F4.2 River-Flat Eucalypt Forest on Coastal Floodplains state assessment

This assessment is based on the extent of River-Flat Eucalypt Forest on Coastal Floodplains in the non-certified areas in the Growth Centre (1.7 ha, refer Figure F-2).

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

Not applicable to a Threatened ecological community.

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

The proposal will result in the clearing of 1.7 ha of River-Flat Eucalypt Forest on Coastal Floodplains across four areas of non-certified areas within the South West Growth Centre (refer Figure F-3).

River-Flat Eucalypt Forest on Coastal Floodplains occurs along larger drainage lines in the study area that also correspond generally with local wildlife corridors. The project will result in a new movement barrier within these corridors. The use of fish-friendly waterway crossing, such as bridges, will however maintain connectivity for many faunal species utilising these wildlife corridors. In addition, the hydraulic capacity of the waterway crossings have been designed so as to minimise changes to the frequency or intensity of flooding events.

Construction activates have potential to result in conditions that favour the establishment or proliferation of weeds, such as exposed soil and stockpiles. The control of weeds will be managed however through the construction environmental management plan.

Clearing of vegetation required for the project will be a permanent impact to the River-Flat Eucalypt Forest on Coastal Floodplains. However, the proposal is unlikely to affect natural regeneration and recolonisation of existing species in River-Flat Eucalypt Forest on Coastal Floodplains in the adjoining non-certified areas.

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

River-Flat Eucalypt Forest on Coastal Floodplains occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions and the study area is not at the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

The proposal is unlikely to affect the existing disturbance regimes of the community. The proposal will not modify the intensity or frequency of fires, nor is it likely to modify the flooding flows.

How is the proposal likely to affect habitat connectivity?

River-Flat Eucalypt Forest on Coastal Floodplains occurs along larger drainage lines in the study area that also correspond generally with local wildlife corridors. The project will represent a new barrier in these corridors. However, the proposal is unlikely to form a barrier to the dispersal of plant propagules (such as seeds) or pollinators (birds, insects and wind) that would reduce the viability of the community.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for River-Flat Eucalypt Forest on Coastal Floodplains under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community in accordance with section 37 of the *Threatened Species Conservation Act 1995*.

Conclusion

The proposal will result in the clearing of 1.7 ha of River-Flat Eucalypt Forest on Coastal Floodplains across four non-certified areas within the South West Growth Centre (refer Figure F-3).

Given suitable offsets are determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006, the project should improve or maintain biodiversity outcomes despite the direct impacts to the River-Flat Eucalypt Forest on Coastal Floodplains.

F5. Cumberland Land Snail (*Meridolum corneovirens*)

F5.1 Cumberland Land Snail profile

Status

The Cumberland Land Snail (*Meridolum corneovirens*) is listed as Endangered under the *Threatened Species Conservation Act 1995*.

Description

Cumberland Land Snail is a terrestrial species of snail that is generally tan to dark orange in colour ranging in size from 15-30 mm which occurs in Cumberland Plain Woodland and Castlereagh Woodlands in western Sydney (NSW National Parks and Wildlife Service 1999).

Microhabitat features used by the species include the underparts of logs and other debris, leaf and bark accumulations around the bases of trees and sometimes under grass clumps. Loose soil is sometimes used by the species for burrowing, and the species is a fungal feeder and is generally active at night. The bulk of the known populations are small, isolated and vulnerable to impacts from clearing and habitat modification such as the removal of ground cover as this removes shelter, breeding habitat and sources of food (NSW National Parks and Wildlife Service 1999).

Currently, there is little known about the biology, life history, dispersal patterns and distance movement of the Cumberland Land Snail (NSW National Parks and Wildlife Service 1999). The species is known to be genetically structured over short distances. Spatial autocorrelation analysis has shown individuals from any one location (within a few metres of each other) are very likely to be genetically related and the genetic neighbourhood is limited to about 350 m (Clarke & Richardson 2002). As a result, small and isolated populations may be subject to reduced genetic and morphological diversity and increased rates of inbreeding.

Distribution in the study area

Searches for the species were done in all woodland remnants and patches of derived native grasslands. Cumberland Land Snail was recorded in Shale Plains Woodland that was in good condition at Ingleburn and Edmondson Park (refer Figure F-4). Both live specimens and shells were recorded. Shells were collected for species verification by Martyn Robinson of the Australian Museum, Sydney. At these locations, the Shale Plains Woodland consisted of a moderate to high density native dominated ground cover. The native derived grasslands between patches of Shale Plains Woodland at this location are also suitable habitat for the Cumberland Land Snail.

No other live specimens, shells or suitable habitat for the Cumberland Land Snail was recorded. Other patches of Shale Plains Woodland and Shale Hills Woodland in the study area were too highly modified including lack of ground cover habitat as a result of grazing and / or high weed infestations.

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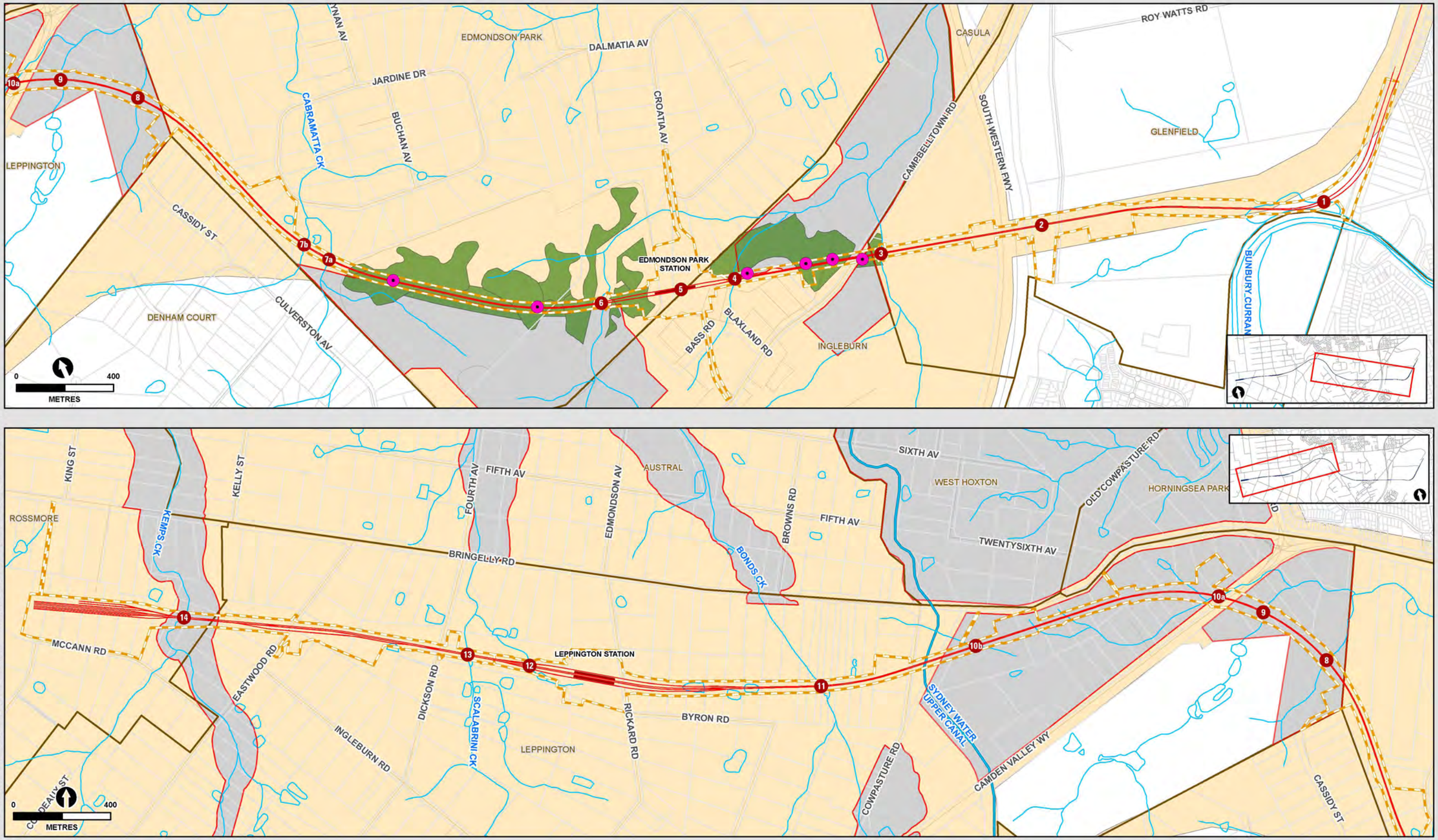

Figure F-4 Cumberland Land Snail records and habitat in the study area

A total of 6.6 ha of known or likely Cumberland Land Snail habitat will be affected by the project. This includes 0.9 ha within non-certified areas in the Growth Centre and an additional 5.7 ha in certified areas.

Threats and recovery of Cumberland Land Snail

Clearing and degradation of Cumberland Plain Woodland remnants is the primary threat to the Cumberland Land Snail. There is however a poor understanding of other threats to this species (Department of Environment and Climate Change 2008).

A recovery plan has not been prepared for the Cumberland Land Snail under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change have, however, identified nine priority actions to help recover the species (see Table F-4).

