsis	**Black-faced Monarch**		**M**	**The Black-faced Monarch occurs in rainforests, eucalypt woodlands, coastal scrubs, and damp gullies in rainforest, eucalypt forest and in more open woodland when migrating (Pizzey & Knight 2007).**	**Present.** **The Black-faced Monarch has been previoulsy recorded near the Hawthorne Canal by the IWEG**
Myiagra cyanoleuca	Satin Flycatcher		M	The Satin Flycatcher occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Neophema chrysogaster	Orange-bellied Parrot	E1	ZM	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. Orange-bellied Parrots are known to forage among flocks of Blue-winged Parrots (Higgins 1999).	Low No suitable habitat is present in the study area
Neophema pulchella	Turquoise Parrot	V		The Turquoise Parrot occurs in the foothills of the great dividing range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey. Nests in hollows in trees, stumps or even fence posts. It feeds on seeds of both native and introduced grass and herb species (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Nettapus coromandelianus	Cotton Pygmy-Goose	E1		The Cotton Pygmy-Goose is found on freshwater lakes, swamps, and large water impoundments. Congregates in flocks on permanent water bodies during the dry season. Lays eggs in the hollow of trees that stand in or beside water. Principle foods are Pondweed Potamogeton seeds and other aquatic vegetation (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Ninox connivens	Barking Owl	V		The Barking Owl occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Ninox strenua	Powerful Owl	V		The Powerful Owl is a sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. The Powerful Owl generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Pandion cristatus	Eastern Osprey	V	M	The Eastern Osprey is generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Petroica boodang	Scarlet Robin	V		In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Department of Environment Climate Change and Water 2010b; Higgins & Peter 2002).	Low No suitable habitat is present in the study area
Petroica phoenicea	Flame Robin	V		In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats (Higgins & Peter 2002). The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (Department of Environment Climate Change and Water 2010a).	Low No suitable habitat is present in the study area
Pezoporus wallicus	Ground Parrot	V		The Ground Parrot lives in low heathland and sedgeland. Nests are made on ground beneath dense vegetation. Heathland becomes unsuitable immediately after fire. Seeds are eaten from a wide range of herbs, graminoids and heath, the diet reflecting range of available plants, but excludes seeds that need removal of woody husks. Patchy distribution throughout east coast of NSW (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Ptilinopus superbus	Superb Fruit-Dove	V		The Superb Fruit-Dove occurs in rainforests and fringes, scrubs, mangroves and wooded stream-margins, lantana thickets, isolated figs, Pittosporum fruit, lilly pillies and blackberries (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area. Although Figs do occur in the study area it is unlikely this species would utilise this habitat
Puffinus assimilis	Little Shearwater	V		The Little Shearwater is a marine species that occurs over the Tasman Sea and possibly the Coral Sea. The species breeds on island in burrows dug in soft soil among mats of succulents or among loose rocks and they forage far out to sea (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Pyrrholaemus sagittatus	Speckled Warbler	V		The Speckled Warbler occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Rhipidura rufifrons	Rufous Fantail		M	The Rufous Fantail occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Rostratula australis	Australian Painted Snipe	E1	VM	The Australian Painted Snipe inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudlflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Stagonopleura guttata	Diamond Firetail	V		The Diamond Firetail occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range. Feed on seeds, mostly of grasses (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Sterna albifrons	Little Tern	E1	M	The Little Tern is a coastal species found along the coast of New South Wales. They nest between the high tide mark and shore vegetation on undisturbed and unvegetated sites near estuaries and adjacent freshwater lakes. They feed on fish taken from inshore waters (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Stictonetta naevosa	Freckled Duck	V		In most years the Freckled Duck appears to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Tyto capensis	Grass Owl	V		The Grass Owl is typically found in tussock-grasslands but also occur in heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, grassy gaps between trees and crops. Nest on the gound generally under tussocks. They generally feed on rodents but will also eat insects (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Tyto novaehollandiae	Masked Owl	V		The Masked Owl occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000).	Low No suitable habitat is present in the study area
Xenus cinereus	Terek Sandpiper	V	M	The Terek Sandpiper is found on tidal mudflats and estuaries and on shores and reefs of offshore islands (Pizzey & Knight 2007).	Low No suitable habitat is present in the study area
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	V		The Eastern Pygmy-possum is found in a range of habitats from rainforest through sclerophyll forest to tree heath. It feeds largely on the nectar and pollen of banksias, eucalypts and bottlebrushes and sometimes soft fruits. It nests in very small tree holes, between the wood and bark of a tree, abandoned birds nests and shredded bark in the fork of trees (Turner & Ward 1995).	Low No suitable habitat is present in the study area
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Dasyurus maculatus	Spotted-tailed Quoll	V	E	The Spotted-tailed Quoll occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range (NSW National Parks and Wildlife Service 1999i). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. Nests in rock caves and hollow logs or trees (NSW National Parks and Wildlife Service 1999g, 1999i).	Low No suitable habitat is present in the study area
Dasyurus viverrinus	Eastern Quoll	E1		The Eastern Quoll is found in a variety of habitats including dry sclerophyll forest, scrub, heathland and cultivated land. Lives in dens which consist of several chambers including underground burrows, hollow logs, rock piles and hay sheds (Strahan 1995).	Low No suitable habitat is present in the study area
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		The Eastern False Pipistrelle usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill 1998).	Low Although listed in the DGRs, there is no habitat present within the study area for this species
Isoodon obesulus	Southern Brown Bandicoot	E1	E	The Southern Brown Bandicoot occurs in a variety of habitats in south-eastern Australia, including heathland, shrubland, dry sclerophyll forest with heathy understorey, sedgeland and woodland. Many of the habitats are prone to fire (NSW National Parks and Wildlife Service 1999f).	Low No suitable habitat is present in the study area
Miniopterus australis	Little Bent-wing Bat	V		The Little Bent-wing Bat feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan 1995).	Low No suitable habitat is present in the study area
Miniopterus schreibersii oceanensis	**Eastern Bent-wing Bat**	**V**	**C**	**The Eastern Bent-wing Bat is usually found in well timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill 2008).**	**Present** **The Eastern Bent-wing Bat has been recorded previously within the study area by AMBS**

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Myotis adversus	Large-footed Myotis	V		Colonies of Large-footed Myotis occur in caves, mines, tunnels, under bridges and buildings. Colonies always occur close to bodies of water where this species feeds on aquatic insects (Churchill 2008).	Low No suitable habitat is present in the study area
Perameles nasuta	**Long-nosed Bandicoot; Inner Western Sydney population**	**E2**		**The Long-nosed Bandicoot occurs in a range of habitats from rainforest through wet and dry woodland areas with little ground cover. Nests in a shallow hollow on the surface of the ground (Strahan 1995). The Long-nosed Bandicoot; Inner Western Sydney population occurs in the highly disturbed and urbanised inner western suburbs of Sydney in non-natural weed infested habitats and parkland.**	**Present** **The Long-nosed Bandicoot has been recorded previously within the study area by AMBS and DECCW**
Petaurus australis	Yellow-bellied Glider	V		The Yellow-bellied Glider is restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide helter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999j, 2003d).	Low No suitable habitat is present in the study area
Petaurus norfolcensis	Squirrel Glider	V		The Squirrel Glider is found in dry sclerophyll forest and woodland but not found in dense coastal ranges. Nests in hollows and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999h).	Low No suitable habitat is present in the study area
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	The Brush-tailed Rock-wallaby occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003a).	Low No suitable habitat is present in the study area
Phascolarctos cinereus	Koala	V		The Koala is found in sclerophyll forest. In any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include *Eucalyptus tereticornis, E. punctata, E. cypellocarpa* and *E. viminalis*. In coastal areas, *E. microcorys* and *E. robusta* are important food species, while in inland areas *E. albens, E. populnea* and *E. camaldulensis* are favoured (NSW National Parks and Wildlife Service 1999e, 2003c).	Low No suitable habitat is present in the study area

