Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Pimelea curviflora var. curviflora	A small shrub confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Distribution associated with shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Unlikely No records within 10 km of the study area. No suitable habitat exists within the study area.
Pimelea spicata	In western Sydney, occurs on undulating topography of substrates derived from Wianamatta Shale in associated with Cumberland Plain Woodland.	Unlikely There are records of this species to the west of the study area. The closest record near the south-west corner of the waste disposal site is dated from 1962. The only areas where soil derived from Wianamatta Shale has been mapped in the study area are in the south of the waste disposal site. The vegetation here appears to be highly fragmented and degraded and is unlikely to provide suitable habitat for this species.
Pomaderris brunnea	Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers. Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Unlikely No records within 10 km of the study area. No suitable habitat exists within the study area.
Pterostylis gibbosa	Known from a small number of populations in the Hunter, Illawarra and Shoalhaven regions. Apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Unlikely No records within 10 km of the study area; the study area appears to be outside the current known geographical rangeof this species.
Pterostylis saxicola	Distribution restricted between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	Unlikely No records within 10 km of the study area. No suitable habitat exists within the study area.
Pultenaea parviflora	Endemic to the Cumberland Plain from Windsor to Penrith and east to Dean Park, with outlier populations in Kemps Creek and Wilberforce. Associated with scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	Possible One record approximately 7.5 km north-west of study area Marginal potential habitat may occur in Castlereagh Scribbly Gum Woodland in study area.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Pultenaea pedunculata	In NSW represented by just three disjunct populations, including one on the Cumberland Plain. Generally grows in woodland but plants have also been found on road batters and coastal cliffs.	Possible Marginal potential habitat may occur in Castlereagh Scribbly Gum Woodland in study area.
Thelymitra sp. Kangaloon (D.L.Jones 18108)	Endemic to the Fitzroy Falls/Robertson/ Kangaloon area; grows in seasonally swampy sedgeland on grey silty clay loam at 600–700m above sea level.	Unlikely No records within 10 km of the study area. No suitable habitat exists within the study area.

3.3 Terrestrial Fauna

3.3.1 Database Searches

Based on database and literature review, 54 animal species listed under the EPBC and/or TSC Acts are either known or have the potential to occur within 10 kilometres of the study area (Table 12). TSC Act records occurring within 10 kilometres of the study area are shown in Figure 11.

Table 12: Threatened fauna occurring within 10 kilometres of the study area

Scientific name	Common name	Status under EPBC Act	Status under TSC Act
Anthochaera phrygia	Regent Honeyeater	Endangered	Critically endangered
Apus pacificus	Fork-tailed Swift	Migratory	
Ardea alba	Great Egret	Migratory	
Ardea ibis	Cattle Egret	Migratory	
Burhinus grallarius	Bush Stone-curlew		Endangered
Callocephalon fimbriatum	Gang-gang Cockatoo		Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable
Circus assimilis	Spotted Harrier		Vulnerable
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Vulnerable
Dasyurus maculatus maculatus	Spotted-tailed Quoll	Endangered	Endangered
Ephippiorhynchus asiaticus	Black-necked Stork		Endangered
Epthianura albifrons	White-fronted Chat		Vulnerable

Scientific name	Common name	Status under EPBC Act	Status under TSC Act
Epthianura albifrons	White-fronted Chat Population in the Sydney Metropolitan Catchment Area		Endangered population
Falsistrellus tasmaniensis	Eastern False Pipistrelle		Vulnerable
Glossopsitta pusilla	Little Lorikeet		Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory	
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Hieraaetus morphnoides	Little Eagle		Vulnerable
Hirundapus caudacutus	White-throated Needletail	Migratory	
Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable	Endangered
Gallinago hardwickii	Latham's Snipe	Migratory	
Isodon obesulus obesulus	Southern Brown Bandicoot	Endangered	
Lathamus discolor	Swift Parrot	Endangered	Endangered
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Endangered
Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	
Litoria raniformis	Growling Grass Frog	Vulnerable	
Lophoictinia isura	Square-tailed Kite		Vulnerable
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)		Vulnerable
Meridolum corneovirens	Cumberland Plain Land Snail		Endangered
Merops ornatus	Rainbow Bee-eater		
Miniopterus schreibersii oceanensis	Eastern Bent-wing bat		Vulnerable
Monarcha melanopsis	Black-faced Monarch	Migratory	
Mixophyes balbus	Stuttering Frog	Vulnerable	Endangered
Mormopterus norfolkensis	Eastern Free-tail bat		Vulnerable
Myiagra cyanoleauca	Satin Flycatcher	Migratory	
Myotis macropus	Southern Myotis		Vulnerable
Neophema chrysogaster	Orange-bellied Parrot	Critically Endangered	
Ninox connivens	Barking Owl		Vulnerable
Ninox strenua	Powerful Owl		Vulnerable
Petaurus norfolcensis	Squirrel Glider		Vulnerable

Scientific name	Common name	Status under EPBC Act	Status under TSC Act
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	Endangered
Petroica boodang	Scarlet Robin		Vulnerable
Petroica phoenicea	Flame Robin		Vulnerable
Phascolarctos cinereus	Koala		Vulnerable
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	Vulnerable	Vulnerable
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	
Pseudophryne australis	Red-crowned Toadlet		Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Rhipidura rufifrons	Rufous Fantail	Migratory	
Rostratula australis	Australian Painted Snipe	Vulnerable	Endangered
Saccolaimus flaviventris	Yellow-bellied Sheath-tail bat		Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat		Vulnerable

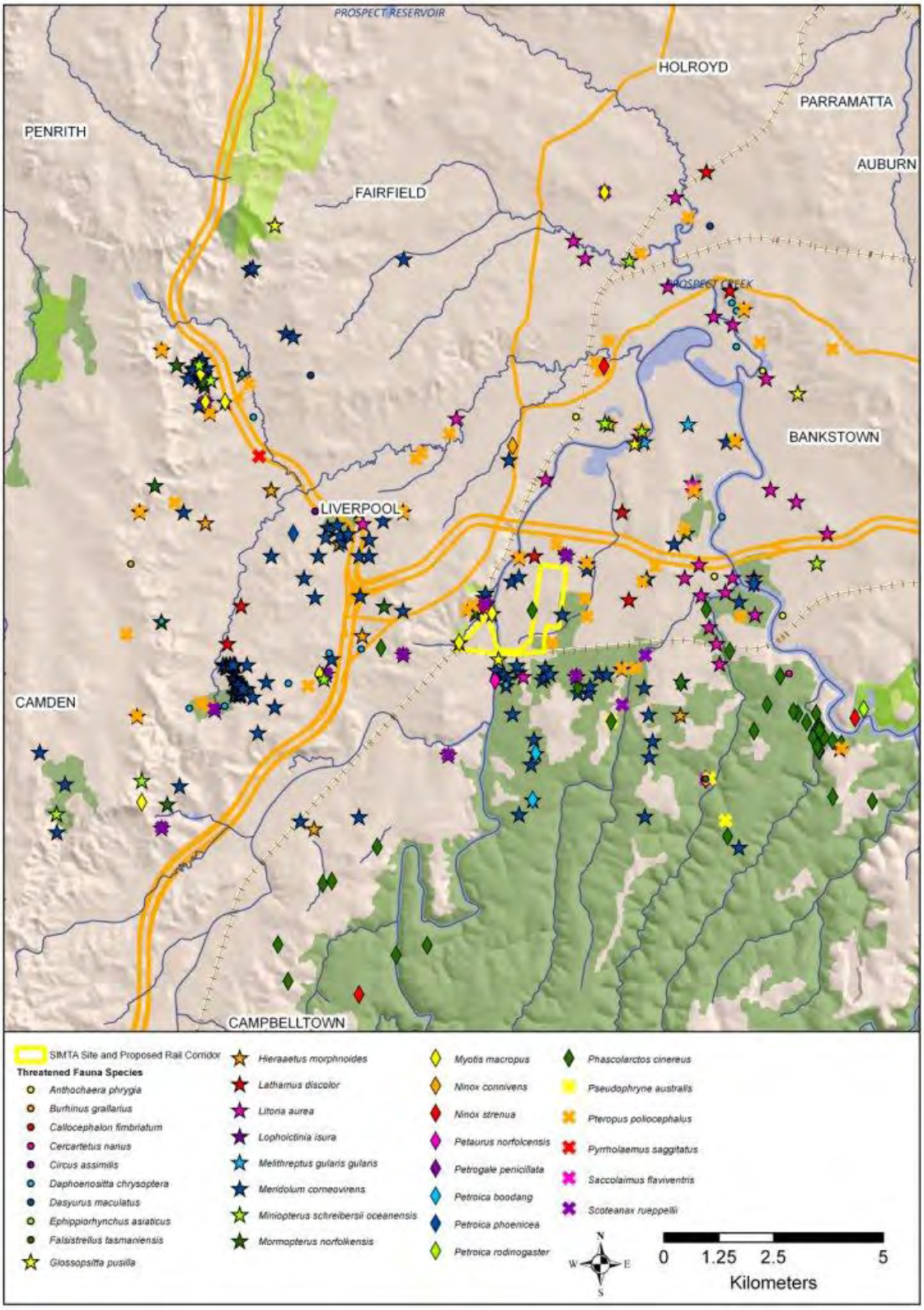

Figure 11: Threatened fauna species records within 10 kilometres of the study area

3.3.2 Field Survey

3.3.2.1 Fauna Species

A total of 59 vertebrate fauna species, comprising 54 native and 5 exotic species, were recorded during the current field investigation (Appendix 3). Thirty-eight species of birds, 15 species of mammals, four species of reptiles and two species of amphibians were aurally and visually identified from the study area. Three threatened mammal species, Southern Myotis (*Myotis macropus*), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Grey-headed Flying Fox (*Pteropus poliocephalus*) were recorded in the study area; these species are discussed in further detail in Section 3.3.2.4.

Plate 21. White-winged Choughs on SIMTA site

Plate 22. Rainbow Lorikeets in tree hollowon SIMTA site

Plate 23. Red-bellied Black Snake in rail corridor

Plate 24. Red-rumped Parrots on SIMTA site

3.3.2.2 Fauna Habitats

Three broad fauna habitat types were identified from the study area; remnant vegetation, riparian habitats and cleared and disturbed areas (Figure 12).

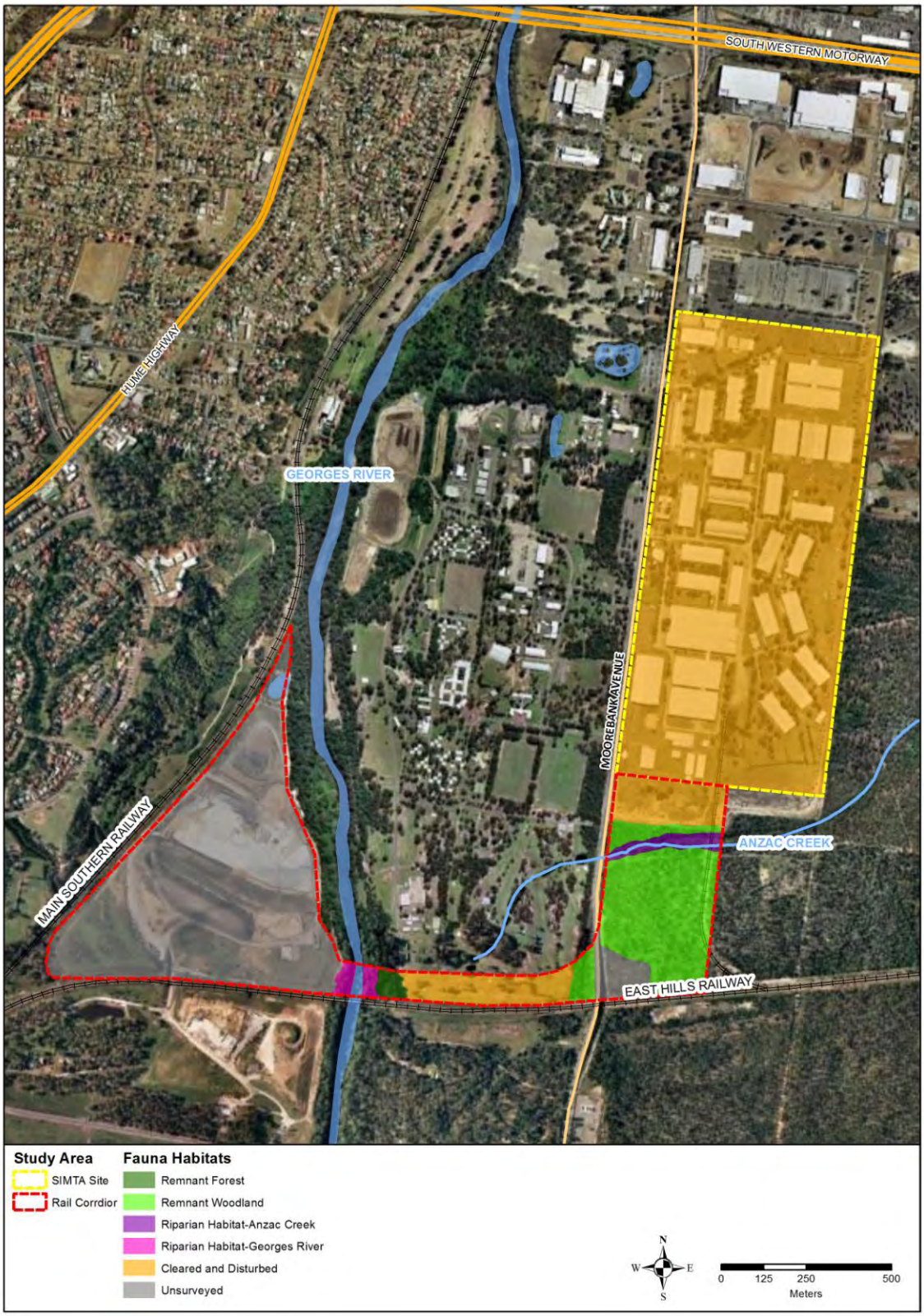

Figure 12: Fauna habitat types in the study area

Remnant Vegetation

Remnant Woodland

Plate 25. Remnant woodland of rail corridor

Plate 26. Remnant woodland of rail corridor

Remnant woodland communities occur across the proposed rail corridor south of the SIMTA site. The low canopy is dominated by eucalypts and melaleucas, providing potential nesting, roosting and sheltering habitat for birds such as Black-faced Cuckoo-shrike (*Coracina novaehollandiae*) and Spotted Pardalote (*Pardalotus punctatus*).

The dense shrub layer offers sheltering and foraging habitat for birds such as Red-browed Finch (*Neochmia temporalis*). Well-deveoped leaf litter and groundlayer vegetation offers sheltering and foraging habitat for reptiles such as Red-bellied Black Snake (*Pseudechis porphyriacus*) and Eastern brown Snake (*Pseudonaja textilis*). Micro-chiropteran bat species including Gould's Wattled Bat (*Chalinolobus gouldii)* and the threatened Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis)* were recorded by Anabats placed in remnant woodland, suggesting these species may forage for invertebrates above, within and along the margins of woodland vegetation.

Remnant Forest

Plate 27. Remnant forest upslope of Georges River riparian zone

Plate 28. Remnant forest upslope of Georges River riparian zone

Remnant forest upslope of the Georges river riparian zone supports large canopy trees, predominantly eucalypts, that offer nesting and sheltering habitat to birds including Golden Whistler (*Pachycephala pectoralis*), Eastern Rosella (*Platycercus eximius*) and Eastern Yellow Robin (*Eopsaltria australis*).

The mid-storey of small trees and shrubs of the understorey offer sheltering and foraging habitat arboreal mammals such as Ringtail Possum (*Pseudocheirus peregrines*). Groundlayer features including well-developed leaf litter and ground timber offers foraging and sheltering habitat to reptiles and small terrestrial mammals. Possible recordings of microchiropteran bat species including the threatened Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) the Southern Myotis (*Myotis macropus*) and an unidentified Long-eared Bat (*Nyctophilus sp*.), were made by Anabats placed in remnant forest; such species may forage amongst forest vegetation or along Georges River.

Riparian Habitats

Anzac Creek

Plate 29. Anzac Creek within rail corridor

Plate 30. Anzac Creek within rail corridor

Anzac Creek is heavily vegetated and contains few pools of open water. Aquatic vegetation included *Typha, Salvinia molesta* and the dense covering of ferns, sedges and rushes fringing the creek provides habitat for amphibians such as Common Eastern Froglet (*Crinia signifera*). Riparian vegetation is dominated by a canopy of melaleaucas and eucalypts with a dense understorey of flowering shrubs such as *Hakea sp., Banksia sp.* and *Acacia,* providing sheltering, nesting and foraging habitat for a variety of birds including Brown Gerygone (*Gerygone mouki*), Grey Butcherbird (*Cracticus torquatus*) and Fan-tailed Cuckoo (*Cacomantis flabelliformis*). Well-developed leaf litter and small ground timber offers shelter and foraging habitat to small terrestrial mammals, although there is an absence of rocky features and hollow logs.

Georges River

Plate 31. Dense infestion of Balloon Vine within Georges River riparian vegetation

Plate 32. Georges River

Georges River is approximately 50m wide and slow-flowing through the study area, providing habitat for water birds such as Pacific Black Duck (*Anas superciliosa*), Dusky Moorhen (*Gallinula tenebrosa*) and Purple Swamphen (*Poryphyrio poryphyri*). Riparian vegetation associated with Georges River is highly disturbed and the understorey and groundlayer strata are dominated by woody weeds such as Small-leaved Privet (*Ligustrum sinense*) and Lantana (*Lantana camara)* and exotic climbers such as Balloon Vine (*Cardiospermum grandiflorum)*.

Dense infestations of these weeds have reduced available habitat to many fauna species by smothering native vegetation; however, offer potential sheltering and foraging habitat to birds such as Superb Fairy Wren (*Malurus cyaneus*) and Eastern Whipbird (*Psophodes olivaceus*).

Cleared and Disturbed

Cleared and disturbed habitat occurs across the entire SIMTA site and the southern portion of the rail corridor (the Royal Engineers Golf Course) that adjoins the East Hills Railway. Native vegetation has been predominently cleared from these areas and persists as isolated trees amongst expanses of mown exotic and native grasses.

Isolated trees offer potential nesting, sheltering and roosting habitat to birds such as Pied Currawong (*Strepera graculina*) and Noisy Miner (*Manorina melanocephala*). Flowering eucalypts also provide foraging habitat for Grey-headed Flying Fox (*Pteropus poliocephalus)*. A small number of scribbly gums (*Eucalyptus sclerophylla)* located in the south of the SIMTA site support small and medium-sized hollows, offering nesting habitat to hollow-dependent species such as Rainbow Lorikeet (*Trichoglossus haematodus*) and Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*).

A diversity of microchirpoteran bat species were recorded in cleared and disturbed areas, including White-striped Mastiff Bat (*Tadarida australis*), Gould‘s Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*Chalinolobus morio*), Little Forest Bat (*Vespadelus vulturnus*) and the threatened Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).

Open grassy areas provide foraging habitat for ground-feeding birds such as White-winged Chough (*Corcorax melanorhamphos*), Red-rumped parrot (*Psephotus haematonotus*) and small terrestrial mammals such as the Brown Hare (*Lupus capensis*).

Scattered native and exotic shrubs and trees assocated with the formalised drainages channels in the south of the SIMTA site, such as Black She-oak (Allocasuarina littoralis), eucalypts, Camphor laurel (Cinnamomum camphora) and Cotoneaster sp., offer foraging, sheltering and roosting habitat to birds such as Noisy Miner (Manorina melanocephala), Raven (Corvus coroboides) and Magpie Lark (Grallina cyanoleuca). Other small trees and shrubs throughout the SIMTA site that may offer sheltering and nesting habitat to smaller birds are restricted to small areas of horticultural plantings.

Other fauna habitat features such as rocky features, well-developed leaf litter, ground timber and hollow logs are absent from cleared and disturbed areas. As a result, availability of sheltering and foraging habitat for reptiles and cover-dependent terrestrial mammals is reduced. Depressions in open areas that contain temporary water following rain events offer habitat to colonising amphibians such as Common Eastern Froglet (Crinia signifera).

Plate 33. Cleared areas of rail corridor

Plate 34. Isolated trees of SIMTA site

Unsurveyed Areas

The portion of the study area west of Georges River, including Glenfield Waste Disposal site, was not surveyed due to restricted access. It is likely that the western bank of Georges River within the study area supports similar riparian vegetation to the eastern bank; it appears degraded by dense infestation of woody weeds and exotic climbers. However, the western bank supports larger trees than the eastern bank and these trees may contain tree hollows. Any fauna species or habitat features occurring on the western bank of the Georges River, within Glenfield Waste Disposal site or in the south-western corner of the study area are unknown and accordingly, have not been assessed at this stage.

3.3.2.3 Habitat Connectivity

The study area contains and is bound by significant barriers to fauna movement, including Moorebank Ave, the East Hills Railway Line and chain-mesh fencing surrounding the SIMTA site, rail corridor and Royal Engineers Golf Course. The chain-mesh fencing would limit movement into and through the study to small terrestrial mammals, reptiles, amphibians and birds and bats. Larger terrestrial mammals that may occur in the locality would be excluded from much of the study area as a result.

Plate 37. SIMTA site bound by chain mesh fencing and adjoining Moorebank Avenue

Plate 38. Rail corridor bound by chain mesh fencing adjoining East Hills Railway

Vegetation of cleared and disturbed areas is generally limited to single, isolated trees amongst expanses of mown exotic and native grasses. The lack of connectivity between vegetation of the study area and adjoining areas reduces potential movement of arboreal mammals and cover-dependent fauna into and through the study area.

Habitat connectivity is greatest within the riparian vegetation associated with Georges River, which maintains connectivity with riparian vegetation to the north and south, including Holsworthy Military Area. This riparian corridor would facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals.

The locality surrounding the study area includes substantial areas of intact native vegetation contained with the Holsworthy Military Area. Holsworthy Military Area, located to the east and south of the study area, comprises approximately 18,000 hectares of continuous native vegetation, much of which has remained largely undisturbed as a result of restricted access to the Military Area (French *et al.* 2000). The diversity of vegetation communities within the Military Area includes forests, woodlands, heath and swamp communities, which in turn provide important habitat to locally and regionally occurring, and threatened flora and fauna species. Highly mobile fauna species such as birds and some mammals may predominantly reside within the Holsworthy Military Area and utilise the resources offered by the study area on a temporary or transient basis. Such species may include Powerful owl (*Ninox strenua*) and Greater broad-nosed bat (*Scoteanax rueppellii*) (DEH 2004).