Table F-4 Priority actions to help recover Cumberland Land Snail

Description of priority action[1]	Does action relate to the project?
Approach priority private site landholders to negotiate implementing protective management regimes.	Not applicable. Biodiversity certification of the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 will assist this action within the Growth Centre.
Review species' conservation status with consideration of data obtained since listing as endangered.	Not applicable.
Implement appropriate fire regimes (ones that allow build up of grass and litter layers).	Not applicable.
Reserve Fire Management Strategy to include operational guidelines to protect this species from fire. .	Not applicable.
Ensure public land plans of management include appropriate actions for species' protection.	Not applicable.
Install structures (where necessary) to prevent accidental slashing and removal of plant debris.	Not applicable.
Implement weed control at sites where necessary.	Not applicable.
Investigate population census techniques and responses to environmental conditions, with the aim of developing estimates of true population size based on numbers detected in standard surveys.	Not applicable.
Identify priority sites for conservation actions on private land.	Not applicable. Biodiversity certification of the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 will assist this action within the Growth Centre.
Approach priority private site landholders to negotiate implementing protective management regimes.	Not applicable.

Source: Department of Environment and Climate Change (2008)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

F5.2 Cumberland Land Snail state assessment

This assessment is based on the Cumberland Land Snail population and its habitat in the non-certified areas in the Growth Centre only (0.9 ha, refer Figure F-4). No Cumberland Land Snail habitat was indentified in the study area outside of the Growth Centre.

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

The proposal will result in the removal of 0.9 ha of non-certified Cumberland Land Snail habitat including within the Ingleburn Defence lands on the north and south side of Campbelltown Road.

The proposal will also result in direct mortality of Cumberland Land Snails within the Ingleburn Defence lands. A Cumberland Land Snail translocation plan will be prepared to salvage Cumberland Land Snail from the habitats where they were recorded. However, the translocation plan is unlikely to successfully collect all individuals of the cryptic and fragile species without some direct mortality. The success rate of Cumberland Land Snails translocation is also difficult to predict or assess.

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

The proposal will result in the removal of 0.9 ha of non-certified Cumberland Land Snail habitat including within the Ingleburn Defence lands on the north and south side of Campbelltown Road. The proposal is unlikely to result in other modification to habitat suitable for this species, such as through changes to the fire or flooding regime of introduction to weeds that will modify the vegetation or ground cover habitat structure.

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

Cumberland Land Snails occur throughout Cumberland Plain Woodland and Castlereagh Woodlands in western Sydney (NSW National Parks and Wildlife Service 1999). As such, the Cumberland Land Snail population within the study area is not considered at the limit of the species distribution.

How is the proposal likely to affect current disturbance regimes?

The proposal is unlikely to affect the existing disturbance regimes relevant to the Cumberland Land Snail or its habitat. The proposal will not modify the intensity or frequency of fires, nor will it modify the flooding flows in its habitat.

How is the proposal likely to affect habitat connectivity?

While the proposal will result in fragmentation of habitat for this species along the project, it will not fragment habitat within non-certified lands. As such, the proposal will not affect habitat connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for the Cumberland Land Snail. The habitat within the study area also is not considered to be critical to the survival of Cumberland Land Snail

Conclusion

Impacts to Cumberland Land Snail in the non-certified areas will result in loss of 0.9 ha of habitat. The project is also likely to result in the loss of some individuals despite a proposed translocation plan. However, Cumberland Land Snails within the study area are not at the limit of their range and the proposal is unlikely to modify current disturbance regimes, reduce habitat connectivity and will not affect critical habitat.

Given a Cumberland Land Snail translocation is proposed to minimise the direct mortality of Cumberland Land Snails within non-certified and certified lands, and offsets will be determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006, the project should improve or maintain biodiversity outcomes despite the direct impacts to the Cumberland Land Snail.

F6. Grey-headed Flying-fox (*Pteropus poliocephalus*)

F6.1 Grey-headed Flying-fox profile

Conservation status

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

Description

The Grey-headed Flying-fox has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. This species can be distinguished from other flying-fox species by leg fur which extends to the ankle. Wing membranes are black and the wingspan can be up to one metre.

The Grey-headed Flying-fox occurs within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (Department of Environment and Climate Change 2008). They occur predominantly in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Grey-headed Flying-fox forage on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias, and fruits of rainforest trees and vines and is an important pollinator and seed-disperser of many native species of plant.

Extent within the study area

Grey-headed Flying-fox was recorded flying over the entire study area. Numerous individuals were recorded foraging in the flowering *Eucalyptus* spp. in Alluvial Woodland at Bunburry Curran Creek and Shale Plains Woodland at Ingleburn and Edmondson Park. Grey-headed Flying-fox are likely to seasonally forage in Shale Plains Woodland, Shale Hills Woodland and Alluvial Woodland over the entire study area. 25.9 ha of this habitat type will be affected within the study area including 4.6 ha in non-certified areas (Figure F-5).

No Grey-headed Flying-foxes were recorded roosting in the study area during day time surveys and no known camps are located within the study area. It is likely that the individuals recorded were foraging from the Cabramatta Creek camp in south-western Sydney.

Threats and recovery of Grey-headed Flying-fox

Grey-headed Flying-fox is subject to a range of threats including:

- unregulated shooting
- electrocution on powerlines
- loss of foraging habitat.
- disturbance of roosting sites (Department of Climate Change 2008).

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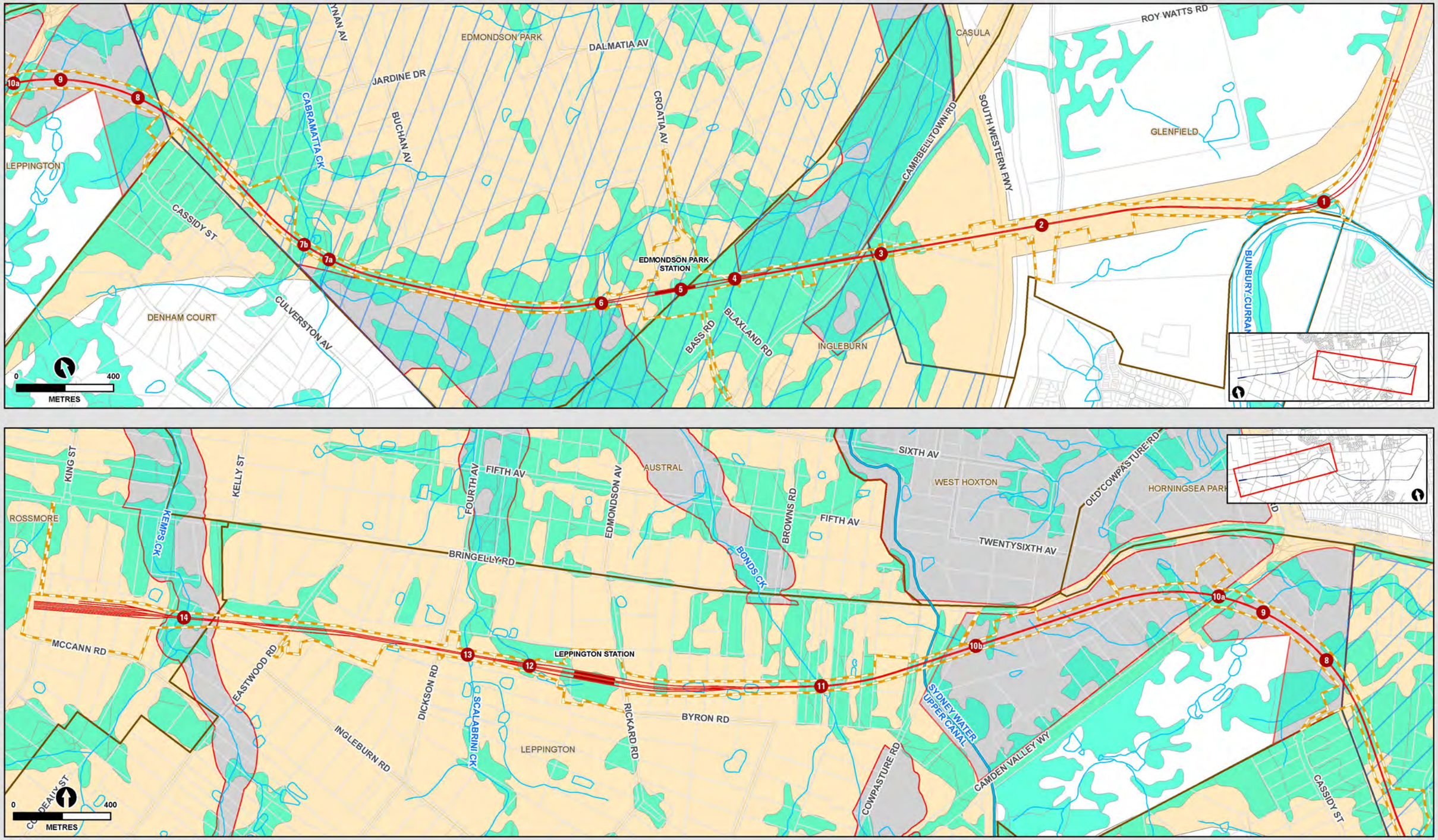

1 Waterway crossing
Cadastre
Suburbs
Drainage
Proposed track
Clearing footprint
Non-certified areas
Certified areas
Grey-headed Flying-fox habitat
Edmondson Park Conservation Agreement

Figure F-5 Grey-headed Flying-fox habitat in the study area

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A recovery plan has not been prepared for the Grey-headed Flying-fox under either the *Threatened Species and Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999*. The Action Plan for Australian Bats (Duncan *et al.* 1999) identified the following objectives for recovery of the species:

- stabilise the population at its current level
- define patterns of landscape use, and identify and protect essential habitat
- develop non-destructive methods for crop protection
- develop non-destructive methods for management of camps in problem areas
- ensure consistent management of the species across all range states (Queensland, New South Wales and Victoria).