Scientific name	Common name	TSC Act[1]	EPBC Act[2]	Preferred habitat	Likelihood of occurrence within the study area[4]
Potorous tridactylus	Long-nosed Potoroo	V	V	The Long-nosed Potoroo has a disjunct distribution along coastal south-east Australia from near Gladstone in Queensland, to south-west Victoria and in Tasmania. In NSW, it is found throughout coastal and subcoastal areas. Occurs in a range of habitats: coastal forest and woodland with a moderately dense heathy understorey, dense coastal scrubs or heath, wet and dry sclerophyll forest and sub-tropical, warm temperate and cool temperate rainforest of the eastern slopes and highlands. Often associated with gullies and forest ecotones. Relatively thick ground cover is a major habitat requirement and it seems to prefer areas with light sandy soils (Johnston 1995; NSW National Parks and Wildlife Service 1999i).	Low No suitable habitat is present in the study area
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	**The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (Churchill 2008; NSW National Parks and Wildlife Service 2001b)**	**Present** **The Grey-headed Flying-fox was recorded during the survey**
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	E1	V	The Broad-headed Snake is a nocturnal species that occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb, J.K. & Shine 1994; Webb, J.K & Shine 1998).	Low No suitable habitat is present in the study area
Varanus rosenbergi	Heath Monitor	V		The Heath Monitor is found in coastal heaths, humid woodlands, wet and dry sclerophyll forests. Mostly a terrestrial species it shelters in burrows, hollow logs and rock crevices (Cogger 2000).	Low No suitable habitat is present in the study area

Notes:

1. TSC Act - *Threatened Species and Conservation Act 1995*. CE = Critically Endangered, E1 = Endangered V = Vulnerable E2= Endangered Population
2. EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999*. CE = Critically Endangered, E = Endangered V = Vulnerable
3. Likelihood of Occurrence – see methods (see Section 3.5)

Appendix C References

Anstis, M 2002, *Tadpoles of South-eastern Australia: a Guide with Keys*, vol. 1, 1 vols., New Holland Publishers, Sydney.

Australian Museum 2003, *Great Egret factsheet*, Australian Museum,

Churchill, S 1998, *Australian Bats*, Reed New Holland, Sydney.

Churchill, S 2008, *Australian Bats*, 2nd edn, Allen & Unwin, Sydney.

Cogger, HG 2000, *Reptiles and Amphibians of Australia*, Reed Books, Sydney.

Department of Environment and Climate Change 2009, *Threatened species, populations and ecological communities*, NSW Department of Environment and Conservation, 2009, <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>.

Department of Environment and Conservation 2004, *Green and Golden Bell Frog environmental impact assessment guidelines* Department of Environment and Conservation (NSW), Hurstville.

Department of Environment and Conservation 2005, *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*, Department of Environment and Conservation (NSW), Hurstville, NSW,

Department of Environment Climate Change and Water 2010a, *Flame Robin Petroica phoenicea (Gould 1837) - vulnerable species listing*, Department of Environment Climate Change and Water, viewed 20 April 2010 2010, <http://www.environment.nsw.gov.au/determinations/flamerobinFD.htm>.

Department of Environment Climate Change and Water 2010b, *Scarlet Robin Petroica boodang - proposed vulnerable species listing*, Department of Environment Climate Change and Water, viewed 20 April 2010 2010, <http://www.environment.nsw.gov.au/determinations/scarletrobinpd.htm>.

Department of Environment Climate Change and Water 2010c, *Spotted Harrier Circus assimilis - proposed vulnerable species listing*, Department of Environment Climate Change and Water, viewed 20 April 2010 2010, <http://npws.nsw.gov.au/determinations/spottedharrierpd.htm>.

Department of Environment Climate Change and Water 2010d, *Varied Sittella Daphoenositta chrysoptera (Latham 1802) - vulnerable species listing*, Department of Environment Climate Change and Water, viewed 20 April 2010 2010, <http://www.environment.nsw.gov.au/determinations/variedsittellaFD.htm>.

Garnett, ST & Crowley, GM 2000, *The Action Plan for Australian Birds*, Environment Australia, Canberra.

Higgins, PJ (ed.) 1999, *Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbirds*, Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne.

Higgins, PJ & Peter, JM (eds) 2002, *Handbook of Australian, New Zealand and Antarctic Birds*, Volume 6: Pardalotes to Shrike-thrushes, Oxford University Press, Melbourne.

Higgins, PJ, Peter, JM & Steele, WK (eds) 2001, *Handbook of Australian, New Zealand and Antarctic Birds Volume 5: Tyrant-flycatchers to Chats*, Oxford University Press, Melbourne.

Johnston, PG 1995, 'Long-nosed Potoroo', in R Strahan (ed.), *The Mammals of Australia*, Reed New Holland, Sydney, pp. 301-2.

Marchant, S & Higgins, PJ (eds) 1993, *Handbook of Australian, New Zealand and Antarctic Birds Volume 2: Raptors to Lapwings*, vol. 2, Volume 2: Raptors to Lapwings, Oxford University Press, Melbourne.

McKilligan, N 2005, *Herons, egrets and bitterns: their biology and conservation in Australia*, CSIRO Publishing, Collingwood, Victoria.

NSW National Parks and Wildlife Service 1997, *Submission to the mining warden's inquiry into the renewal of special leases 567 and 568 for the extraction of peat from Wingecarribee Swamp*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999a, *Broad-billed Sandpiper threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999b, *Bush Stone-curlew threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999c, *Cumberland Plain Large Land Snail threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999d, *Glossy Black-cockatoo threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999e, *Koala threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999f, *Southern Brown Bandicoot threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999g, *Spotted-tailed Quoll threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999h, *Squirrel Glider threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 1999i, *Terms of licence under the Threatened Species Conservation Act 1995. Appendix B of the Integrated Forestry Operations Approval for the Upper North East Region.*,

NSW National Parks and Wildlife Service 1999j, *Yellow-bellied Glider threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2001a, *Giant Burrowing Frog threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2001b, *Grey-headed Flying Fox threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2002, *Threatened Species of the Upper North Coast of New South Wales - Fauna*, NSW National Parks and Wildlife Service, Northern Directorate, Coffs Harbour.

NSW National Parks and Wildlife Service 2003a, *Brush-tailed Rock Wallaby Warrumbungles endangered population threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2003b, *Draft Recovery Plan for the Bush Stone-curlew Burhinus grallarius*, National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2003c, *Draft Recovery Plan for the Koala*, NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service 2003d, *Recovery Plan for the Yellow-bellied Glider (Petaurus australis)*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 2003, *Final determination to list the Stuttering Frog as an endangered species*, NSW National Parks and Wildlife Service, Hurstville.

Pizzey, G & Knight, F 2007, *Field Guide to the Birds of Australia*, Harper and Collins, Sydney.

Strahan, R 1995, *The Mammals of Australia*, Reed New Holland, Sydney.

Swift Parrot Recovery Team 2001, *Swift Parrot Recovery Plan*, Department of Primary Industries, Water and Environment, Hobart.

Traill, BJ & Duncan, S 2000, *Status of birds in the New South Wales temperate woodlands region*, Consultancy report to the NSW National Parks and Wildlife Service by the Australian Woodlands Conservancy, Chiltern, Victoria.

Turner, V & Ward, SJ 1995, 'Eastern Pygmy-possum', in R Strahan (ed.), *The Mammals of Australia*, Reed New Holland, Sydney, pp. 217-8.

Webb, JK & Shine, R 1994, *Habitat use by the broad-headed snake, Hoplocephalus bungaroides*, Environment Australia, Canberra.