3.3.2.4 Significant Fauna

Threatened Species

Three threatened fauna species were recorded within the study area (Figure 13).

Assessments of Significance have been undertaken for threatened species listed under the TSC Act (Appendix 5), while Significant Impact Assessments have been undertaken for threatened species listed under the EPBC Act (Appendix 6).

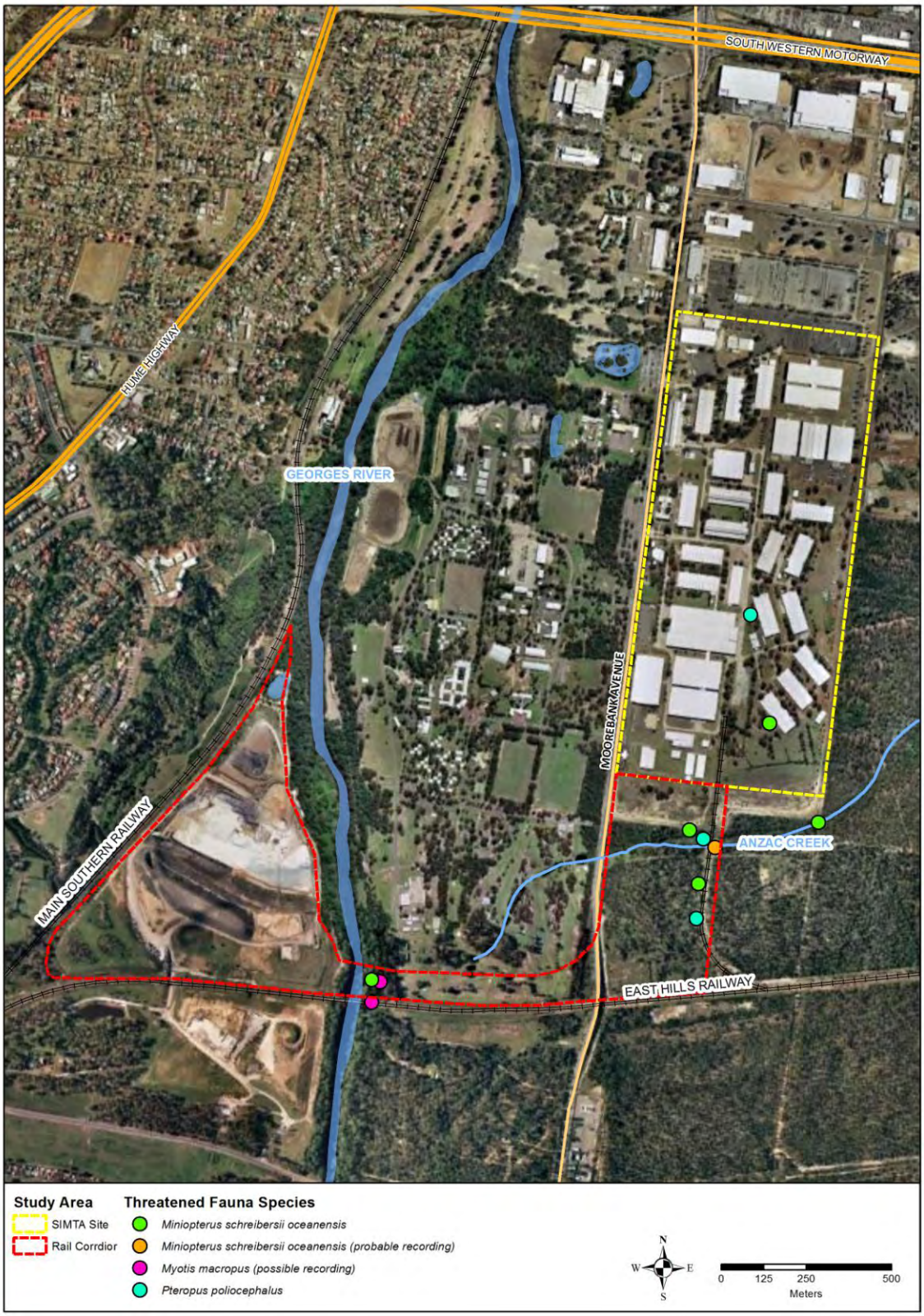

Figure 13: Locations of threatened fauna species recorded in the study area

Southern Myotis (*Myotis macropus*)

The Southern Myotis (previously known as the Fishing Bat) is listed as Vulnerable under the TSC Act. A possible ultrasonic call of the species was recorded at two locations in proximity to

Georges River; in remnant forest, upslope of Georges River riparian vegetation and under the existing railway bridge abutment that adjoins the study area to the south.

The Southern Myotis occurs across the northern and eastern coasts of Australia (from the Kimberley to Victoria) and is rarely found more than 100 kilometres inland. Although widespread it is considered to be relatively rare and is only patchily distributed within areas of apparently suitable habitat (Lumsden and Menkhorst 1995).

The species is typically found in association with riparian vegetation and also in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species forages over water for insects and small fish that they catch by raking their large feet of the water surface, however, also forage aerially for moths, beetles, crickets and flies.

The species roosts communally in groups of up to 15 individuals in caves, mine shafts, tree hollows, under bridges and in buildings, stormwater drains and amongst dense vegetation fringing watercourses. Less commonly, the species has been recorded roosting in partly submerged dead trees and within limestone cliffs. Roosts are typically located in proximity to water.

Within the study area the Southern Myotis may forage along the slow-flowing waters of Georges River for fish and invertebrates. No hollow trees were identified on the eastern side of Georges River within the study area that may offer roosting habitat to the species.

There is potential for the species to roost in hollow-bearing trees, under the existing rail bridge or amongst dense vegetation on the western side of the Georges River. No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result, potential habitat resources that may occur in this portion of the study area are unknown.

Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)

The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the TSC Act. Ultrasonic calls of the species were recorded at five locations across the SIMTA site and rail corridor.

The Eastern Bent-wing Bat bat occurs along the east and north-west coasts of Australia (DECC 2005) where it is known from a variety of habitats including rainforest, dry and wet sclerophyll forest, open woodland, paperbark forest and open grassland. The species hunts for moths and other flying insects above the canopy or open areas (DECC 2005). Eastern Bent-wing bats are known to utilise a number of roost sites throughout the year (Chuchill 1998).

Caves are the primary roosting habitat for this species; however Eastern Bent-wing Bats also use derelict mines, storm-water tunnels, buildings and other man-made structures (DECC 2005b). The most significant of these roosts are maternity roosts and those roosts used over winter for hibernation (DEC 2004a).

Female Eastern Bent-wing Bats inhabit and congregate in specific caves that provide constant high temperate and humidity to give birth and raise young (Dwyer 1995). Maternity caves are used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within a territorial range of about 300 kilometres from the maternity cave (Churchill, 1998). Movement between territories is rare. Breeding or roosting colonies can range from 100 to 150,000 individuals. As such, they are prone to population damage if their roosting site is disturbed or modified.

The Eastern Bent-wing Bat was recorded in remnant woodland and forest, and cleared and disturbed areas, suggesting that these areas may offer foraging habitat to this species. The species may also forage over the larger, continuous canopy of vegetation occurring in the

adjoining Holsworthy Military and on occasion extend its nightly foraging flights into the study area.

The study area does not support cave systems and as such, no preferred roosting habitat was identified. No roosts were identified from man-made structures although a thorough examination of warehouses and potential roost sites in the SIMTA site was not undertaken. No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result potential habitat resources that may occur in this portion of the study area are unknown.

Grey-headed Flying Fox (*Pteropus poliocephalus*)

The Grey-headed Flying-Fox is listed as Vulnerable under both the TSC Act and the EPBC Act. The Grey-Headed Flying fox was observed foraging amongst eucalypts in the SIMTA site and flying over remnant woodland of the proposed rail corridor south of the SIMTA site.

The Grey-headed Flying-fox occurs from Bunderberg in Queensland in the north to Melbourne in Victoria to the south, typically between the coast and the western slopes of the Great Dividing Range. In NSW, it occurs along the east coast, eastern slopes of the Great Dividing Range and the tablelands. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops.

The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range of 20 to 50 kilometres from a roosting camp. Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998); in summer, diet mainly comprises fruits of rainforest trees and vines in addition to the nectar and blossom of Eucalyptus, Melaleuca and Banksia. In winter, diet is dominated by nectar and blossom. Non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species within the locality; where previously existed a period of reduced availability of native food resource during the winter months, non-native species now supply food resources throughout the year (Parry-Jones & Augee 2001, Williams et al 2006).

Grey-headed Flying-foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young. Camps are typically located in gullies, close to water, in vegetation with a dense canopy, within 20 kilometres of a regular food source. Site fidelity to camps is high, with some camps being used for over 100 years (NPWS 2001). The closest known roosting camp to the subject site is located at located at Cabramatta Creek, approximately five kilometres to the north of the study area in Jacqui Osmond Reserve adjoining Cabramatta Creek. Other roosting camps are located within the Botanic Gardens at Farm Cove 27 kilometres to the east and Gordon 35 kilometres to the north-east.

The study area does not contain roosting habitat for this species. Habitat features of the study area which may support the Grey-Headed Flying-Fox include foraging habitat provided by a number of flowering exotic and native trees, predominantly eucalypts, located within the study area.

A tree survey has been conducted on the SIMTA site and 590 trees occurring on the site were mapped. Of those trees identified to species, at least 147 comprise known feed tree species (ABS 2001) for the Grey-headed Flying Fox including *Corymbia maculata* (Spotted Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus longifolia* (Woolybutt), *Eucalyptus saligna (*Sydney Blue Gum), *Lophostomon confertus* (Brush Box), *Angophora subvelutina* (Broad-leaved Apple) and *Eucalyptus parramattensis* (Parramatta Gum.

No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result, potential habitat resources that may occur in this portion of the study area are unknown.

3.3.3.5 Probability of Occurrence of Threatened and Migratory Species

The probability of each of the locally recorded threatened and migratory fauna species to occur within the study area was assessed using knowledge of each species' habitat and lifecycle requirements with regard to the habitat present within the study area (Table 12). Species were assessed as being either Unlikely, Possible, Likely or Known to occur in the study area. The location and number of nearby, recent records (Figure 11) were also considered in determining probability of occurrence.

Table 13: Probability of threatened fauna species identified from the locality to occur in the study area

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Anthochaera phrygia	Distribution is extremely patchy; in NSW the species has been recorded from coastal areas to Narrabri with important breeding areas west of Armidale. Occurs in temperate eucalypt woodlands, most commonly box-ironbark associations and wet lowland coastal forests. Nests usually constructed in eucalypts, casuarinas or mistletoes. Forage for nectar and arthropods.	Possible. Study area supports potential foraging habitat.
Apus pacificus	Migrates from north-eastern Asia for the summer. Summer distribution is throughout Australia. Spend almost all day and night on the wing, hunting resting and sleeping.	Unlikely. Species rarely visits terrestrial habitats.
Ardea alba	Occurs throughout Australia excluding arid areas. Inhabit lakes, swamps, dams and rivers and occasionally damp grasslands. Wades through shallows to hunt fish and invertebrates. Constructs a nest platform in a tree over water.	Possible. Georges River offers potential foraging habitat.
Adrea ibis	Migrates south from Asia and northern Australia for the winter. Occurs in woodlands and wetlands, damp pasture and grassland around the northern, eastern and western Australian coasts where it forages for invertebrates. Commonly forage in proximity to grazing cattle. Nest in trees and shrubs along watercourses.	Possible. Species may nest in proximity to Georges River or Anzac Creek.
Burhinus grallarius	Rare throughout south-eastern Australia where it inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Forages nocturnally for insects and small vertebrates. Nests in a shallow scrape on the ground.	Unlikely. Study area does not support preferred habitat.
Callocephalon fimbriatum	Found in the central NSW coast and tableland areas, including Canberra and the Hawkesbury/Nepean and Sydney Metro region. Usually frequents forested areas with old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well timbered country.	Possible. Study area supports marginal foraging habitat. Study area does not support preferred nesting or roosting habitat.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Chalinolobus dwyeri	Found mainly in areas with extensive cliffs and caves. It is generally rare with a very patchy distribution in NSW, with scattered records from the New England Tablelands and North-west Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Hirundo ariel). Forage in low to mid-elevation dry open forest and woodland and well-timbered areas containing gullies close to roosting habitat, for small, flying insects. Most likely hibernates through coolest months.	Unlikely. Study area does not support preferred foraging habitat or a roost site.
Circus assimilis	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Hunts for small terrestrial mammals including bandicoots, bettongs and rabbits. Nest constructed in open or remnant woodland.	Possible. Study area supports nesting habitat and potential prey species (small terrestrial mammals and ground-birds).
Daphoenositta chrysoptera	Widespread throughout mainland Australia, where it is found in eucalypt woodlands. Forages for insects in rough-bark eucalypts. Nests in a tree branch or fork.	Unlikely. Study area does not support preferred foraging habitat.
Dasyurus maculatus maculatus	Found along the escarpments, tablelands and coast of the eastern seaboard from the Bundaberg area in south-east Qld south through NSW to Victoria and Tasmania. Known from dry and moist eucalypt forests and rainforest. Species tends to move along drainage lines and make dens in fallen hollow logs or among large rocky outcrops. Usually nocturnal but are known to hunt and bask during the day. Hunts terrestrially and arboreally.	Unlikely. Study area does not support preferred habitat.
Ephippiorhynchus asiaticus	Widespread in coastal and subcoastal northern and eastern Australia; in NSW, the species becomes increasingly uncommon south of the Northern Rivers region. Rarely occurs south of Sydney. Found in association with wetlands, swamps, billabongs, estuaries and surrounding vegetation. Forages in shallow still water, for small vertebrates and crustaceans. Nests in a tall live tree, including paddock trees and paperbarks.	Possible Study area supports marginal nesting habitat. Study area does not support preferred foraging habitat.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Epthianura albifrons	In NSW, occurs in association with damp, open habitats below 1000m elevation along the coast (such as wetlands and saltmarsh), and in association with waterways in the west. Forage for insects on the ground. Nests in low vegetation elevated from the ground.	Unlikely. Study area does not support preferred habitat.
Falsistrellus tasmaniensis	Occurs along the east coast of NSW, where it inhabits tall moist forests. Roosts in hollows of eucalypts, occasionally under loose bark on trees or in buildings. Hunts for flying insects above or below the tree canopy.	Unlikely. Study area does not support preferred habitat.
Glossopsitta pusilla	In NSW, the species occurs from the coast to the western slopes of the Great Dividing Range. Inhabits forests and woodlands, where it forages for nectar and pollen within the canopy stratum. Requires living, hollow-bearing eucalypts for nesting habitat.	Possible. Study area support potential foraging and marginal nesting habitat.
Haliaeetus leucogaster	Occurs throughout coastal Australia, along the coast, large lowland rivers and lakes. Occasionally found in association with inland lakes. Mainly hunts over water for aquatic animals; small terrestrial mammals and carrion may be taken from land. Typically nests in large trees to 30m, less often in smaller trees, on rocks or the ground.	Possible. Study area offers potential terrestrial and aquatic foraging habitat.
Heleioporus australiacus	Distribution largely restricted to sandstone geology of Sydney Basin, within heath, woodland and open dry sclerophyll forest. Moves to breeding habitat before or after heavy rain in autumn; typically soaks, pools in first or second order streams or hanging swamps. Outside of breeding period, inhabits burrows below soil surface or leaf litter, within 300m of breeding habitat. Generalist diet of invertebrates.	Unlikely. Study area does not support preferred habitat.
Hieraaetus morphnoides	Widespread throughout mainland Australia, often observed over woodland, forested land and open country. Appears to avoid rainforest and dense forest. Hunts for small terrestrial and arboreal mammals. Nests in a large living tree in open woodland or tree-lined watercourses.	Possible. Study area support potential foraging habitat.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Hirundapus caudacutus	Migrates from northern Asia to eastern Australia for the summer. In NSW, occurs from the coast to the western slopes of the Great Dividing Range. Species is almost exclusively aerial, most commonly recorded above open forest and rainforest. Rarely recorded flying over treeless areas. Forages aerially for insects. May roost aerially or in tree canopies or hollows in forests and woodland.	Unlikely. Study area does not support roosting habitat. Species may forage aerially above study area.
Hoplocephalus bungaroides	Distribution restricted to sandstone habitats within approximately 250 kilometres of Sydney. Requires rock crevices and flat sandstone rocks on exposed cliff edges for sheltering in cooler months, shelters in tree hollows near sandstone escarpments in summer. Forages for small reptiles, occasionally frogs and small mammals.	Unlikely. Study area does not support preferred habitat.
Gallinago hardwickii	Migrates to south-east Australia for the summer. Inhabits freshwater wetlands on or near the coast, generally among dense cover. Also known from short-grassed marshes and wet, treeless grasslands. Occasionally found in crops and pasture. An omnivorous species that forages in soft mudflats or shallow water. Roosts amongst low vegetation during the day.	Unlikely. Study area does not support preferred habitat.
Isodon obesulus obesulus	Occurs east of the Great Dividing Range, south from the Hawkesbury River, where it is found in heath or open forest with a heathy understorey on sandy or friable soils. Nests in a shallow depression in the ground covered by vegetation. Searches for insects or underground-fruiting fungi by digging conical holes in the soil.	Unlikely. Study area does not support preferred habitat.
Lathamus discolor	Migrates from breeding grounds in Tasmania to the Australian mainland in winter. Preferred over-winter habitat is woodlands and riparian vegetation where there are winter flowering eucalypts such as the Swamp Mahogany, *Eucalyptus robusta* in coastal areas.	Possible. Study area supports marginal foraging habitat.
Litoria aurea	Isolated, scattered populations throughout coastal NSW, several within the Sydney metropolitan area, Shoalhaven and mid-north coast. Breeding habitat comprises natural and constructed waterbodies including wetlands, stormwater detention basins, marshes, dams and streams-side, preferably those that are unshaded but with fringing vegetation. Forage for invertebrates within grassy habitats near breeding habitat. May shelter under vegetation, rocks and building materials such as fibro, sheet iron or bricks.	Possible. Anzac Creek offers marginal habitat, however *Gambusia holbrooki* is known to occur (a predator of tadpoles)

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Litoria littlejohni	Distributed throughout the plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Breeds in the upper reaches of permanent streams and in perched swamps where it lays eggs on temporary or permanent slow flowing pools. Outside of the breeding season, inhabits forests and woodlands where it shelters under leaf litter and low vegetation and hunts for invertebrates.	Unlikely. Study area does not support preferred habitat.
Litoria raniformis	Occurs in association with the Murray and Murrumbidgee River valleys and their tributaries. Inhabits emergent vegetation within or fringing still or slow-flowing waterbodies, including lagoons, ponds, swamps and dams. Basks on rocks or vegetation in summer and shelters in soil cracks, fallen timber, dense vegetation. Requires permanent, freshwater shallow lagoons for breeding.	Unlikely. Study area is outside of current geographic range of the species.
Lophoictinia isura	Widespread but sparsely distributed throughout mainland Australia. Is a resident of the north and north-east of NSW and in association with major river systems where it is often found in association with forest dominated by Woolybutts (*Eucalytus longiflora)*, Spotted Gum (*E. maculata)* or Peppermint Gum (*E. elata).* Hunts for smaller birds such as honeyeaters amongst the canopy layer. Nests on a large limb of a eucalypt or angophora along or near a watercourse.	Possible. Study area offers potential nesting and foraging habitat.
Melithreptus gularis gularis	Eastern subspecies occurs from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range. Inhabits forests or woodlands dominated by box and ironbark eucalypts where it forages for insects and nectar. Nests high in tree crown.	Unlikely. Study area does not support preferred habitat.
Meridolum corneovirens	Distribution restricted to Cumberland Plain Woodland in western Sydney, from Richmond in the north to Picton in the south. Found under leaf litter, bark, logs or loose soil at the base of trees, may bury deep into the soil to evade drought. Species is a fungus specialist.	Possible. Study area supports small isolated areas of marginal habitat.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Merops ornatus	Occurs throughout mainland Australia, excluding arid areas. Southern populations migrate north in winter. Found in open forest, woodland, shrubland and occasionally remnant vegetation within farmland, orchards and vineyards. Forages aerially for insects. Roosts in small shrubby trees. Constructs a tunnel in which to nest, in sandy bank or bare flat ground.	Possible. Study area offers potential roosting and nesting habitat. Species may forage aerially above study area.
Miniopterus schreibersii oceanensis	Distributed throughout eastern and north-western Australia. In NSW, recorded from the coast to the western slopes of the Great Dividing Range. Occurring in forests and woodlands the species live in colonies and roost in caves, old mines and occasionally buildings. The species forages for insects above the tree canopy	Known. Ultrasonic recordings made of this species at five locations within the study area.
Mixophyes balbus	In NSW, known only from three locations south of Sydney. Inhabits rainforest and wet, tall forest in the foothills and escarpment east of the Great Dividing Range. Requires streams with rock shelves or shallow riffles for breeding in summer. Outside of breeding period, species is found under deep leaf little and thick understorey vegetation on forest floor.	Unlikely. Study area does not support preferred habitat.
Monarcha melanopsis	Migrates to south-eastern coast of Australia from the north-eastern coast. Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Forages on the wing or amongst vegetation for insects. Nests in small tree or shrub 3-6m above ground.	Unlikely. Study area does not support preferred habitat.
Mormopterus norfolkensis	Occurs along the east coast of NSW inland to the Great Dividing Range, where it is found in dry sclerophyll forest, woodland, swamp forest and mangrove forest. Roosts in trees hollows, occasionally under bark or in man-made structures. Forages for insects.	Possible. Study area supports potential foraging and roosting habitat.
Myiagra cyanoleuca	Occurs along east coast of Australia, migrates north to Cape York Peninsula and Papua New Guinea in winter. Inhabits tall, wet eucalypts forests in gullies where it forages for insects. Nests in tree 3-25m above ground.	Unlikely. Study area does not support preferred habitat.
Myotis macropus	Distribution generally limited to within 100 kilometres of the coast. Forages over streams and pools for insects and small fish. Roosts communally in mine shafts, tree hollows, under bridges and storm water channels.	Possible. Possible ultrasonic recording made of this species in proximity to Georges River.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Neophema chrysogaster	In NSW, occurs from the coastal plains to the western slopes of the Great Diving Range. Found along the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Forages on the ground for seeds and grasses. Nests in a tree hollow, log or post.	Unlikely. Study area does not support preferred habitat.
Ninox connivens	Scattered distribution throughout Australia, excluding central arid areas. In NSW, core populations located on western slopes and plains. Inhabits woodland and open forest, where it hunts for arboreal mammals, occasionally birds, invertebrates and small terrestrial mammals. Roosts in canopy or tall mid-storey trees. Requires large, hollow-bearing eucalypts for nesting habitat.	Unlikely. Study area does not support preferred nesting habitat.
Ninox strenua	Widely distributed throughout NSW, from the coast inland to the tablelands. Inhabits woodland, open forest, tall wet forest and rainforest, where it hunts for arboreal mammals, occasionally birds. Roosts in dense vegetation, requires old, large hollow-bearing eucalypts for nesting habitat.	Unlikely. Study area does not support preferred nesting habitat.
Petaurus norfolcensis	Sparsely distributed throughout eastern Australia. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Require abundant tree hollows for refuge and nest sites. Forages for nectar, sap, invertebrates and pollen.	Unlikely. Study area does not support preferred habitat.
Petrogale penicillata	Occurs along NSW coast, inland to the Warrumbungle Ranges. Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Shelter in rock crevices and overhangs. Forages in and adjacent to rocky areas for grasses, foliage and fruits of shrubs and trees.	Unlikely. Study area does not support preferred habitat.
Petroica boodang	Distributed from the coast, inland to the western slopes of the Great Dividing Range. Inhabits open forests and woodlands, also found in grasslands in winter. Constructs a cup-shaped nest in a tree fork. Forages for insects on the ground. In NSW, the species breeds in tall moist eucalypt forests and woodlands in upland areas. In winter, moves to dry forests, open woodlands and grasslands of the inland slopes and plains. Forages amongst low branches for invertebrates. Nests near the ground in sheltered areas such as tree cavities or stumps.	Unlikely. Study area does not support preferred habitat.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Petroica phoenicea	In NSW, the species breeds in tall moist eucalypt forests and woodlands in upland areas. In winter, moves to dry forests, open woodlands and grasslands of the inland slopes and plains. Forages amongst low branches for invertebrates. Nests near the ground in sheltered areas such as tree cavities or stumps.	Unlikely. Study area does not support preferred habitat.
Phascolarctos cinereus	Distribution of the species throughout Australia is highly fragmented. In NSW it mainly occurs on the central and north coasts with some populations in the western region inhabiting eucalypt woodlands and forests. The species feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Unlikely. Study area does not support preferred habitat.
Potorous tridactylus tridactylus	Distribution in NSW restricted to coastal heaths and forests east of the Great Dividing Range. Also known from dry and wet sclerophyll forest. Requires dense understory and groundlayer vegetation for sheltering. Forages from fungi, roots tubers and insects in the soil.	Unlikely. Study area does not support preferred habitat.
Pseudomys novaehollandiae	Fragmented distribution across Tasmania, Victoria, NSW and Queensland where it inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Forages for seeds, insects, leaves, flowers and fungi. Shelters and nests communally in burrows.	Unlikely. Study area does not support preferred habitat.
Pseudophryne australis	Distribution restricted to the Sydney Basin, from Pokolbin, south to Nowra, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, where it typically inhabits periodically wet drainage lines below sandstone ridges. Breeds in dense vegetation and debris beside ephemeral creeks and gutters. Outside of breeding season, is found under rocks and logs on sandstone ridges where it forages amongst leaf-litter.	Unlikely. Study area does not support preferred habitat.
Pteropus poliocephalus	Found within 200 kilometres of the east coast of Australia. Roosting camps commonly found in gullies, close to water, in vegetation with a dense canopy. Camps typically located within 20 kilometres of a regular food source; nectar and pollen of native trees and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	Known. This species was visually identified at two locations within the study area.