The Department of Environment and Climate Change has identified 31 priority actions (also referred to at the Priority Action Statement or PAS) to help recover the species (see Table F-4).

Table F-4 Priority actions for the Grey-headed Flying-fox

Description of priority action[1]	Does action relate to the development of Glenfield Junction and associated works?
Provide educational resources to improve public attitudes toward Grey-headed Flying-foxes.	Not applicable.
Develop materials for public education & provide them to land managers & local community groups working with controversial flying-fox camps, highlighting species status, reasons for being in urban areas, reasons for decline etc.	Not applicable.
Monitor public attitudes towards flying-foxes.	Not applicable.
Review & evaluate camp site management activities, summarising outcomes of past experiences at controversial camps. Noise impacts on neighbours of camps to be considered. For use in managing future conflicts with humans at flying-fox camps.	Not applicable.
Conduct periodic range-wide assessments of the population size of Grey-headed Flying-foxes to monitor population trends.	Not applicable.
Grey-headed Flying-fox National Recovery Team to undertake an annual review of the national recovery plan's implementation.	Not applicable.
Enhance and sustain the vegetation of camps critical to the survival of Grey-headed Flying-foxes.	Not applicable.
Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.	Not applicable.
Protect roosting habitat critical to the survival of Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.	Not applicable. No roosting camps areas located in the study area.
Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works.	Not applicable.

Description of priority action[1]	Does action relate to the development of Glenfield Junction and associated works?
Develop and implement a grower-based program to monitor trends in damage to commercial fruit crops by flying-foxes, and use the results to monitor the performance of actions to reduce crop damage.	Not applicable.
Systematically document the levels of flying-fox damage to the horticulture industry within the range of the Grey-headed Flying-fox.	Not applicable.
Develop guidelines to assist land managers dealing with controversial flying-fox camps.	Not applicable.
Complete national recovery plan in 2007.	This plan was not prepared at the time of preparation of this assessment.
Develop and promote incentives to reduce killing of flying-foxes in commercial fruit crops.	Not applicable.
Develop methods for rapid estimates of flying-fox damage on commercial crops, allowing the long-term monitoring of industry-wide levels and patterns of flying-fox damage.	Not applicable.
Review and improve methods used to assess population size of Grey-headed Flying-foxes.	Not applicable.
Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts.	Not applicable.
Describe the species, age structure & demographics of flying-foxes killed in fruit crops to improve the understanding of the impact by assessing trends in the species, sex, age & reproductive status of animals killed on crops.	Not applicable.
Determine characteristics of roosting habitat for Grey-headed Flying-foxes, exploring the roles of floristic composition, vegetation structure, microclimate and landscape features, and assess the status of camps.	Not applicable.
Investigate the age structure and longevity of Grey-headed Flying-foxes.	Not applicable.
Assess the impacts Grey-headed Flying-fox camps have on water quality, and publish results in a peer-reviewed journal.	Not applicable.
Develop methods to monitor landscape scale nectar availability trends, to explain/potentially predict crop damage trends where crop protection is absent, & promote importance of foraging habitat productive in seasons critical to the horticulture industry.	Not applicable.
Investigate between-year fidelity of Grey-headed Flying-fox individuals to seasonal camps.	Not applicable.
Investigate the differences in genetic relatedness, sex, age etc. between sedentary and transient Grey-headed Flying-foxes.	Not applicable.
Investigate the genetic structure within Grey-headed Flying-fox camps, including levels of relatedness within and between members of adult groups, occupants of individual trees etc.	Not applicable.
Investigate the patterns of juvenile Grey-headed Flying-fox dispersal and mortality, allowing identification of the specific habitat requirements of juveniles.	Not applicable.
Identify the commercial fruit industries that are impacted by Grey-headed Flying-foxes, to provide an information base for use by the various stakeholders.	Not applicable.

Description of priority action[1]	Does action relate to the development of Glenfield Junction and associated works?
Set priorities for protecting foraging habitat critical to the survival of Grey-headed Flying-foxes and generate maps of priority foraging habitat.	Not applicable.
Establish & maintain a range-wide database of Grey-headed Flying-fox camps, including information on location, tenure, zoning & history of use, for distribution to land management/planning authorities, researchers & interested public.	Not applicable.
Improve knowledge of Grey-headed Flying-fox camp locations, targeting regional areas and seasons where information is notably incomplete, such as inland areas during spring and summer.	Not applicable.

Source: Department of Environment and Climate Change (2008)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

F6.2 Grey-headed Flying-fox state assessment

This assessment is based on the Grey-headed Flying-fox habitat in the non-certified areas in the Growth Centre (4.8 ha, refer Figure F-5).

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

The proposal will not affect or disrupt any Grey-headed Flying-fox roosting habitat (camps) and therefore will not affect the life cycle of the species.

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

The project will remove 4.8 ha of Grey-Headed Flying-fox foraging habitat in non-certified areas in the Growth Centre. This represents less than 3% of equivalent habitat within 1 km of the study area. The proposal will not affect or disrupt and Grey-headed Flying-fox roosting habitat (camps).

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

The study area is not at the limit of Grey-headed Flying-fox distribution. The Grey-headed Flying-fox occurs within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (Department of Environment and Climate Change 2008).

How is the proposal likely to affect current disturbance regimes?

The proposal is unlikely to affect the existing disturbance regimes of the Grey-Headed Flying-fox habitats remaining in non-certified areas of the Growth Centre.

How is the proposal likely to affect habitat connectivity?

Grey-Headed Flying-foxes are highly mobile animals that may travel up to 50 km each night to forage. The project and associated works will not form a barrier or otherwise fragment the local Grey-Headed Flying-fox population.

The foraging habitat in the study areas represents a small percentage of available foraging habitat for Grey-Headed Flying-foxes that would be used opportunistically as the dominant *Eucalyptus* spp. flower. As such, the woodlands in the study area are of low importance to the long-term survival of Grey-Headed Flying-fox.

How is the proposal likely to affect critical habitat?

The Grey-headed Flying-fox is ineligible for critical habitat declaration given its status as a Vulnerable Species. Habitat within the study area is further considered not to be critical to the survival of the species in a more general sense.

Conclusion

The project and associated works will result in the removal of 4.8 ha of Grey-Headed Flying-fox foraging habitat in non-certified areas of the Growth Centre. This represents a small percentage (<3%) of similar habitats available within 1 km of the proposal and given the high mobility of the species, is unlikely to represent a significant reduction in the availability of foraging resources. The proposal will not affect or disrupt and Grey-headed Flying-fox roosting habitat (camps) and therefore will not affect the life cycle of the species.

Given suitable offsets are determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006, the project should improve or maintain biodiversity outcomes despite the direct impacts to the Grey-Headed Flying-fox foraging habitat.

F6.3 Grey-headed Flying-fox Commonwealth assessment

Under the *Environment Protection and Biodiversity Conservation Act 1999*, an action is likely to have a significant impact on a Vulnerable species if it affects an important population of the species. Under the Principle Significant Impact Guidelines an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- populations that are near the limit of the species range.

The population of Grey-headed Flying-fox using the study area would not be important as defined above.

This assessment is based on all woodland foraging habitats that will be affected by project and the associated works (refer Figure F-5).

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

The population of Grey-headed Flying-fox in the study area is not an important population. Development of the project and associated works will remove a total of 25.9 ha of suitable foraging habitat for Grey-Headed Flying-fox in the study area which represents 3% within 1 km of the study area. 12.0 ha of this clearing is not covered by the Edmondson Park conservation agreement and therefore represents a small loss of the local extent of the similar habitat.

No Grey-headed Flying-fox camps will be affected by the proposal. As such, the proposal is unlikely to lead to a long-term decrease in the size of the local population.

Will the action reduce the area of occupancy of an important population?

The population of Grey-headed Flying-fox in the study area is not an important population. Development of the project and associated works will remove a total of 25.9 ha of suitable foraging habitat for Grey-Headed Flying-fox in the study area which represents 3% within 1 km of the study area. 12 ha of this clearing is not covered by the Edmondson Park conservation agreement and therefore represents a small loss of the local extent of the similar habitat. Grey-headed Flying-fox are highly mobile species that may travel up to 50 km each night to forage and the local population will not be restricted to habitat resources in the study area.

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

The population of Grey-headed Flying-fox in the study area is not an important population. No Grey-Headed Flying-fox camps will be affected by the proposal which would be a likely cause of fragmentation of an existing population into two or more populations.

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

Critical habitat under the *Environment Protection and Biodiversity Conservation Act 1999* is habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

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

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the *Environment Protection and Biodiversity Conservation Act 1999*.

No critical habitat has been listed for Grey-headed Flying-fox under the *Environment Protection and Biodiversity Conservation Act 1999*. While known Grey-Headed Flying-fox camps may be considered critical to the survival of local populations, no camps will be affected by the proposal.

Will the action disrupt the breeding cycle of an important population?

The proposal will not affect or disrupt and Grey-headed Flying-fox roosting habitat (camps) and therefore will not affect the life cycle of the species.

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

The study area contains limited foraging resources for Grey-headed Flying-fox. The action is unlikely to significantly decrease the availability of foraging habitat in the study area and locality. The large home range of the species allows offsite foraging resources to be accessed. Isolation of habitat would not result from the action.

It is unlikely that the action would isolate and decrease the availability of quality habitat to the extent that the species is likely to decline.