Webb, JK & Shine, R 1998, 'Ecological characteristic of an endangered snake species *Hoplocephalus bungaroides* (Serpentes: Elapidae)', *Animal Conservation*, vol. 1, pp. 185-93.

Appendix D

Significance assessments

Contents

Significance assessments introduction

For Threatened biodiversity listed under the *Threatened Species Conservation Act 1995*, this section details the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Conservation / Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation & Department of Primary Industries 2005). The guidelines present methods to consider the impacts on biodiversity of Projects assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*, including presenting heads of consideration for determining the significance of impacts.

For Threatened biodiversity listed under the *Environment Protection and Biodiversity Conservation Act 1999*, significance assessment have been completed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Significant Impact Guidelines* (Department of the Environment and Heritage 2006).

Species listed under both the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999* have been assessed using both assessment guidelines separately.

A. Long-nosed Bandicoot (*Perameles nasuta*), inner western Sydney population

A.1 Profile

Status

The population of Long-nosed Bandicoot in inner western Sydney is listed as an Endangered Population under the *Threatened Species Conservation Act 1995*.

Description

Long-nosed Bandicoot is a nocturnal marsupial of medium size. Males are larger than females with adults ranging from 310 - 425 mm in head and body length, tail length varies from 120 - 155 mm and body weight may vary from 850 – 1,100 g. They are typically dark, greyish-brown above and creamy white below. The forefeet and upper surfaces of the hind feet are also creamy white. The muzzle is long and pointed and the ears are distinctly larger and more pointed than short-nosed bandicoots of the genus *Isoodon* (Department of Environment Climate Change and Water 2010).

Distribution

Once common within Sydney, two populations of the Long-nosed Bandicoot are now disjunct and occur at North Head Manly and in Sydney's inner western suburbs. While the North Head population is confined to North Head at Manly, the location of the inner western Sydney population is not clearly defined. The Long-nosed Bandicoot in inner western Sydney population is thought to occur within the Marrickville and Canada Bay local government areas (LGAs), with the likelihood that it also inhabits the Canterbury, Ashfield and Leichhardt LGAs. In inner western Sydney, there are apparently no large blocks of suitable habitat that are likely to support a large source population of the Long-nosed Bandicoot. Other populations are known to occur north of the Parramatta River or much further south at Holsworthy Military Reserve (Department of Environment Climate Change and Water 2010).

Habitat and ecology

Essentially a solitary animal, the Long-nosed Bandicoot forages mainly at or after dusk, digging for invertebrates, fungi and tubers. The holes from diggings it leaves in the soil are often seen at the interface of naturally vegetated areas and areas of open grass (Strahan 1995).

Mating takes place at night and may occur throughout the year in the Sydney Region, although there is a trough in breeding activity from late autumn (April) to mid-winter (June). Has a very high reproductive capacity. There are 8 teats in the pouch and litter sizes range from one to five but usually two to three. Birth takes place during the daylight hours after a gestation of only 12.5 days. The young are carried in the pouch for 50 to 54 days and are then left in the nest. When the young are about 50 days old the mother may mate again and produce another litter several days after the previous one has been weaned. In good years, females may produce up to 4 litters. Female bandicoots may begin breeding at about four months of age and males at about five months. They are thought to live for up to three years.

Typically they shelter during the day in a well-concealed nest based on a shallow hole lined with leaves and grass, sometimes under debris, sometimes hidden with soil and with the entrance closed for greater concealment (Strahan 1995).

In the urban areas of Sydney's inner west, it shelters mostly under older houses and buildings and forages in parkland and backyards (Department of Environment Climate Change and Water 2010).

Threats

Threats to the populations include (Department of the Environment Climate Change and Water 2010b):

- road mortality in residential areas is a very significant threat
- predation by foxes and domestic dogs and cats.
- loss of shelter sites from residential development.

Recovery actions

There is no recovery plan for the Long-nosed Bandicoot in inner western Sydney population. However, the DECCW has identified five priority actions to help recover the Long-nosed Bandicoot population, Inner Western Sydney in New South Wales (refer Table A-1).

Table A-1 Recovery actions

Recovery strategy	Priority actions	Likely to be affected by project
Community and land-holder liaison / awareness and / or education	Undertake community awareness program to increase knowledge of the species, threats and reporting of sightings.	No. The project is likely to raise community awareness of this population
Data recording and storage	Develop and maintain database of all records	No. The project has the capacity to add to records
Monitoring	Monitor status of all known sub-populations.	No.
Research	Undertake radio tracking studies to determine habitat use.	No.
Survey/mapping and habitat assessment	Undertake surveys to determine extent of population.	No. The project will add to the survey effort undertaken for this population

Local occurrences

The Long-nosed Bandicoot was thought to have disappeared from the inner west of Sydney in the late 1950's, until rediscovered in 2007 (AMBS 2007). Further surveys undertaken by DECCW identified and mapped locations based on sightings of individuals as well as diggings. Sightings included Petersham, Lewisham and Dulwich Hill (Marrickville Council

2009). The Inner West Environment Group (IWEG) and local residents have also made opportunistic sightings of the Long-nosed Bandicoot in these areas.

Specific impacts of the project

The project will result in the removal of approximately 1.7 ha of dense weed growth within the rail corridor that is suitable habitat for the Long-nosed Bandicoot inner western Sydney population. Increased light rail movements along the rail line may increase the chance of train strike leading to increased mortality.

A.2 Environmental Planning and Assessment Act 1979 assessment

How is the project likely to affect the habitat of a threatened species, population or ecological community?

The project will result in the removal of approximately 1.7 ha of dense weed growth within the rail corridor that is suitable habitat for the Long-nosed Bandicoot.

How is the project likely to affect current disturbance regimes?

The study area has remained in its current state since the original construction of the Rozelle freight line. The project is not introducing a new rail line into the habitat of the Long-nosed Bandicoot, inner western Sydney population, it is proposing the operation of an existing line.

The environment of the study area is highly disturbed and natural disturbance regimes upon which biodiversity depend, such as fire intervals, no longer occur. Consequently, the project will not interfere with the current disturbance regimes present within the study area.

Some disturbance of dense weed growth that forms habitat for the Long-nosed Bandicoot will occur. However, revegetation and establishment of Bushcare sites along the alignment will re-establish dense shrub cover that will provide habitat for this population after a short time lag.

How is the project likely to affect habitat connectivity?

The construction of stops along the route requires the removal of dense weed growth that is suitable sheltering habitat for the Long-nosed Bandicoot. Consequently, some habitat fragmentation may occur. However, the revegetation and bushcare sites proposed as part of the Project will serve to decrease the currently fragmented habitat that exists for Long-nosed Bandicoots within the study area. Some habitat connectivity may be lost due to barrier effects posed by running trains.

How is the project likely to affect critical habitat?

No critical habitat has been declared for the Long-nosed Bandicoot in inner western Sydney population. Therefore no critical habitat will be affected by the project. However, all habitats in the suburbs of Petersham, Lewisham and Dulwich Hill can be considered important to the survival of this Endangered population.

Conclusion

Taking in to concern the above heads of consideration, it is unlikely that the project will have a significant impact on the Long-nosed Bandicoot, inner western Sydney population. Some removal of habitat (approximately 1.7 ha) and fragmentation will occur. However, the revegetation and establishment of Bushcare sites along the rail alignment will create a greater area of habitat for the Long-nosed Bandicoot in the long-term. The current disturbance regimes will not be interfered with and critical habitat will not be affected.

B. Swift Parrot (*Lathamus discolor*) and Little Lorikeet (*Glossopsitta pusilla*)

The Swift Parrot and Little Lorikeet have been assessed together in the *Environmental Planning and Assessment Act 1979* assessment due to their shared preferences of foraging habitats. Although these two species were not recorded during the survey, the study area supports suitable forging resources for these two species in the form of mature eucalypt trees.