Scientific name	Habitat preference/ known distribution	Probability of occurrence in the study area
Rhipidura rufifrons	Occurs throughout east coast of Australia, migrates from eastern NSW to north-eastern Queensland and Papua New Guinea in winter. Inhabits rainforest, wet forest, swamp woodlands and mangroves, where it forages amongst a shrubby understorey for insects. Constructs a nest suspended from a tree fork.	Unlikely. Study area does not support preferred habitat.
Rostratula australis	Occurs throughout Australia. Inhabits shallow freshwater wetlands, vegetated ephemeral and permanent lakes and swamps, and inundated grasslands. Roosts during the day in dense vegetation and is active at dusk, throughout the night and dawn. It nests on the ground amongst tall reed-like vegetation near water, and forages near the water‘s edge and on mudflats for invertebrates and seeds.	Unlikely. Study area does not support preferred habitat.
Saccolaimus flaviventris	Occurs thoughout tropical and south-east of Australia, excluding Tasmania. Found in a variety of habitat types including wet and dry sclerophyll forest, open woodland, *Acacia* shrubland, mallee, grassland and desert. Forages for insects above the tree canopy. Roost in tree hollows, abandoned sugar glider nests or animals burrows.	Possible. Study area supports marginal foraging habitat.
Scoteanax rueppellii	Found mainly in the gullies and river systems that drain the Great Dividing Range. Distribution of the species in NSW is widespread on the New England Tablelands, however does not occur at altitudes above 500m. The species is known from woodland through to moist and dry eucalypt forest and rainforest; most commonly found in tall wet forest. The species forages along creek and river corridors. The species typically roosts in tree hollows but has also been found roosting in buildings. Maternity roosts usually comprise a suitable tree hollow.	Possible. Study area supports marginal foraging habitat.

3.4 Aquatic Fauna

3.4.1 Aquatic Fauna Species

Macroinvertebrates

A total of 27 macroinvertebrate families were recorded in aquatic environments of the study area; 18 families in Georges River site and 23 families in Anzac Creek site (ALS 2011).

Both sites have relatively poor macroinvertebrate communities. Family diversity was generally low and many sensitive taxa were not recorded. The Georges River site falls into Band C in accordance with the AUSRIVAS model, indicating that it is ‗severely impaired‘; fewer

macroinvertebrate families were observed than expected. This result may be attributed to ‗substantial' impacts on water quality, habitat quality, or both. Anzac Creek falls into Band B, indicating that the macroinvertebrate community was ‗significantly impaired'; fewer families than expected were observed. This result may be attributed to a ‗potential' impact on water quality or habitat quality or both (ALS 2011).

Fish

Three fish species were recorded within the study area; one native species, Flathead Gudgeon (Ph*ilypnodon grandiceps*), and the introduced Gambusia (*Gambusia holbrooki*). A single Flathead Gudgeon was recorded at the Georges River site while Gambusia was recorded at both sites. Gambusia was more abundant in Georges River than in Anzac Creek. One Long-fin Eel (*Anguilla reinhardtii*) was identified in the upper reaches of Anzac Creek within the Royal Engineers Golf Course (outside of the study area).

3.4.2 Aquatic Fauna Habitats

Anzac Creek

Plate 39. Anzac Creek – upstream of existing rail spur

Plate 40. Anzac Creek – downstream of existing rail spur

Anzac Creek comprises a named waterway with intermittent flow supporting semi-permanent to permanent water in pools and as such, is classified as Class 3 (Minimal Fish Habitat) in accordance with Fairfull and Witheridge (2003).

Aquatic habitat types of Anzac Creek within the study area included soft substrate pools and extensive macrophyte cover. Water in Anzac Creek was mostly static and shallow; small pools were heavily vegetated with floating and emergent macrophytes such as *Typha sp*. and *Salvinia molesta*.

Georges River

Plate 41. Georges River

Plate 42. Georges River beneath rail bridge

Georges River comprises a major permanently flowing river and as such, is classified as Class 1 (Major Fish Habitat) in accordance with Fairfull and Witheridge (2003). Aquatic habitats of Georges River within the study area included soft substrate pool habitat, large woody debris and extensive macrophyte cover. Overhanging vegetation, fallen logs, mats of sticks, submerged (*Elodea canadiensis*) and floating aquatic plants (*Azolla sp., Salvinia molesta*) were present along the bank. This extensive macrophyte cover of submerged and floating aquatic plants has reduced the heterogeneity of aquatic habitat and most likely affects the composition of the macroinvertebrate community present.

Georges River within the study area may be considered poor quality habitat, attributed to the lack of diversity of micro-habitats required to support a diverse and healthy macroinvertebrate community (ALS 2011).

Other aquatic habitats

In addition to Georges River and Anzac Creek, formalised drainage channels are located in the south-east of the SIMTA. These channels do not all support permanent water; some flow only ephemerally following rain. Channels that support aquatic and fringing vegetation, such as Typha sp, offer habitat for reptiles and amphibians such as Common Eastern Froglet (*Crinia signifera*).

Plate 35. Formalised channels of SIMTA site

Plate 36. Formalised channels of SIMTA site

Constructed artificial wetlands within the Royal Engineers Gold Course, within the Rail corridor, offer potential habitat to amphibians, fish and aquatic birds. Those wetlands supporting aquatic and fringing vegetation offer sheltering and potential nesting habitat to such species.

3.4.3 Groundwater habitats

A previous investigation of groundwater in the wider study area (URS, 2002) indicates that the depth to groundwater on the SIMTA site is generally between 4.0 to 5.0 mbgl. Groundwater flow is generally radial from the topographic high with the location of the Georges River, indicating that groundwater flow underlying the area would be predominantly westerly (URS, 2002).

Groundwater was not sampled as part of the current study, as no groundwater monitoring bores were located in the study area. Results from the URS (2002) study indicated that that local recharge is occurring, which suggests that groundwater contributes to the existing surface water, particularly in Anzac Creek, and there is connectivity between the groundwater and the Georges River. Although the extent of groundwater distribution in the area is not clear it is probable, due to local hydrogeology, that groundwater across the study area and the wider region is interconnected. This would suggest that if stygofauna were present they are unlikely to be isolated to the vicinity of the study area, and while isolated areas of the groundwater may be influenced, a significant impact on the wider region is highly unlikely (ALS 2011).

3.4.4 Significant aquatic fauna

3.4.3.1 Threatened Species

One threatened species, Macquarie Perch (*Macquaria australasica*), has been identified in parts of the upper Georges River catchment (NSW Industry & Investment, 2010). Macquarie Perch is listed as Endangered under the *Fisheries Management Act 1994* (FM Act). Generally, the species is found upstream of areas inhabited by Australian Bass (Native Fish Australia, 2009b); Australian Bass is known from stretches of the Georges River adjacent to the study area. As a result, it is highly unlikely that Macquarie Perch occur in the lower reaches of the Georges River at or near this site (ALS 2011).

3.5 Matters of National Environmental Significance

Matters of National Environmental Significance (MNES) are identified by the Protected Matters Report generated by the Protected Matters Search (Appendix 4). With the exception of the threatened and migratory species and ecological communities discussed in this report, no MNES were identified within 10 kilometres of the study area.

4 IMPACT ASSESSMENT

4.1 SIMTA Proposal Construction Activities

The SIMTA proposal will incorporate the following construction activities:

Site area	Phase	Construction activities
SIMTA site	Site Preparation	Establishment of compound area, portable offices, amenities and connection to utilities. Demolition of existing structures and pavements. Clearing and grubbing of existing vegetation. Stripping of topsoil and stockpiling for re-use or disposal, followed by earthworks including excavation and filling.
	Earthworks, Drainage and Utilities Installation	Excavation and filling on SIMTA site. Excavation of trenches for construction of open stormwater channels. Installation of utilities including electricity, sewage, water and gas
	Rail Construction	Construction of 640 metres of rail siding (25 metres wide). Construction of 640 metres of gantry rail (assume two tracks two metres wide).
	Pavement Construction and Ancillary Works	Construction of pavement and base slabs including formwork and placement of reinforcement. Construction of kerbs, gutters and concrete barriers. Installation of signposts, lighting and guard rails.
	Building Structures	Construction of building slabs. Erection of steel building frames, roof and wall cladding.
Rail Corridor	Site preparation	Clearing of native vegetation for the rail link, access and maintenance tracks and ancillary areas. Possible establishment of an Asset Protection Zone adjoining the rail link.
	Rail Construction	Construction of rail crossing (most likely a bridge) over Anzac Creek. Construction of rail crossing (most likely a bridge) over Georges River.

4.2 Likely Impacts

Likely impacts are those impacts that may arise as a result of unmitigated activities associated with the construction and operation of the SIMTA proposal. Likely impacts include:

- Loss of native vegetation, including Endangered Ecological Communities and threatened flora species.
- Loss of fauna habitat including that of threatened and migratory species.
- Impact on fauna connectivity.
- Alteration and degradation of aquatic habitats.

- Edge effects and weed invasion.

4.2.1 Impacts on values of SIMTA site

Ecological impacts within the SIMTA site are likely to be low. Habitat fauna is limited across the SIMTA site as a result of previous clearing of native vegetation from much of the site and ongoing maintainence such as mowing across the site. Habitat connectivity is currently severely restricted by significant barriers to fauna movement and is unlikely to be further fragmented as a result of the SIMTA proposal. Although the numerous mature trees on the site support fauna habitat and have amenity value, they are mainly planted specimens with low conservation significance and do not comprise a significant area of fauna habitat in the locality. Vegetation in and adjoining the constructed drains in the south of the site is a mixture of native and exotic species and provides limited fauna habitat.

The scattered trees immediately to the south of the SIMTA site with patches of native groundcover, which meet the criteria for degraded Castlereagh Scribbly Gum Forest, are of conservation significance and should be retained if possible.

4.2.2 Impacts on values of rail corridor

There are likely to be impacts to the native vegetation in the rail corridor lands to the south of the SIMTA site, given the requirement for a 30m wide area of impact for the length of the proposed rail link.

The rail corridor generally supports the highest abundance of and highest quality fauna habitat components within the study area, including intact native vegetation, riparian habitats and aquatic habitats that offer nesting, sheltering and foraging habitat to a variety of fauna species. There is a notable absence of fauna habitat components such as mature hollow-bearing trees, rocky features and hollow logs. Fauna habitat within the rail corridor is also bound by significant barriers to fauna movement, that limit movement into and through the rail corridor tosmall terrestrial mammals, reptiles, amphibians and birds and bats. Larger terrestrial mammals that may occur in the locality are currently excluded from the rail corridor. As a result, habitat connectivity is unlikely to be further fragmented as a result of the SIMTA proposal.

When assessing rail corridor options, the relative rarity and population sizes of the two threatened plant species on the site must be considered. The population of the endangered species *Persoonia nutans* to the north of Anzac Creek consists of 43 recorded plants, most of which appeared to be mature. This population is considered very significant in the context of the generally low population sizes observed in this species and given the limited distribution of *P. nutans* in southern Sydney.

Accordingly it is considered that this population of *P. nutans* represents the highest biodiversity constraint in the study area. Impacts on the *P. nutans* population in the study area can be avoided by designing the rail link to follow the existing rail spur along eastern boundary of the rail corridor lands. This option would, however, have impacts on the *Grevillea parviflora* subsp. *parviflora* which is distributed in the eastern parts of this bushland.

The population of the Vulnerable species *Grevillea parviflora* subsp. *parviflora* is also of significance, as there are few records of species in the locality of the study area. Potential habitat for this species is mapped on the Defence land to the east and south-east of the study area; there may be populations of the species on these lands, however there is only one record in the NSW Wildlife Atlas in this area, approximately one kilometre to the east of the study area near Wattle Grove. Given the large size of the population and the paucity of records for this species in the locality, it is recommended that impacts on this population be minimised as far as is practicable.

The rail corridor will also require clearing of threatened ecological communities; all native vegetation in the rail corridor lands, with the exception of scattered trees in planted landscape areas, is consistent with threatened ecological communities under the TSC Act.

4.2.3 Extent or Scale of Impacts in Study Area

The extent or scale of values likely to be affected as a result of the SIMTA proposal is outlined in Table 14. The extent or scale refers to areas within the SIMTA site and rail corridor. Design information regarding the location of the rail link within the rail corridor is not available at this time. As a result, the extent or scale of impacts has been estimated; potential impacts may be reviewed once design and siting studies are completed for the project application stage.

Table 14: Extent or scale of values likely to be affected as a result of the SIMTA proposal

SIMTA Proposal Activity	Likely Impact	Comment	Extent/Scale
Site Preparation, involving clearing and grubbing of existing vegetation and stripping of topsoil	Loss of native vegetation	Involves removal of grasses and trees, grubbing of roots and stumps.	Over 590 native, non-local native and exotic trees will be removed; some areas of mixed native and exotic understorey removed
	Loss of threatened flora species	*Persoonia nutans* was identified at two locations adjoining the south-west of the SIMTA site.	
	Loss of fauna habitat	Includes hollow-bearing trees, foraging habitat for threatened species (Grey-headed Flying Fox), damp areas (such as formalised channels) in the south-east.	Includes approximately six hollow-bearing trees
Earthworks, drainage and utility installation	Altered hydrological regimes; alteration to existing flow directions and volumes	Additional channels and swales to capture and store stormwater.	Proposed channels and swales to extend across SIMTA site in north-south direction
Rail construction within rail corridor	Loss of Endangered Ecological Communities	Castlereagh Scribbly Gum Woodland Castlereagh Swamp Woodland River-flat Eucalypt Forest Freshwater Wetlands Cumberland Plain Woodland.	Areas unknown

	Loss of threatened flora species	Species known (*Persoonia nutans, Grevillea parviflora)* or likely to occur within the study area. The proposed rail alignment is likely to have direct impacts on at least one of the threatened plant populations recorded in the study area.	Unknown number of threatened plant species
	Loss of fauna habitat	Includes woodland, open forest and riparian habitats for reptiles, amphibians, birds, mammals. Includes hollow-bearing trees located in the SIMTA site.	Area unknown
	Loss of native vegetation	Location and extent of vegetation required to be cleared is unknown.	At minimum, a 30 metre wide area of impact will result from the construction of the rail link
	Weed invasions	Trains may transport weed propagules into native vegetation in the rail corridor; creation of new edges will increase fragmentation and vulnerability of native vegetation to weed incursions.	
Construction of rail link over Anzac Creek	Degradation of aquatic habitats	Caused by changes in runoff, redirection of flows, influences to groundwater, infiltration, pollution and erosion. May influence downstream habitats.	
	Obstruction to fish passage	Construction of rail crossing over Anzac Creek (classified as Class 3-Minimal Fish Habitat) will likely require installation of ~~L~~ow Flow design" culverts.	
Construction of rail link over Georges River	Degradation of aquatic habitats	Caused by changes in runoff, redirection of flows, influences to groundwater, infiltration, pollution and erosion.	
	Obstruction to fish passage	Construction of rail crossing over Georges River (classified as Class 1-Major Fish Habitat) will require a bridge or arch structure; locating bridge piers or foundations in the main waterway should be avoided.	

4.3 Key Threatening Processes

The SIMTA proposal may result in the operation of a key threatening process or the exacerbation of a key threatening process currently in operation in the study area. Key threatening processes are listed under the TSC Act, FM Act and EPBC Act.

4.3.1 *Threatened Species Conservation Act, 1995*

Key threatening processes are processes that ~~t~~threaten or could threaten the survival or evolutionary development of species, populations or ecological communities". They are listed under Schedule 3 of the TSC Act and may adversely affect threatened species, populations or ecological communities or could cause species, populations or ecological communities that are not threatened to become threatened. The SIMTA proposal may contribute to the following Key threatening processes:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Clearing of native vegetation.
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*).
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion of native plant communities by exotic perennial grasses.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara.*
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of hollow-bearing trees.

4.3.2 *Environment Protection and Biodiversity Conservation Act, 1999*

The EPBC Act defines a key threatening process as one that ~~t~~threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community." The SIMTA proposal may contribute to the following Key Threatening Processes:

- Land clearance.

4.3.3 *Fisheries Management Act, 1994*

Under the FM Act key threatening processes are processes that, in the opinion of the Fisheries Scientific Committee, adversely affect threatened species populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened The SIMTA proposal may contribute to the following Key Threatening Processes:

- Degradation of native riparian vegetation along New South Wales water courses.
- Human-caused climate change.
- Flow regimes of rivers and streams.

4.4 Cumulative Impacts

The Commonwealth Department of Finance and Deregulation is currently undertaking a feasibility study into the potential development of an intermodal terminal on the site of the Moorebank and Steele Barracks, which lies immediately to the west of the SIMTA site across Moorebank Avenue. The IMT project was referred to DSEWPC in August 2011 and was determined by DSEWPC to be a controlled action requiring an Environmental Impact Statement (EIS) in September 2011. At the time of the current study, the draft EIS guidleines were on exhibition and works on the feasibility study were continuing (Department of Finance and Deregulation 2012).

The two threatened plant species recorded on the SIMTA site, *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora*, were also recorded on the IMT site (Parsons Brinckerhoff 2011). The threatened plant species habitat on the IMT site is adjacent to Moorebank Avenue and is likely to be cleared for the IMT project, according to the indicative concept plan drawing on the project website (Department of Finance and Deregulation 2012).

The preliminary significance assessment for the two threatened plant species on the IMT site by Parsons Brinckerhoff (2011) concluded that potential impact from the project on the species was not considered significant, as the populations on the IMT site are likely to make up a small proportion of the local populations under the EPBC Act definition, as the 6.5 hectares of potential habitat within the IMT site represents a small percentage of the estimated area of potential local habitat for the species.

Given the uncertainties regarding the areas of habitat for threatened species and ecological communities that will be cleared as part of the SIMTA proposal and the IMT proposal, it is difficult to estimate cumulative impacts at this stage. The cumulative impacts arising from the development of both sites will be considered in the environmental assessment for the Project Approval phase of the project.

4.5 Part 3A Guidelines for Threatened Species Assessment

The impacts of the SIMTA proposal on threatened species and ecological communities listed under the TSC Act have been assessed in accordance with the Draft Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005).

4.5.1 Threatened Ecological Communities

Five Threatened Ecological Communities (TECs) listed under the TSC Act were recorded in the study area:

- Castlereagh Scribbly Gum Woodland in the Sydney Basin bioregion
- Cumberland Plain Woodland in the Sydney Basin Bioregion
- Castlereagh Swamp Woodland
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

The potential impacts of the SIMTA proposal on the five TECs are considered in detail in Appendix 5.

4.5.2 Flora species

An intensive targeted search for threatened plant species was undertaken in areas of potential habitat in the study area. Two threatened plant species listed under the TSC Act were recorded:

- *Persoonia nutans* (Nodding Geebung), listed as Endangered
- *Grevillea parviflora* subsp. *parviflora* (Small-flowered Grevillea), listed as Vulnerable

The potential impacts of the SIMTA proposal on the two threatened flora species are considered in detail in Appendix 5.