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

It is highly unlikely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become further established as a result of the action.

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

The proposal would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Will the action interfere with the recovery of the species?

The proposal is unlikely to interfere with the recovery of Grey-headed Flying-fox.

Conclusion

The Grey-headed Flying-fox is unlikely to be significantly affected by the project.

F7. Microchiropteran bats

Microchiropteran bats are assessed collectively because of their similarity of habitats, habits and potential impacts.

F7.1 Microchiropteran bat profiles

Conservation status

Four species of microchiropteran bats were recorded in the study area and an additional species was considered likely to occur based on the presence of suitable habitat (refer Table F-6). All five species are listed Vulnerable under the *Threatened Species Conservation Act 1995*. The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) is also listed as Conservation Dependent under the *Environment Protection and Biodiversity Conservation Act 1999.* A Conservation Dependent species is not however considered to be a Matter of National Environmental Significance and therefore is not a trigger of the *Environment Protection and Biodiversity Conservation Act 1999*.

Table F-6 Conservation status of Microchiropteran bats recorded or likely to occur in the study area

Species	Conservation Status		Recorded in study area
	State [1]	National [2]	
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)	V	-	Yes
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	Yes
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	V	-	Yes
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	Yes
Eastern False Pipistrelle *(Falsistrellus tasmaniensis)*	V	-	No

1. State conservation status: V= Vulnerable, (*Threatened Species Conservation Act 1995*).

2. National conservation status: (*Environment Protection and Biodiversity Conservation Act 1999*)

Description

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat is a very distinctive, large, insectivorous bat with a white to yellow belly extending to the shoulders and just behind the ear. They occur in a range of habitats including wet and dry sclerophyll forests, open woodlands, *Acacia* shrublands, grasslands and deserts (Churchill 1998). Their distribution extends across northern Australia from Western Australia to Queensland and most of the east coast including all of NSW, Victoria and the eastern part of South Australia (Churchill 1998). They generally roost in solitary in trees, however may form small groups in late winter to spring. They have also been recorded roosting in buildings and other structures.

Eastern Freetail-bat

The Eastern Freetail Bat, like other free-tail or mastiff bats, has a long (3 - 4 cm) bare tail protruding from the tail membrane. They occur in dry eucalypt woodlands east of the Great Dividing Range from southern Queensland near Brisbane to south of Sydney. They generally roost in solitary in trees, however may use other man made structures.

Eastern Bent-wing Bat

The Eastern Bent-wing Bat occurs from along the coastal side of the Great Dividing Range from Cape York, through Queensland, New South Wales and Victoria and into south-east corner of South Australia. They also occur in Northern Australia from the Kimberly through the western Gulf of Carpentaria. They occur in a range of habitats across their range including rainforests, wet and dry sclerophyll forests and open grasslands. Eastern Bent-wing Bats are cave roosting bats, however also roost in man-made habitats including road culverts.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat is a large bat up to 95 mm long. They occur along the east coast of Australia from the Atherton Tablelands in Queensland to southern New South Wales. They generally occur in moist gullies in association with coastal forest and rainforest. Greater Broad-nosed Bat roost in tree hollows as well as in man made structures.

Eastern False Pipistrelle

The Eastern False Pipistrelle occurs along the coastal side of the Great Dividing Range from South East Queensland, through New South Wales and Victoria. They also occur throughout Tasmania. They generally occur in sclerophyll forests on the mainland. Eastern False Pipistrelle generally roost in tree hollows in groups of 3 to 36 animals (Churchill 1998).

Distribution in the study area

Microbats were recorded through the study area at all locations sampled. Yellow-bellied Sheathtail Bat was recorded at the Glenfield end of the study area only. Eastern Freetail-bat was recorded at Edmondson Park only. Eastern Bent-wing Bat and Greater Broad-nosed Bat were recorded at the Sydney Wester Regional Parklands only. Eastern False Pipistrelle was not recorded in the study area.

All remnant woodland habitat (25.9 ha) in the study area is considered as potential roosting and foraging habitat for all these threatened species of microbat (refer Figure F-6). There is 4.6 ha of this habitat type in the non-certified areas of the Growth Centre.

Threats and recovery

Microbats include the Threatened species recorded or likely to occur in the study area are subject to a range of threats (refer Table F-6). These generally relate to loss of or disturbance of roosting sites and foraging habitats and the effects of pesticides and herbicides to food availability or bioaccumulation.

The Department of Environment, Climate Change and Water have identified priority actions (also referred to at the Priority Action Statement or PAS) to direct recover actions for Threatened microbats (refer Table F-7). None of these actions relate to impacts of the project. Several actions however relate to the value of hollow bearing trees, and these important microhabitat elements will be considered in determining offsets.

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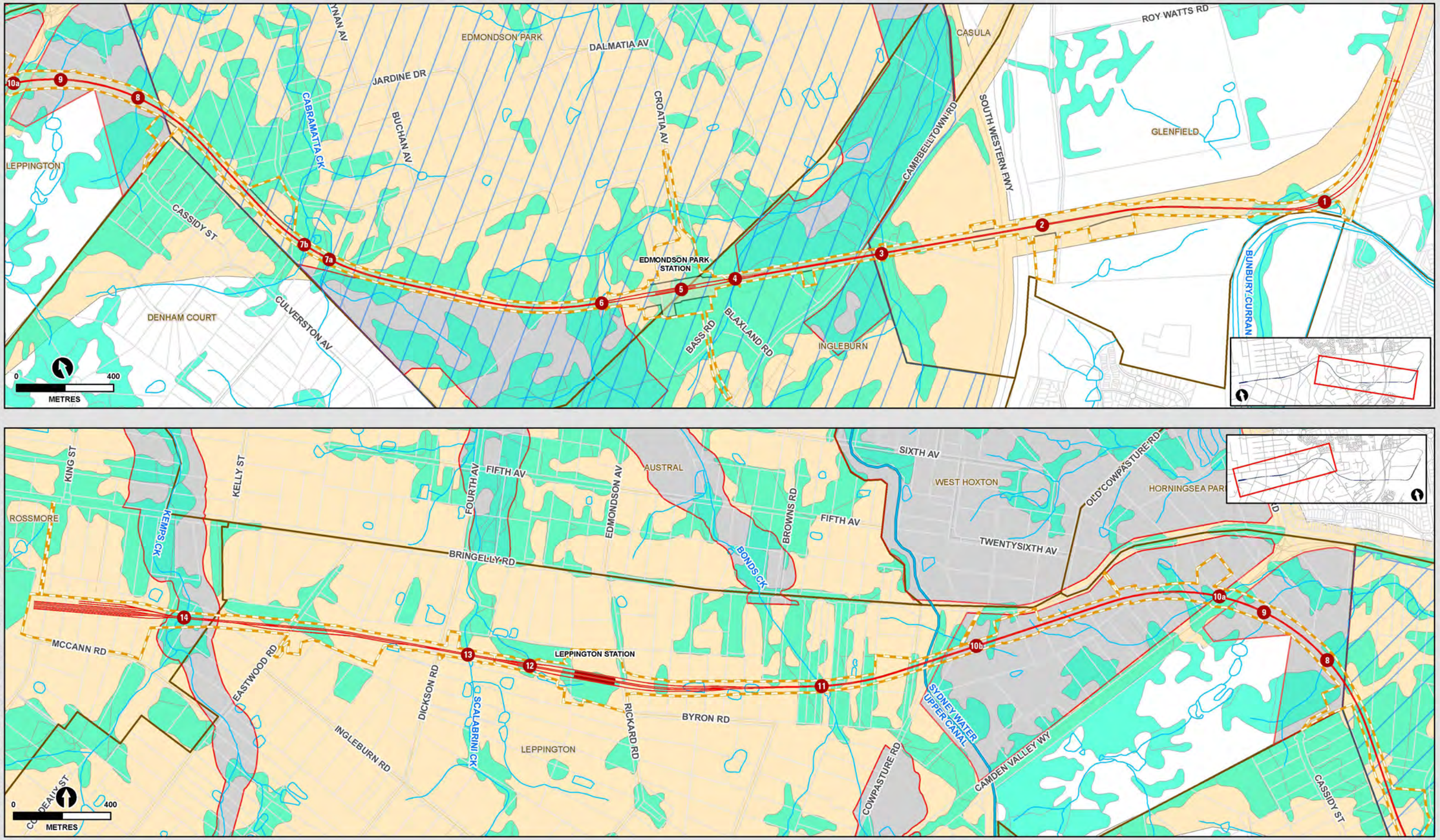

Figure F-6 Microbat habitat in the study area

Table F-6 Threats to microbats

Description of priority action[1]	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Disturbance to roosting and seasonal breeding sites.	●		●	●	●
Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.	●	●	●	●	
Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.	●	●		●	
Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.	●	●	●	●	●
Damage to or disturbance of roosting caves, particularly during winter or breeding.			●		
Predation by feral cats and foxes.			●		

Source: Department of Environment and Climate Change (2008)