Status

The Swift Parrot is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Threatened Species Conservation Act 1995*.

The Little Lorikeet is listed as Vulnerable under the *Threatened Species Conservation Act 1995*.

Description

The Swift Parrot is small parrot about 25 cm long and has a long (12 cm), thin, dark red tail. It is bright green with red around the bill, throat and forehead. The red on its throat is edged with yellow and there are also bright red patches under the wings. Its crown is blue-purple. It can also be recognised by its flute-like chirruping or metallic "kik-kik-kik" call (Department of the Environment Climate Change and Water 2010c).

The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immature birds are duller with less red on face and brown bill (Higgins 1999; NSW Scientific Committee 2009).

Distribution

Swift Parrots migrate to the Australian south-east mainland between March and October. Following winter they return to Tasmania where they breed from September to January (Department of the Environment Climate Change and Water 2010c)

The Little Lorikeet is found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia (Higgins 1999). NSW provides a large portion of the species' core habitat, with Little Lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year (Department of the Environment Climate Change and Water 2010a; NSW Scientific Committee 2009).

Habitat and ecology

On the mainland the Swift Parrot occurs in areas where eucalypts are flowering profusely or where there are abundant lerp infestations (Department of the Environment Climate Change and Water 2010c) Favoured feed trees include winter flowering species including *Eucalyptus robusta*, *Corymbia maculata*, *Corymbia gummifera*, *Eucalyptus sideroxylon*, *Eucalyptus albens* and *Eucalyptus tereticornis* (Higgins 1999). The Swift Parrot return to home foraging sites on a cyclic basis depending on food availability (Department of Environment and Conservation 2006). Following winter, the Swift Parrot returns to Tasmania (Webster 1988).

The Swift Parrot flies and feeds with other parrots including Rainbow Lorikeets, Musk Lorikeets and Little Lorikeets.

The Little Lorikeet forages mainly on flowers, nectar and fruit in the canopy of open eucalypt forest and woodland. Riparian habitats are particularly used. Isolated flowering paddock trees and roadside remnants help sustain viable populations of the species. The Little Lorikeet roosts in treetops, often distant from feeding areas and nest in proximity to feeding areas, typically selecting hollows in the limb or trunk of smooth-barked eucalypts (NSW Scientific Committee 2009).

Threats

On mainland Australia, the main threat facing the Swift Parrot is the loss of habitat through clearing for agriculture and urban and industrial development. During the breeding season and winter migration, collisions with wire netting fences, windows and cars, threaten the Swift Parrot, particularly where such obstacles are in close proximity to suitable habitat (Department of the Environment Climate Change and Water 2010c).

The extensive clearing of woodlands for agriculture has significantly decreased food for the Little Lorikeet and has reduced survival and reproduction. Small scale clearing, such as that which may occur during road works and fence construction, continues to destroy habitat. The loss of old hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species that need large hollows with small entrances to avoid predation. Felling of hollow trees for firewood collection or other human demands increases this competition. Competition with the introduced Honeybee for both nectar and hollows exacerbates these resource limitations (Department of the Environment Climate Change and Water 2010a).

Recovery actions

No recovery plan has been prepared for the Swift Parrot or Little Lorikeet under the *Threatened Species Conservation Act 1995*. However, there is a federally supported statement for the Swift Parrot (Swift Parrot Recovery Team 2001). The DECCW (2010c) have identified 14 priorities action statements within 10 recovery strategies to help the Swift Parrot (

Table B-1). A priorities action statement has not yet been prepared for the Little Lorikeet. However, the following actions are recommended for land managers (Department of the Environment Climate Change and Water 2010a):

- retain large old trees, especially those that are hollow-bearing
- ensure recruitment of trees into the mature age class so that there is not a lag period of decades between the death of old trees and hollow formation in younger trees
- protect large flowering *Eucalyptus* trees throughout the habitats frequented by this species. Manage remnant woodlands and forest for recovery of old-growth characteristics
- where natural tree recruitment is inadequate, replant local species to maintain foraging habitat and breeding sites
- reduce the abundance of feral Honeybees and limit the exploitation of nectar by domestic bees where resources are spatially or temporally sparse (e.g. in years of drought)
- document nest sites and ensure their protection.

Table B-1 Recovery actions for the Swift Parrot

Recovery strategy	Priority actions	Likely to be affected by project
Aboriginal liaison and/or interpretation	Consult and involve Indigenous community through employment of community liaison officer..	No
Community and land-holder liaison/ awareness and/or education	Reduce the incidence of Swift Parrot collisions by raising community awareness of the threat of man-made hazards (including windows/glass panes and high wire-mesh fences) in the vicinity of suitable habitat.	No
	Compile, produce and distribute the annual Swift Parrot volunteer newsletter "Swifts Across the Strait".	No
Coordinate the recovery and/or threat abatement program	Employ community liaison officer to coordinate conservation actions for the species, including the maintenance of community and volunteer networks through.	No
	Manage the recovery process through the continued operation of the Swift Parrot Recovery Team.	No
Develop and implement protocols and guidelines	Prepare a recovery plan for the Squirrel Glider.	No
	Develop and distribute Swift Parrot habitat identification, management and enhancement guidelines.	No
Habitat management: Ongoing EIA - Advice to consent and planning authorities	Develop and distribute EIA guidelines to decision makers.	No
Habitat Protection (inc vca/jma/ critical habitat nomination etc)	Protect, manage and restore Swift Parrot habitat on private land through conservation agreements, management agreements and incentive payments (refer to species profile for regionally specific habitat information).	No
Habitat Rehabilitation/Restoration and/or Regeneration	Enhance habitat for Swift Parrots by planting suitable tree species to complement natural regeneration or to enhance remnants (refer to species profile for regionally specific habitat information).	No
Recovery Plan Preparation: Single species	Finalise review of National Recovery Plan by 2007.	No
Research	Conduct Swift Parrot habitat research on both private and public land.	No
Survey/Mapping and Habitat assessment	Coordinate volunteer surveys at known and potential Swift Parrot sites on private and public land.	No
	Identify and map the extent and quality of Swift Parrot foraging and roosting habitat on private and public land (refer to species profile for regionally specific habitat information).	No

Specific impacts of the project

Surveys were completed during winter when Swift Parrots' arrive in their wintering grounds on mainland Australia. The Swift Parrot was not recorded during current survey. However, the study area provides a very small amount of potential habitat for this species in the form of suitable winter foraging resources, being a small number of eucalypt trees. The project may result in removal of 0.05 ha of this forging habitat.

The Little Lorikeet was not recorded during the survey. However, the Little Lorikeet is likely to utilise the same foraging resources as the Swift Parrot within the study area. Consequently, a small area, 0.05 ha, of foraging habitat may be removed by the project.

B.1 *Environmental Planning and Assessment Act 1979* assessment for Swift Parrot and Little Lorikeet

How is the project likely to affect the habitat of a threatened species, population or ecological community?

Approximately 0.05 ha of foraging habitat suitable for the Swift Parrot and Little Lorikeet may be removed by the project.

How is the project likely to affect current disturbance regimes?

The study area has remained in its current state since the original construction of the Rozelle freight line and urbanisation of the Sydney area. The project is not introducing a new rail line into the habitat of the Swift Parrot and Little Lorikeet so is not introducing a new form of disturbance.

The environment of the study area is highly disturbed and natural disturbance regimes upon which biodiversity depend, such as fire intervals, no longer occur. Consequently, the project will not interfere with the current disturbance regimes present within the study area.

Some disturbance of mature eucalypt trees that form suitable foraging habitat for the Swift Parrot and Little Lorikeet may occur. However, revegetation and establishment of Bushcare sites along the alignment will re-establish tree species that will provide foraging habitat for these species in the long-term.

How is the project likely to affect habitat connectivity?