4.5.3 Fauna

Three threatened fauna species listed under the TSC Act were recorded in the study area:

- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)
- Southern Myotis (*Myotis macropus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

The potential impacts of the SIMTA proposal on the three threatened fauna species are considered in detail in Appendix 5.

4.5.4 Conclusions of the Impact Assessments

The majority of likely impacts on the above threatened entities will occur as a result of construction of the rail link. The extent of scale and impacts within the rail corridor cannot be quantified until the alignment of the rail link has been finalised. The requirement for a 30 metre wide zone of clearing and/or disturbance will result in the removal and fragmentation of threatened communities and threatened plant populations. As the exact area to be cleared and/or disturbed is not yet known, the impacts cannot be assessed with any certainty, a conclusion on the significance of impacts and the potential requirement for additional assessment cannot be made at this stage.

4.5.5 Key Thresholds

The Part 3A Guidelines for Threatened Species Assessment (DEC & DPI 2005) specify key thresholds that need to be addressed to justify the preferred option for a development proposal. The key thresholds are:

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values;
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community;
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction; and,
- whether or not the proposal will adversely affect critical habitat.

The SIMTA proposal is likely to impact the native vegetation in the rail corridor lands to the south of the SIMTA site, given the requirement for a 30m wide area of impact for the length of the proposed rail link. The rail corridor supports high biodiversity values including threatened

plant species populations, threatened ecological communities and nesting, sheltering and foraging habitat for threatened fauna species.

The impacts of the SIMTA proposal are likely to result in the loss of some biodiversity values of the locality. The loss of biodiversity values can be minimised by incorporating the proposed mitigation measures detailed in Section 5, particularly measures to avoid significant habitat features and to rehabilitate disturbed areas of native vegetation.

Based on the impact assessments following the Part 3A Guidelines for Threatened Species Assessment (Appendix 5), it is not yet possible to form a conclusion on whether the SIMTA proposal is likely to reduce the long-term viability of or accelerate the extinction of threatened species and ecological communities within the study area. The majority of likely impacts on threatened entities will occur as a result of construction of the rail link, and there is currently no preferred option for the rail link alignment.

No critical habitat for any threatened species, population or ecological community has been identified in the locality of the study area, therefore the proposal will not adversely affect critical habitat.

4.6 EPBC Significant Impact Criteria

Assessments against the EPBC Act Significant Impact Criteria have been prepared for the following threatened entities (Appendix 6):

- *Persoonia nutans* (Nodding Geebung)
- *Grevillea parviflora* subsp. *parviflora* (Small-flowered Grevillea)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

5 MITIGATION MEASURES

The Part 3A Guidelines for Threatened Species Assessment (DEC & DPI 2005) require the description and justification of measures to mitigate adverse effects arising from development proposals. Primary consideration should be given to measures to avoid or minimise impacts; where avoidance and mitigation are not possible, offset strategies may be considered as a last resort. The steps in the avoid, mitigate and offset approach are as follows:

- Avoid areas of high biodiversity value wherever possible;
- Mitigate actions and safeguard values identified for retention by prescribing appropriate controls; and
- Compensate for or offset the removal of biodiversity values.

5.1 Avoid Impacts

The identified ecological values should be avoided as far as practicable (Table 15). The construction footprint incorporating the rail link footprint and construction access requirements should be reduced as far as possible to minimise impacts. Given the distribution of threatened plant species across the study area, it is likely that impacts on at least one of the threatened plant populations will be unavoidable.

Table 15: Avoidance measures for proposed actions

Activity	Issue	Avoidance Measure
Site establishment, earthworks and rail construction	Vegetation removal	Avoid Endangered Ecological communities and known locations of threatened flora species where possible.
	Fauna habitat loss	Avoid important fauna habitat features such as large hollow bearing trees where possible.

5.2 Mitigate Impacts

Where impacts cannot be avoided, safeguards should be implemented to mitigate these impacts during construction (Table 16).

Table 16: Mitigation measures for proposed actions

Activity	Issue	Safeguard
Soil disturbance related to site establishment, earthworks and rail construction	Erosion and sedimentation resulting from newly exposed soils degrading waterways	Installation of appropriate drainage and sediment control infrastructure (eg sediment basins), sediment and erosion controls.
	Weed establishment	A weed control program is recommended as part of the conservation management of the retained vegetation.
		Ongoing monitoring for identification of weed outbreaks and treatment if required.
Vegetation clearance for rail construction, access and maintenance tracks	Loss of fauna habitat	Fauna microhabitat such as logs should be removed from areas to be cleared and relocated to suitable nearby bushland areas in the presence of an ecologist. Strategic removal of hollow-bearing trees.
		Consider the installation of nest boxes in woodland vegetation in the rail corridor that may offer alternative nesting habitat to hollow-dependent species recorded in the study area.
		High visibility plastic fencing is to be installed to clearly define the limits of the works area as to not further encroach on fauna habitat.
	Injury to fauna species	Pre-clearance surveys for fauna species. Prior to tree felling, trees are to be nudged using a bulldozer or banged loudly with the back of an axe or sledge hammer to flush out sheltering wildlife.
		Undertake a pre-start up check for sheltering native fauna of all infrastructure, plant and equipment and/or during relocation of stored construction materials.
	Loss of native vegetation	Clearance of native vegetation should be minimised as far as is practicable.
		Consider retention of some, or all, of the remnant scattered *E. sclerophylla* over patches of shrub and grass cover in the cleared grassland immediately south of the SIMTA site in landscaping areas.

Activity	Issue	Safeguard
		Extent of clearing should be fenced with highly visible temporary fencing to ensure that clearing does not extend beyond the area necessary.
		A Vegetation Management Plan (VMP) should be prepared prior to construction of the rail corridor, detailing restoration, regeneration and rehabilitation of areas of native vegetation in the vicinity of the proposed rail corridor. The VMP should also detail appropriate management for the potential habitat of threatened plant species in the study area, including monitoring during and after construction works to ensure impacts are minimised. Appropriate management may include fencing the habitat, signage and educating contractors of the presence of habitats, its significance and no-go zones. The VMP should be integrated with the landscape plan for the SIMTA proposal.
	Loss of EECs	High visibility plastic fencing is to be installed to clearly define the limits of the works area as to not further encroach on EEC and locations of threatened flora species
	Loss of threatened flora species	The route of the proposed rail line should be designed to minimise impacts on the populations of *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* in the study area.
Construction in riparian areas/ in proximity to watercourses	Sedimentation and erosion leading to a reduction in water quality and degradation of aquatic habitat	Installation of appropriate drainage infrastructure (eg sediment basins), sediment and erosion controls.
	Obstruction to or alteration of fish passage	Design and construction of rail crossings over Anzac Creek and Georges River to be in accordance with *Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge 2003).
	Development within the Castlereagh Swamp Woodland community adjoining Anzac Creek altering existing infiltration and run-off	Consider potential impacts on groundwater quality and quantity as any localised pollution or reduction in the groundwater table is likely to influence this endangered community.
Construction of pavement, slabs and building structures	Altered hydrological regimes related to an increase in impervious surface such as changes in runoff and infiltration, redirection of flows	Landscaped zones to capture gross pollutants and oil and grits from pavement. These area can be regularly maintained to remove rubbish and can be renewed ona regular basies.
		Bio-retention installed in base of channels and swales proposed to capture and store stormawater. This will consist of bio-filtratiion layers, planting and and subsoil collection and drainage.

Activity	Issue	Safeguard
Hot works (including vegetation clearing requiring heat producing equipment)	Outbreak of bushfire	Hot work not to be undertaken on declared total fire ban days. Vehicles and plant should not block fire trails. Bushfire awareness included in staff induction and in toolbox talks pre-commencement.

5.3 Offsetting

If impacts are unable to be avoided or safeguarded against, biodiversity offsets may be used to counterbalance the impact of development on biodiversity. Offsets are to be determined with reference to the *Principles for the Use of Biodiversity Offsets in NSW* (OEH 2011).

The Biodiversity Banking and Offsets Scheme (BioBanking) (DECC 2007) is a scheme that has been established by OEH to address the loss of biodiversity and threatened species and provides a consistent, robust and transparent approach for offsets. It should be noted that Biobanking only addresses threatened species listed under the TSC Act. It may be appropriate to use the Biobanking assessment process to calculate offsets required to compensate for the impacts of the SIMTA proposal.

The bushland south of the SIMTA site is of high conservation significance, but is degraded in parts and restoration and ongoing management of this area is recommended. It may be possible to offset biodiversity losses as a result of the SIMTA proposal through the development and implementation of a restoration plan for this vegetation. The restoration plan would require the inclusion of the following measures as a minimum:

- Removal of dumped fill and rubble from the site, particularly from the Castlereagh Swamp Woodland south of Anzac Creek.
- Weed management around cleared edges.
- Revegetation of disturbed areas using local native species.

Given the specific disturbance regimes required by *Persoonia nutans,* the use of fire or other disturbance mechanisms as a management tool should be considered, in consultation with OEH and DSEWPC.

6 CONCLUSION

The flora and fauna of the SIMTA site and associated rail corridor lands (the study area) was assessed using desktop and field assessment.

Detailed flora surveys including six quadrats, random meanders, tree assessment and targeted threatened species searches recorded a total of 269 vascular plant species were recorded in the study area, comprising 193 local native species, eight non-local native species (mainly planted trees) and 68 exotic species.

Two threatened plant species listed under the EPBC Act and TSC Act, the endangered species *Persoonia nutans* and the vulnerable species *Grevillea parviflora* subsp. *parviflora,* were recorded in the rail corridor lands to the south of the SIMTA site. The populations in these areas are relatively large and are considered to be of significant conservation value. Another threatened plant species, the vulnerable *Acacia pubescens,* was recorded to the east of the SIMTA site.

Five threatened ecological communities listed under the TSC Act were identified in the study area, based on analysis of existing vegetation maps and ground truthing:

- Castlereagh Scribbly Gum Woodland in the Sydney Basin bioregion
- Castlereagh Swamp Woodland
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
- Cumberland Plain Woodland in the Sydney Basin Bioregion

All threatened ecological communities in the study area are located within the rail corridor lands.

The SIMTA site supports over 590 planted native, non-local native and exotic trees and vegetation on the site mainly consists of landscaped and regularly mown areas of native and exotic grassland. The SIMTA site is considered to be of limited conservation significance. The scattered trees immediately to the south of the SIMTA site with patches of native groundcover, which loosely meet the criteria for degraded Castlereagh Scribbly Gum Forest, are of conservation significance and should be retained if possible.

Detailed terrestrial fauna surveys across the study area identified the presence of five exotic and 54 native fauna species, including three threatened fauna species; Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), Southern Myotis (*Myotis macropus*) and Grey-headed Flying Fox (*Pteropus poliocephalus*). The probability of threatened species recorded within 10 kilometres of the study to occur within the study area was assessed and it is possible that 16 species may occur in the study area on a temporary or transient basis, predominantly highly mobile species such as bird and micochiropteran bats.

Three broad terrestrial habitat types were identified within the study area; remnant vegetation, riparian habitats and cleared and disturbed areas. Notable habitat features across the study area that offer potential shelter and foraging resources to fauna include flowering trees and shrubs, damp areas and watercourses, well-developed leaf litter in places and several hollow-bearing trees. There is, however, an absence of other important features such as large hollow-bearing trees, rocky features and hollow logs across the site.

The study area contains and is bound by significant barriers to fauna movement, including Moorebank Ave, the East Hills Railway Line and chain-mesh fencing surrounding the SIMTA

site, rail corridor and Royal Engineers Golf Course. These barriers and large areas cleared of vegetation fragments habitat connectivity and would limit movement into and through the study area to small terrestrial mammals, reptiles, amphibians, bats and birds. Larger terrestrial mammals that may occur in the locality would be physically excluded from much of the study area.

Aquatic fauna surveys identified a low diversity of macroinvertebrates and one native and one exotic fish species from sampling sites in the Georges River and Anzac Creek. Aquatic habitats in both the Georges River and Anzac Creek are considered to be poor quality.

The SIMTA site is considered to be of limited conservation significance and ecological impacts within the site are likely to be low.

The majority of likely impacts on threatened species and communities will occur as a result of construction of the rail link. The extent of scale and impacts within the rail corridor cannot be quantified until the alignment of the rail link has been finalised. The requirement for a 30 metre wide zone of clearing and/or disturbance will result in the removal and fragmentation of threatened communities and threatened plant populations. As the exact area to be cleared and/or disturbed is not yet known, the impacts cannot be assessed with any certainty, a conclusion on the significance of impacts and the potential requirement for additional assessment cannot be made at this stage.

7 REFERENCES

ABS (2001) Diet of Grey-headed Flying Fox Pteropus poliocephalus. Australian Bat Society Inc.

AHMS (2010) *Aboriginal and Historical Impact Assessment.* Archaeological & Heritage Management Solutions, Annandale.

Allen, G. R., Midgley, S. H., and Allen, M., (2002). *Field Guide to the Freshwater Fishes of Australia.* (Western Australian Museum: Perth.)

ALS (2011) *Assessment of the Sydney Intermodal Terminal Facility, Moorebank: Aquatic Ecology.* Australian Laboratory Services, Penrith.

ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra

Arup (2008) *Moorebank Intermodal Terminal: Geotechnical Desk Study Report.* Report prepared for Stockland dated December 2008.

Bannerman S.M. and Hazelton P.A. (1990) *Soil Landscapes of the Penrith 1:100,000 Map Sheet* (Soil Conservation Service NSW, Sydney)

Benson, D.H. (1992) The natural vegetation of the Penrith 1:100 000 map sheet. *Cunninghamia* 2(4): 541-596.

Benson D.H. and Howell J. (1990) *Taken for Granted: the bushland of Sydney and its suburbs.*Kangaroo Press, Kenthurst NSW in association with the Royal Botanic Gardens, Sydney.

Benson D. and McDougall L. (2000) *Ecology of Sydney Plant Species Part 7b: Dicotyledon families Proteaceae to Rubiaceae.* Cunninghamia 6(4): 1017-1202.

Bernhardt P. and Weston P.H. (1996) T*he pollination ecology of Persoonia in eastern Australia.* Telopea. 6(4):775-804.

BOM (2011) Holsworthy Control Range (station 067117) May 2011 Daily Weather Observations. Bureau of Meteorology Climate Data Online website: www.bom.gov.au/climate/data/. Accessed 4 July 2011.

Churchill S (1995) *Australian Bats.* Reed New Holland, Frenchs Forest

Clark, N. R. and Jones, D. C. (1990) *Geology of the Penrith 1:100 000 map sheet*. NSW Department of Mineral Resources.

DEC (2004) *Environmental Impact Assessment Guidelines: Persoonia nutans.* NSW National Parks and Wildlife Service, May 2004.

DEC & DPI (2005) *Draft Guidelines for Threatened Species Assessment.* Department of Environment and Conservation and Department of Primary Industries. Dated July 2005.

DECC (2005). *Threatened Species Profile: Eastern Bentwing Bat.* Department of Environment and Conservation (NSW), Hurstville.

DEC (2005*) Persoonia nutans R Br (Nodding Geebung) Recovery Plan.* NSW Department of Environment and Conservation, Hurstville NSW.

DECC (2007) *Threatened Species Assessment Guidelines: the assessment of significance.* Department of Environment and Climate Change NSW, August 2007.

DECC (2007) *Biobanking: Biodiversity Banking and Offsets Scheme Overview.* NSW Department of Environment and Climate Change, Hurstville.

DECCW (2009) *The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area.* Department of Environment, Climate Change and Water NSW, Hurstville.

DECCW (2010) *Cumberland Plain Recovery Plan.* Department of Environment, Climate Change and Water NSW, Sydney.

Department of Finance and Deregulation (2012) Moorebank Intermodal Terminal website: http://www.finance.gov.au/property/property/moorebank-intermodal-freight-terminal/index.html Accessed 16 February 2012.

DSEWPC (1999) *The Action Plan for Australian Bats: Southern Myotis.*Department of Sustainability, Environment, Water, Population and Communities.Website: http://www.environment.gov.au/biodiversity/threatened/publications/action/bats/25.html Accessed 30 June 2011.

DSEWPC (2011a) *Persoonia nutans in Species Profile and Threats Database,* Department of Sustainability, Environment, Water, Population and Communities, Canberra. http://www.environment.gov.au/sprat. Accessed 6 July 2011.DSEWPC

DSEWPC (2011b) *Grevillea parviflora* subsp. *parviflora in Species Profile and Threats Database,* Department of Sustainability, Environment, Water, Population and Communities, Canberra. http://www.environment.gov.au/sprat. accessed 6 July 2011.

Dwyer P (1995) Common Bentwing Bat. In (Eds) Strahan R The Australian Museum Complete Book of Australian Mammals (pp 494-495) Angus & Robertson, Sydney

Eco Logical (2006) *Simmos Beach Reserve; Plan of Management*. Report prepared for Campbelltown City Council dated April 2006.

French K., Pellow B. and Henderson M. (2000) Vegetation of the Holsworthy Military Area. *Cunninghamia* **6(4)**: 893-940.

GRCCC (2010) *Community River Health Monitoring Program Report Card - Autumn 2010.* Georges River Combined Councils' Commitee.

Harden G. (1990-1993) *Flora of New South Wales Volumes 1-4.* University of New South Wales Press, Kensington.

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

Hyder (2011) *SIMTA Moorebank Intermodal Terminal Facility Part 3A Concept Application: Civil Engineering Design.* Hyder Consulting, North Sydney.

NPWS (2001). *Threatened Species Information: Grey-headed Flying Fox.* Department of Environment and Climate Change, Hurstville.

NPWS (2002a) *Threatened Species Information: Grevillea parviflora* subsp. *parviflora*. NSW National Parks and Wildlife Service, August 2002.

NPWS (2002a) *Interpretation Guidelines for the Native Vegetation of the Cumberland Plain.* NSW National Parks and Wildlife Service.

NPWS (2002b) Environmental Impact Assessment Guidelines: *Grevillea parviflora* subsp. *parviflora*. NSW National Parks and Wildlife Service, August 2002.

NPWS (2002b) *Conservation significance guidelines for the Native Vegetation of the Cumberland Plain.* NSW National Parks and Wildlife Service.

NPWS (2004) *Endangered Ecological Community Information: Castlereagh Swamp Woodland.* NSW National Parks and Wildlife Service, February 2004.

OEH (2011) *Principles for the use of biodiversity offsets in NSW.* NSW Office of Enviroment and Heritage www.environment.nsw.gov.au/biocertification/offsets.htm accessed 6 July 2011.

Parry-Jones K & Augee M (2001) Factors affecting the occupation of a colony site in Sydney, New South Wales by the Grey-headed Flying-fox Pteropus poliocephalus (Pteropodidae). *Austral Ecology*, 26 (1) pp.47-55

Parsons Brinckerhoff (2011) *Moorebank Intermodal Freight Terminal – Existing Ecological Values.* Prepared for the Department of Finance and Deregulation. Dated August 2011.

Robertson, G., Matthes, M. and Smith, M. (1996) *Conservation Research Statement and Species Recovery Plan for Persoonia nutans R.Br.* NSW NPWS Hurstville.

Steller, D., and Bryant A (eds.) (2004) *Biodiversity of the Georges River Catchment: Terrestrial biodiversity.* Department of Infrastructure, Planning and Natural Resources, Sydney.

Strahan R. (ed). (1995) *The Mammals of Australia.* Australian Museum/Reed Books, Chatswood.

Tidemann C (1995) Grey-Headed Flying-Fox. In (Eds) Strahan R *The Australian Museum Complete Book of Australian Mammals* (pp 494-495) Angus & Robertson, Sydney

Tozer (2003) The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. *Cunninghamia* **8(1)**: 1-75.

Tozer M.G., Turner K., Keith D.A., Tindall D., Pennay C., Simpson C., MacKenzie B., Beukers P. and Cox S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* **11(3)**: 359-406.

Triggs B. (1996). Tracks, Scats and Other Traces: A Field Guide to Australian Mammals. Oxford University Press, Melbourne.

Turak E, Waddell N & Johnstone G (2004). *New South Wales (NSW) Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual 2004.* http://ausrivas.canberra.edu.au/man/NSW/.

URS (2002*). Investigation Review Report. DNSDC, Moorebank Defence Lands.* Prepared for Property Disposal Task Force, Department of Defence.

Williams N McDonnell M Phelan G Keim L Van Der Ree R (2006) Range expansion due to urbanization: Increased food resources attract Grey-headed Flying-foxes (*Pteropus poliocephalus*) to Melbourne. *Austral Ecology*, 31 (2) pp. 190-198.

APPENDIX 1

AQUATIC ECOLOGY REPORT

APPENDIX 2

FLORA SPECIES INVENTORY

Appendix 2. Plant species recorded in the study area

Notes:

* indicates exotic species; † indicates non-local native species; + indicates threatened species.

Columns Q1 to Q6 represent Quadrats 1 to 6. The values for each species are the estimated percentage foliage cover of the species within the 0.04 hectare quadrat.

Columns T1 to T4 represent Transects 1 to 4. The X indicates that the species was observed along the random meander transect.

Species that are not defined as present within a specific sampling location are those that were opportunistically recorded within the study area during surveys.