Table F-7 Priority actions for microbats

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Better define species distribution through survey in coastal lowlands on- and off-reserve.	Not applicable.		●	●		
Confirm species taxonomy of NSW populations, relative to other Australian populations.	Not applicable.			●		
Control foxes and feral cats around roosting sites, particularly maternity caves and hibernation sites.	Not applicable.			●		
Determine the effectiveness of PVP assessment, offsets and actions for bats.	Not applicable.			●		
Develop and promote State-wide bat awareness programs for schools, CMAs, landholders and industry groups etc.	Not applicable.		●		●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Ensure largest hollow bearing trees, inc. dead trees and paddock trees are given highest priority for retention in PVP assessments (offsets should include remnants in high productivity) and/or other land assessment tools.	Not applicable.	●	●		●	●
Ensure protection of known roosts and forest within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments.	Not applicable.			●		
Ensure the Code of Practice for private native forestry includes adequate measures to protect large, hollow-bearing trees and viable numbers of recruit trees.	Not applicable.	●			●	●
Establish a community program to encourage the reporting of roost trees.	Not applicable.	●				
Establish a gating design for disused mines across species range that will not adversely impact species. Consultation with cave bat specialist prior to any gating operations.	Not applicable.			●		
Exclude prescription burns from 100m from cave entrance, ensure smoke/flames of fires do not enter caves/roosts in artificial structures.	Not applicable.			●		
For roost caves vulnerable to human disturbance, monitor their visitation by people, particularly during winter and spring/summer maternity season and in school holidays.	Not applicable.			●		
Identify and protect significant roost habitat in artificial structures (eg culverts, old buildings and derelict mines).	Not applicable.			●		
Identify areas of private land that contain high densities of large hollow-bearing trees as areas of high conservation value (HCV) planning instruments and land management negotiations e.g. LEP, CAPs, PVPs.	Not applicable.	●	●		●	●
Identify important foraging range and key habitat components for this species.	Not applicable.		●		●	●
Identify the effects of fragmentation in a range of fragmented landscapes i.e. the farmland/forest interface and the urban/forest interface e.g. movement and persistence across a range of fragment sizes.	Not applicable.	●	●		●	
Identify the susceptibility of the species to pesticides.	Not applicable.		●	●		
Investigate the effectiveness of logging prescriptions.	Not applicable.	●	●		●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Measure genetic population structure among cave roosts of maternity colonies to estimate dispersal and genetic isolation, and vulnerability to regional population extinction.	Not applicable.			●		
Monitor the breeding success of a representative sample of maternity colonies in cave roosts over a number of years to determine the viability of regional populations.	Not applicable.			●		
Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees.	Not applicable.	●		●	●	●
Prepare fire management plans for significant roost caves, disused mines, culverts, especially maternity and winter roosts.	Not applicable.			●		
Prepare management plans for significant bat roosts especially all known maternity colonies and winter colonies.	Not applicable.			●		
Promote bats throughout the rural community as ecologically interesting and important, but sensitive to disturbance at caves/disused mine tunnels. Promote the conservation of these key roost areas using measures such as incentive funding to landholders, offseting and biobanking, acquisition for reserve establishment or other means. Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means.	Not applicable.	●	●	●	●	●
Quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops.	Not applicable.		●		●	●
Raise awareness of the effects of pesticides.	Not applicable.	●			●	
Regular censuses of maternity colonies (Wee Jasper, Bungonia, Willi-Willi, Riverton) and other key roosts in network, especially where there are population estimates from banding in the 1960s.	Not applicable.			●		
Research the degree of long-term fidelity to roost trees and roosting areas in order to assess their importance and the effects of their removal.	Not applicable.	●	●		●	●
Research the effect of different burning regimes on cave and roosting habitat disturbance and surrounding foraging habitat.	Not applicable.	●	●	●	●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Research the effectiveness of rehabilitation measures intended to increase bat populations in degraded landscapes, such as revegetating riparian zones and installing bat boxes.	Not applicable.	●	●		●	●
Research the potential for long distance/seasonal movement.	Not applicable.	●				
Research the roosting ecology of tree-roosting bats. For example identifying the attributes of key roosts.	Not applicable.	●	●		●	●
Research to identify important foraging range and key habitat components around significant roosts.	Not applicable.			●		
Research to quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops.	Not applicable.	●				
Restrict access where possible to known maternity sites. (e.g.: signs; bat-friendly, preferably external gates at caves).	Not applicable.			●		
Restrict caving activities at significant roosts during important stages of the annual bat life cycle (eg winter hibernation, summer maternity season).	Not applicable.			●		
Restrict caving activity during critical times of year in important roosts used by species, particularly maternity and hibernation roosts.	Not applicable.			●		
Search for significant roost sites and restrict access where possible (e.g. gating of caves). Significant includes maternity, hibernation and transient sites including in artificial structures.	Not applicable.			●		
Study the ecological requirements of maternity colonies and their environs and migratory patterns.	Not applicable.			●		
Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species.	Not applicable.	●	●	●	●	
Study the species biology such as reproductive capacity, longevity, mortality rate and life history, or thermal and energy requirements to better determine capacity to respond to changes in climate or recover from losses in the population.	Not applicable.	●				
Study the susceptibility of this species to pesticide accumulation.	Not applicable.	●			●	

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Eastern Bent-wing Bat	Greater Broad-nosed Bat	Eastern False Pipistrelle
Undertake a systematic survey of productive coastal river valleys to quantify the importance of private land relative to public lands.	Not applicable.				●	
Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.	Not applicable.	●	●		●	●
Undertake non-chemical removal of weeds (e.g. lantana, blackberry) to prevent obstruction of cave entrances.	Not applicable.			●		
Use radio-tracking to identify important foraging range and help interpret density of records.	Not applicable.	●				

F7.1.1 Microbat state assessment

This assessment is based on the Microbat habitat in the non-certified areas in the Growth Centre (4.8 ha, refer Figure F-6).

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

The proposal will result in the removal of 4.8 ha of microbat habitat. This is likely to result in the loss of hollows that provide roosting habitat for microbats, including the Threatened species recorded or likely to occur in the study area. Tree hollows of suitable size for microbats occur at low abundance throughout the study area including in regrowth vegetation. In addition, some species of microbat are known to roost under the peeling bark or fissures of various species of eucalypt.

Microbats are highly mobile species and many species are known to change their roosts daily (Churchill 1998). Given the proposed vegetation clearing protocols for habitat trees which will attempt to remove microbats prior to clearing, the proposal is unlikely to result in significant direct mortalities of Threatened microbats.

Eastern bent-wing bats form discrete populations centred on maternity caves that are used annually for the birth and rearing of young. No known maternity caves are known to occur in the study area that would be impacted by the proposal.

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

The proposal will result in the removal of 4.8 ha of microbat habitat in non-certified areas of the study area. This is likely to result in the loss of hollows which provide roosting habitat for microbats, including the Threatened species recorded or likely to occur in the study area. However, this represents <1 % of equivalent microbat habitat within 1 km of the study area.

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

The study area is not at the limit of the distribution of Yellow-bellied Sheathtail Bat, Eastern Freetail-bat, Eastern Bent-wing Bat, Greater Broad-nosed Bat or Eastern False Pipistrelle.

How is the proposal likely to affect current disturbance regimes?

The proposal is unlikely to affect the existing disturbance regimes of the remaining microbat habitat in non-certified areas of the Growth Centre.

How is the proposal likely to affect habitat connectivity?

Microbats are mobile species that fly between patches of suitable habitat for foraging and roosting. The project and associated works will not form a barrier or otherwise fragment the microbat movements in the locality.

How is the proposal likely to affect critical habitat?

The species of Threatened microbat recorded or likely to occur in the study area are all ineligible for critical habitat declarations given their status as a Vulnerable Species. Habitat within the study area is further considered not to be critical to the survival of the species in a more general sense.

Conclusion

The project and associated works will result in the removal of 4.8 ha of microbat habitats in non-certified areas of the Growth Centre. This represents a small percentage (<1%) of similar habitats available within 1 km of the proposal and given the high mobility of the species, is unlikely to represent a significant reduction in the availability of foraging resources.

Given suitable offsets are determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006, the project should improve or maintain biodiversity outcomes despite the direct impacts to the microbat habitat.

Appendix F References

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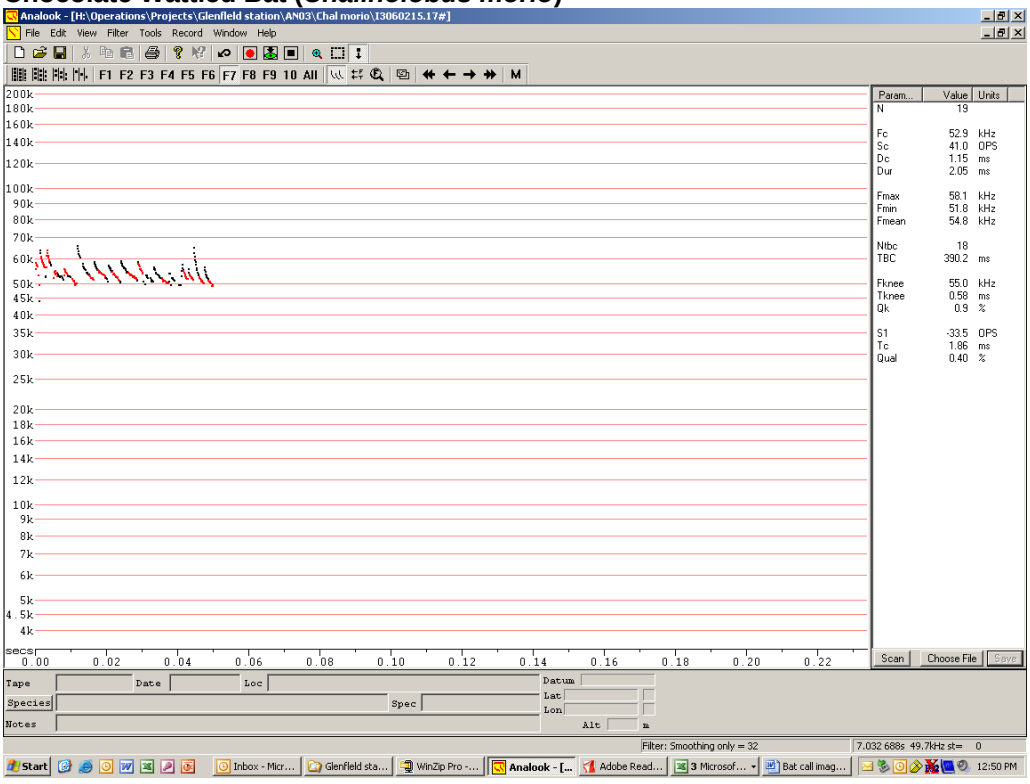
Appendix G