The construction of stops along the route does not require the removal of large eucalypt trees. Therefore little habitat fragmentation will occur. As the Swift Parrot and Little Lorikeet are highly mobile birds capable of fast and long flight to find foraging resources, it is unlikely that any fragmentation of the GreenWay would affect these species.

The revegetation and Bushcare sites proposed by the project will serve to decrease the amount of fragmentation that is currently present within the study area including the GreenWay. Operation of the rail line is unlikely to present a barrier effect to these two species.

How is the project likely to affect critical habitat?

No critical habitat has been declared for the Swift Parrot and Little Lorikeet. Therefore no critical habitat will be affected by the project. However, isolated urban street trees and mature eucalypts in parks and gardens of Sydney can still be considered an important food source for these species when they frequent the area.

Conclusion

Taking in to concern the above heads of consideration, it is unlikely that the project will have a significant impact on the Swift Parrot or Little Lorikeet. Some removal of habitat (approximately 0.05 ha) will occur. However, the revegetation and establishment of Bushcare sites along the rail alignment and GreenWay will create a greater area of foraging habitat for the Swift Parrot and Little Lorikeet in the long-term, enhancing the viability of the habitat for these species. The current disturbance regimes will not be interfered with and critical habitat will not be affected.

B.2 Environment Protection and Biodiversity Conservation Act 1999 significance assessment for the Swift Parrot

Will the action lead to a long-term decrease in the size of a population of a species?

The project may result in the removal of approximately (0.05 ha) of potential foraging habitat for the Swift Parrot. The removal of potential foraging habitat within the site represents a very small area, which is unlikely to be of high significance to Swift Parrots during winter when they may frequent the study area. As Swift Parrots breed in Tasmania, no breeding resources will be affected by the project. Therefore, it is considered unlikely that the project would lead to a long-term decrease in the size of the Swift Parrot population.

Will the action reduce the area of occupancy of the species?

The project may remove approximately 0.05 ha of potential foraging habitat for the Swift Parrot. This area of habitat is not considered to be of great significance to the Swift Parrot and it is unlikely to influence whether the Swift Parrot frequents the study area during winter.

Will the action fragment an existing population into two or more populations?

The Swift Parrot is a highly mobile species that can traverse large areas of unsuitable habitat to find foraging resources. Consequently, the removal of 0.05 ha of potential habitat is unlikely to fragment the Swift Parrot population.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat is listed for the Swift Parrot under the *Environment Protection and Biodiversity Conservation Act 1999* or the *Threatened Species Conservation Act 1995*. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The project may remove approximately 0.05 ha of potential foraging habitat. As this species is highly mobile, it is likely that the abundance of higher quality foraging resources in the greater locality would be utilised by locally occurring Swift Parrots in preference to the very small amount of foraging resources within the study area.

Will the action disrupt the breeding cycle of a population?

Swift Parrots breed in Tasmania during spring and summer, migrating to south-eastern Australia during autumn and winter (Department of Environment and Conservation 2006). While Swift Parrots are dependent on flowering resources across a wide range of habitats (woodlands and forests) within their NSW wintering grounds, the removal of approximately 0.05 ha of potential habitat is not likely to disrupt their movements to the Tasmanian breeding grounds. As such the project is not likely to affect their breeding cycle.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The project may remove approximately 0.05 ha of potential foraging habitat for the Swift Parrot. Although the project represents the removal of potential foraging habitat within the study area, this potential loss is very small. This habitat removal is unlikely to cause a decline of this species, due to the abundance of similar foraging habitat elsewhere in the locality.

The revegetation and establishment of Bushcare sites within the study area by the project will serve to establish new areas of suitable foraging habitat for the Swift Parrot in the long-term.

Will the action result in invasive species that are harmful to an endangered species becoming established in the endangered species´ habitat?

Due to the highly modified and urbanised nature of the study area and the presence of feral animals, it is not likely that invasive species (such as introduced predators or nectar competitors) that are harmful to the Swift Parrot would become further established as a result of the project.

Will the action introduce disease that may cause the species to decline?

No. It is not likely that disease, such as Psittacine circoviral disease (Beak and feather disease), would be increased in prevalence by the project.

Will the action interfere with the recovery of the species?

The *Action Plan for Australian Birds* (Garnett & Crowley 2000) addresses the need for further ecological research on the Swift Parrot and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Specific objectives of the Swift Parrot Recovery Plan (Swift Parrot Recovery Team 2001) include:

- identify priority habitats and sites across the range of the Swift Parrot
- implement management strategies to protect and improve priority habitats and sites resulting in a sustained improvement in carrying capacity
- reduce the incidence of collisions with man-made structures
- determine population trends within the breeding range
- quantify improvements in carrying capacity by monitoring changes in extent and quality of habitat
- increase public awareness about the recovery program and to involve the community in the recovery.

Based on the potential ecological impacts of the project on the Swift Parrot, as discussed above, it is unlikely that the project would be in conflict with any of the objectives above.

Conclusion

The study area contains some suitable foraging habitat for the Swift Parrot in the form of eucalypt trees. Approximately 0.05 ha of this habitat may be removed by the project. This small amount of habitat removal is unlikely to be significant to the Swift Parrot, due to the abundance of comparable foraging habitat elsewhere within Sydney and the wider Sydney Basin. Taking into consideration the questions of the matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment Water Heritage and the Arts 2009), the project is unlikely to have a significant impact upon the Swift Parrot.

C. Grey-headed Flying Fox (*Pteropus poliocephalus*)

Status

The Grey-headed Flying Fox is listed as Vulnerable under both the *Threatened Species Conservation Act 1995* and *Environment Protection and Biodiversity Conservation Act 1999*.

Description

The Grey-headed Flying-fox is the largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.

Distribution

The Grey-headed Flying is endemic to Australia and presently occurs along the east coast from Maryborough in Queensland to Melbourne, Victoria (Department of the Environment and Heritage 2003). This species is also occasionally found west of the Great Dividing Range to the western slopes of NSW and Queensland. At any one time, the majority of animals only occupy a small proportion of this entire range (NSW National Parks and Wildlife Service 2001).

Habitat and ecology

The Grey-headed Flying-fox utilises subtropical and temperate rainforests, tall sclerophyll forests, woodlands, heaths, swamps and mangroves, as well as urban gardens and fruit crops for foraging (Churchill 2008; NSW National Parks and Wildlife Service 2001). This species is considered an important pollinator and seed disperser of native trees, as they forage on the nectar and pollen of eucalypts, angophoras, melaleucas and banksias, as well as fruit of rainforest trees and vines (NSW National Parks and Wildlife Service 2001; Van Dyck & Strahan 2008). While the majority of foraging events occur within 20 km of their day roost, some individuals will disperse and commute up to 50 km (Van Dyck & Strahan 2008).

Grey-headed Flying-foxes are highly mobile and as the availability of native fruits, nectar and pollen varies over time and throughout their range, they respond to this by migrating between camps up and down the east coast, sometimes travelling hundreds of kilometres (NSW National Parks and Wildlife Service 2001). When migration occurs they do not move as a colony, but as individuals or small groups resulting in the intermixing of sub-populations (Churchill 2008). The population concentrates in May and June in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany, Forest Red Gum and Paperbark, dispersing south during the summer (Department of the Environment and Heritage 2003).

Grey-headed Flying-fox roost in large colonies of up to tens of thousands and may be shared with *Pteropus scapulatus* (Little Red Flying-fox) and *P. alecto* (Black Flying-fox) (Churchill 2008). Camps are generally located in gullies with dense vegetation (such as mangrove, rainforest, *Melaleuca* and *Casuarina*), close to water and generally located within 20 km of a regular food source (NSW National Parks and Wildlife Service 2001). Site fidelity to camps is high with some camps in NSW used for over a century (NSW National Parks and Wildlife

Service 2001).These bats usually return annually to particular camps for rearing young (NSW National Parks and Wildlife Service 2001).