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Pteridophytes														
Adiantaceae		*Adiantum aethiopicum*	Common Maidenhair Fern											
		Cheilanthes sieberi	Rock Fern			1						X	X	
Dennstaedtiaceae		*Hypolepis muelleri*						30			X			
		Pteridium esculentum	Bracken											
Dicksoniaceae		*Calochlaena dubia*	Rainbow Fern, False Bracken											
Gleicheniaceae		*Gleichenia dicarpa*	Pouched Coral-fern								X			
Lindsaeaceae		*Lindsaea linearis*	Screw Fern								X			
Salviniaceae	*	*Salvinia molesta*	Salvinia											
Gymnosperms														
Araucariaceae		*Araucaria heterophylla*	Norfolk Island Pine											X
Cupressaceae		*Callitris rhomboidea*	Port Jackson Cypress-pine							X				

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
	*	*Cupressus sempervirens cv. Stricta*	Pencil Pine, Mediterranean Cypress											X
Pinaceae	*	*Pinus sp.*												
Zamiaceae		*Macrozamia spiralis*	Burrawang											

Angiosperms: Dicotyledons

Acanthaceae		*Brunoniella australis*	Blue Trumpet, Blue Yam											
Amaranthaceae		*Alternanthera denticulata*	Common Joyweed			2								
		Alternanthera sp.						1						
Apiaceae		*Centella asiatica*	Indian Pennywort					1		X	X			
	*	*Hydrocotyle bonariensis*	Beach Pennywort					1						
		Hydrocotyle peduncularis						1						
		Platysace ericoides	Heath Platysace	3			1							
		Trachymene incisa		1			1						X	
Apocynaceae	*	*Nerium oleander*	Oleander											X
		Parsonsia straminea	Common Silkpod, Monkey Rope		15									
Araliaceae		*Polyscias sambucifolia*	Elderberry Panax											
Asclepiadaceae	*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush											
Asteraceae	*	*Aster subulatus*	Wild Aster			1								
	*	*Bidens pilosa*	Cobblers Pegs		1									
		Cassinia uncata	Sticky Cassinia							X		X		

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
	*	*Chrysanthemoides monilifera* subsp. *rotundata*	Bitou Bush											
	*	*Cirsium vulgare*	Black Thistle, Spear Thistle											
	*	*Conyza sp.*	Fleabane							X				
		Coronidium scorpioides	Button Everlasting			1	1						X	
	*	*Delairea odorata*	Cape Ivy											
	*	*Hypochaeris radicata*	Catsear, False Dandelion						1			X		
		Olearia microphylla				1						X		
		Ozothamnus diosmifolius	White Dogwood			2	1			X				
	*	*Senecio madagascariensis*	Fireweed, Madagascar Ragwort							X				
	*	*Tagetes minuta*	Stinking Roger											
		Vernonia cinerea						1						
Bignoniaceae	*	*Jacaranda mimosifolia*	Jacaranda											X
Cactaceae	*	*Opuntia sp.*	Prickly Pear											
Caprifoliaceae	*	*Lonicera japonica*	Japanese Honeysuckle											
Casuarinaceae		*Allocasuarina littoralis*	Black She-Oak									X		
		Casuarina glauca	Swamp Oak, Swamp She-oak											X
Chenopodiaceae		*Einadia nutans* subsp. *linifolia*	Climbing Saltbush											
Clusiaceae		*Hypericum gramineum*	Small St Johns-wort	1					1					
Convolvulaceae		*Dichondra repens*	Kidney-weed, Mercury Bay Weed		1					X				
Dilleniaceae		*Hibbertia obtusifolia*	Guinea-flower	2									X	
		Hibbertia sp.		5			1							

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Ericaceae Styphelioideae		*Astroloma humifusum*	Cranberry Heath			1			2					
		Leucopogon ericoides	Beard-heath				1						X	
		Lissanthe strigosa	Peach Heath			1								
		Melichrus procumbens					1							
Euphorbiaceae		*Breynia oblongifolia*	Coffee Bush		1			1						
		Micrantheum ericoides				5						X		
	*	*Triadica sebifera*	Chinese Tallow Tree											X
Fabaceae Caesalpinioideae	*	*Senna pendula var. glabrata*	Easter Cassia							X				
Fabaceae Faboideae		*Bossiaea heterophylla*	Variable Bossiaea			1	2		1			X	X	
		Bossiaea scolopendria					1							
		Daviesia ulicifolia	Gorse Bitter-pea			2				X		X		
		Dillwynia parvifolia												
	*	*Erythrina x sykesii*	Coral Tree											X
		Glycine clandestina	Twining Glycine							X			X	
		Gompholobium glabratum	Dainty Wedge Pea	1		1			1					
		Gompholobium pinnatum	Pinnate Wedge Pea	1										
		Hardenbergia violacea	False Sarsaparilla	1		1	1	1			X	X		
		Pultenaea retusa	Notched Bush-pea								X			
		Pultenaea tuberculata		1			1							
		Pultenaea villosa	Hairy Bush-pea	1		50				X	X	X		
	*	*Trifolium repens*	White Clover							X				

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
	*	*Wisteria sinensis*	Chinese Wisteria											
Fabaceae Mimosoideae		*Acacia binervia*	Coast Myall											X
		Acacia brownii	Golden Prickly Moses	1		1	2		1					
		Acacia decurrens	Black Wattle			5		1	2	X				
		Acacia falcata	Sickle Wattle							X	X	X		
		Acacia floribunda	White Sally											
		Acacia implexa	Hickory Wattle		10									
		Acacia longifolia	Sydney Golden Wattle					1			X	X	X	
		Acacia parramattensis	Parramatta Green Wattle			1		5			X			X
Fagaceae	*	*Quercus palustris*	Pin Oak											X
Goodeniaceae		*Dampiera stricta*	Blue Dampiera	1										
		Goodenia hederacea	Ivy Goodenia	1		1						X		
		Goodenia paniculata					1							
Haloragaceae		*Gonocarpus tetragynus*	Common Raspwort	1										
	*	*Myriophyllum aquaticum*	Parrot's Feather, Brazilian Water-milfoil					1						
Hamamelidaceae	*	*Liquidambar styraciflua*	Liquidambar, Sweet Gum											X
Lauraceae		*Cassytha glabella*		1		1	1	1					X	
		Cassytha pubescens	Devil's Twine, Dodder-laurel		2						X			
	*	*Cinnamomum camphora*	Camphor-laurel					1						X
Lobeliaceae		*Pratia purpurascens*	Whiteroot		1			1			X		X	
Loganiaceae		*Mitrasacme polymorpha*	Mitre Weed				1							

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Loranthaceae		*Amyema gaudichaudii*	Paperbark Mistletoe											
Malaceae	*	*Cotoneaster sp.*								X				
	*	*Sorbus sp. (unidentified)*												X
Malvaceae	*	*Modiola caroliniana*	Red-flower Mallow											
	*	*Sida rhombifolia*	Paddy's Lucerne									X		
Myrtaceae		*Acmena smithii*	Lilly-pilly											
	†	*Agonis flexuosa*	Willow-myrtle, Peppermint Tree											
		Angophora bakeri	Narrow-leaved Apple	1		5	5	2			X	X	X	X
		Angophora costata	Sydney Red Gum, Smooth-barked Apple											X
		Angophora floribunda	Rough-barked Apple											X
		Angophora subvelutina	Broad-leaved Apple								X			
		Callistemon citrinus	Scarlet Bottlebrush											
		Callistemon linearis	Narrow-leaved Bottlebrush			1			1		X		X	
		Callistemon salignus	White Bottlebrush, Pink-tips											X
	†	*Corymbia citriodora*	Lemon-scented Gum											X
		Corymbia eximia	Yellow Bloodwood											X
		Corymbia maculata	Spotted Gum							X				X
		Eucalyptus amplifolia	Cabbage Gum											X
		Eucalyptus botryoides	Bangalay											X
	†	*Eucalyptus camaldulensis*	River Red Gum											X
		Eucalyptus crebra	Narrow-leaved Ironbark											X

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
		Eucalyptus fibrosa	Red Ironbark											X
		Eucalyptus longifolia	Woollybutt											X
	†	*Eucalyptus microcorys*	Tallowwood											X
		Eucalyptus moluccana	Grey Box											X
		Eucalyptus parramattensis	Parramatta Red Gum	7		5		2		X	X	X		X
		Eucalyptus punctata	Grey Gum											X
		Eucalyptus racemosa	Snappy Gum, Scribbly Gum											X
	†	*Eucalyptus saligna*	Sydney Blue Gum							X				X
		Eucalyptus saligna x botryoides			15									
		Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	7		5	10		30	X	X	X		X
		Eucalyptus sideroxylon	Mugga, Red Ironbark											X
		Eucalyptus tereticornis	Forest Red Gum							X				X
		Kunzea ambigua	Tick-bush			5			30	X		X	X	
		Leptospermum juniperinum	Prickly Tea-tree											
		Leptospermum parvifolium	Small-leaved Tea-tree				1						X	
	†	*Leptospermum petersonii*	Lemon-scented Tea-tree											
		Leptospermum polygalifolium	Tantoon								X			
		Leptospermum trinervium	Slender Tea-tree	5			2						X	
	†	*Lophostemon confertus*	Brush Box											X
		Melaleuca armillaris	Bracelet Honey-myrtle							X				
		Melaleuca decora	White Cloud Tree	4						X	X	X		X
		Melaleuca erubescens		1									X	

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
		Melaleuca linariifolia	Flax-leaved Paperbark			1		40		X	X		X	
		Melaleuca nodosa	Ball Honey-myrtle	6		2	5				X	X	X	
		Melaleuca quinquenervia	Broad-leaved Paperbark							X				
		Melaleuca thymifolia	Thyme Honey-myrtle	1			8							
		Syncarpia glomulifera	Turpentine											X
Nyctaginaceae	*	*Bougainvillea cv. (unidentified)*	Bougainvillea											X
Oleaceae	*	*Ligustrum sinense*	Small-Leaved Privet, Chinese Privet		2					X				
		Notelaea longifolia	Mock-olive							X				
	*	*Olea europaea* subsp. *cuspidata*	African Olive		1									
Pittosporaceae		*Billardiera scandens*	Hairy Apple Berry			1						X		
		Bursaria spinosa	Boxthorn			3								
		Pittosporum undulatum	Pittosporum									X		
Plantaginaceae	*	*Plantago lanceolata*	Plantain, Ribwort							X				
Polygonaceae	*	*Acetosa sagittata*	Rambling Dock, Turkey Rhubarb											
		Persicaria decipiens	Slender Knotweed											
		Persicaria praetermissa						1						
Proteaceae		*Banksia ericifolia*	Heath-leaved Banksia											
		Banksia oblongifolia	Fern-leaved Banksia	1			2	2			X		X	
		Banksia serrata	Saw Banksia, Old Man Banksia					1			X			
		Banksia spinulosa var. spinulosa	Hairpin Banksia	8			1				X		X	

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
	+	*Grevillea parviflora* subsp. *parviflora*		2										
	†	*Grevillea robusta*	Silky Oak											X
		Hakea dactyloides	Finger Hakea	1			2							
		Hakea salicifolia	Willow Hakea							X				
		Hakea sericea	Needlebush, Silky Hakea	5		1	10				X	X	X	
		Hakea teretifolia	Needlebush, Dagger Hakea											
		Isopogon anemonifolius	Broad-leaf Drumsticks	1			1						X	
		Lambertia formosa	Mountain Devil			2								
		Lomatia silaifolia	Crinkle Bush									X		
		Persoonia lanceolata	Geebung			1	1						X	
		Persoonia laurina subsp. *laurina*	Laurel Geebung				1						X	
		Persoonia linearis	Narrow-leaf Geebung	1			1		1					
	+	*Persoonia nutans*							1				X	
		Petrophile sessilis				1	10							
Ranunculaceae		*Clematis aristata*	Traveller's Joy, Old Man's Beard		2									
		Clematis glycinoides	Headache Vine, Traveller's Joy								X			
		Ranunculus inundatus	River Buttercup					1				X		
Rhamnaceae		*Pomaderris ferruginea*									X			
Rosaceae	*	*Rubus discolor*	Blackberry					1			X	X		
		Rubus parvifolius	Native Raspberry											

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Rubiaceae		*Morinda jasminoides*	Morinda		1									
		Opercularia varia	Variable Stinkweed			1	1		1					
		Pomax umbellata	Pomax			1	1		1					
	*	*Richardia humistrata*												
Rutaceae		*Philotheca salsolifolia*	Philotheca				1							
Santalaceae		*Exocarpos cupressiformis*	Cherry Ballart, Native Cherry		2					X				
Sapindaceae	*	*Cardiospermum grandiflorum*	Balloon Vine											
Solanaceae	*	*Lycium ferocissimum*	African Boxthorn											
	*	*Solanum nigrum*	Blackberry Nightshade											
Stylidiaceae		*Stylidium graminifolium*	Grass-leaf Triggerplant	1			1							
Thymelaeaceae		*Pimelea linifolia*	Slender Rice Flower	1			1		1				X	
Verbenaceae	*	*Lantana camara*	Lantana		2									
	*	*Verbena bonariensis*	Purpletop											
	*	*Verbena rigida*	Veined Verbena							X				

Angiosperms: Monocotyledons

Agavaceae	*	*Agave americana*	Century Plant, American Aloe											
Alismataceae		*Alisma plantago-aquatica*	Water-plantain											
Alliaceae	*	*Agapanthus praecox* subsp. *orientalis*	Agapanthus											
Anthericaceae		*Laxmannia gracilis*	Slender Wire Lily											

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Asparagaceae	*	*Asparagus aethiopicus*	Asparagus Fern		1									
	*	*Asparagus asparagoides*	Bridal Creeper, Florists' Smilax		2									
Asphodelaceae	*	*Aloe maculata*	Common Soap Aloe											
Colchicaceae		*Burchardia umbellata*	Milkmaids											
Commelinaceae	*	*Tradescantia fluminensis*	Wandering Jew											
Cyperaceae		*Baumea articulata*	Jointed Twig-rush								X			
		Baumea sp.						2						
		Bolboschoenus fluviatilis	Club-rush					1						
		Carex appressa	Tall Sedge					1				X		
		Carex breviculmis												
		Chorizandra cymbaria	Heron Bristle-rush							X				
		Cyathochaeta diandra		5		1	5	1				X	X	
		Cyperus brevifolius				1		2						
	*	*Cyperus eragrostis*	Drain Flat-sedge, Umbrella Sedge					1						
		Fimbristylis dichotoma				1								
		Fimbristylis ferruginea												
		Gahnia clarkei	Tall Saw-sedge		1						X			
		Gahnia sp.					1					X	X	
		Isolepis inundata	Water Club-rush					1						
		Lepidosperma laterale	Variable Sword-sedge			1						X		
		Ptilothrix deusta		20			1							
		Schoenus apogon	Fluke Bog-rush, Common Bog-rush											

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
Iridaceae		*Patersonia sericea*	Native Iris, Silky Purple-flag	5		2								
Juncaceae	*	*Juncus cognatus*	Argentine Rush											
		Juncus continuus	Rush											
		Juncus prismatocarpus	Branching Rush											
		Juncus usitatus	Common Rush			3				X		X		
Lomandraceae		*Lomandra cylindrica*	Needle Mat-rush			1								
		Lomandra longifolia	Spiny-headed Mat-rush	1		1			1			X	X	
		Lomandra multiflora	Many-flowered Mat-rush	1		1								
Orchidaceae		*Pterostylis acuminata*	Sharp Greenhood Orchid									X		
Philydraceae		*Philydrum lanuginosum*	Woolly Waterlily, Frogmouth							X				
Phormiaceae		*Dianella caerulea*	Blue Flax-lily	1	1	1	1	1	2		X		X	
		Dianella revoluta	Blue Flax-lily, Spreading Flax-lily						1					
Poaceae	*	*Andropogon virginicus*	Whisky Grass							X				
		Aristida ramosa	Wiregrass	1					5				X	
		Aristida vagans	Threeawn Speargrass			2	1							
		Aristida warburgii	Wiregrass						2					
	*	*Arundo donax*	Giant Reed											
		Austrodanthonia fulva	Wallaby Grass						2			X		
		Austrostipa pubescens	Speargrass	10		2	10							
		Austrostipa ramosissima	Bamboo Speargrass		3									
		Austrostipa rudis							2					

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
		Bothriochloa macra	Redleg Rass											
	*	*Briza subaristata*												
	*	*Chloris gayana*	Rhodes Grass					1			X			
	*	*Cortaderia selloana*	Pampas Grass											
		Cynodon dactylon	Couch, Bermuda Grass			1				X				
	*	*Dactylis glomerata*	Cocksfoot, Cocksfoot Grass											
	*	*Digitaria sanguinalis*	A Summer Grass, Crab Grass											
		Digitaria sp.							1					
		Echinopogon ovatus	Forest Hedgehog Grass			1					X			
	*	*Ehrharta erecta*	Panic Veld-grass		30									
		Entolasia marginata	Bordered Panic		1									
		Entolasia stricta	Wiry Panic	2		2	1	1	2		X	X	X	
		Eragrostis brownii	Brown's Lovegrass						1	X				
	*	*Eragrostis curvula*	African Lovegrass		1	1			1	X	X		X	
		Eragrostis leptostachya	Paddock Lovegrass	1		2								
		Hemarthria uncinata	Mat Grass					2		X				
		Imperata cylindrica	Blady Grass					10			X			
		Microlaena stipoides	Weeping Grass, Meadow Rice-grass	1	20	1		15	5		X	X	X	
		Oplismenus aemulus	Broad-leaved Basket Grass		1									
		Panicum simile	Two-colour Panic	2		1	1					X		
		Paspalidium distans								X	X			
	*	*Paspalum dilatatum*	Paspalum											

Family		Botanical name	Common name	Q1	Q2	Q3	Q4	Q5	Q6	T1	T2	T3	T4	SIMTA trees
	*	*Paspalum urvillei*	Vasey Grass							X				
	*	*Pennisetum clandestinum*	Kikuyu Grass											
	*	*Phyllostachys aurea*	Yellow Bamboo											
		Poa sp.		1						X				
	*	*Setaria gracilis*	Slender Pigeon Grass			3		10		X	X			
	*	*Setaria parviflora*												
	*	*Sporobolus africanus*	Rat-tail Grass, Parramatta Grass											
		Themeda australis	Kangaroo Grass	10		2	5				X		X	
Restionaceae		*Leptocarpus tenax*					1	2			X			
		Lepyrodia scariosa					1							
Typhaceae		*Typha orientalis*	Broad-leaf Cumbungi, Bulrush					2		X				
Xanthorrhoeaceae		*Xanthorrhoea media*	Grass Tree	5		1	1	1				X	X	

APPENDIX 3

FAUNA SPECIES INVENTORY

General Status	
*	Exotic/introduced species
(?)	Uncertain identification
P	Protected
U	Unprotected

Conservation Status	
CE	Critically Endangered - listed under Schedule 1A of the TSC Act
E	Endangered - listed under Schedule 1 of the TSC Act
V	Vulnerable - listed under Schedule 2 of the TSC Act

Observation Type			
Fl	Flying over the site	Hp	Harp
Vi	Visual observation	El	Elliot
Au	Aural (call recognition)	An	Anabat
Ul	Ultrasonic call recognition (Anabat)	Cg	Cage
Sc	Scat or scent	CP	Call Playback
T	Tracks	Pt	Pittfalls
Scr	Scratch marks on tree trunks or other	A	Anecdotal
D	Diggings	E	Eggs or juvenille morphs
N	Nest	F	Fur or feathers
B	Burrow	H	Hollows (in trees, trunks or other)

Status	Group	Scientific Name	Common Name	Obs Type	Certainty
P	Amphibian	*Crinia signifera*	Common Eastern Froglet	Au	
P	Amphibian	*Litoria fallax*	Dwarf Tree Frog	Au	
*	Bird	*Acridotheres tristis*	Indian Myna	Vi	
P	Bird	*Anas superciliosa*	Pacific Black Duck	Vi	
P	Bird	*Anthochaera carunculata*	Red Wattlebird	Au	
P	Bird	*Cacatua galerita*	Sulphur-crested Cockatoo	Au	
P	Bird	*Cacatua roseicapilla*	Galah	Vi	
P	Bird	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	Au	

P	Bird	*Calyptorhynchus funereus*	Yellow-tailed Black Cockatoo	Vi	
P	Bird	*Chenonetta jubata*	Australian Wood Duck	Vi	
P	Bird	*Coracina novaehollandiae*	Black-faced Cuckoo Shrike	Au	
P	Bird	*Corcorax melanorhamphos*	White-winged Chough	Vi	
P	Bird	*Corvus coronoides*	Australian Raven	Vi	
P	Bird	*Cracticus torquatus*	Grey Butcherbird	Au	
P	Bird	*Dacelo novaeguineae*	Laughing Kookaburra	Au	
P	Bird	*Egretta novaehollandiae*	White-faced Heron	Vi	
P	Bird	*Eopsaltria australis*	Eastern Yellow Robin	Au	
P	Bird	*Gallinula tenebrosa*	Dusky Moorhen	Vi	
P	Bird	*Gerygone mouki*	Brown Gerygone	Au	
P	Bird	*Grallina cyanoleuca*	Magpie Lark	Vi	
P	Bird	*Gymnorhina tibicen*	Australian Magpie	Vi	
P	Bird	*Hirundo neoxena*	Welcome Swallow	Vi	
P	Bird	*Malurus cyaneus*	Superb Fairy Wren	Vi	
P	Bird	*Manorina melanocephala*	Noisy Miner	Vi	
P	Bird	*Manorina melanophrys*	Bell Miner	Au	
P	Bird	*Neochmia temporalis*	Red-browed Finch	Vi	
P	Bird	*Ocyphaps lophotes*	Crested Pigeon	Vi	
P	Bird	*Pachycephala pectoralis*	Golden Whistler	Au	
P	Bird	*Pardalotus punctatus*	Spotted Pardelote	Au	
P	Bird	*Phalacrocorax melanoleucos*	Little Pied Comorant	Vi	
P	Bird	*Platycercus elegans*	Crimson Rosella	Vi	
P	Bird	*Platycercus eximius*	Eastern Rosella	Vi	
P	Bird	*Porphyrio porphyrio*	Purple Swamphen	Vi	
P	Bird	*Psephotus haematonotus*	Red-rumped Parrot	Vi	
P	Bird	*Psophodes olivaceus*	Eastern Whipbird	Au	
P	Bird	*Pycnonotus jocosus*	Red-whiskered Bulbul	Vi	
P	Bird	*Rhipidura leucophrys*	Willie Wagtail	Vi	
P	Bird	*Strepera graculina*	Pied Currawong	Au	
P	Bird	*Trichoglossus haematodus*	Rainbow Lorikeet	Vi	
P	Bird	*Vanellus miles*	Masked Lapwing	Vi	
*	Mammal	*Canis lupus familiaris*	Dog	T	
P	Mammal	*Chalinolobus gouldii*	Gould's Wattled Bat	An	C
P	Mammal	*Chalinolobus morio*	Chocolate Wattled Bat	An	C
*	Mammal	*Felis catus*	Cat	Vi	

*	Mammal	*Lepus capensis*	Brown Hare	Vi	
P	Mammal	*Macropus sp.*	Kangaroo	T	
V	Mammal	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat*	An	C
P	Mammal	*Mormopterus sp.*	Free-tail Bat	An	C
V	Mammal	*Myotis macropus*	Southern Myotis*	An	Po
P	Mammal	*Nyctophilus sp.*	Unidentified Long-eared Bat	An	Po
P	Mammal	*Pseudocheirus peregrinus*	Ringtail Possum	Vi	
V	Mammal	*Pteropus poliocephalus*	Grey-headed Flying Fox	Vi	
P	Mammal	*Tachyglossus aculeatus*	Echidna	Vi	
P	Mammal	*Tadarida australis*	White-striped Mastiff Bat	An	C
P	Mammal	*Vespadelus vulturnus*	Little Forest Bat	An	C
*	Mammal	*Vulpes vulpes*	Fox	Vi	
P	Reptile	*Lampropholis sp.*	Skink	Vi	
P	Reptile	*Pseudechis porphyriacus*	Red-bellied Black Snake	Vi	
P	Reptile	*Pseudonaja textilis*	Eastern Brown Snake	Vi	
P	Fish	*Anguilla australis*	Short-finned Eel	Vi	
*	Fish	*Gambusia holbrooki*	Gambusia	Vi	
P	Fish	*Philypnodon grandiceps*	Flathead Gudgeon	Vi	

APPENDIX 4

EPBC ACT PROTECTED MATTERS REPORT

APPENDIX 5

PART 3A IMPACT ASSESSMENTS

Threatened Ecological Communities

Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion

Castlereagh Scribbly Gum Woodland is listed as Vulnerable under the TSC Act.