Microbat calls recorded within the study area

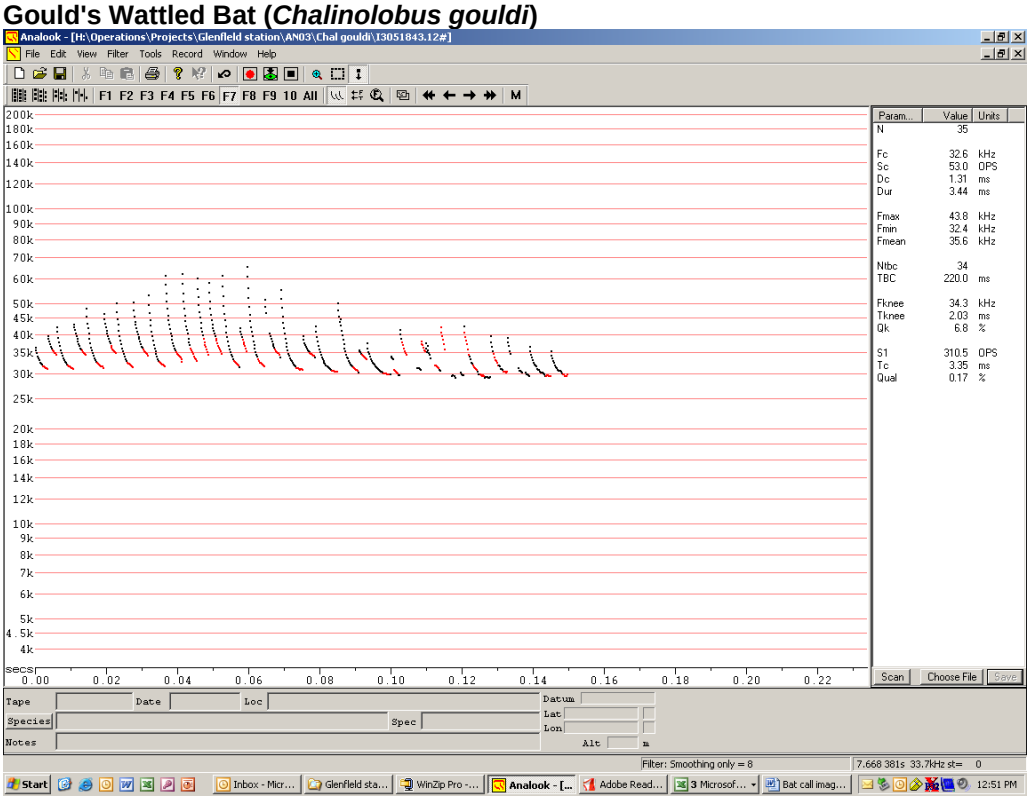
Attachment G Microbat calls recorded within the study area

This attachment details a sample of the 'frequency vs. time' graphs for each species of microbat recorded using an Anabat II Bat detector (Titley Electronics Pty Ltd) during current field surveys of the study area. This appendix also provides an indication of the number of bat calls processed and the percentage of these that were identified.

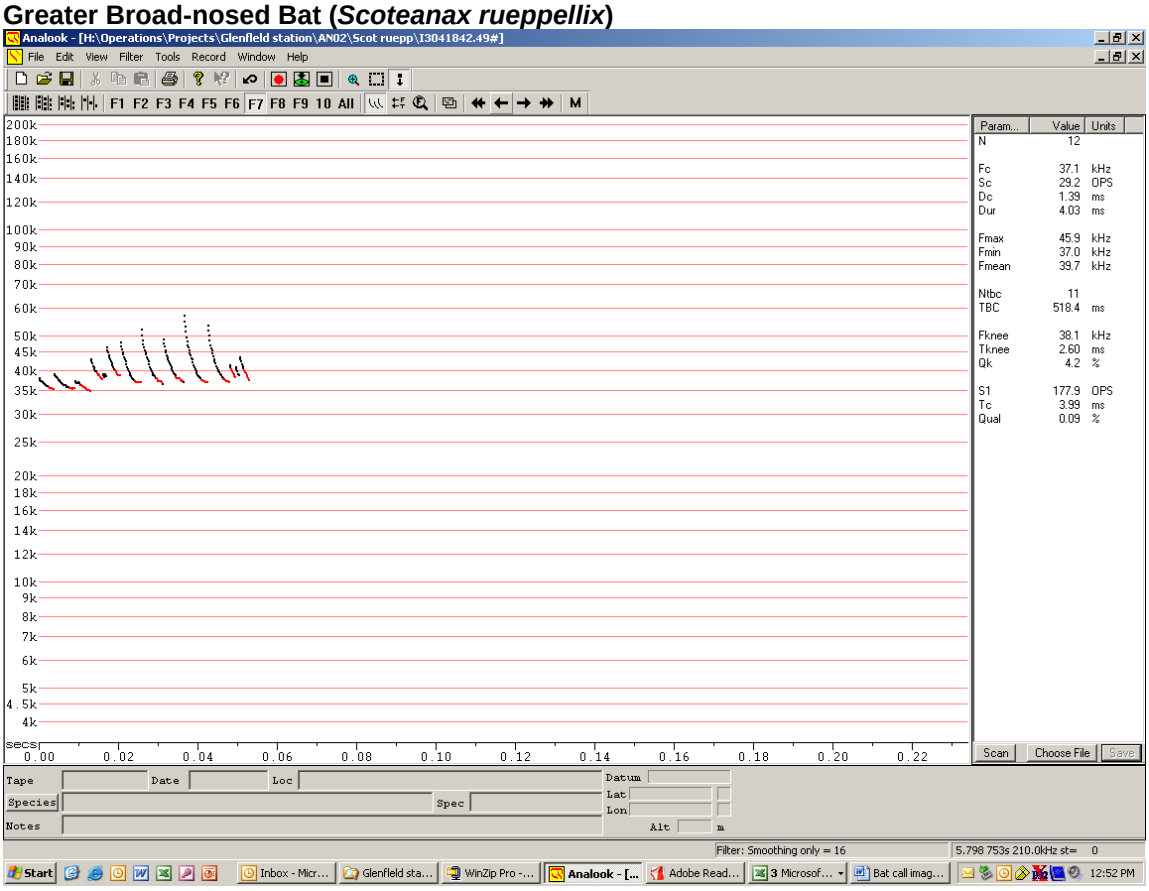
Chocolate Wattled Bat (*Chalinolobus morio*)



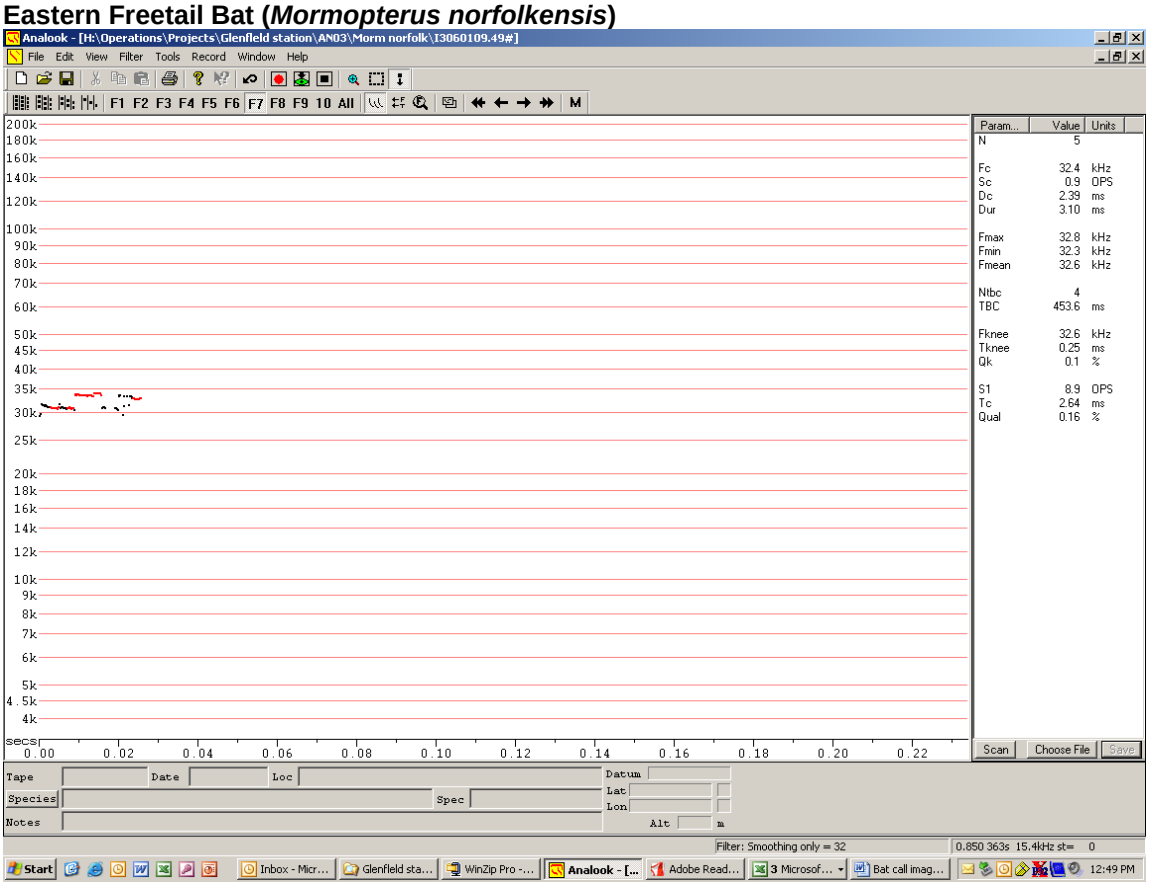
Gould's Wattled Bat (*Chalinolobus gouldi*)