Camp sites are generally located in gullies with dense vegetation (mangrove, rainforest, Melaleuca and Casuarina) close to water and in proximity to foraging resources. They are known to fly up to 50km for food resources (NSW National Parks and Wildlife Service 2001).

Threats

Key threats to this species include:

- loss of foraging habitat
- disturbance of roosting sites
- unregulated shooting
- electrocution on powerlines.

Recovery actions

No recovery plan has been prepared for Grey-headed Flying-fox under the *Threatened Species Conservation Act 1995*. The department of Environment, Climate Change and Water has however; identified 31 priority actions in 10 recovery strategies to help recover this species (Table C-1).

Table C-1 Recovery actions

Recovery strategy	Priority actions	Likely to be affected by project
Community and land-holder liaison / awareness and/or education	Provide educational resources to improve public attitudes toward Grey-headed Flying-foxes.	No. There is opportunity for the project to increase public awareness of the Grey-headed Flying-fox
	Develop materials for public education & provide them to land managers & local community groups working with controversial flying-fox camps, highlighting species status, reasons for being in urban areas, reasons for decline etc.	No
	Monitor public attitudes towards flying-foxes.	No
	Review & evaluate camp site management activities, summarising outcomes of past experiences at controversial camps. Noise impacts on neighbours of camps to be considered. For use in managing future conflicts with humans at flying-fox camps.	No
	Conduct periodic range-wide assessments of the population size of Grey-headed Flying-foxes to monitor population trends.	No
Coordinate the recovery and/or threat abatement program	Grey-headed Flying-fox National Recovery Team to undertake an annual review of the national recovery plan's implementation.	No
Habitat management: Other	Enhance and sustain the vegetation of camps critical to the survival of Grey-headed Flying-foxes.	No

Recovery strategy	Priority actions	Likely to be affected by project
Habitat Protection (inc vca/jma/ critical habitat nomination etc)	Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.	No
	Protect roosting habitat critical to the survival of Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.	No
Habitat Rehabilitation/Restoration and/or Regeneration	Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works.	No
Monitoring	Develop and implement a grower-based program to monitor trends in damage to commercial fruit crops by flying-foxes, and use the results to monitor the performance of actions to reduce crop damage.	No
	Systematically document the levels of flying-fox damage to the horticulture industry within the range of the Grey-headed Flying-fox.	No
Other Action	Develop guidelines to assist land managers dealing with controversial flying-fox camps.	No
Recovery Plan Preparation: Single species	Complete national recovery plan.	No
Research	Develop and promote incentives to reduce killing of flying-foxes in commercial fruit crops.	No
	Develop methods for rapid estimates of flying-fox damage on commercial crops, allowing the long-term monitoring of industry-wide levels and patterns of flying-fox damage.	No
	Review and improve methods used to assess population size of Grey-headed Flying-foxes.	No
	Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts.	No
	Describe the species, age structure & demographics of flying-foxes killed in fruit crops to improve the understanding of the impact by assessing trends in the species, sex, age & reproductive status of animals killed on crops.	No
	Determine characteristics of roosting habitat for Grey-headed Flying-foxes, exploring the roles of floristic composition, vegetation structure, microclimate and landscape features, and assess the status of camps.	No
	Investigate the age structure and longevity of Grey-headed Flying-foxes.	No
	Assess the impacts Grey-headed Flying-fox camps have on water quality, and publish results in a peer-reviewed journal.	No
	Develop methods to monitor landscape scale nectar availability trends, to explain/potentially predict crop damage trends where crop protection is absent, & promote importance of foraging habitat productive in seasons critical to the horticulture industry.	No
	Investigate between-year fidelity of Grey-headed Flying-fox individuals to seasonal camps.	No

Recovery strategy	Priority actions	Likely to be affected by project
	Investigate the differences in genetic relatedness, sex, age etc. between sedentary and transient Grey-headed Flying-foxes.	No
	Investigate the genetic structure within Grey-headed Flying-fox camps, including levels of relatedness within and between members of adult groups, occupants of individual trees etc.	No
	Investigate the patterns of juvenile Grey-headed Flying-fox dispersal and mortality, allowing identification of the specific habitat requirements of juveniles.	No
Survey/Mapping and Habitat assessment	Identify the commercial fruit industries that are impacted by Grey-headed Flying-foxes, to provide an information base for use by the various stakeholders.	No
	Set priorities for protecting foraging habitat critical to the survival of Grey-headed Flying-foxes and generate maps of priority foraging habitat.	No
	Establish & maintain a range-wide database of Grey-headed Flying-fox camps, including information on location, tenure, zoning & history of use, for distribution to land management/planning authorities, researchers & interested public.	No
	Improve knowledge of Grey-headed Flying-fox camp locations, targeting regional areas and seasons where information is notably incomplete, such as inland areas during spring and summer.	No

Specific impacts of the project

The project may result in the removal of approximately 0.05 ha of suitable foraging habitat for the Grey-headed Flying-fox.

C.1 Environmental Planning and Assessment Act 1979 assessment

How is the project likely to affect the habitat of a threatened species, population or ecological community?

The project may result in the removal of a small amount of foraging habitat (0.05 ha) for the Grey-headed Flying-fox in study area. This is not considered to be significant as abundant food resources are present in the bushland, parklands, roadsides and backyard gardens of Sydney and the greater Sydney Basin in the form of fruit trees, *Phoenix canariensis* and other palm species, fig trees, and eucalypt species.

How is the project likely to affect current disturbance regimes?

The study area has remained in its current state since the original construction of the Rozelle freight line and urbanisation of the Sydney area. The project is not introducing a new rail line into the habitat of the Grey-headed Flying-fox so is not introducing a new form of disturbance.

The environment of the study area is highly disturbed and natural disturbance regimes upon which biodiversity depend, such as fire intervals, no longer occur. Consequently, the project will not interfere with the current disturbance regimes present within the study area.

Some disturbance of mature eucalypt trees that form suitable foraging habitat for the Grey-headed Flying-fox may occur. However, revegetation and establishment of Bushcare sites along the alignment will re-establish tree species that will provide foraging habitat for the Grey-headed Flying-fox in the long-term.

How is the project likely to affect habitat connectivity?

The construction of stops along the route does not require the removal of large eucalypt trees. Therefore little habitat fragmentation will occur. As the Grey-headed Flying-fox is a highly mobile species capable of long distance flight (up to 50 km) to find foraging resources, it is unlikely that any fragmentation of the GreenWay would affect this species. Dispersal to other camps will not be affected.

The revegetation and Bushcare sites proposed by the project will serve to decrease the amount of fragmentation that is currently present within the study area including the GreenWay. Operation of the rail line is unlikely to present a barrier effect to the Grey-headed Flying-fox.

How is the project likely to affect critical habitat?

No critical habitat has been declared for the Grey-headed Flying-fox. Therefore, no critical habitat will be affected by the project. However, isolated urban street trees and mature eucalypts in parks and gardens of Sydney can still be considered an important food source for the Grey-headed Flying-fox, particularly during winter when other food resources are limited. Camps are critical for the survival of the Grey-headed Flying-fox and none will be affected by the project.

Conclusion

Taking in to concern the above heads of consideration, it is unlikely that the project will have a significant impact on the Grey-headed Flying-fox. Some removal of habitat (approximately 0.05 ha) will occur. However, the revegetation and establishment of Bushcare sites along the rail alignment and GreenWay will create a greater area of foraging habitat for the Grey-headed Flying-fox in the long-term, enhancing the viability of the habitat for these species. The current disturbance regimes will not be interfered with and critical habitat will not be affected.