Castlereagh Scribbly Gum Woodland occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium. The main occurrence of the community is in the Castlereagh area, with small patches occurring at Kemps Creek, Longneck Lagoon and around Holsworthy; the floristic composition of the community in the Holsworthy area shows stronger similarities to Castlereagh Ironbark Forest than at other localities (Tozer 2003).

In the study area, this community occurred to the north and south of Anzac Creek in the rail corridor lands to the south of the SIMTA site, and in a narrow strip adjoining the eastern edge of the golf course. The community was in relatively good condition, with high native species diversity and occurrence of exotic species mostly limited to bushland edges and tracks. There were also remnant scattered E. sclerophylla over patches of shrub and grass cover in the cleared grassland immediately south of the SIMTA site. The application of the precautionary principle requires consideration of the trees with native shrub/grass understorey as regrowth, highly fragmented Castlereagh Scribbly Gum Woodland.

The SIMTA proposal is likely to have direct impacts on the Castlereagh Scribbly Gum Woodland in the study area; the scale and extent of impacts will depend on the route alignment of the proposed rail link.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable. Castlereagh Scribbly Gum Woodland is a threatened community.

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

The SIMTA proposal includes the construction of the 30m wide rail link which will result in the removal of an area of CSGW. The location and extent of CSGW to be removed is not currently known and will depend on the route alignment of the rail link. It is also possible that there will be impacts on the scattered trees comprising fragmented CSGW in the cleared lands immediately to the south of the SIMTA site. The potential to retain some or all of these trees in landscaping areas should be considered.

Construction of the rail link will create a large area of additional edge for the remaining patches of CSGW to the south of the SIMTA site, making them more vulnerable to weed incursion and degradation and potentially altering the vegetation structure of the community near the new edge. A weed control program is recommended as part of the conservation management of the remaining patches of CSGW.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. Castlereagh Scribbly Gum Woodland is a threatened community.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Castlereagh Scribbly Gum Woodland in the study area. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and

frequency of fires. Flooding flows in the area of CSGW in the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

Construction of the rail link will create an approximately 30 metre wide fenced linear gap in the vegetation community south of the SIMTA site. This is considered unlikely to inhibit genetic exchange for most plant species within the remaining patches, but may result in the isolation of part of the community from ground-dwelling fauna, as the fenced rail link will create a barrier to fauna movement, and this may have impacts on the composition and ecological function of the community.

The area of CSGW to the south of the SIMTA site is currently fenced along Moorebank Avenue to the west and along the East Hills rail link to the south, so there is already a barrier to adjacent areas of CSGW in these directions. The areas of CSGW mapped to the west and north-west of the study area by DECCW (2009) appear to be fragmented patches of urban trees, some of which were observed to be planted trees in the golf course.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Castlereagh Scribbly Gum Woodland.

Conclusion

The Castlereagh Scribbly Gum Woodland in the study area forms the western extent of an approximately 62 hectare area of this community that is effectively, if not formally, conserved in the Holsworthy Military Area. The CSGW in the study area will be directly impacted by the SIMTA proposal: an area of this community will be removed for construction of the rail corridor and the remaining patches will be fragmented and have an increase in edge length, making them more vulnerable to weed invasion and changes in vegetation structure. However, given the current fragmentation of the CSGW in the study area and the large area of remnant CSGW to the east, it is considered unlikely that the SIMTA proposal represents a significant impact to the community, particularly if mitigation measures are implemented.

Castlereagh Swamp Woodland

Castlereagh Swamp Woodland is listed as Endangered under the TSC Act.

Castlereagh Swamp Woodland (CSW) is a low woodland occurring in poorly drained depressions along intermittent watercourses; the community is restricted to alluvial deposits in the Castlereagh and Holsworthy areas (NPWS 2004).

In the study area, this community occurred as narrow bands adjoining the north and south of Anzac Creek in the rail corridor lands to the south of the SIMTA site. The CSW intergrades with Castlereagh Scribby Gum Woodland to the south and there is no clear boundary between the communities. The CSW was in variable condition, with generally high native species diversity and localised occurrence of exotic weed species. The CSW on the southern side of Anzac Creek has historically been disturbed by dumping of construction waste including large concrete blocks, bricks, metal and other rubble. This rubble is now partially buried by sediment and many of the dumpings have been overgrown by native and exotic shrub and groundlayer species.

The SIMTA proposal is likely to have direct impacts on the Castlereagh Swamp Woodland in the study area; the scale and extent of impacts will depend on the route alignment of the proposed rail link.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable. Castlereagh Swamp Woodland is a threatened community.

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

The SIMTA proposal includes the construction of the 30m wide rail corridor which will result the removal of an area of CSW. The location and extent of CSW to be removed is not currently known and will depend on the route alignment of the rail line.

The rail corridor will result in further fragmentation of the already fragmented CSW in the study area and create additional edge for the remaining patches of CSW along Anzac Creek, making them more vulnerable to weed incursion and degradation and potentially altering the vegetation structure of the community near the new edge.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. Castlereagh Swamp Woodland is a threatened community.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Castlereagh Swamp Woodland in the study area. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires.

Flooding flows in the area of CSW in the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The area of CSW in the study area is currently fenced along Moorebank Avenue to the west, so there is already a barrier to connectivity with the small area of CSW to the west. The existing rail spur in the east of the study area also forms a barrier between CSW in the study area and the larger mapped areas to the east.

Construction of the rail link will create an approximately 30 metre wide fenced linear gap in the vegetation community south of the SIMTA site. This is considered unlikely to inhibit genetic exchange for most plant species within the remaining patches, but may result in the isolation of part of the community from ground-dwelling fauna, as the fenced rail link will create a barrier to fauna movement, and this may have impacts on the composition and ecological function of the community.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Castlereagh Swamp Woodland.

Conclusion

The Castlereagh Swamp Woodland in the study area forms the western extent of an approximately 9.4 hectare area of this community that is effectively, if not formally, conserved in the Holsworthy Military Area. The CSW in the study area will be directly impacted by the SIMTA proposal: an area of this community will be removed for construction of the rail corridor and the remaining patches will be fragmented and have an increase in edge length, making them more vulnerable to weed invasion and changes in vegetation structure. However, given the current fragmentation and degradation of the CSW in the study area and the large area of remnant CSW to the east, it is considered unlikely that the SIMTA proposal represents a significant impact to the community, particularly if mitigation measures are implemented.

Cumberland Plain Woodland in the Sydney Basin Bioregion

Cumberland Plain Woodland in the Sydney Basin Bioregion is listed as a critically endangered ecological community under the TSC Act.

Vegetation in and adjoining the far south-western corner of the study area, on the Glenfield Waste Disposal site, has been mapped as Cumberland Plain Woodland (CPW) in two vegetation mapping studies (NPWS 2002/Tozer 2003 and DECCW 2009) (Figures 4 and 6). Of the approximately 0.5 hectare mapped patch of vegetation, only about 0.14 hectares falls within the boundary of the current study area. This area was not accessible for the current survey due to access constraints. As a result, a detailed assessment of species composition, structure and condition of this stand of CPW, in addition to assessing its consistency with the legal definition of this critically endangered ecological community could not be undertaken.

In the absence of field assessment of this patch, application of the precautionary principle requires an assumption that this vegetation is consistent with Cumberland Plain Woodland as defined under the TSC Act.

It is assumed that the small patch of Cumberland Plain Woodland located in and adjoining the far south-western corner of the study area lies outside of the footprint of the rail corridor, when consideration is given to the arch likely required to connect the rail link to the Main Southern Railway. Details regarding other works proposed for the south-western corner of the study area, such as compound areas, access track or stockpiles, are unavailable at this time. This assessment assumes that CPW occurring within and adjoining the study area will be retained.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable. Cumberland Plain Woodland in the Sydney Basin Bioregion is a threatened community.

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

Although the route alignment for the proposed rail link has not yet been finalised, this assessment assumes that the potential CPW in and adjoining the study area lies outside of the footprint of the rail corridor and will not be cleared.

Provided that appropriate safeguards are installed and maintained during construction operations, including highly visible exclusion fencing, sediment and erosion controls and Tree Protection Zones (which may be required if mature trees are present), the proposed actions are unlikely to have an adverse effect on the CPW in the study area.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. Cumberland Plain Woodland is a threatened community.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Cumberland Plain Woodland in the study area. Fire prevention and control measures undertaken as part of the operation of the rail link may decrease the intensity and frequency of fires. Flooding flows in the area of CPW in the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The proposed action will not further increase fragmentation or isolation of the community. The CPW occurring in the study area is currently isolated from other stands of native vegetation by the Main Southern Railway, East Hills Railway and the Glenfield Waste Disposal site and as a result, does not maintain habitat connectivity with other stands of CPW in the locality.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Cumberland Plain Woodland.

Conclusion

The 0.5ha patch of vegetation located within and adjoining the south-western corner of the study area was mapped as Cumberland Plain Woodland by NPWS (2002)/Tozer (2003) and DECCW (2009). In the absence of field assessment of this patch, it is assumed that this vegetation is consistent with the critically endangered ecological community Cumberland Plain Woodland as defined under the TSC Act.

It has been assumed for the purpose of this assessment that this 0.5ha patch of Cumberland Plain Woodland lies outside of the footprint of the proposed rail corridor. Provided that this area of vegetation is retained and that appropriate safeguards are installed and maintained as necessary during construction operations, including highly visible exclusion fencing, sediment and erosion controls and Tree Protection Zones, it is considered unlikely that the SIMTA proposal represents a significant impact to the community.

Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions

Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions (FWCF) is listed as an endangered ecological community under the TSC Act.

This community is typically associated with periodic or semi-permanent inundation by freshwater, or with ephemeral or semi-permanent standing water and is dominated by herbaceous plants with a low abundance of woody species (NSW Scientific Committee 2004).

Anzac Creek supported a wetland dominated by *Typha orientalis* and *Bolboschoenus fluviatilis*. The wetland was in moderate condition with the aquatic weed *Myriophyllum aquaticum* abundant, and an infestation of the noxious weed *Salvinia molesta* near the culvert in the east of the study area. This wetland meets the criteria for Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions. Vegetation mapping by DECCW (2009) has mapped 0.42 hectares of this community within the study area, verified during flora surveys.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable. Freshwater Wetlands on Coastal Floodplains is a threatened community.

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

The SIMTA proposal includes the construction of the 30m wide rail corridor which will result the removal of an area of FWCF. The location and extent of FWCF to be removed is not currently known and will depend on the route alignment of the rail line.

Species diversity within FWCF in the study area is low and much of the community is degraded by infestations of aquatic weeds such as *Myriophyllum aquaticum* and the noxious weed *Salvinia molesta.* The rail corridor will result in further fragmentation of the already fragmented and degraded FWCF in the study area and create additional edge for the remaining patches of FWCF along Anzac Creek, making them more vulnerable to weed incursion and degradation and potentially altering the vegetation structure of the community near the new edge. A weed control program is recommended as part of the conservation management of the remaining patches of CSGW.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. Freshwater Wetlands on Coastal Floodplains is a threatened community.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the FWCF in the study area. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires.

Anzac Creek has already been subject to alterations in flooding flow regimes, with the headwaters of the creek situated in a highly modified landscape in the golf course, a culvert beneath Moorebank Avenue and another culvert beneath the existing rail spur. Provided that construction of the Anzac Creek rail crossing incorporates appropriate culvert design that maintains current flows, it is unlikely that flooding flows affecting FWCF will be significantly modified.

How is the proposal likely to affect habitat connectivity?

Freshwater Wetlands within the study currently persists as a narrow, linear community that occurs in association with Anzac Creek. It is currently fragmented by the existing railway crossing. In the absence of detail regarding the location of the rail crossing, there is potential for this community to be further fragmented by construction of the rail link if it is not located immediately adjacent to the existing crossing.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Freshwater Wetlands on Coastal Floodplains.

Conclusion

The Freshwater Wetlands in the study area forms the western extent of an approximately 0.67 hectare area of this community that extends along Anzac Creek to the east. Species diversity within Freshwater Wetlands of the study area is low and much of the community is degraded by infestations of aquatic weeds.

The Freshwater Wetlands in the study area will be directly impacted by the SIMTA proposal: an area of this community will be removed for construction of the rail corridor and the remaining patches will be fragmented and have an increase in edge length, making them more vulnerable to weed invasion and changes in vegetation structure. In the absence of detail regarding design and associated works required for the completion of the rail link across Anzac Creek, it is unknown what area of Freshwater Wetland will be required to be cleared.

It is considered unlikely that the SIMTA proposal represents a significant impact to the community, particularly if mitigation measures are implemented; however given the limited extent of this community in the locality and the unknown extent of impacts, it is not possible to form a conclusion at this stage.

River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions

River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions is listed as Endangered under the TSC Act.

River-flat Eucalypt Forest on Coastal Floodplains (RFEF) occurs on silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The ecological community occurs on floodplains throughout the coastal areas of NSW.

The degraded riparian vegetation adjoining the Georges River loosely meets the criteria for River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions. The riparian vegetation in the study area consisted of remnant trees of *Eucalyptus botryoides* x *saligna* and *Eucalyptus longifolia* and scattered small trees of *Acacia implexa* and *Hakea salicifolia* with an understorey dominated by dense cover of *Ligustrum sinense* and *Cardiospermum grandiflorum*, which was smothering the shrub and ground layer. These weed-infested areas are considered to have little capacity for the regeneration of natural vegetation without significant resources allocated to weed control and revegetation. Further upslope were areas of riparian forest with higher native diversity and lower exotic cover.

The SIMTA proposal is likely to have direct impacts on the degraded River-flat Eucalypt Forest in the study area; the scale and extent of impacts will depend on the route alignment of the proposed rail line.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable. River-flat Eucalypt Forest on Coastal Floodplains is a threatened community.

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

The SIMTA proposal includes the construction of a 30m wide rail corridor which will result in the removal of an area of degraded RFEF. The location and extent of RFEF to be removed is not currently known and will depend on the route alignment of the rail link, however, given that the width of mapped RFEF is fairly uniform within the study area, it is expected that the proposed rail link will impact approximately 0.2 hectares of RFEF.

The River-flat Eucalypt Forest in the study area is currently highly degraded, with low native species diversity, dominance by weedy exotic shrubs and vines in the understorey and a lack of natural structure. Construction of the rail link will create an approximately 30 metre wide fenced linear gap in the RFEF. This is considered unlikely to modify the current composition of the community. The main impact of the SIMTA proposal on community composition will be the removal of canopy trees of *Eucalyptus botryoides* x *saligna* and *E. longifolia* from the areas of RFEF within the study area and the subsequent alteration of plant community structure in these areas.

Given that the RFEF in the study area is currently highly modified by weed invasion, impacts from edge effects are expected to be minimal. The SIMTA proposal may have some positive effects on the RFEF in the study area through mitigation measures to reduce the existing weed infestation. A weed control program is recommended as part of the conservation management of the remaining patches of RFEF.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable. River-flat Eucalypt Forest on Coastal Floodplains is a threatened community.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the FWCF in the study area. Fire prevention and control measures undertaken as part of the operation of the rail link may decrease the intensity and frequency of fires.

The Georges River is already subject to modifications in flooding flow regimes, with a number of weirs, bridges and other structures historically constructed along the river. The bridge design for the proposed rail corridor has not been finalised, but is unlikely to result in any further significant modification of flooding flows affecting the RFEF adjoining the Georges River.

How is the proposal likely to affect habitat connectivity?

The RFEF adjoining the Georges River is currently fragmented by the East Hills rail link bridge adjoining the southern boundary of the study area. Construction of the proposed rail link will increase the existing gap by up to another 30 metres. Given the existing weed dominance in the understorey of the RFEF, the proposed upgrade is unlikely to significantly affect the movement of characteristic native plant species through this community. If native groundlayer species do persist in the understorey then dispersal may be facilitated through the areas beneath the existing and proposed bridges.

As riparian forest adjoining a major river, the RFEF in the study area has an important ecological function. The native tree and shrub layer are significant and removal of these layers should be minimised as far as possible.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for River-flat Eucalypt Forest on Coastal Floodplains.

Conclusion

The RFEF in the study area will be directly impacted by the SIMTA proposal: it is likely that an area of approximately 0.2 hectares of this community will be removed and/or disturbed for construction of the rail corridor and extend the length of the existing gap between mapped areas of the community to the north and south. However, given the poor condition of the RFEF in the study area, it is considered unlikely that the SIMTA proposal represents a significant impact to the community, particularly if removal of the tree and shrub layers is minimised. A weed control and bushland restoration program is recommended for the RFEF in the study area.

Threatened species

***Persoonia nutans* (Nodding Geebung)**

Persoonia nutans is listed as Endangered under Schedule 1 of the TSC Act.

Persoonia nutans is an erect to spreading shrub 0.5–1.5m high, with linear leaves and hairy young branches. Persoonia nutans is endemic to the Cumberland Plain where it is confined to aeolian and alluvial sediments. The species has a disjunct distribution, with the majority of the population occurring in the north of the range around Agnes Banks, Londonderry, Castlereagh and Windsor Downs, and isolated and relatively small populations found at Kemps Creek, Moorebank, Holsworthy and Voyager Point and Villawood (DEC 2005).

Persoonia nutans was recorded in the Castlereagh Scribbly Gum Woodland north of Anzac Creek, in the rail corridor lands. A targeted search for this species recorded 44 individual plants. Plants ranged from 30cm to about 1.8 m in height, and many individuals were observed to be flowering and/or fruiting. Although the bushland east of the disused railway line was not searched as it was not within the current study area, P. nutans was observed at the edge of bushland in this area.

The SIMTA proposal is likely to have direct impacts on the population of P. nutans in the study area; the scale and extent of impacts will depend on the route alignment of the proposed rail link.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The following is known about the life cycle of Persoonia nutans:

- Flowering occurs from November to April, with some flowers as late as July (Robertson et al. 1996); a minority of plants recorded in the study area were flowering at the time of survey in May 2011.
- Long-tongue bees in the Leioproctus and Chalicodoma genera have been observed carrying P. nutans pollen (Bernhardt and Weston, 1996) and are likely to be the primary pollinators for this species.
- Seed is likely to be dispersed by large birds such as Currawongs, and mammals such as rats, kangaroos and possums, after consumption of the fruit. Viable seed has been found in wallaby scats (DEC 2005).
- The species is an obligate seed regenerator; plants are killed by fire and regeneration is dependent upon recruitment from a soil stored seed bank (DEC 2004).

According to the Environmental Impact Assessment Guidelines for Persoonia nutans (DEC 2004), proposals which are likely to impact on the life cycle of the species such that a local population is put at risk of extinction would include proposals that:

- result in total destruction of habitat;

Vegetation clearing for the construction of the 30m wide rail corridor may result in the destruction of a small area of occupied habitat within the P. nutans population north of Anzac Creek, depending on the route alignment of the rail link.

- result in a partial destruction or modification of habitat (including changes to hydrology and nutrification of the soil substrate) which may result in changes to vegetation community structure;

The proposed rail corridor is likely to result in partial destruction of habitat as well as changes to the vegetation community structure through disturbance and creation of new edges. These

changes to the remaining habitat may not be entirely detrimental to this species; P. nutans is often found at the disturbed edge of bushland, and Robertson et al. (1996) suggested that the species requires disturbance to persist and is capable of surviving extreme disturbance. Nutrification of the soil substrate may occur adjacent to the construction area depending on the construction materials and methods used; this should be avoided as it would result in increased risk of weed incursions.

- result in increased fragmentation of P. nutans habitat;

If the proposed rail corridor intersects the recorded population of P. nutans to the north of Anzac Creek, this will result in fragmentation of habitat. The extent of fragmentation is not yet known, but it could be expected that part of this population could be separated from the other members by a gap of over 30 metres. While this may not prevent genetic exchange through pollination, the barrier represented by the fenced rail link would prevent dispersal of seed by mammals.

- result in a requirement for frequent (<10 year) hazard reduction activities (fire or slashing), preventing establishment of a soil stored seed bank;

It is unlikely that the area of occupied habitat for P. nutans will be subject to frequent hazard reduction activities, however this will depend on the requirements for bushfire protection adjacent to the rail link. There may be scope to co-ordinate hazard reduction activities with habitat management for this species.

- increase vehicular, bike, pedestrian, or other, access to habitat; or

The proposed rail corridor is unlikely to increase vehicular, bike, pedestrian, or other access to habitat; the rail link will be fenced and access to the adjoining bushland will be restricted.

- increase rubbish dumping and associated weed invasion or arson (for example, through adjacent residential development).

The proposed rail corridor will be fenced and there is no public access to the study area east of Moorebank Avenue, so no increase in rubbish dumping or arson is expected. There may be potential for weed propagules to be spread into the P. nutans habitat via trains.

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

The core area of occupied habitat (not including the two isolated individuals) for P. nutans within the study area occupies an area of approximately 0.34 hectares. The remainder of the approximately 1.18 hectare area of Castlereagh Scribbly Gum Woodland to the north of Anzac Creek, in which this 0.34 hectare area of occupied habitat occurs, is likely to constitute potential habitat for this species, although most individuals were recorded within 10 metres of the northern edge of the bushland. It is possible that an area of potential habitat for P. nutans will be impacted as a result of the proposed rail corridor. The actual extent of potential habitat to be cleared is not known.