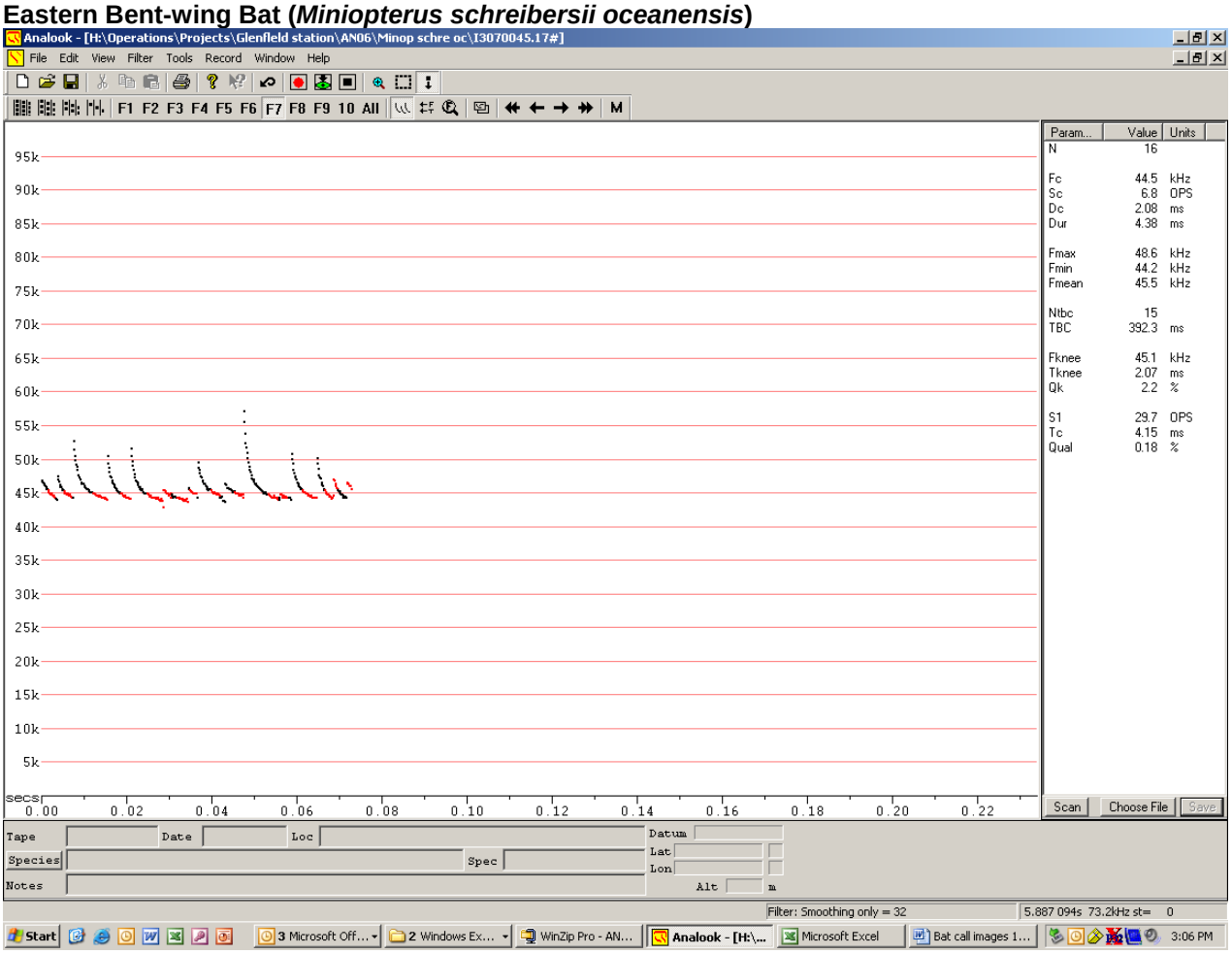
Greater Broad-nosed Bat (*Scoteanax rueppellix*)



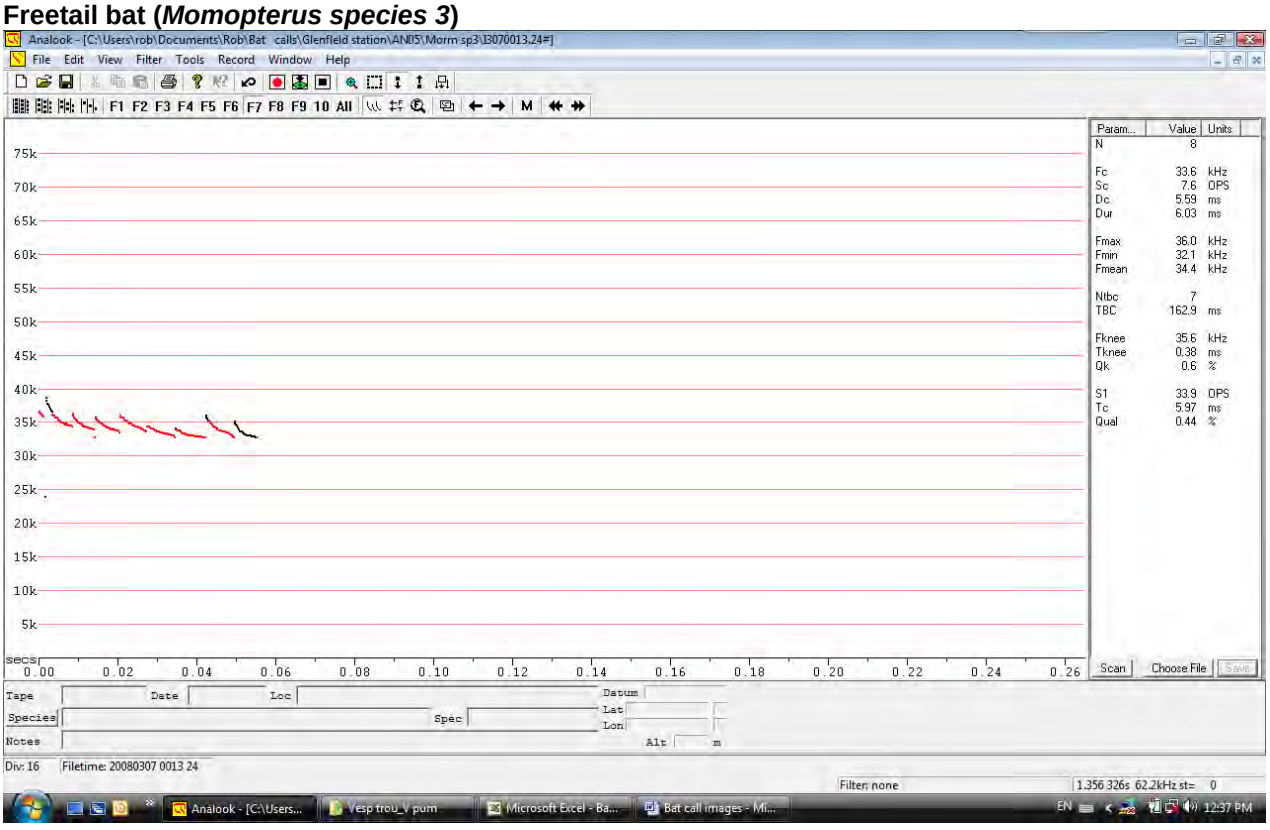
Eastern Freetail Bat (*Mormopterus norfolkensis*)