C.2 Environment Protection and Biodiversity Conservation Act 1999 significance assessment

The Grey-headed Flying-fox is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment Water Heritage and the Arts 2009). Under the *Environment Protection and Biodiversity Conservation Act 1999* important populations are:

- likely to be key source populations either for breeding or dispersal

- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

Grey-headed Flying-foxes occurs across a range of wooded habitats where their favoured food, eucalypt blossom occurs. They set up roosting camps in association with blossom availability, which are usually situated in dense vegetation and associated with water. Grey-headed Flying-foxes can migrate up to 750 km north during the winter and during this time young flying-foxes establish camps. The study area does not contain suitable habitat for roosting camps and such habitat does not occur within its close vicinity. Roosting camps are present at Wolli Creek Nature Reserve, Clyde along the Duck River, and in the Royal Botanic Gardens in the Sydney CBD. Due to their highly mobile nature and large foraging range, individuals from these and other camps may visit the study area for foraging purposes. Therefore the study area is not considered likely to be a key source population for breeding or likely to be considered necessary for maintaining genetic diversity.

The range of the Grey-headed Flying-fox range extends from Melbourne Victoria to Maryborough Queensland and therefore the subject site is not at the limit of the species range. Therefore, it is not considered that the Grey-headed Flying Fox population foraging within the subject site is an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

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

The Grey-headed Flying-fox that utilise the study area for foraging would not be considered part of an important population. Furthermore, the removal of a small amount of foraging habitat (0.05 ha) in study area would not lead to a long-term decrease in the size of the Grey-headed Flying-fox population as abundant food resources are present in the parklands, roadsides and backyard gardens of Sydney in the form of fruit trees, *Phoenix canariensis* and other palm species, fig trees, and eucalypt species.

Reduce the area of occupancy of an important population of the species

The Grey-headed Flying-fox that utilise the study area for foraging would not be considered part of an important population. Furthermore, the removal of a small amount of foraging habitat (0.05 ha) in study area would not lead to a long-term decrease in the area of occupancy for the Grey-headed Flying-fox as this species will still utilise the study area, and surrounding urban areas, for foraging.

Fragment an existing important population into two or more populations

The Grey-headed Flying-fox utilising the study area for foraging would not be part of an important population. Due to the large foraging range of the Grey-headed Flying-fox (up to 50 km from camps) it is unlikely that the removal of 0.05 ha of foraging habitat that may result from the project will result in fragmentation of the Grey-headed Flying-fox population.

Adversely affect habitat critical to the survival of a species

No critical habitat has been declared for the Grey-headed Flying-fox. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be removed (0.05 ha) is a very small proportion of the available habitat within the locality. Importantly, no Grey-headed Flying-fox camps will be impacted by the project. The habitat that would be cleared as a result of the project does not represent habitat critical to the survival of the Grey-headed Flying-fox. Foraging habitat attributes occurring within the study area are not considered critical to maintaining the viability of Grey-headed Flying-fox individuals in the locality, or individuals that may be a part of an 'important population'.

The project design and mitigation measures that include revegetation and establishment of Bushcare sites will serve to increase the amount of foraging habitat that is available to the Grey-headed Flying-fox in the long-term. Eucalypt species planted in these areas will provide a valuable source of food as they mature and begin to flower.

Disrupt the breeding cycle of an important population

The Grey-headed Flying-Fox foraging within the study area would not be part of an important population. Nonetheless, the project does not involve the removal or disturbance of any Grey-headed Flying-fox camps. Consequently, the breeding cycle of the Grey-headed Flying-fox will not be disrupted by the project.

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

The project will remove a small area (0.05 ha) of foraging habitat for the Grey-headed Flying-fox. Foraging habitat attributes occurring within the study area are not considered so important to maintaining the viability of Grey-headed Flying-fox such that the species is likely to decline if they were to be removed. Comparable forging resources are available in the locality and are present in the parklands, roadsides and backyard gardens of Sydney in the form of fruit trees, *Phoenix canariensis* and other palm species, fig trees and eucalypt species.

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

It is not likely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become further established as a result of the project. The study area is currently occupied by a range of introduced predators including foxes, cats and dogs and the project will not increase the prevalence of these species due to its highly urbanised nature.

Introduce disease that may cause the species to decline

No. There are no known diseases that are likely to increase in the area as a result of the project.

Interfere with the recovery of the species

Based on the potential ecological impacts of the project on the Grey-headed Flying-fox, as discussed above, it is not likely that the project would interfere with the recovery of this species or any actions outlined in the national recovery plan (Department of Environment Climate Change and Water 2009).

Conclusion

The Grey-headed Flying-fox frequents habitats that contain eucalypt blossom and trees with fruits such as figs and palms. The study area contains a very small area (0.05 ha) of suitable foraging habitat in the form of planted eucalypt, fig, and palm trees that may be removed by the project. This small amount of habitat removal is unlikely to be significant to the local population, due to the abundance of comparable foraging habitat elsewhere within Sydney and the wider Sydney Basin. There are no Grey-headed Flying-fox camps within the study area, but there are camps in the locality at Wolli Creek, Clyde, and the Royal Botanic Gardens. Therefore, taking into consideration the questions of the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment Water Heritage and the Arts 2009), the project is unlikely to have a significant impact upon the Grey-headed Flying-fox.

D. Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

Status

The Eastern Bentwing-bat is listed as Vulnerable under the *Threatened Species Conservation Act 1995*.

Description

The Eastern Bentwing-bat is typically blackish to reddish brown above and paler below. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing" appearance. It weighs up to 20 g, has a head and body length of about 6 cm and a wingspan of 30 - 35 cm (Churchill 2008; Duncan et al. 1999; NSW Scientific Committee 2004)

Distribution

Eastern Bentwing-bats occur along the east and north-west coasts of Australia (Churchill 2008; NSW Scientific Committee 2004).

Habitat and ecology

Distributed across the east coast of Australia, it rests in caves, old mines, stormwater channels and comparable structures including occasional buildings (Dwyer 1998). Eastern Bentwing-bat is typically found in well-timbered valleys where it forages above the tree canopy on small insects (Churchill 2008).

Threats

Key threats to this species include (NSW Scientific Committee 2004):

- loss of habitat
- feral predators such as cats and foxes
- disturbance of winter roost sites
- application of pesticides in or adjacent to foraging areas.

Recovery actions

No recovery plan has been prepared for any microchiropteran bat under the *Threatened Species Conservation Act 1995*. The Department of Environment, Climate Change and Water has however identified 25 priority actions within 11 recovery strategies to help recover this group (

Table D-1).

Table D-1 Recovery actions

Recovery strategy	Priority actions	Likely to be affected by project
Community and land-holder liaison/ awareness and/or education	Promote bats throughout the rural community as ecologically interesting and important, but sensitive to disturbance at caves/disused mine tunnels.	No
Data recording and storage	Compile register of all known roost sites in natural and artificial structures including current and historical data and identify significance of roost, e.g. maternity, hibernation, transient roost.	No
Habitat management: Feral Control	Control foxes and feral cats around roosting sites, particularly maternity caves and hibernation sites.	No
	Control goats around roosting sites, particularly maternity caves and hibernation sites.	No
Habitat management: Fire	Exclude prescription burns from 100m from cave entrance, ensure smoke/flames of fires do not enter caves/roosts in artificial structures.	No
	Prepare fire management plans for significant roost caves, disused mines, culverts, especially maternity and winter roosts.	No
Habitat management: Other	Prepare management plans for significant bat roosts especially all known maternity colonies and winter colonies.	No
	Ensure protection of known roosts and forest within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments.	No
Habitat management: Site Protection (e.g. Fencing/Signage)	Search for significant roost sites and restrict access where possible (e.g. gating of caves). Significant includes maternity, hibernation and transient sites including in artificial structures.	No
	Identify and protect significant roost habitat in artificial structures (e.g. culverts, old buildings and derelict mines).	No
	Restrict access where possible to known maternity sites. (e.g.: signs).	No
	Restrict caving activity during critical times of year in important roosts used by species, particularly maternity and hibernation roosts	No
	Restrict caving activities at significant roosts during important stages of the annual bat life cycle (e.g. winter hibernation, summer maternity season).	No
Habitat management: Weed Control	Undertake non-chemical removal of weeds (e.g. lantana, blackberry) to prevent obstruction of cave entrances	No
Habitat Protection (inc vca/ jma/ critical habitat nomination etc)	Promote the conservation of these key roost areas using measures such as incentive funding to landholders, offsetting and biobanking, acquisition for reserve establishment or other means.	No
Monitoring	Monitor the breeding success of maternity colonies in cave roosts over a number of years to determine the viability of regional populations.	No
	Regular censuses of maternity colonies (Wee Jasper, Bungonia, Willi-Willi, Riverton) and other key roosts in network, especially where there are population estimates from banding in the 1960s.	No