It is also possible that the Castlereagh Scribbly Gum Woodland to the south of Anzac Creek constitutes potential habitat for the species, but given that intensive targeted searches in this area did not record any individuals of P. nutans, this is considered unlikely.

There has been some modification of the habitat of P. nutans in the study area; the soils appeared to have been disturbed some time ago, with two parallel earthern bunds running east-west within the area of habitat. At the time of survey these bunds had been mostly overgrown by native shrubs, herbs and grasses, and P. nutans was occasionally recorded growing on the bunds. The rail corridor may result in further fragmentation of the *P. nutans* habitat in the study area and create additional edge for the remaining habitat patches, making them more vulnerable to weed incursion and degradation and potentially altering the habitat structure near the new edge.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Examination of the records of this species in the NSW Wildlife Atlas as well as the distribution descriptions in the species recovery plan (DEC 2005) and the SPRAT profile (DSEWPC 2011a) indicates that the study area is close to the southern recorded limit of P. nutans, and that most historical records to the south-west of the study area have subsequently been cleared, with the exception of the population at Simmos Beach Reserve adjoining the Georges River in Macquarie Fields, where 17 plants have been recorded (Eco Logical 2006). There are isolated records of the species in the Holsworthy Military Area to the east and south-east of the study area and it is considered likely that more populations occur here, given the large area of potential habitat for this species in the area.

According to the Environmental Impact Assessment Guidelines for P. nutans (DEC 2004), any area of known habitat in the southern part of the species' distribution should be considered a significant area of habitat. Recorded population sizes vary from only a few individuals to thousands of plants, although the majority of populations support a low number of plants; 64% of populations consist of less than ten mature individuals. Less than 1% of individuals occur within the southern part of the species range. In this context, a population of 44 plants, most of which appear to be mature, is considered to be important to the long-term survival of the species in the locality.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the population of *Persoonia nutans* in the study area. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires. Flooding flows in the vicinity of the population of *Persoonia nutans* in the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The proposed rail link is likely to result in fragmentation of P. nutans habitat; regardless of where the rail alignment is routed, the construction of the rail link will create a gap of 30 metres between individuals of the species, either within the known area of occupied habitat or in other areas of known habitat to the east, with a fenced barrier that will prevent seed dispersal by mammals.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Persoonia nutans.

Conclusion

The population of Persoonia nutans in previously disturbed Castlereagh Scribbly Gum Woodland north of Anzac Creek is considered highly significant. There are few remaining populations of P. nutans in the south of the species' distribution and most consist of less than 10 mature individuals. The core population in the study area consists of 42 plants and there are an additional two plants beneath scattered trees immediately to the south of the SIMTA site.

It is recommended that the route of the proposed rail corridor is designed to minimise impacts on the population of Persoonia nutans in the study area. Depending on the route of the proposed rail link, the removal of individual plants and known habitat of the species, fragmentation of the population and associated edge impacts may constitute a significant impact on this endangered species.

Grevillea parviflora subsp. parviflora

Grevillea parviflora subsp. parviflora is listed as Vulnerable on Schedule 2 of the TSC Act.

G. parviflora subsp. parviflora is a spindly shrub varying from prostrate to erect, usually 0.3–1m high but growing up to 1.5 to 2m. The species suckers readily from rhizomes, although individuals sometimes have single stems (DSEWPC 2011).

Grevillea parviflora subsp. parviflora has a widespread but sporadic distribution, with the main occurrence centred south of Sydney in the Appin-Wedderburn-Picton-Bargo districts, disjunct northern populations at Kurri Kurri and Heddon Greta and on the western shores of Lake Macquarie, and small populations in western Sydney at Kemps Creek and Voyager Point (NPWS 2002). The species occurs on sandy clay loam soils, often with lateritic ironstone gravels, mostly derived from Tertiary sands or alluvium and from the Mittagong Formation (NPWS 2002).

In the study area, Grevillea parviflora subsp. parviflora was recorded in the east of the large patch of Castlereagh Scribbly Gum Woodland south of Anzac Creek. A total of 1038 stems of G. parviflora subsp. parviflora were recorded from 4m wide transects spaced 10m apart; as the survey method sampled 40% of the survey area, the population estimate within the study area is approximately 2,645 stems. The number of genetic individuals is likely to be lower than this estimate given the suckering habit of this species and the localised high density of plant stems observed. The species was more widespread within the more open, grassy areas of bushland, with few plants recorded from the western parts of this patch where there was a dense tall shrub layer.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The life cycle of Grevillea parviflora subsp. parviflora is poorly known, with the following understood:

- The main flowering period occurs between July and December (NPWS 2002a).
- The species is insect pollinated, however the pollinator has not been identified (Benson and McDougall 2000).
- Dispersal is either not well understood, or not explained in the existing literature. Seeds are stated to be gravity dispersed, but it is also suggested that it is likely to have a food-body for ant dispersal (Benson and McDougall 2000). According to NPWS (2002b), there is limited natural seed dispersal (probably <2m).
- Most populations are likely to be dependent on seedling recruitment for long-term viability (NPWS 2002b).
- The species can regenerate from rhizomes in the soil following fire events and may be long-lived (between 25 and 60 years) (DSEWPC 2011b).

According to the Environmental Impact Assessment Guidelines for G. parviflora subsp. parviflora (NPWS 2002b), proposals which are likely to impact on the life cycle of the species such that a local population is put at risk of extinction would include:

- Any activity that impacts on the accumulation of seed in the soil seedbank, seed germination or seed growth. Inappropriate fire regimes are most likely to have impacts on these processes; high fire frequency may cause a decline in the soil seedbank and limit seedling recruitment, whereas low fire frequency may result in poor levels of seed germination and dense shrub growth.

The proposed action is unlikely to increase the frequency of fire. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal are more likely to

decrease the frequency of fires, which could have impacts on the G. parviflora subsp. parviflora population in the study area.

- Those that require regular mowing or slashing of the understorey to maintain visibility or for protection around buildings.

It is likely that some form of asset protection zone will be required for bushfire protection adjoining the rail link, but the width of this buffer and resultant impacts from slashing and/or fuel reduction in the ground layer are unknown at this stage.

- Urban development generally, including road construction, may result in considerable modification of habitat including overshading, altered hydrology, increased soil nutrients and dumping of fill and waste. This could have impacts such as preventing plants from maturing and setting seed, changes in the relative frequency of species, potential increase in weed colonisation and changes in soil conditions.

The proposed rail corridor is unlikely to have any significant overshading effect on the G. parviflora subsp. parviflora habitat; although the rail links will be raised above the existing ground level they will not be high enough to cast a large shadow. It is expected that soil and water management actions will be implemented during the construction and operation of the rail corridor to prevent changes in hydrology and increases in soil nutrients. The proposed action will not result in dumping of fill and waste; the population is in an area that has restricted public access and this will be maintained following construction of the SIMTA proposal.

- The native shrub Kunzea ambigua (Tick Bush) is considered a threat to G. parviflora subsp. parviflora as it is an aggressive early coloniser of bare sites and has prolific seedling recruitment in disturbed areas.

Kunzea ambigua was recorded in the study area and, although locally abundant in some parts of the Castlereagh Scribbly Gum Woodland, was not dominating the shrub layer in the vicinity of the G. parviflora subsp. parviflora population. This species could aggressively colonise any areas cleared for construction operations following completion of the SIMTA proposal.

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

The core area of occupied habitat (not including isolated individuals in denser bushland to the west) for G. parviflora subsp. parviflora within the study area occupies an area of approximately 2.42 hectares. The remainder of the approximately 8.22 hectare area of Castlereagh Scribbly Gum Woodland to the south of Anzac Creek, in which this 2.42 hectare area of occupied habitat occurs, is likely to constitute potential habitat for this species, although most plants were recorded in the more open, grassy areas in the east of the bushland. It is likely that occupied and/or potential habitat for G. parviflora subsp. parviflora will be cleared for the rail corridor, but the extent of this clearing is not currently known.

According to the Environmental Impact Assessment Guidelines for G. parviflora subsp. parviflora (NPWS 2002b), all sites are considered important and the habitat considered significant until there is adequate protection of this species. Sites of particular significance include: those with over 50 plants; those with a varied age structure including active recruitment of species; and areas of intact habitat away from high disturbance areas. The population of G. parviflora subsp. parviflora in the study area is considered to be of particular significance given the large number of stems (although the species is known to sucker from rootstock and the number of stems is considerably higher than the number of individuals, it is nevertheless considered likely that over 50 individuals occur on the site); evidence of a range of age classes, with mature plants and seedlings both observed; and the relatively intact habitat, although the adjoining areas have been disturbed.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The known distribution of Grevillea parviflora subsp. parviflora extends from the main occurrence in the Appin-Wedderburn-Picton-Bargo districts to disjunct northern populations at Kurri Kurri and Heddon Greta and on the western shores of Lake Macquarie (NPWS 2002).

The study area is not at the limit of the known distribution of G. parviflora subsp. parviflora, however this population is considered to be significant due to the isolated occurrence of the species in western Sydney. The only other known locations in the locality are at Kemps Creek and Voyager Point (NPWS 2002b).

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the population of G. parviflora subsp. parviflora in the study area. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires. Flooding flows in the vicinity of the population of G. parviflora subsp. parviflora in the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The proposed rail corridor is likely to result in fragmentation of G. parviflora subsp. parviflora habitat; regardless of where the rail alignment is routed, the construction of the rail link will create a gap of at least 30 metres between individuals of the species, either within the known area of occupied habitat or in other areas of known habitat to the east and south-east, with a fenced barrier. The presence of G. parviflora subsp. parviflora in bushland east of the study area was confirmed during field surveys, but the extent of the population of this species east of the existing rail spur is not known, as no detailed survey were done in this area.

G. parviflora subsp. parviflora is considered to be gravity dispersed (Benson and McDougall 2000) and have limited natural seed dispersal (probably less than two metres) (NPWS 2002b), so even minimal clearing may act as an effective barrier to gene flow. Given that the existing disused rail link adjoining the eastern edge of the study area is at least five metres in width and raised above the ground level, there is already an existing barrier between the population in the study area and other populations to the east.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Grevillea parviflora subsp. parviflora.

Conclusion

The population of G. parviflora subsp. parviflora in Castlereagh Scribbly Gum Woodland to the south of Anzac Creek is considered significant as the population size is relatively large and due to the very low occurrence of this species in the western Sydney region.

It is recommended that the route of the proposed rail corridor is designed to minimise impacts on the population of G. parviflora subsp. parviflora in the study area. Depending on the route of the proposed rail link, the removal of individual plants and known habitat of the species, fragmentation of the population and associated edge impacts may constitute a significant impact on this endangered species.

Eastern Bent-Wing Bat (Miniopterus schreibersii oceanensis)

The Eastern Bent-Wing Bat (Miniopterus schreibersii oceanensis) is listed as Vulnerable under the TSC Act.

The Eastern Bent-Wing Bat occurs along the east and north-west coasts of Australia (DECC 2005) where it is known from a variety of habitat including rainforest, dry and wet sclerophyll forest, open woodland, paperbark forest and open grassland. The species hunts for moths and other flying insects above the canopy or open areas (DECC 2005). Eastern Bent-Wing bats are known to utilise a number of roost sites throughout the year (Churchill 1998).

Caves are the primary roosting habitat for this species; however they also use derelict mines, stormwater tunnels, buildings and other man-made structures (DECC 2005b). Of these, the most important to the species are those used through winter for hibernation and those comprising maternity roosts (DEC 2004a). Female Eastern Bent-Wing Bats congregate in specific caves that provide constant high temperate and humidity to give birth and raise young (Dwyer 1995). Maternity caves are used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within a territorial range of about 300 kilometres from the maternity cave (Churchill, 1998). Movement between territories is rare. Breeding or roosting colonies can range from 100 to 150,000 individuals. As such, they are prone to population damage if their roosting site is disturbed or modified.

Ultrasonic calls of the Eastern Bent-Wing Bat were recorded at five locations across the SIMTA site and rail corridor. The species was recorded in remnant woodland and forest, and cleared and disturbed areas, suggesting that these areas may offer foraging habitat to this species. The species may also forage over the larger, continuous canopy of vegetation occurring in the adjoining Holsworthy Military and on occasion extend its nightly foraging flights into the study area, or simply fly through the study area enroute to foraging habitat.

The study area does not support cave systems and as such, no preferred roosting habitat was identified. No roosts were identified from man-made structures, although a thorough examination of warehouses and potential roost sites in the SIMTA site was not undertaken. No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result, potential habitat resources that may occur in this portion of the study area are unknown.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The SIMTA proposal will involve the staged removal of all existing vegetation from the SIMTA site, followed by staged modification and construction of buildings and associated services. Vegetation occurring within the construction footprint of the 30 metre rail link, within the rail corridor, will also be removed. The rail link will transect woodland and forest vegetation, Anzac Creek and Georges River; however, the exact location of the rail link within the corridor is unknown at this time. It is assumed that completion of the rail link will require construction of a crossing across Anzac Creek and a bridge spanning Georges River.

No roosting habitat for the species was identified from the eastern side of the Georges River within the study area. It is unknown if potential roosting habitat occurs on the western side of Georges River. Provided no roosting habitat is identified from western side of Georges River, the SIMTA proposal is unlikely to impacts upon the roosting habitat or breeding habits of the Eastern Bent-Wing Bat.

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

The Eastern Bent-wing Bat was recorded in remnant woodland and forest, and cleared and disturbed areas, suggesting that these areas may offer foraging habitat to this species. The species may also forage over the larger, continuous canopy of vegetation occurring in the adjoining Holsworthy Military Area and on occasion extend its nightly foraging flights into the study area, or fly through the study area en route to foraging sites within the Holsworthy Military Area.

Foraging activities and flight paths of the Eastern Bent-wing Bat within the SIMTA site may be temporarily disturbed during construction of the SIMTA proposal. Staged development of the SIMTA site may allow the species to alter their flight paths to forage in other parts of the SIMTA site in order to avoid work areas. Long-term, the SIMTA proposal should not prevent the Eastern Bent-wing Bat from flying over the SMITA site, or foraging in open areas of the SMITA site.

Foraging activities and flight paths of the Eastern Bent-wing Bat over native vegetation in the rail corridor may similarly be temporarily disturbed during construction of the rail link. However, the removal of vegetation occurring within the construction footprint of the 30 metre rail link is unlikely to prevent the Eastern Bent-wing Bat from foraging over the canopy of adjoining retained patches of native vegetation.

No roosting habitat for the species was identified from the eastern side of the Georges River within the study area. It is unknown if potential roosting habitat occurs on the western side of Georges River. Provided no roosting habitat is identified from western side of Georges River, the SIMTA proposal is unlikely to impacts upon the roosting habitats of the Eastern Bent-Wing Bat

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The known distribution of the Eastern Bent-Wing Bat extends along the east and north-west coasts of Australia (DECC 2005) where it is known from a variety of habitat including rainforest, dry and wet sclerophyll forest, open woodland, paperbark forest and open grassland. The study area is not at the limit of the known distribution of the Eastern Bent-Wing Bat.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Eastern Bent-wing bat. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires. Flooding flows in the vicinity of the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The study area occurs in a landscape that has been substantially modified as a result of urban residential, industrial and infrastructure development. The study area supports isolated patches of vegetation that do not maintain connectivity with vegetation in adjoining areas, due to surrounding linear infrastructure including adjoining access tracks, Moorebank Ave and the East Hills Railway Line.

As such, the removal of vegetation from the study area for the SIMTA proposal will not further fragment or isolate foraging habitat from other areas of habitat within the locality. The Eastern Bent-wing Bat may continue to foraging over the canopy of retained patches of native vegetation and open areas of the SIMTA proposal.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Eastern Bent-Wing Bat.

Conclusion

Foraging activities and flight paths of the Eastern Bent-wing Bat within the study area may be temporarily disturbed during construction of the SIMTA proposal. Long-term, the SIMTA proposal should not prevent the Eastern Bent-wing Bat from flying over the SMITA site, foraging in open areas of the SMITA site or over vegetation in the rail corridor. Given the current fragmentation of habitat in the study area and the wider locality for the species, it is unlikely that the SIMTA proposal represents a significant impact to the Eastern Bent-wing Bat.

Southern Myotis (*Myotis macropus*)

The Southern Myotis (Myotis macropus) (previously known as the Fishing Bat) is listed as Vulnerable under the TSC Act.

The Southern Myotis occurs across the northern and eastern coasts of Australia (from the Kimberley to Victoria) and is rarely found more than 100 kilometres inland. Although widespread it is considered to be relatively rare and is only patchily distributed within areas of apparently suitable habitat (Lumsden and Menkhorst 1995).

The species is typically found in association with riparian vegetation, also in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species forages over water for insects and small fish that they catch by raking their large feet over the water surface. They also forage aerially for moths, beetles, crickets and flies.

The species roosts communally in groups of up to 15 individuals in caves, mine shafts, tree hollows, under bridges and in buildings, stormwater drains and amongst dense vegetation fringing watercourses. Less commonly, the species has been recorded roosting in partly submerged dead trees and within limestone cliffs. Roosts are typically located in proximity to water.

A possible ultrasonic call of the Southern Myotis was recorded at two locations in proximity to Georges River: at the existing railway bridge abutment that adjoins the study area to the south and remnant forest, and upslope of Georges River riparian vegetation within the study area.

Within the study area the Southern Myotis may forage along the slow-flowing waters of Georges River for fish and invertebrates. No hollow trees were identified on the eastern side of Georges River within the study area that may offer roosting habitat to the species. There is potential for the species to roost in habitat on the western side of the Georges River, and in hollow-bearing trees, under the existing rail bridge or amongst dense vegetation adjoining the study area. No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result, potential habitat resources that may occur in this portion of the study area are unknown.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The SIMTA proposal will involve the staged removal of all existing vegetation from the SIMTA site, followed by staged modification and construction of buildings and associated services. Vegetation occurring within the construction footprint of the 30 metre rail link, within the rail corridor, will also be removed. The rail link will transect woodland and forest vegetation, Anzac Creek and Georges River; however, the exact location of the rail link within the corridor is unknown at this time. It is assumed that completion of the rail link will require construction of a crossing across Anzac Creek and a bridge spanning Georges River.

No roosting habitat for the species was identified from the eastern side of the Georges River within the study area. It is unknown if potential roosting habitat occurs on the western side of Georges River. Provided that no roosting habitat occurs within the western portion of the study area, the SMITA proposal is unlikely to have an adverse effect on the life cycle of the Southern Myotis

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

A possible ultrasonic call of the Southern Myotis was recorded at two locations in proximity to Georges River: at the existing railway bridge abutment that adjoins the study area to the south and remnant forest, and upslope of Georges River riparian vegetation within the study area.

Within the study area the Southern Myotis may forage along the slow-flowing waters of Georges River for fish and invertebrates.

The SIMTA proposal is unlikely to have an adverse impact upon foraging habitat provided by Georges River in the study area. The rail bridge spanning Georges River will not impede or obstruct foraging activities for the species.

No roosting habitat for the species was identified from the eastern side of the Georges River within the study area. It is unknown if potential roosting habitat occurs on the western side of Georges River. Provided that no roosting habitat occurs within the western portion of the study area, the SMITA proposal is unlikely to have an adverse effect on roosting habitat of the Southern Myotis.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The known distribution of the Southern Myotis extends across the northern and eastern coasts of Australia (from the Kimberley to Victoria) and is rarely found more than 100 kilometres inland. The study area is not at the limit of the known distribution of the Southern Myotis.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Southern Myotis. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires. Flooding flows in the vicinity of the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

The SIMTA proposal will not remove or fragment foraging habitat provided by Georges River in the study area. Habitat connectivity of riparian vegetation associated with Georges River is currently fragmented by existing linear infrastructure spanning the river, such as the existing Eastern Hills Railway Bridge. The construction of a similar, adjacent bridge will not further fragment habitat connectivity, and will not obstruct the movement of the Southern Mytois over the river channel itself.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Southern Myotis

Conclusion

Foraging activities and flight paths of the Southern Myotis within the study area may be temporarily disturbed during construction of the SIMTA proposal, particularly during construction of the bridge over Georges River. Long-term, the SIMTA proposal should not impact foraging habitat of the Southern Myotis within the study area. It is unlikely that the SIMTA proposal represents a significant impact to the Southern Myotis.b

Grey-Headed Flying-Fox (*Pteropus poliocephalus*)

Grey-Headed Flying-Fox (Pteropus poliocephalus) is listed as a Vulnerable species under Part 1 of Schedule 2 of the Threatened Species Conservation Act 1995 (TSC Act).

The Grey-Headed Flying-Fox occurs from Bundaberg in Queensland in the north to Melbourne in Victoria in the south, typically between the coast and the western slopes of the Great Dividing Range. In NSW, it occurs along the east coast, eastern slopes of the Great Dividing Range and the tablelands. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops.

The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range from a roosting camp of 20 to 50 kilometres. Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998); in summer, diet mainly comprises fruits of rainforest trees and vines in addition to the nectar and blossom of Eucalyptus, Melaleuca and Banksia. In winter, diet is dominated by nectar and blossom. Non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species within the locality; where previously existed a period of reduced availability of native food resource during the winter months, non-native species now supply food resources throughout the year (Parry-Jones & Augee 2001, Williams et al. 2006).

Grey-Headed Flying-Foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young. Camps are typically located in gullies, close to water, in vegetation with a dense canopy, within 20 kilometres of a regular food source. Site fidelity to camps is high, with some camps being used for over 100 years (NPWS 2001). The closest known roosting camp to the subject site is located at Cabramatta Creek, approximately five kilometres to the north of the study area in Jacqui Osmond Reserve adjoining Cabramatta Creek. Other roosting camps are located within the Botanic Gardens at Farm Cove to the east and Gordon to the north-east.

The Grey-Headed Flying-Fox was observed foraging amongst eucalypts in the SIMTA site and flying over remnant woodland of the proposed rail corridor south of the SIMTA site.

Habitat features of the study area which may support the Grey-Headed Flying-Fox include foraging habitat provided by a number of flowering exotic and native trees, predominantly eucalypts, located within the study area. No survey was undertaken of the study area on the western side of Georges River due to restricted access to this area and as a result, potential habitat resources that may occur in this portion of the study area are unknown. The study area does not contain roosting habitat for this species.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The SIMTA proposal will involve the staged removal of all existing vegetation from the SIMTA site, followed by staged modification and construction of buildings and associated services. Vegetation occurring within the construction footprint of the 30 metre rail link, within the rail corridor, will also be removed. The rail link will transect woodland and forest vegetation, Anzac Creek and Georges River; however, the exact location of the rail link within the corridor is unknown at this time. It is assumed that completion of the rail link will require construction of a crossing across Anzac Creek and a bridge spanning Georges River.