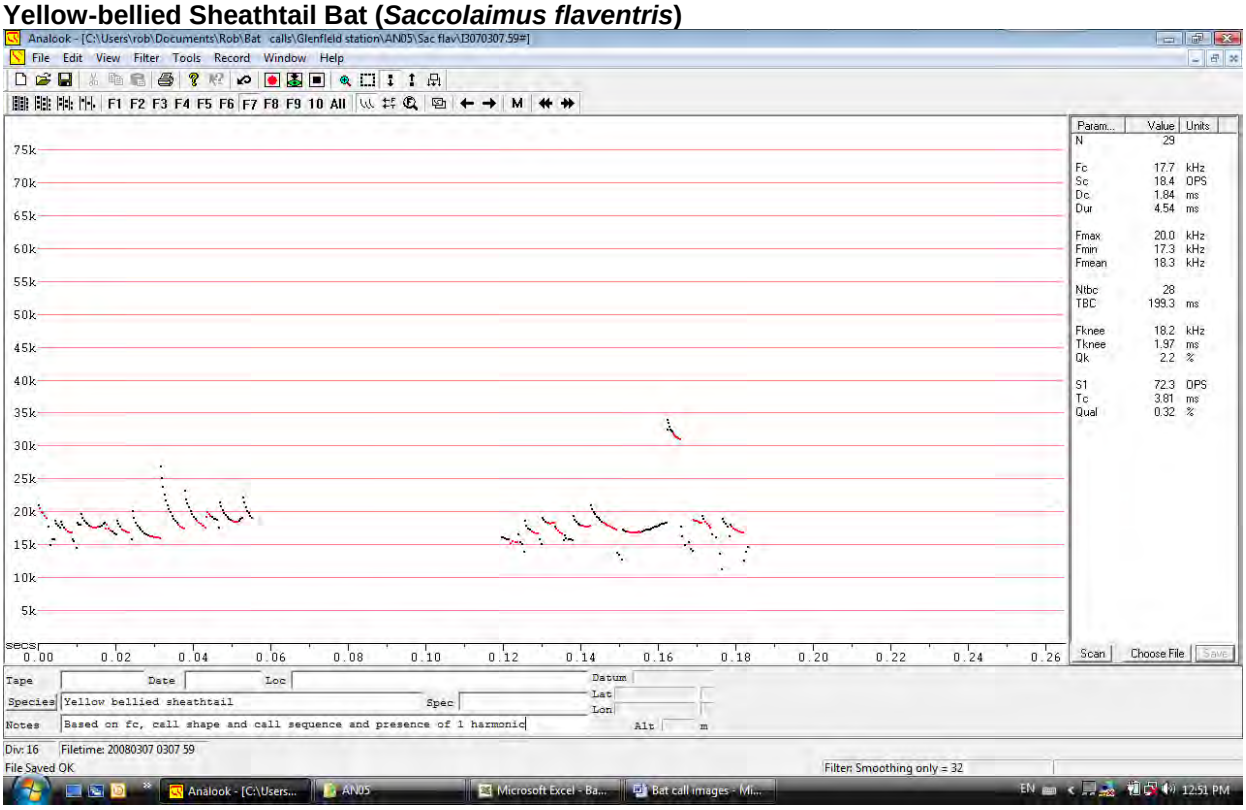
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)



Freetail bat (*Momopterus species 3*)



Yellow-bellied Sheathtail Bat (*Saccolaimus flaventris*)



White-striped Freetail Bat (*Tadarida australis*)

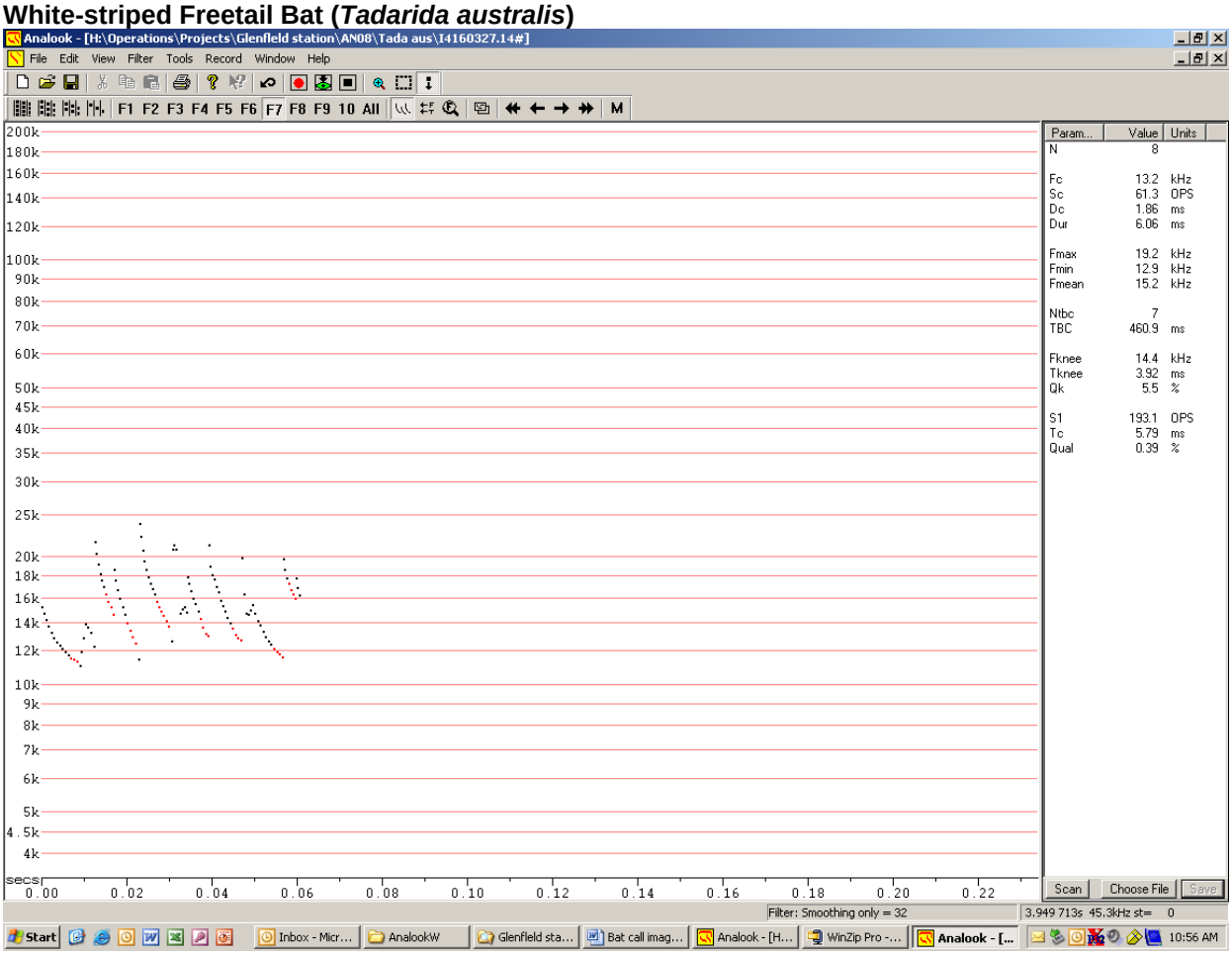


Table G-1 Number of bat calls processed and the percentage of these that were identified

Species	AN01	AN02	AN03	AN04	AN05	AN06	AN07	AN08
Total number of files recorded	17	28	69	101	140	105	131	99
Total number of unidentified calls (poor quality or call length)	13	15	40	49	70	25	67	72
Percentage of total calls	76%	54%	58%	49%	50%	24%	51%	73%
Calls identified to species level								
Chocolate Wattled Bat (*Chalinolobus morio*)	0	0	2	1	0	0	1	0
Gould's Wattled Bat (*Chalinolobus gouldi*)	2	5	24	0	25	26	10	9
Greater Broad -nosed Bat (*Scoteanax rueppellii*)	0	4	0	0	0	4	0	0
Eastern Freetail Bat (*Mormopterus norfolkensis*)	0	0	1	0	0	0	0	0
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	0	0	0	0	0	26	0	0
Freetail bat (*Mormopterus species 3*)	0	0	0	0	4	0	0	0
Yellow-bellied Sheathtail Bat (*Saccolaimus flaventris*)	0	0	0	0	1	0	0	0
White-striped Freetail Bat (*Tadarida australis*)	0	0	0	0	0	2	0	1
Total	2	9	27	1	30	58	11	10
Percentage of total calls	12%	32%	39%	1%	21%	55%	8%	10%
Calls not identified to species level								
Mormopterus spp (*Mormopterus sp4 / Mormopterus sp2 / Mormopterus norfolkensis*)	0	2	0	0	19	0	0	0
Goulds Watted Bat (*Chalinolobus gouldi) / Mormopterus spp (Mormopterus sp 4 & 2*)	0	2	0	49	16	19	21	12
Goulds Watted Bat (*Chalinolobus gouldi) / Broad-nosed Bat (Scoteanax rueppellii / Scotorepens sp*)	0	0	0	0	0	1	0	0
Eastern Falsistrellus *(Falsistrellus tasmaniensis) / Broad-nosed Bat (Scoteanax rueppellii / Scotorepens sp)*	0	0	0	0	1	0	0	0
Large Forest Bat *(Vespadelus darlingtoni) / Eastern Bent-wing Bat (Miniopterus schreibersii oceanensis)*	0	0	0	0	0	0	28	0

Species	AN01	AN02	AN03	AN04	AN05	AN06	AN07	AN08
Forest Bats *(Vespadelus sp)*	0	0	0	0	0	0	4	1
Eastern Forest Bat *(Vespadelus pumilus) / Little Bent-wing Bat (Miniopterus australis)*	0	0	0	0	3	0	0	3
Long-eared Bats *(Nyctophilus sp)*	0	0	2	2	0	2	0	0
Eastern Cave Bat *(Vespadelus troughtoni) / Eastern Forest Bat (Vespadelus pumilus)*	2	0	0	0	1	0	0	1
Total	2	4	2	51	40	22	53	17
Percentage of total calls (%)	12%	14%	3%	50%	29%	21%	40%	17%

Notes: AN01: Western Sydney Regional Parkland (Open Woodland), AN02: Western Sydney Regional Parkland (Open Woodland), AN03: Edmondson Park (Remnant Woodland), AN04: Edmondson Park (Open Woodland), AN05: Glenfield (Highly Modified Area), AN06: Western Sydney Regional Parkland (Open Woodland), AN07: Kemps Creek (Open Woodland/Riparian), AN08: Ingleburn Defence Site (Remnant Woodland).