Recovery strategy	Priority actions	Likely to be affected by project
	For roost caves vulnerable to human disturbance, monitor their visitation by people, particularly during winter and spring/summer maternity season and in school holidays.	No
Research	Confirm species taxonomy of NSW populations, relative to other Australian populations.	No
	Determine the effectiveness of PVP assessment, offsets and actions for bats.	No
	Establish a gating design for disused mines across species range that will not adversely impact species. Consultation with cave bat specialist prior to any gating operations.	No
	Identify the susceptibility of the species to pesticides.	No
	Measure genetic population structure among cave roosts of maternity colonies to estimate dispersal and genetic isolation, and vulnerability to regional population extinction.	No
	Study the ecological requirements of maternity colonies and their environs and migratory patterns.	No
	Research the effect of different burning regimes on cave disturbance and surrounding foraging habitat	No

D.1 Environmental Planning and Assessment Act 1979 assessment

How is the project likely to affect the habitat of a threatened species, population or ecological community?

The project may result in the removal of a small amount of foraging habitat (0.05 ha) for the Eastern Bentwing-bat in the study area. Abundant food resources are present in the bushland, parklands, roadsides and backyard gardens of Sydney and the greater Sydney Basin. Therefore, the removal of a small amount of vegetation is unlikely to significantly affect the Eastern Bentwing-bat. Disturbance to bridges resulting from the project may have an impact on roosting habitat.

How is the project likely to affect current disturbance regimes?

The study area has remained in its current state since the original construction of the Rozelle freight line and urbanisation of the Sydney area. The project is not introducing a new rail line into the habitat of the Eastern Bentwing-bat so is not introducing a new form of disturbance.

The environment of the study area is highly disturbed and natural disturbance regimes upon which biodiversity depend, such as fire intervals, no longer occur. Consequently, the project will not interfere with the current disturbance regimes present within the study area.

Some disturbance of mature eucalypt trees that form part of the foraging habitat for the Eastern Bentwing-bat may occur. However, revegetation and establishment of Bushcare sites along the alignment will re-establish tree species that will provide foraging habitat for the Eastern Bentwing-bat in the long-term.

How is the project likely to affect habitat connectivity?

The construction of stops along the route does not require the removal of large eucalypt trees. Therefore little habitat fragmentation will occur. As the Eastern Bentwing-bat is a highly mobile species capable of long distance flight, it is unlikely that any fragmentation of the GreenWay would affect this species.

The revegetation and Bushcare sites proposed by the project will serve to decrease the amount of fragmentation that is currently present within the study area including the GreenWay. Operation of the rail line is unlikely to present a barrier effect to the Grey-headed Flying-fox.

How is the project likely to affect critical habitat?

No critical habitat has been declared for the Eastern Bentwing-bat. Therefore no critical habitat will be affected by the project. Habitat such as maternity caves may be considered critical to the survival of the Eastern Bentwing-bat; however, no caves will be affected by the project.

Conclusion

Taking in to concern the above heads of consideration, it is unlikely that the project will have a significant impact on the Eastern Bentwing-bat. Some removal of habitat (approximately 0.05 ha) may result from the project and disturbance to bridges that may provide suitable roosting habitat may also occur. However, the revegetation and establishment of Bushcare sites along the rail alignment and GreenWay will improve the foraging habitat for the Eastern Bentwing-bat in the long-term, enhancing the viability of the habitat for this species. The current disturbance regimes will not be interfered with and critical habitat will not be affected.

Appendix D References

AMBS 2007, *Fauna study, Marrickville LGA*, AMBS, Sydney.

Churchill, S 2008, *Australian Bats*, 2nd edn, Allen & Unwin, Sydney.

Department of Environment and Conservation 2006, *Threatened species, populations and ecological communities*, NSW Department of Environment and Conservation, 2006, <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>.

Department of Environment and Conservation & Department of Primary Industries 2005, *Draft guidelines for Threatened species assessment under Part 3A*, Department of Environment and Conservation, Hurstville.

Department of Environment Climate Change and Water 2009, *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*, Department of Environment, Climate Change and Water, Sydney.

Department of Environment Climate Change and Water 2010, *Long-nosed Bandicoot population, Inner Western Sydney - profile*, Department of Environment Climate Change and Water, viewed 30 August 2010 2010, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20107>.

Department of the Environment and Heritage 2003, *EPBC Act Administrative Guidelines on Significance - Supplement for the Grey-headed Flying-fox*, Department of the Environment and Heritage, Canberra.

Department of the Environment and Heritage 2006, *EPBC Act Policy Statement 1.1 Significant Impact Guidelines*, Department of the Environment and Heritage, Canberra.

Department of the Environment Climate Change and Water 2010a, *Little Lorikeet - profile*, Department of the Environment Climate Change and Water, viewed 30 August 2010 2010, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20111>.

Department of the Environment Climate Change and Water 2010b, *Long-nosed Bandicoot population, Inner Western Sydney - profile*, Department of Environment Climate Change and Water, viewed 30 August 2010 2010, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20107>.

Department of the Environment Climate Change and Water 2010c, *Swift Parrot - profile*, Department of the Environment Climate Change and Water, viewed 30 August 2010 2010, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10455>.

Department of the Environment Water Heritage and the Arts 2009, *EPBC Act Policy Statement 1.1 Matters of National Environmental Significance, Significant Impact Guidelines*, Department of the Environment Water Heritage and the Arts, Canberra.

Duncan, A, Baker, BG & Montgomery, N 1999, *The Action Plan for Australian Bats*, Canberra.

Dwyer, PD 1998, 'Common Bent-wing Bat. ' in R Strahan (ed.), *The Mammals of Australia.*, New Holland Publishers., Sydney.

Garnett, ST & Crowley, GM 2000, *The Action Plan for Australian Birds*, Environment Australia, Canberra.

Higgins, PJ (ed.) 1999, *Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbirds*, Volume 4: Parrots to Dollarbird, Oxford University Press, Melbourne.

Marrickville Council 2009, *State of the environment report 2008-2009*, Marrickville Council.

NSW National Parks and Wildlife Service 2001, *Grey-headed Flying Fox threatened species information*, NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee 2004, *Eastern Bentwing Bat - vulnerable species listing*, Department of Environment and Conservation, Hurstville.

NSW Scientific Committee 2009, *Little Lorikeet Glossopsitta pusilla - vulnerable species listing NSW Scientific Committee - final determination*, Department of Environment, Climate Change and Water.

Strahan, R 1995, *The Mammals of Australia*, Reed New Holland, Sydney.

Swift Parrot Recovery Team 2001, *Swift Parrot Recovery Plan*, Department of Primary Industries, Water and Environment, Hobart.

Van Dyck, S & Strahan, R 2008, *Mammals of Australia*, 3rd edn, Reed New Holland, Sydney.

Webster, R 1988, *The Superb Parrot. A Survey of the Breeding Distribution and Habitat Requirements.*, ANPWS Report Series No. 12, Canberra.