The study area does not contain roosting habitat (i.e. a camp) for this species. The removal of seasonal foraging habitat as a result of the SIMTA proposal is unlikely to have an adverse effect on the life cycle of the Grey-Headed Flying-Fox.

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

A tree survey has been conducted on the SIMTA site and 590 trees occurring on the site were mapped. Of those trees identified to species, at least 147 comprise known feed tree species (ABS 2001) for the Grey-Headed Flying-Fox, that are proposed to be removed for the SIMTA proposal:

- 28 Spotted Gum (Corymbia maculata).
- 12 Narrow-leaved Ironbark (Eucalyptus crebra).
- 11 Woolybutt (Eucalyptus longifolia).
- 14 Grey Box (Eucalyptus moluccana).
- 23 Sydney Blue Gum (Eucalyptus saligna).
- 31 Forest Red Gum (Eucalyptus tereticornis).
- 15 Brush Box (Lophostemon confertus).
- At least 13 additional trees of various native species.

The diversity of tree species across the study area provides a seasonal foraging resource to this species; availability of nectar and blossom would vary with flowering periods of each tree species. However, the trees proposed to be removed do not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox. Holsworthy Military Area together with smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. Street and garden trees in the locality offer further foraging habitat to the species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The known distribution of the Grey-Headed Flying Fox extends from Bundaberg in Queensland in the north to Melbourne in Victoria in the south, typically between the coast and the western slopes of the Great Dividing Range. The study area is not at the limit of the known distribution of the Grey-Headed Flying Fox.

How is the proposal likely to affect current disturbance regimes?

The SIMTA proposal is unlikely to significantly affect current disturbance regimes for the Grey-Headed Flying Fox. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal may decrease the intensity and frequency of fires. Flooding flows in the vicinity of the study area are unlikely to be modified by the SIMTA proposal.

How is the proposal likely to affect habitat connectivity?

Foraging habitat for the Grey-Headed Flying Fox within the study area is currently fragmented from other areas of habitat in the locality by surrounding linear infrastructure such as the East Hills Railway, Moorebank Avenue and access tracks. Removing vegetation, including feed trees, from the study area for the SIMTA proposal will not further fragment or isolate foraging habitat from other areas of habitat within the locality.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Southern Myotis.

Conclusion

The SIMTA proposal involves the removal of known feed trees that offer a seasonal foraging resource to the Grey-Headed Flying Fox. . However, habitat that will be lost from the study area

does not comprise a significant area of foraging habitat in the locality. No camps for Grey-Headed Flying Fox are located within the study area. The closest known roosting camp to the subject site is located at Cabramatta Creek, approximately five kilometres to the north of the study area in Jacqui Osmond Reserve adjoining Cabramatta Creek and this is unlikely to be impacted by the SIMTA proposal. As a result, it is unlikely that the SIMTA proposal represents a significant impact to the Grey-Headed Flying Fox.

APPENDIX 6

EPBC ACT SIGNIFICANT IMPACT ASSESSMENTS

***Persoonia nutans* (Nodding Geebung)**

Persoonia nutans is listed as Endangered under the EPBC Act.

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

(a) lead to a long-term decrease in the size of an important population of the species

Given that *Persoonia nutans* populations are considered likely to be dynamic throughout the landscape, and fluctuations in space and time of above ground individuals will be a natural occurrence (DEC 2004), it is difficult to determine whether the proposed action is likely to lead to a long-term decrease in the population. If *P. nutans* individuals are removed for the construction of the rail corridor then there will be an immediate decrease in the size of the population in the study area, however the associated disturbance of vegetation and creation of new bushland edge may promote germination of soil-stored seed, and subsequently result in a small increase in the population size. Fragmentation and isolation of sections of the population could result in a long-term decline, however this could also be associated with other factors including increased or decreased fire interval and changes in vegetation structure through natural succession that are not directly associated with the proposed action.

(b) reduce the area of occupancy of the species

The proposed action could potentially reduce the area of currently occupied habitat, depending on the route alignment of the rail corridor. It is possible that a small area of potential habitat for *P. nutans* will be impacted as a result of the proposed rail corridor. The actual extent of occupied and/or potential habitat for this species to be cleared is not known.

(c) fragment an existing population into two or more populations

The proposed rail corridor is likely to result in fragmentation of *P. nutans* habitat; regardless of where the rail alignment is routed, the construction of the rail link will create a gap of 30 metres between individuals of the species, either within the known area of occupied habitat or in other areas of known habitat to the east and south-east, with a fenced barrier that will prevent seed dispersal by mammals.

(d) adversely affect habitat critical to the survival of a species

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *Persoonia nutans*.

(e) disrupt the breeding cycle of a population

- Long-tongue bees in the Leioproctus and Chalicodoma genera have been observed carrying *P. nutans* pollen (Bernhardt and Weston, 1996) and are likely to be the primary pollinators for this species.
- Seed is likely to be dispersed by large birds such as Currawongs, and mammals such as rats, kangaroos and possums, after consumption of the fruit. Viable seed has been found in wallaby scats (DEC 2005).

The proposed construction of a fenced rail corridor through either occupied or potential habitat for *P. nutans* will result in fragmentation of habitat. The extent of fragmentation is not yet known, but it could be expected that part of this population could be separated from the other members by a gap of over 30 metres. While this should not prevent genetic exchange through pollination, the barrier represented by the fenced train line would prevent dispersal of seed by mammals.

(f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The core area of occupied habitat (not including the two isolated individuals) for *P. nutans* within the study area occupies an area of approximately 0.34 hectares. The remainder of the approximately 1.18 hectare area of Castlereagh Scribbly Gum Woodland to the north of Anzac Creek, in which this 0.34 hectare area of occupied habitat occurs, is likely to constitute potential habitat for this species, although most individuals were recorded within 10m of the northern edge of the bushland. It is possible that approximately 0.15 hectare of potential habitat for *P. nutans* will be impacted as a result of the proposed rail corridor, based on the average area of vegetation cleared for a 30m wide north-south rail corridor. The actual extent of potential habitat to be cleared is not known.

It is also possible that the Castlereagh Scribbly Gum Woodland to the south of Anzac Creek constitutes potential habitat for the species, but given that intensive targeted searches in this area did not record any individuals of *P. nutans*, this is considered unlikely.

(g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species´ habitat

The rail corridor will create additional edge for *P. nutans* habitat, making it more vulnerable to invasion by exotic species. A weed control program is recommended as part of the conservation management of the study area.

(h) introduce disease that may cause the species to decline

Phytophthora cinnamomi is a soil borne pathogen that infects roots and is associated with plant damage and death. *P. cinnamomi* may be dispersed over large distances in flowing water, such as storm runoff, or may be spread within a site via mycelial growth from infected roots to roots of healthy plants. Propagules of *P. cinnamomi* may also be dispersed by vehicles (e.g. cars and earth moving equipment), animals, walkers and movement of soil. There is an increased risk of *P. cinnamomi* dispersal as a result of the proposed action if precautionary measures are not taken during construction of the rail corridor.

(i) interfere with the recovery of the species

A recovery plan has been prepared for Persoonia nutans (DEC 2005). The overall objective of the recovery plan is ~~to~~ ensure the continued and long-term survival of P. nutans in the wild by promoting the in situ conservation of the species across its natural range".

This plan consists of six specific recovery objectives (DEC 2005 p18):

- minimise the loss and fragmentation of P. nutans habitat using land-use planning mechanisms

Actions associated with this recovery objective include ensuring that:

- all relevant Environmental Planning Instruments (prepared under Pt 3 of the EP&A Act) are prepared, or reviewed, with reference to this recovery plan and any future advice from the Department of Environment and Conservation regarding the species.
- all relevant consent and determining authorities (under Pt 4 & 5 of the EP&A Act) will assess developments and activities with reference to this recovery plan, environmental impact assessment guidelines... and any future advice from the Department of Environment and Conservation regarding the species.

The SIMTA proposal is being assessed with reference to the recovery plan, environmental impact assessment guidelines and all publicly available information regarding the species.

- identify and minimise the operation of threats at sites where P. nutans occurs

This recovery objective is aimed at minimising threats operating at known P. nutans sites (in addition to land clearing), including inappropriate fire regimes (particularly frequent fire), and habitat degradation and rubbish dumping related to unrestricted access.

- implement a survey and monitoring program that will provide information on the extent and viability of P. nutans

Not relevant to the current assessment.

- provide public authorities with information that assists in conserving the species

Not relevant to the current assessment.

- raise awareness of the species and involve the community in the recovery program

Not relevant to the current assessment.

- promote research questions that will assist future management decisions

Not relevant to the current assessment.

Conclusion

The population of *Persoonia nutans* in previously disturbed Castlereagh Scribbly Gum Woodland north of Anzac Creek is considered highly significant. There are few remaining populations of *P. nutans* in the south of the species' distribution and most consist of less than 10 mature individuals. The core population in the study area consists of 42 plants and there are an additional two plants beneath scattered trees immediately to the south of the SIMTA site.

It is recommended that the route of the proposed rail corridor is designed to minimise impacts on the population of *Persoonia nutans* in the study area. Depending on the route of the proposed rail link, the removal of individual plants and known habitat of the species, fragmentation of the population and associated edge impacts may constitute a significant impact on this endangered species.

A referral to the Commonwealth Environment Minister under the provisions of the EPBC Act will be required for this species.

Grevillea parviflora* subsp. *parviflora

Grevillea parviflora subsp. *parviflora* is listed as Vulnerable under the EPBC Act.

An action has, will have, or is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

(a) lead to a long-term decrease in the size of an important population of a species

According to the Environmental Impact Assessment Guidelines for *G. parviflora* subsp. *parviflora* (NPWS 2002b), all sites are considered important and the habitat considered significant until there is adequate protection of this species. Sites of particular significance include: those with over 50 plants; those with a varied age structure including active recruitment of species; and areas of intact habitat away from high disturbance areas. The population of *G. parviflora* subsp. *parviflora* in the study area is considered to be of particular significance given the large number of stems (although the species is known to sucker from rootstock and the number of stems is considerably higher than the number of individuals, it is nevertheless considered likely that over 50 individuals occur on the site); evidence of a range of age classes, with mature plants and seedlings both observed; and the relatively intact habitat, although the adjoining areas have been disturbed.

This population of *G. parviflora* subsp. *parviflora* is also considered to be significant due to the isolated occurrence of the species in western Sydney. The only other known locations in the locality are at Kemps Creek and Voyager Point (NPWS 2002b).

The extent of impacts from the SIMTA proposal on this species, and whether they will lead to a long-term decrease in the size of the population, is unknown at this stage. It would be difficult to determine whether the proposed action would lead to a long-term decrease in the population. If *G. parviflora* subsp. *parviflora* individuals are removed for the construction of the rail corridor then there will be an immediate decrease in the size of the population in the study area, however the associated disturbance and changes in vegetation structure may promote germination of soil-stored seed, and subsequently result in a small increase in the population size. Fragmentation and isolation of sections of the population could result in a long-term decline, however this could also be associated with other factors including increased or decreased fire interval and changes in vegetation structure through natural succession that are not directly associated with the proposed action.

(b) reduce the area of occupancy of an important population

The proposed action could potentially reduce the area of currently occupied habitat, depending on the route alignment of the rail corridor. The core population of *G. parviflora* subsp. *parviflora* in the Castlereagh Scribbly Gum Woodland south of Anzac Creek covers an area of approximately 2.42ha. The actual extent of occupied and/or potential habitat for this species to be cleared is not known.

(c) fragment an existing important population into two or more populations

The proposed rail corridor is likely to result in fragmentation of *G. parviflora* subsp. *parviflora* habitat; regardless of where the rail alignment is routed, the construction of the rail link will create a gap of at least 30 metres between individuals of the species, either within the known area of occupied habitat or in other areas of known habitat to the east and south-east, with a fenced barrier. The presence of *G. parviflora* subsp. *parviflora* in bushland east of the study area was confirmed during field surveys, but the extent of the population of this species east of the existing rail spur is not known, as no detailed survey were done in this area.

G. parviflora subsp. *parviflora* is considered to be gravity dispersed (Benson and McDougall 2000) and have limited natural seed dispersal (probably less than two metres) (NPWS 2002b), so even minimal clearing may act as an effective barrier to gene flow. Given that the existing

disused rail link adjoining the eastern edge of the study area is at least five metres in width and raised above the ground level, there is already an existing barrier between the population in the study area and other populations to the east.

(d) adversely affect habitat critical to the survival of a species

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for *Grevillea parviflora* subsp. *parviflora*

(e) disrupt the breeding cycle of an important population

The breeding cycle of *Grevillea parviflora* subsp. *parviflora* is poorly understood. The species is insect pollinated, however the pollinator has not been identified (Benson and McDougall 2000). Seeds are stated to be gravity dispersed, but it is also suggested that it is likely to have a food-body for ant dispersal (Benson and McDougall 2000). According to NPWS (2002b), there is limited natural seed dispersal (probably <2m). Most populations are likely to be dependent on seedling recruitment for long-term viability (NPWS 2002b).

Any activity that impacts on the accumulation of seed in the soil seedbank, seed germination or seed growth is considered likely to threaten the life cycle processes of the species (NPWS 2002b). Inappropriate fire regimes are most likely to have impacts on these processes; high fire frequency may cause a decline in the soil seedbank and limit seedling recruitment, whereas low fire frequency may result in poor levels of seed germination and dense shrub growth.

The proposed action is unlikely increase the frequency of fire. Fire prevention and control measures undertaken as part of the operation of the intermodal terminal are more likely to decrease the frequency of fires, which could have impacts on the *G. parviflora* subsp. *parviflora* population in the study area.

Depending on the location of the rail link, the SIMTA proposal may create a fenced barrier between the population in the study area and adjoining populations and potential habitat for the species to the east; this will increase the existing gap between populations formed by the existing disused rail spur, which is considered to currently form a barrier to dispersal.

(f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The core area of occupied habitat (not including isolated individuals in denser bushland to the west) for *G. parviflora* subsp. *parviflora* within the study area occupies an area of approximately 2.42 hectares. The remainder of the approximately 8.22 hectare area of Castlereagh Scribbly Gum Woodland to the south of Anzac Creek, in which this 2.42 hectare area of occupied habitat occurs, is likely to constitute potential habitat for this species, although most plants were recorded in the more open, grassy areas in the east of the bushland. It is likely that occupied and/or potential habitat for *G. parviflora* subsp. *parviflora* will be cleared for the rail corridor, but the extent of this clearing is not currently known.

(g) result in invasive species that are harmful to a vulnerable species becoming established in the endangered or critically endangered species´ habitat

The rail corridor will create additional edge for *G. parviflora* subsp. *parviflora* habitat, making it more vulnerable to invasion by exotic species. A weed control program is recommended as part of the conservation management of the study area.

(h) introduce disease that may cause the species to decline

Phytophthora cinnamomi is a soil borne pathogen that infects roots and is associated with plant damage and death. *P. cinnamomi* may be dispersed over large distances in flowing water, such as storm runoff, or may be spread within a site via mycelial growth from infected roots to roots of

healthy plants. Propagules of *P. cinnamomi* may also be dispersed by vehicles (e.g. cars and earth moving equipment), animals, walkers and movement of soil. There is an increased risk of *P. cinnamomi* dispersal as a result of the proposed action if precautionary measures are not taken during construction of the rail corridor.

(i) interfere substantially with the recovery of the species

- No recovery plan has been prepared for Grevillea parviflora subsp. parviflora. (DEC 2005) has specified four priority actions to assist the recovery of this species:
- Liaise with land managers to encourage the preparation of site management plans and the implementation of appropriate threat abatement measures, particularly in fire management, bush regeneration, roadside management, weed control and fencing and signage.
- Monitor known populations, so that potential local extinctions are detected before they occur and mechanism can be put in place to reverse trends.
- Conduct research into life history, genetic diversity of known populations, production and viability of seed, seed predation or germination rates and requirements.
- Identify and survey potential habitat to detect new populations.

The SIMTA proposal is not inconsistent with these priority actions, however, the listed actions are aimed at threatened species management from a conservation agency perspective and are not directly relevant to the planning and design stage of the SIMTA proposal.

Conclusion

The population of *G. parviflora* subsp. *parviflora* in Castlereagh Scribbly Gum Woodland to the south of Anzac Creek is considered highly significant as the population size is relatively large and due to the very low occurrence of this species in the western Sydney region.

It is recommended that the route of the proposed rail corridor is designed to minimise impacts on the population of *G. parviflora* subsp. *parviflora* in the study area. Depending on the route of the proposed rail link, the removal of individual plants and known habitat of the species, fragmentation of the population and associated edge impacts may constitute a significant impact on this endangered species.

A referral to the Commonwealth Environment Minister under the provisions of the EPBC Act will be required for this species.

Grey-Headed Flying-Fox (*Pteropus poliocephalus*)

The Grey-headed Flying-Fox (*Pteropus poliocephalus*) is listed as Vulnerable species under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The Grey-Headed Flying-Fox was observed foraging amongst eucalypts in the SIMTA site and flying over remnant woodland of the proposed rail corridor south of the SIMTA site.

The action involves staged removal of all existing vegetation from the SIMTA site, followed by staged modification and construction of buildings and associated services. Vegetation occurring within the construction footprint of the 30m rail link, within the rail corridor, will be removed. The rail link will transect woodland and forest vegetation, Anzac Creek and Georges River; however, the exact location of the rail link within the corridor is unknown at this time. It is assumed that completion of the rail link will require construction of a crossing across Anzac Creek and a bridge spanning Georges River.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

(a) lead to a long-term decrease in the size of an important population of the species

The nearest important population of the Grey-Headed Flying-Fox is located at Cabramatta Creek, approximately five kilometres to the north of the study area in Jacqui Osmond Reserve. Other important camp sites supporting populations of the species are located within the Botanic Gardens at Farm Cove approximately 20 kilometres to the east, and at Gordon approximately 25 kilometres to the north-east.

Whilst individuals may occur within the study area on a transient or temporary basis during nightly feeding activities, they do not use the study area for permanent roosting or as a maternity camp. Native trees across the study area provide a seasonal food resource for the Grey-Headed Flying-Fox; however this foraging resource sources do not comprise a significant area of foraging habitat within the locality.

Holsworthy Military Area, park and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. Street and garden trees in the locality offer further foraging habitat to the species. As a result, the removal of native trees from the study area that offer a seasonal foraging resource is unlikely to lead to a reduction in any individuals in the locality, and will not lead to a long-term decrease in the size of an important population.

(b) reduce the area of occupancy of an important population

Three important roosting camps of the Grey-Headed Flying-Fox are located within a 30 kilometre radius of the subject site; Cabramatta Creek, the Royal Botanic Gardens and Gordon. The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range of 20 to 50 kilometres from a roosting camp (Tidemann 1995, Churchill 1998). Native tree species located in the study area offer seasonal foraging resources to the species. The action will not remove a significant area of foraging habitat for this species, as Holsworthy Military Area, parks, reserves and street and garden trees in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. As a result, the removal of seasonal feed trees from the study area will not significantly reduce the area of occupancy available for an important population of the species.

(c) fragment an existing important population into two or more populations

The nearest important population of the Grey-Headed Flying-Fox is located at Cabramatta Creek, approximately five kilometres to the north of the study area in Jacqui Osmond Reserve. Two other important camp sites supporting populations of the species are located within 25

kilometres of the study area. While the species is known to range from 20 to 50 kilometres from a roosting camp during nightly feeding activities, the removal of seasonal foraging habitat from the study area will not fragment an important local, regional or other population of the Grey-Headed Flying-Fox into two or more populations.

(d) adversely affect habitat critical to the survival of a species

The action will involve the removal of native trees that offer a seasonal foraging resource to Grey-Headed Flying-Foxes. However, these trees do not comprise habitat critical to the survival of the Grey-Headed Flying-Fox. Large expanses of native vegetation contained with Holsworthy Military area, in addition to parks and reserves, garden and street trees provide additional foraging habitat for this species within the locality.

(e) disrupt the breeding cycle of an important population

The nearest known maternity colony of the species is 5 kilometres away at Cabramatta Creek. NPWS (2001) has stated that Grey-Headed Flying-Fox camps are usually located in close proximity to a regular food source (20 kilometres or less) and are often in stands of riparian rainforest or commonly in gullies, close to water, in vegetation with a dense canopy. The Grey-Headed Flying-Fox most likely utilises the site on occasion during foraging activities and there is no roosting habitat on the study area. The removal of trees from the study area will not disrupt the breeding cycle of a local, regional or other population by impacts on potential roosting and maternity camp habitat or foraging habitat.

(f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The action will involve the removal of a variety of known feed trees of the Grey-Headed Flying-Fox (ABS 2001) that occur throughout the SIMTA site and rail corridor, including Corymbia maculata (Spotted Gum), Eucalyptus crebra (Narrow-leaved Ironbark), Lophostomon confertus (Brush Box), Angophora subvelutina (Broad-leaved Apple) and Eucalyptus parramattensis (Parramatta Gum). The diversity of tree species across the study area provides a seasonal foraging resource to this species; availability of nectar and blossom would vary with flowering periods of each tree species. The trees proposed to be removed, however, do not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying-Fox. Holsworthy Military Area together with smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. Street and garden trees in the locality offer further foraging habitat to the species.

As a result, the removal of seasonal foraging habitat from the study area is unlikely to decrease the availability or quality of habitat to the extent that the Grey-Headed Flying-Fox is likely to decline.

(g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action is unlikely to result in the establishment of an invasive species that is harmful to the Grey-Headed Flying-Fox. Known predators of the species include native reptiles and birds; no invasive fauna species are known to predate upon Grey-Headed Flying-Foxes. The action is highly unlikely to result in the establishment of invasive flora species that are harmful to the Grey-Headed Flying-Fox.

(h) introduce disease that may cause the species to decline, or

The action is highly unlikely to introduce disease that may cause the Grey-Headed Flying-Fox to decline.

(i) interferes substantially with the recovery of the species

No federal or state recovery plan is currently in place for the Grey-Headed Flying-Fox.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (SEWPC) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Grey-Headed Flying-Fox. The assessment above concludes that the action will not have a significant impact on the Grey-Headed Flying-Fox and as such the action does not require referral to DSEWPC for a decision by the Minister on whether further assessment and approval is required under the EPBC Act.